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Why do Consumers resist buying Electric Vehicles?

An empirical Study of Innovation Perception and the Effect of Consumer Characteristics, Innovation Exposure, and Buying Incentives

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Declaration

This thesis does not contain any material that has been accepted for the award of any other degree or diploma in any educational institution and, to the best of our knowledge and belief, it does not contain any material previously published or written by another person than the authors of this thesis Nadine Bessenbach and Sebastian Wallrapp, except where the due reference in the text has been made.

Copenhagen, 12th August 2013

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Abstract

Initial Situation

Climate change and resource shortage have led to rethink traditional forms mobility. While much effort has been put in the research and development of e-mobility, less attention has been paid to consumers' acceptance (Yeh, 2007). The majority of consumers still consider EVs as disadvantageous compared to traditional cars. However, without consumer acceptance there will be no technological shift and long-term success of sustainable transport systems (Wiedmann et al., 2011).

Structure

The research examines the effect of innovation perception on innovation resistance towards EVs. Additionally, three drivers that effect the perception are deployed, namely consumer characteristics, innovation exposure and buying incentives. In addition, we assess market-specific differences from Norway, Sweden, Denmark and Germany. In order to examine the *Innovation Perception Model,* we conducted a web-based survey.

Research Outcome

This research reveals that almost two thirds of the consumers surveyed can be considered resistant. Overall, eight value- and risk barriers exist that prevent consumers from adoption. Furthermore, consumer characteristics, innovation exposure and buying incentives have a relevant effect on the perception of EVs. Additionally, all outcomes vary from market to market.

Managerial Implications

Relevant recommendations are developed that aim to overcome these barriers. In specific, product-, service-, and communication-strategies are developed to provide a comprehensive solution.

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1. Introduction

Climate change and its consequences have recently grown in importance on political agendas worldwide. CO2 emissions is one of the gases that has a dramatic impact on the environment resulting in rising coastal flooding, reduction in water supplies and increase malnutrition (IEA, 2010). In order to protect the environment for future generations, a global reduction in CO2 emissions is required along with reduced consumption of non-renewable energy resources. One major CO2 contributor is the transport sector, which is responsible for around a quarter of EU greenhouse gas emissions, making it the second biggest greenhouse gas-emitting sector after energy. While emissions from other sectors are shrinking, those from transport have increased by 36% since 1990. As a consequence, the European Union has set mandatory emission reduction targets for passenger cars of 95g/km by 2020, which is a reduction of 40% compared to 2007. Automobile manufacturers that fail to comply face drastic fines. In order to reach these targets and prevent penalty payments for excess emissions, innovative propulsion systems have gained increasing attention. Vehicles with electric propulsion are considered as a promising alternative on the pathway towards low-emission vehicles that could enable the transport sector to reduce emissions significantly.

During the last few years, electric vehicles (EV) got more and more attention in national and European policies and public awareness increased significantly. While much effort has been put in the research and development of e-mobility, less attention has been paid to consumers' acceptance (Yeh, 2007). The majority of consumers still consider EVs as disadvantageous compared to traditional cars. However, without consumer acceptance there will be no technological shift and long-term success of sustainable transport systems (Wiedmann et al., 2011). Therefore, it is crucial to gain in-depth insights in consumers' perception towards EVs that affect preferences for and the adoption of alternative fuelled vehicles.

1.1 Aims and Objectives

This research aims to give a deeper understanding of why consumers resist to buy electric vehicles. With the examination of consumers from Norway, Sweden, Denmark and Germany we want to work out market specific differences. We aim to give a comprehensive market assessment and provide strategies with the goal to overcome existing adoption barriers and attract a larger number of consumers to electric cars. The findings of this research may be useful for manufacturers and suppliers of the automobile industry, governments, as well as other public or private institutions dealing with e-mobility, sustainability or green business solutions.

1.2 Problem Statement

Although the EV is the solution to many problems related to climate change and resource shortage, its adoption is still low and only few car manufacturers have already introduced EVs at small production volumes in the market. They still represent a small niche market hardly exceeding 1% of the passenger car market. Until now, only little is known why people resist buying EVs. While much attention has been paid to developments in sustainable mobility solutions less attention has been paid to consumers' willingness to adopt. However, understanding why people do not adopt is arguably at least as important as knowing about those who do adopt. In fact, one of the major causes for market failure of innovations is the resistance they encounter from consumers. Yet, little research has been done on this subject. So far only few scholars have examined why consumers resist some innovations while others do not (Sheth, 1987; Ram, 1987; and Klein, 1967).

Innovation resistance clearly takes more than one form and its marketers should be aware of the range of situational and personality factors that could lead to resistance. In our research we apply the concept of innovation resistance on e-mobility, which leads us to the following research question:

Why do consumers resist to buy electric vehicles?

To achieve a constructive and comprehensive answer to our research question, we divide this research into two research questions. First, we measure the general consumer perception of EVs as an innovation (RQ1a). In specific we are interested in how consumes evaluate EV characteristics. Then, we examine the actual innovation resistance towards EVs (RQ1b). Third, we identify adoption barriers to explain innovation resistance (RQ1c). The investigative sub-questions are as follows:

1. How does EV perception influence resistance?
    a) How do consumers evaluate the innovation?
    b) How resistant are consumers?
    c) What are the adoption barriers?

After the identification of barriers, we examine the effect of three drivers of EV perception that have an indirect effect on consumer resistance. In particular, we evaluate the role of car involvement and eco-consciousness as forms of consumer characteristics (RQ2a). In addition, we examine how innovation exposure (e.g. mass media and social media communication) affects the consumer perception (RQ2b). Finally, we look at buying incentives to find out whether monetary and functional benefits make the EV more attractive to consumers (RQ2c). This leads us to the following sub-questions:

2. What are relevant drivers of EV perception?
    a) What is the effect of consumer characteristics?
    b) What is the effect of EV exposure?
    c) What is the effect of buying incentives?

1.3 Structure

Overall, this research paper is divided into seven chapters. The first provides an overview of popular EV models currently available in the market and a short comparison of the four target markets in terms of CO2 regulations, EV market share as well as infrastructure developments. Chapter 2 contains the methodology including research philosophy as well as data collection and -usage methods. In order to get profound insights into consumers' perception we make use of a quantitative study in the form of a web-based survey. In the following chapter we utilize Roger's *Diffusion of Innovation Theory* and Ram's *Model of Resistance* to introduce essential concepts of adoption research. A special focus is put on consumer resistance as this concept helps to explain why consumers resist some innovations while others not. In Chapter 4 we develop the *Innovation Perception Model*. This conceptualization establishes the link between innovation resistance and EV perception. In addition, it integrates three relevant drivers that affect the consumer's perception. After the introduction of the *Innovation Perception Model*, the analysis and discussion of the survey conducted follows (Chapter 5). Barriers as well as significant drivers are tested and ranked according to their relevance. Additionally, an analysis by target market is conducted, to assess country specific consumer perceptions. Chapter 6 provides managerial implications in form of product, service and communication strategies that help to overcome the identified adoption barriers. In addition, limitations and areas of future research are discussed.

Figure 1: Structure of the Thesis

2. Product and Market Overview

2.1 Types of Electric Vehicles

There are three main types of vehicles which are driven by electric motors and which get their energy from a battery: hybrid electric, plug-in hybrid and battery electric vehicles.

Battery Electric Vehicles

The Battery electric vehicles (EV), also known as the all-electric, the full-electric or the pure-electric vehicle, is powered solely by an electric motor and has no internal combustion engine (ICE). The battery is charged by electricity from the grid. As the battery is the only power source, EVs are usually equipped with powerful lithium-ion batteries with a capacity of 20 kWh or more than 50kWh for high performance models (Lytton, 2010; Perugo and Ciuffo, 2010). Common of the EV products are: Tesla Roadster, Nissan Leaf and Mitsubishi i-MiEV.

Plug-in hybrid Electric Vehicles

Plug-in hybrid electric vehicles (PHEVs) have an ICE and a battery with up to 40 kWh capacity, typically lithium-based, that can be charged either by the ICE or directly from the grid. They are able to run on electric power alone, at urban speeds, for short distances and have an all-electric range of 5 to 50 miles (Lytton, 2010). When the all-electric range reaches its range limit, the ICE would kick in and provide power. The PHEV addresses the range issues of the BEV by combining the electric motor and battery with the combustion engine. Examples include: Toyota Prius Plug-in Hybrid5 and the Chevrolet Volt.

Hybrid Electric Vehicles

The hybrid electric vehicle (HEV) used to be known simply as the "hybrid" or the "full hybrid" but nowadays is often referred to as the "conventional hybrid". It has a battery, which is charged by the ICE and by regenerative braking but not from an external source of electricity. Typically, it is capable of pure electric drive at low speeds and for a limited range, equipped with batteries that have a capacity up to 30 kWh (Lytton, 2010). The main difference between the PHEV and HEV is that the PHEV draws electricity from the grid, whereas the HEV does not. Some common examples of the HEV are the early versions of the Toyota Prius, Honda Insight and Honda Civic Hybrid.

This research will focus solely on all-electric vehicles (EV).

2.2 Model Overview

This section provides an overview of the most popular EV models currently available. It includes models currently available on most European markets.

Nissan Leaf

Three years after its launch, the Nissan Leaf is already considered the best-selling EV in history with global sales of over 65,000 units (Nissan, 2013). The European market is led by Norway with more than 4,600 units sold through June 2013. This makes it the fifth best-selling car of 2013 in Norway (CleanTechnica, 2013). The Leafs engine power is 80 kW and its range is up to 200 km (Crowe, 2013).

Mitsubishi i-MiEV family

Launched in 2009, the Mitsubishi i-MiEV family was sold over 33,000 times (Loveday, 2013). The relevant markets in Europe are France, Norway and Germany (Plugincars, 2013). The vehicle is equipped with a 49 kW electric motor and a possible of driving range of up to 160 km (Mitsubishi, 2013).

Tesla Model S

Already one year after its launch in 2012, Tesla's Model S is already the third best-selling EV on the market (12,00 units) (Cobb, 2013). Within the market for EVs the Model S is the only full-sized sports sedan available. The car is propelled by a 60-85 kW strong electric engine and has a potential driving range of up to 500 km (Tesla Motors, 2013).

Renault Kangoo Z.E.

Since 2011 the Renault Kangoo Z.E. is the fourth best-selling electric vehicle on the market with over 8,000 sold units. Within the market for EVs the Kangoo Z.E. is the best-selling product in the van category. The vehicle is equipped with a 44 kW electric motor and a possible driving range of up to 170 km (Renault, 2013).

Renault Zoe

The Renault Zoe was launched in December 2012 and generated global sales of 3460 through May 2013 (Renault, 2013). It has been the top selling all-electric car in France during the first five months of 2013 (Automobile Propre, 2013). The car is propelled by a 65 kW strong electric engine and has a potential driving range of up to 210 km (Renault, 2013).

Renault Fluence Z.E.

Since the launch of the *Renault Fluence Z.E.* in 2011, around 3,400 units have been sold (InsideEVs, 2013). This compact sedan was the first electric car enabled with battery swapping technology (Ingram, 2013).

The vehicle is equipped with a 70 kW electric motor and a possible of driving range up to 185 km (Renault, 2013).

Smart electric drive

The Smart electric drive was introduced in 2009 and generated global sales of more than 3,100 on the major global markets (Germany, U.S., France, the Netherlands, and Italy. The vehicle is equipped with a 30 kW electric motor and a possible driving range of up to 110 km (Smart USA, 2013).

2.3 Market Comparison

Introduction

In the following section, we compare Norway, Sweden, Denmark and Germany with respect to different market criteria. The selection of countries was based on our aim to include countries of differing size, different histories of investment in the automotive industry and new technologies, as well as different structures of electricity provision and renewable energy policies. In addition, the rate of diffusion of electric cars played an important role in the market selection. For these reasons we chose to focus on Scandinavia and Germany.

CO2 Regulations

All countries but Norway belong to the European Union (EU). In 2008, the EU set legally binding CO2 standards, which require that cars sold in Europe in 2015, should emit 130g of CO2 per kilometre in average and those sold in 2012, only 95g (European Commission, 2013).

Norway has set its own ambitious targets to reduce CO2 emissions. In 2007, the government introduced its CO2 targets, which determine 30% reduction of green house gas (GHG) emission in 2020, 10% below the Kyoto-commitment and 100% reduction within 2050 (Internationaltransportforum, 2013). In addition, all countries signed the Kyoto protocol and agreed on fulfilling the commitment to reduce their collective GHG emissions to 20% below 1990 level until 2020 (European Commission, 2013).

EV per Market

The Scandinavian countries consider themselves as leaders in the arena of climate change initiatives and therefore have early promoted the sales of EVs. Today, Norway has the highest per capita rate of EVs (2.59%). Followed by Denmark (0.34%) and Sweden (0.13%). Although Sweden has a high share of renewable energy and thus seems to be an attractive market for electric cars, EV market share is the lowest compared to their neighbour countries. Even lower is the EV market share (0.12%) in Germany.

EV models

With regard to EV models in the respective markets, no big difference can be revealed. In all markets only a limited number of EVs are available. Among the most frequent sold cars are Nissan Leaf, Mitsubishi i-MiEV family and Tesla Model S.

EV Infrastructure

Except for Norway all other countries lack a proper charging station infrastructure. Denmark had the chance to become a pioneer in battery charging as it was selected as test market for Better Place. The new venture introduced a battery-swapping model that should revolutionize the EV market. In collaboration with the Danish energy corporation DONG, Better Place invested €100m to build up an EV infrastructure in Denmark (Better Place, 2013). The idea was to make it just as fast to charge up a battery, as it is to fill up a tank of gas and to grow the numbers of electric cars up to 100,000 within two years (Danish Energy Agency, 2012). However, before it gained full market acceptance it filed for bankruptcy in March 2012.

Investment in E-mobility

Countries deploy different strategies to increase EV sales. While the German government makes large investments to support the research and development of electric cars, the Scandinavian markets invest in the generation of renewable energy supply. As part of the national *Economic Stimulus Package II*, the German government set up a € 500m programme that covers research and development of battery technologies and electric cars, as well as the financial support of several demonstration projects with electric vehicles that will be launched soon (EU Parliament, 2010). The Danish government, on the other side, allocated a budget of €5.6m for the *EDISON R&D project* on intelligent integration of EVs in the electrical grid and their optimal interaction with wind power (Danish Energy Agency, 2012). In addition a €4 mil EV fleet trial programme is funded by the Danish Energy Authorities.

Criteria		Norway	Sweden	Denmark	Germany
Electric Vehicles	Per Market	9338 (March 2013)	1699 (March 2013)	1160 (June 2012)	7479 (Dec 2012)
	Per Capita	0.19%	0.017%	0.02%	0.01%
	Market Share (June 2012)	2.59%	0.13%	0.34%	0.12%
Infrastructure	Charging Stations	4,156	600	280	3800
	Thereof Fast-charging St.	127	n/a	n/a	n/a
(Public) Investments		n/a	SEK 28m Project Hyper Bus	€5.6m Edison R&D Project €4m Danish Energy Authorities	€500m Economic Stimulus Package II
Regulations	CO2 Emission Reduction	-30% by 2010 (comp.1990)	-40% by 2020 (comp.1990) Carbon Tax	-40% by 2020 (comp. 1990)	-40% by 2020 (comp. 1990)
	Noise Restriction	-10% by 2020 (comp. 1999)	-	-	-

Table 1: Market Comparison

3. Methodology

3.1 Research Philosophy

Knowledge about research philosophies can help to clarify the research design and facilitate the choice of an appropriate one (Blumberg et al. 2008). There are two main distinguished research philosophies, positivism and interpretivism.

Positivism applies the notion that *"knowledge develops by investigating the social reality through observing objective facts"* (Blumberg et al. 2008). This concept encompasses three basic principles: Firstly, the social world exists externally and is viewed objectively. Secondly, research is value free and thirdly, the researcher is independent, taking the role of an objective analyst (Blumberg et al., 2008). This implies that different researchers observing a social phenomenon arrive at the same facts describing the social world. As a consequence, concepts need to be operationalized to allow quantitative measurement of the facts.

In contrast, *Interpretivism* views the world as socially constructed instead of objectively determined and behavior is time- as well as context-specific. The researcher is seen as a part of what is observed, meaning that he/she is not independent of his/her own feelings and understandings (Blumberg et al., 2008). Therefore, interpretivists reject the notion that research can be conducted value-free. They further claim that complex issues exist and cannot be generalized, especially regarding business, where situations are unique and dependent on circumstances (Saunders et al. 2003).

In our study, we combine both philosophies – positivism and interpretivism. Although we conduct a quantitative study which is rather associated with positivism, we see our research more under interpretivism because consumer's perception towards EVs are rather subjective and context dependent. In order to answer the formulated research question, we need to collect information about consumer's attitudes, believes and values that explain their resistance towards electric cars. This leads us to two important facts: (1) during the research process we will gather subjective information from people and (2) we will need to interpret this information according to our own criteria. As a consequence, the researchers in this study are not completely independent.

After elaborating the two research philosophies, the subsequent step is to analyze how theory is included in the research. Regarding the role and position of theory, two different reasoning approaches can be distinguished: *deduction and induction* (Blumberg et al., 2008).

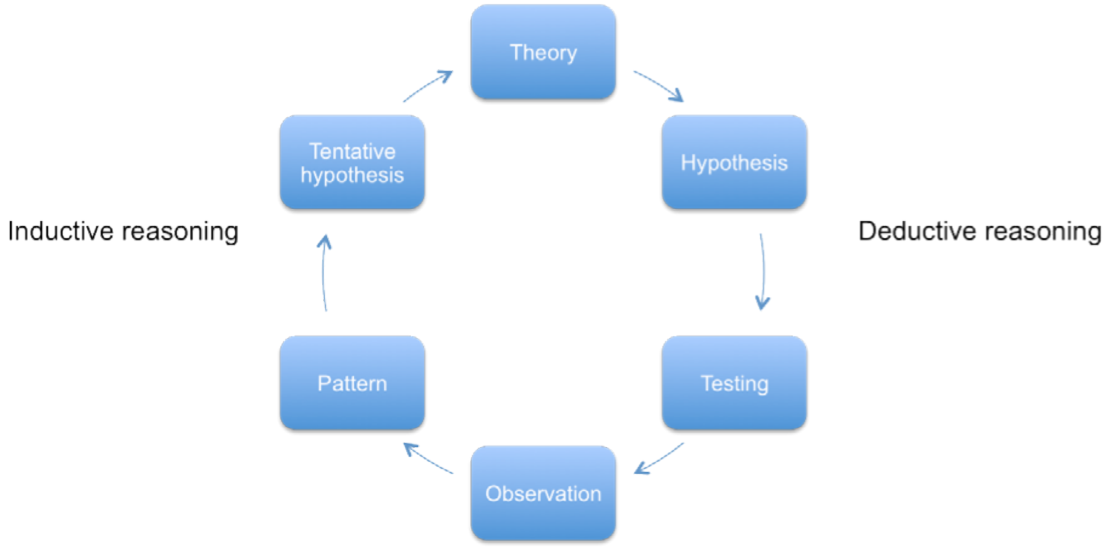

Figure 2: Deductive and Inductive Reasoning (Blumberg et. Al., 2003)

As the figure shows, induction begins by observing behaviour and identifying patterns, which will serve as basis for making hypothesis and building theory. On the contrary, deduction is concerned with testing existing theories and hypothesis by observation. Deduction is closely related to the positivistic philosophy of research where structured methodology is emphasized. It must be possible to measure and quantify the facts, as well as replicate and generalize (Blumberg el al., 2008). Induction and deduction can also be combined in a systematic way. Dewey (1910) describes this process as the *"double movement of reflective thoughts"*. In our study, we incorporate both deductive as well as inductive elements. First, we look at theories, models and frameworks in order to identify a guideline on how to approach our research problem and to collect the required information to answer the research question. In the second step we propose hypothesis to explain the fact that we believe to be logically related to the problem. Finally, these hypotheses are tested whether they are capable of explaining the fact.

3.2 Primary versus Secondary Data

According to Homburg and Krohmer (2006), data provides the basis for every marketing research. While primary data refer to information collected by the researcher, secondary data consist of information that has already been collected by others. The collection of primary data can be expensive and time consuming but necessary when no suitable secondary data is available (Blumberg et al., 2008). Secondary data, on the other side are readily available and therefore save time and money.

In our study we make use of both primary and secondary data. Secondary data were used to provide information about the EV in general. A large number of external sources from the International Energy Agency and European Commission were investigated to get an overview about recent EV developments in Norway, Sweden, Denmark and Germany including EV penetration, government incentives or infrastructure expansion. We also made use of secondary data to identify potential buying incentives that have the potential to increase the rate of adoption.

Primary data is obtained through a survey to examine consumers' perception towards electric cars. The survey is also used to evaluate the importance of the previous defined purchasing incentives from a consumer's perspective. The reasoning how we designed and structured the survey is discussed in the next section.

In addition, we attended the Green Vehicle Days in Malmö which is the biggest electric vehicle event in Scandinavia to date hosted by InnoVentum in collaboration with Tesla Motors and Green Matmarknad. During this event several presentations, dialogues and debates took place where we obtained useful information about the progress of green mobility in the Scandinavian market. We also had the opportunity to exchange some insights and information with various EV experts such as Christian Marcus, (Tesla Motors), Ole Henrik (Grøn Bi) or Jonas Lööf (Greencharge Sydost). They provided us with valuable information about government initiatives in the respective markets and gave us a general update on the EV market in general. The event was also very helpful to pre-test our questionnaire.

3.3 Quantitative versus Qualitative Research

Primary data can be of qualitative and quantitative nature. The distinction is mainly based on the kind of information used in order to analyze the specific phenomenon mentioned in the research questions. Qualitative data is less structured and based on qualitative information e.g. mimics, gestures and other observations that are subject to further interpretations. Such studies are of explorative character and provide an insights and understanding of the problem. In contrast, quantitative studies are often of descriptive nature and rely on quantitative information such as numbers, figures and statistics (Blumberg et al., 2008). The emphasis lies on testing and verification, with focus on facts or reasons for social events. This approach is more logical and critical than qualitative methods. The research techniques are e.g. observations, interviews, surveys and experiments, all of a structured nature (Gauri and Grønhaug, 2005). The choice between the two research approaches depends on the research problem, its explorative, descriptive or predictive nature as well as on its objective (Blumberg et al., 2008).

With regard to our study we consider a quantitative survey as suitable. The reason for the chosen approach is that it allows us to quickly obtain data from a large number of respondents in order to determine attitudes, believes and values customers have regarding electric cars.

3.4 Web-Based-Survey

Conducting a survey the used communication instrument can either be a personal interview, a telephone interview, a self-administered survey or a web-based survey (Blumberg et al., 2011). To find the most suitable instrument for the purpose of this study, we examined them on the basis of three criteria: Cost efficiency, the time available and accessibility of the target group.

First, by using the Internet as platform for our survey, we could reach a sample size of 143 participants. To distribute the questionnaire we utilized social networks (Facebook, LinkedIn and Xing) With respect to the criteria time available, such a large sample size could only be achieved by using a web-based survey as communication instrument. However, it should also be taken into account that using a social network as platform might distort reality and hence reduce validity. Furthermore, a web-based survey provides the highest degree of cost efficiency (Blumberg et al.,2008). On the Internet several freeware provider exist which allow designing, conducting and analysing a questionnaire in a professional way. We used the freeware of the research software company Qualtrics. Another advantage of web-based surveys is the accessibility of the targeted group. Without the Internet, it would have been difficult to reach the large number of Norwegians, Swedes, Danes and Germans. However, a web-based survey has also its shortcomings. Since online surveys are anonymous, participants might answer not seriously or do not take sufficient time to complete the questionnaire (Blumberg et al., 2008). Another major weakness of the web-based survey is the non-response error. Some people, for example, refused to participate in the survey because they are not familiar with electric cars. The absence of the interviewer might also be a problem when the respondent has difficulties of understanding or need support in answering the questions. Although the shortcomings should not be neglected, we consider a web-based survey as the most suitable communication instrument for our study. Especially, with concern to the above stated criteria cost efficiency, time availability and accessibility of the target group.

3.5 Sampling

After determining the method of research, the next step is to design the sampling plan. This is the process of distinguishing between how many individuals are selected for the survey and on what basis the selection is made (Schmidt and Hollensen, 2006). The method of sampling has several compelling reasons including lower cost, greater accuracy of result, speedier data collection and easy availability of the population element (Blumberg et. al., 2008).

According to Blumberg (2008), the size of a study should range around 50 – 100 participants. Although, it is noteworthy that there are no exact numbers that best reflect the exact target population needed for sampling. It is advisable that the sample size needs to be sufficiently large to be representative (Blumberg et al., 2011). Hence, we decide to include a minimum of 20 people for each nationality. In total we got 143 participants in our survey from which 28 Norwegians, 23 Swedes, 25 Danes and 51 Germans participated. We put a research focus on consumers in their twenties with an academic background. They represent a future high buying power segment and are, therefore, a group that will likely be concerned with buying a car in the future

The two different categories of sampling procedures are *probability* and *non-probability* sampling. A probability sampling method is any method of sampling that utilizes some form of random selection to ensure that the different units in the population have equal probabilities of being chosen. When using non-probability, on the other side, it is not known which of the units of a population will be selected. Some of the units have a zero probability of being chosen. In our case, a non-probability sample is most suitable because it allows us to select units of the sample according to personal judgment.

Within non-probability samples, researchers can choose among convenience, judgment or theoretical sampling. We chose a convenience sample because it gives us the freedom to include everyone who is accessible. Compared to the other two, this method is the cheapest and easiest to conduct. For our purpose the *convenient sample* is appropriate for developing an understanding of human opinion and to provide better insights into our research question.

By spreading the questionnaire through Facebook a continuous contribution from users occurred, which created a *snowball sampling* procedure. This refers to individuals discovering others that have the same characteristics or interests and might be interested in taking part in the survey who in turn, identify others (Blumberg et al., 2011).

3.6 Questionnaire

Aim

The overall goal is to get a better understanding about the reasons why consumers resist buying EVs. Following our research question, we are interested in how EV perception influences the adoption. In order to answer this question, we ask participants to evaluate predefined EV characteristics according to their preferences. Secondly, we want to find out what determines EV perception. We previously defined consumer characteristics, EV exposure and buying incentives as drivers of EV perception. With the aid of this survey, we want to examine the relati ve importance of these drivers from a consumer's perspective.

Structure

We based our overall structure on the approach by Blumberg, Cooper and Schindler (2011) who suggest three different types of questions: administrative-, classification-, and target questions. First we give a short introduction of our research topic and clarify some terms and expressions. We also informed participants about the time needed to complete the survey and assured them that their data are used confidentially and only for academic purposes. Next, we utilize *target questions* to address our research question. The target question section is divided into four parts.

In the first one we investigate how consumers evaluate the characteristics of an EV involving compatibility, relative advantage, risk, complexity, trialability and observability (Question 1 – 8). In the second part we aim to detect consumer-specific characteristics such as ecological consciousness and car involvement (Question 9-12 and Question 15). The next part deals with the exposure of the innovation. We are interested in how often people come in contact with information about EVs and which communication channels namely TV, Print, Radio, Internet, Social media and personal environment are most often used in providing information regarding EVs (Question 13). In the final part, buying incentives are evaluated. Our secondary research resulted in ten different incentives that have an impact on conumers' EV perception. To get a better understanding of how consumers value these incentives we asked them to assess them according to their perceived importance (Question 14). The questionnaire ends with *classification questions* determining the respondents' demographic and geographic variables such as gender, age and origin. This allows us to draw comprehensive segmentations (Question 16-18).

In order to increase reliability of the data we run a pre-test where we asked some friends and experts on this fields to complete the questionnaire and check it for potential errors.

Furthermore, we focused on formulating all questions in a coherent and understandable way to ensure low complexity and avoid unclarity.

Measurement Methods

In the design of the questionnaire we used two different scales of measurement. Nominal scales were used in the form of a simple category scale as well as multiple choice single-response scale. In addition, interval scales were used in the form of a likert scale summated rating (Blumberg et al.,2011). *Simple category scales* offers two mutually exclusive response choices (e.g. yes, no or important unimportant). This response strategy is useful for demographic questions or where dichotomous response is adequate (e.g. Question 16). When there are multiple options for the respondent but only one answer is sought, *multiple choice, single response scale* is appropriate (Question 1, 3, 11, 17 and 18) (Blumberg et al., 2011).
In this research the *Likert scale summated rating* is applied most. It consists of statements that express either a favourable or unfavourable attitude towards the object of interest. In our case the participant is frequently asked to what degree he or she agrees with each statement (Question 4, 5, 9, 10 and 15). For other questions we also made use of multiple rating list scale where we collect a large number of statements, which were than rated according to consumer's degree of importance or agreement (Question 8 and 14).

3.7 Evaluation of Inaccuracy

According to Schmidt and Hollensen (2006), the measurement of items or individuals is likely to hold some considerable errors. Especially in marketing research this is often observed. Therefore, data and findings should be evaluated on the basis of checking the accuracy of information obtained. Inaccuracy often occurs in form of measurement validity, reliability and non-response errors.

Validity

Validity refers to the ability of a research instrument to measure what it is supposed to measure (Schmidt and Hollensen, 2006). When deciding for our research design, we carefully considered our theoretical framework to ensure that the information obtained are relevant to the topic of research. A matter that may have limited the validity is the unequal distribution of nationalities in our research. Another issue is that the sample was not selected randomly but through social media contacts and their contacts. The answers are likely to be biased to a certain extent, as friends often want to contribute positively and typically offer support, when asked for help.

Reliability

Reliability is associated with the consistency of results. Reliable instruments are robust and provide the same result every time conducted. Reliability often lacks when the surveys are taken over time, are conducted by different means and people or are assessed very subjectively (Blumberg et al., 2008). Being aware of the fact that our interpretation of data might be biased, we discussed our data analysis thoroughly to incorporate different perspectives and ensure objectivity. Furthermore, by pre testing our questionnaire, potential errors or misunderstandings were revealed and improved in order to increase reliability.

Non-Response Error

This term refers to the statistical differences in a questionnaire that contain information from only those who responded. A perfect questionnaire is one that would also include those who failed to respond (Zikumund and Babin, 2006). This occurs when a person is included in the sample, but for any reason is not reached. There are several issues that have to be taken into account that make individuals decide whether to participate or not. Common reasons are lack of interest and time or unfamiliarity with the topic (Zikumund and Babin, 2006). Some actions that have been taken to overcome the non-response error in this study include sending out follow-up messages after three days or the application of concurrent techniques such as shortening the questionnaire length to eight minutes and personalizing the questionnaire send-outs by addressing the particular individual by name, if possible.

Ethical Considerations

Ethics in research relate to the question of how to conduct research in a responsible and moral way. This includes the ethical treatment of the participants, sponsors, researchers and team members as well as ethical obligations to the research community (Blumberg et al., 2008). Throughout the whole research project such ethical considerations were carefully taken into account and strictly observed by the authors of this paper. All participants was guaranteed confidentiality regarding any personal data provided and assured that their data were only used for academic purposes. Other ethical issues were considered when formulating the questionnaire. In order to guarantee best possible objectivity and to convey seriousness on our part, the language was kept as neutral and proper as possible.

4. Essential Concepts of Innovation Research

4.1 Innovation Diffusion and -Adoption

Diffusion theory seeks to explain why and how new ideas spread through a system from a macro perspective. Rogers (1971), as one of the first who popularized this field of research, defines diffusion as the process in which an innovation is communicated through certain channels over time among the members of a social system. This definition comprises the four essential elements that drive diffusion: innovation, communication channels, time, social system.

Innovation is defined as an idea, practice, or object that is perceived as new by an individual or other unit of adoption. *communication channels* encompasses the process by which innovation-related information get from individual to another. In diffusion theory *Time* involves the innovation decision process by which an individual passes from first knowledge of an innovation through its adoption or rejection. The element *social system* is defined as a set of interrelated units that are engaged in joint problem solving to accomplish a common goal. In definite, these systems can be for instance local communities, industries or markets. In contrast to this, the term *innovation adoption* describes the individual process by which a consumer moves along the decision process from first knowledge to final adoption or rejection of the innovation (micro perspective). This paper aims to contribute to the adoption research by examining factors that drive consumer's decision of whether to adopt or reject EVs.

4.2 Types of Innovations

Since the subjective definition of innovation allows for flexibility, it has been criticised by Gatignon and Roberts (1989) who argue that 'there are considerable difficulties in operationalizing this definition' as it relies on each individual's perception. A careful classification of different types of innovations is therefore necessary.

One categorization that is often used in research is the degree of novelty associated with an innovation. Some employ a high degree of novelty, while others only involve little 'cosmetic' changes to an existing design. Scholars in this area define innovations that entail significant changes as *radical innovation* and those with small changes as *incremental* (Henry and Walker, 1990*)*. Henderson and Clark (1990) introduce an innovation matrix where incremental – and radical innovations are positioned at the opposite extremes with two intermediate stages, which are called *modular innovation* and *architectural innovation*.

Components/Core Concepts

		Reinforced	Overturned
System/ Linkages	Unchanged	**Incremental Innovation**	**Modular Innovation**
	Changed	**Architectural Innovation**	**Radical Innovation**

Figure 3: Typology of Innovations (Henderson and Clark, 1990)

Incremental Innovation

Incremental innovation refines and improves an existing design, through improvements in the components. However, it is important to stress that these are improvements not changes, the components are not radically altered. Christensen (1997) defines incremental innovation in terms of: '*a change that builds on a firm's expertise in component technology within an established architecture*.' In contrast to radical innovations, they are less risky and require fewer recourses, making them easier to manage (Henry and Walker, 1990*)*. Consequently they offer less potential for returns for the organization. With the system and the linkages between components unchanged and the design of the components reinforced (through refinements and performance improvements) incremental innovation are placed in the top left-hand quadrant of figure 1.

Radical Innovation

Radical innovation is about much more than improvements to existing designs. A radical innovation calls for a whole new design, ideally using new components configured in a new way. Christensen (1997) defines this type of innovation as *disruptive innovation*. Disruptive innovations often occur because new sciences and technology are introduced or applied to a new market that offers the potential to exceed the existing limits of technology. Undertaking disruptive innovation can bring dramatic benefits for an organization in terms of increased sales and extraordinary profits, but it is also highly resource intensive and risk laden (Christensen, 1997). In terms of Henderson and Clark's framework radical innovation is located in the bottom right hand quadrant, at the opposite extreme from incremental innovation, as it involves both new components and a new design with a new architecture that links the components together in a different way.

Modular Innovation

Modular innovation uses the architecture and configuration associated with the existing system of an established product, but employs new components with different design concepts. In terms of Henderson and Clark's framework, modular innovation is in the top right quadrant.

As with incremental innovation, modular innovation does not involve a whole new design. However, modular innovation does involve new or at least significantly different components. New technology can transform the way in which one or more components within the overall system operate, but the system and is configuration/architecture remains unchanged.

In Henderson and Clarks framework the EV can be classified as modular innovation because the only significant change is the type of engine. The internal combustion engine is replaced by an electric one. Apart from that the electric car operates in much the same way as any other car.

Architectural Innovation

With architectural innovation, the components and associated design concepts remain unchanged but the configuration of the system changes as new linkages are instituted. As Henderson and Clark (1990) point out 'the essence of an architectural innovation is the reconfiguration of an established system to link together existing components in a new way.' Manufacturers may take the opportunity to refine and improve some components, but essentially the changes will be minor leaving the components to function as they have in the past but within a new re-designed and re-configured system.

Other Classifications

Any kind of innovation requires some degree of change in behaviour. Each individual has a different attitude towards change where some are more open while others are rather adverse towards change. Hence, it is reasonable to classify an innovation according to an individual's compatibility and existing usage patterns. Robertson (1971) proposed an innovation continuum, where innovations are classified according to the degree of change on existing consumption patterns. A *continuous innovation* has only a limited effect on consumption patterns and would be used similarly to existing products or services. Incremental innovations can be classified as continuous innovations. A *dynamically continuous* innovation, involving modular and architectural innovations, entails new technologies that require some behavioural change (Solomon et al.,1999). At the other extreme, a *discontinuous innovation* creates dramatic changes in behaviour and requires new skills to be utilised. These kind of innovations often have a radical or disruptive nature. For instance airplanes and Internet services were discontinuous innovation that radically changed consumer behaviour in terms of mobility and communication.

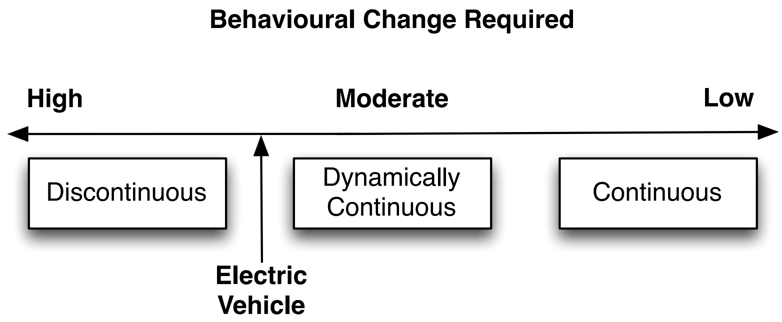

Figure 4: Innovation Continuum (Robertson, 1981)

Referring to Robertson's innovation continuum (1971), there are several arguments that the EV can be categorized somewhere between a dynamically continuous and discontinuous innovation. Replacing an internal combustion engine with an electric one has numerous technical implications ranging from the electric engine to issues of crash safety as well as maintenance. Moreover, the necessary charging infrastructure requires significant changes in the power grid, which shall influence the economy far beyond the automotive industry. As such, from a technological perspective, the move to electric cars has a disruptive impact. However, from a consumer's point of view, EVs are not necessarily disruptive as long as the objective is to develop EVs to the same specifications in terms of range, speed and price as conventional cars.

4.3 Innovation Resistance

The vast body of literature on innovation diffusion has suffered from pro-change bias (Sheth, 1981; Ram, 1987; Rogers, 2003). It assumes that all innovations are always good and should be adopted by everyone (Rogers, 2003). The premise of the assumption is that the innovations are, without exception, improvements over existing product or service substitutes (Ram, 1987). However, innovations mean change to consumers, and resistance to change is a normal consumer response that has to be overcome before adoption may begin (Ram, 1987).

Therefore, the literature calls for attention and for respect to be paid to those individuals who resist change. We need to understand their psychology of resistance and apply this knowledge in the development and promotion of innovations (Sheth, 1981). Thus, understanding why consumers do not adopt is at least as important as knowing about those who do adopt (Szmigin and Foxall, 1998).

4.3.1 Definition

Research has established the term of innovation resistance to explain why consumers hesitate to adopt or reject innovations. According to Ram (1987) adoption only begins after the consumer has overcome the initial resistance towards the innovation. Therefore, there is always some resistance existent before adoption and further, adoption and resistance may also exist concurrently. It has to be noted, however, that the adoption process does not necessarily lead to adoption, since ultimate rejection may discontinue the process.

The distinction between the concepts of resistance and rejection has been somewhat obscure in the earlier literature. Thus, Kuisma, Laukkanen, and Hiltunen (2007) have suggested that whereas rejection is a passive form of consumer behaviour resulting in an ultimate decision not to adopt an innovation, resistance, for its part, is an active behaviour, which may occur in every adoption process leading to adoption or rejection.

Ram and Sheth (1984) have provided the initial and fairly recognized conceptualization where consumer resistance can shape different forms of behaviour. They define innovation resistance as ‘the resistance offered by consumers to an innovation, either because it poses potential changes from a satisfactory status quo or because it conflicts with their belief structure’. This broad definition, however, is criticized as rather ambiguous since it essentially defines innovation resistance as ‘resistance to innovation’ (Kleijnen et al., 2009).

4.3.2 Characteristics of Resistance

There are three characteristics of innovation resistance (Ram & Sheth, 1989):

a. Innovation resistance affects the timing of adoption;
b. Innovation resistance varies in degree;
c. Innovation resistance exists across product classes.

<u>Timing</u>

Rogers (2003) has classified the adopters of innovations into five categories: Innovators, Early Adopters, Early Majority, Late Majority and Laggards. Each of these groups has a different level and type of resistance to an innovation, which affects the timing of adoption (Ram & Sheth, 1989).

First, innovators usually exhibit no resistance to innovations and are the first of a social system to adopt them. They are willing to take risk, have great financial liquidity and close contact to scientific sources and interactions with other innovators. Clearly, innovators are therefore characterized with an innate innovativeness. The concept of innovativeness describes the underlying preference for new and different experiences motivating a search for new stimulation within a specific product category (Venkatesan, 1973; Carlson and Grossbart, 1985; Venkatraman and Price, 1990). They constitute only a small minority of the overall social system (around 2.5%) and, therefore, do not represent the broader market or social system (Conway and Steward, 2009).

Early adopters are the second segment and also account for only a minor share in the social system (around 13.5%). Typically, they are characterized as less price-sensitive, primarily because they have a relatively high social status (high income, standard of living, wealth) (Rogers, 1995).
However, other research has questioned the connection between price sensitivity and innovativeness. Link and Malm (1994) found that consumers most willing to pay were not the most prepared to adopt an innovation. Also Goldsmith and Flynn (1992; 1993) found no relationship between innovativeness and income. Other sources justify the high degree of innovativeness due to high education, a general openness to change as well as close connections in the social system (Conway and Steward, 2009). Because of their central position in the social system, they are often perceived as opinion leaders and thus, have a relevant impact on the overall diffusion process.

The early majority, on the other hand, adopts an innovation just before the average person in a social system. Such individuals make up about one third of the overall group (34%). Although they need more time to adopt than the previous groups presented, they still have a critical role in the diffusion process. They can promote an innovation by providing interconnectedness between individuals in the social system (network effects), creating social pressure and building a critical mass.

The late majority adopts an innovation after the average person in a social system and also make up around one third (34 %). One reason for late adoption is often that these consumers are more cautious or sceptical towards new ideas or simply lack the financial resources necessary to adopt. Finally, the Laggards, which constitute about one sixth of the overall group (16%), have the highest level of resistance making them last ones to adopt a new product or service. In general, individuals of this group are fairly suspicious of new ideas or change in general as well as poorly connected within the social system.

Since its introduction the EV is characterized with a high degree of innovation resistance. Until today only few people have recognized the need for EVs and bought an EV or converted their existing cars into electric cars. 20 years after the innovation has been launched it still has hardly passed the innovators stage or stagnates in the beginning of the early adopter stage. Therefore, this research tries to explain especially the innovation resistance of the early adopters group towards EVs.

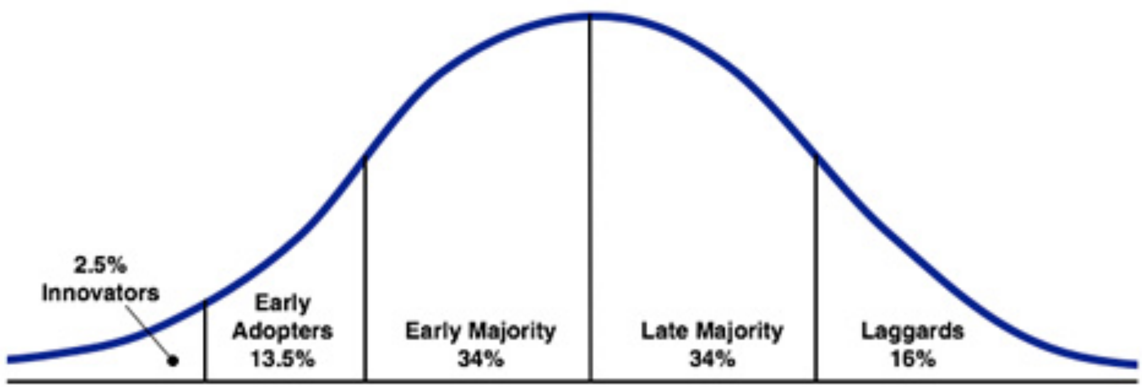

Figure 5: Innovation Diffusion Cycle (Rogers, 2003)

Degree

Existing literature states that resistance towards an innovation varies in degree (Ram and Seth, 1989; Szmigin and Foxall, 1998). However, there is no unanimity regarding the conceptualization and terminology the different forms of resistance. Therefore, we synthesize different approaches in this thesis.

Inertia

According to Ram and Sheth (1989) inertia refers to the state where consumers may feel disinclined to adopt the innovation, which can also be described as passive resistance. Similarly, this non-adoption behaviour could also be driven by a simple lack of awareness about the innovation (Rogers, 2003). For example few men adopted cosmetics when they were first introduced exclusively for the male segment (Ram and Sheth, 1989).

Postponement

Consumers may feel that the innovation is too risky and postpone the adoption decision (Szmigin and Foxall, 1998). Therefore, Ram and Sheth (1989) describe this behaviour as form of active resistance. Clearly, the decision made by the consumer is not final, similar to Greenleaf and Lehmann's "delay" as form of innovation resistance (1995). For instance, microwave ovens met with high market resistance initially since consumers feared that the radiation might cause physical risk. (Ram and Sheth, 1989)

Opposition

Characteristic for this consumer behaviour is not only the rejection decision itself, but also actively taking actions to prevent innovation's success (e.g. complaint letters, protests, negative word-of-mouth) (Szmigin and Foxall, 1998). For instance, when diesel cars were introduced, early adopters had to cope with high diesel costs and radically new maintenance problems; these dissatisfied consumers diffused resistance to the innovation through the rest of the market (Ram and Sheth, 1989). Existing literature refers to this kind of oppositional behaviour also as innovation sabotage (Davidson and Walley, 1985), active resistance (Ram and Seth, 1989) or active rebellion (Fournier, 1998).

Product Class

Finally, innovation resistance exists across product classes. This means that instead of the product class to which the innovation belongs, the resistance is derived from the degree of change or discontinuity and the extent to which an innovation conflicts with the consumer's belief structure (Ram & Sheth, 1989). Consequently, an innovation that is totally new to the consumer encounters high resistance, whereas an innovation that is based on an existing product or service provokes much less resistance but may still go against the consumer's belief structure.

5. Innovation Perception Model

The Innovation Perception Model is the integral element of this research. The framework conceptualizes the relevant aspects regarding the innovation resistance towards EVs. *EV Perception* describes the consumer evaluation of EVs on the basis of certain innovation characteristics. Thereby, we establish the negative effect on innovation resistance. The less favourable *EV Perception* the higher the *innovation resistance* towards it. This cause and effect relationship will allow us to answer the first research question. Central to an understanding of the individual decision to adopt or non-adopt is the acceptance that may also be dependent on consumer characteristics, or situational characteristics (Szmigin and Foxall, 1998). In the context of this research we integrate certain *Consumer Characteristics*, *EV Exposure* and *Buying Incentives* as situational (marked-specific) characteristics. They visualize the second research question.

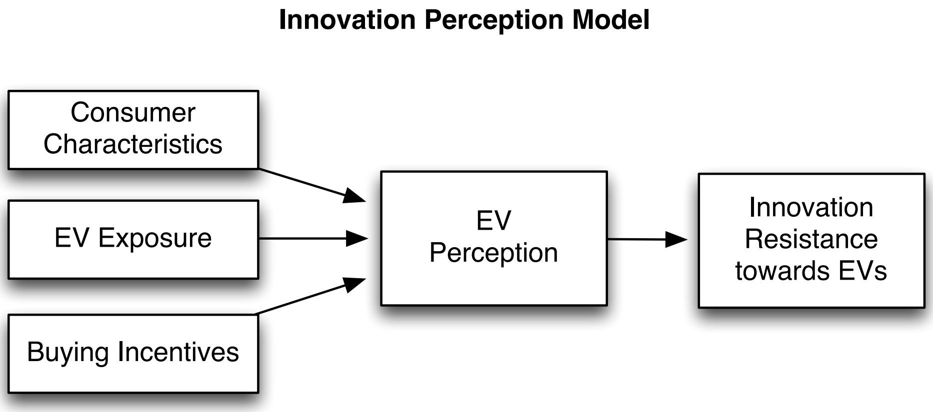

Figure 6: Innovation Perception Model

5.1 EV Perception

Adoption research originally draws from Rogers (2003), who conceptualized dimensions to assess innovations, namely *compatibility*, *relative advantage*, *complexity*, *trialability*. Rogers' concept follows the notion that the more beneficial the consumer evaluates an innovation the more likely he is to adopt it. Although this conceptualization was formulated in 1962, the stated dimensions remain popularly applied throughout recent innovation research (e.g. Tornatzky and Klein, 1982). Another dimension that has frequently been examined is the *risk* related to an innovation (Wiedmann et al., 2011). Risk perception refers to consumer's feelings of uncertainty and possible future adverse consequences (Dohlakia, 2001). The higher the consumer perceives this risk, the higher the innovation resistance. (Dowling and Staelin, 1994; Ostlund, 1974). We argue that especially EVs are currently linked to various uncertainties. This is due to a highly dynamic development regarding technologic progress, price development of fossil fuels, national and supranational policy influence, shift of consumer value.

For the purpose of this research we utilize five innovation characteristics to evaluate EVs as an innovation. This will allow us to identify weaknesses of the innovation, which might pose relevant adoption barriers. The following paragraph introduces the innovation characteristic and their effect on innovation resistance.

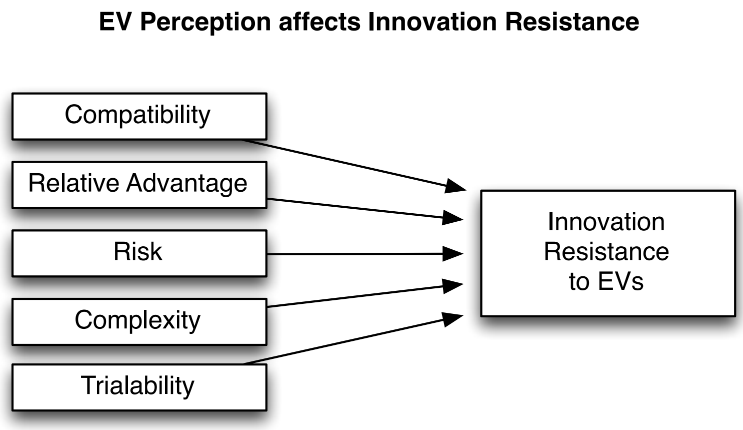

Figure 7: The Effect of EV Perception on Innovation Resistance

5.1.1 Compatibility

Rogers defines *compatibility* as the degree to which an innovation is perceived as being consistent with existing values, past experiences, practices and needs of the receiver (Rogers and Shoemakers, 1971). Compatibility is positively related to adoption of the innovation. Innovation literature differentiates between cognitive and operational compatibility.

Cognitive Compatibility

Cognitive (or normative) compatibility comprises what individuals feel or think about an innovation. It describes to what extend the innovation fits in the individual's set of values and norms (Rogers, 2003).

Many consumers might perceive EVs as disadvantageous and therefore have a negative opinion about it per se. Many consumers have used traditional fossil-fuelled cars for several decades now. It is likely that the longstanding usage creates a natural distance or scepticism towards a substituting technology among consumers. We assume that a low cognitive compatibility towards EVs is likely to pose an adoption barrier.

Operational Compatibility

Operational (or practical) compatibility describes to what extend the innovation fits in the individual's set of practices like consumption patterns or the individual usage preferences (Rogers, 2003).

In this context, it is arguable that the consumption scheme of an ICE vehicle and EV are fairly comparable. The only significant difference is the EV's smaller range, due to the battery technology as limiting factor. To qualify this factor's influence, we measure the consumer's average driving distance per day. We expect that many consumers have daily travel distances that exceed the feasible range of an average EV. This in return, would imply a rather low *operational compatibility.* Therefore, operational compatibility could pose a relevant adoption barrier for consumers.

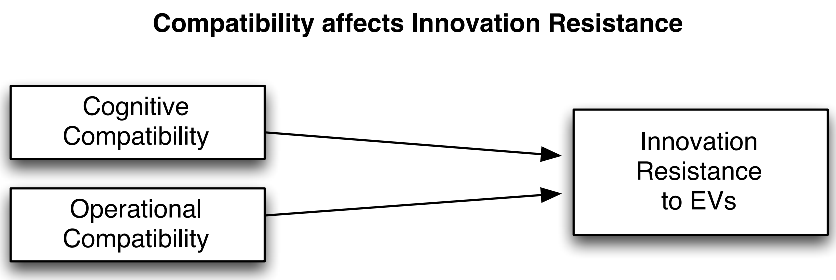

Figure 8: The Effect of Compatibility on Innovation Resistance

5.1.2 Relative Advantage

Relative advantage refers to the degree to which an innovation is perceived as being better than the idea it supersedes (Rogers, 2003). Although often cited as the most significant variable as adoption driver, "being better" is such a general notion that the measurement of relative advantage presents a lack of clarity (Sheth, 1981).

Relative advantage can express economic gains or cost savings compared to product substitutes (Ram, 1987). The costs saved can be either financial such as investment costs or social such as ridicule, ostracism, or exclusion from peer groups (Homans, 1961). An innovation could also provide improved performance at comparatively lower cost – in other words a superior value for money ratio. If the innovation provides only a minor relative advantage or even a relative disadvantage over existing substitutes, clearly, consumers have a higher innovation resistance (Rogers, 2003). In order to evaluate the EV's relative advantage we differentiate between economic-, functional- and social value.

Economic Value

Firstly, we examine the economic value of an EV including purchase price, maintenance and running cost. In comparison to ICEs, the up-front purchase price of electric cars is significantly higher due to the high cost of batteries. Maintenance and operating costs are, however, lower for EVs than ICE vehicles. A internal combustion engine has hundreds of moving parts that require oil, coolant and filter changes which leads to comparably high maintenance cost. In contrast, an electric motor will generally require one yearly check up to top off brake fluids and lubricate bearings (Chain, 2003). All in all, we expect only the high purchase price to pose a major adoption barrier.

Functional Value

The functional value contains technical and additional product features. Technical features include range, speed, acceleration and engine sound while additional product features include safety, design, size, model variety as well as environmental friendliness.

Technical features might be a barrier due to limitations in battery technology. Most people might hesitate to buy an EV because of the limited *range* of EVs. The average range of the Nissan Leaf, for instance, is 200km (Crowe, 2013). However, this might vary depending on driving conditions as well as weather condition. A very hot or cold climate has a negative impact on the battery capacity (Thomas, 2010). *Speed* could be another problem. On average electric cars drive 120-150 kilometres per hour (Crowe, 2013). Since most people enjoy driving fast, it is assumable that they will dislike the reduced speed limit. Speed might be compensated by the faster *acceleration* of EVs at least to some degree. Due to the relatively constant torque of an electric motor, acceleration is stronger and smoother than with comparable ICEs and therefore should not present a barrier (Wiedmann et al., 2011). Another barrier might be the non-existent *engine sound*. Similar to speed, engine sound is one of the core characteristics of a traditional car and thus people perceive it as an essential product feature. Furthermore, some may believe that the absence of engine noise poses a safety hazard to pedestrians particularly to the visually impaired (Thomas, 2010).
Additional features such as *safety, design* and *size* are also potential barriers towards adoption. In order to compensate for the heavy battery, car manufactures solely build compact electric cars. Especially for families the limited space in compact cars might present a barrier in their daily life. Apart from size, consumers also have to get used to a new *design*. Car manufactures differentiate their EVs from ICE vehicles by giving them a very futuristic look.

Many consumers have already expressed their dislikes in terms of "cheaper-look", "ugly" or "plastic toy car" (Ulk, 2009). Safety issues might be another concern of many consumers. This might result from the small size and the unfamiliarity of the battery technology.

Besides those, we expect the limited amount of *model variety* to be a major barrier. In contrast to ICE vehicles, consumers can only choose among a few models recently on the market. On the other side, *environmental friendliness* of EVs is the biggest advantage compared to ICE vehicles. Road transport contributes about one-fifth of the EU's total CO2 emission and has increased by around 23% between 1990 and 2010 (IEA, 2010). Due to its electric propulsion, EVs do not produce any emission and thus are a promising solution to reduce greenhouse gas emissions.

Social Value

Apart from functionality, cars have meaning or symbolic benefits. For some customers a car's ability to "make them what they want to be" is often more important than its functionality (Heffner et al. 2005). Therefore, we include the vehicle's image to determine whether the perceived social value of an EV is considered as a barrier towards adoption. It is however important to note that, the perceived image of an EV is highly dependent on a consumer's social context, which will be discussed in more depth in the risk section. In general, the image of an EV is positively associated with its low impact on environment. However, sometimes it can be perceived as potential liability when EVs are perceived as "too progressive" or representative for radical political views (Heffner et al., 2005).

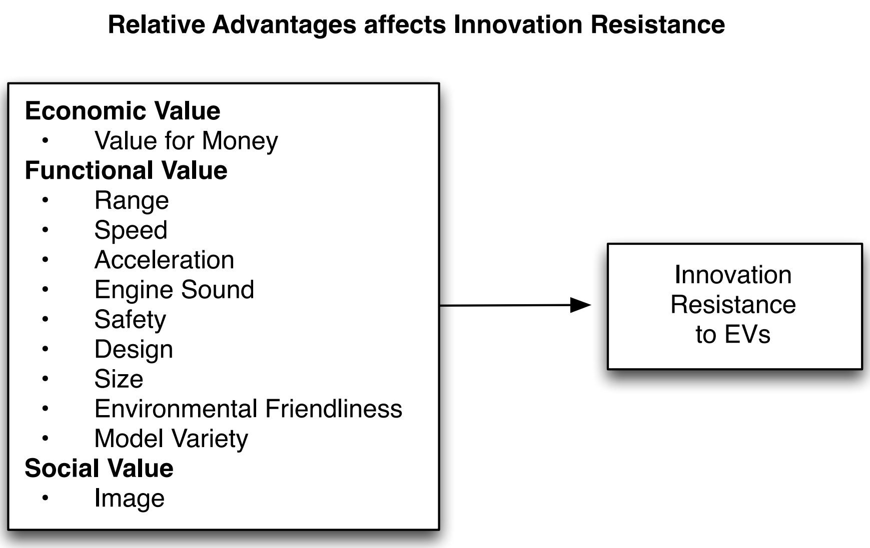

Figure 9: The Effect of Relative Advantage on Innovation Resistance

5.1.3 Risk

As stated before, resistance is also driven by the individually perceived risk towards an innovation. Consumers can experience uncertainties regarding performance, reliability and other relevant characteristics. Existing research defines several specific risk forms of which physical, economic, functional and social risk were identified as drivers of consumer resistance (e.g. Ram and Sheth, 1989; Wiedmann et al., 2011). In the following section different forms of risk and their impact on innovation resistance are discussed.

Physical Risk

Physical risk comprises the consumer's perception of potential damage to persons or property that the innovation might cause (Klerck and Sweeney, 2007). Physical risks associated with EVs are typically safety issues including electrical hazards and collision safety due to the absence of engine noise (Tsang et al., 2012). Although the absence of engine noise can be seen as a desirable feature, it is arguable that the low volume of engine sound poses a threat to the safety of pedestrians, particularly to the visually impaired (Thomas, 2010).

Financial Risk

Financial risk comprises uncertainties related to the cost of an innovation (Wiedmann et al., 2011). Within this innovation characteristic, we distinguish between uncertainty towards the market acceptance, initial investment and operating expenses of an EV.

Market Acceptance

As durable consumer goods EVs typically require a rather high initial investment. However, the innovation of e-mobility has not taken-off yet, which leaves alternatives propulsion technologies using bio fuel or hydrogen still as competing technologies. Thus, consumer might hesitate to make a relatively big investment for a technology that will not necessarily find market acceptance.

Purchase Price Development

Another financial risk is the uncertainty regarding the purchase price of EVs. The reason for the high initial price is due to the batteries. They are usually the most expensive component of EVs, being about half the retail cost of the car (Armand et al., 2008). This cost is likely to decrease in the future due to increasing returns to scale as well as advances in battery technology. As a consequence, consumers might postpone their purchase with the prospect of saving money. Additionally, governments might decide to foster EV attractiveness by expanding the amount of buying incentives during the next years. This is another factor that likely intensifies this uncertainty and could result in a postponement of the purchase.

Operating Cost Development

Besides initial investment uncertainties, individuals may perceive risk also towards the operating expenses of an EV. Although, the electricity price is currently lower than the gasoline, it is likely to increases steadily during the next years (IEA, 2010). The actual existence of a general tendency to avoid financial uncertainty can also be derived from empirical studies, which indicate that the majority of consumers require short payback periods for investments in fuel efficiency technologies (Greene et al., 2005, Santini and Vyas, 2005).

Functional Risk

The individual's uncertainty towards the performance of the innovation is defined as *functional risk*. For instance, consumers could be concerned that the innovation may not have been fully tested and, thus, may not function in a proper and reliable manner (Wiedmann et al., 2011).

Uncertainty related to the long-term functionality of the EV battery might be a functional risk. In specific, the battery capacity could decrease over time, which clearly determines an EV's driving range. Additionally, recharge time might increase after frequent usage (Turrentine, T.S. and Kurani, 2007). Closely related are risks regarding the necessary charging infrastructure expansion. Although a dense charging station network is crucial to compensate the EV's functional constraint (range), most areas lack this proper infrastructure. We expect this condition to be one fundamental adoption barrier. Additionally this perceived risk gets intensified through a vicious circle. Without charging stations, many consumers are not willing to purchase EVs, however without consumers reaching a critical mass, no energy suppliers invest in charging station businesses (Flynn, 2002). How soon this vicious circle will be overcome is still uncertain and, therefore, represents probably the key functional risk.

Social Risk

Social risk refers to the consumer's uncertainty about their social environment's (e.g. reference groups) approval of the adoption. Perceived disapproval or social isolation have a positive effect on innovation resistance.

The relevance of social risk in the context of EV is given, taking into consideration Golob et al.'s resarch (1997) that shows that cars can project a certain image of their owners. In the process of consumption stereotyping, other people interpret a vehicle's image and draw conclusions about its holder (Ligas, 2000). Individuals might hesitate to buy an EV, because they are concerned that other people perceive them as too progressive or as a green geek (Heffner et al., 2005). Nevertheless, we suppose that this uncertainty probably only pose a subordinate adoption barrier.

Time Risk

The *time risk* category expresses the consumer's concern that more time and effort has to be invested for adopting an innovation than previously assumed. Uncertainties can be related to the time necessary to search for the desired product as well as finally purchasing it (Mitchell, 1999).

In the context of EVs this might be of relevance. Even though, this innovation is only of technologic nature, automobile manufacturers create a new market by differentiating EVs from traditional ICE vehicles also in size and design. Accordingly, it might take consumers more time to get familiar with the category and its products. Until now only few companies equipped a popular ICE models with electric propulsion like the Smart Fortwo electric drive (Smart USA, 2013). Therefore, consumers might be concerned of a protracted purchase process. Another relevant uncertainty for the consumer is related to the amount of time required learning how to use the new product or technology (Mitchell, 1999). A necessary learning could be adapting to new functionalities like non-existing engine noise or the search costs to get familiar with the local or regional infrastructure of charging station. Although, we suppose that the time risk only poses a subordinate barrier.

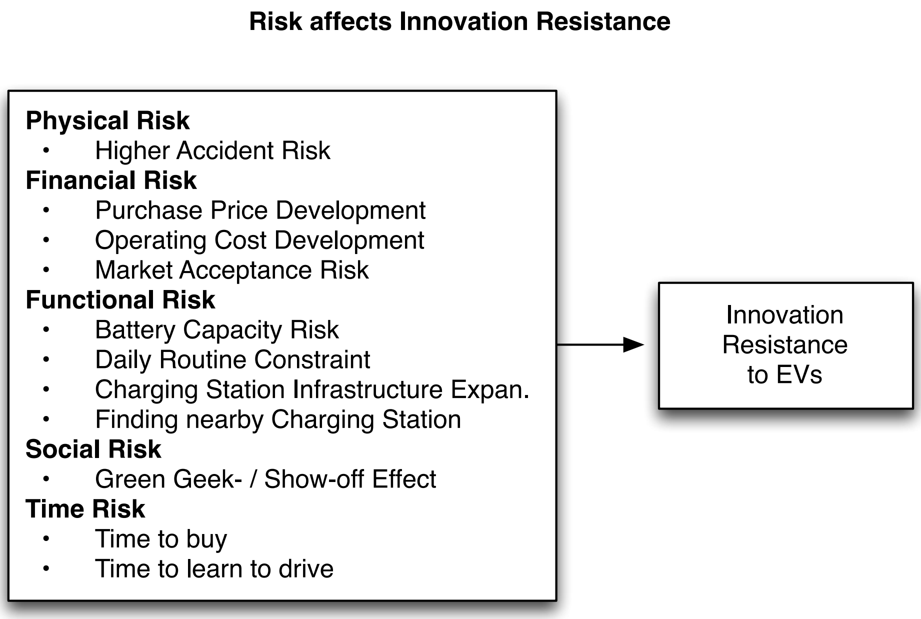

Figure 10: The Effect of Risk on Innovation Resistance

5.1.4 Complexity

Complexity is the degree to which an innovation is perceived as relatively difficult to understand and use. Perceived complexity positively affects adoption unless corrected for example by marketing efforts or interpersonal communications. Measures that are typically used to express complexity include difficulty of using and operating the innovation (for instance, the length of the operator's manual or special required skills) (Rogers and Shoemakers, 1971).

EVs are a technologic innovation and, therefore, consumers might be concerned they would not understand the product sufficiently enough for adoption. It is arguable that the impact of this effect is only of subordinate relevance, because traditional cars are also a complex technology. From a technological perspective, ICE vehicles are actually regarded even more sophisticated. However, considering the fact that consumers perceive novel technologies typically as less familiar and hence, rather complex, we belief that the effect of complexity is fairly applicable in the case of EVs.

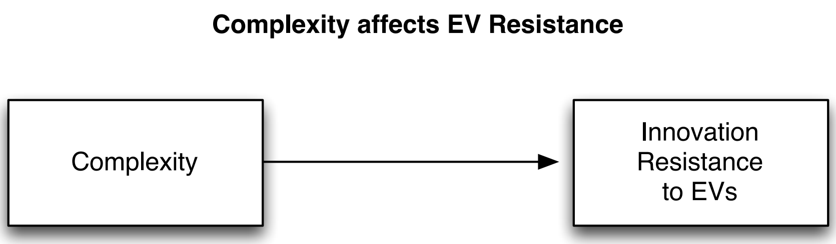

Figure 11: The Effect of Complexity on Innovation Resistance

5.1.5 Trialability

Trialability is the degree to which an innovation may be experimented with on a limited basis (Rogers, 2003). Innovations that can be tried are typically adopted more often and more quickly than less trialable innovations. The personal trying out is one way for an individual to give meaning to an innovation and to find out how it works under one's own conditions.

Test drives of cars always have been a common instrument to give potential buyers a better understanding of the product and its performance. Thus, the trialability of EVs is assumably high. In the context of this research, we want to refine Rogers (2003) definition of trialability. Instead of using it as simple innovation characteristic, we aim to measure the actual possibility for consumers to test-drive EVs. In fact, many car retailers do not sell EVs yet and thus do not offer test-drives.

In specific, when examining the actual possibility of product trial, we distinguish between active and passive product trials. The former are activities, that require the consumer's active intention to test, for instance test drives at a local car dealer and the latter as activities, where consumers get proactively encouraged to test, for example promotional activities. We expect that trialability poses a relevant adoption barrier.

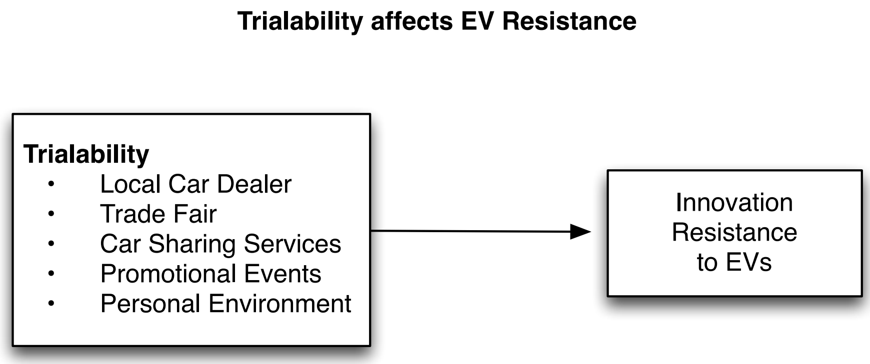

Figure 12: The Effect of Trialability on EV Perception

5.2 Consumer Characteristics

Whether a consumer perceives an innovation as favourable or unfavourable also depends on his or her attitudes, beliefs and values (Ram, 1987). For this research, we assess the influence of two consumer-specific characteristics, namely *car involvement* and *ecological consciousness.*

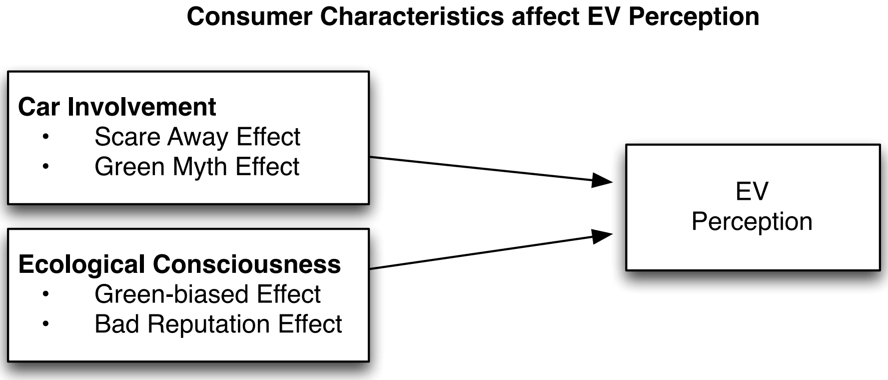

Figure 13: The Effect of Consumer Characteristics on EV Perception

5.2.1 Car Involvement

Car involvement describes the consumer's personal interest in cars and related technology trends. We assume that consumers expressing a high car involvement are more knowledgeable about EVs than the average consumer.

In their adoption research regarding natural gas vehicles, Wiedman et al. (2011) already conceptualized this psychographic variable with a moderating effect on innovation resistance. However, its actual impact is only implicitly supposed but not empirically examined. Therefore, the examination of *car involvement* may give relevant insights about its influence on innovation resistance. In this research we utilize this item to investigate to what extent missing knowledge regarding e-mobility makes consumers misperceive EVs, which could thereby also affect innovation resistance to a certain extent.

Scare Away Effect

Existing literature indicates that consumers have problems to grasp long-term monetary benefits of fuel-efficiency technologies (Tsang et. al, 2012). Applied to e-mobility, it is assumable that consumers also have difficulties to assess the economic value of an EV. Currently the purchase price of an EV is proportionally more than the price of an ICE vehicle. Proponents of the EV argue that over the EV's lifetime the higher initial costs are offset by the lower operating costs due to cheaper energy prices and lower maintenance cost (Auto Motor und Sport, 2012). Logically, it takes more time and effort to predict the break-even point of a certain EV model. Due to this higher complexity it is likely that consumers tend to assess car models mainly by comparing purchase prices instead. This can result in a rather misleading consumer perception of an EV's value for money ratio.

To address this issue we examine how consumers perceive the innovation characteristic value for money depending on their knowledge. We suppose that consumers with a low *car involvement* are also less aware of the value for money ratio of EVs and therefore perceive them more unfavourable than consumers with a high *car involvement.* This insight may help automobile firms to clarify the question whether a focus on informative communications may be an effective solution to overcome this adoption barrier.

Green Myth Effect

Clearly, the unique selling proposition of an EV derives from its clean propulsion. However, when including the process of electricity generation in the calculation of the carbon footprint, this argument does not necessarily hold true. For instance taking a look at the electricity mix of Germany in 2012, 56% of the gross electricity production is still based on fossil fuels (natural gas, black- and brown coal) (Agentur für erneuerbare Energie, 2012). In addition, current research emphasizes that half of the lifetime carbon-dioxide emissions from an EV come from the energy used to produce the car. Especially the battery production produces a great amount of CO_2 emissions. By contrast, the production of a gas-powered car accounts for 17% of its lifetime carbon-dioxide emissions (Lomborg, 2013). Disposal or recycling of the battery adds additional emissions to the balance. Hence, the overall carbon footprint of an EV is yet far away from the zero emission image most of the consumers do have. One could argue that in contrast to the ordinary early adopters of cars, highly involved consumers are aware of this eco-bias and postpone or reject the adoption of an EV. Therefore, we expect that involved consumers are more aware about the actual state of eco-friendliness of EVs and likely perceive it as less advantageous than non-involved consumers.

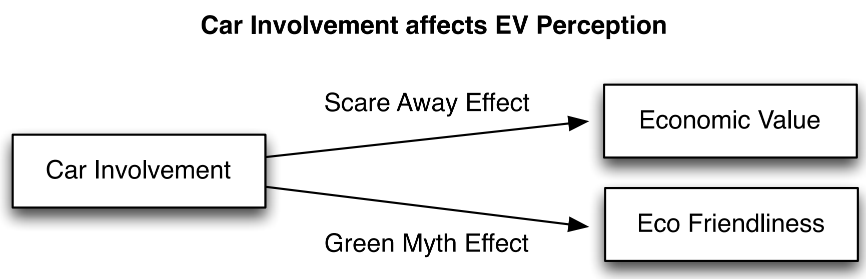

Figure 14: The Effect of Car Involvement on EV Perception

5.2.2 Ecological Consciousness

Furthermore, we utilize *ecological consciousness* as driver of EV perception. *Ecological consciousness* can be defined as a consumer's personal desire for eco-friendly products and sustainable behaviour in general. Clearly, individuals who have a specific concern for environmental issues are more likely to behave environmental friendly i.e. consuming fewer natural resources or reducing their ecological footprint (Tanner and Kast, 2003; Heffner et al., 2007). We are interested in two relevant effects, namely the green-biased effect and the bad reputation effect.

Green-biased Effect

Clearly, eco-conscious consumers are likely to value product features like the EV's ecological friendliness or its green image more than those who are not. More interesting is probably the question whether green consumers are biased in their perception of the EVs advantageousness for its non-green product features. We suppose that eco-conscious consumers perceive the product features of an EV more benevolent than those who are not and hence expect that ecological consciousness has a positive affect on relative advantage.

Bad Reputation Effect

Furthermore we examine whether consumer's perceived image (cognitive compatibility) towards EVs is driven by ecological consciousness. In general, we expect consumers who value eco-friendly products and behave sustainably to have a positive opinion towards EVs. However, there might be some who describe themselves as eco- conscious but who have a rather negative opinion towards EV. This might come from the initial high cost, uncertainties in technology developments or the slow expansion of the charging infrastructure. In order to develop effective communication and promotion strategies, it is important to know how consumers feel and think about EVs. For instance, green-minded consumers with a negative image of EVs would not be attracted by marketing strategies that emphasize its green quality as unique selling proposition. More promising would be to provide information that reduces consumers' fears and uncertainties.

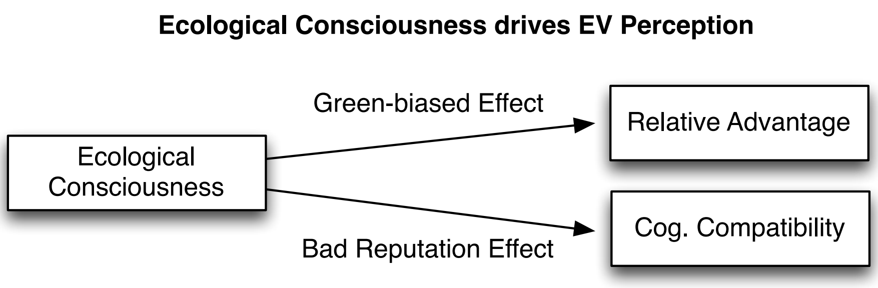

Figure 15. The Effect of Ecological Consciousness on EV Perception

5.3 EV Exposure

Ram (1987) and Rogers (2003) state that exposure can help to lower resistance. Per definition a consumer can get exposed through direct contact with the innovation or information through one or more communication channels. The logic behind this is that exposed consumers have more information available and thus can evaluate an innovation in a more profound manner (Ram, 1987). Subsequently, they are less resistant towards the innovation compared to non-exposed consumers.

In this research we examine if Ram's notion of innovation exposure (1987) is also applicable to the case of EVs. We raise the question whether a potentially low innovation exposure might be an explanation for the currently existent consumer resistance towards EVs. Therefore, we hypothesize *EV Exposure* as driver of *EV Perception* in our conceptualization. In specific, we expect that *relative advantage* and *cognitive compatibility* to be positively affected by *EV Exposure.* In the following section, we are going to evaluate this effect in detail by examining the mass media and reference groups as the two exposure drivers.

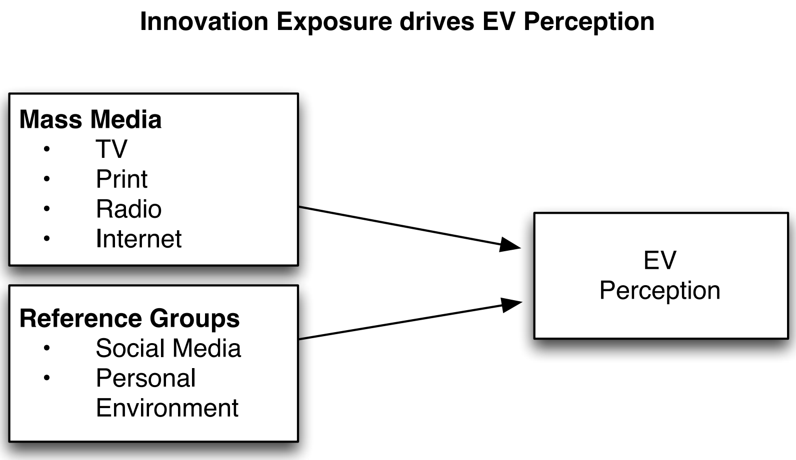

Figure 16: The Effect of EV Exposure on EV Perception

The Informing Effect

At the early stages of the life of an innovation, mass media is a powerful communication method in order to increase awareness (Ram, 1989). Especially, *TV, print, radio* and *Internet* are useful means to demonstrate positive features of new products (Rogers, 2003).

The EV is in the early stage of the innovation process and therefore we expect high media coverage through mass media. By providing valuable information regarding EVs and related topics, consumers will obtain a better understanding of product features and consequently better evaluate the relative advantage.

We therefore assume that the more information is provided by mass media the better the EV perception.

According to Rogers (2003) mass media channels are relatively more important at the knowledge stage and interpersonal channels are relatively more important at the persuasion stage in the innovation decision process. Persuasion occurs when an individual forms favourable or unfavourable attitude towards the innovation. At this stage interpersonal and interactive communication becomes very important since the individual seeks social reinforcement from others that share his or her attitudes toward the innovation (Rogers, 2003). The interaction among people can either be personal through direct contact with other people or impersonal trough virtual communities and networks. We therefore distinguish between *personal environment* and *social media*. Both channels are considered powerful mediums because they provide information, which is perceived as more reliable and trustworthy than information from formal sources (Kaplan et al., 2010).
The perceived newness of an EV and the uncertainty associated with this newness requires information seeking and processing to reduce uncertainties about the advantages and disadvantages of an innovation.
We expect the more information is exchanged the better the perception towards EVs. In particular, we assume that frequent exchange of information will increase the individuals' knowledge, which in turn enables them to better evaluate the relative advantage of electric cars.

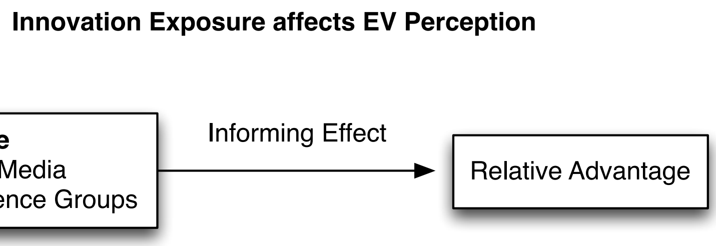

Figure 17: The Effect of EV Exposure on EV Perception

The Bad Publicity Effect

In order to create initial knowledge mass media is the most effective channel to push information out into the market. However, the challenge is to deliver the right message at the right time to the right audience. Clearly, more information is not always better. It also depends on the tone of the media coverage. Negative media coverage, for instance, can induce negative image perception of innovations (Rogers, 2003). When collecting preliminary data for this research, we experienced a rather negatively connoted media coverage regarding EVs and e-mobility. According to Christian Marcus of Tesla Motors (Green Vehicle Days, 2013), negative reporting is also prevalent in Denmark, which results in the impression that EVs perform poorly. Additionally, the news about the bankruptcy of the e-mobility business Better Place might intensify the consumer's impression (Green Vehicle Days, 2013). The consumer's reference groups might additionally enhance this effect.

Thus, we are interested if a bad publicity effect is existent in the case of EVs. To do so, we measure whether *EV exposure* has a negative effect on *EV perception*. If this hypothesis holds true this would be contrary to Ram's research (1987) that claims a positive effect of exposure on innovation perception.

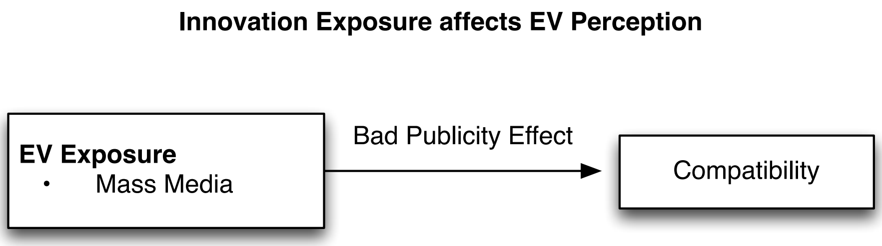

Figure 18: The Effect of EV Exposure on EV Perception

5.4 Buying Incentives

So far we introduced the effect of consumer characteristics and the influence of innovation exposure. This chapter introduces buying incentives as our third driver of *EV perception*.
Buying incentives are market specific benefits usually introduced by a government or other decision makers to enhance the EVs' *economic* or *functional value* (*relative advantage*)
At present, European governments follow rather distinct policies to foster electric mobility, which leads to a differing EV attractiveness from market to market. This research examines to what extend these incentives influence the consumer's perception of an EV's *relative advantage.* This will help to draw conclusions about the actual effectiveness of instruments to promote e-mobility. To do so we survey consumers from markets with different sets of EV incentives, namely Germany, Sweden, Denmark, and Norway.

Norway sees itself as a leader in the arena of climate change initiatives and therefore has early introduced buying incentives for EVs to increase their sales. Today, Norway has the highest per capita rate of EVs and offers many different buying incentives.

Denmark also takes a leading role in reducing CO2 by promoting the use of electric cars (Ulk et al, 2009)). In contrast to Norway, it has a rather moderate amount of EV incentives but besides Japan the highest purchase price subsidies worldwide (Gärling, and Thøgersen, 2001). Additionally, due to its high proportion of renewable (wind) energy, the country of Denmark is seen as an appropriate market for EVs and currently a considerable amount of money is invested into the establishment of a widespread network of EV charging infrastructure (IEA, 2012).

Similar to Denmark, Sweden has a high share of renewable energy and thus seems to be an attractive market for electric cars (Gärling, and Thøgersen, 2001). However, compared to its neighbour countries, the number of EVs per capita is the lowest. One reason for this phenomenon might be missing buying incentives. Until now only marginal subsidizes for EV purchase exist.

Germany, well known for its automobile industry, does not offer substantial EV incentives to consumers. However, the government has been investing more than one billion Euros in the national automobile sector to e-mobility innovation (IEA, 2010).

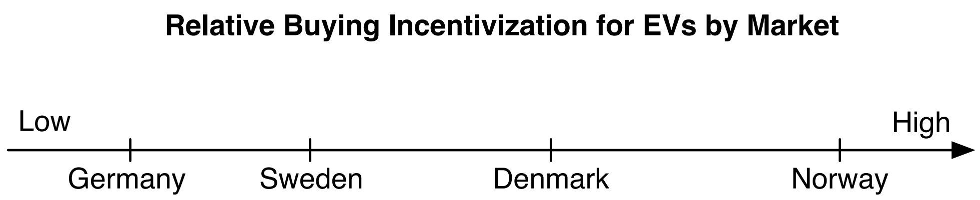

Figure 19: Relative Buying Incentivization

The following paragraph gives an overview of the different markets, to provide the reader with a profound understanding of the applied incentives to promote e-mobility. The EV related incentives are separated into monetary-, functional-, and indirect incentives.

5.4.1 Monetary Benefits

Monetary benefits are all incentives that affect the economic value of an EV. The most common instrument are purchase price benefits.

Purchase Price Benefits

In the context of EVs purchase price benefits typically takes place in form of exemption of the value added tax (VAT) or a market specific registration fee, which can account for a major share of the overall initial investment. Especially in Scandinavia vehicles are subject to a number of taxes based on different measures, such as the vehicles price, weight, or fuel consumption. Because of rather high vehicle taxes in Norway and Denmark, tax exemption for low carbon emitting vehicles is particularly important. In Denmark, for example the vehicle registration tax (VRT) is based on the car's price. It is set at 105% of the vehicle's price for vehicles priced up to DKK 79,000 and 180 times the price of the vehicle for vehicles priced over DKK 79,000 (Skatteministeriet [Danish Ministry of Taxation], 2010). EVs and hydrogen-powered vehicles, weighing under 2000 kilograms/2 tons are exempt from registration tax, currently until 2018.The Swedish government also promotes efficient and environmental friendly cars through tax exemption. They offer up to 4,680 Euro for private users and a 35% deduction of the initial purchase price for businesses (European Parliament, 2011). In Germany no subsidies for purchase on EVs exist so far.

Operating Cost Benefits

Another economic incentive is the exemption of operating expenses as for instance the car tax. This is a common incentive, which is applied in nearly all of our target markets. EV owners in Germany, Sweden and Denmark are exempt from car tax for at least five years (European Parliament, 2011). In Norway EV owners do not have to pay the annual road tax, which vary by vehicle classification but amounts on average to 2940 NOK (IEA, 2010). Compared to purchase price incentives this instrument only has a rather moderate monetary impact. Furthermore, consumers can also benefit from two other incentives namely free battery charging and free parking. The former, however, is currently only deployed in Norway, while the latter is also available in Denmark. In Oslo and Copenhagen, EVs can park for free in zones where other vehicles have to pay as long as they have a valid free parking licence (Gronnbil, 2012,).

To examine the effect of the market specific monetary effects we examine the consumer perception of the EV's economic value by nationality. We assume that existent monetary incentives lead to a more favourable perception of the EV's economic value

5.4.2 Functional Benefits

Besides monetary incentives, governments also try to increase the attractiveness of EVs by providing their users with functional benefits. Non-monetary initiatives aim at making EVs easy to use for the general public, increasing their visibility, and gathering information about how EVs are and could be used in practice (Tsang et al., 2012).

Charging Stations

Currently, most markets lack a proper network of charging stations, because EVs represent only a small niche market so far. By investing in the expansion of the charging infrastructure, governments can provide additional value to the consumer and thereby overcome the EV's rather small range. Nevertheless, until today only the Norwegian government invests heavily in the network expansion operating more than 4,156 charging stations (as at October 2012) (Gronnbil. 2012). The remaining markets considered in this research do not follow a similar approach on a relevant scale.

For the purpose of this research, we are interested if public investments in the charging station infrastructure can lead to a more favourable consumer perception towards EVs. In specific, we expect Norwegian consumers to evaluate *range* as comparably less disadvantageous. Moreover, we assume that the uncertainty regarding a future expansion of the charging station network as well as the risk of not finding a nearby charging station when travelling is sensed as less relevant.

Parking Space and Bus Lanes

Another way to provide the consumer with additional value can be parking space exclusively for drivers of EVs. Currently, only Sweden deploys dedicated parking space in Stockholm (IEA, 2013). Another functional benefit is the permission for EVs to use bus or taxi lanes, which is currently conducted only in Norway (Gronnbil. 2012).

With regards to our conceptualization, these incentives will be hardly measurable in any of the defined innovation characteristics within *EV perception*. Therefore, we evaluate the consumer preference regarding these instruments (See section 5.4.4 Consumer Preference of Buying Incentives).

5.4.3 Indirect Benefits

The last category of EV incentives comprises instruments that make ICE vehicles and their ownership more costly. For instance low-emission-zones are typically introduced in agglomeration areas to keep noisy and non eco-friendly vehicles away. Currently, these zones are present in all of our target markets, although they apply only for busses and trucks in the Scandinavian countries. Only Germany has a low-emission-zone that applies for all kind of vehicles (Bundesministerium für Umwelt, 2012). Furthermore, a stricter regulation of CO2 emission for ICE vehicles likely influences the attractiveness of EVs positively.

With regards to our framework, indirect benefits will be hardly measurable in any of the defined innovation characteristics within *EV perception*. Therefore, we evaluate the consumer preference regarding these instruments (See section 5.4.4 Consumer Preference of Buying Incentives).

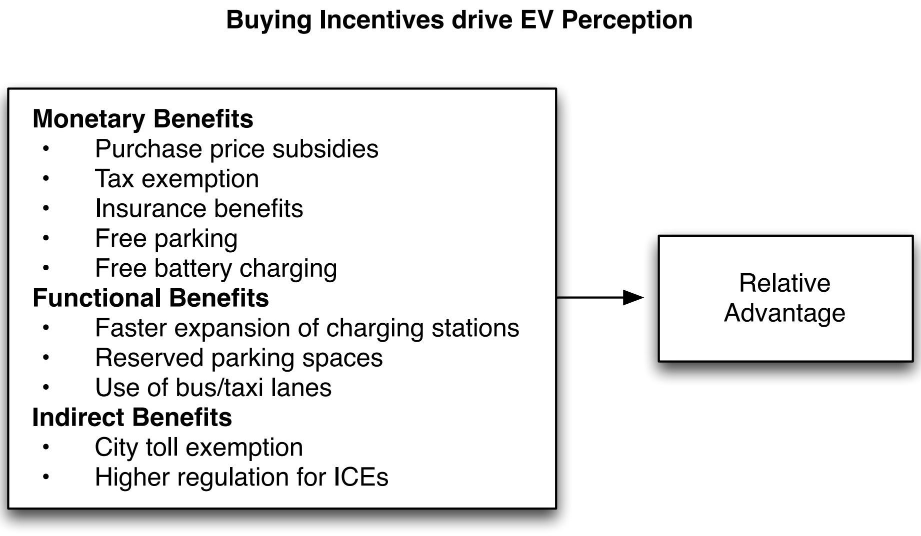

Figure 20: The Effect of Buying Incentives on EV Perception

5.4.4 Consumer Preferences

Besides the link between buying incentives and EV perception, relatively little is known about to what extent consumer actually value these instruments. For instance, certain incentives could be fairly cost-intensive to implement and maintain, but practically ineffective, because consumers hardly value them. Therefore, we are interested in the actual consumer preference regarding EV buying incentives. To do so, we provide participants with an overview of all defined incentives and let them evaluate each instrument with regards to their personal benefit. The insights generated may be of special interest for governments and decision makers in two ways. Firstly, if a market plans to introduce instruments to increase the EV's general attractiveness, these data can help to assess incentives not only by their costs for the government, but also by the perceived benefit of the consumer. Secondly, incentives already deployed in certain markets can be critically re-assessed with regards to their effectiveness.

Buying Incentives		Norway	Sweden	Denmark	Germany
Monetary Benefits	Subsidies for Purchase	✓	✓	✓	
	Car Tax Exemption		✓	✓	✓
	Free Battery Charging	✓			
	Free Parking	✓		✓	
Functional Benefits	Dense Charging Station Network	✓			
	Parking Space		✓		
	Bus Lanes	✓			
Indirect Benefits	Low-Emission-Zones				✓
	CO2 Regulations	✓	✓	✓	✓

Table 2: Overview of the current Buying Incentives by Market (August 2013)

6. Analysis and Discussion

6.1 EV Perception

6.1.1 Compatibility

As previously stated in the theoretical framework we utilize Rogers innovation characteristic compatibility to measure to what degree EVs are perceived as being consistent with existing values, past experiences, practices and needs of the consumer (Rogers and Shoemakers, 1971).

First, we asked participants regarding their opinion towards EVs and e-mobility in general to assess cognitive compatibility (Question 1). The outcome of our research suggests a relatively high cognitive compatibility. More than three out of four participants indicated a positive opinion towards EVs (76%). Of the remaining quarter only 6% indicated a negative opinion, while the rest indicated to be neutral (18%).

Secondly, we measured whether the individual consumption pattern is compatible with the usage restriction of EVs (operational compatibility). We defined that the range is the only product feature that significantly differs from ICEs. Therefore, we asked consumers for the average distance they typically drive per day (Question 3). Contrary to our expectations, operational compatibility can be considered comparably high. The majority of consumer's average daily driving distance is compatible with range of an average EV with over two third of the participants indicating a daily driving distance of 50km or less (71%). Additionally, one quarter indicates to travel 51 – 150km per day, which is still within the possible driving range of many EV models (25%). Only a minority of the consumers surveyed, indicated to travel more than 150km a day (4%).

This result is surprising, because we expected more consumers to regularly to middle or long travelling. The operationalization of this item in the survey could help to explain these results to a certain degree. We asked participants to state their average distance they go by car on an average day. Thereby, we likely left out consumers with a high variation in their driving routines. That means that occasional peaks in the usage pattern like for instance using the car to reach the holiday destination were not covered.

6.1.2 Relative Advantage

To assess the innovation characteristic *relative advantage*, we compare economic, functional, social value of EVs to ICE vehicles. In order to evaluate how consumers perceive the advantageousness of EVs, we let participants rate their functionality in relation to traditional vehicles (Question 2).

Economic Value

When it comes to the evaluation of *value for money*, there is a slight tendency towards a negative perception. Almost half of the respondent (48%) rates the value for money as disadvantageous compared to traditional cars. In contrast, 25% of our respondents state the opposite. The slightly negative perception might be due to several reasons. Either, those who perceive the EV as low value for money might be more price-sensitive than the rest of the respondent. Or they are simply not aware of potential savings due to lower cost and buying incentives.

Functional Value

In general, consumers rate the functional product features as partially comparable (e.g. acceleration) or rather disadvantageous (e.g. speed and range) compared to conventional cars. As supposed, the EV's range is rated the most disadvantageous functional feature (79%).

In general, the number of kilometres reached by an EV is not only dependent on the battery capacity but also the driving condition. Since a fast driving style shortens range, it is not surprising that 48% evaluated speed as the EV's second weakest point.

More surprisingly, however, is the relatively bad perception of acceleration (30%). In fact, the constant torque of electric motors tends to increase the acceleration performance of an EV relative to that of the same rated motor power ICE. This outcome could be explained by a consumer's lack of relevant knowledge regarding acceleration.

Regarding engine sound, more respondents (61%) perceive it as a benefit. However, the variance is quite high (1,92) which implies that there is no clear tendency towards one option. One explanation for this outcome is that the perception of the missing engine sound is very subjective. For those who perceive it as a shortcoming, the missing engine sound entails a risk for pedestrians and cyclist. For the others (31%) the missing engine sound means a reduction in noise and is therefore perceived as favourable. Clearly, this contrary consumer preference poses a challenge for car manufactures.

Additional features including safety, design and size are assessed as comparable to traditional cars. As we assumed, consumer rate design and size as slightly "disadvantageous", which might be due to the smaller size and "different-look" of EVs. This finding is consistent with Ulk's study where one of the early adopters of EVs mentioned that a commonly held belief among non-EV owners was that EVs were slower than conventional vehicles and ugly, looking much like plastic toy cars (Ulk et al., 2009). Car manufactures try indeed to establish a new segment of electric cars by giving them a more futuristic look such as the i3 from BMW. Because many people are not used to this "new-look" they might observe it as somewhat unfavourable.

Although several reports by the European Commission (2010) outlined potential safety concern, our research results cannot confirm this outcome 73% perceive the EV's safety as comparable and even 18% rate it as advantageous compared to ICEs. The reason why our results are rather positive could be let back to the established safety standards by the EU last year as well as due to recent developments in safer battery technology (Tang et al., 2012).

Consistent with our assumption, the majority of respondents (86%) rates model variety as biggest problem. Interestingly, even before range. Consumers are used to choose among a wide variety of ICE vehicles and therefore might dislike the limited amount of EV models available.

Social Value

In general, our results reveal a positive image towards electric cars. This favourable perception could be derived from the green image that most people probably associate with them. As mentioned before image is very context specific and therefore means different things to different people. The majority (66%) has a positive perception towards EVs, which can be explained by their environmental friendliness. The others have either a comparable (21%) or rather unfavourable (12%) opinion, which might result from high cost, limited range and speed, or uncertainties about future developments concerning EV infrastructure. It is a matter of effective marketing strategies to change the perception in a favourable manner by delivering the right message.

6.1.3 Risk

As third primary driver of EV resistance we conceptualized the innovation characteristic risk. Due to the various uncertainties related to EVs and e-mobility in general, this driver is divided in different forms of risks (Question 7).

Physical Risk

Physical risk comprises the consumer's perception of potential damage to persons or property, which the innovation might cause (Klerck and Sweeney, 2007). In the context of this research we identified the non-existent engine sound, as the potential risk consumers are likely to feel anxious about. Consumers could expect a higher accident risk, because EVs are more difficult to notice by other traffic participants like pedestrians or bikers.

The result of the physical risk assessment is relatively widespread and therefore rather ambiguous (Variance: 1,46). Nearly half of the participants state that the missing engine sound has no substantial relevance for them (48%). A third, on the other side, actually does perceive it as potential safety threat (32%).

Financial Risk

In this research we differentiate between three financial uncertainties regarding EVs. Firstly, we are interested in the *market acceptance* risk. Until now it is still uncertain when e-mobility will gain full market acceptance. Thus, consumers might hesitate to make a investment for a technology that might not prevail on the market. Like other risks related to EVs, the results of this research show two equal groups with oppositional perception. On the one hand 40%

perceive this potential pitfall as relevant, while on the other hand more than 36% state that this risk has not a significant relevance in their purchase decision.
Secondly, uncertainties regarding the purchase price development of EVs. Due to battery technology progress prices are likely to decline continuously in the near future. This foreseeable development is also reflected in our research outcome. Almost every second consumer considers buying a potentially “overpriced” EV as relevant risk (48%). Interestingly, 30% of the participants indicate no explicit opinion concerning this uncertainty, which could be explained by a lack of knowledge.
Third, we assessed perceived uncertainties regarding the development of an EV’s operating cost. Due to many external factors electricity prices may increase during the next years and therefore reduce the economic value to a certain degree. However, against our expectations only 16% of the consumers surveyed for this research consider this uncertainty a relevant factor for the purchase of an EV. More than half even consider it an explicitly irrelevant concern (55%). This outcome could be explained by the still significant price difference between fuel and electricity, which makes the latter seem as a rather irrelevant cost driver for the consumer.

Functional Risk

In this research we examined the relevance of three uncertainties regarding the functionality of an EV. As previously described, the long-term usage of the battery might negatively affect its capacity over time and therefore reduce the vehicle’s range. In contrast to our expectations, this functionality risk seems to be of major relevance for the consumer, being ranked as the third most relevant risk. Around 60% of the participants expressed the concern regarding the long-term functionality of EV batteries to be relevant. This might be partly due by the consumer’s familiarity with similar problems in the context of electronic consumer goods like smart phones or laptops.
Second, uncertainties regarding the EV usage in daily life. Consumers might feel anxious that they misjudge the relatively long charging time (pre-purchase) and then experience a higher flexibility constraint than expected (post-purchase). Interestingly, more than 54% of the participants see this risk as relevant if purchasing an EV.
The third risk examined is not directly EV-related, but towards its complementary infrastructure. Currently, most markets lack a sufficient infrastructure of publicly available charging stations. The time necessary to build it up is still hardly foreseeable due to the vicious circle explained in the theoretical framework. As expected, this functional uncertainty

poses of the key risks related to EVs. More than 78% of the consumers surveyed confirm its relevance.

Social Risk

In the context of EVs we were interested whether social risks are relevant for consumers. Potential buyers of EVs could be afraid that other people would consider them as too progressive or showy. However, the results of our survey show this potential risk as rather negligible, as it shows the lowest value of all risks examined. Over 80 % percent of the consumers interviewed stated that it would have no relevance if buying an EV.

It is possible that consumers either do not admit the existence of a potential social risk or EVs are just perceived positively in every respect.

Time Risk

We examined two effects with relation to time risk. As automobile manufacturers try to create a whole new market by differentiating EVs also by size and design, it gets more complex for the consumer to get familiar with the new models available. Therefore, consumers could fear a protracted and complex purchase process. The outcome of this risk measurement is rather widespread. While 37% attributing no relevance to it, then again the same amount of participants has issues to grasp this risk at all (37%). This could be explained by the fact that most consumers are actually not considering to buy an EV and therefore have problems to estimate potential search costs.

Furthermore, we were interested in time risks with regards to driving an EV. Clearly, EVs are rather comparable in their driving characteristics, but unaware consumers might anyhow be concerned about adapting to it. Learning how to drive an EV or getting familiar with the local or regional charging station infrastructure might take more time than they are willing to spent. However, we expected this effect only to be of minor relevance in this context. The results of this time risk assessment confirm this presumption. Only 10% of the consumers surveyed indicated this effect as relevant. On the other hand two third attributes the learning risk as not relevant in their purchase decision (66%).

6.1.4 Complexity

We defined complexity as an indirect driver of resistance. We argued the higher the perceived complexity, the lower the relative advantage, which in turn increases resistance. Apart from theory, it is logical reasoning that consumers having difficulties to understand or use a product are less likely to buy it.

In order to evaluate the innovation characteristic *complexity*, we asked consumers whether they have difficulties to understand the concept of EVs and e-mobility in general (Question 4). Other than expected two third of the participants stated to have no problems to understand the innovation. This result is kind of questionable as we previously found out that a lack of knowledge exist. One possible explanation might be that consumers do not want to admit that they have problems or are simply not aware about it.

In addition, we were interested whether consumers might be concerned to have problems to be able to drive an EV (Question 5). Again, 72% disagreed with the statement from which the majority even strongly disagreed. This outcome is reasonable because it is in fact easier to drive an EV than ICEV due to the missing gearshift. We therefore conclude that consumers perceive EVs as a hardly complex innovation.

6.1.5 Trialability

Trialability is the degree to which an innovation may be experimented with on a limited basis (Rogers, 2003). To evaluate the *trialability* of EVs, we measured the possibility of product test offerings. In specific, consumers were asked to rate actual possibility (convenience) to test EVs (Question 6). Among all alternatives, product testing in the context of *promotional events* is perceived as least difficult (33%) followed by *car sharing services* (42%), *trade fair* (43%), *local car dealer* (52%) and *personal environment* (67%). Interesting to note is that those possibilities to test EVs classified as passive (e.g. promotional events or car sharing) are perceived as less difficult than those where the consumer has to become active (e.g. local car dealer). Especially the high-perceived difficulty to test-drive an EV at the local car dealer is alarming. When considering an EV purchase, the local car dealer should be the first option to go to for a test drive. One possible explanation for this outcome might be that the majority are not planning to buy an EV in the near future and thus find testing an EV as rather irrelevant. This would also explain why passive alternatives, where consumers accidently come in contact with EVs, received more votes than active ones. Overall, our results implicate a rather low trialability of EVs, as consumers perceive the general possibility of product trial as rather difficult.

Innovation Characteristics	EV Perception		
	Low	Middle	High
Compatibility			
– Cognitive			✔
– Operational			✔
Relative Advantage			
– Economic Value		✔	
– Functional Value		✔	
– Social Value			✔
Risk			
– Physical		✔	
– Financial		✔	
– Functional			✔
– Social	✔		
– Time	✔		
Complexity	✔		
Trialability		✔	

Table 3: Results of EV Perception

6.2 Innovation Resistance towards EVs

The previous section gives a comprehensive insight of the consumer's basic perception of EVs. The results of this analysis revealed that consumers rate certain EV characteristics as beneficial while others as detrimental.

The following part tries to give a better understanding of which innovation characteristics actually cause consumers to *reject* the adoption of an EV. Existing research describes these characteristics as adoption barriers (Ram, 1989). To do so, we examine the innovation resistance towards EVs by measuring the consumer's willingness to purchase an EV.

The results of our research reveal that more than half of the respondents (65%) do not consider buying an EV in the near future. We categorize this share of innovation rejecters as resistant. Contrary to this, 17% actually do consider the purchase of an EV under the current circumstances. We categorize these (potential) adopters as non-resistant towards EVs. In addition, 18% of the consumers surveyed consider themselves as undecided regarding an EV purchase. We interpret this as behaviour of passive resistance (inertia), where consumers have never consciously considered buying an EV at all.

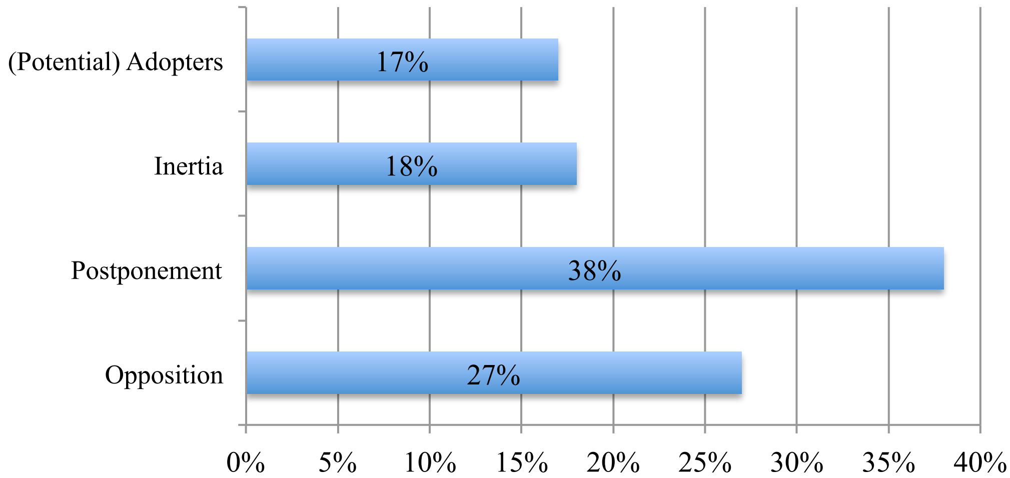

Figure 21: Innovation Resistance towards EVs

Innovation Resistance by Market

Additionally, we analyse the innovation resistance towards EVs by nationality to assess if market-specific patterns of resistance do exist. Figure 22 provides an overview of innovation resistance by market. The results show several interesting facts. For instance Danish consumers have the highest share of oppositional consumers (40 %). This could be explained by the fact that many of our Danish participants (Young and from the Metropolitan area of Copenhagen) do not consider to buy a car at all anyway. Sweden and Germany has the highest share of "*postponers*". Clearly, they might wait for buying incentives to be introduced. Furthermore, among the Swedish consumers is the highest share of potential adopters. This could be explained through the survey's participants of the Green Vehicle Days 2013 in Malmö, Sweden where several (potential) EV owner attended.

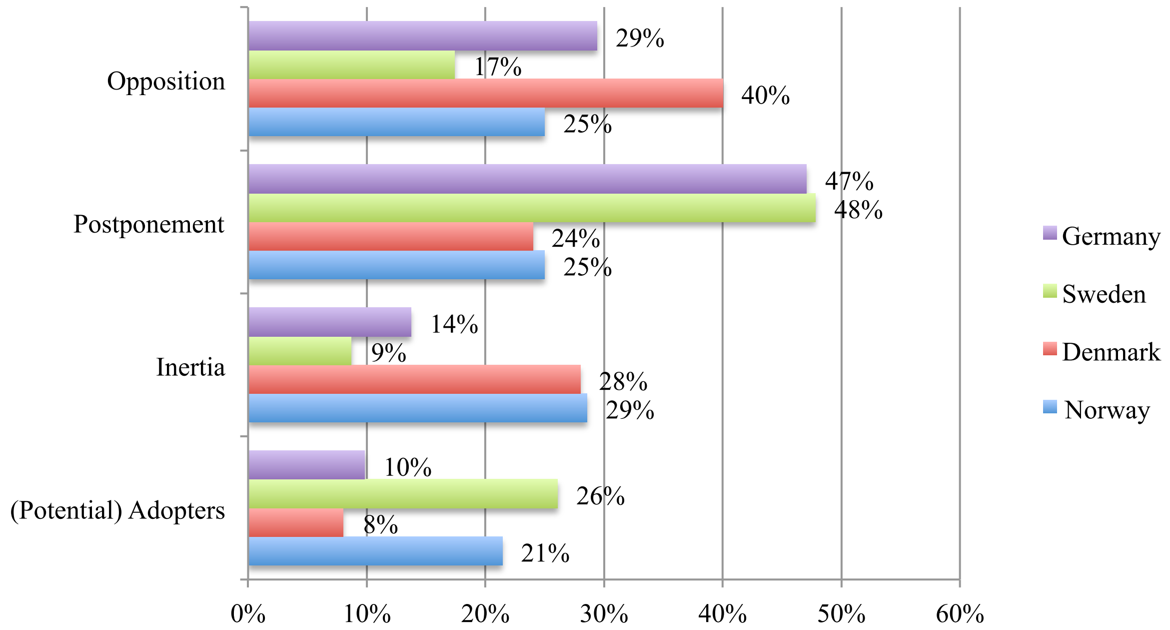

Figure 22: Innovation Resistance towards EVs by Market

6.3 Adoption Barriers

The previous section gave a comprehensive insight of the consumer's essential EV perception. The analysis revealed that consumers rate certain characteristics as beneficial while others as detrimental. The following part aims to give a better understanding of those innovation characteristics that actually cause the consumer to resist an EV. Existing research describes these characteristics as adoption barriers (Ram, 1989). Therefore, the sample utilized in this section comprises only those participants that indicate either *postponement* or *opposition* (65%). We expect these consumers to have a different – likely more critical – perception of EVs compared to the overall sample of this research's survey. Per definition we classify an innovation characteristic as adoption barrier if more than 30% of the resistant consumers indicate it as disadvantageous.

6.3.1 Compatibility

The results show that more than one third of the resistant consumers state a negative opinion towards EVs (34%), whereas only 8% of the non-resistant consumers express a comparable attitude (*cognitive compatibility*). Thus, cognitive compatibility can be considered a relevant barrier.

Regarding *operational compatibility*, there is no significant difference between resistant and non-resistant consumers identifiable. Both groups show similar usage patterns of cars. Only four percent of the participants do long distances on a regular basis. The remaining participants usually drive less than 150km a day, which is within the range of an average EV when fully charged. Therefore, operational compatibility cannot be seen as relevant adoption barrier.

6.3.2 Relative Advantage

Functional Value

Range (81 %) and *model variety* (88 %) are perceived as major disadvantages of EVs and therefore pose relevant adoption barriers. This outcome is consistent with our previous findings, which show that both consumer groups have a fairly comparable perception.

This result is interesting, because it reveals a rather contradictory consumer perception. Typically consumers argue for the range as the major shortcoming of an EV as it limits ones mobility, although referring to our research the majority actually uses the car mainly for short or middle distance drives. One explanation could be that consumers value the fundamental freedom and possibility to go long distances, even though they rarely make actual use of it.

Furthermore, resistant consumers additionally evaluate *speed* (58%), *size* (42%) and *acceleration* (36%) as fairly disadvantageous compared to conventional cars, which makes them relevant adoption barriers.

Only a small share rates the remaining features *design (27%)* and *safety (11%)* as disadvantageous and therefore do not present barriers.

Economic Value

The assessment of the *economic value* of an EV appears to be another issue that was frequently mentioned among resistant consumers (55%). This outcome implies that consumer are not fully aware of potential savings due to lower operating cost and buying incentives. The high purchase price scares many consumers away and thus presents a major barrier towards EV adoption.

Social Value

Of the resistant consumers 17% perceive the image of EVs as disadvantageous, which is more compared to non-resistant consumers (6%) but still not enough to be classified as relevant adoption barriers.

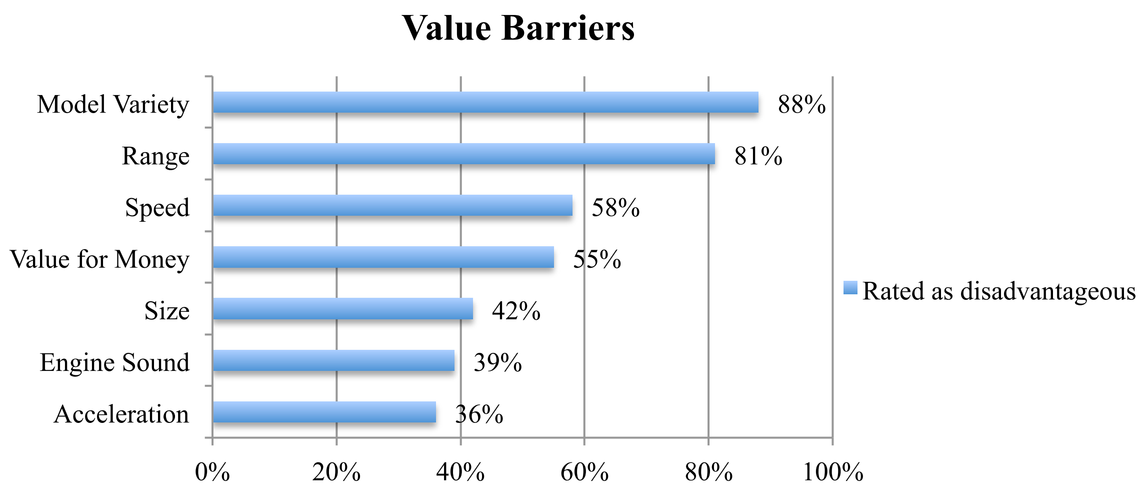

Figure 23: Identified Value Barriers

6.3.3 Risk

Overall, resistant consumers perceive almost every uncertainty higher than non-resistant consumers. Hence, resistant consumers can be generally considered more risk averse in the case of EVs.

The most relevant risks is the concern of not finding a nearby charging station when travelling (88%) and closely related the uncertainty regarding the future expansion of the charging station infrastructure (87%), which makes them the two most relevant adoption barriers. Interestingly, similar results can be found among consumers who are not resistant. Additionally, more than half of the resistant consumers (61%) are concerned that the EV *charging time* might constrain them more than expected in their daily routines. Therefore, this uncertainty can be classified as relevant adoption barrier. Among the non-resistant consumers this risk is notably lower (38%).

Another risk that was mentioned frequently is the uncertainty regarding the battery performance over time, which could lead to a potential range reduction (60%). This is consistent with the previous findings. Another concern frequently stated by resistant consumers is the perceived risk of doing a misinvestment when buying an EV. Half of them consider potential price drops in the next years a relevant risk (53%). Additionally, almost the same number of consumers are concerned the technology might never gain full market acceptance (48%). Hence, both risks can be considered as adoption barrier. Non-resistant consumers evaluate this risk is comparably lower (38% and 26% respectively).

The concern that more time might be needed to buy an EV or to learn how to use one is apparently not a relevant risk. It is however interesting to mention that non-resistant consumers perceive the time risk as more prevalent than their counterparts. This could be explained buy a couple of consumers that currently are engaged in a rather protracted buying process or already experienced it.

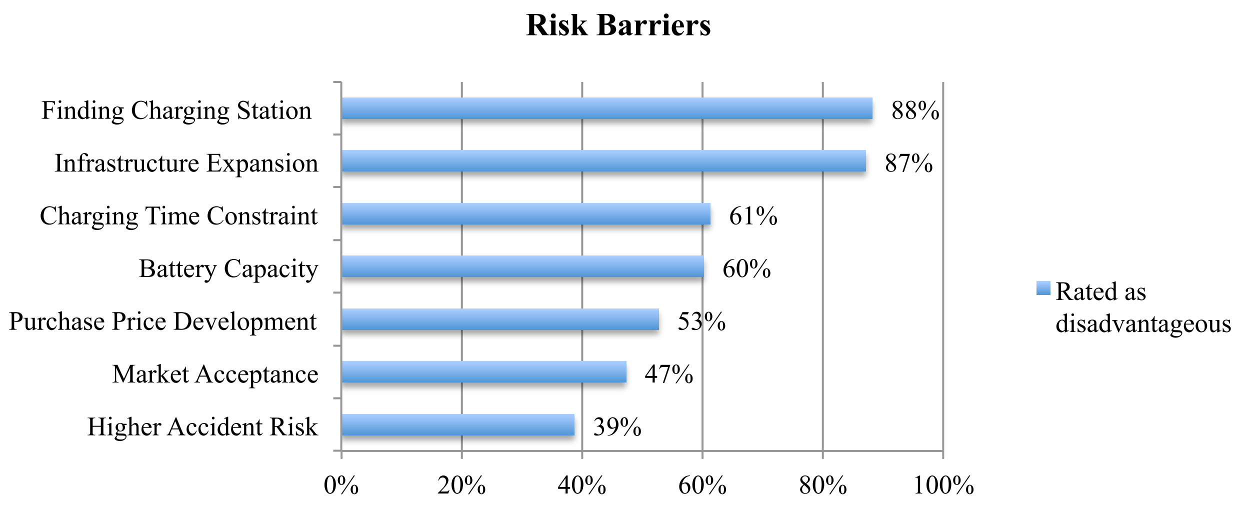

Figure 24: Identifed Risk Barriers

6.3.4 Complexity

As previously mentioned in the analysis part complexity is not perceived as problematic. Only 12% of the resistant consumers mentioned that they might have problems to drive an EV. Even less mentioned problems to understand the new product and related topics. Only 3% of the resistant consumers acknowledged some problems.

It is, however, important to note that these low perceived complexity might result from a wrong self-assessment or lack of knowledge. Nevertheless, we conclude that complexity is not considered as a relevant adoption barrier.

6.3.5 Trialability

In general, resistant consumers perceive all defined possibilities in their environment to test EVs as relatively less common and rather inconvenient (>36%). Therefore, the innovation characteristic trialability does pose an adoption barrier. Our findings show that product trial offerings that require the consumer's active intention to test (e.g. test drives at a local car dealer) are considered less common than options where consumer get encouraged to test EVs (e.g. promotional activities).

The second most difficult option for product trial is the local car dealer. More than half of the resistant group (56%) mentioned this option as problematic and even among the non-resistant difficulties exist. Ideally, the local car dealer should be the easiest option to test an electric car and hence can be considers as barrier towards adoption. The relatively high percentage of the non-resistant consumers indicates that at present only few car dealers actually offer test drives. Regarding carsharing the outcome is quite surprising. By now there are only a few providers who integrated EVs in their car sharing fleet. However, the majority find testing EVs through car-sharing services easy (51%). This might indicate that car-sharing services are a promising mean to test-drive EVs.

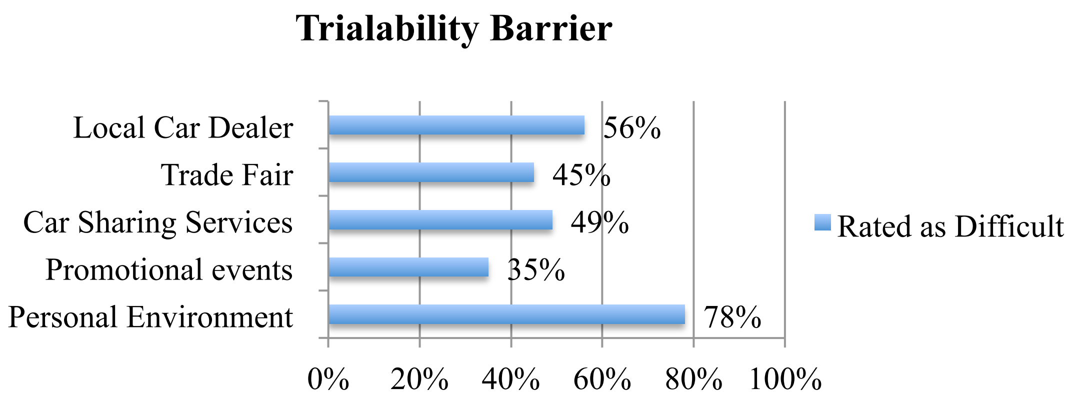

Figure 25: Identifed Trialability Barriers

6.3.6 Market Comparison

In the this section, we take a closer look at the predefined adoption barriers in order to detect different perceptions of Norwegian, Swedes, Danes and Germans. We only take those into account who are resistant towards EVs. The outcome will help the respective governments and car manufacturers to establish effective strategies to remove those barriers.

We first evaluated the perception towards relative advantage and risk in general and ranked them according to the highest values in a second step.

Norway

Value Barriers

Taking only the Norwegian participants into account, we notice that they have the highest number of value barriers compared to the other countries (Norway: 9; Sweden: 6; Denmark and Germany: 7). Among the first three barriers, range (100%), model variety (86%) and speed/size (57%) were mentioned most frequently. The high value of speed and size is surprising. In comparison to the other countries, an interesting outcome worth mentioning is the relatively low ranking of value for money (43%). This could be explained by the prevailing low price sensitivity among Norwegians in general. Another interesting outcome is the relatively low value of engine sound (36%). Although still considered as barrier it is ranked quite low before image and environmental friendliness.

Overall, the large number of value barriers is unexpected taking Norwegian's generally positive attitude towards EVs into account. This could mean that those who are resistant have an overproportionally bad perception with regard to functional product features.

Risk Barriers

Six of the uncertainties towards e-mobility are perceived by a relevant number of Norwegian consumers and therefore, classified as adoption barriers. Besides Denmark, this is the lowest number of risk barriers among the target markets. This outcome might help to explain the EV diffusion rate on the Norwegian market, which is the highest among the four markets (2.59%). Besides the usual top risk barriers of finding a nearby charging station (93%) and the expansion of the charging station (86%), the risk towards the battery performance is rated (71%) and ranked (Nr. 3) highest compared to the other markets. This could be explained by Norway's geographic location, where the cold climate might reduce on battery performance (Allen, 2013). Furthermore, consistent with the previous finding, Norway is the only market, where a potential higher accident risk due to the non-existent engine sound does not pose an adoption barrier.

<u>Sweden</u>

Value Barriers

While the Norwegians are the most sceptical towards the functional value of EVs, Swedes are the least critical. In total, Swedish people evaluated six product features as barriers. Next to model variety (73%) and range (71%) they perceive value for money (53%) and acceleration (53%) as most disadvantageous features compared to ICE vehicles.

Interesting to note is that in contrast to its neighbour countries and Germany, Swedish people perceive the engine sound as beneficial. Only 7% mentioned some concern regarding the missing engine sound.

Risk Barriers

The analysis of our research reveals that the majority of the Swedish consumer perceives seven risks related to EVs as relevant, which therefore pose adoption barriers. Besides the usual top risk barriers of finding a nearby charging station (93%) and the expansion of the charging station (86%), the risk towards the purchase price development is ranked third (53%). This could be explained by the currently not existing buying incentives. Moreover, the risk towards a potential constraint of the consumer's daily routines due to the long time required to fully charge an EV, is rated (33%) and ranked (Nr. 6) the lowest among the target markets. Interestingly, Swedish consumers perceive the risk regarding the uncertainty of the EV's future market acceptance as comparably low (33%).

Denmark

Value Barriers

Similar to Germans, Danes rank seven produce features as relevant barriers. Under the first thee barriers, they ranked model variety (93%), range (75%) and value for money (53%). Taking the high purchase price subsidies and tax exemption into account, it is quite surprising that value for money is ranked that high. On the other side, the relatively high value of engine sound (47%) is consistent with our expectations. As Christian Marcus (Tesla) mentioned on the Green Vehicle Day, Danes appreciate "loud and heavy cars".

Risk Barriers

Among Danish consumers, seven uncertainties are regarded adoption barriers. This result helps to explain the fact that Denmark has the second highest EV diffusion rate (0.34%) among the four markets. Unlike consumers of the other markets, the majority of the Danish survey participants perceive the expansion of the charging station network as the biggest adoption barrier (94%). Another key outcome is that the purchase price development risk is rated (44%) and ranked (Nr. 5) the lowest. The high purchase price subsidies in Denmark might be a reasonable explanation for this outcome. In addition, Denmark is the only target market, where the risk of market acceptance does not pose an adoption barrier.

Germany

Value Barriers

Like the Scandinavian countries, Germans value model variety (89%) and range (79%) as the most disadvantages features. Followed by speed (74%). This outcome comes with no surprise, as Germans love to drive fast. It is the only country in the EU without speed limit on the motorways. Especially the Germans favour traditional product features including speed as well as engine sound. This also explains the high ranking of engine sound (55%), which is the highest among all target markets. More remarkable is the low value of acceleration. Only 26% perceive the acceleration as disadvantageous, which is the lowest ranking in comparison to the other markets.

Risk Barriers

Germany has the highest number of risk barriers among all target markets, which could explain its low diffusion rate (0.12%). Furthermore, the risk regarding the purchase price development is rated highest compared to the other markets (62%), which is likely due to the non-existence of any relevant buying incentives. The outcome of this research also reveals that many German consumers see a higher accident risk due to the missing engine sound as relevant barrier. Among the target markets it is rated (51%) and ranked the highest (Nr. 5).
Another remarkable result is that the fear of a long purchase process does pose a barrier among German consumers exclusively. Although it is the smallest perceived barrier (31%, Nr. 5). Moreover, the battery capacity risk barrier is ranked lowest among the target markets (Nr. 6).

	Norway		**Sweden**		**Denmark**		**Germany**	
1	Range	100 %	Model Variety	73 %	Model Variety	93 %	Model Variety	89 %
2	Model Variety	86 %	Range	71 %	Range	75 %	Range	79 %
3	Speed	57 %	Value for Money	53 %	Value for Money	53 %	Speed	74 %
4	Size	57 %	Acceleration	53 %	Engine Sound	47 %	Value for Money	63 %
5	Acceleration	43 %	Speed	47 %	Acceleration	38 %	Engine Sound	55 %
6	Value for Money	43 %	Size	33 %	Size	33 %	Size	47 %
7	Safety	36 %	Image	21 %	Speed	31 %	Design	34 %
8	Design	36 %						
9	Engine Sound	36 %						

Table 4: Value Barrier by Market

	Norway		Sweden		Denmark		Germany	
1	Nearby CSt	93 %	Nearby CSt	87 %	Expansion	94 %	Nearby CSt	87 %
2	Expansion	86 %	Expansion	80 %	Nearby CSt	88 %	Expansion	85 %
3	Batt. Cap.	71 %	Purchase Pr.	53 %	Daily Routines	69 %	Daily Routines	67 %
4	Daily Routines	64 %	Batt. Cap.	47 %	Batt. Cap.	63 %	Purchase Pr.	62 %
5	Purchase Pr.	50 %	Accident Risk	33 %	Market Accept.	49 %	Batt. Cap.	59 %
6	Market Accept.	36 %	Daily Routines	33 %	Purchase Pr.	44 %	Market Acc.	56 %
7			Market Accept.	33 %	Accident Risk	38 %	Accident Risk	51 %
8							Buying Process	31 %

Table 5: Risk Barriers by Market

6.4 Consumer Characteristics

6.4.1 Car Involvement

The Scare away Effect

As elaborated in the theory section, we were interested whether the comparably high purchase price for EVs induce the perception of a detrimental economic value. We supposed that informed consumers have a more favourable perception, because they know that a high purchase price of an EV can be compensated by its lower operating costs.

Contrary to our expectation the research results suggest a negative correlation between *car involvement* and *value for money.* More than half of the participants characterized with a high interest in cars and related technology developments perceive the economic value of an EV as disadvantageous (55%). This is significantly more than the share of non-involved consumers with the same opinion (41%). Additionally, involved consumers perceive the value for money ratio as less favourable (20%) compared to the ones not involved (32%). Therefore, the existence of a scare off effect in the case of EVs cannot be confirmed for uninformed but instead for informed consumers. One possible explanation is the potential uncertainty regarding the resale value of EVs. It is very likely that future improvements in battery technology will enhance the EV's fall in value. Even though existing literature's opinion regarding the likelihood of this scenario is not unanimous (e.g. Propfe et al., 2012).

The Green Myth Effect

As discussed in the theory section, we want to find out whether informed consumers more likely recognize the ambiguity of the EV's ecological friendliness than uninformed consumers. The results of our research confirmed our assumption of a negative correlation between *Car Involvement* and *Ecological Friendliness,* although the gap is smaller than expected. 62% of the high involvement consumers perceive EVs eco friendliness as strongly advantageous. In comparison, more than two-thirds of the low involvement consumers share the same opinion (71%).

As a result, the existence of the green myth effect can be confirmed. However, we supposed a higher share of involved consumers having a more critical perception towards the ecological friendliness of EVs.

6.4.2 Ecological Consciousness

Green Biased Effect

With the green biased effect, we examine whether green consumers are more biased in their perception of the EV advantageousness for its non-green product features. We are now going to analyse how ecological consciousness influences the relative advantage and thus EV perception.

In terms of the *economic value* of an EV, people who attach great importance to environmental friendly products rate the value for money more beneficial (34%) than those who do not (14%) The green biased effect also becomes visible when analysing the perception of the *functional value.* Consumers who value eco friendly products perceive design (19%) and size (11%) as more favourable than those who are not (Design: 10%; size: 3%). Another interesting finding is that almost half of the non-eco-conscious consumers (42%) perceive the missing engine sound as disadvantageous, while only 26% of their counterparts share the same opinion. Lastly, most consumers also perceive *social value* as beneficial. Compared to 55% of the non-eco conscious consumers, 72% of the eco-conscious consumers value the image of the EV, which is certainly due to its low impact on the environment

In conclusion our results confirm the existence of the *green biased effect*. We found out that eco-conscious consumers have a more favourable perception towards EVs' compared to non eco-conscious consumers.

Bad Reputation Effect

Ecological consciousness does not only influence how people evaluate the relative advantage of EVs but also how they feel and think about an innovation. In particular we were interested whether consumers have a rather negative opinion towards EVs even though they would consider themselves as green-minded.

In general our outcome confirms the underlying assumption of a positive effect of eco-consciousness on compatibility. While only 64% of the non-green consumers have a positive opinion about EVs, around 83% of the green-consumers share the same opinion. In Addition, these results support the hypothesis of a bad reputation effect, because yet 18 % of the participants have a neutral or negative opinion towards EVs, even though they consider themselves green-minded.

Car Involvement	**Scare away Effect** (Value for Money)	**Green Myth Effect** (Eco-Friendliness)
	Not supported	Supported
Ecological Consciousness	**Green Biased Effect** (Relative Advantage)	**Bad Reputation Effect** (Cognitive Compatibility)
	Supported	Not Supported

Table 6: Results of Consumer Characteristics

6.5 EV Exposure

The Informing Effect

Mass Media

Rogers (2003) and Ram (1987) argue the more consumers are exposed to an innovation the more favourable their perception of the *relative advantage*. The logic behind this is that exposed consumers have a more information available and thus can evaluate an innovation in a more profound manner (Ram, 1987).

Although, the results of our analysis support only partially the hypothesis. While exposure through *mass media* has a positive effect on *functional*- and *social value*, it has a negative effect on *economic value*. After frequent exposure through mass media consumers perceive speed (19%) and design (18%) as more favourable compared to those who are rarely exposed (speed: 14%, design: 12%). Especially, the perception of acceleration is significantly better. On average 34% of the respondents who are frequently exposed and only 21% who are rarely exposed perceive acceleration as advantageous. On the other side, range and model variety are evaluated as worse. Those who are frequently exposed perceive range (83%) and model variety (84%) as disadvantageous compared to 71% and 75% respectively who are rarely exposed. Particularly, value for money is perceived as inferior with frequent media exposure. While on average 53% of the frequent exposed group evaluate value for money as disadvantageous, only 41% of those rarely exposed share the same perception.

Reference Groups

Consumers exposed trough social media or their personal environment perceive almost all characteristics of *functional value* as more favourable. Especially remarkable are acceleration, engine sound, speed and safety. For instance, four times more of the exposed group perceive speed (28%) as favourable product feature compared to the rarely exposed ones (7%). With respect to acceleration, 76% of the frequently exposed consumers perceive it advantageous whereas only 40% of the rarely exposed consumers have the same opinion. Only range and model variety are still perceived as disadvantageous even among the highly exposed group. Furthermore*, social value* is perceived as significant better with frequent exposure (73%) compared to rarely exposure (56%). This outcome shows the great impact of reference groups and its ability to reduce some risk and uncertainty.

We therefore conclude that the *informing effect* is existent but only for selected innovation characteristics. Contrary to Rogers' and Ram's claim, our results showed that frequent media exposure does not necessarily results in a better perception.

<u>The Bad Publicity Effect</u>

Experts state that negative media coverage regarding e-mobility could be a reason for consumers' rather unfavourable attitude towards it (Green Vehicle Days, 2013). Therefore, we examine the consumer's *cognitive compatibility* dependent on the degree of *EV exposure*. As a matter of research simplification, we classify consumers in two distinct groups in form of *rarely*- and *frequently*-exposed consumers.

The analysis of the data suggests the existence of a *Bad Publicity Effect* partially. Exposure through TV, print and radio actually does affect the consumer's opinion towards EVs negatively. However, this does not hold true for exposure via the Internet. Regarding TV, three quarters of the rarely exposed consumers indicate a positive opinion towards EVs (76%). This is slightly more than consumers who are frequently exposed (73%). The effect is more pronounced within print where 79% of rarely exposed participants state a positive opinion. This share decreases by 9% with frequent exposure (70%). Furthermore, exposure via radio also has a negative effect on compatibility. Among the rarely exposed consumer 75% state a positive opinion towards EVs. However, this share drops to 71% with frequent exposure. As already indicated, the bad publicity effect is not existent for the Internet. Here the share of consumers with a positive opinion increases with exposure from 72% (rarely) to

76% (frequently). One reason for this result might be that unlike the other mass media channels, frequent exposure via the Internet usually requires a certain motivation of the consumer to actively look for information regarding a topic.

	Informing Effect (Relative Advantage)	**Bad Publicity Effect** (Cognitive Compatibility)
Mass Media	(Partially) Supported	Supported
Reference Group	Supported	-

Table 7: Results of EV Exposure

6.6 Buying Incentives

As discussed in the theoretical framework, monetary incentives can help to increase the *relative advantage* of an EV. This section investigates whether market-specific buying incentives have an impact on consumer's *EV perception.* We suppose that beneficial buying incentives lead to a more favourable consumer perception.

6.6.1 Effect on EV Perception

Monetary Benefits

Monetary incentives can help to increase the economic value of an innovation. In the context of EVs this usually takes place in form of purchase price subsidies or car tax exemptions. Since, monetary incentives differ significantly from market to market, we assumed that consumers of highly subsidised markets also perceive the economic value of EVs higher. Norway can be considered as a market with high monetary benefits. Hence, it is not surprising that the Norwegians perceive the economic value of EVs as most beneficial compared to the other countries. Only one third (29%) perceive value for money as disadvantageous. In contrast, Germany, who has the fewest buying incentives among the target markets, perceives the value for money as least beneficial. Almost two third identified it as detrimental (62%). The shares of the remaining markets lie somewhere in between, with around one half of the participants from Sweden (48%) and Denmark (50%) who perceive the economic value as rather disadvantageous. Overall, our research confirms a positive effect of monetary incentives on the economic value of an EV.

Consumer Preference

In addition to the relation between buying incentives and EV perception, we were also interested in the individual consumer preference towards (potential) monetary benefits. The analysis of this research revels that especially Swedish consumers value monetary incentives that reduce the disadvantageousness of the EV initial investment. More than two thirds indicate the major relevance of purchase price subsidies or tax exemptions (70%). This could be explained by the neighbouring countries Denmark and Norway, which – in contrast to Sweden – already deploy such practices. Interestingly, the second biggest group favouring purchase price subsidies (56%) and tax exemptions (68%) of EVs are Danish consumers. Followed by German consumers of who the majority (63%) evaluated car tax exemption as more important than purchase price subsidies. Among the Norwegians there is no big difference identifiable between those two. Half of them evaluated both incentives (purchase price subside: 46%; car tax exemption 48%) as important.

The results of the consumer preference towards buying incentives that reduce the operating costs of an EV are relatively widespread among consumers. *Insurance benefits* for EVs are preferred fairly equally among the Scandinavian countries (Norway: 68%, Sweden: 65%, Denmark: 72%), while the group of Germans evaluated this potential incentive as comparably low (55%). Similar results can be found for *free charging services*, which is valued equally high among the four countries (Norwegian: 64%, Swedish: 69%, Danish: 68%, German: 70%). The evaluation of the third benefit reveals another noticeable outcome. More than two thirds of the Norwegian consumers indicate a high personal importance regarding *free parking* for EVs (72%). The other groups of consumers sharing this view are significantly smaller (Swedish: 43%, Danish: 44%, German: 44%).

Functional Benefits

Charging Stations

In the theory section we presented the incentive of a publicly build up and managed charging station network and argued that it can provide consumers of EVs with additional value. In particular, a well developed charging infrastructure network will result in a more favourable consumer perception with respect to range and two related risks, namely the uncertainty towards the *expansion of the charging station network* and the risk of not finding a *nearby charging station* when travelling. In order to analyse this impact we put Sweden, Denmark and Germany in one group and compare their perceptions with those of Norway because Norway is the only market with an dense charging station network.

As expected around 15% of the Norwegian consumers do consider the risk regarding the expansion of charging stations as not relevant, while only 6% of the consumers of the other

target markets share the same opinion. This outcome becomes more striking when having a look at the risk of finding nearby charging stations. One quarter of the Norwegian consumers (25%) do consider the risk regarding the expansion of charging stations as explicitly not relevant, while only 3% of the consumers of the other target markets share the same opinion.
In addition to the relation between buying incentives and risk perception, we were also interested in the individual consumer preference towards (potential) functional benefit of a public charging station network. The results of our research suggest a rather comparable preference among the four target markets. Public charging stations and its further expansion are highly valued by at least three quarter of every market (Norwegian 75%, Swedish: 83%, Danish: 80%, German: 82%).

Parking Space and Bus Lanes

In the theoretical framework we mentioned dedicated parking spaces as additional functional benefits. Currently, this incentive is only deployed in Stockholm, Sweden. The results of our research suggest a remarkable link between the existence of dedicated parking spaces and the related consumer preference. Swedish consumers with the privilege of this function incentive actually rate the importance of this incentive as the lowest of all (43%). In contrast, Norwegian consumers attach the highest importance to EV parking lots (75%). Probably because its one of the few incentives the Norwegian government has not made use of yet. Denmark and German consumers are somewhere in between with comparable preference towards this functional incentive (48%, 52%).
The second functional incentive elaborated on is the benefit of using *bus or taxi lanes* with an EV, which is currently utilized exclusively in Norway. The outcome of the research reveals that only Norwegians show a major preference towards this incentive. Nearly three quarters indicate its major importance (71%). Compared to this, consumers of the other target markets state a significant smaller relevance (Swedish: 26%, Danish: 28%, German: 31%). This could mean that consumers likely realize or appreciate the value of this incentive only once they actually made use of it. Cleary, consumers from Sweden or Germany might perceive this incentive as fairly subordinate compared to possible monetary incentives.

Indirect Incentives

Indirect incentives comprise instruments that make ICEs and their ownership more costly and thus EVs more attractive. We examined two indirect incentives, the use of so-called *environmental zones*, where vehicles have to pay a fee according to their CO2 emission as well as a general *CO2 emission restriction* for vehicles. Only German municipalities deploy the first one, while the European Union and the Norwegian government regulate the latter instrument.The outcome of our research shows that especially Norwegian consumers strongly value the indirect benefit environmental zones (75%). Compared to this, only a few consumers of the other nationalities indicate the same preference (Sweden: 48%, Danish: 36%, Germany. 43%).

Having a look at the results for consumer's preference regarding stricter emission regulations for ICE vehilces reveals that especially Swedish consumer state a major relevance of this indirect incentive (65%). Probably, because they perceived costs of an ICE as rather low compared to their Scandinavian neighbours. Compared to this, way less consumers of the other nationalities indicate the same preference (Norwegian: 36%, Danish: 44%, German: 44%).

6.6.2 Ranking of Buying Incentive Valuation by Market

After evaluating the effect of buying incentives on certain innovation characteristics, this section examines the market-specific sets of consumer preferences towards buying incentives. In particular, we focus on the three most valued incentives of each market as well as significant findings.

Norway

In general, Norwegian consumers evaluate monetary incentives as less important. The three most valued incentives are dedicated parking space (75%), city toll exemption (75%) and free parking (72%). Closely followed by access of bus lanes (71%). Incentives related to parking appear to be a reasonable strategy to promote EV sales in Norway. Interestingly, Norwegians value the permission to use bus lane highest compared to the other markets. As mentioned before, consumers are likely to appreciate this privilege once they actually make use of it.

Sweden

In contrast to Norway, Swedish consumer rate monetary incentives including purchase price subsides (70%) and car tax exemption (70%) more important compared to functional benefits such as dedicated parking space (43%) or bus lanes (26%).

Denmark

For Danes monetary incentives are most important. Especially those that reduce the operating cost such as lower insurance cost (72%), car tax exemption (68%) or free charging (68%). Less valued are indirect benefits including higher CO2 regulations (44%) or city toll for ICE vehicles (36%) as well as bus lanes (28%).

Germany

In their preference towards buying incentives, Danes and Germans show great similarities. Both value monetary incentives as most important, especially benefits that reduce the operating cost. The top three valued incentives include free charging (70%), car tax exemption (63%) and reduction in insurance cost (55%). Again indirect benefits and bus lane are perceived as less important.

	Norway		**Sweden**		**Denmark**		**Germany**	
1	Parking Space	75 %	Purchase Price	70 %	Insurance	72 %	Free Charging	70 %
2	City Toll	75 %	Car Tax	70 %	Car Tax	68 %	Car Tax	63 %
3	Free Parking	72 %	Free Charging	69 %	Free Charging	68 %	Insurance	55 %
4	Bus Lane	71 %	Insurance	65 %	Purchase Price	56 %	Parking Space	52 %
5	Insurance	68 %	CO2 Reg.	65 %	Parking Space	48 %	Purchase Price	45 %
6	Free Charging	64 %	City Toll	48 %	Free Parking	44 %	Free Parking	44 %
7	Car Tax	48 %	Free Parking	43 %	CO2 Reg.	44 %	CO2 Reg.	44 %
8	Purchase Price	46 %	Parking Space	43 %	City Toll	36 %	City Toll	43 %
9	CO2 Reg.	36 %	Bus Lane	26 %	Bus Lane	28 %	Bus Lane	31 %

Table 8: Consumer Valuation of Buying Incentives by Market

7. Managerial Implications

7.1 Value Barriers

Value for Money

Communication Strategy

As our results suggest, the high resistance towards EVs are partly due to a negative perceived value for money ratio. Many consumers are hesitant to adopt EVs because they generally put a low value on future savings and have a negative perception or misunderstand the composition of costs including initial-, running- and maintenance cost. One way to overcome this barrier would be to offer online platforms that allow consumers to calculate their economic value of EVs. On Tesla's website, for instance, consumers can calculate the "true cost of ownership" (Tesla Motors, 2013). The platform shows that careful consideration is needed to include all relevant variables that constitute the economic value.

In addition, effective communication strategies are necessary to educate people about incentives and the low operating cost. When selecting communication channels, it is important to take the informing as well as bad publicity effect into consideration. For instance, we found out that frequent media exposure via mass media does not necessarily result in a better perception of value for money and thus should not be utilized to push information into the market. More effective are channels that allow interactive communication such as social media or reference groups.

Range

Product Strategy

The limited range of EVs is one major reason (81%) that prevents consumers from adoption. Clearly, this performance constraint is due to battery technology constraints and will likely not be solved in the next years. Therefore, we stress the importance of hybrid propulsion technologies that accelerate the transition from fossil- to renewable fuel-based mobility. Plug-in hybrid electric vehicles combine an electric engine with a conventional internal combustion engine. The two propulsion forms can work together depending on distance or the driver's preference. This technological solution has additional benefits besides overcoming the range constraint. Many consumers sceptical about e-mobility (low cognitive compatibility) might be more likely to adopt such a transition-solution because it combines the familiarity of a traditional technology with the innovativeness of a sustainable solution. Additionally, other previously identified barriers like *engine sound* or *accident risk* could be alleviated with this technology as well. Another technologic solution to mitigate the range barrier is the application of a *range extender*. Usually, a range extender works in form of a combustion engine that propels a generator recharging the EV's battery during active usage. Clearly, the difference to the plug-in hybrid is the engines performance, which is strong enough to generate electricity, but too weak for direct vehicle propulsion.

Service Strategy

Another strategy to overcome the range barrier is to offer *car rental services*. We recommend car manufactures to offer customers ICE vehicles for long distance drives for instance when going on vacation. BMW is recently considering such a business model where they offer i3 customers the opportunity to rent a BMW model with a traditional engine for free (BMW, 2013).

Communication Strategy

In addition to car rental services, effective communication strategies that position the EV as city car can help to reduce the perception of range as a barrier. Clearly positioning the EV as daily car used within the city should effect range in a positive manner. Some scholars recommend targeting multi-car households where EVs are used for efficient and clean drive in the city while larger ICE vehicles are used for long distance journeys (e.g. Gärling et al., 2001). The EV as city car has a positive effect on range as well as on size and speed as neither really large nor really fast cars are required within towns.

Speed

Communication Strategy

When positioning the EV as city car, it is important that consumer still perceive it as "sporty-car" that is fun to drive. Product features such as speed and design play an important role in the purchase decision and thus must not be neglected. One way to highlight the sportiness of EVs is to develop high performance vehicles. Over the last months, some manufactures of sport cars, such as Lotus, Porsche and Ferrari have unveiled vehicles driven partly by electric motors. This is an effective strategy as high performance electric cars have the potential to change the public's perception of EVs in a positive way.

Model Variety

Product Strategy

The results of our research reveal the limited *model variety* of EVs as the biggest adoption barrier (88%). The overview of EVs available presented in section 2.2 confirms this situation as well. To date, most EVs available on the market are primarily vehicles of the (sub)-compact class (e.g. Nissan Leaf) or the high-end class (e.g. Tesla Model S). By extending the model lines, car manufacturers might attract a certain group of consumers whose only constraint is this particular barrier and additionally benefit from first mover advantages.

Acceleration

Communication Strategy

Although some EV product features are clearly advantageous compared to conventional cars, our findings show that consumers still perceived them as inferior. In particular, acceleration and engine sound should work in favour of EVs. Effective communication strategies are necessary to educate consumers that EVs achieve performance levels comparable to ICE vehicles, if not better.

Engine Sound

Product Strategy

Another barrier identified in this research is the EV's non-existent *engine sound* (39%). There is a controversial debate about the absence of the engines sound. While opponents believe that the missing engine sound poses a threat to pedestrians, particularly to the visually impaired, proponents emphasize the advantage of the reduction in noise pollution. One solution to meet the need of the former is the application of artificial engine sound systems. A small device installed in the engine compartment could compensate the characteristic ICE sound. Although, it is yet to examine to what extend consumers actually do accept an artificial sound system as a proper substitute.

Communication Strategy

In order to meet the needs of the proponents of the missing engine sound, communication strategies should emphasize it as a positive feature compared to conventional cars. An increasing number of people living in metropolitan areas complain about damage to health and stress due to noise. Marketers have to emphasize that the absence of engine sound has a positive effect on noise pollution making the life in cities more worthwhile.

Size

Service Strategy

Like car rental services to overcome the barrier of range, the same service should be applied to address the issue of the small size of EVs. Especially for large families the small size is one reason why they decide not to purchase an EV. In addition, a frequently mentioned concern was the limited space if odd sized items need to be carried. Similar to the above case, car manufactures could offer their customers comparably larger vehicles for extraordinary occasions.

7.2 Risk Barriers

<u>Higher accident Risk</u>

Product Strategy

A likely higher accident risk of EVs compared to ICE vehicles was another barrier revealed in our analysis. This is due to concerns related to collision safety, electrical safety and the lack of engine noise. Especially with regard to Lithium-ion batteries consumers are afraid of electrical short or overheat. Electronic systems should be integrated in the board computer that informs the driver about heat and battery capacity early in order to prevent any accident. In addition, more safety and quality test could be conducted to reduce concern about collision safety. As mentioned above the lack of engine noise can be compensated by an artificial noise that warn others early before an accident might occur.

Service Strategy

A different strategy to reduce this barrier is to offer „*Electric Vehicle Safety Trainings*". The trainings could contain both online and offline sessions. While online courses provide consumers with useful information about technical and safety issues, „on the road" training gives them the opportunity to experience the joy of driving an EV. Training is also essential for fire brigade, police, emergency medical services, tow truck operators and other first responders to safely handle emergency situations.

<u>Purchase Price Development</u>

Service Strategy

Besides uncertainties regarding battery technology progress that is likely to decrease the purchase price of an EV significantly, concerns about the resale value exist. One possibility for car manufacturers to reduce this risk is to introduce a financing program, which *guarantees a certain re-sale value* after a predefined period. A few weeks ago Tesla announced that they guarantee Model S customers the same resale value as any high volume premium sedan brand (Audi, BMW, Mercedes or Lexus) after three-year ownership. This innovative financing scheme should be deployed by other car manufactures, too.

Another way to circumvent price development uncertainties is providing consumers with flexible leasing offers. *Leasing* can protect the buyer against potentially lower resale value for electric cars. At the end of the lease the car is returned to the car manufacturer without any financial loss for the consumer. In America, leasing is a popular option where 93% of the people who obtained an electric car at the fourth quarter of 2012 leased it rather then financed it (Wall Street Journal, 2013). This is, however, not surprising as most of the companies that sell electric cars offering much lower monthly payments to customers who lease one. When introducing EVs to the market, European car manufactures should consider EV leasing as a strategy to gain new customers. Another advantage of leasing is that it insulates the customer from long-term costs related to replacing old batteries, which will be discussed in more detail below.

Battery Capacity

Service Strategy

The concern of a decreasing battery performance over time was also identified as a major barrier. Instead of owning the battery, *leasing* it from car manufacturer or other utilities for a given period entail many advantages. First, it protects EV users from any financial loss regarding decreasing resale value or battery capacity. Second it ensures the most up to date battery technology.

Besides leasing, car manufactures could offer long lasting battery *warranties*. In the case of Nissan LEAF and the Chevy Volt, warranties are valid eight years long or 100,000 miles (Dailygreen, 2012).

Another strategy to overcome the concern about sudden breakdowns due low battery capacity is to offer (free) battery maintenance services. Through regular checks consumers are aware of the actual capacity of the battery and thus better able to plan recharging in advance.

Apart from that exchange services appear not to be a viable business solution. Although Better Place introduced a revolutionary battery-switching service, they had to file for bankruptcy in May 2013.

Charging Time Constraint

Service Strategy

Closely related to battery capacity is the concern of being too constraint during the recharge time. One obvious way to address this issue is by installing so called fast charging stations that recharge the battery in less than an hour. Another option is to offer advisory service to communities. For instance, Sweden's Vattenfall recently initiated a project to develop user-friendly, value added services and applications for time- and cost-efficient charging of EVs at home and for fleet operators (European Parliament, 2012).

Communication Strategy

Besides advisory service for time- and cost-efficient charging, advantages of home charging should be stressed through various communication channels. When charging the car over night, consumer will always have a fully charged car in front of their house and therefore do not need to waste time at crowded gas stations or being exposed to toxic substances.

<u>Infrastructure Expansion</u>

Service Strategy

To overcome the concern regarding the slow expansion of infrastructure must be an fundamental goal for all e-mobility stakeholders. The energy sector will have to *build up a recharging infrastructure* as a prerequisite for customer's acceptance of EVs. In order to build an appropriate infrastructure that provides the availability and required density of charging spots, three essential steps need to be taken into consideration when planning the expansion. First, install charging stations at strategic locations including parking garages, supermarkets, shopping malls, fast food chains and cinemas. In Stockholm, for instance, Elforsk is conducting a pilot by running charging stations at McDonald's restaurants (Elforsk, 2013). Second, install private charging points. Anyone who buys an EV is likely to pay the extra money to install a private charging point in front of his or her house. Third, build capacity at workplaces.

From a company's perspective, one way to overcome this barrier is to develop *an exclusive charging station networks*. Tesla recently builds a nationwide network in America. The goal is to allow owners of Tesla's Model S sedans to travel from Los Angeles to New York. The stations will be free of charge and thus do not add any revenue. However they are necessary to appeal to a wider group of more mainstream customers.

<u>Nearby charging Station</u>

Service Strategy

The biggest barrier related to e-mobility is the fear of not finding a nearby charging station when needed. One way to address this issue is by providing a platform that shows nearby charging stations. Promising solutions could be navigation maps that not only show the location of charging stations but also their current availability. Car manufactures and utility services should develop applications that provide this kind of information and make them accessible on the Internet. If possible it is advisable to integrate them into the board computer of the car as well.

Market Acceptance

Communication Strategy

In order to overcome the market acceptance barrier several communication strategies should be utilized. *Brand endorsement*, for instance, is an effective marketing strategy to increase trust in a new product. Car manufacture should provide celebrities with EV models and share their experience on social networks. By doing so they not only gain attention of a larger audience, but also increase the trust.

Another method of attacking this barrier is to package the innovation under *a well-known brand name* in which consumers trust. For instance, if "project i", an initiative of BMW about the mobility of the future, communicates its faith in new technology and invest heavily in R&D, many consumers will be convinced that soon the EV will gain full market acceptance.

In addition, environmental pollution and resource shortages require a fundamental change in attitude and make new, sustainable mobility systems increasingly important. EVs are a promising solution to overcome these threats. Governments, car manufacturers, utilities and other interest groups should therefore position the EV as new form of mobility in the near future. Taking the movement towards electric mobility as granted, will certainly diminish the risk of market acceptance.

7.3 Consumer Preference of Buying Incentives

Norway

When thinking of introducing additional incentives, benefits regarding parking should be taken into consideration. Both dedicating parking spaces and free parking are highly valued. In order to attract many people, the Norwegian government needs to collaborate with local communities to find attractive locations in the city centre for exclusive or free EV parking.

Sweden

Swedish consumers put a great value on monetary incentives especially on reductions in operating cost. This implies that recent subsidies on purchase price and car tax exemptions could be perceived as insufficient. In order to increase EV attractiveness, the government should reconsider those incentives and improve them. Besides monetary benefits, the government should invest in a charging station network and offer electricity for free. Since a free charging network requires great investments, a first step should be to collaborate with local businesses such as supermarkets, fast food chains and cinemas and convince them to offer free charging to their customers.

Denmark

Besides the existing purchase price subsidies, the Danish government should additionally introduce car tax exemptions as well as incentives that reduce operating cost in order to increase EV use. In particular, insurance benefits are highly valued. Insurances against battery breakdowns, for instance, are promising to increase EV adoption, as Danes perceive range and limited battery capacity as major barrier. Furthermore, the government should invest in the expansion of a public charging station network and collaborate with energy utilities to provide electricity for free.

Germany

For the German consumers the two greatest barriers are the risk of not finding a nearby charging station when needed and a slow expansion of the charging network. Hence, it is not surprising that free charging is considered the most important incentive. Since installation and operation of public charging infrastructure in Germany is quite expensive and less profitable (€2-4 per charge), the government is dependent on cross-subsides. Either the regulator allows the energy firm to add the cost to the grid costs and charge grid users, or local communities pick up the tab, or the incumbent utility invests in a public charging infrastructure to run a pilot and promote its brand. Another option is to partner with local business as explained above.

	Product Strategy	Service Strategy	Communication Strategy	Norway	Sweden	Denmark	Germany
Value Barrier							
Model Variety (88%)	New Car Categories			✔	✔	✔	✔
Range (81%)	- Hybrid Populsion - Range Extender	Rent-a-Car Service	"It's a City Car"	✔	✔	✔	✔
Speed (58%)	Introduce Sports Cars		"It's a Sports Car"	✔			✔
Value for Money (55%)		Online Platform for Cost Savings	"Electricty is the cheaper Fuel"		✔	✔	✔
Size (42%)		Rent-a-Car Service		✔			
Engine Sound (39%)	Artificial Engine Sound		"Noise Reduction is appealing"			✔	✔
Acceleration (36%)			"EVs are faster"	✔	✔	✔	
Risk Barrier							
Higher Accident Risk (39%)	Advanced Driver Assistance Systems	Safe driving Training for Customers					✔
Purchase Price Development (53%)		- Guaranteed re-Sale Value - Leasing Solutions			✔		✔
Battery Capacity (60%)		(Free) Battery Services	"We take Care of your Car"	✔		✔	
Charging Time Constrain (61%)		Fast charging Stations	"A charged Car in the Morning"			✔	✔
Infrastructure Expansion (87%)		Automobile Brand exclusive Charging Station Network		✔	✔	✔	✔
Nearby Charging Station (88%)		Technology to locate nearby Charging Spot (e.g. GPS)		✔	✔	✔	✔
Market Acceptance (47%)			"The future Form of Mobility"			✔	✔

Table 9: Summary of the Managerial Implications

8. Conclusion

8.1 Limitations and Future Research

Several decisions made when designing this research have a limiting impact on the overall quality of its findings. Due to the scope and size of this study, we were restricted in the number of factors and reasons taking into account. The following section points out specific shortcomings and elaborates on them to support the reader in judging the quality of this research.

Theory

To date, the field of research about innovation resistance is still rather small and inconsistent with regards to its operationalization. We synthesized different existing concepts to contribute to this field. Additionally, when terming the different forms of resistance we followed the established terminology. Some of them implied concrete actions within the innovation decision process, but in fact we measured the resistance on the consumer's hypothetical willingness to purchase a car instead of specific decision like rejection or adoption. Future research should elaborate on the integration of the resistance concept in the innovation decision process.

Within the innovation characteristic *relative advantage* we measured the economic value of EVs in relation to ICE vehicles using the item value of money. This operationalization might be too superficial, a differentiation between purchase prices; fuel costs, maintenance costs and resale value would likely provide a more comprehensive picture.

Sample

We utilized an online questionnaire to measure the *Innovation Perception Model*. Besides the typical shortcomings of this research method there are several limitations regarding sample quality and data collection.

To reach a high number of respondents with a comparably small use of resources, we distributed the survey online. Especially, social networks helped to spread it among a large number of people. However, this accompanies many disadvantages. First, this method leads to a rather unequal age distribution among the sample with the majority being between 16 and 35 years old (39%). We argue, however, that this specific segment is likely to represent the early adopters of tomorrow. Besides age, the sample primary represents consumers with an academic or higher education background. Moreover, the fact that the participants of the survey were mainly friends or friends of friends probably biased the response behaviour.

Participants might have indicated a more favourable perception as act of courtesy or to show support or appreciation for the research topic. Also, we noticed that people with interest in e-mobility were more likely to participate than those who are not. Many actually hesitated or even refused to participate reasoning with their insufficient knowledge. This effect is also reflected in the gender distribution of the sample, which is slightly male-shaped (59%).
Also our data collection is German-shaped (36%) due to the authors' origin. Compared to this the sample size of the Scandinavian markets were comparably small. When reproducing this study in future research equally sized samples will increase validity and reliability significantly. When designing the questionnaire we chose English as language thereby neglecting the respective language of the target market. This could have posed grasping problems for some participants.
Besides the online distribution we also gave out the questionnaire during the Green Vehicle Days 2013 in Malmö, Sweden. However, most of the participants were highly involved in e-mobility either through profession or personal interest. Clearly, this biased the overall outcome and in particular the results for the Swedish consumer analysis.

Analysis

When conducting the analysis we did not make use of any statistical tools (e.g. IBM SPSS Statistics) for testing our hypotheses. It is likely, that not all of our results are significant. Furthermore, we designed the questionnaire utilizing Likert scales with five grades, to allow the participants to provide a differentiated picture of their perception. However, we frequently merged several grades for reasons of simplification. Future research should analyse this data collection for more in-depth results.

8.2 Summary

Climate change and global resource shortage have led to rethink traditional individual mobility. Although, EVs are a promising alternative to overcome these problems, they are characterized with low acceptance among consumers. Therefore this research aimed to give a better understanding of why consumers resist buying electric cars.

For this purpose we designed the *Innovation Perception Model,* a theoretical framework that conceptualizes the link between innovation perception and innovation resistance. In addition, it incorporates the effect of consumer characteristics, innovation exposure, and buying incentives. In order to examine this model we conducted a consumer survey with a social media-distributed online questionnaire. The analysis of the data collected allowed us to answer the two formulated research sub-questions.

How does EV Perception influence Resistance?

The first sub-question aimed to examine the innovation perception and innovation resistance for the identification of the relevant adoption barriers. First, an overview of how consumers generally perceive the EV is provided. Furthermore, the analysis reveals that almost two third of the consumers surveyed can be considered resistant towards EVs (65%).

Moreover, it suggests that the EV currently faces seven value barriers. In a descending order those are model variety, range, speed, value for money, size, engine sound, and acceleration. Moreover, the EV is also related to several uncertainties that reflect in seven risk barriers. In particular uncertainties regarding the charging process and the expansion of a charging station infrastructure pose fundamental obstacles. Furthermore, the actual *trilability* of EVs currently poses an adoption barrier. The analysis also revealed that the relevance of the identified barriers varies from market to market. In order to eliminate these barriers we developed product-, service- and communication strategies.

What are relevant drivers of EV Perception?

The second sub-question aimed to investigate the effect of three innovation perception drivers, namely consumer characteristics, innovation exposure, and buying incentives. Regarding consumer characteristics, we examined the existence of four hypothesized effects. The analysis of the data collected suggests the following relationships. First, the high purchase price of EVs does not scare off consumers per se (*Scare off Effect*). Second, the more consumers involve in cars and e-mobility the less beneficial they perceive the ecological friendliness of EVs (*Green Myth Effect*). Third, the more eco-conscious consumers are, the more favourable they evaluate the EV overall (*Green-biased Effect*). Last, many consumers have a negative opinion about EVs, even though they consider themselves green-minded (*Bad Reputation Effect*).

As second driver we examined the effect of innovation exposure on innovation perception. The outcome of the analysis reveals the following relationships. First, the more consumers are exposed to the innovation the better they identify/assess its strengths (e.g. acceleration) and weaknesses (e.g. value for money) (*Informing Effect*). Second, the more consumers are exposed to EVs through (negative) mass media coverage the less favourable their opinion about them (*Bad Publicity Effect*).

The third driver involved the effect of buying incentives on innovation perception. The outcome of our research suggests that monetary incentives do enhance the perceived economic value of an EV. Furthermore, functional incentives also positively effect EV perception. In addition, we examined the consumer valuation regarding buying incentives and revealed market-specific preference sets. This might be of help for governments and other decision makers in designing consumer-tailored incentive systems.

Why Consumers resist buying Electric Cars?

All in all, we conclude that various adoption barriers prevents the electric car from a broad market acceptance. This study shows evidence for the effectiveness of buying incentives. However, most markets do not deploy buying incentives extensively. In the future, considerable R&D investments, support for the creation of new markets and new business models are required in order to increase EV adoption. Once established on the market, it has the power to significantly change the mobility behaviour of both individual people and the society as a whole.

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10. Appendix

ADOPTION BARRRIERS

RELATIVE ADVANTAGE		Non-Resistant		Resistant		Total
Range	Strongly Disadvantageous	6	12%	31	34%	37
	Disadvantageous	30	60%	43	47%	73
			72%		**81%**	
Speed	Strongly Disadvantageous	1	2%	11	12%	12
	Disadvantageous	16	32%	42	46%	58
			34%		**58%**	
Acceleration	Strongly Disadvantageous	0	0%	4	4%	4
	Disadvantageous	9	18%	29	32%	38
			18%		**36%**	
Engine Sound	Strongly Disadvantageous	3	6%	16	18%	19
	Disadvantageous	8	16%	19	21%	27
			22%		**38%**	
Safety	Strongly Disadvantageous	0	0%	3	3%	3
	Disadvantageous	2	4%	7	8%	9
			4%		**11%**	
Design	Strongly Disadvantageous	1	2%	2	2%	3
	Disadvantageous	8	16%	23	25%	31
			18%		**27%**	
Size	Strongly Disadvantageous	1	2%	4	4%	5
	Disadvantageous	13	26%	34	37%	47
			28%		**42%**	
Environmental friendliness	Strongly Disadvantageous	0	0%	1	1%	1
	Disadvantageous	0	0%	1	1%	1
			0%		**2%**	
Image	Strongly Disadvantageous	0	0%	2	2%	2
	Disadvantageous	3	6%	14	15%	17
			6%		**17%**	
Value for money	Strongly Disadvantageous	4	8%	12	13%	16
	Disadvantageous	14	28%	38	42%	52
			36%		**55%**	
Model variety	Strongly Disadvantageous	10	20%	31	34%	41
	Disadvantageous	29	58%	49	54%	78
			78%		**88%**	

RISK		Non-Resistant		Resistant		Total
The absence of the engine sound of EVs might result in a higher accident risk.	**Agree**	10	20%	26	28%	36
	Strongly Agree	1	2%	10	11%	11
			22%		**39%**	
I do not consider to buy an EV now because purchase prices may drop in the next years.	**Agree**	18	36%	40	43%	58
	Strongly Agree	1	2%	9	10%	10
			38%		**53%**	
I hesitate to buy an EV because the operating cost (e.g. electricity) might increase in the next years.	**Agree**	4	8%	14	15%	18
	Strongly Agree	0	0%	4	4%	4
			8%		**19%**	
The driving range (battery capacity) of an EV might decrease over time.	**Agree**	27	54%	41	44%	68
	Strongly Agree	1	2%	15	16%	16
			56%		**60%**	
The EV's charging time might constrain me more than expected in my daily routines.	**Agree**	17	34%	39	42%	56
	Strongly Agree	2	4%	18	19%	20
			36%		**61%**	
The expansion of the charging station infrastructure might take longer than expected.	**Agree**	28	56%	63	68%	91
	Strongly Agree	2	4%	18	19%	20
			60%		**87%**	
I might have problems finding a nearby charging station when travelling with an EV.	**Agree**	25	50%	46	49%	71
	Strongly Agree	10	20%	36	39%	46
			70%		**88%**	
If I own an EV, people might consider me as too progressive or showy.	**Agree**	4	8%	2	2%	6
	Strongly Agree	0	0%	2	2%	2
			8%		**4%**	
The process of buying an EV might take more time than expected.	**Agree**	14	28%	21	23%	35
	Strongly Agree	0	0%	1	1%	1
			28%		**24%**	
The learning process to use an EV might take more time than expected.	**Agree**	3	6%	10	11%	13
	Strongly Agree	0	0%	1	1%	1
			6%		**12%**	
The EV technology might hardly gain full acceptance on the market	**Agree**	13	26%	37	40%	50
	Strongly Agree	0	0%	7	8%	7

COMPATIBILITY		Non-Resistance		Resistance		Total
How is your opinion towards electric vehicles (EV) and e-mobility in general?	Negative	1	2%	8	9%	9
	Neutral	3	6%	24	26%	27
			8%		**34%**	
How much do you typically drive with a car within a day?	151 - 200km	2	4%	3	3%	5
	201 - 250km	0	0%	0	0%	0
	More than 250km	0	0%	1	1%	1
			4%		**4%**	
COMPLEXITY		**Non-Resistant**		**Resistant**		Total
I have difficulties to understand EV	Agree	3	6%	2	2%	5
	Strongly Agree	0	0%	1	1%	1
			6%		**3%**	
I (might) have problems to drive an EV	Agree	3	6%	10	11%	13
	Strongly Agree	2	4%	1	1%	3
			10%		**12%**	
TRIALABILITY		**Non-Resistant**		**Resistant**		Total
Local car dealer	Very Difficult	5	10%	14	15%	19
	Difficult	18	36%	37	41%	55
			46%		**56%**	
Trade fair	Very Difficult	5	10%	5	5%	10
	Difficult	14	28%	36	40%	50
			38%		**45%**	
Car sharing services	Very Difficult	2	4%	10	11%	12
	Difficult	12	24%	35	38%	47
			28%		**49%**	
Promotional events	Very Difficult	1	2%	6	7%	7
	Difficult	12	24%	26	29%	38
			26%		**35%**	
Personal environment (e.g. testing a friend's EV)	Very Difficult	9	18%	44	48%	53
	Difficult	15	30%	27	30%	42
			48%		**78%**	

ADOPTION BARRIER/NATIONALITY

RELATIVE ADVANTAGE		Norwegian	Swedish	Danish	German	Other	Total
Range	**Strongly Disadvantageous**	5	3	3	17	3	31
	Disadvantageous	9	7	9	13	5	43
		100%	**71%**	**75%**	**79%**	**89%**	**81%**
	Total	14	14	16	38	9	91
Speed	**Strongly Disadvantageous**	3	1	0	5	2	11
	Disadvantageous	5	6	5	23	3	42
		57%	**47%**	**31%**	**74%**	**56%**	**58%**
	Total	14	15	16	38	9	92
Acceleration	**Strongly Disadvantageous**	2	1	0	1	0	4
	Disadvantageous	4	7	6	9	3	29
		43%	**53%**	**38%**	**26%**	**33%**	**36%**
	Total	14	15	16	38	9	92
Engine Sound	**Strongly Disadvantageous**	2	0	4	10	0	16
	Disadvantageous	3	1	3	11	1	19
		36%	**7%**	**47%**	**55%**	**11%**	**38%**
	Total	14	15	15	38	9	91
Safety	**Strongly Disadvantageous**	3	0	0	0	0	3
	Disadvantageous	2	0	1	4	0	7
		36%	**0%**	**7%**	**11%**	**0%**	**11%**
	Total	14	15	15	37	8	89
Design	**Strongly Disadvantageous**	1	1	0	0	0	2
	Disadvantageous	4	2	2	13	2	23
		36%	**20%**	**13%**	**34%**	**22%**	**27%**
	Total	14	15	15	38	9	91
Size	**Strongly Disadvantageous**	1	1	1	1	0	4
	Disadvantageous	7	4	4	17	2	34
		57%	**33%**	**33%**	**47%**	**22%**	**42%**
	Total	14	15	15	38	9	91
Environmental friendliness	**Strongly Disadvantageous**	0	0	1	0	0	1
	Disadvantageous	0	0	0	1	0	1
		0%	**0%**	**6%**	**3%**	**0%**	**2%**
	Total	14	15	16	38	9	92
Image	**Strongly Disadvantageous**	1	0	0	1	0	2
	Disadvantageous	1	3	0	10	0	14
		15%	**21%**	**0%**	**29%**	**0%**	**18%**
	Total	13	14	14	38	9	88
Value for money	**Strongly Disadvantageous**	1	1	1	7	2	12
	Disadvantageous	5	7	7	17	2	38
		43%	**53%**	**53%**	**63%**	**44%**	**55%**
	Total	14	15	15	38	9	91
Model variety	**Strongly Disadvantageous**	6	2	5	16	2	31
	Disadvantageous	6	9	9	18	7	49
		86%	**73%**	**93%**	**89%**	**100%**	**88%**
	Total	14	15	15	38	9	91

RISK		Norwegian	Swedish	Danish	German	Other	Total
The absence of the engine sound of EVs might result in a higher accident risk.	**Agree**	3	5	6	12	0	26
	Strongly Agree	1	0	0	8	1	10
		29%	**33%**	**38%**	**51%**	**11%**	**39%**
I do not consider to buy an EV now because purchase prices may drop in the next years.	**Agree**	6	6	7	18	3	40
	Strongly Agree	1	2	0	6	0	9
		50%	**53%**	**44%**	**62%**	**33%**	**53%**
I hesitate to buy an EV because the operating cost (e.g. electricity) might increase in the next years.	**Agree**	1	3	2	6	2	14
	Strongly Agree	1	0	1	2	0	4
		14%	**20%**	**19%**	**21%**	**22%**	**19%**
The driving range (battery capacity) of an EV might decrease over time.	**Agree**	7	6	6	18	4	41
	Strongly Agree	3	1	4	5	2	15
		71%	**47%**	**63%**	**59%**	**67%**	**60%**
The EV's charging time might constrain me more than expected in my daily routines.	**Agree**	6	5	8	16	4	39
	Strongly Agree	3	0	3	10	2	18
		64%	**33%**	**69%**	**67%**	**67%**	**61%**
The expansion of the charging station infrastructure might take longer than expected.	**Agree**	9	11	9	27	7	63
	Strongly Agree	3	1	6	6	2	18
		86%	**80%**	**94%**	**85%**	**100%**	**87%**
I might have problems finding a nearby charging station when travelling with an EV.	**Agree**	9	8	9	18	2	46
	Strongly Agree	4	5	5	16	6	36
		93%	**87%**	**88%**	**87%**	**89%**	**88%**
If I own an EV, people might consider me as too progressive or showy.	**Agree**	1	0	0	1	0	2
	Strongly Agree	2	0	0	0	0	2
		21%	**0%**	**0%**	**3%**	**0%**	**4%**
The process of buying an EV might take more time than expected.	**Agree**	2	3	2	12	2	21
	Strongly Agree	0	0	1	0	0	1
		14%	**20%**	**19%**	**31%**	**22%**	**24%**
The learning process to use an EV might take more time than expected.	**Agree**	2	1	2	4	1	10
	Strongly Agree	0	0	1	0	0	1
		14%	**7%**	**19%**	**10%**	**11%**	**12%**
The EV technology might hardly gain full acceptance on the market	**Agree**	3	5	9	16	4	37
	Strongly Agree	2	0	1	3	1	7
		36%	**33%**	**63%**	**49%**	**56%**	**47%**

CONSUMER CHARACTERISTICS

CAR INVOLVEMENT/RELATIVE ADVANTAGE		Low		High		Total
Range	**Strongly Disadvantageous**	12	18%	25	33%	37
	Disadvantageous	33	51%	40	53%	73
	Comparable	18	28%	9	12%	27
	Advantageous	1	2%	2	3%	3
	Strongly Advantageous	0	0%	0	0%	0
	Total	64	98%	76	101%	140
Speed	**Strongly Disadvantageous**	4	6%	8	11%	12
	Disadvantageous	31	47%	27	36%	58
	Comparable	28	42%	31	41%	59
	Advantageous	3	5%	6	8%	9
	Strongly Advantageous	0	0%	4	5%	4
	Total	66	102%	76	101%	142
Acceleration	**Strongly Disadvantageous**	2	3%	2	3%	4
	Disadvantageous	28	43%	10	13%	38
	Comparable	26	40%	31	41%	57
	Advantageous	7	11%	20	26%	27
	Strongly Advantageous	2	3%	13	17%	15
	Total	65	100%	76	100%	141
Engine Sound	**Strongly Disadvantageous**	4	6%	15	20%	19
	Disadvantageous	10	15%	17	23%	27
	Comparable	6	9%	5	7%	11
	Advantageous	23	35%	25	33%	48
	Strongly Advantageous	23	35%	13	17%	36
	Total	66	102%	75	100%	141
Safety	**Strongly Disadvantageous**	1	2%	2	3%	3
	Disadvantageous	3	5%	6	8%	9
	Comparable	47	72%	55	73%	102
	Advantageous	13	20%	9	12%	22
	Strongly Advantageous	1	2%	2	3%	3
	Total	65	100%	74	99%	139
Design	**Strongly Disadvantageous**	1	2%	2	3%	3
	Disadvantageous	12	18%	19	25%	31
	Comparable	45	68%	41	55%	86
	Advantageous	6	9%	11	15%	17
	Strongly Advantageous	2	3%	2	3%	4
	Total	66	100%	75	100%	141
Size	**Strongly Disadvantageous**	2	3%	3	4%	5
	Disadvantageous	24	37%	23	31%	47
	Comparable	37	57%	40	53%	77
	Advantageous	3	5%	5	7%	8
	Strongly Advantageous	0	0%	3	4%	3
	Total	66	102%	74	99%	140

Environmental friendliness	**Strongly Disadvantageous**	1	2%	0	0%	1
	Disadvantageous	0	0%	1	1%	1
	Comparable	3	5%	9	12%	12
	Advantageous	15	23%	19	25%	34
	Strongly Advantageous	47	71%	47	62%	94
	Total	66	100%	76	100%	142
Image	**Strongly Disadvantageous**	0	0%	2	3%	2
	Disadvantageous	8	12%	9	12%	17
	Comparable	17	26%	10	14%	27
	Advantageous	20	31%	35	48%	55
	Strongly Advantageous	20	31%	17	23%	37
	Total	65	100%	73	100%	138
Value for money	**Strongly Disadvantageous**	4	6%	12	16%	16
	Disadvantageous	23	35%	29	39%	52
	Comparable	18	27%	19	25%	37
	Advantageous	19	29%	10	13%	29
	Strongly Advantageous	2	3%	5	7%	7
	Total	66	100%	75	100%	141
Model variety	**Strongly Disadvantageous**	12	18%	29	39%	41
	Disadvantageous	40	61%	38	51%	78
	Comparable	13	20%	5	7%	18
	Advantageous	1	2%	1	1%	2
	Strongly Advantageous	0	0%	2	3%	2
	Total	66	100%	75	100%	141

CAR INVOLVEMENT/COMPLEXITY		**Low**		**High**		Total
I have difficulties to understand EVs	**Strongly Disagree**	17	26%	33	43%	50
	Disagree	31	47%	31	40%	62
	Neither Agree nor Disagree	16	24%	9	12%	25
	Agree	2	3%	3	4%	5
	Strongly Agree	0	0%	1	1%	1
	Total	66	100%	77	100%	143
I (might) have problems to drive an EV	**Strongly Disagree**	18	27%	39	51%	57
	Disagree	25	38%	19	25%	44
	Neither Agree nor Disagree	17	26%	9	12%	26
	Agree	5	8%	8	10%	13
	Strongly Agree	1	2%	2	3%	3
	Total	66	100%	77	100%	143

ECOCONSCIOUSNESS/RELATIVE ADVANTAGE		Low		High		Total
Range	**Strongly Disadvantageous**	19	32%	17	22%	36
	Disadvantageous	28	47%	45	57%	73
	Comparable	11	18%	16	20%	27
	Advantageous	2	3%	1	1%	3
	Strongly Advantageous	0	0%	0	0%	0
	Total	60	100%	79	100%	139
Speed	**Strongly Disadvantageous**	8	13%	4	5%	12
	Disadvantageous	25	42%	33	41%	58
	Comparable	24	40%	34	42%	58
	Advantageous	2	3%	7	9%	9
	Strongly Advantageous	1	2%	3	4%	4
	Total	60	100%	81	100%	141
Acceleration	**Strongly Disadvantageous**	2	3%	2	2%	4
	Disadvantageous	16	27%	21	26%	37
	Comparable	26	43%	31	38%	57
	Advantageous	10	17%	17	21%	27
	Strongly Advantageous	6	10%	9	11%	15
	Total	60	100%	80	99%	140
Engine Sound	**Strongly Disadvantageous**	14	23%	5	6%	19
	Disadvantageous	11	18%	16	20%	27
	Comparable	4	7%	7	9%	11
	Advantageous	20	33%	27	33%	47
	Strongly Advantageous	10	17%	26	32%	36
	Total	59	98%	81	100%	140
Safety	**Strongly Disadvantageous**	2	3%	1	1%	3
	Disadvantageous	3	5%	6	7%	9
	Comparable	40	67%	61	75%	101
	Advantageous	11	18%	11	14%	22
	Strongly Advantageous	2	3%	1	1%	3
	Total	58	97%	80	99%	138
Design	**Strongly Disadvantageous**	3	5%	0	0%	3
	Disadvantageous	11	18%	19	23%	30
	Comparable	39	65%	47	58%	86
	Advantageous	5	8%	12	15%	17
	Strongly Advantageous	1	2%	3	4%	4
	Total	59	98%	81	100%	140
Size	**Strongly Disadvantageous**	2	3%	3	4%	5
	Disadvantageous	23	38%	23	28%	46
	Comparable	31	52%	46	57%	77
	Advantageous	0	0%	8	10%	8
	Strongly Advantageous	2	3%	1	1%	3
	Total	58	97%	81	100%	139

Environmental friendliness	**Strongly Disadvantageous**	1	2%	0	0%	1
	Disadvantageous	1	2%	0	0%	1
	Comparable	5	8%	7	9%	12
	Advantageous	16	27%	17	21%	33
	Strongly Advantageous	37	62%	57	70%	94
	Total	60	100%	81	100%	141
Image	**Strongly Disadvantageous**	2	3%	0	0%	2
	Disadvantageous	8	13%	9	11%	17
	Comparable	14	23%	13	16%	27
	Advantageous	22	37%	32	40%	54
	Strongly Advantageous	11	18%	26	32%	37
	Total	57	95%	80	99%	137
Value for money	**Strongly Disadvantageous**	7	12%	9	11%	16
	Disadvantageous	27	45%	24	30%	51
	Comparable	17	28%	20	25%	37
	Advantageous	7	12%	22	27%	29
	Strongly Advantageous	1	2%	6	7%	7
	Total	59	98%	81	100%	140
Model variety	**Strongly Disadvantageous**	19	32%	21	26%	40
	Disadvantageous	34	57%	44	54%	78
	Comparable	5	8%	13	16%	18
	Advantageous	1	2%	1	1%	2
	Strongly Advantageous	0	0%	2	2%	2
	Total	59	98%	81	100%	140

ECOCONSCIOUSNESS/COMPATIBILITY		**Low**		**High**		Total
How is your opinion towards electric vehicles (EV) and e-mobility in general?	**Positive**	39	64%	67	83%	106
	Negative	6	10%	3	4%	9
	Neutral	16	26%	11	14%	27
	Total	61	100%	81	100%	142

EV EXPOSURE

RANGE	Rarely	Frequently
TV		
Dis	73%	84%
Ad	1%	3%
Print		
Dis	76%	81%
Ad	3%	1%
Radio		
Dis	78%	83%
Ad	2%	4%
Internet		
Dis	57%	84%
Ad	3%	2%
Social Media		
Dis	76%	80%
Ad	2%	2%
Personal environment		
Dis	74%	84%
Ad	4%	0%

SPEED	Rarely	Frequently
TV		
Dis	54%	45%
Ad	6%	13%
Print		
Dis	46%	52%
Ad	9%	10%
Radio		
Dis	51%	46%
Ad	10%	8%
Internet		
Dis	65%	45%
Ad	3%	11%
Soical Media		
Dis	54%	45%
Ad	2%	15%
PE		
Dis	53%	45%
Ad	5%	13%

ACCELERATION	Rarely	Frequently
TV		
Dis	36%	24%
Ad	26%	34%
Print		
Dis	39%	21%
Ad	23%	37%
Radio		
Dis	31%	25%
Ad	30%	30%
Internet		
Dis	69%	20%
Ad	7%	36%
Soical Media		
Dis	37%	24%
Ad	19%	37%
PE		
Dis	36%	22%
Ad	21%	39%
Dis	7%	10%
Ad	17%	19%

ENGINE SOUND	Rarely	Frequently
TV		
Dis	20%	46%
Ad	69%	50%
Print		
Dis	22%	34%
Ad	59%	60%
Radio		
Dis	33%	33%
Ad	59%	63%
Internet		
Dis	35%	31%
Ad	48%	63%
Soical Media		
Dis	30%	35%
Ad	58%	62%
PE		
Dis	38%	27%
Ad	52%	69%
Dis	24%	24%
Ad	12%	18%

SIZE	Rarely	Frequently
TV		
Dis	34%	40%
Ad	10%	6%
Print		
Dis	42%	31%
Ad	8%	7%
Radio		
Dis	36%	43%
Ad	9%	4%
Internet		
Dis	42%	35%
Ad	3%	9%
Soical Media		
Dis	40%	36%
Ad	9%	8%
PE		
Dis	37%	37%
Ad	6%	9%
Dis	16%	11%
Ad	62%	71%

EF	Rarley	Frequently
TV		
Dis	1%	1%
Ad	92%	89%
Print		
Dis	1%	1%
Ad	92%	89%
Radio		
Dis	1%	4%
Ad	90%	92%
Internet		
Dis	3%	1%
Ad	84%	92%
Social Media		
Dis	2%	1%
Ad	88%	92%
PE		
Dis	2%	0%
Ad	88%	93%
Dis	51%	45%
Ad	22%	30%

MODEL VARIETY	Rarely	Frequently
TV		
Dis	86%	83%
Ad	4%	1%
Print		
Dis	80%	89%
Ad	2%	2%
Radio		
Dis	87%	75%
Ad	3%	4%
Internet		
Dis	65%	90%
Ad	6%	2%
Soical Media		
Dis	83%	86%
Ad	4%	2%
PE		
Dis	81%	88%
Ad	2%	2%

COMPATIBILITY	Rarely	Frequently
TV		
Positiv	76%	73%
Negativ	22%	15%
Print		
Positiv	79%	70%
Negativ	15%	23%
Radio		
Positiv	75%	71%
Negativ	19%	21%
Internet		
Positiv	72%	76%
Negativ	28%	16%
Social Media		
Positiv	68%	79%
Negativ	25%	15%
Personal environment		
Positiv	67%	84%
Negativ	26%	10%

BUYING INCENTIVES

Monetary Incentives

EV PERCEPTION		**Norwegian**		**Swedish**		**Danish**		**German**		**Total**
Value for money	**Strongly Disadvantageous**	1	4%	3	13%	2	8%	7	14%	16
	Disadvantageous	7	25%	8	35%	10	42%	24	48%	52
			29%		**48%**		**50%**		**62%**	
	Comparable	8	29%	6	26%	8	33%	10	20%	37
	Advantageous	9	32%	3	13%	4	17%	9	18%	29
	Strongly Advantageous	3	11%	3	13%	0	0%	0	0%	7
			43%		**26%**		**17%**		**18%**	
	Total	28	100%	23	100%	24	100%	50	100%	141

CONSUMER PREFERENCE		Norwegian		Swedish		Danish		German		Total
Purchase price subsidies	**Not Important**	2	7%	0	0%	1	4%	4	8%	9
	Slightly Important	3	11%	1	4%	6	24%	8	16%	19
	Fairly Important	10	36%	6	26%	4	16%	16	31%	42
	Important	7	25%	13	57%	10	40%	13	25%	48
	Very Important	6	21%	3	13%	4	16%	10	20%	25
			46%		**70%**		**56%**		**45%**	
	Total	28	100%	23	100%	25	100%	51	100%	143
Tax exemption	**Not Important**	1	4%	0	0%	1	4%	3	6%	6
	Slightly Important	2	7%	1	4%	2	8%	7	14%	14
	Fairly Important	6	21%	6	26%	5	20%	9	18%	29
	Important	9	32%	11	48%	12	48%	22	43%	61
	Very Important	10	36%	5	22%	5	20%	10	20%	33
			48%		**70%**		**68%**		**63%**	
	Total	28	100%	23	100%	25	100%	51	100%	143
Insurance benefits	**Not Important**	1	4%	2	9%	1	4%	3	6%	8
	Slightly Important	1	4%	1	4%	4	16%	7	14%	15
	Fairly Important	7	25%	5	22%	2	8%	13	25%	31
	Important	14	50%	13	57%	16	64%	21	41%	71
	Very Important	5	18%	2	9%	2	8%	7	14%	18
			68%		**65%**		**72%**		**55%**	
	Total	28	100%	23	100%	25	100%	51	100%	143
Free battery charging	**Not Important**	1	4%	1	4%	1	4%	3	6%	7
	Slightly Important	3	11%	2	9%	3	12%	4	8%	12
	Fairly Important	6	21%	4	17%	4	16%	8	16%	26
	Important	11	39%	10	43%	13	52%	21	41%	60
	Very Important	7	25%	6	26%	4	16%	15	29%	38
			64%		**69%**		**68%**		**70%**	
	Total	28	100%	23	100%	25	100%	51	100%	143
Free parking	**Not Important**	3	11%	5	22%	5	20%	11	22%	26
	Slightly Important	2	7%	5	22%	8	32%	4	8%	23
	Fairly Important	3	11%	3	13%	1	4%	13	26%	25
	Important	12	43%	6	26%	6	24%	14	28%	40
	Very Important	8	29%	4	17%	5	20%	8	16%	28
			72%		**43%**		**44%**		**44%**	
	Total	28	100%	23	100%	25	100%	50	100%	142

Functional Benefits

EV PERCEPTION		Norwegian		Others	
Range	Strongly Disadvantageous	6	21%	27	28%
	Disadvantageous	17	61%	48	50%
			82%		**78%**
The expansion of the charging station	Strongly Disagree	1	4%	0	0%
	Disagree	3	11%	6	6%
			15%		**6%**
I might have problems finding a nearby charging	Strongly Disagree	1	4%	1	1%
	Disagree	6	21%	2	2%
			25%		**3%**

CONSUMER PREFERENCE		Norwegian		Swedish		Danish		German		Total
Faster expansion of charging stations	Not Important	1	4%	0	0%	1	4%	2	4%	4
	Slightly Important	0	0%	1	4%	2	8%	1	2%	6
	Fairly Important	6	21%	3	13%	2	8%	6	12%	19
			25%		**17%**		**20%**		**18%**	
	Important	9	32%	8	35%	12	48%	22	43%	53
	Very Important	12	43%	11	48%	8	32%	20	39%	61
			75%		**83%**		**80%**		**82%**	
	Total	28	100%	23	100%	25	100%	51	100%	143
Reserved parking spaces	Not Important	3	11%	4	17%	4	16%	9	18%	22
	Slightly Important	3	11%	4	17%	6	24%	3	6%	21
	Fairly Important	1	4%	5	22%	3	12%	12	24%	24
			15%		**39%**		**36%**		**30%**	
	Important	15	54%	6	26%	8	32%	18	36%	50
	Very Important	6	21%	4	17%	4	16%	8	16%	25
			75%		**43%**		**48%**		**52%**	
	Total	28	100%	23	100%	25	100%	50	100%	142
Use of Bus/Taxi lane	Not Important	3	11%	6	26%	8	32%	14	27%	32
	Slightly Important	3	11%	5	22%	6	24%	5	10%	22
	Fairly Important	2	7%	6	26%	4	16%	16	31%	32
			18%		**48%**		**40%**		**41%**	
	Important	11	39%	4	17%	4	16%	10	20%	33
	Very Important	9	32%	2	9%	3	12%	6	12%	24
			71%		**26%**		**28%**		**31%**	
	Total	28	100%	23	100%	25	100%	51	100%	143

Indirect Benefit

INDIRECT BENEFIT		Norwegian		Swedish		Danish		German		Total
City toll exemption (e.g. environmental zone)	Not Important	1	4%	0	0%	4	16%	6	12%	11
	Slightly Important	1	4%	3	13%	4	16%	8	16%	18
	Fairly Important	5	18%	9	39%	8	32%	15	29%	42
	Important	11	39%	8	35%	5	20%	15	29%	44
	Very Important	10	36%	3	13%	4	16%	7	14%	28
			75%		**48%**		**36%**		**43%**	
	Total	28								
Higher regulations of CO2 emissions for traditional cars.	Not Important	7	25%	0	0%	5	20%	11	22%	27
	Slightly Important	5	18%	2	9%	6	24%	10	20%	25
	Fairly Important	6	21%	6	26%	3	12%	8	16%	26
	Important	5	18%	9	39%	8	32%	17	33%	43
	Very Important	5	18%	6	26%	3	12%	5	10%	22
			36%		**65%**		**44%**		**44%**	
	Total	28	100%	23	100%	25	100%	51	100%	143

Initial Report

Last Modified: 08/09/2013

1. Question 1: How is your opinion towards electric vehicles (EV) and e-mobility in general?

#	Answer	Bar	Response	%
1	Positive		127	77%
2	Negative		10	6%
3	Neutral		29	17%
	Total		166	

Statistic	Value
Min Value	1
Max Value	3
Mean	1.41
Variance	0.59
Standard Deviation	0.77
Total Responses	166

2. Question 2: How do you rate the functionality of an EV compared to a traditional car?

#	Question	Strongly Disadvantageous	Disadvantageous	Comparable	Advantageous	Strongly Advantageous	Total Responses	Mean
11	Acceleration	5	43	66	28	19	161	3.08
4	Design	3	32	101	19	5	160	2.94
2	Engine Sound	21	30	13	56	41	161	3.41
6	Environmental friendliness	1	1	14	36	110	162	4.56
7	Image	2	17	34	67	38	158	3.77
9	Model variety	47	90	18	4	2	161	1.91
1	Range	41	86	29	3	1	160	1.98
3	Safety	3	10	117	25	4	159	3.11
5	Size	6	50	90	10	3	159	2.71
10	Speed	13	64	70	10	5	162	2.57
8	Value for money	18	59	44	32	8	161	2.71

Statistic	Range	Speed	Acceleration	Engine Sound	Safety	Design	Size	Environmental friendliness	Image	Value for money	Model variety
Min Value	1	1	1	1	1	1	1	1	1	1	1
Max Value	5	5	5	5	5	5	5	5	5	5	5
Mean	1.98	2.57	3.08	3.41	3.11	2.94	2.71	4.56	3.77	2.71	1.91
Variance	0.57	0.72	1.04	1.92	0.39	0.52	0.52	0.53	0.95	1.13	0.61
Standard Deviation	0.76	0.85	1.02	1.39	0.62	0.72	0.72	0.73	0.98	1.06	0.78
Total Responses	160	162	161	161	159	160	159	162	158	161	161

3. Question 3: How much do you typically drive with a car within a day?

#	Answer	Bar	Response	%
1	Less than 50km		118	72%
2	51 - 150km		39	24%
3	151 - 200km		6	4%
4	201 - 250km		0	0%
5	More than 250km		1	1%
	Total		164	

Statistic	Value
Min Value	1
Max Value	5
Mean	1.34
Variance	0.37
Standard Deviation	0.61
Total Responses	164

4. Question 4: To what extent do you agree with the following statement?"I have difficulties to understand the concept of EVs and e-mobility."

#	Answer	Bar	Response	%
1	Strongly Disagree		58	35%
2	Disagree		69	42%
3	Neither Agree nor Disagree		29	17%
4	Agree		9	5%
5	Strongly Agree		1	1%
	Total		166	

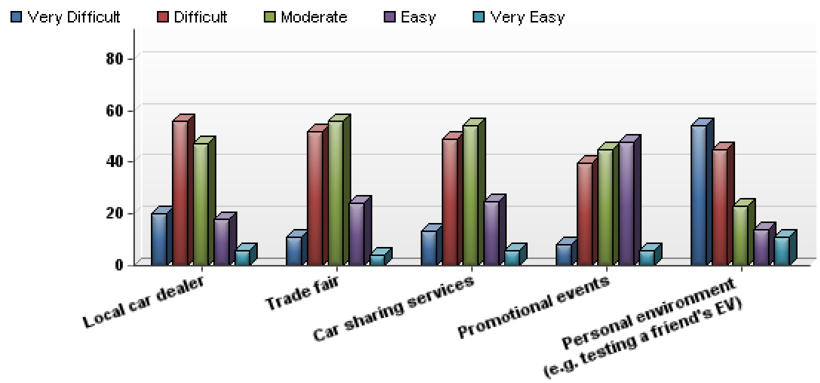
Statistic	Value
Min Value	1
Max Value	5
Mean	1.95
Variance	0.80
Standard Deviation	0.89
Total Responses	166

5. Question 5: To what extent do you agree with the following statement?"I (might) have problems to drive an EV."

#	Answer	Bar	Response	%
1	Strongly Disagree		67	41%
2	Disagree		52	32%
3	Neither Agree nor Disagree		29	18%
4	Agree		14	8%
5	Strongly Agree		3	2%
	Total		165	

Statistic	Value
Min Value	1
Max Value	5
Mean	1.99
Variance	1.09
Standard Deviation	1.04
Total Responses	165

6. Question 6: How do you perceive the actual possibility (convenience) to test EVs?



#	Question	Very Difficult	Difficult	Moderate	Easy	Very Easy	Total Responses	Mean
1	Local car dealer	13.61%	38.10%	31.97%	12.24%	4.08%	147	2.55
2	Trade fair	7.48%	35.37%	38.10%	16.33%	2.72%	147	2.71
3	Car sharing services	8.84%	33.33%	36.73%	17.01%	4.08%	147	2.74
4	Promotional events	5.44%	27.21%	30.61%	32.65%	4.08%	147	3.03
5	Personal environment (e.g. testing a friend's EV)	36.73%	30.61%	15.65%	9.52%	7.48%	147	2.20

Statistic	Local car dealer	Trade fair	Car sharing services	Promotional events	Personal environment (e.g. testing a friend's EV)
Min Value	1	1	1	1	1
Max Value	5	5	5	5	5
Mean	2.55	2.71	2.74	3.03	2.20
Variance	1.02	0.85	0.96	0.99	1.55
Standard Deviation	1.01	0.92	0.98	0.99	1.24
Total Responses	147	147	147	147	147

7. Question 8: When thinking about purchasing an EV, to what extent do you agree with the following statements?

#	Question	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	Total Responses	Mean
1	The absence of the engine sound of EVs might result in a higher accident risk.	22	50	29	36	12	149	2.77
2	I do not consider to buy an EV now because purchase prices may drop in the next years.	10	22	45	62	10	149	3.27
3	I hesitate to buy an EV because the operating cost (e.g. electricity) might increase in the next years.	18	65	43	19	4	149	2.50
4	The driving range (battery capacity) of an EV might decrease over time.	7	20	37	69	16	149	3.45
5	The EV's charging time might constrain me more than expected in my daily routines.	5	26	37	60	20	148	3.43
6	The expansion of the charging station infrastructure might take longer than expected.	1	12	20	94	22	149	3.83
7	I might have problems finding a nearby charging station when travelling with an EV.	4	10	15	74	46	149	3.99
8	If I own an EV, people might consider me as too progressive or showy.	71	48	21	6	3	149	1.81
9	The process of buying an EV might take more time than expected.	18	37	54	38	1	148	2.78
10	The learning process to use an EV might take more time than expected.	45	52	36	15	1	149	2.16
11	The EV technology might hardly gain full acceptance on the market	10	44	37	51	7	149	3.01

Statistic	The absence of the engine sound of EVs might result in a higher accident risk.	I do not consider to buy an EV now because purchase prices may drop in the next years.	I hesitate to buy an EV because the operating cost (e.g. electricity) might increase in the next years.	The driving range (battery capacity) of an EV might decrease over time.	The EV's charging time might constrain me more than expected in my daily routines.	The expansion of the charging station infrastructure might take longer than expected.	I might have problems finding a nearby charging station when travelling with an EV.	If I own an EV, people might consider me as too progressive or showy.	The process of buying an EV might take more time than expected.	The learning process to use an EV might take more time than expected.	The EV technology might hardly gain full acceptance on the market
Min Value	1	1	1	1	1	1	1	1	1	1	1
Max Value	5	5	5	5	5	5	5	5	5	5	5
Mean	2.77	3.27	2.50	3.45	3.43	3.83	3.99	1.81	2.78	2.16	3.01
Variance	1.45	1.04	0.91	1.02	1.08	0.64	0.93	0.93	0.98	0.99	1.10
Standard Deviation	1.20	1.02	0.96	1.01	1.04	0.80	0.96	0.96	0.99	0.99	1.05
Total Responses	149	149	149	149	148	149	149	149	148	149	149

8. Question 9: To what extent do you agree with the following statement?"Environmental consciousness is important to me and therefore impacts my buying behaviour."

#	Answer	Bar	Response	%
1	Strongly Disagree		5	4%
2	Disagree		19	13%
3	Neither Agree nor Disagree		37	26%
4	Agree		63	44%
5	Strongly Agree		18	13%
	Total		142	

Statistic	Value
Min Value	1
Max Value	5
Mean	3.49
Variance	0.99
Standard Deviation	0.99
Total Responses	142

9. Question 10: To what extent do you agree with the following statement?"I am interested in cars and related product or technology trends."

#	Answer	Bar	Response	%
1	Strongly Disagree		13	9%
2	Disagree		24	17%
3	Neither Agree nor Disagree		29	20%
4	Agree		45	31%
5	Strongly Agree		32	22%
	Total		143	

Statistic	Value
Min Value	1
Max Value	5
Mean	3.41
Variance	1.58
Standard Deviation	1.26
Total Responses	143

10. Question 7: Do you notice EVs in the streets on a regular basis?

#	Answer	Bar	Response	%
1	Yes		57	38%
2	No		79	53%
3	Not sure		13	9%
	Total		149	

Statistic	Value
Min Value	1
Max Value	3
Mean	1.70
Variance	0.39
Standard Deviation	0.62
Total Responses	149

11. Question 11: How many cars do you have in your household?

#	Answer	Bar	Response	%
1	None		40	28%
2	One		38	27%
3	Two		32	22%
4	Three or more		33	23%
	Total		143	

Statistic	Value
Min Value	1
Max Value	4
Mean	2.41
Variance	1.27
Standard Deviation	1.13
Total Responses	143

12. Question12: Do you think environmentally friendly vehicles are worth paying more money for?

#	Answer	Bar	Response	%
1	Yes		77	54%
2	No		35	24%
3	Not sure		31	22%
	Total		143	

Statistic	Value
Min Value	1
Max Value	3
Mean	1.68
Variance	0.66
Standard Deviation	0.81
Total Responses	143

13. Question 13: How often do the following communication channels provide you with information about EVs and e-mobility in general (e.g. advertisement, news report, documentary etc.)?

#	Question	Very Rarely	Rarely	Occasionally	Frequently	Very Frequently	Total Responses	Mean
1	TV	31	41	47	20	4	143	2.48
2	Print	27	45	54	14	3	143	2.45
3	Radio	72	45	20	3	1	141	1.70
4	Internet	15	17	53	37	20	142	3.21
5	Social media	23	37	50	24	8	142	2.70
6	Personal environment	42	34	40	19	8	143	2.42

Statistic	TV	Print	Radio	Internet	Social media	Personal environment
Min Value	1	1	1	1	1	1
Max Value	5	5	5	5	5	5
Mean	2.48	2.45	1.70	3.21	2.70	2.42
Variance	1.14	0.95	0.71	1.33	1.22	1.44
Standard Deviation	1.07	0.98	0.84	1.15	1.10	1.20
Total Responses	143	143	141	142	142	143

14. Question 14: How important are the following (potential) benefits related to EVs for you?

#	Question	Not Important	Slightly Important	Fairly Important	Important	Very Important	Total Responses	Mean
1	Purchase price subsidies	9	19	42	48	25	143	3.43
2	Tax exemption	6	14	29	61	33	143	3.71
3	Insurance benefits	8	15	31	71	18	143	3.53
4	Free battery charging	7	12	26	60	38	143	3.77
5	Faster expansion of charging stations	4	6	19	53	61	143	4.13
6	Reserved parking spaces	22	21	24	50	25	142	3.25
7	Free parking	26	23	25	40	28	142	3.15
8	Use of Bus/Taxi lane	32	22	32	33	24	143	2.97
9	City toll exemption (e.g. environmental zone)	11	18	42	44	28	143	3.42
10	Higher regulations of CO2 emissions for traditional cars.	27	25	26	43	22	143	3.06

Statistic	Purchase price subsidies	Tax exemption	Insurance benefits	Free battery charging	Faster expansion of charging stations	Reserved parking spaces	Free parking	Use of Bus/Taxi lane	City toll exemption (e.g. environmental zone)	Higher regulations of CO2 emissions for traditional cars.
Min Value	1	1	1	1	1	1	1	1	1	1
Max Value	5	5	5	5	5	5	5	5	5	5
Mean	3.43	3.71	3.53	3.77	4.13	3.25	3.15	2.97	3.42	3.06
Variance	1.25	1.12	1.05	1.18	0.97	1.78	1.96	1.96	1.36	1.86
Standard Deviation	1.12	1.06	1.03	1.09	0.98	1.33	1.40	1.40	1.17	1.36
Total Responses	143	143	143	143	143	142	142	143	143	143

15. Question 15: To what extent do you agree with the following statement?"Under the current circumstances I do not plan to buy an EV in the near future."

#	Answer	Bar	Response	%
1	Strongly disagree		7	5%
2	Disagree		17	12%
3	Neither Agree nor Disagree		26	18%
4	Agree		55	38%
5	Strongly Agree		38	27%
	Total		143	

Statistic	Value
Min Value	1
Max Value	5
Mean	3.70
Variance	1.28
Standard Deviation	1.13
Total Responses	143

16. Question 16: What is your gender?

#	Answer	Bar	Response	%
1	Male		85	59%
2	Female		58	41%
	Total		143	

Statistic	Value
Min Value	1
Max Value	2
Mean	1.41
Variance	0.24
Standard Deviation	0.49
Total Responses	143

17. Question 17: What is your age?

#	Answer	Bar	Response	%
1	16 - 25 years		66	46%
2	26 - 35 years		62	43%
3	36 - 45 years		4	3%
4	46 - 55 years		9	6%
5	56 years and older		2	1%
	Total		143	

Statistic	Value
Min Value	1
Max Value	5
Mean	1.73
Variance	0.80
Standard Deviation	0.90
Total Responses	143

18. Question 18: What is your nationality?

Statistic	Value
Min Value	1
Max Value	5
Mean	3.03
Variance	1.76
Standard Deviation	1.33
Total Responses	143

#	Answer	Bar	Response	%
1	Norwegian		28	20%
2	Swedish		23	16%
3	Danish		25	17%
4	German		51	36%
5	Other		16	11%
	Total		143	

Statistic	Value
Min Value	1
Max Value	5
Mean	3.03
Variance	1.76
Standard Deviation	1.33
Total Responses	143

Electric Cars

Climate change and global resource shortage have led to rethink traditional individual mobility. Electric vehicles (EV) are a promising alternative to overcome these problems.

In this survey the focus is on pure-electric vehicles, powered solely by an electric motor.

The aim of our master thesis is to get a better understanding of consumers' perception towards EVs. Your participation should not take longer than five minutes, but will give us profund insights for our research. The information you provide will be treated confidentially.

Thank you for taking the time to participate in our survey!

Question 1: How is your opinion towards electric vehicles (EV) and e-mobility in general?

- ○ Positive
- ○ Negative
- ○ Neutral

Question 2: How do you rate the functionality of an EV compared to a traditional car?

	Strongly Disadvantageous	Disadvantageous	Comparable	Advantageous	Strongly Advantageous
Range	○	○	○	○	○
Speed	○	○	○	○	○
Acceleration	○	○	○	○	○
Engine Sound	○	○	○	○	○
Safety	○	○	○	○	○
Design	○	○	○	○	○
Size	○	○	○	○	○
Environmental friendliness	○	○	○	○	○
Image	○	○	○	○	○
Value for money	○	○	○	○	○
Model variety	○	○	○	○	○

Question 3: How much do you typically drive with a car within a day?

- ○ Less than 50km
- ○ 51 - 150km
- ○ 151 - 200km
- ○ 201 - 250km
- ○ More than 250km

Question 4: To what extent do you agree with the following statement?

"I have difficulties to understand the concept of EVs and e-mobility."

- ○ Strongly Disagree

- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Question 5: To what extent do you agree with the following statement?

"I (might) have problems to drive an EV."

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Question 6: How do you perceive the actual possibility (convenience) to test EVs?

	Very Difficult	Difficult	Moderate	Easy	Very Easy
Local car dealer	○	○	○	○	○
Trade fair	○	○	○	○	○
Car sharing services	○	○	○	○	○
Promotional events	○	○	○	○	○
Personal environment (e.g. testing a friend's EV)	○	○	○	○	○

Question 7: Do you notice EVs in the streets on a regular basis?

- Yes
- No
- Not sure

Question 8: When thinking about purchasing an EV, to what extent do you agree with the following statements?

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
The absence of the engine sound of EVs might result in a higher accident risk.	○	○	○	○	○
I do not consider to buy an EV now because purchase prices may drop in the next years.	○	○	○	○	○
I hesitate to buy an EV because the operating cost (e.g. electricity) might increase in the next years.	○	○	○	○	○
The EV technology might hardly gain full	○	○	○	○	○

acceptance on the market					
The driving range (battery capacity) of an EV might decrease over time.	○	○	○	○	○
The EV's charging time might constrain me more than expected in my daily routines.	○	○	○	○	○
The expansion of the charging station infrastructure might take longer than expected.	○	○	○	○	○
I might have problems finding a nearby charging station when travelling with an EV.	○	○	○	○	○
If I own an EV, people might consider me as too progressive or showy.	○	○	○	○	○
The process of buying an EV might take more time than expected.	○	○	○	○	○
The learning process to use an EV might take more time than expected.	○	○	○	○	○

Question 9: To what extent do you agree with the following statement?

"Environmental consciousness is important to me and therefore impacts my buying behaviour."

○ Strongly Disagree

○ Disagree

○ Neither Agree nor Disagree

○ Agree

○ Strongly Agree

Question 10: To what extent do you agree with the following statement?

"I am interested in cars and related product or technology trends."

○ Strongly Disagree

○ Disagree

○ Neither Agree nor Disagree

○ Agree

○ Strongly Agree

Question 11: How many cars do you have in your household?

○ None

○ One

○ Two

○ Three or more

Question12: Do you think environmentally friendly vehicles are worth paying more money for?

- Yes
- No
- Not sure

Question 13: How often do the following communication channels provide you with information about EVs and e-mobility in general (e.g. advertisement, news report, documentary etc.)?

	Very Rarely	Rarely	Occasionally	Frequently	Very Frequently
TV	○	○	○	○	○
Print	○	○	○	○	○
Radio	○	○	○	○	○
Internet	○	○	○	○	○
Social media	○	○	○	○	○
Personal environment	○	○	○	○	○

Question 14: How important are the following (potential) benefits related to EVs for you?

	Not Important	Slightly Important	Fairly Important	Important	Very Important
Purchase price subsidies	○	○	○	○	○
Tax exemption	○	○	○	○	○
Insurance benefits	○	○	○	○	○
Free battery charging	○	○	○	○	○
Faster expansion of charging stations	○	○	○	○	○
Reserved parking spaces	○	○	○	○	○
Free parking	○	○	○	○	○
Use of Bus/Taxi lane	○	○	○	○	○
City toll exemption (e.g. environmental zone)	○	○	○	○	○
Higher regulations of CO2 emissions for traditional cars.	○	○	○	○	○

Question 15: To what extent do you agree with the following statement?

"Under the current circumstances I do not plan to buy an EV in the near future."

- Strongly disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Question 16: What is your gender?

- ◯ Male
- ◯ Female

Question 17: What is your age?

- ◯ 16 - 25 years
- ◯ 26 - 35 years
- ◯ 36 - 45 years
- ◯ 46 - 55 years
- ◯ 56 years and older

Question 18: What is your nationality?

- ◯ Norwegian
- ◯ Swedish
- ◯ Danish
- ◯ German
- ◯ Other