



# To Buy or not to Buy a BEV - Drivers and Concerning Factors Influencing German Customers Purchase Intention

Julian Niklas Feller

Dissertation written under the supervision of Professor Miguel  
Fontes Rita

Dissertation submitted in partial fulfilment of requirements for the  
International MSc in Management with Specialization in Strategy and  
Consulting, at the Universidade Católica Portuguesa, April 2024.

## I. Abstract

Title: To Buy or not to buy a BEV – Drivers and Concerning Factors Influencing German customers Purchase Intention

Author: Julian Niklas Feller

This thesis aims to analyse the current drivers and concerns that influence the purchase intention for electric vehicles in the German market. Based on a deductive analysis, factors were identified in the literature that are considered relevant indicators for the purchase intention of EVs internationally. These factors have not yet been analysed as drivers and concerns in this constellation in the German context, which led to the research questions about the connection with the purchase intention. In addition, demographic characteristics were considered and analysed for possible differences between the participant groups.

The methods used included a sample of German residents as well as conducting semi-structured interviews and an online survey to record attitudes. The statistical analysis included correlation analysis to assess the relationships between the determinants and purchase intention.

The most important results show that the drivers and barriers for the purchase of EVs on the German market are in line with international findings and that there is a significant correlation between all variables and the purchase intention. Regarding demographic differences, no effects on the purchase intention can be identified. Limitations of this study include potential biases due to the sample size and the limited scope of the methods used.

These findings help to deepen the understanding of purchase intention for EV and provide valuable insights for companies and research institutes to develop targeted marketing strategies. Future research could focus on validating these findings in different contexts and further investigating the impact of long-term trends on purchasing behaviour.

**Keywords:** purchase intention; battery electric vehicle; Germany; German customer

## II. Abstrato

Autor: To Buy or not to buy a BEV – Drivers and Concerning Factors Influencing German customers Purchase Intention

Título: Julian Niklas Feller

Esta tese tem como objetivo analisar os factores e preocupações que influenciam a intenção de compra de veículos eléctricos no mercado alemão. Com base numa análise dedutiva, foram identificados na literatura factores que são considerados indicadores relevantes para a intenção de compra de veículos eléctricos a nível internacional. Estes factores não foram analisados como factores e preocupações nesta constelação no contexto alemão, o que levou a questões de investigação sobre a ligação com a intenção de compra. Para além disso, as características demográficas foram consideradas e analisadas quanto a possíveis diferenças entre os grupos de participantes.

Os métodos utilizados incluíram uma amostra de residentes alemães, bem a realização de entrevistas semi-estruturadas e um inquérito em linha para registar as atitudes. A análise estatística incluiu uma análise de correlação.

Os resultados importantes mostram que os factores e barreiras para a compra de veículos eléctricos no mercado alemão estão em linha com os resultados internacionais e que existe uma correlação significativa entre variáveis e a intenção de compra. Relativamente às diferenças demográficas, não se identificam efeitos na intenção de compra. As limitações deste estudo incluem potenciais enviesamentos à dimensão da amostra e ao âmbito limitado dos métodos utilizados.

Estes resultados ajudam a aprofundar a compreensão da intenção de compra de VE e fornecem informações valiosas às empresas e à investigação para desenvolver estratégias de marketing direccionadas. A investigação futura poderá centrar-se na validação destes resultados em diferentes contextos e na investigação do impacto das tendências a longo prazo no comportamento de compra.

**Palavras-chave:** intenção de compra; veículo eléctrico a bateria; Alemanha; cliente alemão

### III. Acknowledgement

Firstly, I would like to thank my professor and head of the "New Product Innovation" seminar, Miguel Rita, for his help with the thesis as well as his constant availability for questions and valuable constructive feedback. The encouraging words helped to motivate me a lot.

I would also like to thank the interview participants who shared their views and insights with me and took the time to participate in the interviews.

I would also like to thank my family and my girlfriend for their continuous support and for always being there for me.

### IV. List of Figures

Figure 1: Electric car registrations and sales share in selected regions .....	5
Figure 2: Number of Named Drivers .....	27
Figure 3: Number of named Concerns .....	29
Figure 4: Final most important BEV characteristics .....	30
Figure 5: Descriptive Statistics – Gender in per cent.....	31
Figure 6: Descriptive Statistics – Age in per cent .....	32
Figure 7: Descriptive Statistics: Educational Qualification in per cent .....	33
Figure 8: Descriptive Statistics - Employment Status in per cent.....	34
Figure 9: Descriptive Statistics: Annual Gross Household Income in per cent .....	34

### V. List of Tables

Table 1: KMO- and Bartlett-Test Concerns .....	35
Table 2: KMO- and Bartlett-Test Driver .....	35
Table 3: Total Variance Explained Drivers.....	36
Table 4: Total Variance Explained Concerns.....	37
Table 5: Screenplot Driver .....	37
Table 6: Screenplot Concerns.....	38
Table 7: Correlation of Drivers with purchase intention .....	41

## VI. List of Appendices

Appendix 1: Interview Guideline

Appendix 2: Interview Summary

Appendix 3: Survey Questionnaire

## VII. List of Abbreviations

BEVs	Battery electric vehicles
EEA	European Environment Agency
HEVs	Hybrid electric vehicles
ICE	internal combustion engine
NEVs	New electric vehicle
PHEVs	Plug in Hybrid electrical vehicles
TCO	Total Cost of Ownership

## VIII. Table of contents

1. Chapter: Introduction .....	1
1.1 Problem Statement and Research Questions .....	1
1.2 Academic and Managerial Relevance (Research Gap) .....	2
2. Chapter: Literature Review and theoretical background .....	3
2.1 Industry Overview .....	3
2.2 Different types of electrical vehicles .....	3
2.3 Historical Development .....	4
2.4 Purchase Intention .....	6
2.5 Socio-Demographics .....	7
2.6 Purchase Intention Drivers for a BEV by potential car buyers in Germany .....	8
2.6.1 Environmental Aspect .....	8
2.6.2 Economic Driver .....	10
2.6.3 Functional and technical Driver .....	12
2.6.4 Personal Characteristics .....	13
2.7 Concerns of potential German BEV Buyers in their Purchasing Intention .....	15
2.7.1 Lack of trust in environmental benefit .....	15
2.7.2 Economic Restrictions .....	15
2.7.3 Technical Restrictions .....	17
2.7.4 Personal Characteristics .....	20
3. Chapter: Methodology and Data Collection .....	21
3.1 Primary Data Collection .....	21
3.2 Secondary Data Collection .....	23
4. Chapter: Analysis and Results .....	26
4.1 Qualitative Data .....	26
4.2 Quantitative Data .....	31
5. Chapter: Discussion .....	44

6. Chapter: Conclusion.....	47
7. Chapter: Limitations .....	48
8. Appendices.....	50
Appendix 1: Interview Guideline .....	50
Appendix 2: Interview Summary .....	52
Appendix 3: The survey questionnaire .....	70
9. Bibliography .....	79

## 1. Chapter: Introduction

The market for electric cars has developed strongly in recent years. Vehicle sales have continuously doubled from the beginning of 2020 to the end of 2022 (Hecht et al., 2022).

According to Bloomberg, for the first time in 8 years, the German EV market is expected to see a slump in sales, which the lobby believes is due to subsidy cuts ('Europe's Biggest Car Market to See First EV Slump in Seven Years', 2024).

This news from Bloomberg is a confirmation of the relevance of analysing the factors that on the one hand are a driver for the purchase intention and on the other hand are concerns and thus obstacles for the German consumer. Therefore, this scientific work focuses on the transportation sector. Transport is one of the most important economic sectors contributing to air pollution (Higuera-Castillo et al., 2019).

### 1.1 Problem Statement and Research Questions

On an international level, various factors have already been tested that have an influence on the purchase intention for BEV. Part of this scientific research is, on the one hand, to test existing factors that have been researched for German consumers in other countries and, on the other hand, to integrate additional factors that could be obtained through semi-structured interviews to ensure a comprehensive consideration of the motives and influences on purchase intention. This results in the following three research questions, which are to be answered based on this academic paper.

**Research Question 1:** *What are the main driver factors of a German customer in the potential purchase intention of a BEV?*

**Research Question 2:** *What are the main concern factors of a German customer in the potential purchase intention of a BEV?*

**Research Question 3:** *Which socio-demographic characteristics of the German customer have an influence on the purchase intention?*

Research question 3 is divided into the following two sub-hypotheses.

Sub hypothesis Gender:

*H0: There is no significant difference between the genders (male, female, diverse) regarding the purchase intention.*

*H1: There is a significant difference between the genders (male, female, diverse) regarding the purchase intention.*

Sub hypothesis Education:

*H0: There is no significant difference between the Educational Qualification regarding the purchase decision.*

*H1: There is a significant difference between the Educational Qualification regarding the purchase intention.*

The research objective of this thesis is therefore to find out how individual factors on both the driver and the concern side affect the purchase intention of German consumers. The factors on both sides were structurally categorised into the four levels: environmental dimension, economic dimension, functional technical dimension, and personal dimension.

The following hypotheses were derived from the literature review and the results of the semi-structured interviews conducted and are to be tested.

## 1.2 Academic and Managerial Relevance (Research Gap)

The research gap can be accurately explained by Dutta & Hwang (2021), among others, by the fact that the introduction of new products like a BEV is associated with different problems in different countries, as each country has its own culture, demographics, and social conditions. It therefore seems appropriate to analyse the drivers and concern factors specifically for Germany and thus for the German end customer and their purchase intention.

The results of this study could provide useful guidelines for the development of marketing strategies and provide a resource for EV stakeholders to improve the practicability of current EV adoption policies with a special focus on the German market.

## 2. Chapter: Literature Review and theoretical background

The literature review first provides an overview of the relevant industry and then goes on to discuss the various types of EVs. The relevant literature for purchase intention and sociodemographic is then provided. This is followed by the core of the literature review in the form of driver factors and concerns. The next chapter is the Methodology and Data collection.

### 2.1 Industry Overview

Firstly, this scientific work is exclusively concerned with the private purchase of BEVs by consumers in Germany. Accordingly, the company-specific consideration in the form of logistics is not considered. The target market considered and analysed is therefore the private German end consumer who is faced with the potential intention to purchase a BEV. The first step is to gain an overview of the various concepts and types of cars that fall into the category of EVs, with a more precise identification and differentiation.

### 2.2 Different types of electrical vehicles

In the following chapter different types of EVs are portrayed to become an overview of the electrical vehicle landscape and the differences between several car types are summarized. Basically, the EEA distinguishes between electric light duty vehicles and electric heavy-duty vehicles. The focus of this paper is on the former, as the latter - trucks and buses - do not reflect the consumer perspective (International Energy Agency, 2023). Generally, three categories are prevalent present on the market and addressed in research as well.

HEVs are each powered by a gasoline internal combustion engine and an additional electric motor (Nanaki, 2021). However, as the car only has a limited battery capacity, the electric motor can only be used to start and accelerate the vehicle. In addition, it is not possible to charge the batteries at the electrical grid. Instead, the batteries are charged by recovering energy when decelerating or braking (W. Li et al., 2017).

A PHEV, a further development of the HEV, has an extended battery capacity and can also be charged via the electrical grid (Longo et al., 2021). The main difference between PHEVs and HEVs is that the former have a short purely electric range, usually around 50-100 km, and must be driven with a combustion engine once the battery is discharged (W. Li et al., 2017).

A BEV does not use another energy source like an ICE or hydrogen fuel cell. Only the energy from the battery is used to drive. The technologies used here are the electric motor, motor controllers and the battery pack, whereby the battery is charged by an external charging station and energy is also recovered when braking (Kamran, 2023). However, BEVs have a shorter range compared to the total range of these other vehicle types and, due to longer charging times, require timely charging to avoid running out of energy. Choosing for a BEV requires a significant change in user habits, while the decision factors for HEVs, PHEVs and E-REVs differ from those for BEVs (W. Li et al., 2017). BEVs have the highest energy efficiency of all drive types and can convert around 80 % or more of the stored energy into kinetic energy. Regenerative braking recovers additional energy that would be lost as waste heat with conventional braking. BEVs do not emit any exhaust gases while driving and thus improve local air quality. The greatest added value for the environment is achieved when BEVs are powered by electricity from renewable sources. Even with a mixture of electricity from renewable energy and fossil fuels, the emission values are lower than with conventional fuel-powered vehicles. However, BEVs still have a limited range and require a longer charging time. They usually have correspondingly large batteries to maximize range (European Environment Agency., 2016).

A differentiation is made from HEV and PHEV which will not be considered in further detail as they belong to vehicles still requiring fossil fuels to drive (European Environment Agency., 2016). Furthermore, the focus on this research paper is on BEVs as it demonstrates the biggest sales share of EVs in Europe and Germany as well, which will be further discussed in more detail in the following chapter. In addition, BEVs stand out the most from the other declared alternatives and conventional gas-powered vehicles.

## 2.3 Historical Development

The sale of EVs in European countries has been promoted by both local and EU authorities, with local initiatives dominating EU policy during the first decade of EV expansion. Since

2019, the situation has changed, and the role of the EU has increased due to a new emissions regulation that sets an EU-wide fleet target of 95 g CO<sub>2</sub>/km for the average emission levels of new passenger cars. As a result of this policy, European countries had the largest EV market share in the early 2020s (Pelegov & Chanaron, 2023).

The shift to electric mobility is changing trade flows and will continue to influence them. Typically, Europe has been a net exporter of ICE vehicles by value, while China has been a net importer. But with the shift to electric cars, the market for ICEs will decline over time, while the market for EVs will increase. China, Japan and Korea are all net exporters of electric cars, electric motors and Li-ion batteries and are well equipped to gain from an expanding electric car market. However, these battery-exporting countries are also heavily reliant on imports of critical minerals such as lithium, cobalt and nickel (International Energy Agency, 2023).

The following figure illustrates the electric car sales share and car registrations in selected countries in recent years. As stated, before the Chinese market represents the highest sales share worldwide. The second biggest market is Europe. Overall, when looking at the graph, it turns out that regardless of the geographical market under consideration, more BEVs are sold and registered than PHEVs, which supports the thesis focus on BEVs as BEVs represent the largest share of EVs and thus also reflect the greatest demand from the end consumer for which various driver and consideration aspects should be applied in the German market.

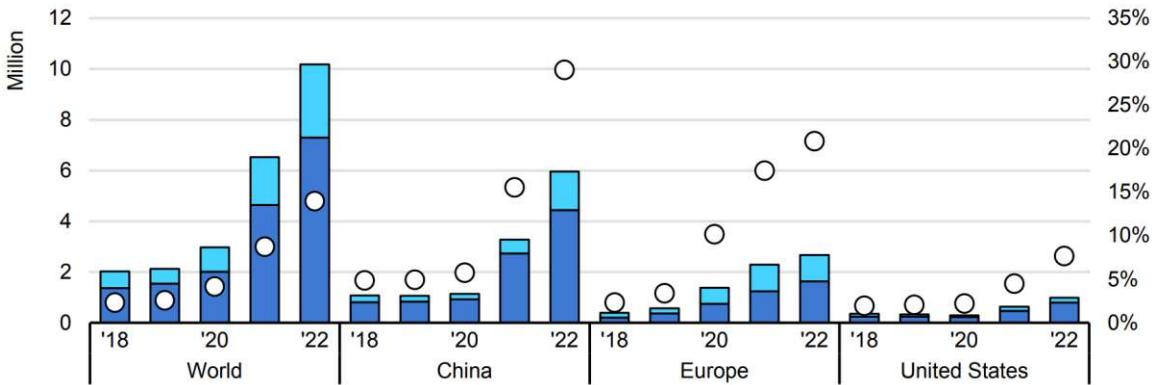


Figure 1: Electric car registrations and sales share in selected regions

■ BEV ■ PHEV ○ Sales share (right)

## 2.4 Purchase Intention

As the spread of BEVs has ultimately progressed in recent years, the question arises as to why more BEVs are not now to be found on German roads. For this reason, the purchase intention is the central dependent variable in this scientific work, which is intended to show how different drivers and concerns affect the purchase intention of German consumers. To better understand consumer behaviour in relation to BEVs. The purchase intention is heavily responsible for the BEV market development. Consumer behaviour consists of complex and diverse factors that are relevant in the process of a purchase intention (Zhao et al., 2022). As formulated in the three research questions, the aim of this thesis is to analyse the influence of various factors on the purchase intention of German customers.

Intention is defined by Fishbein (1975) as the subjective probability of performing a certain behaviour (Fishbein & Ajzen, 1975). Furthermore, Ajzen defines intention as “how hard people are willing to try, of how much of an effort they are planning to exert, to perform the behaviour” (Ajzen, 1991). In a transferred meaning, the intention to purchase a BEV is therefore determined by the subjective probability that German consumers assign to the act of buying a BEV which is mirroring their internal likelihood of making this purchase.

The basis for the selected criteria that are relevant for the purchase intention is, among other things, an extensive literature review research from Biresselioglu et al. (2018) that was conducted at European level. During the decision-making process, the scientific work was analysed on three levels regarding motivators and barriers for the diffusion of electric mobility in Europe. In this research paper, only the individual unit of the decision making process is considered and the levels of Formal Social Units and Collective Decision-Making Units are not further elaborated, as the focus should be end-consumer-centered (Biresselioglu et al., 2018). The study by Ivanova et al. (2023), which not only classifies the antecedents of EV purchase intention but also provides an overview of the positive and negative impact of the factors on EV purchase intention, also plays a major role in the selection of relevant factors. This makes it easier to categorize a factor and its influence on purchase intention, especially at the beginning (Ivanova et al., 2023). Furthermore, the insights gained from the semi-structured interviews, which are discussed in more detail in Chapter 4, also play an important role in the selection of factors.

Finally, a model was developed based on Biresselioglu et al. (2018) and Ivanova et al. (2023). This thesis looks at the purchase intention from the following four dimensions: Environmental dimension, economic dimension, technical-functional dimension, and the personal dimension. With these dimensions the aim is to develop a comprehensive model that allows to understand the purchase intention of different factors from different perspectives.

## 2.5 Socio-Demographics

The third research question of my scientific work deals with the socio-demographic characteristics of the respondents who took part in the survey. The aim here is to get a more accurate picture of which type of German potential consumer with which characteristics decides in favour of or against potentially buying a BEV. Part of the survey, which is described in more detail in chapter 3 and analysed in chapter 4, are the socio-demographic factors gender and educational qualification.

A South Korean study concludes that the average male respondent is more likely to buy a BEV. Regarding the age structure, it is found that younger age groups, especially those in their 20s, tend to have a significantly negative attitude towards the purchase intention. The lack of willingness is justified by the fact that the high purchase price represents a clear barrier for young people and they are therefore more likely to choose a conventional car (Lashari et al., 2021). Several studies conclude that individuals with a higher income are more willing to buy a BEV. On the one hand, this is shown by Xu (2019), who sees above undergraduate level as a higher educational level and higher income as an indicator (Y. Xu et al., 2019).

In the German geographical area, there is already an academic paper from 2014 which concluded that early adopters are men with families who work full-time and value the environment and new technologies. These early adopters also drive a lot and commute as they live in the countryside (Plötz et al., 2014). Since this work does not focus on early adopters, but on the average German consumer, it makes sense to analyse the named characteristics.

Kawgan-Kagan asks in German major cities whether women are greener in the context of sustainable urban mobility and concludes, among other things, that in the BEV sector, women who have a child and a lower income are more willing to pay more for a BEV than men. It is seen as particularly relevant in the introduction phase of new mobilities that the potential users are understood at the beginning to prevent the development of obstacles and barriers.

This also applies to boundaries that might result from gender differences in attitudes towards mobility (Kawgan-Kagan, 2020).

The literature shows that mainly men and individuals with a higher educational level are more likely to have a purchase intention for a BEV. Therefore, a possible differentiation in terms of gender and its influence on purchase intention as well as educational qualification and its influence on purchase intention is investigated, which comprises the third research question of this thesis.

## 2.6 Purchase Intention Drivers for a BEV by potential car buyers in Germany

Since part of this scientific work is to analyse various drivers that have an influence on the purchase Intention of potential buyers of BEVs, an overview of factors already analysed in the literature should first be provided. Subsequently, various selected factors will be applied to the German market and thus to the German end consumer to get a more concrete picture of influencing factors that are decisive for the Intention to purchase of a BEV.

### 2.6.1 Environmental Aspect

The most prominent driver for buying a BEV is the environmental aspect. Additionally no emissions are emitted during driving (European Environment Agency., 2016).

#### 2.6.1.1 Environmental Concern

Environmental concern is an emotional characteristic of consumers that involves their considerations and concerns about the quality of the environment (Yeung, 2004).

Urban air pollution and rising consumer concern for the environment led to an increased demand for responsible behaviour from both businesses and consumers, signalling a social commitment to environmentally friendly alternatives (Buhmann et al., 2024).

Environmentally conscious buyers may therefore be concerned about the impact of their behaviour on the environment, which influences their decision-making behaviour. Further, consumers who care about environmental quality tend to evaluate the impact of products on

the environment. They prefer to inform themselves about environmentally friendly options and improve the environmental characteristics of these alternatives (X. He et al., 2018).

The statement is further supported by Dutta (2021), who added the factor which also shows that environmental concerns can be a driver for the decision to buy an electric car. For instance, Dutta (2021) found for the Taiwan market that the attitude of Taiwanese people towards EVs is to a large extent positively influenced by environmental concerns, and this has a significant impact on consumer attitudes (Dutta & Hwang, 2021).

The German market and the German consumer have not yet been referred to in detail in the literature on the environmental concern factor as a driver.

#### *2.6.1.2 Emission Reduction*

A key motivator for the diffusion of EVs on European level that was identified is to protect the environment by reducing CO<sub>2</sub> Emissions, which represents the second consumer driver that will be analysed in context of the German market (Biresselioglu et al., 2018). Based on the results of the qualitative semi-structured interviews in chapter 4, this thesis also shows that emission reduction is one of the strongest factors identified by the interviewees as a driver of a BEV.

The study of Lieutenant et al. (2022) compares the environmental impact of electric cars and gasoline cars in different European countries with different energy sources. The vehicle's energy consumption per 100 km, emissions during manufacture, battery production and the vehicle's life cycle are considered when assessing the total amount of CO<sub>2</sub> released. In Germany, where a significant proportion of electricity is generated from carbon-based fuels, short-distance urban BEVs are more environmentally friendly than gasoline vehicles. The 44% electricity generation from fossil fuels in Germany results in higher CO<sub>2</sub> emissions for electric cars, especially long-distance models, and fuel cell vehicles, while mid-range electric cars and hybrid solutions have similar CO<sub>2</sub> emissions to ICEV. For electric cars to be beneficial to the environment, low-carbon electricity generation is crucial (Lieutenant et al., 2022).

But not all environmental aspects positively influence the purchasing decision of potential customers. Part of the Concerns is Chapter 2.7.1 is that addresses the lack of trust in environmental benefits of BEV for end-consumers. By replacing fossil fuels with grid-based

electricity, EVs offer significant economic and environmental advantages over ICEVs. The ecological advantages were hereby cited on the one hand by environmental concern as a behavioural reason as well as emission reduction as an advantage, which primarily includes the reduction of emissions while driving (Hoeft, 2021). In a next step, the dimension of economic benefits will be addressed.

## 2.6.2 Economic Driver

The economic dimension is used to analyse the TCO, followed by a more specific discussion of the operating costs and finally the financial incentives by the government.

### 2.6.2.1 TCO

The TCO is currently higher for BEVs than ICEs, but this is to change by 2025. BEVs will become a cost-competitive alternative from 2025 onwards, which is reflected in the increasing spread and further development of BEVs and the associated reduction in costs and the rising fuel costs of ICVs on the other (Felgenhauer et al., 2016).

The uptake of electric mobility is influenced by individual choices, criteria, and motivations, including the economic impact and cost of the decision. In a Hungarian study, the total cost of ownership was compared over seven years for different annual mileages and different car categories in Hungary using a cost-benefit analysis. Specifically, four vehicle segments were considered for EVs and ICEVs. The study used the EAFO method and compared representative EV and ICEV models in each car segment. Contrary to the previous study the results showed that despite higher acquisition costs, the total costs of BEVs were lower than those of ICEVs in each of the four segments studied over a seven-year period. Consequently, the use of electric cars in Hungary has significant long-term economic benefits, including lower maintenance costs and fuel prices (Horváth et al., 2023). In another study, the authors predicting future cost efficiency for 2025 and discuss how the differences in cost-effectiveness between vehicle classes mean that encouraging a market shift towards smaller vehicles could indirectly encourage the uptake of EVs. The cost-effectiveness of EVs varies depending on the annual distance travelled and vehicle class. For shorter distances for longer distances EVs could overtake ICEVs due to lower operating costs per kilometres.

Nevertheless, EVs have higher capital costs than conventional vehicles in all scenarios. Longer distances and smaller vehicles, which have lower capital costs, emphasize operating costs more when calculating the TCO, increasing EVs' cost efficiency (Wu et al., 2015).

#### *2.6.2.2 Operating Costs*

The operating costs of BEVs are already different. As previously shown by Horváth et al. (2023) in the TCO calculations, BEVs have lower maintenance costs. These are significantly lower and are estimated to be one-seventh of the operating costs of a comparable ICE Vehicle. These savings are less noticeable when the vehicle is purchased for the end-consumer, but can compensate for the higher capital costs after a few years (Mahmoudzadeh Andwari et al., 2017). A South Korean study on operating costs concludes that the economic efficiency of EVs and the associated economic benefits are achieved through lower operating costs (Lashari et al., 2021). In a Germany-wide representative study focusing on technology-specific attributes, it was found that higher fuel costs/operating costs have a negative effect on purchase intention. The fuel and operating costs of BEVs are lower than those of ICEVs, which supports BEV adoption (Berneiser et al., 2021). Cost savings in fuel costs are a key cost advantage for BEVs. In various European countries, for example, the lowest running costs for ICEVs are those of BEVs. In Germany, however, the high electricity price increases the operating costs are 75% of the average relative fuel cost respectively (Lévy et al., 2017).

#### *2.6.2.3 Financial Incentives by the government*

Especially in Germany purchase subsidies are regarded as an important determinant (Anastasiadou & Gavanis, 2022). Governments around the world are using financial incentives to convince consumers that EVs are environmentally friendly and cost-effective to increase the uptake of EVs (Dutta & Hwang, 2021).

Since 2020, there has been major financial support from the German government that goes up to 9,000 euros. This financial incentive had a direct impact on the sales figures of BEV and PHEV vehicles, which rose by more than 200 per cent. However, the financial support was cancelled for PHEVs in 2023 and reduced to 4000 euros for BEVs and is then to be deleted by 2026 (Jurlin, 2023). According to the latest findings on the German government's website, a total of around €10 billion has been paid out under the environmental bonus for around 2.1 million EVs since 2016. No new applications for the environmental bonus can be submitted

after 17 December 2023 (*Umweltbonus für Elektrofahrzeuge | Bundesregierung, 2023*). Furthermore, there will be a complete exemption from vehicle tax for BEVs in Germany until 2030 (*Elektroautos: Das 2024 Gilt Bei Der Kfz-Steuer, n.d.*).

### 2.6.3 Functional and technical Driver

In the semi-structured interviews, the two functional drivers Recharge at home and Noise reduction were often chosen as an advantage when purchasing a BEV.

#### 2.6.3.1 Recharge at home

One of the benefits of charging at home is that you don't have to go to a petrol station, which saves time (Axsen et al., 2013). In addition, the charging at home factor was perceived more positively than before by many participants who had previously been able to test a BEV in practice and started to integrate the process in their life. In addition, charging time was considered reasonable in a sample of US drivers, partly since they had access to a charging station at home. If access to personal charging infrastructure is not guaranteed, this clearly has a negative impact on the EV driving experience evaluation. (Bühler et al., 2014). Based on this, Schmalfuß (2017) concludes from several studies that the assessment of BEV properties before and after one's own experience is rated differently (Schmalfuß et al., 2017).

Another advantage is the possibility of charging the BEV at home overnight, which most owners also do (Skippon & Garwood, 2011). This makes it possible to reduce the cost of charging the BEV at a lower electricity price and to manage without fast charging, which increases the battery life (Turker & Bacha, 2018). Based on this literature research, it is summarised that there is little current literature in this area, and it therefore seems reasonable to consider this aspect in the survey.

#### 2.6.3.2 Noise reduction

The low noise level of the BEV engine is said to have a significant influence on consumer attitudes, which in turn has a positive effect on purchase intention (Higuera-Castillo et al., 2019). Part of a Nordic focus group was the perception of low noise emissions in BEVs. Surprisingly, this factor received a relatively high level of attention. It was mentioned

relatively often as the second benefit after CO2 savings and on the other hand, the question of safety for pedestrians quickly came up, who do not hear a BEV (Kester et al., 2019).

#### 2.6.4 Personal Characteristics

In the case of personal characteristics, the consumer and their behaviour will be examined in more detail in the form of social influence, personal innovativeness and previous driving experience.

##### *2.6.4.1 Social influence*

Social influence refers to people modifying their thoughts, feelings, attitudes, or behaviours because of interactions with other people. It is the willingness to conform to the standards and rules set by peers (Hu et al., 2019). The literature shows that consumers are vulnerable to the influence of reference groups when purchasing products (Fernandes & Panda, 2019). For example, Hu et al. (2019) concluded that there is a positive significant effect of social influence on purchase intention.

A country comparison by Clark et al. (2019) revealed country-specific differences between the USA and China. In a collectivist culture, social influence appears to be a powerful motivating factor. The difference between green consumerism and social influence is being researched. According to this, Chinese consumers are more susceptible to social influence in purchasing behaviour (Clark et al., 2019). It therefore also seems reasonable and relevant to look at social influence among German consumers to create better comparability in an international comparison.

##### *2.6.4.2 Openness to experience/ Personal innovativeness*

Another personality trait that is discussed in the context of personal characteristics is personal innovativeness, which can be defined as the degree of innovations or new ideas (Rogers & Shoemaker, 1971). Furthermore, individuals with personal innovativeness have a distinct sense of curiosity and like to seek out new things. Consumers with a high degree of innovativeness are therefore more willing to experience new things and adopt new concepts. This behaviour can therefore result in individuals with a high level of EVs perceiving the trend and thus being able to benefit from economic advantages such as government subsidies

(X. He et al., 2018). On the other hand, it could be that due to the associated higher tolerance for risks, the concerns associated with the adoption of a BEV, such as range anxiety, are less likely to be taken into account (S. Yang et al., 2012).

As existing literature connects personal innovativeness with openness to experience, openness to experience is discussed below to create a comprehensive picture (Ivanova et al., 2023). In general, openness to new experiences is associated with curiosity, creativity and a preference for versatility and innovation (Gustavsen & Hegnes, 2020). As potential customers have different personalities, Cui et al. (2021) explain that the degree of openness to experience can help to identify whether a higher level of openness to experience is an indicator for the purchase of an electric car. The result of their study is a positive effect of the factor openness to experience on consumer purchase motivation (Cui et al., 2021).

#### *2.6.4.3 Previous EV driving experience*

Purchasing willingness was analysed in a study using the service experience, among other things. Carrying out a test drive or a driving experience effectively changed the perception of the potential customer and can therefore improve the attitude towards a BEV and its advantages and purchase intention. In addition, a negative pre-sales consulting experience or a poor experience service can prevent potential customers from being willing to buy a BEV (Q. Li et al., 2017). To further promote the spread of EVs, another research paper concludes that test drives EV sharing can be an advantage for purchase intention. The result of the study is that the experience of having already driven or shared a BEV has a statistically positive influence on the BEV purchase intention (Ling et al., 2021). A study of consumers' driving experience looked at how emotions and cognitions in relation to BEVs influence potential purchases. The result is that the purchase intention is influenced both directly and indirectly. The perceived relative advantages and perceived ease of use have a positive and significant effect on the intention to adopt an EV. EV driving experience has a negative and significant effect on perceived risk, and perceived risk is negatively associated with the intention to adopt an electric car (G. Xu et al., 2020). With increasing experience, for example, the perceived range satisfaction also improved and after the first period of driving the range satisfaction also changed positively (Franke et al., 2017).

The driver factors mentioned are now the basis of the factors to be analysed for the first research question. To answer Research Question 1, the design of the questionnaire is

explained below in Chapter 3, in which the measurement is conducted for each factor in an overview using one or more items. Prior to this, however, the factors on the concern side are elaborated based on the literature.

## 2.7 Concerns of potential German BEV Buyers in their Purchasing Intention

As with the drivers, the various concerns are discussed below, which are based on the same four dimensions as the drivers in the literature research.

### 2.7.1 Lack of trust in environmental benefit

Even though BEVs seem to produce less emissions in operation than ICE vehicles, factors such as manufacturing, transportation for disposal or recycling will significantly affect the total life cycle CO<sub>2</sub> emissions of BEVs. Scientific analyses indicate that BEVs of medium size will lead to a 51 percent reduction in total global warming emissions compared to ICE vehicles of the same size (Chiluwal et al., 2021; Nealer et al., 2015). Potential uncertainties regarding the environmental friendliness of EVs associated with the entire life cycle of EVs described above could lead some end consumers to question the purchase of such a vehicle and lead to a lack of trust in the environmental benefit accordingly (Haddadian, 2015). A study from the UK looks at the availability of reliable information in relation to EVs and their ecosystem. The lack of information among consumers can lead to mistrust and negative perceptions of EV technology, with the durability of batteries being one of the environmental issues cited in the field. These negative perceptions have become embedded, ignoring the technological progress of EVs. The paper emphasizes the importance of closing the information gap about market readiness of the technology and reliability with end-consumers to drive the further adoption of EV (Berkeley et al., 2018).

### 2.7.2 Economic Restrictions

A negative perception is also evident in several economic restrictions. Cost factors often play an important role for the purchase intention. This is why the high purchase price, battery replacement costs and uncertainty about the recharging costs are discussed below.

### *2.7.2.1 High purchase price*

The purchase price refers to the total acquisition costs when buying a battery EV. The higher purchase costs therefore have a negative effect on the willingness to pay for a BEV in the majority of studies (Wicki et al., 2023). Part of a study conducted in Germany that analysed cost related advantages and disadvantages is the finding that compared to ICEs, BEVs have high acquisition costs that are seen as the main obstacle to EV adoption (Barth et al., 2016). The current expenditure is often estimated to be higher than the long-term savings that can be achieved with a BEV. Consequently, the purchasing price was also ranked second out of 53 factors analysed, symbolising the relevance of this factor (Noel et al., 2020). This finding is also supported by the concerns identified in the qualitative interviews in chapter 4.1, in which 5 out of 8 interviewees described the price as a concern.

If the observed learning rates continue, cost-competitive EVs will be available in the luxury and mid-range segments soon. For small cars, the observed price trends suggest that it will take longer for BEVs to become price competitive in this market segment. In short, the cheaper petrol cars are, the longer it will take for BEVs to have a similar price and an attractive range (Goetzel & Hasanuzzaman, 2022).

### *2.7.2.2 Battery Replacement Cost*

Battery costs are seen as an obstacle to the adoption of BEVs due to the uncertainty of battery life, which is discussed in the technical restrictions chapter. Despite the generous manufacturer warranties, such as BYD with a 6-year/150,000-kilometre warranty on the batteries, this is not acceptable to the interviewees due to the uncertain service life, according to surveys in China. Accordingly, the high cost of battery replacement is 80,000-100,000 yuan, which is more than 10,000 euros (She et al., 2017). A further investigation comes to a similar conclusion, namely that potential customers are discouraged by various factors relating to the battery characteristics of a BEV, e.g. the battery life is considered too short and the cost of changing the battery is perceived as too high (Liu et al., 2020). In the 15-year TCO model of Suttakul et al. (2022), the battery replacement costs, and home charger equipment costs result in higher expenditure for BEVs than for HEVs and PHEVs. It was assumed that the battery in BEVs often must be replaced in the 10th year of use (Suttakul et al., 2022).

### *2.7.2.3 Uncertainty about recharging costs*

This factor is included in the economic dimension of the concerns, as interviewees in the qualitative interviews were uncertain about the costs of charging the BEV. The uncertainty regarding the costs of charging with a BEV was not only noticeable among the interview participants. Especially with regard to the driving range and refuelling costs, uncertainty plays a major role in not choosing a BEV (Fetene et al., 2017). The uncertainty is also reflected in the variation in electricity prices that will have to be paid for a charging process in the future (Scorrano et al., 2020). No suitable item was found in the relevant literature for measuring the uncertainty about recharging cost factor. Therefore, a separate question was created as part of the questionnaire design using one item.

### *2.7.3 Technical Restrictions*

After the environmental dimension and the economic dimension already discussed, the technical restrictions will now be addressed. The content covers the distance range, battery life span, recharging time and charging infrastructure.

#### *2.7.3.1 Distance Range*

Many other papers discuss the fact that electric cars only have a limited range with a single battery charge. One of the main technical concerns is the driving range, which is a key concern for consumers' purchasing decisions in Beijing (Y. Yang & Tan, 2019). If a person has strong concerns about the range of a BEV, which may be due to real range issues such as long daily journeys, they will not be likely to buy a BEV (Carley et al., 2019). Most important is the role of the vehicle's range between charging or refuelling sessions. Although range anxiety is a frequently mentioned barrier to adoption, the daily journeys and driving behaviour of most households can be met (Lane et al., 2018).

Interestingly, in contrast to most other publications, another author describes the distance range as a psychological barrier and not as a technical barrier. According to his study, car owners systematically underestimate the existing range of BEVs and their compatibility with their own mobility needs. Furthermore, this underestimation goes hand in hand with an increased demand for range and a low willingness to switch to BEVs (Herberz et al., 2022).

Especially in comparison to ICEs, the range of a BEV is usually seen as a disadvantage (Wicki et al., 2023).

#### *2.7.3.2 Battery Lifespan*

According to a scientific work the battery life rating is low for both experienced and inexperienced consumers. Therefore, some potential buyers are discouraged from buying a BEV, which is a technical barrier that BEV manufacturers need to overcome (Liu et al., 2020). Respondents of a Chinese study also showed concern regarding battery life which is strongly linked to the fear of battery replacement costs explained in the economic restrictions of this thesis (She et al., 2017).

In their analysis of the barriers to BEVs in Italy, Giansoldati et al. (2020) also include concerns about battery degradation, which also describe battery lifetime. In the end, the factor ranked eight out of twenty concerns analysed. The risk of battery degradation is more important in two other studies in which the factor is ranked fourth out of 19 and 17 out of 53 (Berkeley et al., 2018; Noel et al., 2020).

In the next step, as part of the technical functional restrictions, the charging duration is discussed first and then the entire infrastructure.

#### *2.7.3.3 Charging Technology Long Recharging time*

The charging of used EVs in the private sector should be adapted to both the energy transition and the mobility transition. From the customers point of view, normal charging of the EV battery takes much longer than refuelling a gas-powered car. The charging options for BEVs must therefore be adapted to better meet the expectations, needs and behaviour of users (Daina et al., 2017). The charging duration is considered relevant in this thesis, as it is a decisive factor for the evaluation of the infrastructure that has a significant influence on BEV adoption intention (Globisch et al., 2019).

Another finding is that consumers prefer shorter charging times in combination with charging stations that are close to home or along the travel route (Y. Yang et al., 2016). The results of another literature research study reveal that respondents are willing to pay a considerable amount of money to reduce the waiting time and thus the uncertainty regarding the

availability of charging points. Therefore, the reservation of charging points could be a promising business case (Wolff & Madlener, 2019).

#### *2.7.3.4 Lack of Charging Infrastructure*

An important barrier to the diffusion of BEVs is the degree of expansion of the charging infrastructure. A research team is investigating a technical and economic cost-efficiency comparison between expanding the infrastructure and improving the battery for longer mileage, which is, however, associated with comparatively high costs. The results show that the fast-charging network should be expanded further, as it ensures that all journeys can be covered by BEVs. The additional costs per BEV are three to seven times lower with an expansion of the fast-charging infrastructure than with a significant increase in battery capacity. Furthermore, an investment of around 40 million euros is assumed to achieve minimum geographical coverage, which is relatively low compared to other infrastructure investments. The measurements were based on the assumption of around 1 million BEV cars among German consumers (Funke et al., 2019).

This raises the question of who will bear the costs of setting up such an infrastructure. On the consumer side, the willingness to pay for public charging infrastructure is limited. The results of the study suggest that government support and the associated further expansion could convince consumers who are more willing to buy a BEV and thus promote a further spread of BEVs (Globisch et al., 2019).

A recent study analysing German consumers' perceptions of infrastructure shows that the public infrastructure network is insufficient according to private EV owners. The results show the dominance of charging at home, which has already been addressed in this thesis. Although the charging infrastructure is used more by BEV than PHEV users, consumers want more flexibility for spontaneous journeys. In addition to the charging price, capacity utilisation and the additional waiting time play an important role (Anderson et al., 2023).

BEV users and non-BEV users were asked about the attributes of the charging infrastructure in Germany that they felt were important. It reveals that the acceptance and thus the purchase intention responds to an improved charging infrastructure (Brückmann & Bernauer, 2023).

To summarise, the availability of charging infrastructure has a significant positive influence on the purchase intention of potential customers. This shows that the expansion is necessary

as there are still concerns about BEV range due to the current infrastructure situation, which is perceived as insufficient (Wicki et al., 2023).

#### 2.7.4 Personal Characteristics

At the personal characteristics level, the last two concern factors are addressed. These are subdivided into personal norm on the one hand and consumer knowledge on the other.

##### 2.7.4.1 Personal Norm

The personal norm factor is interesting for the purchase intention and should be considered. In the norm-activation model, personal norm is the central variable, which by definition is explained as the intrinsic feeling of moral obligation, according to which an individual behaves in accordance with the individual value system (Schwartz, 1977).

Specifically for the purchase intention of fuel-efficient cars there is a study that includes personal norm as a factor and confirms that personal norm has a direct influence on intention (Peters et al., 2015). However, the following study comes to the opposite conclusion. A direct effect of personal norm on the intention of consumers to purchase an EV could not be determined in a study including this factor (Ninh, 2021). In the survey for this thesis, the personal norm was measured with two items from Peters et al. (2011) research paper suggesting that the personal norm has a positive association with the intention to adopt EVs (Peters et al., 2011).

##### 2.7.4.2 Consumer knowledge and awareness about BEV

During the semi-structured interviews, it became evident that there was a lot of uncertainty regarding knowledge about BEV on various topics. For this reason, the last step of the factors used in the literature will focus on consumer knowledge and awareness about BEVs.

Customer awareness can be defined as consumers' understanding of a product which helps them to predict their behaviour in relation to the acceptance of a product (Ellen, 1994). In another academic paper it is defined as the knowledge of facts, information, descriptions or skills learnt through experience or education that indicate practical and theoretical understanding of a particular topic (Sang & Bekhet, 2015).

In a scientific study in Ghana looking at various factors for BEVs through the extended form of the theory of planned behaviour, the results show that attitudes were influenced by knowledge about electric cars. Attitudes in turn showed a direct correlation with intention to purchase (Ackaah et al., 2022). Another paper concludes that the knowledge of potential customers had no significant correlation with willingness to pay (Sovacool et al., 2019).

The last factor has been described literature comes to an end, in which findings from the qualitative interviews were partially incorporated. The next chapter then explains the methodological approach to the secondary literature that has already been conducted, as well as the design of the questionnaire for the quantitative part of this academic paper and thus the primary literature.

### 3. Chapter: Methodology and Data Collection

To provide a more detailed insight into the methodological approach of this work, the secondary data collection and then the primary data collection is summarized in more detail below.

#### 3.1 Primary Data Collection

Semi-structured interviews were conducted to obtain primary qualitative data. The aim of the interviews was to identify new factors not yet considered in the literature and to check the relevance for the participants of the factors already discussed in the literature.

Afterwards, a survey was created via Qualtrics to collect quantitative data. The aim of the study is to analyse the relationship between the respective factor and the purchase intention as a dependent variable. In addition, the socio-demographic data results known from the literature, which are explained in the chapter on socio-demographics, are to be tested on German consumers. Firstly, the semi-structured interviews will be discussed in more detail, followed by the Qualtrics survey.

The language in which the interviews and the survey were conducted was German, which can be explained by the selected target group. In addition, language barriers could be avoided, and the focus could be on the content in question. To ensure the accuracy of the translation, the submitted answers were checked independently by a German English bilingual person.

The methodological approach of conducting semi-structured interviews prior to the survey allows a first deeper insight into the motivations and associated motivational factors and barriers. At the same time, the method allows sufficient flexibility to follow up on aspects to gain a better understanding of the behaviour and mindset of the respective participant. In addition, this approach is suitable before a large-scale survey is developed to conduct some in-depth reconnaissance (Adams, 2015). Of the ten interview partners requested, eight agreed to participate. The 8 interviews conducted had the purpose of an additional check and verification of whether the main drivers and the main concerns that play a role for the individual consumer were covered in this scientific work. It was possible to ensure that the awareness and definition of a BEV is correct for all participants. The interview lasted between 20 and 25 minutes per participant.

In the online study, the sampling method used to obtain the participants is snowballing sampling and is therefore part of non-probability sampling. The selection was therefore based on non-random criteria as the social network was used to infer further participants (Johnson, 2014). Participants were asked about the various factors of drivers and concerns regarding the purchasing intention for or against a BEV. Of the total of 145 surveys sent out in person via WhatsApp, Instagram and LinkedIn, 125 were fully validated. In principle, the survey was completed exclusively by German participants as this is the target group addressed. The survey was based on the literature review and the responses to the semi-structured interviews. Below is a table with the respective sources for the questions used in the questionnaire.

The survey was created using the Qualtrics survey tool and ran from 6 December 2023 to 22 December inclusive. When preparing and checking the questions, emphasis was placed on the expert review scoring in Qualtrics, whereby only the predicted duration was noted as slightly improvable, as the expected duration was approx. 7.7 minutes. However, it was subsequently shown that the average processing time was around 5 minutes. The structure of the questions is aligned with the structure of the factors in the thesis.

After the introductory text, five questions were asked about the socio-demographic characteristics of the respondents. The following questions were all created in the format of a

5-point Likert scale with verbal response descriptors from strongly agree to strongly disagree. This scale ensures a balanced range of answers, which allows respondents to clearly state their answers without unnecessarily overwhelming them with too many possible answers. In addition, the reliability and effectiveness of this scale makes it a robust choice for this study (Dawes, 2008).

An Instructional manipulation check question was asked in the form of Q21, which was answered correctly by all participants who completed the survey in full (Oppenheimer et al., 2009). To avoid incorrect feedback, a test run with eight participants was undertaken before the official sending out to avoid losing any relevant data.

In chapter 4 the quantitative data is analysed including an Exploratory Factor analysis, initial tests ensure the data is suitable for analysis. Further the reliability of these factors is assessed using Cronbach's alpha. The study analyses the correlations between these factors and purchase intentions for BEVs, for what the Pearson correlation analysis is used in the study. Measurement is done using Cohen values which measures the size of the effects and categorise them into weak, medium, or strong effects to gain a differentiated understanding of how each factor influences the BEV purchase intentions of German customers.

### 3.2 Secondary Data Collection

The secondary literature serves to identify existing factors that have already been applied for other geographical markets and to test these for the German end consumer. The approach for the relevant literature, which is predominantly used in the literature review and for the theoretical background, is initially based on various databases. Thus, various databases listed on the website of the Universidade Católica Portuguesa in Management and Economics were selected to lay as complete a theoretical foundation as possible. Specifically, the databases used included EBSCO Discovery Service (EDS), JSTOR, ScienceDirect, ProQuest and Google Scholar. In addition, subject-specific industry reports such as those from the International Energy Agency (IEA) and similar websites were used to represent the status quo as up to date as possible.

The quality criteria that were considered for reviewing research paper selection were the use of peer-reviewed literature from the listed databases approximately from the last 10 years. SCIMAGO Journal and Country Rank (SJR) was mostly used as a tool to understand impact

index, as it is the free alternative to Journal Citation Reports (JCR). The focus here was on journals from the 1st quartile.

This results in the questions and statements for the design of the questionnaire, which can be presented clearly and comprehensibly in the table. The majority is based on existing literature, some of which is supplemented by the results of the semi-structured interviews.

<b>1. Driver</b>			
<b>Factor</b>	<b>Abbreviation</b>	<b>Survey Question (see Appendix 3)</b>	<b>Author</b>
Emission reduction	D_EN_ER	Q7	(Lashari et al., 2021)
Environmental concern	D_EN_EC1	Q8	(X. He et al., 2018),
	D_EN_EC2	Q9	(X. He et al., 2018), (Buhmann et al., 2024)
TCO	D_ECO_TCO	Q10	(X. He et al., 2018)
Operating costs	D_ECO_OC	Q11	(Lashari et al., 2021)
Financial incentives	D_ECO_FI1	Q12	(Wang et al., 2021)
	D_ECO_FI2	Q13	(Wang et al., 2021)
Noise reduction	D_T_NR	Q14	(Schmalfuß et al., 2017)
Recharge at home	D_T_RH	Q15	(Aksen et al., 2013)
Social influence	D_P_SI1	Q16	(Lashari et al., 2021)
	D_P_SI2	Q17	
Openesse to experience / personal innovativeness	D_P_OE1	Q18	(X. He et al., 2018)
	D_P_OE2	Q19	(X. He et al., 2018)

Previous EV driving experience	D_P_PDE	Q20	(Ling et al., 2021)
<b>Attention Q</b>		Q21	

<b>2. Concerns</b>			
Lack of trust	C_EN_LTB	Q22	(Giansoldati et al., 2020)
High Purchasing Price	C_ECO_PP	Q23	(Giansoldati et al., 2020)
Battery replacement cost/ Risk of battery degradation	C_ECO_BRC	Q24	(Giansoldati et al., 2020)
Uncertainty recharging costs	C_ECO_URC	Q25	own
Distance range	C_TR_DR1	Q26	(Franke et al., 2017)
	C_TR_DR2	Q27	(Franke et al., 2017)
Battery lifespan	C_TR_BL	Q28	(She et al., 2017)
Charging technology	C_TR_CT	Q29	(Giansoldati et al., 2020)
Lack of charging infrastructure	C_CI_LCI1	Q30	(Haustein et al., 2021)
	C_CI_LCI2	Q31	(Giansoldati et al., 2020)
Personal norm	C_P_PN1	Q32	(Peters et al., 2011)
	C_P_PN2	Q33	(Peters et al., 2011)
Knowledge/ Awareness about EVs	C_P_KA	Q34	
	PI1	Q35	(X. He et al., 2018)

	PI2	Q36	(X. He et al., 2018)
--	-----	-----	----------------------

## 4. Chapter: Analysis and Results

### 4.1 Qualitative Data

In summary, the questionnaire guideline for the semi-structured Interviews is divided into 5 sections. In the warm-up phase, the aim of the Master thesis is explained and what follows. Firstly, it is checked whether all participants can define a BEV, which ensures the necessary prior knowledge. This is followed by a discussion of drivers and then concern factors, whereby the first step is to ask openly which factors are most important for the participant so as not to influence them. As some counterarguments have already been listed directly with the drivers during the interviews, these are communicated directly at the points mentioned to ensure a direct comparison of the arguments. In a final step, a summary with a conclusion is presented to give the respondents the chance to share new thoughts that arose during the interview. In addition, respondents are asked whether aspects that they personally consider important were not included in the interview. Finally, all participants were thanked for taking part in the interview.

To summarize 1a), it can be said that all 8 respondents were able to define a BEV exactly and knew how it is used and how it differs from other electric cars. It can therefore be stated that the further questioning process appears to make sense due to the prior knowledge. The question 1b) of whether the purchase of a BEV has already been considered is controversial. Those in favour cite environmental reasons and appealing models. On the other hand, there are respondents who are currently against a purchase, citing the purchase price directly and expressing uncertainty regarding further technological development.

The socio-demographic factors generally include the age, gender, income, occupational group, and environmental awareness of consumers. Income was directly mentioned by half of the respondents as having an influence on the decision to buy a BEV. There is no uniform opinion on the other factors. Respondent E, for example, suspected that the age group between 20 and 40 was more interested in buying a BEV than people over 45. However, the finding is subsequently revised, as it is added that young people are more likely to follow the trend towards BEVs.

Two open questions were then asked in 2) about various factors that are personally relevant in the decision process when potentially deciding to buy a BEV. The most frequently mentioned factors are shown below in the radar diagram. Listed the most was No Fuel Cost, which was named by five out of eight respondents. Accordingly, 50 percent of the participants mentioned the factors Reduced Emission and the environmental aspect in general. The last two mentioned, status symbol and future oriented, are driver factors that were included as insight gained in the drivers used after literature research. The future-oriented point was recorded in terms of content and behaviour in the factor openness for innovation among consumers in the literature review.

For example, Respondent A justifies the Environmental Aspect factor in 2b) as having a lower carbon footprint, which is the central aspect for her. Furthermore, the respondent cites the convenient aspect of charging from home. This is an aspect of the literature review that was already defined before the survey and is addressed by two other respondents in the final section.

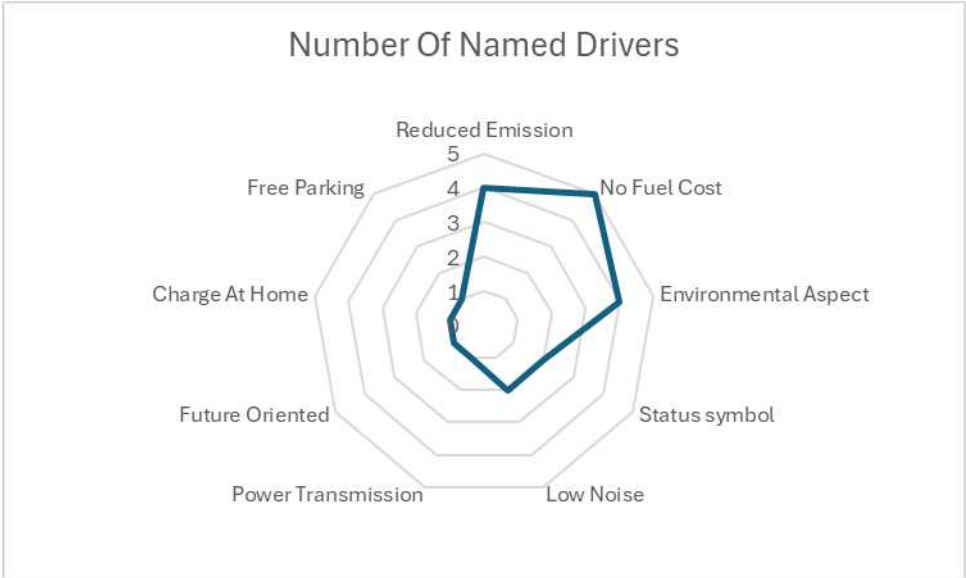


Figure 2: Number of Named Drivers

Starting with the environmental dimension 3) of the driver all participants clearly state that environmental friendliness is important to them when choosing a vehicle and that they value it in 3a). Looking at the CO2 balance of the entire lifecycle from production to disposal as in 3b), opinions tend to differ again. The environmental friendliness of the BEV is viewed rather critically, with the production of the battery being cited several times, as well as the disposal. For the respondents, a better CO2 balance is linked to conditions such as a long service life and high mileage of the BEV as well as the need for green energy. An interesting aspect in

recycling is that of interviewer F, who notes that there will be no second or third owner if the battery cannot be recycled, which worsens the CO<sub>2</sub> balance. Interviewer H counters this by saying that car batteries can be reused. At the environmental level, this paper analyses environmental concern, which can be indicated by the environmental friendliness, as well as emission reduction, which is explicitly mentioned by half of the participants.

When participants were asked about financial incentives, there was uncertainty about the extent of the benefits. Free charging stations, tax relief and government subsidies were emphasised. Overall, it was suggested that incentives like state subsidy and tax relief are appealing but not the primary deciding factors for BEV purchase. One interviewee saw it as problematic that financial support is given to buyers who have enough money for a new car and that support is not given to lower income groups who might be able to buy a used BEV car. A few interviewees consider BEVs to be cost-efficient in 4b) due to maintenance and running costs, as well as lower charging costs and fewer mechanical parts that could break. This is opposed by statements that the purchase price is higher and that a new battery must be bought. Therefore, there is uncertainty regarding clear information that would allow a picture of the total cost of ownerships. The majority see lower long-term costs with a BEV. Only respondent E says in 4c) assumes that ICEV have a longer service life than BEVs. All participants assume that these are lower maintenance costs for BEVs. Only battery replacement was identified as a concern. Awareness of government incentives varied among participants. Some were well informed about specific subsidies and benefits while others were unsure about the details of the incentives. This variance in awareness shows the importance of clear communication from the government if it wants to promote BEV adaptation. There were mixed opinions regarding the influence of incentives on purchase intention. Some feel that the subsidies and tax savings are particularly interesting for reducing the purchase price, others feel that this is of secondary importance. The high purchase price was more important.

Regarding the functional and technical drivers in 5), many different arguments are listed that weigh positively in the decision to buy a BEV. For example, the convenience of charging at home, noise reduction and the driving experience are mentioned in detail. However, there were reservations about the impact of quieter vehicles on safety, especially for vulnerable road users such as children and the elderly. In addition, Respondent C in 5b) argued that above 30km/h the abrasion of the tyres drowns out the engine noise.

As with the drivers, this is followed by a graphical representation in the form of a radial diagram of the perceived concerns in the purchase intention of German consumers beginning with question six.

What is remarkable about the list compared to the drivers is that the answers were given much more quickly, and the number of factors is higher. The multiple answers are slightly higher with the charging infrastructure being mentioned the most. The fear of range is documented similarly often. Otherwise, three participants mention the purchase price as an obstacle and multiple responses can be seen for charging time, grid capacity in Germany and green electricity as a concern.

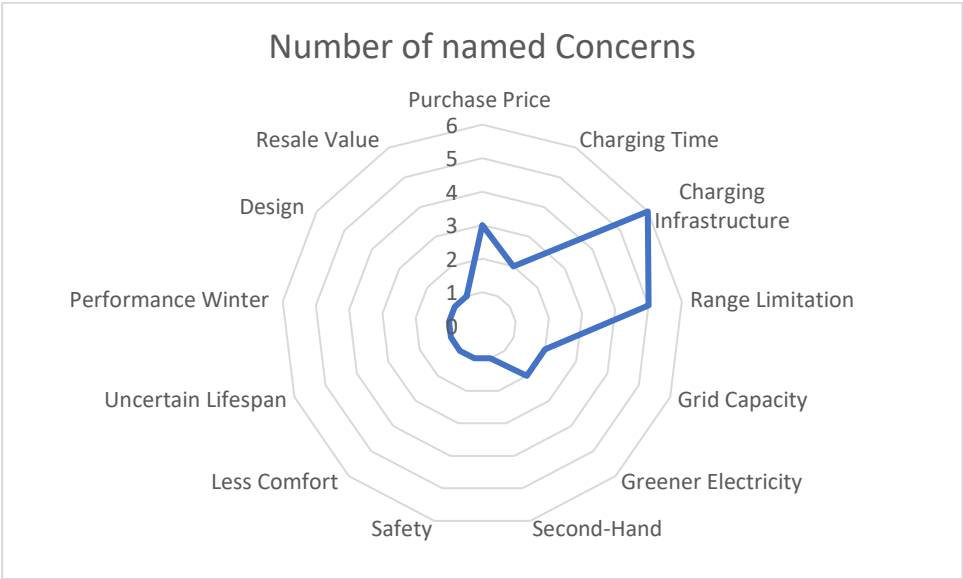


Figure 3: Number of named Concerns

For the environmental dimension, which has already been analysed in 3), it can be added to the concerns that interviewer C, in comparison to an ICE, states the intensity of use as a decisive criterion when considering the entire life cycle. Accordingly, he argues that with little use there is no difference to an ICE.

When asked whether the purchase price or the total costs are more relevant, the majority cited the purchase price as the critical factor. This corresponds to typical consumer behaviour in which the upfront costs represent a significant barrier or criterion. Many respondents made it clear that TCO plays a key role in the purchase intention. This group recognised the long-term financial benefit despite the high acquisition costs. Concerns were expressed e.g. from answerer H about the future price development of electricity in Germany and from respondent F the value stability as technology advances in 8) it can be noted that the impression is created

that the preoccupation with the financial aspects goes beyond the purchase price and evaluates in detail and with a view to the future whether the purchase is currently worthwhile for a BEV.

The fear of the BEV's inadequate range, which had already been identified in the literature beforehand, was addressed. This is confirmed by the statements of the participants, who are all rather critical of the range as soon as a longer distance must be covered. For short distances, the consensus is that the range is sufficient. Regarding the charging infrastructure, which is generally much discussed and noted, it is felt to be suitable in urban centres, i.e. large cities, but this differs as soon as the infrastructure in more rural areas is the subject. The technological concerns in 9d) address battery life, the environmental impact of the battery and its recycling after use, as well as the lower range in winter, which could be improved as factors in favour of buying a BEV.

As part of the conclusion, the interviewees were asked to select the personally most important ones. The purchase price was named as the most important characteristic. Innovation, operating costs, and the range are mentioned several times. This visualisation illustrates the different priorities of potential BEV buyers.

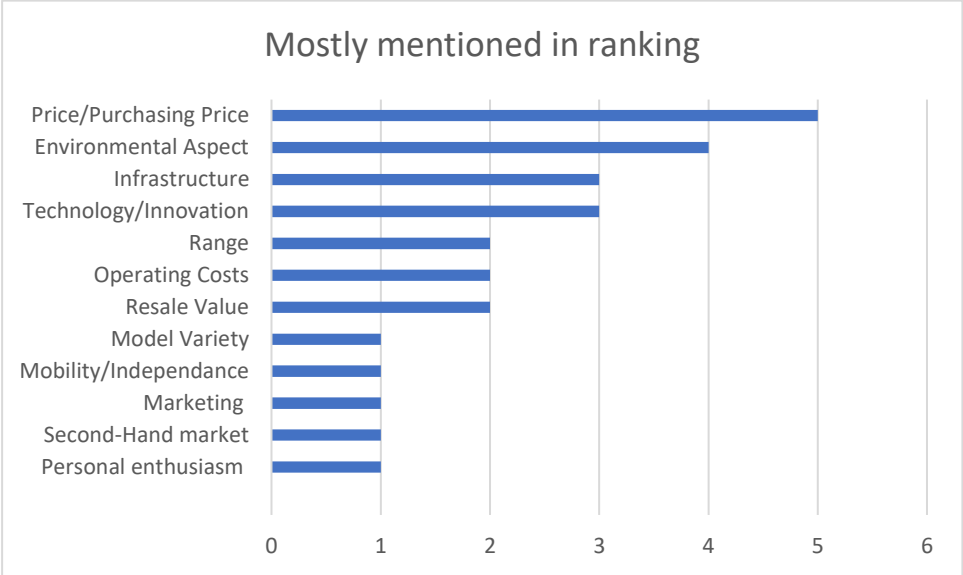


Figure 4: Final most important BEV characteristics

When given the opportunity to add something else 10b), charging from home was again mentioned, as well as the desire for better expansion of the fast-charging network and the wish for more transparency in tracking right through to raw materials.

Overall, it is striking that the comparison to an ICE is quickly drawn, even if this was not addressed in the question. New findings in the form of newly added factors, such as social influence and openness to innovation, were added to the other factors examined. Nevertheless, insights gained represent only a partial aspect and therefore factors that were not found to be so relevant by the participants are still included, as these are supported by the scientific literature and thus justify their selection.

### 4.2 Quantitative Data

The first step is to explain the composition of the sample based on socio-demographic factors. Gender, age, educational qualification, employment status and annual gross household income are discussed below. Figure 2 describes the participants included n= 62 men (50%) and n=61 women (49%). A total of n= 2 people (1%) stated other when asked about their gender.

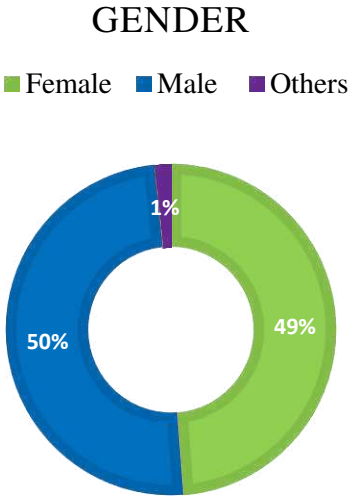


Figure 5: Descriptive Statistics – Gender in per cent

The horizontal bar chart Figure 5 shows the distribution of people by age group. The age groups are listed on the vertical axis, from 18-24 years to 65+ years. The horizontal axis shows the number of people, ranging from 0 to 60. The bars for each age group are shown in different colours and show the number of people in that group. The largest number is found in

the age group 25-34 years with n= 55, followed by 18-24 years with n=32. The other age groups have significantly fewer people.

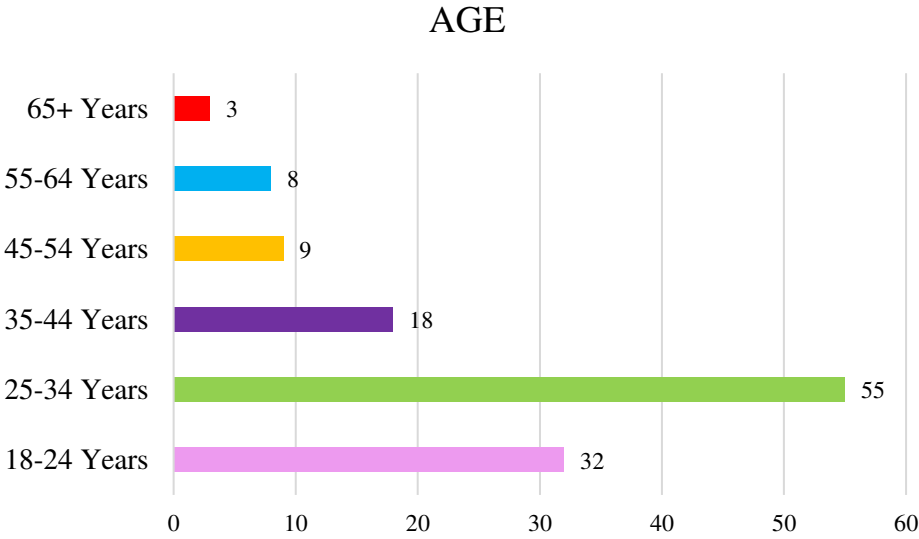


Figure 6: Descriptive Statistics – Age in per cent

In the education chart 2% (n=2) stated that they had obtained a secondary school leaving certificate and 9% (N=11) a secondary school certificate. 19% (n=24) stated that they had obtained an Abitur and 6% (n=7) a Fachhochschulreife. 31% of the sample (n=39) stated that they had a bachelor’s degree, as 31% or n=39 had a master’s degree. 2.3% (n=3) stated that they had a doctorate.

## Educational qualification

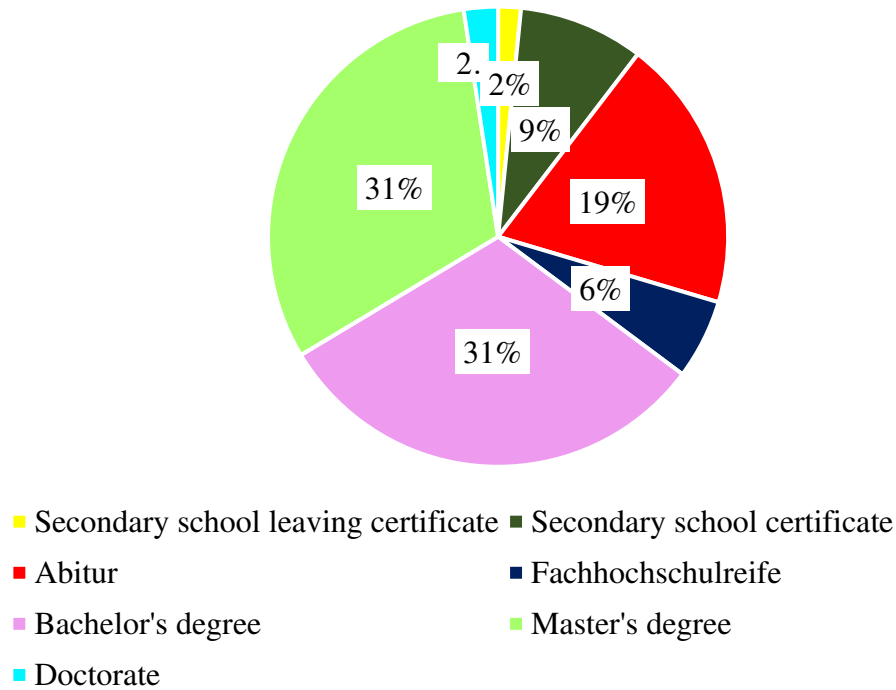


Figure 7: Descriptive Statistics: Educational Qualification in per cent

According to their own statements, most participants are employees (40%, n=51). The second largest group consists of students (35%, n=45), followed by the self-employed (8%, n=10). 7% (n=9) of participants stated that they were unemployed, 4% (n=5) were pensioners. 1.6% (n=2) were civil servants, and 1.6% (n=2) were students. One person (0.8%) stated that they were a housewife/househusband.

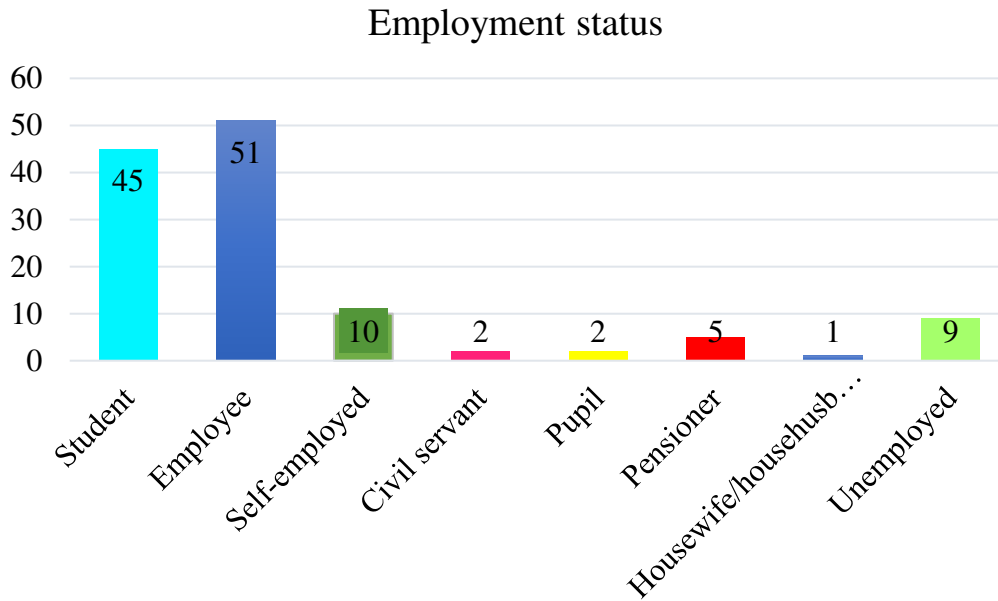


Figure 8: Descriptive Statistics - Employment Status in per cent

The largest group in terms of annual gross household income is found among those who have less than €25,000/year annual gross household income at their disposal, namely 38% (n=47). The second largest group are those who have €25000-49000/year at their disposal (23%, n=29). Those who have between €50000 and €99999 per year are n=26 people in total (20%). The fourth largest group (9%, n=12) did not answer the question. 8% (n=10) stated that they have between €100,000 and €1,999 a year at their disposal and one person (n=1, 0.8%) has more than €200,000 a year at their disposal.

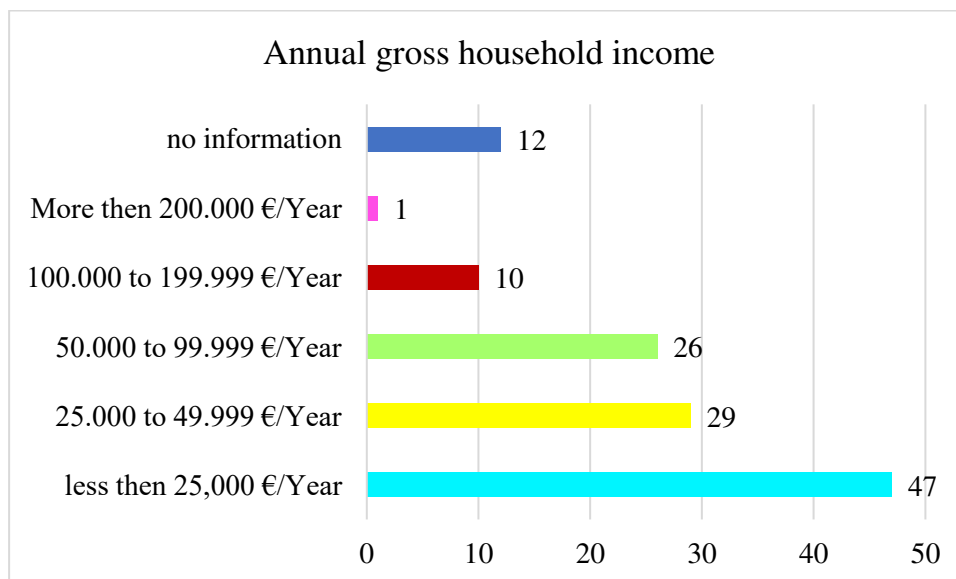


Figure 9: Descriptive Statistics: Annual Gross Household Income in per cent

## Exploratory Factor Analysis

For the Exploratory factor analysis to be interpreted afterwards, the prerequisites must first be checked. Three values must be considered here: Firstly, we look at the Kaiser-Meyer-Olkin value, which should be greater than .5. In this case, this requirement was met for both the drivers and the concerns, as the KMO value was .625 for the drivers and .716 for the concerns. In the same step, the condition of the Bartlett's test for sphericity is checked to see whether the initial variation is high enough. This condition was met in both tests, as the test was highly significant both times with  $p < .001$ . This means that the samples were not homogeneous, which leads to the conclusion that there should not be too many weak factors.

For the third requirement, the anti-image matrices are considered and checked to see whether all values in the main diagonal are above the value .5. These were all above .5 in the output of the concerns. In the anti-image matrices of the drivers, the values of the main diagonal were all above .5.

Table 1: KMO- and Bartlett-Test Concerns

Maß der Stichprobeneignung nach Kaiser-Meyer-Olkin.		,716
Bartlett-Test auf Sphärizität	Ungefähres Chi-Quadrat	531,626
	df	78
	Signifikanz nach Bartlett	<,001

Table 2: KMO- and Bartlett-Test Driver

Maß der Stichprobeneignung nach Kaiser-Meyer-Olkin.		,625
Bartlett-Test auf Sphärizität	Ungefähres Chi-Quadrat	432,679
	df	91
	Signifikanz nach Bartlett	<,001

Now that the prerequisites have been met, the number of factors can be determined. Three criteria can be used for this. Firstly, the Eigenvalue criterion is considered, which expresses the importance of the factor and should be greater than one. If this is the case, then more variance can be explained than by a single item.

Table 3: Total Variance Explained Drivers

### Erklärte Gesamtvarianz

Komponente	Anfängliche Eigenwerte			Summen von quadrierten Faktorladungen für Extraktion		
	Gesamt	% der Varianz	Kumulierte %	Gesamt	% der Varianz	Kumulierte %
1	3,233	23,092	23,092	3,233	23,092	23,092
2	1,987	14,194	37,286	1,987	14,194	37,286
3	1,279	9,134	46,420	1,279	9,134	46,420
4	1,222	8,726	55,147	1,222	8,726	55,147
5	1,169	8,348	63,495	1,169	8,348	63,495
6	1,075	7,677	71,171	1,075	7,677	71,171
7	,871	6,218	77,390			
8	,733	5,234	82,623			
9	,645	4,604	87,228			
10	,458	3,269	90,496			
11	,447	3,195	93,691			
12	,346	2,472	96,164			
13	,306	2,189	98,352			
14	,231	1,648	100,000			

Extraktionsmethode: Hauptkomponentenanalyse.

For the drivers, the calculation showed that six factors are meaningful according to the Eigenvalue criterion. The second criterion, the information criterion, checks whether the six components add up to more than 60% of the variance. The six factors explain 71.17% of the variance, thus confirming the result of the eigenvalue criterion.

Table 4: Total Variance Explained Concerns

Komponente	Anfängliche Eigenwerte			Summen von quadrierten Faktorladungen für Extraktion		
	Gesamt	% der Varianz	Kumulierte %	Gesamt	% der Varianz	Kumulierte %
1	3,658	28,139	28,139	3,658	28,139	28,139
2	2,307	17,743	45,882	2,307	17,743	45,882
3	1,264	9,723	55,605	1,264	9,723	55,605
4	1,153	8,872	64,477	1,153	8,872	64,477
5	1,025	7,882	72,359	1,025	7,882	72,359
6	,822	6,327	78,686			
7	,571	4,395	83,081			
8	,536	4,123	87,204			
9	,470	3,614	90,818			
10	,346	2,664	93,482			
11	,325	2,497	95,978			
12	,279	2,146	98,124			
13	,244	1,876	100,000			

Extraktionsmethode: Hauptkomponentenanalyse.

The Eigenvalue criterion shows that 5 factors are meaningful for the Concerns, which is supported by the information criterion, which states that 72.36% of the variance is already explained by the 5 factors. For completeness, the screen plots in Table 5 and 6 should be mentioned here, which shows a breakpoint after 2 variables for the drivers and for the concerns. However, this is not representative for this study and is therefore not considered in the statistical calculation.

Table 5: Screenplot Driver

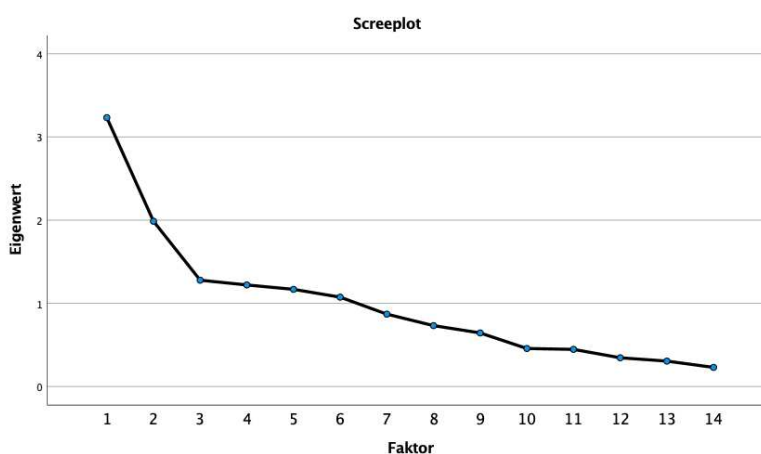
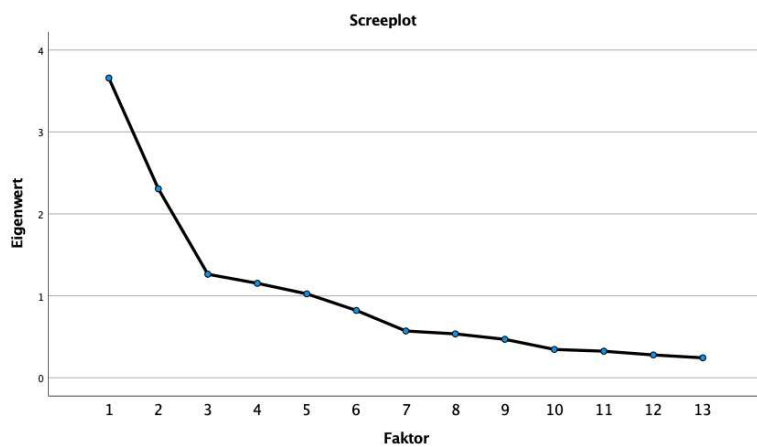


Table 6: Screenplot Concerns



Originally, 10 facets were planned for the drivers, but the rotated component matrix as well as the information and eigenvalue criterion resulted in six meaningful facets, which explained 71.17% of the variance. Due to some large discrepancies in content, 8 facets were finally created:

1. Openness to Experience
2. Environmental Concern
3. Reduction of sources of interference
4. Financial Incentives
5. Social influence
6. Costs
7. Recharge at Home
8. Previous EV driving experience

### Reliability Analysis

This internal consistency is calculated using the Cronbach alpha coefficient, which must reach a value of at least 0.80 for good internal consistency to be assumed. However, a value of 0.60 is considered acceptable in practice. In addition to internal consistency, item discriminatory power was calculated, which is used to test how well or accurately an individual item represents the overall scale. The item discriminatory power is in the interval between minus one and plus one and must be at least + 0.3 for good discriminatory power ( $r = +.3$ ). This is now done for all the dimensions surveyed. The table below lists the items for the respective dimensions regarding the drivers. OE2 is eliminated because the content is too similar. This

means that a Cronbach's alpha is not possible for one variable, and it is not possible to calculate discriminatory power in a meaningful way.

<b>Dimensions (Facet)</b>	<b>Items</b>	<b>Cronbach's Alpha (Must be min &gt;.6)</b>	<b>Item selectivity (Must min &gt;.3 )</b>
Openness to Experience	D_P_OE1 D_P_OE2	eliminated	
Environmental Concern	D_EN_EC1 D_EN_EC2	.750 fits	.600 fits
Reduction of sources of interference	D_T_NR D_EN_ER	.483 Too low	.323
Financial Incentives	D_ECO_FI1 D_ECO_FI2	.565 Borderline	.394 fits
Social influence	D_P_SI1 D_P_SI2	.525 Borderline	.389 fits
Costs	D_ECO_TCO D_ECO_OC	.584 Borderline	.422 fits
Recharge at Home	D_T_RH	Not possible/necessary	Not possible/necessary
Previous EV driving experience	D_P_PDE	Not possible/necessary	Not possible/necessary

For the concerns, 10 facets were originally planned, but the rotated component matrix and the information and eigenvalue criterion resulted in five meaningful facets (which explained 72.36% of the variance). DR2 is eliminated because the content is too similar. This means that a Cronbach's alpha is not possible for one variable, and it is not possible to calculate discriminatory power in a meaningful way. Due to some large discrepancies in content, 8 facets were finally created:

1. Distance Range
2. Battery life span

3. Charging technology
4. Financial restriction
5. Lack of charging infrastructure
6. Personal standard
7. Awareness about EV
8. Environmental Concern

Dimensions (Facet)	Items	Cronbach's Alpha (Must be min >.6)	Item selectivity (Must min >.3 )
Distance Range	C_TR_DR1 <del>C_TR_DR2</del>	eliminated	
Battery life span	C_TR_BL C_ECO_BRC	.738 → super	.589 → super
Charging technology	C_TR_CT	Not possible/necessary	Not possible/necessary
Financial restriction	C_ECO_PP C_ECO_URC	.291 Not good	.179 Not good
Lack of charging infrastructure	C_CI_LCI1 C_CI_LCI2	.706 super	.564 super
Personal standard	C_P_PN1 C_P_PN2	.831 super	.712 super
Awareness about EV	C_P_KA	Not possible/necessary	Not possible/necessary
Environmental Concern	C_EN_LTB	Not possible/necessary	Not possible/necessary

## Evaluation

In the following, a Pearson correlation is carried out for Research Question 1 and Research Question 2, as the variables are interval-scaled variables. These are treated as metric variables in the correlative analysis, which is why a Pearson correlation can be used as an evaluation method (Krüger et al., 2012).

The effect size was determined using the Cohen values. A value from  $+0.1$  stands for a weak effect, a value of  $+0.3$  for a medium effect and a value greater than or equal to  $+0.5$  for a large effect. A negative sign indicates a negative linear correlation, a positive sign indicates a positive linear correlation.

## RQ1

For Research Question 1: *What are the main drivers for a German customer who is potentially considering buying a BEV?* The Hypothesis was *There is a significant correlation between the "purchase intention" variable and the driver variables* and the result is *There is a significant correlation between the variable "purchase intention" and all driver variables.*

Table 7: Correlation of Drivers with purchase intention

		Korrelationen								
		Kaufentscheidung_Zusammengefügt	Unter Gleichaltrigen bin ich normalerweise der/die Erste, der/die neue Produkte ausprobiert.	D_EN_EC_ZUSAMMEN	D_ECO_FL_ZUSAMMEN	D_P_SI_ZUSAMMEN	D_ROFOI	D_ECO_Costs	Man muss sich nicht um das Tanken an der Tankstelle kümmern (da man zu Hause aufladen kann).	Ich habe bereits Erfahrung gemacht mit einem Elektrofahrzeug, dass ich gefahren bin, oder ich bin bereits Beifahrer gewesen.
Kaufentscheidung_Zusammengefügt	Pearson-Korrelation	1	,320**	,233**	,357**	,556**	,397**	,522**	,308**	,345**
	Sig. (2-seitig)		<,001	,009	<,001	<,001	<,001	<,001	<,001	<,001
	N	125	125	125	125	125	125	125	125	125
Unter Gleichaltrigen bin	Pearson-Korrelation	,320**	1	-,178*	,207*	,265**	,009	,208*	,116	,096

In the following, each correlation with the variable "purchase intention" is analysed at the level of the driver dimensions. There is a significant, positive linear correlation between the purchase intention and Openness to Experience ( $r=.32$ ,  $p<.001$ ). There is a significant, positive linear correlation of weak effect between the purchase intention and Environmental Concern ( $r=.23$ ,  $p=.009$ ). Between the purchase intention and reduction of sources of interference there is a significant, positive linear correlation of medium effect ( $r=.40$ ,  $p<.001$ ). Between the purchase intention and financial incentives there is a significant, positive linear correlation of medium effect ( $r=.36$ ,  $p<.001$ ). Between the purchase intention and social influence there is a significant, positive linear correlation of large effect ( $r=.56$ ,  $p<.001$ ). Between the purchase intention and costs there is a significant, positive linear correlation of large effect ( $r=.52$ ,  $p<.001$ ). Between the purchase intention and Recharge at Home there is a significant, positive linear correlation of medium effect ( $r=.31$ ,  $p<.001$ ). Between the purchase intention and the Previous EV driving experience there is a significant, positive linear correlation of medium effect ( $r=.35$ ,  $p<.001$ ).

## RQ2

For Research Question 2: *What are the main concern factors of a German customer in the potential purchase intention of a BEV?* With the

Hypothesis: There is a significant correlation between the variable "purchase decision" and the variables of the Concerns.

**Korrelationen**

		Kaufentscheidung_Zusammengefügt	Die Reichweite des Elektroautos ist ein großes Hindernis für die Nutzung als Alltagsfahrzeug.	C_CL_LCI_ZUSAM	C_P_PN_ZUSAM	C_LIFE_BATT	C_ECO_FinancialResriction	Ich habe eine ausgeprägte Kenntnis von Elektrofahrzeugen.	Ich bin nicht davon überzeugt, dass Elektrofahrzeuge die Umwelt weniger verschmutzen als herkömmliche Autos, wenn man bedenkt, dass Strom in Deutschland auch durch Kohle und Öl erzeugt wird.
Kaufentscheidung_Zusammengefügt	Pearson-Korrelation	1	-,310**	-,183*	,306**	-,394**	-,293**	,248**	-,198*
	Sig. (2-seitig)		<,001	,042	<,001	<,001	<,001	,005	,027
	N	125	125	125	125	125	125	125	125

**Korrelationen**

		Kaufentscheidung_Zusammengefügt	Das Aufladen eines Elektrofahrzeuges während einer Reise dauert zu lange.
Kaufentscheidung_Zusammengefügt	Pearson-Korrelation	1	-,304**
	Sig. (2-seitig)		<,001
	N	125	125
Das Aufladen eines Elektrofahrzeuges während einer Reise dauert zu lange.	Pearson-Korrelation	-,304**	1
	Sig. (2-seitig)	<,001	
	N	125	125

\*\* . Die Korrelation ist auf dem Niveau von 0,01 (2-seitig) signifikant.

Between the purchase decision and distance range there is a significant, negative linear correlation of medium effect ( $r=-.31$ ,  $p<.001$ ). Between the purchase decision and battery lifespan there is a significant, negative linear correlation of medium effect ( $r=-.39$ ,  $p<.001$ ). Between the purchase decision and charging technology there is a significant, negative linear correlation of medium effect ( $r=-.30$ ,  $p<.001$ ). Between the purchase decision and financial restriction there is a significant, negative linear correlation of small effect ( $r=-.29$ ,  $p<.001$ ).

There is a significant, negative linear correlation between the purchase decision and Lack of Charging Infrastructure ( $r=-.18$ ,  $p=.042$ ). Between the purchase decision and personal standard there is a significant, positive linear correlation of medium effect ( $r=.31$ ,  $p<.001$ ). Between the purchase decision and awareness about EV there is a significant, positive linear correlation of small effect ( $r=.25$ ,  $p=.005$ ). There is a significant, negative linear correlation between the purchase decision and Environmental Concern ( $r=-.20$ ,  $p=.027$ ).

### RQ3

#### Sub hypothesis 1

Finally, the evaluation for research question three follows: *Which socio-demographic characteristics of the German customer have an influence on the purchase intention?*

**H0:** *There is no significant difference between the genders (male, female, diverse) regarding the purchase intention.*

Since gender is a metric variable with more than two values, and the purchase decision is often regarded as interval-scaled and therefore metric due to the multi-level Likert scale, a GLM-1 (ANOVA) can be carried out here. To do this, the prerequisites must first be checked. These are the normal distribution in each group and the homogeneity of the variances.

The normal distribution was checked for normal distribution using the K-S and S-W tests, with the result that the normal distribution is not given in every group. Therefore, an ANOVA cannot be calculated, and an H-test should be used instead.

H-test:

**Teststatistiken<sup>a,b</sup>**

	Kaufentscheidung_Zusammengefügt
Kruskal-Wallis-H	5,469
df	2
Asymp. Sig.	,065

a. Kruskal-Wallis-Test  
b. Gruppenvariable: Geschlecht

The H-test (Kruskal-Wallis-H test) is not significant at  $p=.065$ . The  $H_0$  is retained. There is no significant difference between the genders (male, female, diverse) regarding the purchase decision.

## Sub hypothesis 2

**$H_0$ :** *There is no significant difference between the Educational Qualification regarding the purchase intention.*

Since Educational Qualification is a metric variable here, as with the purchase decision, the prerequisites for an ANOVA are first checked (normal distribution in each group and homogeneity of the variances).

The normal distribution was checked for normal distribution using the K-S and S-W tests, with the result that the normal distribution is not given in every group. Therefore, no ANOVA can be calculated; instead, an H-test should be used.

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistik	df	Signifikanz	Statistik	df	Signifikanz
Residuum für Kaufentscheidung_Zusammengefügt	,108	125	,001	,965	125	,003

a. Signifikanzkorrektur nach Lilliefors

The H-test (Kruskal-Wallis-H test) is not significant at  $p=.706$ . The  $H_0$  is retained.  $H_0$ : There is no significant difference between the Educational Qualification about the purchase decision.

## 5. Chapter: Discussion

From a socio-demographic point of view, the results are mostly ambiguous. Regarding gender, no clear scientific result could be identified at international level. In Germany, however, studies were found that suggest that men are more likely to have a BEV purchase intention (Plötz et al., 2014). A recent study, though, indicates that women who have a child and a lower income are more likely to have a purchase intention in Germany than men (Kawgan-Kagan, 2020). However, the first sub hypothesis  $H_0$  is retained. With regard to income, the analysed literature shows that higher incomes are more likely to have a purchase

intention for a BEV (Y. Xu et al., 2019). Again, this could not be confirmed in the survey conducted either. That's why the H0 in the second sub hypothesis will be retained too. No ANOVA could be calculated as there is no normal distribution, which can be attributed to the size of the sample.

Various theoretical perspectives were used to assess the drivers and concerns. Based on the sample, it was found that the higher the personal innovativeness, the higher the purchase intention. This result is consistent with the statement by X. He et al. (2018), which addresses the higher willingness to experience and thus the ability to adopt new concepts.

Regarding the next facet, the higher the environmental concern, the higher the purchase intention according to the survey, which is in line with Dutta & Hwang (2021) who found for the Taiwanese market that the attitude towards EVs is positively largely influenced by environmental concern.

The next facet that was analysed consisted of emission reduction and noise reduction in the composition. On the one hand, this is confirmed in the emission reduction by Lashari et al. (2021), which goes into more detail on the importance of environmental benefits and sees these as a strong predictor for a positive attitude towards EVs. On the other hand, the finding by Higuera-Castillo et al. (2019) confirms that a lower noise level of the BEV has a positive effect on the purchase intention. This study concluded that the higher the opinion that electric cars reduce sources of interference, i.e. noise, CO<sub>2</sub> emission, the higher the purchase intention.

About financial incentives, it is clear from the relevant literature that financial incentives had a direct influence on the sales figures of BEVs in Germany (Jurlin, 2023). For participants in this study, the more attractive financial incentives from the state are for the participants the more likely they are for purchase intention. This raises the question of the extent to which consumers in Germany can be persuaded to make purchases through further financial incentives, as the direct financial support expired at the end of 2023. The vehicle tax exemption remains in place.

The quantitative results between the purchase intention and social influence show there is a significant, positive linear correlation of large effect. This means the higher the social influence on BEV, the more likely is a purchase intention. This corresponds to the literature under consideration in which Hu et al. (2019) concluded that there is a positive significant effect of social influence on purchase intention.

The costs facet is a combination of the factors TCO and operating costs. The cost facet shows that the more the participants are convinced that their costs will be reduced by an electric car, the more likely it is that they will express an intention to purchase. When analysing the TCO and the other factors in the economic dimension, it is noticeable how strongly these depend locally on electricity prices, for example, which vary greatly from country to country. In addition, there are contradictory scientific papers that are difficult to compare as each study uses different criteria and measurement methods, the types of cars analysed differ and this makes an overall assessment difficult. Nevertheless, the quantitative results show that the more the participants are convinced that their costs will be reduced by an electric car, the more likely it is that they will express an intention to buy. The item measured was by X. He et al. (2018) who looked at the perceived monetary benefit, which in her study had a positive influence on consumers' purchase intention.

There is a positive correlation with charging at home. The realisation is that the sooner people are convinced that charging at home is practical for them, the higher their purchase intention. There was little literature on charging at home,

Bühler et al. (2014) found that after a driving experience, the perception of charging at home was more positive than before. This is consistent with the analysis carried out, according to which the higher the previous experience of driving a BEV, the higher the purchase intention.

In principle, the results of the thesis on the Driver side correspond closely to those of the literature and can be confirmed in the literature.

The more the range of a BEV represents a major obstacle to its use as an everyday vehicle for the participant, the less likely for a purchase intention. This statement can be academically justified by the finding of Carley et al. (2019), which states that a person who has strong concerns about the range of a BEV, which may be due to real-world range issues such as long daily journeys, is unlikely to buy a BEV.

Different theoretical perspectives were used to analyse the behaviour of customer according to the purchase intention of battery lifetime. The more a person in the survey is convinced that the battery lifespan is not long, the lower the probability of BEV purchase intention. This is confirmed by Liu et al. (2020), who describe that some potential buyers are discouraged from buying a BEV, which is a technical barrier that BEV manufacturers need to overcome.

As described in the relevant chapter about uncertainty in recharging structure there are indications that the more a person in the survey is convinced that charging of BEV takes too long, the lower the purchase intention. However, there was no suitable item in the literature for this facet, which is why a direct comparison is difficult. For example, Fetene et al. (2017) found that uncertainty regarding driving range and refuelling cost played a major role, but the study did not focus on charging time.

The scientific situation regarding the purchase price was clearer, so it can be summarised that the more people are convinced that BEVs are still too expensive, the less likely they are to buy them which is clearly confirmed by Wicki et al. (2023).

Regarding the charging infrastructure, the more you are convinced that there is too little charging infrastructure, the lower the purchase intention. This can be inferred from Wicki et al. (2023), who described the infrastructure as insufficient in their survey.

The personal norm factor is taken up by Peters et al. (2015), who conclude that the more participants are convinced, based on their personal values, that driving their car has as little impact on the environment as possible, the higher the purchase decision which is a positive linear correlation.

Interestingly, the study shows that the higher the knowledge about EVs, the higher the purchase decision which is confirmed by Ackaah et al. (2022).

The final interpretation of the results of the study in the last facet is that the more I am convinced that an electric car is harmful to the environment, the lower the purchase intention. Similar results were observed by Haddadian (2015).

The results of the online survey are supported on the Concern side by the literature in all the facets analysed.

## 6. Chapter: Conclusion

The aim of this thesis was to understand the complexity of German customers' potential purchase intention for BEVs. It focussed on identifying the key drivers and concerns that influence the purchase intention, as well as analysing socio-demographic characteristics specifically gender and education to better understand the customer.

All facets of both the drivers and the educated concerns can be confirmed, which speaks in favour of the existing literature and shows that these factors are relevant in Germany. About the socio-demographic factors, no clear characteristics can be identified for gender or education level, even based on the random sample.

The semi-structured interviews provided interesting in-depth insights for the expansion of the existing factors. For example, it was possible to include the social influence factor and thus better address the personal characteristics of the participants.

For the managerial implications, there are still existing concerns, which will be noticeable as direct financial support will not be available in 2024 and a decline in sales figures is expected, as described by BLOOMBERG at the beginning. The industry must therefore continue to develop and find solutions customised to the customer to eliminate their concerns for the purchase intention. For example, rapid technical progress must be made in the further development of the battery.

The influence of the government should not be underestimated either, as evidenced by the lack of direct financial support. The tax advantages remain. Consideration must be given to how further incentives can be created for the customer so that the government's targets for climate neutrality can be achieved if the BEV route is still seen as sustainable.

The uptake of electric mobility is influenced by individual choices, criteria, and motivations, including the economic impact and cost of the decision and thus depends enormously on the wishes and preferences of the end customer whose influence should not be underestimated.

## 7. Chapter: Limitations

The results above discussed provide useful insights on the effects of various drivers and concern factors on purchase intention. However, it must be recognised that, on the one hand, complete coverage of all relevant complex and multifaceted factors for the German end consumer cannot be addressed and the focus is on important factors that have already been discussed scientifically.

For time and scope reasons a further limitation can be seen in the level of detail, as a specific car type such as a small car, mid-range car or a specific model as in Horváth (2023) was not selected as the results of this thesis are at the more general level of the BEV type itself.

With regard to the quantitative part, the snowball sampling method was used for the online survey, whereby the sample of 125 participants is not representative and is non-random due to the chosen method (Johnson, 2014). In addition, the data was obtained using Qualtrics. This survey tool can lead to a bias in the sample, as consumers who do not have access to the internet are not included in the sample. For this reason, future studies should consider the inclusion of potential offline customers. The structural equation model has been used several times in a similar context but was not used due to the absence of access to AMOS.

Another important limitation of this scientific work is the intention-behaviour gap, which is evident in NEVs and thus in BEVs. According to this, customers who have an intention to buy a BEV do not necessarily decide in favour of the purchase (Z. He et al., 2021). Furthermore, Carrington (2010), for instance, argues and explains that there is only a small to medium correlation between pro-environmental intention behaviour and actual pro-environmental behaviour (Carrington et al., 2010).

## 8. Appendices

### Appendix 1: Interview Guideline

#### **Introduction and warm-up phase:**

Thank you for taking the time to participate in this interview. I am conducting the interviews for my master's thesis, which is about understanding certain factors that influence the purchasing decisions of private individuals/consumers for battery electric vehicles (BEVs) in Germany.

#### Brief topic introduction and background:

A battery electric vehicle (BEV) is a car that runs solely on electricity from rechargeable batteries. This means that no combustion engine is used, only a rechargeable battery.

#### 1) Awareness raising and prior knowledge:

- a. Can you briefly describe what you know about battery electric vehicles (BEVs)?
- b. Have you ever thought about buying an electric vehicle and why?
- c. Do you think the decision to buy a BEV is linked to socio-demographic factors?

#### 2) Driver for buying a BEV:

- a. What factors influence your decision to consider a BEV as a potential purchase?
- b. Why would you choose a BEV car?

#### 3) Environment

- a. How important is environmental friendliness when choosing your vehicle?

b.

4) Economical

- a. Are there any financial incentives or benefits that would persuade you to buy a BEV?
- b. In your opinion, is a BEV cost-effective?
- c. Do you think that the long-term costs (more than 7 years) of a BEV are lower than those of a conventional gas powered car?
- d. Are the maintenance costs the same?
- e. Do you know the incentives or measures taken by the German government to promote the introduction of electric vehicles?
- f. Do these incentives influence your decision-making process when buying a BEV?

5) Functional & Technical

- a. Are there functional and technical aspects that speak in favour of a BEV?
- b. Is it a purchase argument in favour of less noise pollution from BEVs?

**6) Concerns and obstacles:**

- a. What are your biggest concerns or obstacles when it comes to buying a BEV?

1) Environmentally friendly Confidence BEV sustainable

- a. How do you rate the CO<sub>2</sub> balance of the BEV for the total lifecycle from production to disposal?

2) Economical

- a. Do you tend to look at the purchase price or at the total costs when buying cars

3) Functional & Technical

- a. How do you rate the range of electric vehicles? Is this a problem for you?
- b. Would the current range of electric vehicles fulfil your daily driving requirements in DE?
- c. Are concerns about charging infrastructure in Germany a factor in your decision-making process?
- d. Are there any technological concerns or uncertainties with BEVs that worry you?

#### 4) Conclusion

Thank the respondent for their valuable insights.

- a. What features or characteristics are most important to you in a BEV?
- b. Ask if there is anything else they would like to add or share about BEVs

## Appendix 2: Interview Summary

### **Introduction and warm-up phase:**

Thank you for taking the time to participate in this interview. I am conducting the interviews for my master's thesis, which is about understanding certain factors that influence the purchasing decisions of private individuals/consumers for battery electric vehicles (BEVs) in Germany.

**Respondent A: 25, female, psychologist, or Psychotherapist in training**

**Respondent B: 60, female, pensionist**

**Respondent C: 28, male, business student**

**Respondent D: 24, male, real estate student**

**Respondent E: 59, male, Risk Manager**

**Respondent F: 57, female, Project Manager**

**Respondent G: 46, male, Entrepreneur (BEV owner)**

**Respondent H: 24, female, Haircutter**

### **BRIEF TOPIC INTRODUCTION AND BACKGROUND**

**A battery electric vehicle (BEV) is a car that runs solely on electricity from rechargeable batteries. This means that no combustion engine is used, only a rechargeable battery.**

#### **7) Awareness raising and prior knowledge:**

**1a) Can you briefly describe what you know about battery electric vehicles (BEVs)?**

**A:** A vehicle charged by electricity from power grid and no ICE is used.

**B:** Referred to know someone using a BEV and defined as a vehicle that does not require fossil fuel energy to be powered and is not to be confused with a hybrid car that has an ICE as well.

**C:** They're just ordinary cars that instead of an ICE use an electric motor and they are much more efficient. Theoretically they should also be more environmentally friendly.

**D:** In the first sense of a purely electric vehicle that is battery-powered, with a certain battery capacity for storing the energy required for driving.

**E:** BEV is a vehicle that has a large battery, where I can store electricity quickly and drive with 100 percent energy from the electricity grid.

**F:** purely electrically powered 100 percent electrically charged.

**G:** As the word suggests, an electric vehicle with an electric motor, not a combustion engine, not even a hybrid. In other words, where the battery is not charged via a diesel generator or petrol, but purely electrically from a socket. And it has a battery in it as energy storage.

**H:** A BEV is powered 100 percent by electricity that can be charged at an electric filling station and where the energy is stored in the form of a large battery.

**1b) Have you ever thought about buying an electric vehicle and why?**

**A:** Yes, environmental aspects.

**B:** Yes, actively has a BEV in sight that she would like to buy because of its looks, range and affordability

**C:** No, they're not yet available in the price range I'm in, or the models I would like.

**D:** No, I wouldn't choose an electric car for my first car.

**E:** Yes, I have been looking into buying a BEV, but more for the future than the present.

**F:** No because charging capacity too low and uncertainty about battery life, cold and high energy consumption in winter

**G:** Yes owns one. Professionally, I've leased a BEV.

**H:** Yes, due to rising fuel prices.

**1c) Do you think the decision to buy a BEV is linked to socio-demographic factors?**

**A:** Differences in age groups and the environmental awareness of consumers.

**B:** Purchasing power plays a role, rather middle class but not dependent on age or gender.

**C:** Maybe there are gender-specific differences, men are less likely to buy a BEV. In terms of age, I can imagine that with age comes a higher income. So yes, with a higher age purchasing power factor increases and you can more likely afford these purchasing prices. But I could even imagine that young people are more willing to go with the trend and buy BEV's.

**D:** Do not think that socio-demographic factors play a role, as there are different models that address different income groups.

**E:** People in the age group between 20-40 have a greater degree of interest in an electric vehicle than people in the age group 45 upwards. We may have a slightly higher correlation with men in buying BEV. In Germany it depends on income. I think there's a big spread.

**F:** Probably yes. The higher the level of education, the more people think more comprehensively, regardless of price. I think that younger people are more open to newer technologies. Men are more interested.

**G:** In terms of cost alone, I think it's still very expensive. I don't think everyone can buy an electric car straight away, I don't even know where the entry-level prices are, but I think they're still far too expensive. From the age structure and gender specific there are young and old people who think it's equally good. So I think it's primarily linked to the financial aspect.

**H:** Since BEVs often cost many times more than ICEs, I think there is a recognizable difference in terms of income. In addition, younger age groups are less likely to buy a BEV.

## **8) DRIVER FOR BUYING A BEV**

### **2a) What factors influence your decision to consider a BEV as a potential purchase?**

**A:** The safety of the car and handling are to be mentioned first. Then the range that is possible with one battery charge and how long the charging process takes. The purchase price is also an important factor.

**B:** The main argument for me is that it would reduce my CO<sub>2</sub> emissions because my main CO<sub>2</sub> emissions come from travelling. We already have full equipment in the garage and the roof is full of photovoltaics. Savings effect, because refuelling has become so expensive.

**C:** No more fuel costs, that would be the main factor for me. The second would of course be the environmental aspect. Otherwise, that would be the main factor. For other consumers I can imagine that many have a Tesla as a status symbol.

**D:** Support for the technology that it is still developing, which is still in its infancy compared to the combustion engine. You can certainly get super-efficient cars out of it and they will also be more environmentally friendly. Of course, they are also quiet. They are very future orientated.

**E:** Ecological reasons, emissions are prevented. The CO<sub>2</sub> reduction in operation. That could be one reason. Ecological, Economical, vehicles with low noise emissions, could basically be an issue.

**F:** car as an energy source for generated solar energy.

**G:** CO<sub>2</sub>-free travel, free mobility. Fuel is cheaper to maintain. That's a side effect, but not an insignificant one. In my opinion, a much better driving experience.

**H:** As a motivator, I would mention the environmental friendliness of not emitting CO<sub>2</sub> during operation. The power transmission is very efficient, and I think that the running costs are lower.

### **2b) Why would you choose a BEV car?**

**A:** Less impact on the climate with an electric car. I believe that I simply have a better carbon footprint or a smaller carbon footprint. That's what's most important to me. For me, one advantage would be to charge on my doorstep and not have to drive to a filling station,

because the filling station is always a hassle. Another advantage is that charging on the electricity grid, costs me less than refuelling, especially if I also produce my own electricity. And that is not influenced by such strong fluctuations as diesel or gasoline, for example.

**B:** addressed the issue of environmental friendliness most important. Nice side effect that I don't have to fill up with diesel and spend so much money for refuelling. Free parking spaces for electric cars. Another image, fancy to drive Tesla or the BMWI as a status symbol.

**C:** No more fuel costs, that would be the main factor for me. The second would be the environmental aspect and better drive efficiency. I can imagine consumers driving a Tesla as a status symbol.

**D:** modern, technologically innovative, better efficiency.

**E:** Not for ecological reasons but for innovation reasons to maintain progress in the automotive industry in Germany. I see it more as a bridge technology to better batteries that promise more progress. Emissions are prevented during operation could be a reason for some consumers. Additionally, noise reduction with low noise emissions.

**F:** reasons mentioned above

**G:** reasons above

**H:** above

## 9) Environment

### 3a) How important is environmental friendliness when choosing your vehicle?

**A:** very important if I can afford it.

**B:** Important. main argument for me, that it would reduce my CO2 emissions, so to speak, because my main CO2 emissions come from travelling back and forth to Italy.

**C:** In general, environmental friendliness is very important to me. When buying a car, I can't take it into account much because the purchase price is simply too high for me.

**D:** Important.

**E:** Is important to me. With the current vehicle, it has a medium priority.

**F:** Make sure the car doesn't consume too much fuel unnecessarily.

**G:** very important.

**H:** It is becoming increasingly important to me personally.

**3b) How do you rate the CO<sub>2</sub> balance of the BEV for the total lifecycle from production to disposal?**

**A:** I can save CO<sub>2</sub> if I use the car for a long time and not just say years, but if I can use the car for as long as possible and the service life of this car is long, then I can save CO<sub>2</sub>.

**B:** Overall lifecycle considered bad, unfortunately. I don't have any in-depth knowledge about it. I keep hearing that batteries have a bad environmental footprint during production and then when you must discard them.

**C:** The difference is only noticeable when you drive a lot when you look at the entire cycle. Because the production is very CO<sub>2</sub> intensive and the disposal of the batteries afterwards. But I think if you drive a lot, you can make up for it with other factors.

**D:** At least during production, where they are not quite as environmentally friendly as they are always advertised. However, they may be later during operation if the electricity is renewable. Then it works very well, but the electricity is also largely non-renewable in Germany, so far, although that will, of course, take some time and that's why it's good when electric cars become established.

**E:** You read different things. I think given the significantly shorter service life of electric vehicles. Of course, the emissions in production also must be distributed over a short period and I believe that this is always a total energy balance. But it is possible that the electric vehicle does not perform particularly well in terms of emissions.

**F:** Fewer materials used in the BEV car, CO<sub>2</sub> balance battery very intensive due to rare earths. 2nd or 3rd hand car not possible less recycling.

**G:** Production of the batteries is of course the most critical point, the other is just like another car. I think that after 5 to 6 years, the BEV will be on a level with the gasoline or diesel engine, and in my opinion, it will have great advantages. But when it comes to recycling, I don't know if there will be a decrease or a recycling option again, then I think that overall, it will perform much, much better than a diesel or gasoline-powered vehicle. But that would mean that more components return into the cycle..

**H:** Production of the battery is very harmful to the environment. Rare metals must be extracted, which is not very sustainable. During operation, I think it is more sustainable than ICEs and when it comes to recycling, I have heard that batteries can be reused afterward, not in other cars but for other products that require less energy.

## **10) Economical**

**4a) Are there any financial incentives or benefits that would persuade you to buy a BEV?**

**A:** I don't know if that exists. But I do know that there are many or, for a while, several stations that you could charge for free. I don't know if there are any subsidies, but I would like to see them, but it's not the deciding factor for me to buy an electric car.

**B:** Don't pay road tax when you buy a car like this. Benefits from the state, and I assumed for myself that we're talking about no car tax.

**C:** I think a 5000€ subsidy when you buy a new one but it's only for new cars that I find dubious because then those who already have money when they buy a new one have more of it than those who need it.

**D:** Not very well informed about it now. However, I do know that there was funding in any case. But as far as I know, they were also cut back.

**E:** There used to be a corresponding Tax relief, but that has expired. But even that, I would say tax concessions are not attractive offers.

**F:** Early electromobility bonus from the state for car purchases.

**G:** Yes, I find a state subsidy for CO<sub>2</sub>-free driving interesting. Then you get into the same financial situation where you can say it's the same as a petrol-powered vehicle. Perhaps also subsidized loans, where you could finance a car cheaply. There used to be a tax or a subsidy of €2000 to €3000 from the German state, but you had to pay tax on that straight away.

**H:** I think that if you pay less for the parking ticket when parking in the city, that can be an advantage. In addition, there is also financial support from the government. But I don't know how much you get there.

**4b) In your opinion, is a BEV cost-effective?**

**A:** It's more cost-efficient to maintain because the charge simply costs me less than a tank of gas. Regarding the higher purchase price again, it depends on the durability of my car. But I would be more willing to pay a higher price and spend less money in everyday life.

**B:** It's lower maintenance and I think the running costs are lower as it's only electricity.

**C:** It always depends. You can also buy a €4,000 car and drive it four hundred thousand kilometers, then it's also very cost-efficient. If I were to compare new cars now, I think yes.

**D:** Unsure about the battery replacement cost. I think it's more cost-efficient than a combustion engine in terms of electricity costs alone.

**E:** No, it is not cost-efficient.

**F:** No more purchase premium, question of how much it costs to recharge a tank about a combustion engine, difficult to estimate maintenance costs.

**G:** In my opinion, it is cost-efficient, yes.

**H:** To reduce petrol costs yes, I think so. It is not so maintenance intensive.

**4c) Do you think that the long-term costs (more than 7 years) of a BEV are lower than those of a conventional gas-powered car?**

**A:** Long-term costs are lower for a battery-powered electric car than for a conventional car.

**B:** I hope that the long-term costs are lower, but I don't know for sure.

**C:** Yes, but I don't know how cost-intensive a battery replacement is at some point.

**D:** With energy recovery it's probably more cost-efficient.

**E:** I don't know that. I would assume that electric operation is more expensive. Combustion engines and there are certainly average values that show how long combustion cars last, that's certainly more than 7 years and I should measure it against that value.

**F:** Fewer parts so less can break, I wonder if it's worth buying a new battery, can I sell it?

**G:** I can imagine that this might even happen sooner, because the consumption under electricity, you only need 70% or 50% of what a gasoline engine consumes and costs. So, I do think that you are more cost-efficient. The inspections are cheaper, there are fewer parts.

**H:** Yes, I just think that if you must replace the battery in the BEV, it will be very costly. Petrol prices are also continuing to rise and are being taxed more.

**4d) Are the maintenance costs the same?**

**A:** I expect the BEV energy costs lower and maintenance as well. The only point that could get very expensive is battery replacement.

**B:** Electric energy is significantly cheaper than driving a gas-powered car now. Very low maintenance.

**C:** Overall lower cost but not sure about battery replacement.

**D:** Lower.

**E:** The combustion engine requires more replacement, but there is more experience, and the processes are probably more standardized. Electric cars have individual manual steps, I suspect, so the costs are relatively high. In the case of battery-powered cars, I think battery repairs are currently very time-consuming and probably less efficient.

**F:** Lower, fewer wearing parts.

**G:** The maintenance costs are significantly lower and that's because you simply don't have so many engine-specific things to replace. The battery must be replaced at some point. I'll say 50%, probably of the car is the cost of the battery. Manufacturers give a guarantee, let's say 5 to 10 years, that it will still perform at 80%. Such a guarantee would of course influence the purchase decision as it is one of the main things of the car. What's most critical would then be replaced if they were broken. If you must replace it yourself, it's a considerable cost.

**H:** As previously reported, I think they are lower.

**4e) Do you know the incentives or measures taken by the German government to promote the introduction of electric vehicles?**

**A:** I don't know if there are. I know that at many stations you could charge for free. I think it would be good, but for me it's not the deciding factor for buying an electric car.

**B:** I don't think you pay road tax when you buy a car like this. So at least when I was looking at this new Toyota there are also benefits from the state, and I assumed that we were talking about no road tax.

**C:** I think a grant of 5000€ when buying a new car.

**D:** Am not currently very well informed about it. However, I do know that there was a subsidy program. But as far as I know, they were also cut back.

**E:** Yes, I think it is for car tax. The state says we'll give you €5,000 for the purchase of vehicle XY. But the manufacturer will increase the purchase price for XY accordingly for the German market.

**F:** Tax savings, lower vehicle taxes, no traffic bans in low emission zones.

**G:** See 4a.

**H:** Car park price reductions and financial incentives, however, are unknown to me.

**4f) Do these incentives influence your decision-making process when buying a BEV?**

**A:** No, not essential for decision-making.

**B:** Yes, it would reduce the purchasing price.

**C:** No, the current subsidies don't make sense. It's only for new cars, which I find a bit daft because then those who already have more money have a lower purchase burden when they buy a new one and those who need support have none of it.

**D:** It would be a support.

**E:** No.

**F:** Depending on where I live, short distances, enough charging stations, maybe as a second car, big influence city vs country.

**G:** Maybe.

**H:** Rather less, because the purchase price is still enormously high and if parking is too expensive for me in the city I drive publicly.

### **11) Functional & Technical**

#### **5a) Are there functional and technical aspects that speak in favour of a BEV?**

**A:** Convenient that you can charge from home whenever you want and are not dependent on gas prices. Of course, noise protection is better. Convenience to drive in automatic mode.

**B:** Automatic, it's a very pleasant drive. It accelerates very strongly. It's more convenient if you can charge from home.

**C:** The acceleration. Energy transfer is very efficient.

**D:** Significantly lower noise levels from the cars. Technology in electric cars usually looks a bit more modern, even with the large screen inside, or the acceleration, which is very, fast, especially in the range up to 100 - 120 KMH. And the energy feedback during braking.

**E:** Noise reduction and the other is acceleration. It could be a motivator if it was 100% guaranteed to be green electricity. But in Germany, we have an electricity mix.

**F:** No.

**G:** It's noise-free, it's smooth because it doesn't have an ICE. You don't have to change gear, so it's a totally pleasant, quiet ride and very easy. It always starts reliably.

**H:** I believe that the acceleration is very fast, and you can recover energy by braking.

#### **5b) Is it a purchase argument in favour of less noise pollution from BEVs?**

**A:** Yes.

**B:** Conventional cars are already very loud. And the background noise is also very high, especially in cities or in houses that live on the road.

**C:** No, I don't think so. I have a TV episode in my head, they said that at 30 KMH the abrasion from the wheels drowns out the engine noise, so if you drive faster than 30, I think it's the same unless you have a sports exhaust.

**D:** Yes, for others may be very relevant for me no main driver for a BEV.

**E:** Yes.

**F:** Dangerous because they are so quiet that children and older people can hardly hear them.

**G:** Yes, of course it is quieter when you drive through the city

**H:** Yes, I think so, although it is important that there is still a sound when reversing.

## **12) CONCERNS AND OBSTACLES**

### **6a) What are your biggest concerns or obstacles when it comes to buying a BEV?**

**A:** The high purchase price is already a huge issue. I also find that a barrier, is that there are few Second-hand vehicles. For me, the charging time is still a bit of an obstacle, not the range at all, and I don't think it's that bad. I'm more concerned with the long duration because I can't even get 4000 kilometres with my petrol car without refuelling once. The nationwide expansion of fast-charging stations would be important to me. If you tend to drive in areas that are less populated, then of course it looks worse with charging, so perhaps there is generally a greater expansion and the high acquisition costs.

**B:** Range, especially on longer journeys for everyday use is no problem. From my working environment, a personal fear factor is when reinsurance engineers claim that electric cars burn much faster.

**C:** Acquisition costs. Going on vacation far away, maybe with the charging stations. So, I must recharge more often, maybe I don't know if I can do that everywhere or if I would need special fast stations.

**D:** Range. If I were to buy a car, I would also go on holiday occasionally and drive longer distances. Otherwise, I would rather use public local transport. Of course, comfort also counts, heating should not be omitted just because it is also electrically powered and limits the range. Need for increased expansion of the power grid as it won't be able to cope. We need to make electricity a little greener and use even more renewable energies. Extraction of raw materials with rare earths and lithium.

**E:** The biggest obstacle is the infrastructure. Power outages will become more likely in Germany in the future. Apart from that the power grid in Germany still is an energy mix and not only renewable energy which would change something.

**F:** Too little experience in terms of service life, only suitable as a second car for short distances, much more planning, performance decreases in winter, availability of charging stations in Europe, charging time itself, design not appealing, poor resale value.

**G:** The infrastructure! Yes, the availability of charging stations. So, if you're renting somewhere in the city center and don't have a garage with your wall box. The production of the batteries and the disposal of the batteries, just like the charging infrastructure, are not mature yet. More research needs to be done on this; the energy density needs to be increased. Then you can go longer with an electric vehicle without needing such a charging infrastructure. The production and disposal of the batteries is already a big question mark as to whether this will lead to the mobility of the future. The overall electricity consumption if everyone drives electric, whether the electricity can ever be produced?

**H:** The purchase price is very high. In addition, a lot is happening technologically that you don't know whether it will be outdated again in a few years. In addition, the range is not yet as far as that of combustion cars. Infrastructure will make it difficult to always find a free charging space if you live in the city center and perhaps don't have your own parking space.

### **13) Environmentally friendly Confidence BEV sustainable**

#### **14) Economical**

##### **8a) Do you tend to look at the purchase price or at the total costs when buying cars**

**A:** Firstly, the purchase price.

**B:** Purchase Price

**C:** I would do the math a bit. So, I would look at how much it would cost if I were to buy any model from VW that is available in gasoline and electric. Then I assume that the electric one is a bit more expensive. Then I would look at what I can save through the subsidy.

**D:** The first thing you look at, of course, is the purchase price. Then, as a second point, I would add what the running costs are and what the insurance is like. Exactly how this is extrapolated with the expenses for electricity and then all the possible maintenance. There may also be certain tests or results from the batteries later on to see how long they last.

**E:** Both the purchase price and the operating costs play a role in the purchase decision.

**F:** Purchase price resale price after several years.

**G:** I would say 50%, 50% of the purchase price is also crucial, because you must be able to afford it first. The question is whether the profitability calculation over these 10 years works out so that it lasts that long. So, I think the purchase price is a decisive factor, if it becomes cheaper, then your long-term profitability or perspective of the car will also become significantly more favourable.

**H:** I'm already looking at the purchase price, but of course, I'm considering how the cost of electricity might develop in comparison to the price of petrol.

### **15) Functional & Technical**

#### **9a) How do you rate the range of electric vehicles? Is this a problem for you?**

**A:** Range as a city car, it would be sufficient for me. As a long-distance vehicle, I would certainly have to go for a higher-priced model to make it sufficient for me.

**B:** The range is still an obstacle. Even though I see or know that people who drive Tesla's say that you can tell immediately from your display where the nearest charging station is and that's nothing worse than having to look for a petrol station. Geographically more likely in Germany, very convenient in large cities, difficult in decentralized locations.

**C:** If I knew how to deal with it, I don't think so. But I can imagine now, I know there are these quick-charging stations where you can go from 20 to 80 or so percent in half an hour.

**D:** I think probably 200km. I also want to go on holiday with it. At my age and with the capital I have now and could invest, it would be more of an ICE.

**E:** Yes, that would be a criterion and a problem for me, because the range is simply not sufficient.

**F:** 400 to 500 km max and for holiday cars you must take into account that fast charging has a direct effect on the operating time.

**G:** I think it's great for inner-city driving, but still inadequate for longer distances, especially on the highway, because it draws so much energy in the city. With the braking and with the energy recovery and starting and the speeds that you drive on average 30 kilometers or something like that. In my opinion, it's a super vehicle for city and country driving up to 200 or 300 kilometres. I still think longer journeys are difficult because you don't know where to charge.

**H:** Yes, if you go on holiday abroad, the infrastructure is perhaps even worse than in Germany. Also, if there is a charging station along the way, you don't know if it will be occupied when you plan to take a break.

**9b) Would the current range of electric vehicles fulfil your daily driving requirements in DE?**

**A:** It would be sufficient for me.

**B:** In some cases, you can also charge your car at supermarkets, where there's a fast charger for half an hour, then you just pop in, buy something and your car is ready to go again. So, Germany is comfortable.

**C:** But, for everyday life, that's no problem. Rather the opposite because it's almost short and at night with the Cheap electricity better.

**D:** Now, yes. I'm currently always traveling by public transport. That means all short journeys, maybe sometimes. Longer journeys by train, which would then be possible with an electric car. That's still possible, but as I said, if I'm going on holiday, that would no longer be possible by car. That would probably be too far, or it depends.

**E:** That doesn't work. Whereby traveling to work would be acceptable and for small purchases at home, that is mapped. The mobility promise can't be kept at all, when I buy a car, I want it to be able to take me from A to B and I want to have the freedom to decide how many kilometres I drive, and the vehicles can and none of these vehicles can currently deliver on this mobility promise.

**F:** Sufficient as a second car.

**G:** In principle, I would say that the current range of electric vehicles meets the daily driving requirements in Germany.

**H:** Yes, it's certainly enough to get to work and go shopping.

**9c) Are concerns about charging infrastructure in Germany a factor in your decision-making process?**

**A:** If you're not in the central cities or large towns, then perhaps the expansion is simply not yet so great. The expansion of fast-charging stations is particularly important to me.

**B:** I also must bear in mind that the number of electric vehicles is increasing but I don't always have the impression that the charging stations do, they are lagging, often also used by hybrid cars. Outside the major centers of population in Germany the infrastructure level of charging stations might not be so great, but I'm not sure.

**C:** Yes definitely!

**D:** Rather at home, I wonder whether the power supply will allow it, or if I live in a rented flat, whether the parking space can be equipped with a charging point. I think the network needs to be expanded so that it's also possible to charge your car at home. Even in rented flats with a parking space etc.

**E:** The biggest obstacle is the infrastructure. You already must think about it and realize that the power supply is not designed for more and more people switching to electric vehicles. The infrastructure is already causing problems with a 2% share of BEVs.

**F:** How is it on the motorway are there enough options available around the clock, how long does charging take?

**G:** Expanded for short distances in urban centers, but as soon as the distance exceeds 200 km, it becomes difficult to travel with the current infrastructure in Germany.

**H:** Yes, this is a factor, especially if you live a little further away from a big city, the density of charging stations decreases rapidly.

**9d) Are there any technological concerns or uncertainties with BEVs that worry you?**

**A:** At the end of the car's life cycle, I have concerns on an environmental level. And I believe that more advertising can be done. The electric car is much more difficult to extinguish than conventional cars. But it's not a concern.

**B:** battery burns faster. If it's like the electric bike, then I find that the batteries are very quickly no longer as capable as they were at the beginning. Means you must charge much more often than the first year.

**C:** No.

**D:** Range, battery life and possibly also safety, as the battery is difficult to extinguish. Yes, I think most of the development is in the engine on the one hand and in the battery on the other.

**E:** They do exist. Technological development is in the early stages and if I make an investment decision for a vehicle with a service life of 7, 8, or 9 years, I don't know what I'm buying with electric cars. The assumption is that after 3 to 4 years the system will have to be written off because technological development is progressing much faster. It's strange when you've possibly paid a lot of money for something like this and suddenly the value stability is no longer there because solid-state batteries come onto the market, which may have a completely different range. So, these are all safety factors, but they can also be seen to a certain extent as a motivational will, i.e. technological development in early development, the aim is to fulfil the motivational promise. Then that could be a motivator at some point.

**F:** Battery life cycle, effect of cold, how much electricity do you have to charge for music light heat, short distances always more power consumption in the cold? Depending on if there is a power shortage, how quickly do they discharge when not in use?

**G:** No, the fire behaviour that is supposedly always mentioned. Well, I recently heard again that 1 burned in the underground parking garage, but ICEs can also burn. There's no technological concern that it's not fully developed, that it's just an experimental car. It would be even better to have something for long distances, but technologically I think it's good.

**H:** I would be concerned about the battery life as it is very cost intensive. Also, the reduced range when it's cold in winter, which the cars probably can't cope with either.

## **16) Conclusion**

**Thank the respondent for their valuable insights.**

### **10a) What features or characteristics are most important to you in a BEV?**

**A:** Price is decisive, and I would like to see marketing or promotion of cheaper electric cars. It would also be great if there was simply better marketing or subsidization.

**B:** The most important for me is the ecological aspect. The technical aspects of a pleasant driving style and no longer having to spend much money on refuelling, so the operating costs are lower. Caused by the fact that the house is full of photovoltaic panels. Outside of the big urban centers in Germany, the charging station capacity might not be so great.

**C:** The purchasing price because my purchasing power is limited. Then what models there are to choose from. I want to buy a car that I like, the quality of the car in general.

**D:** Personal private enthusiasm for technology. On the one hand, to increase the performance with chip tuning, but also on the other hand with classic cars and carry out repairs yourself. That's all possible with a combustion engine and not with an electric car, you can't do anything yourself.

**E:** If the obstacles were to be removed and it turned out to be more ecological, would of course be a motivator. As a kind of status symbol, it could also be a motivator to be innovative and show others how environmentally conscious you are. The topic of fuel cells, which for me will actually be the target solution in the long term anyway. So, for me, a battery-powered vehicle is only a bridging technology anyway. Except for use cases that have short distances.

**F:** Independence to get quickly from A to B without having to think about where to refuel, service life, resale value.

**G:** Emission-free driving. You have to make sure that your mobility is CO<sub>2</sub> free. That's simply because traffic contributes a lot to CO<sub>2</sub> emissions, and I think that's the main argument. Must look at where the electricity comes from. So that's always a double-edged sword.

**H:** The range is very important to me, as is the purchase price. In addition, the infrastructure must be well developed, otherwise I won't be as mobile as I would like to be with the BEV.

**10b) Ask if there is anything else they would like to add or share about BEVs.**

**A:** More widespread expansion of fast-charging stations and a larger second-hand market.

**B:** No.

**C:** I can't think of anything.

**D:** No.

**E:** Charging at home theoretically yes, but in practice, no, as the infrastructure and the power grid are not currently equipped for this.

**F:** Safety, tested in the same way as combustion engines, more information on actual comparisons with total raw material consumption, more incentives created by the government.

**G:** No.

**H:** No.

### Appendix 3: The survey questionnaire

## INTRODUCTION

Dear participants,

This study is conducted as part of my master's thesis at the Católica Lisbon School of Business and Economics within the seminar "New Product Innovation".

The purpose of this survey is to test different motivators and barriers regarding the purchasing behaviour of battery electric vehicles (BEV) among consumers in Germany.

The study therefore refers exclusively to 100% electric vehicles that are not equipped with a combustion engine.

Please note the following information:

-> The estimated duration is approx. 5 minutes.

-> Please answer all questions spontaneously. There are no right or wrong answers, your true thoughts are very important.

-> All information you provide will be treated anonymously and confidentially and will only be used for research purposes.

Furthermore, only German citizens and residents of Germany may take part in the survey.

If you have any questions or comments, please feel free to contact me by e-mail: s-jfeller@ucp.pt.

If you agree with the following information, please click on "Agree".

Thank you for taking the time to complete this survey!

Julian Feller

## **PART I: GENERAL INFORMATION / Socio-demographic factors**

### **Q2: Gender**

- Female
- Male
- Diverse

### **Q3: Age**

- Under 18 years
- 18-24 years
- 25-34 years old
- 35-44 years old
- 45-54 years old
- 55-64 years old
- 65+ years old

### **Q4: What is your highest educational qualification?**

- No degree
- Lower Secondary school certificate
- Higher Secondary school certificate
- A-levels
- Advanced technical college certificate
- Bachelor's degree
- Master's degree
- Doctorate

### **Q5: What is your current employment status?**

- Student
- Employee
- Self-employed person
- Civil servant
- Pupil
- Pensioner
- Housewife/househusband
- Unemployed person

**Q6: What was your total household income before taxes during the past 12 months in Euros?**

- Less than 25,000 Euros per year
- 25,000 - 49,999 Euros per year
- 50,000 - 99,999 Euros per year
- 100,000 - 199,999 Euros per year
- More than 200,000 Euros per year
- Not specified

**PART II: MAIN PART DRIVER FACTORS**

**Q7: I believe that electric vehicles emit fewer air pollutants than internal combustion engine vehicles.**

- Strongly agree
- Partially agree
- Neither nor
- Partially disagree
- Strongly disagree

**Q8: I think we should take care of the environmental impact.**

- Strongly agree
- Partially agree
- Neither nor
- Partially disagree
- Strongly disagree

**Q9: I feel that environmental pollution has become more and more serious in recent years.**

- Strongly agree
- Partially agree
- Neither nor
- Partially disagree
- Strongly disagree

**Q10: I think that when all costs are taken into account, driving electric vehicles is no more expensive than driving conventional cars.**

- Strongly agree
- Partially agree
- Neither nor
- Partially disagree
- Strongly disagree

**Q11: In my opinion, fuel and maintenance expenses are reduced for electric cars compared to combustion engines.**

- Strongly agree
- Partially agree
- Neither nor
- Partially disagree
- Strongly disagree

**Q12: When deciding to buy an electric vehicle, a direct government subsidy is attractive to me.**

- Strongly agree
- Partially agree
- Neither nor
- Partially disagree
- Strongly disagree

**Q13: If I drive an electric vehicle, I receive government incentives.**

- Strongly agree
- Partially agree
- Neither nor
- Partially disagree
- Strongly disagree

**Q14: I would find the low noise level of electric vehicles pleasant.**

- Strongly agree
- Partially agree

- Neither nor
- Partially disagree
- Strongly disagree

**Q15: You don't have to worry about filling up at the gas station (as you can recharge the electric vehicle at home).**

- Strongly agree
- Partially agree
- Neither nor
- Partially disagree
- Strongly disagree

**Q16: I think that environmentally friendly vehicles are in line with social trends.**

- Strongly agree
- Partially agree
- Neither nor
- Partially disagree
- Strongly disagree

**Q17: Driving an electric vehicle improves my status or my self-image.**

- Strongly agree
- Partially agree
- Neither nor
- Partially disagree
- Strongly disagree

**Q18: I'm usually the first to try out new products among my peers.**

- Strongly agree
- Partially agree
- Neither nor
- Partially disagree
- Strongly disagree

**Q19: I am generally hesitant to try new products.**

- Strongly agree

- Partially agree
- Neither nor
- Partially disagree
- Strongly disagree

**Q20: I have already had experience with an electric vehicle that I have driven or been a passenger.**

- Strongly agree
- Partially agree
- Neither nor
- Partially disagree
- Strongly disagree

### **PART III: ATTENTION QUESTION**

**Q21: The colour test you are about to take is very simple: When asked what your favourite colour is, you have to choose "Green". This is an attention test.**

- Red
- Blue
- Green
- Brown
- Orange

### **PART IV: MAIN PART CONCERN FACTORS**

**Q22: I am not convinced that electric vehicles pollute the environment less than conventional cars, considering that electricity in Germany is also generated by coal and oil.**

- Strongly agree
- Partially agree
- Neither nor
- Partially disagree
- Strongly disagree

**Q23: The purchase price for an electric vehicle is too high for me.**

- Strongly agree

- Partially agree
- Neither nor
- Partially disagree
- Strongly disagree

**Q24: I believe that the batteries used in electric cars are expensive and it is not yet known how long they will last.**

- Strongly agree
- Partially agree
- Neither nor
- Partially disagree
- Strongly disagree

**Q25: I am unsure what the electricity costs are when recharging the electric car.**

- Strongly agree
- Partially agree
- Neither nor
- Partially disagree
- Strongly disagree

**Q26: The range of electric cars is a major obstacle to their use as an everyday vehicle.**

- Strongly agree
- Partially agree
- Neither nor
- Partially disagree
- Strongly disagree

**Q27: The range of the electric vehicle is suitable for everyday use.**

- Strongly agree
- Partially agree
- Neither nor
- Partially disagree
- Strongly disagree

**Q28: I am concerned about the lifespan of the electric vehicle battery.**

- Strongly agree
- Partially agree
- Neither nor
- Partially disagree
- Strongly disagree

**Q29: Charging an electric car during a journey takes too long.**

- Strongly agree
- Partially agree
- Neither nor
- Partially disagree
- Strongly disagree

**Q30: Using an electric car for longer distances is difficult due to the lack of charging stations along the highways in Germany.**

- Strongly agree
- Partially agree
- Neither nor
- Partially disagree
- Strongly disagree

**Q31: I believe that the current number of charging stations is still too small.**

- Strongly agree
- Partially agree
- Neither nor
- Partially disagree
- Strongly disagree

**Q32: Regardless of what other people do, I think it's right to choose a car that uses as little energy as possible.**

- Strongly agree
- Partially agree
- Neither nor
- Partially disagree
- Strongly disagree

**Q33: When you travel by car, it should have as little impact on the climate and energy consumption as possible.**

- Strongly agree
- Partially agree
- Neither nor
- Partially disagree
- Strongly disagree

**Q34: I have a strong knowledge of electric vehicles.**

- Strongly agree
- Partially agree
- Neither nor
- Partially disagree
- Strongly disagree

**PART V: PURCHASE INTENTION**

**Q35: Next time I buy a car, I will consider buying an electric car.**

- Strongly agree
- Partially agree
- Neither nor
- Partially disagree
- Strongly disagree

**Q36: I intend to drive an electric car in the near future.**

- Strongly agree
- Partially agree
- Neither nor
- Partially disagree
- Strongly disagree

## 9. Bibliography

- Ackaah, W., Kanton, A. T., & Osei, K. K. (2022). Factors influencing consumers' intentions to purchase electric vehicles in Ghana. *Transportation Letters*, *14*(9), 1031–1042. <https://doi.org/10.1080/19427867.2021.1990828>
- Adams, W. C. (2015). Conducting Semi-Structured Interviews. In *Handbook of Practical Program Evaluation* (pp. 492–505). John Wiley & Sons, Ltd. <https://doi.org/10.1002/9781119171386.ch19>
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211. [https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T)
- Anastasiadou, K., & Gavanas, N. (2022). State-of-the-Art Review of the Key Factors Affecting Electric Vehicle Adoption by Consumers. *Energies (19961073)*, *15*(24), 9409. <https://doi.org/10.3390/en15249409>
- Anderson, J. E., Bergfeld, M., Nguyen, D. M., & Steck, F. (2023). Real-world charging behavior and preferences of electric vehicles users in Germany. *International Journal of Sustainable Transportation*, *17*(9), 1032–1046. <https://doi.org/10.1080/15568318.2022.2147041>
- Axsen, J., Orlebar, C., & Skippon, S. (2013). Social influence and consumer preference formation for pro-environmental technology: The case of a U.K. workplace electric-vehicle study. *Ecological Economics*, *95*, 96–107. <https://doi.org/10.1016/j.ecolecon.2013.08.009>
- Barth, M., Jugert, P., & Fritsche, I. (2016). Still underdetected – Social norms and collective efficacy predict the acceptance of electric vehicles in Germany. *Transportation*

- Research Part F: Traffic Psychology and Behaviour*, 37, 64–77.  
<https://doi.org/10.1016/j.trf.2015.11.011>
- Berkeley, N., Jarvis, D., & Jones, A. (2018). Analysing the take up of battery electric vehicles: An investigation of barriers amongst drivers in the UK. *Transportation Research Part D: Transport and Environment*, 63, 466–481. <https://doi.org/10.1016/j.trd.2018.06.016>
- Berneiser, J., Senkpiel, C., Steingrube, A., & Gölz, S. (2021). The role of norms and collective efficacy for the importance of techno-economic vehicle attributes in Germany. *Journal of Consumer Behaviour*, 20(5), 1113–1128.  
<https://doi.org/10.1002/cb.1919>
- Biresselioglu, M. E., Demirbag Kaplan, M., & Yilmaz, B. K. (2018). Electric mobility in Europe: A comprehensive review of motivators and barriers in decision making processes. *Transportation Research Part A: Policy and Practice*, 109, 1–13.  
<https://doi.org/10.1016/j.tra.2018.01.017>
- Brückmann, G., & Bernauer, T. (2023). An experimental analysis of consumer preferences towards public charging infrastructure. *Transportation Research Part D: Transport and Environment*, 116, 103626. <https://doi.org/10.1016/j.trd.2023.103626>
- Bühler, F., Cocron, P., Neumann, I., Franke, T., & Krems, J. F. (2014). Is EV experience related to EV acceptance? Results from a German field study. *Transportation Research Part F: Traffic Psychology and Behaviour*, 25, 34–49.  
<https://doi.org/10.1016/j.trf.2014.05.002>
- Buhmann, K. M., Rialp-Criado, J., & Rialp-Criado, A. (2024). Predicting Consumer Intention to Adopt Battery Electric Vehicles: Extending the Theory of Planned Behavior. *Sustainability*, 16(3), Article 3. <https://doi.org/10.3390/su16031284>
- Carley, S., Siddiki, S., & Nicholson-Crotty, S. (2019). Evolution of plug-in electric vehicle demand: Assessing consumer perceptions and intent to purchase over time.

- Transportation Research Part D: Transport and Environment*, 70, 94–111.  
<https://doi.org/10.1016/j.trd.2019.04.002>
- Carrington, M. J., Neville, B. A., & Whitwell, G. J. (2010). Why Ethical Consumers Don't Walk Their Talk: Towards a Framework for Understanding the Gap Between the Ethical Purchase Intentions and Actual Buying Behaviour of Ethically Minded Consumers. *Journal of Business Ethics*, 97(1), 139–158.  
<https://doi.org/10.1007/s10551-010-0501-6>
- Chiluwal, S., Rao, A. M., & Podila, R. (2021). Strategies for improving rechargeable lithium-ion batteries: From active materials to CO2 emissions. *Nanotechnology Reviews*, 10(1), 1993–2026. <https://doi.org/10.1515/ntrev-2021-0114>
- Clark, R. A., Haytko, D. L., Hermans, C. M., & Simmers, C. S. (2019). Social Influence on Green Consumerism: Country and Gender Comparisons between China and the United States. *Journal of International Consumer Marketing*, 31(3), 177–190.  
<https://doi.org/10.1080/08961530.2018.1527740>
- Cui, L., Wang, Y., Chen, W., Wen, W., & Han, M. S. (2021). Predicting determinants of consumers' purchase motivation for electric vehicles: An application of Maslow's hierarchy of needs model. *Energy Policy*, 151, 112167.  
<https://doi.org/10.1016/j.enpol.2021.112167>
- Daina, N., Sivakumar, A., & Polak, J. W. (2017). Electric vehicle charging choices: Modelling and implications for smart charging services. *Transportation Research Part C: Emerging Technologies*, 81, 36–56. <https://doi.org/10.1016/j.trc.2017.05.006>
- Dawes, J. (2008). Do Data Characteristics Change According to the Number of Scale Points Used? An Experiment Using 5-Point, 7-Point and 10-Point Scales. *International Journal of Market Research*, 50(1), 61–104.  
<https://doi.org/10.1177/147078530805000106>

- Dutta, B., & Hwang, H.-G. (2021). Consumers Purchase Intentions of Green Electric Vehicles: The Influence of Consumers Technological and Environmental Considerations. *Sustainability*, *13*(21), Article 21. <https://doi.org/10.3390/su132112025>
- Elektroautos: Das 2024 gilt bei der Kfz-Steuer.* (n.d.). Retrieved 30 March 2024, from <https://www.adac.de/rund-ums-fahrzeug/elektromobilitaet/kaufen/kfz-steuer-elektroautos/>
- Ellen, P. S. (1994). Do we know what we need to know? Objective and subjective knowledge effects on pro-ecological behaviors. *Journal of Business Research*, *30*(1), 43–52. [https://doi.org/10.1016/0148-2963\(94\)90067-1](https://doi.org/10.1016/0148-2963(94)90067-1)
- European Environment Agency. (2016). *Electric vehicles in Europe*. Publications Office. <https://data.europa.eu/doi/10.2800/100230>
- Europe's Biggest Car Market to See First EV Slump in Seven Years. (2024, January 30). *Bloomberg.Com*. <https://www.bloomberg.com/news/articles/2024-01-30/europe-s-biggest-car-market-to-see-first-ev-slump-in-seven-years>
- Felgenhauer, M. F., Pellow, M. A., Benson, S. M., & Hamacher, T. (2016). Evaluating co-benefits of battery and fuel cell vehicles in a community in California. *Energy*, *114*, 360–368. <https://doi.org/10.1016/j.energy.2016.08.014>
- Fernandes, S., & Panda, R. (2019). Influence of Social Reference Groups on Consumer Buying Behavior: A Review. *Journal of Management Research (09725814)*, *19*(2), 131–142.
- Fetene, G. M., Kaplan, S., Mabit, S. L., Jensen, A. F., & Prato, C. G. (2017). Harnessing big data for estimating the energy consumption and driving range of electric vehicles. *Transportation Research Part D: Transport and Environment*, *54*, 1–11. <https://doi.org/10.1016/j.trd.2017.04.013>

- Fishbein, M., & Ajzen, I. (1975). *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research*. Addison-Wesley.
- Franke, T., Günther, M., Trantow, M., & Krems, J. F. (2017). Does this range suit me? Range satisfaction of battery electric vehicle users. *Applied Ergonomics*, *65*, 191–199. <https://doi.org/10.1016/j.apergo.2017.06.013>
- Funke, S. Á., Plötz, P., & Wietschel, M. (2019). Invest in fast-charging infrastructure or in longer battery ranges? A cost-efficiency comparison for Germany. *Applied Energy*, *235*, 888–899. <https://doi.org/10.1016/j.apenergy.2018.10.134>
- Giansoldati, M., Monte, A., & Scorrano, M. (2020). Barriers to the adoption of electric cars: Evidence from an Italian survey. *Energy Policy*, *146*, 111812. <https://doi.org/10.1016/j.enpol.2020.111812>
- Globisch, J., Plötz, P., Dütschke, E., & Wietschel, M. (2019). Consumer preferences for public charging infrastructure for electric vehicles. *Transport Policy*, *81*, 54–63. <https://doi.org/10.1016/j.tranpol.2019.05.017>
- Goetzel, N., & Hasanuzzaman, M. (2022). An empirical analysis of electric vehicle cost trends: A case study in Germany. *Research in Transportation Business & Management*, *43*, 100825. <https://doi.org/10.1016/j.rtbm.2022.100825>
- Gustavsen, G. W., & Hegnes, A. W. (2020). Individuals' personality and consumption of organic food. *Journal of Cleaner Production*, *245*, 118772. <https://doi.org/10.1016/j.jclepro.2019.118772>
- Haddadian, G. (2015). Accelerating the Global Adoption of Electric Vehicles: Barriers and Drivers. *The Electricity Journal*, *28*(10).
- Haustein, S., Jensen, A. F., & Cherchi, E. (2021). Battery electric vehicle adoption in Denmark and Sweden: Recent changes, related factors and policy implications. *Energy Policy*, *149*, 112096. <https://doi.org/10.1016/j.enpol.2020.112096>

- He, X., Zhan, W., & Hu, Y. (2018). Consumer purchase intention of electric vehicles in China: The roles of perception and personality. *Journal of Cleaner Production*, 204, 1060–1069. <https://doi.org/10.1016/j.jclepro.2018.08.260>
- He, Z., Zhou, Y., Wang, J., Li, C., Wang, M., & Li, W. (2021). The impact of motivation, intention, and contextual factors on green purchasing behavior: New energy vehicles as an example. *Business Strategy and the Environment*, 30(2), 1249–1269. <https://doi.org/10.1002/bse.2682>
- Hecht, C., Spreuer, K. G., Figgenger, J., & Sauer, D. U. (2022). Market Review and Technical Properties of Electric Vehicles in Germany. *Vehicles*, 4(4), Article 4. <https://doi.org/10.3390/vehicles4040049>
- Herberz, M., Hahnel, U. J. J., & Brosch, T. (2022). Counteracting electric vehicle range concern with a scalable behavioural intervention. *Nature Energy*, 7(6), 503–510. <https://doi.org/10.1038/s41560-022-01028-3>
- Higueras-Castillo, E., Molinillo, S., Coca-Stefaniak, J. A., & Liébana-Cabanillas, F. (2019). Perceived Value and Customer Adoption of Electric and Hybrid Vehicles. *Sustainability*, 11(18), Article 18. <https://doi.org/10.3390/su11184956>
- Hoefl, F. (2021). Internal combustion engine to electric vehicle retrofitting: Potential customer's needs, public perception and business model implications. *Transportation Research Interdisciplinary Perspectives*, 9, 100330. <https://doi.org/10.1016/j.trip.2021.100330>
- Horváth, G., Bai, A., Szegedi, S., Lázár, I., Máthé, C., Huzsvai, L., Zakar, M., Gabnai, Z., & Tóth, T. (2023). A Comprehensive Review of the Distinctive Tendencies of the Diffusion of E-Mobility in Central Europe. *Energies (19961073)*, 16(14), 5421. <https://doi.org/10.3390/en16145421>

- Hu, X., Chen, X., & Davison, R. M. (2019). Social Support, Source Credibility, Social Influence, and Impulsive Purchase Behavior in Social Commerce. *International Journal of Electronic Commerce*, 23(3), 297–327. <https://doi.org/10.1080/10864415.2019.1619905>
- International Energy Agency. (2023). *Global EV Outlook 2023: Catching up with Climate Ambitions*. OECD. <https://doi.org/10.1787/cbe724e8-en>
- Ivanova, G., Moreira, A. C., & Link to external site, this link will open in a new tab. (2023). Antecedents of Electric Vehicle Purchase Intention from the Consumer's Perspective: A Systematic Literature Review. *Sustainability*, 15(4), 2878. <https://doi.org/10.3390/su15042878>
- Johnson, T. P. (2014). Snowball Sampling: Introduction. In *Wiley StatsRef: Statistics Reference Online*. John Wiley & Sons, Ltd. <https://doi.org/10.1002/9781118445112.stat05720>
- Jurlin, K. (2023). How Efficient and Socially Sensitive Are Fiscal Incentives for Electric Cars in Europe? *Journal of Risk and Financial Management*, 16(6), Article 6. <https://doi.org/10.3390/jrfm16060283>
- Kamran, M. (2023). Chapter 10—Electric vehicles and smart grids. In M. Kamran (Ed.), *Fundamentals of Smart Grid Systems* (pp. 431–460). Academic Press. <https://doi.org/10.1016/B978-0-323-99560-3.00002-8>
- Kawgan-Kagan, I. (2020). Are women greener than men? A preference analysis of women and men from major German cities over sustainable urban mobility. *Transportation Research Interdisciplinary Perspectives*, 8, 100236. <https://doi.org/10.1016/j.trip.2020.100236>
- Kester, J., Zarazua de Rubens, G., Sovacool, B. K., & Noel, L. (2019). Public perceptions of electric vehicles and vehicle-to-grid (V2G): Insights from a Nordic focus group study.

- Transportation Research Part D: Transport and Environment*, 74, 277–293.  
<https://doi.org/10.1016/j.trd.2019.08.006>
- Krüger, C., Borgmann, L., Antonik, T., Meyer, A.-K., Diebig, M., & Kay, A. (2012). Datenauswertung mit SPSS. *Lehrstuhl Für Personalentwicklung Und Veränderungsmanagement, TU Dresden*.
- Lane, B. W., Dumortier, J., Carley, S., Siddiki, S., Clark-Sutton, K., & Graham, J. D. (2018). All plug-in electric vehicles are not the same: Predictors of preference for a plug-in hybrid versus a battery-electric vehicle. *Transportation Research Part D: Transport and Environment*, 65, 1–13. <https://doi.org/10.1016/j.trd.2018.07.019>
- Lashari, Z. A., Ko, J., & Jang, J. (2021). Consumers' Intention to Purchase Electric Vehicles: Influences of User Attitude and Perception. *Sustainability*, 13(12), Article 12. <https://doi.org/10.3390/su13126778>
- Lévy, P. Z., Drossinos, Y., & Thiel, C. (2017). The effect of fiscal incentives on market penetration of electric vehicles: A pairwise comparison of total cost of ownership. *Energy Policy*, 105, 524–533. <https://doi.org/10.1016/j.enpol.2017.02.054>
- Li, Q., Long, R., Chen, H., & Geng, J. (2017). Low Purchase Willingness for Battery Electric Vehicles: Analysis and Simulation Based on the Fault Tree Model. *Sustainability*, 9(5), Article 5. <https://doi.org/10.3390/su9050809>
- Li, W., Long, R., Chen, H., & Geng, J. (2017). A review of factors influencing consumer intentions to adopt battery electric vehicles. *Renewable and Sustainable Energy Reviews*, 78, 318–328. <https://doi.org/10.1016/j.rser.2017.04.076>
- Lieutenant, K., Borissova, A. V., Mustafa, M., McCarthy, N., & Iordache, I. (2022). Comparison of “Zero Emission” Vehicles with Petrol and Hybrid Cars in Terms of Total CO<sub>2</sub> Release—A Case Study for Romania, Poland, Norway and Germany. *Energies*, 15(21), Article 21. <https://doi.org/10.3390/en15217988>

- Ling, Z., Cherry, C. R., & Wen, Y. (2021). Determining the Factors That Influence Electric Vehicle Adoption: A Stated Preference Survey Study in Beijing, China. *Sustainability*, 13(21), Article 21. <https://doi.org/10.3390/su132111719>
- Liu, R., Ding, Z., Jiang, X., Sun, J., Jiang, Y., & Qiang, W. (2020). How does experience impact the adoption willingness of battery electric vehicles? The role of psychological factors. *Environmental Science and Pollution Research*, 27(20), 25230–25247. <https://doi.org/10.1007/s11356-020-08834-w>
- Longo, M., Yaici, W., & Foiadelli, F. (2021). 6—Smart urban mobility traffic control system components. In J. R. Vacca (Ed.), *Solving Urban Infrastructure Problems Using Smart City Technologies* (pp. 129–142). Elsevier. <https://doi.org/10.1016/B978-0-12-816816-5.00006-1>
- Mahmoudzadeh Andwari, A., Pesiridis, A., Rajoo, S., Martinez-Botas, R., & Esfahanian, V. (2017). A review of Battery Electric Vehicle technology and readiness levels. *Renewable and Sustainable Energy Reviews*, 78, 414–430. <https://doi.org/10.1016/j.rser.2017.03.138>
- Nanaki, E. A. (2021). Chapter 2—Electric vehicles. In E. A. Nanaki (Ed.), *Electric Vehicles for Smart Cities* (pp. 13–49). Elsevier. <https://doi.org/10.1016/B978-0-12-815801-2.00006-X>
- Nealer, R., Reichmuth, D., & Anair, D. (2015). *Cleaner Cars from Cradle to Grave* (2015). *Union of Concerned Scientists: Cambridge, MA, USA*.
- Ninh, N. G. (2021). Resistance to change and purchase intention of electric vehicles: Empirical evidence from vietnam. *Asian Journal of Business Research*, 11(2).
- Noel, L., Zarazua de Rubens, G., Kester, J., & Sovacool, B. K. (2020). Understanding the socio-technical nexus of Nordic electric vehicle (EV) barriers: A qualitative discussion

- of range, price, charging and knowledge. *Energy Policy*, 138, 111292.  
<https://doi.org/10.1016/j.enpol.2020.111292>
- Oppenheimer, D. M., Meyvis, T., & Davidenko, N. (2009). Instructional manipulation checks: Detecting satisficing to increase statistical power. *Journal of Experimental Social Psychology*, 45(4), 867–872. <https://doi.org/10.1016/j.jesp.2009.03.009>
- Pelegov, D. V., & Chanaron, J.-J. (2023). Electric Car Market Analysis Using Open Data: Sales, Volatility Assessment, and Forecasting. *Sustainability*, 15(1), Article 1. <https://doi.org/10.3390/su15010399>
- Peters, A., de Haan, P., & Scholz, R. W. (2015). Understanding Car-Buying Behavior: Psychological Determinants of Energy Efficiency and Practical Implications. *International Journal of Sustainable Transportation*, 9(1), 59–72. <https://doi.org/10.1080/15568318.2012.732672>
- Peters, A., Gutscher, H., & Scholz, R. W. (2011). Psychological determinants of fuel consumption of purchased new cars. *Transportation Research Part F: Traffic Psychology and Behaviour*, 14(3), 229–239. <https://doi.org/10.1016/j.trf.2011.01.003>
- Plötz, P., Schneider, U., Globisch, J., & Dütschke, E. (2014). Who will buy electric vehicles? Identifying early adopters in Germany. *Transportation Research Part A: Policy and Practice*, 67, 96–109. <https://doi.org/10.1016/j.tra.2014.06.006>
- Rogers, E. M., & Shoemaker, F. F. (1971). *Communication of Innovations; A Cross-Cultural Approach*. The Free Press, 866 Third Avenue, New York, N.
- Sang, Y.-N., & Bekhet, H. A. (2015). EXPLORING FACTORS INFLUENCING ELECTRIC VEHICLE USAGE INTENTION: AN EMPIRICAL STUDY IN MALAYSIA. *International Journal of Business and Society*, 16(1), Article 1. <https://doi.org/10.33736/ijbs.554.2015>

- Schmalfuß, F., Mühl, K., & Krems, J. F. (2017). Direct experience with battery electric vehicles (BEVs) matters when evaluating vehicle attributes, attitude and purchase intention. *Transportation Research Part F: Traffic Psychology and Behaviour*, *46*, 47–69. <https://doi.org/10.1016/j.trf.2017.01.004>
- Schwartz, S. H. (1977). Normative Influences on Altruism<sup>1</sup>. In L. Berkowitz (Ed.), *Advances in Experimental Social Psychology* (Vol. 10, pp. 221–279). Academic Press. [https://doi.org/10.1016/S0065-2601\(08\)60358-5](https://doi.org/10.1016/S0065-2601(08)60358-5)
- Scorrano, M., Danielis, R., & Giansoldati, M. (2020). Dissecting the total cost of ownership of fully electric cars in Italy: The impact of annual distance travelled, home charging and urban driving. *Research in Transportation Economics*, *80*, 100799. <https://doi.org/10.1016/j.retrec.2019.100799>
- She, Z.-Y., Qing Sun, Ma, J.-J., & Xie, B.-C. (2017). What are the barriers to widespread adoption of battery electric vehicles? A survey of public perception in Tianjin, China. *Transport Policy*, *56*, 29–40. <https://doi.org/10.1016/j.tranpol.2017.03.001>
- Skippon, S., & Garwood, M. (2011). Responses to battery electric vehicles: UK consumer attitudes and attributions of symbolic meaning following direct experience to reduce psychological distance. *Transportation Research Part D: Transport and Environment*, *16*(7), 525–531. <https://doi.org/10.1016/j.trd.2011.05.005>
- Sovacool, B. K., Abrahamse, W., Zhang, L., & Ren, J. (2019). Pleasure or profit? Surveying the purchasing intentions of potential electric vehicle adopters in China. *Transportation Research Part A: Policy and Practice*, *124*, 69–81. <https://doi.org/10.1016/j.tra.2019.03.002>
- Suttakul, P., Wongsapai, W., Fongsamootr, T., Mona, Y., & Poolsawat, K. (2022). Total cost of ownership of internal combustion engine and electric vehicles: A real-world

- comparison for the case of Thailand. *Energy Reports*, 8, 545–553.  
<https://doi.org/10.1016/j.egy.2022.05.213>
- Turker, H., & Bacha, S. (2018). Optimal Minimization of Plug-In Electric Vehicle Charging Cost With Vehicle-to-Home and Vehicle-to-Grid Concepts. *IEEE Transactions on Vehicular Technology*, 67(11), 10281–10292.  
<https://doi.org/10.1109/TVT.2018.2867428>
- Umweltbonus für Elektrofahrzeuge | Bundesregierung*. (2023, December 18). Die Bundesregierung informiert | Startseite. <https://www.bundesregierung.de/breg-de/schwerpunkte/klimaschutz/eenergie-und-mobilitaet/faq-umweltbonus-1993830>
- Wang, X.-W., Cao, Y.-M., & Zhang, N. (2021). The influences of incentive policy perceptions and consumer social attributes on battery electric vehicle purchase intentions. *Energy Policy*, 151, 112163. <https://doi.org/10.1016/j.enpol.2021.112163>
- Wicki, M., Brückmann, G., Quoss, F., & Bernauer, T. (2023). What do we really know about the acceptance of battery electric vehicles? – Turns out, not much. *Transport Reviews*, 43(1), 62–87. <https://doi.org/10.1080/01441647.2021.2023693>
- Wolff, S., & Madlener, R. (2019). *Charged up? Preferences for Electric Vehicle Charging and Implications for Charging Infrastructure Planning* (SSRN Scholarly Paper 3491629). <https://doi.org/10.2139/ssrn.3491629>
- Wu, G., Inderbitzin, A., & Bening, C. (2015). Total cost of ownership of electric vehicles compared to conventional vehicles: A probabilistic analysis and projection across market segments. *Energy Policy*, 80, 196–214.  
<https://doi.org/10.1016/j.enpol.2015.02.004>
- Xu, G., Wang, S., Li, J., & Zhao, D. (2020). Moving towards sustainable purchase behavior: Examining the determinants of consumers' intentions to adopt electric vehicles.

- Environmental Science and Pollution Research*, 27(18), 22535–22546.  
<https://doi.org/10.1007/s11356-020-08835-9>
- Xu, Y., Zhang, W., Bao, H., Zhang, S., & Xiang, Y. (2019). A SEM–Neural Network Approach to Predict Customers’ Intention to Purchase Battery Electric Vehicles in China’s Zhejiang Province. *Sustainability*, 11(11), Article 11.  
<https://doi.org/10.3390/su11113164>
- Yang, S., Lu, Y., Gupta, S., Cao, Y., & Zhang, R. (2012). Mobile payment services adoption across time: An empirical study of the effects of behavioral beliefs, social influences, and personal traits. *Computers in Human Behavior*, 28(1), 129–142.  
<https://doi.org/10.1016/j.chb.2011.08.019>
- Yang, Y., & Tan, Z. (2019). Investigating the Influence of Consumer Behavior and Governmental Policy on the Diffusion of Electric Vehicles in Beijing, China. *Sustainability*, 11(24), Article 24. <https://doi.org/10.3390/su11246967>
- Yang, Y., Yao, E., Yang, Z., & Zhang, R. (2016). Modeling the charging and route choice behavior of BEV drivers. *Transportation Research Part C: Emerging Technologies*, 65, 190–204. <https://doi.org/10.1016/j.trc.2015.09.008>
- Yeung, S. P.-M. (2004). Teaching Approaches in Geography and Students’ Environmental Attitudes. *Environmentalist*, 24(2), 101–117. <https://doi.org/10.1007/s10669-004-4801-1>
- Zhao, X., Ma, Y., Shao, S., & Ma, T. (2022). What determines consumers’ acceptance of electric vehicles: A survey in Shanghai, China. *Energy Economics*, 108, 105805.  
<https://doi.org/10.1016/j.eneco.2021.105805>