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TITLE: Selection factors for behavioral intention regarding electric vehicles in Norway

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Stavanger, June 28th,2020

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Abstrakt (Norwegian)

Norge har tatt en ledende rolle i introduksjonen og utviklingen av et bærekraftig marked for elektriske kjøretøy, og har dermed også fungert som et laboratorium. Ifølge en fersk rapport fra Norsk Elbilforening (NE) er salget av elektriske kjøretøyer i Norge økt med nesten en tredjedel per år de siste tre årene. Hva skyldes denne kraftige økningen i salget? Formålet med denne studien er å identifisere hva som påvirker menneskers motivasjon til å kjøpe elektriske kjøretøyer i Norge. Det er gjennomført en digital undersøkelse, med 281 respondenter, for å kartlegge hvilke faktorer som påvirker og er avgjørende for valg i forbindelse med mulig eller gjennomført kjøp. Gjennom ulike regresjonsanalyser finner studien at det er faktorene miljøhensyn, subjektive normer, opplevelse av økonomiske fordeler og generell oppfatning av elektriske kjøretøyer som har størst betydning for om forbrukere velger å kjøpe elektrisk kjøretøy. Regresjonsanalysen konkluderer med at den direkte effekten av oppfatning av økonomisk fordeler ($\beta = 0{,}309$) er mer signifikant enn den direkte effekten av subjektive normer ($\beta = 0{,}291$) og oppfatningen av elektriske kjøretøy ($\beta = 0{,}241$).

Funnene i studiene gir en bedre forståelse av norske forbrukers motivasjon for å kjøpe elektriske kjøretøy. Dette gir importører og produsenter av elbiler i Norge et bedre underlag i markedsføring og salg. En slik forståelse gir også regjerningen et godt underlag ved utarbeidelse av intensiver og policyer dersom de ønsker å øke andelen kjøretøy uten utslipp i Norge.

Abstract

Norway has acted as a laboratory for electric vehicles. It has taken a leading role in the introduction of electric vehicles and the development of a sustainable electric vehicle market. According to a recent report from the Norwegian Electric Vehicles Association (NEVA), electric vehicles in Norway have enjoyed increasing sales of almost one-third per year. Given this staggering rise, the purpose of this study is to identify the variables that impact Norwegian's intent in adopting electric vehicles. An online survey was conducted to determine the selection factors for the behavioral intentions of 281 individuals towards electric vehicles in Norway. Applying multiple regression analysis, the study finds that environmental concern, subjective norms, reception of economic benefits, and overall perception of electric vehicles have a statistically significant influence on people's behavioral intention to buy an electric vehicle. The regression analysis concludes that the direct effect of the reception of economic benefit ($\beta = 0.309$) is more significant than the direct effect of subjective norms ($\beta = 0.291$) and the perception of electric vehicles ($\beta = 0.241$). Our findings provide a better understanding of Norwegian consumers' motivations in buying electric vehicles and should guide the government, electric vehicle manufacturers, and investors in Norway to better marketing and incentivization decisions.

Keywords: Electric Vehicles, Environmental Concern, Intention, Norway, Subjective Norms, Theory of Planned Behavior.

List of Abbreviations

EV	Electric Vehicles
BI	Behavioral Intention
NEVA	Norwegian Electric Vehicles Association
GHG	Greenhouse Gases
PHEV	Plug-in Hybrid Electric Vehicle
HEV	Hybrid Electric Vehicle
BEV	Battery-powered Electric Vehicle
REEV	Range Extended Electric Vehicle
USA	United States of America
UK	United Kingdom
GP	Governmental Policy
PEV	Perception of Electric Vehicles
CFA	Confirmatory Factor Analysis
SEM	Structural Equation Modeling
EB	Economic Benefits
HFCV	Hydrogen Fuel Cell Vehicle
TPB	Theory of Planned Behavior
TAM	Technology Acceptance Model
TRA	Theory of Reasoned Action
UTAUT	Unified Theory of Acceptance and Use of Technology
PBC	Perceived Behavioral Control
SN	Subjective Norms
EC	Environmental Concern
KMO	Kaiser-Meyer-Olkin

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1. Introduction

After electric power production, transportation is the largest source of carbon emissions worldwide (Birol, 2006). Research has been conducted on how to reduce carbon emissions, examining various aspects of sustainable transportation development and low-carbon technologies over the past few decades. However, consumers continue to rely on the automobile transportation system to meet their needs. Many individuals use vehicles to get to work and run daily errands in same or different cities (Van et al., 2013). While use of vehicles has made their commuting more manageable, it has resulted in severe environmental problems, including the excessive release of greenhouse gases (GHG) into the atmosphere (Faria et al., 2013). Reliance on vehicles, particularly those with a fossil fuel combustion engine, has increased the rate of environmental pollution and climate change.

The efficiency technologies installed in conventional vehicles have not resulted in any significant reduction in the amount of GHG emissions. Various forms of alternative-fueled vehicles are manufactured around the world as a way of minimizing GHG emissions (Ghosh, 2014). Advocacy groups, policymakers, and governments have recommended full electric and hybrid motor vehicles as an alternative that can be used to minimize energy use and release of GHG (Van et al., 2013). The introduction of hybrid and electric means of transportation is considered a significant development that can decrease carbon emissions and improve fuel efficiency (Fulton, Taylor & Kerr, 2009).

In addition to environmental pollution and climate change, the use of fossil fuel-based vehicles is associated with depletion of natural resources, specifically rapid oil depletion. Gerssen-Gondelach and Faaji (2012) argued that fully electric vehicles are an alternative with zero-emission potential if electricity is produced from renewable power sources. Onat et al. (2014) concluded that the use of electric automobile reduces GHG emissions by 34% if charged through solar stations. Unfortunately, electric vehicles are still not commonplace across the globe despite having been available since the dawn of motoring. However, they are currently making a comeback due to contemporary environmental concerns. Choma and Ugaya (2017) argued that increasing population and high-level economic activity have resulted in severe GHG emissions despite the adoption of efficiency technologies in place.

Cars have long been the leading system of transportation (Lefebvre, 1971). Furnishing the possibility to travel almost anywhere at any time, the car is a symbol of social status and freedom (Burgess et al., 2013; Skippon & Garwood, 2011; Heffner et al., 2007; Hoogma et al., 2002). Several waves of interest in testing and developing electric vehicles occurred in the past (Skjolsvold & Ryghaug, 2019). Only recently, however, have they drawn wide-scale attention from policymakers, car manufacturers, and scholars, which further challenges the diesel and petrol cars market (Sorensen, 2015). Norway is one of the countries in the world where this has happened.

Chiu and Tzeng (1999) concluded that reliability, purchasing price, emissions level, agility, maximum speed, style, and safety are significant factors in people's decision to purchase full-electric motorcycles. Ziegler (2012) has found motor power, fuel costs, service station availability, purchase price, and carbon dioxide (CO_2) emissions to be significant contributors for the purchase of alternative energy vehicles. Graham-Rowe et al. (2012) found that effective management, environmental beliefs, cot minimization, and perception of electric vehicles are vital component of people's buying decisions.

In Norway, the focus has been on importing full-electric vehicles, and the country is the largest importer and seller of full-electric vehicles in Europe. According to Holtsmark (2014), beginning in 2021 Norway plans to allow for the sale of hydrogen and fully electric cars exclusively. As much as electric vehicles are believed to offer low or no tailpipe emissions, Choma and Ugaya (2017) indicated that tailpipe emissions are one aspect of environmental impact that may not overly promise the reduction of GHG emission into the environment. Other countries such as Japan are also considering increasing the manufacture and sale of hybrid vehicles alongside electric vehicles, citing that they are both effective in the reduction of GHG. Consequently, the global automotive industry has focused on alternative-fueled vehicles as a way of controlling environmental pollution, depletion of resources, and climate change.

1.1 Electro Mobility in Norway

Norway is acting as a laboratory for and has taken a lead role in the introduction and of electric cars. According to the Norwegian Electric Vehicles Association (NEVA), sales of battery-powered electric cars are growing in Norway. In the first quarter of 2019, they reached a market share of 48% of new cars sold–up from 31.2% in 2018 (NEVA, 2019).This represents almost a one-third increase in electric vehicle sales from year to year. Discussion and analysis of the Norwegian electric vehicles market are useful to investors, manufacturers, and developers working with the private car electrification fleet in other countries. On the other hand, some characteristics peculiar to Norway need to be taken into account when trying to learn from the country's experience with electric vehicles.

Norway has a unique position when it comes to energy production. Unlike the rest of the world, the country generates its electricity exclusively from renewable energy sources (Norway Statistic, 2019). Hoyland et al. (2018) has highlighted that Norway has relatively cheap electricity with a high level of supply security over the years, and a cost that is about one-fourth the cost of petrol. Furthermore, approximately 79% of residents in Norway live in semi-detached and detached houses, meaning that many people have at home access to charging of electric vehicles. In other words, people are less dependent on public infrastructure for charging their electric vehicles daily (Norway Statistics, 2019).

There has been a strong political campaign in Norway to reduce GHG emissions from the transportation sector. The Norwegian Parliament has decided that by 2025, 100% of all new car sales in Norway will be electric cars, provided that car producers can meet the demand. In 2009, Transnova (now merged with Enova) was established to provide a comprehensive package of local and national incentives to achieve this goal. In addition, residents who own electric vehicles are exempted from vehicle registration tax and value-added tax. Due to these tax advantages, the cost of electricity to the end-user is approximately the same as the cost of a new comparable diesel or petrol cars. Without these tax advantages, electric cars would be roughly twice as expensive as comparable diesel or petrol cars.

Moreover, electric vehicles are fully exempt from tunnel-use charges and road tolls, and have reduced fares in national road ferries. Additional strategies for generating electric vehicle sales include free public parking, access to bus lanes, and a dispersed network of charging stations. Another vital factor is that the operational costs of electric vehicles are generally lower than those of diesel or petrol cars due to more efficient engines and relatively inexpensive electricity in Norway (Fridstrom & Ostli, 2017).

In Norway, the transition to electric vehicles has happened in two-stages (Ryghaug & Skjolsvold, 2019). From 1990 to 2009, the first phase saw the introduction of a comprehensive package of incentives for buyers of electric vehicles. The primary goal of these incentives was not to stimulate a mass-market demand but to nurture what many had hoped would be the next Norwegian industrial venture. However, the market demand for electric vehicles in Norway during this period remained limited. During the second phase, from 2009 to the present, electric vehicles have become main stream in Norway. As shown in Appendix – B, this period has witnessed decreased focus on industry development. Ryghaug and Skjølsvold (2019) have argued that it has likewise witnessed a significant shift in how Norwegians think about cars; with their focus shifting from environment and climate to automobility.

For some time, Tesla has been the best-selling car brand in Norway. By the end of 2019, Volkswagen had taken the number one spot; however, the number of Tesla sales was less than 1% from Volkswagen's. Since dethroning the Nissan Leaf in 2018, Tesla's Model 3 remains one of the most popular single models in Norway, with a market share of approximately 11% and sales of about 15,683 units per year, totaling more than 50% of the second-place Volkswagen Golf. Norway is an electric car sales powerhouse and has led the European Union (EU) in electric vehicle sales since the Leaf first entered the market there in 2010. This year, Germany finally edged past Norway in electric car sales at the end of the 2019, but tiny Norway still buys the most electric vehicles per capita of any country in the world, and by quite a margin. Popularity of electric cars has been accompanied by a decreased interest in the petrol cars. Petrol car sales dropped by 31.4% in 2019 as petrol cars are generally small cars for which there are many electric alternatives (OFV, 2019).

1.2 Motivation for the Study

Automobile manufacturers in various parts of the world have focused on the manufacture of partially and fully hybrid vehicles to lower emissions. Interest in the production of fully electric vehicles has also been reported due to their low or no tailpipe emissions. Fossil fuel-based vehicles are losing popularity due to their adverse effects on the environment and their role in the depletion of natural resources (Choma & Ugaya, 2017).Recently, a survey report published by Nordic Energy Research (NER) and the Norwegian Electric Vehicle Association (NEVA) argued that by 2020 it is expected that 0.4 million electric vehicles will be roaming the roads of Norway, and by 2025 100% of all new car sales in Norway will be electric cars, provided that car producers can meet the demand. The survey found that Norway is experiencing rapid electric vehicle deployment compared to other Nordic countries. Moreover, approximately 27% of Norwegians intend to make a purchase of an electric automobile in the next 1 to 2 years, which would result in a 45% increase in new car sales by 2018-19 (NEVA, 2019).

Empirical studies were conducted to determine the most suitable technology (hybrid versus electric) for reducing GHG emission and to explore variables that contribute to consumers' behavioral intention about the purchase of hybrid and electric vehicles. However, they produced mixed results (Graham-Rowe et al., 2012). According to Collins and Chambers (2005), a wide range of factors including social norms, regulatory environment, subjective norms, and economic conditions influence an individual's decision in purchasing a vehicle. Laidley (2013) as well as Choo and Mokhtarian (2014) have highlighted that psychological factor such as personal attitudes, beliefs, and mindsets are equally important. Although some studies have determined the antecedents of consumers' acceptance of hybrid vehicles (Musti & Kockelman, 2011; Graham-Rowe et al., 2012), to our knowledge there is minimal research that emphasizes individuals' perceptions of electric vehicles, especially in Norway. Therefore, the purpose of this study is to identify the variables that impact consumers' intent towards full electric vehicles and, therefore, might affect policies designed to market the adoption of full electric vehicles and reduce carbon emissions. We investigate how are potential consumers' intentions regarding the adoption of electric vehicles in Norway influenced by their subjective norms, environmental concerns, perception of environmental policy, perception of electric vehicles, and perception of economic benefits of electric cars.

The rest of this thesis is organized as follows. Chapter 2 is a review of literature about electric vehicles in various contexts across the world, particularly in Norway. Chapter 3 defines the research methodology by outlining the study's design, the sample size, and a brief profile of the respondents. The sequence is as follows: research design, development of research instrument, sources of data and method of data collection, period of study, population, sample, and sampling techniques. Chapter 4 describes the results and provides an interpretation of the findings. Chapter 5 discusses conclusions and recommendations. After that, some managerial implications are mentioned, followed by the future direction given to the readers and new researchers into this particular discipline.

2. Literature Review

Behavioral intention refers to an individual's willingness, plan, and effort to achieve his/her objective (Bandura, 1997). The term signifies one's maximum likelihood of engaging in an action in the near future (Ajzen, 2002). Several researchers have studied behavioral intentions, using a various synonyms for it, including adoption intention (Zhu, Sangwan, & Lu, 2010), intention to use (Lallmahamood, 2007), and online purchase intention (Sin, Nor, & Al-Agaga, 2012). The most important keyword is "intention," which appears in all the studies, whereas "adoption,""use," and "purchase" are all behaviors or actions. Behavioral intention is a human extrinsic/intrinsic behavior that eventually leads to an action for which the intention was initially made (Zhu, Sangwan, & Lu, 2010).

Electric cars are vehicles that are either fully or partially powered by electric motors. They include battery-powered electric vehicles (BEVs), range-extended electric vehicles (REEVs), and plug-in hybrid vehicles (PHEVs) (Plotz et al., 2014). Despite the challenges associated with the social changes and technological developments required to achieve full electro-mobility, electric cars are advantageous in terms of energy security, energy efficiency, local air pollution, and user costs per kilometers (Pourabdollah et al., 2013). Many countries are considering a shift toward the production and sale of alternate-fueled vehicles. Various studies have analyzed the concept "alternative-fueled vehicles" and their possible impact on the environment, leading to a substantial increase in research on electric vehicles and their adoption over the last few years (Venkatesh & Davis, 2000; Garling & Thogersen, 2001; Stephan & Sullivan, 2008; Curtin, Shrago & Mikkelsen, 2009; Egbue & Long, 2012; Hjorthol, 2013; Caperello, Kurani & Tyree Hageman, 2013; Hawkins et al., 2013; Hong, Khan & Abdullah, 2013; Sierzchula et al., 2014; Lai et al., 2015; Choma & Ugaya, 2017, Yan, Qin, Zhang & Xiao, 2019; Raghavan & Tal, 2020).

An assertion that the behavioral intention leads to definite action has been verified by empirical evidence. For example, Hill, Smith, and Mann (1987) established that intention is a significant predictor of actual usage. Davis, Bagozzi, and Warshaw (1989) found that behavioral intention to use information systems significantly correlated with actual usage. In a related study on the online shopping channel, actual purchase behavior was positively related to people's intention (Li

&Huang, 2009). Yamin and Lee (2010) have maintained that the strength of one's actual behavior is dependent on their intention. Omar and Ala'a (2011) further investigated the determinants of adopting an e-payments system for a traffic violation in Kuwait. It was found that intention to use significantly affects the actual use of the system.

In studying the adoption of agricultural information technology among Chinese rural farmers, Wu (2012) found that intention explained up to 68 percent variance, which is near the 70% variance of behavioral intention found by Venkatesh et al. (2003). These results implies that whenever a person's intentions, their actual behavior or action will change, too; thus, it becomes important to investigate intention to use the system because the intention leads to actual usage. Several studies have investigated behavioral intention to use and found the factors that influence it, which originated from the field of social psychology. However, these studies considered a different set of technologies and systems. Fishbein and Ajzen (1975)'s TRA pioneered the technology adoption literature, which mainly emerged from social psychology. The main constructs proposed by the theory are attitudes and subjective norms as predictors of intentions that lead to behaviors. If that attitude was found to significantly affect intention in both mandatory and voluntary settings, subjective norms would only affect intention in mandatory settings (Venkatesh et al., 2003).

2.1 Environmental Concern and Purchase Intention

Environmental concerns refer to the attitude of a human being regarding a greener environment, including by improving the quality of the atmosphere and the water as well as the overall eco-system. The ideology and concept behind the development of PHEVs are to achieve a better environment in terms of pollution levels. It should not be surprising therefore, that this idea plays a vital role in convincing consumers to adopt the PHEVs. Pradeep (2012) has argued that environmental concern is one of the main factors in provoking environmentally friendly attitudes in society. Moreover, Jensen et al. (2013) concluded that environmental concerns contribute to consumer's decision to purchase of hybrid vehicles. Ozaki and Sevastyanova (2011) have contended that modern society exhibits interests in controlling environmental pollution by reducing poisonous emissions and preserving energy resources, which impacts their association with hybrid vehicles.

On the other hand, Graham-Rowe (2012) suggested that other factors such as technical features, including car performance, car price, and driving range, have more influence than those related to the environment. Afroz et al. (2015) have ascertained that it is not easy to diver consumer interest in purchase behavior; rather, consumers are more concerned about a greener environment. Environmental and economic factors have been far more effective in swaying society towards hybrid vehicles. Harish and Sovacool (2009) have examined the influence of socio-economic and socio-technical factors in consumer attitude about purchasing the PHEVs. The model that they developed has served as a prime and comprehensive method for studying all the variables and factors that can impact the adoption of PHEVs.

Stephan and Sullivan (2008) have explored the implications of hybrid and electric vehicles and found that charging PHEVs using electricity produced from coal has more serious negative environmental effects than gasoline. The study assumed a simple pattern of charging the PHEVs that may harm the infrastructure of the distribution system, presenting the need for more advanced control of the charging infrastructure if the desired benefits of PHEVs are to be attained. Chang and Hwang (2017) found a positive association between the compatibility of hydrogen-powered and bio-fuel cars and consumers' behavioral purchase intent towards hydrogen-powered and bio-fuel cars. They argued that because society is highly curious about climatic changes, air pollution, and environmental concerns these days, the electro mobility sector is keen to develop eco-friendly cars. Furthermore, an increase in awareness about the green environment and a pollution-free society will result in higher demands and hybrid vehicle sales.

Musti and Kockelman (2011) found that price, fuel economy, and reliability are the attributes that people look for when making a vehicle-buying decision. Lane and Potter (2007) suggested that some consumers do not see the environmental impact of electric vehicles as their main concern. However, Caparello and Kurani (2011) found that consumers who drive electric vehicles did not mention the consequences of electric vehicles on the environment. Although, the study still consider it a trial and it will take time to generate positive or negative reviews for the environment. Skippon and Garwood (2011) found that some consumers of electric vehicles were motivated to purchase electric vehicles by the need for a cleaner and pollution-free environment.

Hong, Khan, and Abdullah (2013) examined the key factors in the adoption of hybrid vehicles in the context of the Malaysian electric mobility industry. Their study based on data from 107 respondents found no statistically significant impact of subjective norm on adopting a hybrid vehicle. Conversely, it found perceived behavioral control, compatibility, relative advantage, and pro-environmental concern to have a direct positive association with the adoption of hybrid cars in Malaysia. Moreover, consumers with high income and education tend to adopt hybrid vehicles more frequently than those with lower income and education. In contrast, older adults are less inclined to adopt hybrid vehicles in Malaysia. Perceived behavioral control and individuals' attitude are important factors in the adoption of hybrid vehicles. Business owners can use these results to segment their market. Faria et al. (2013) have also indicated that electric automobiles are efficient in minimizing GHG emissions if electricity production is not based on fossil fuels. Based on the above discussion, it is hypothesized that:

H_1: An individual's environmental concern (EC) has a direct influence on their behavioral purchase intent of electric vehicles.

2.2 Perception of Environmental Policy and Purchase Intention

Byrne and Polonsky (2001) argued that the government is among the biggest stakeholders that positioned to influence the availability of commercial alternative fuel vehicles. Oliver and Lee (2010) found that the influence of green environment information and social values self-image factors encouraged people to purchase hybrid vehicles in the USA and South Korea. On the other hand, Lane, Potter, and Warren (2006) concluded that environmental issues do not have a high impact on either private or fleet customers.

In their study on the influence of hybrid and electric automobiles on the environment, Hawkins, Gausen, and Strømman (2012) focused on comparing the global warming potential of hybrid versus electric vehicles. Their findings indicate that previous studies failed to examine the full life cycle environmental impacts of electric vehicles, sentiments likewise reported by Hawkins et al. (2013). As much as electric vehicles seem to have minimal greenhouse gas emission potential compared to conventional vehicles, high-efficiency internal combustion and grid-dependent vehicles perform comparatively better.

On the other hand, in researching the impact of electric battery production and electricity generators, Graham-Rowe et al. (2012) suggested that consumers might show fear towards the use of electric batteries and generators based on the harm they might cause to the environment and that instead of being eco-friendly, this technology might leave some toxic residue in the environment. Axsen and Kurani (2013) argued that it is possible to increase the proportion of consumers adopting electric vehicles in the USA by promoting green electricity and electric vehicles together. However, little is known about consumers' perceptions regarding electric vehicles in other countries where electricity is produced with a combination of renewable and non-renewable sources.

The government has introduced several attractive policies and incentives to encourage consumers to adopt electric vehicles (Tornatzky et al., 1990). Soltani-Sobh et al. (2015) examined the association between the incentives/policies offered by the government and the electric vehicles' market share. The study also explored the impact of socio-economic factors on the market share of electric vehicles. By utilizing the cross-sectional methodology for the period 2003 – 2011, the study found that urban area road infrastructure and the benefits provided by the government positively impacted the market share of the electric vehicle within a state level, whereas electricity prices negatively impacted the use of electric vehicles. Sensitivity analysis proved that electricity prices are a significant factor in the use of electric vehicles. Moreover, a time trend model analysis showed that the adoption rate of electric vehicles is increasing in the country in accordance with the theory of the diffusion of new technology.

Bjerkan, Nørbech and Nordtømme (2016) conducted a study on the role of government incentives in the promotion of BEVs. The study also investigated the main incentives in buying decisions regarding the BEV in Norway. Drawing data from approximately 3400 BEV owners in Norway through a survey instrument, the study found that more than 80% of the respondents believe that VAT and purchase tax exceptions are crucial incentives for promoting the sale of BEVs in Norway.

This finding is consistent with previous studies that emphasize that up-front price reduction is one of the most rigorous governmental incentives for endorsing the adoption of electric vehicles.

Public charging stations are highly important because most of EV owners need them (Liu, Wen & Ledwich, 2012). Without a charging station, it is not possible to charge the battery and to use EVs. Moreover, it is useless to own a car that does not allow one to travel the distances they require. Charging stations provide charging points like other fuel stations and allow EV owners to recharge their vehicles on the go, also benefiting those who cannot afford to install a charging station at home (Frade et al., 2011). Public charging stations carry certain hurdles such as regulatory uncertainty, unavailability of standardization, and most importantly high cost. It is the obligation of the government to address this issue and invest in developing an infrastructure to promote the use of EVs (Jia et al., 2012).

The government should provide financial assistance to facilitate the installation of charging stations. The more that charging stations are available throughout the country the more EVs will penetrate the market (McCool & Monks, 2017). The reduction of environmental pollution, toward an eco-friendly and green environment is a major global concern. Societies are developing clean and green environmental attitudes that influencing people's decision to opt for alternative fuel vehicles (Chen et al., 2016). As confirmed by other studies, the human attitude towards a clean environment directs people to buy environmentally friendly products (say Martin &Simintiras, 1995; Roberts &Bacon, 1997). Khazaei and Khazaei (2016) argued that any new technological development initially captures a low market share. It is necessary to study factors that influence potential customers of that new technology. Conversely, there is a need to emphasize saving the earth and its resources such as natural gas and oil, which are in danger of being depleted. Several companies are starting, and some have well underway, to produce electric and hybrid cars. In countries that are self-sufficient in renewable energy and the production of electricity, electric cars contribute directly to a healthier environment.

Yong and Park (2017) highlighted that several countries are moving towards eco-friendly products and electric vehicles to implement environmental regulations on greenhouse emissions and avoid scarcity of fossil fuels. They concluded that no single policy can affect the purchase of the electric vehicle. Instead, there must be a suite of combined policies to attract the buyer to switch to electric vehicles. Purchase incentives mean subsidies and other forms of compensation provided by the government and manufacturers in terms of their product and its accessories. These subsidies and incentives are very important in convincing consumers to adopt PHEVs.

Canis (2013) studied how the Obama Administration in the USA provided tax subsidies ranging from $75000 to $10000 to citizens to motivate them to purchase PHEVs. Skerlos and Winebrake (2010) highlighted that all US states should have different policies and different incentives according to their jurisdiction, which fosters competition among states and will result in the further promotion of electric vehicles. Studying incentives and customer attitudes in the UK, Ozaki and Sevastyanova (2011) found that there are different privileges provided to electric car drivers in London. For example, in London, there are charges for parking and driving in certain areas of the city, based on level of congestion in the area. Under this policy, the driver of an electric car is given special permission to enter these areas free of charge.

Diamond (2009) suggested that certain government incentive policies are insufficient for promoting the adoption of HEV. His focus was on various states of Canada, including Ontario, British Colombia, and Quebec, which he suggests have come up with incentive policies that give the consumer a share in investments in basic infrastructure and other privileges. The HEV customer can get up to $85000 as a rebate on a purchase or lease of an HEV. These states also are investing to create a network of charging stations that can serve all areas including highway and residential spaces. In Ontario, HEV drivers also received a special permit to drive on high occupancy lanes. In 2009 and 2012, other states like Manitoba provided incentives of up to $2000 for purchasing or leasing an HEV. Based on the above discussion, we hypothesize that

H_2: An individual's environmental policy perception (GP) has a direct influence on the behavioral purchase intent of electric vehicles.

2.3 Perception of Electric Vehicles and Purchase Intention

Cheron and Zins (1997) found that expectations, perceived risks, reliability, and fair price of parts are the major determinants influence an individual's behavioral intention to buy electric vehicles. In a similar study, Chiu and Tzeng (1999) concluded that reliability, purchasing price, emissions level, agility, maximum speed, style, and safety are significant factors in the decision to purchase full-electric motorcycles. The market share of hybrid vehicles is still less than that of non-hybrid vehicles (Soon, Luen & Siang, 2012).If this trend continues, the slow growth in the sales of hybrid vehicles will cause manufacturers to stop the production of hybrid vehicles. To reverse this trend, it is important to understand the factors that impact hybrid vehicle adoption. Ziegler (2012) found that motor power, fuel costs, service station availability, purchase price and CO_2 emission are significant contributors to individuals' decision to purchase alternative energy vehicles.

To identify the technology that yields the greatest environmental benefits, Gao and Winfield (2012) compared the economic and environmental consequences of PHEVs and electric vehicles. According to their study, the amount of fossil fuel–produced electricity used in charging electric vehicles, the commute distance, and the time it takes to recharge the batteries significantly influence the environmental efficiency of electric vehicles. In studying the main determinants of adoption for hybrid and electric vehicles, Graham-Rowe et al. (2012) found that environmental beliefs, cost minimization, and perception of electric beliefs considered were vital components of people's buying decisions.

Sierzchula et al. (2014) concluded that consumer characteristics, technological factors, and contextual factors such as electricity costs, the availability of charging stations, and fuel prices greatly impact the adoption of electric vehicles. Krupa et al. (2014) found that the main attributes of technology usually revolve around emissions, reliability/practicality, battery specifications and design. Lai et al. (2015) explored factors that affect people's attitudes about the acceptance of electric automobiles. The data sample was comprised of 308 respondents from Macau. Employing SEM and confirmatory factor analysis (CFA) statistical techniques, the study analyzed people's behavioral intentions towards the acceptance of electric automobiles. The results demonstrate that perceptions of environmental policy and environmental concerns are major antecedent factors in people's behavioral intentions toward full-electric vehicles. The study also shows how the idea of being economical is a key factor in the adoption of full-electric vehicles.

Based on the positive impact of electric and hybrid cars on the environment, Rezvani et al. (2015) ascertain that the number of electric vehicles and hybrid vehicles in use remains lower than one might expect. One reason behind the current figures relates to consumers' perception regarding electric vehicles. Examining and reviewing 16 earlier studies on the adoption of BEVs and PHEVs between 2011 and 2014, the researchers found that the majority of these studies were concerned with social/individual and technological factors that affect the probability of electric vehicle adoption. The study also provided theoretical perspectives for exploring and understanding consumers' opinions and acceptance of electric vehicles. Therefore, out next hypothesis:

H_3: An individual's perception of electric vehicles (PEV) has a direct influence on their purchase intention toward electric vehicles.

2.4 Reception of Economic Benefits and Purchase Intention

The experience of PHEV varies from customer to customer based on the features and make/model of a PHEV. Jens et al. (2013) suggested that attitudes toward PHEV depend on the consumer's experience with driving such a vehicle. Similarly, Axsen and Kurani (2009) showed that consumers who have experience driving a PHEV have a better sustainability-oriented attitude, which, in turn, makes them more likely to purchase an EV. Skippon and Garwood (2011) showed that consumers who have experience using battery-operated electric cars are more willing to go for a PHEV even at a slightly higher price, assuming the cost of operation of a PHEV would be lower than that of a battery-operated electric car.

Ozaki and Sevastyanova (2011) studied the five major dimensions of a consumer's decision to purchase a hybrid vehicle as well as the policies that encourage them to do so. They found that the relative advantage of hybrid vehicles in terms of finances is positively linked to the purchase motivations of consumer toward hybrid vehicles. Langbroek et al. (2016) as well as Hoen and Koetse (2014) studied how providing free parking for charging electric cars massively motivated consumers to purchase electric vehicles. Free parking policies are an effective initiative, but they are insufficient to sway consumers to adopt electric vehicles; other incentives must be added to elevate demand for electric vehicles. For example, the USA government has provided tax credits to consumers to encourage the adoption of PHEVs (Skerlos & Winebrake, 2010).

Conducting a survey Tan et al. (2014) found that four factors impact an individual's EV purchasing attitude. These include cost, size and capacity of the battery, and charging method, among others. In their study focused on China, Lui and Santos (2015) found that the main barriers to purchasing electric vehicles were the cost of the vehicle and the cost of its operation and maintenance, including charging the battery and battery replacement services cost, and the maximum speed the vehicle can obtain. Bockkarjova and Steg (2014) similarly showed that the main barrier to purchasing an EV is vehicle and maintenance costs comparative to those associated with conventional vehicles.

Using multi-layer longitudinal data from 153 PHEVs in California, USA, Raghavan and Tal (2020) explored how charging, consumption of energy, driving, and utility factors differ from sticker label expectations. Factor analysis and regression estimate results showed that the utility factor of short-range PHEVs was lower than the label expectations because of higher annual VMT and high-speed driving. The main reasons for the low utility factor of longer-range PHEVs compared to label values are high-speed driving and long-distance traveling. The utility factor of PHEVs, both short-range and long-range, can be improved through enhanced battery-charging infrastructure access at home and at stations. By increasing home charging volume, the utility factor for both ranges of vehicles will be improved.

H_4: An individual's reception of economic benefits (EB) has a positive influence on their purchase intention regarding electric vehicles.

2.5 Subjective Norms and Purchase Intention

Subjective norms are the ways that person's friends, family, and work colleagues react them (Amjad & Wood, 2009) and in which a person is influenced by the society around them to perform a certain task or not (Ajzen, 1991; Pradeep, 2012). Subjective norms represent a positive or negative reaction of society towards a person's attitude or behavior. Different studies offer diverging interpretations of subjective norms. Tayor and Todd (1995) categorized them into peer influence and superior influence. Burnkrant and Page (1984) as well as Grube, Morgan and McGree (1986) classified subjective norms into a primary and secondary group: 1) interpersonal influence is the influence o people with whom a person interacts and spends time with, including friends, colleagues and family; 2) external influence is the impact of remarks from experts and other non-interpersonal sources.

According to Fishbein and Aizen (1975), a person's individual perception about a task they should or should not do under the influence of people whom they deem very important to them and who care the most for them is said to be a subjective norm or social influence. Tan and Teo's (2000) study on Internet banking found that subjective norms are not a critical factor in the adoption of Internet banking among bank clients. On the other hand, Jeon, Yoo and Choi (2012) showed that subjective norm has an impact on the buying attitude of consumers towards electric vehicles; however, in the specific case of China they found that the connectedness among the subjective norms and behavioral intent to buy the EVs is only strong in China.

Jansson, Marell, and Nordlund (2010) found that, out of several other factors, consumer attitude is one of the most important and effective determinants for assessing the behavior of consumers intention to adopt eco-innovations. Kotler and Armstrong (2012) highlighted that the five most important attitudinal characteristics for determining consumers' willingness to adopt electric vehicles are trialability, perceived behavioral control, complexity, compatibility, and relative advantage. They also cited other factors such as social approval, uncertainty and risk. Tornatzky and Klein (1982) found that relative advantage is one of the main variables that affect the adoption of innovative technology. Wu et al. (2010) determined that relative advantage is the predominant factor, directly linked to people's decision whether to buy bio-fuels and electric cars in Taiwan.

Caperello et al. (2013) as well as Carley, Krause, Lane, and Graham (2013) argued that consumer characteristics (lifestyle orientations, social norms, attitude, environmental beliefs, socio-economic characteristics) tend to have low importance compared to the technological aspects of the vehicles. According to Ghosh (2014), a cost comparison of the two vehicles also indicated that electric vehicles performed better than the PHEVs. The study's findings showed that battery electric vehicles had lower lifetime costs than conventional cars and PHEVs.

Jiao (2016) conducted a study to determine customers' attitude toward purchasing PHEVs and HEVs in Manitoba, Canada. He conducted a survey electronically to determine the participant's psychological status which causes a distance from the purchase of PHEVs and HEVs. The results identified the extent to which the society's psychological distance impacts people's purchasing decision, information that can assist the government in making attractive and efficient policies to enhance the adoption of PHEVs and HEVs in society. Choma and Ugaya (2017) indicated that electric vehicles are highly economical because they achieve significant cost savings in their fuel use and maintenance. The researchers indicated, however, that the environmental and economic impact of the electric vehicles is influenced by the local electricity grid.

China is promoting electric cars as eco-friendly and low carbon emission vehicles. However, the percentage of these cars on the roads in China is still very low and as many Chinese citizens are reluctant to purchase such cars until they prove to be reliable and economical. To enhance the development and acceptance of electric vehicles in China, Yan, Qin, Zhang, and Xiao (2019) conducted a survey study about the customers/users in particular areas of Beijing. The results showed that consumers' actual intention is controlled by factors such as subjective norms, perceived behavior, and good/bad attitude. These suggestions might aid in the further diffusion of electric vehicles in society.

Many researchers have examined the influence of subjective norms on behavioral intention. However, few have come to definitive conclusions. For instance, the work of Wang and Yang (2005) found that among the Taiwanese subjective norms greatly impact an individual's intention to use online broker; however, Carlsson et al. (2006) found that it does not influence Finnish mobile e-learning users' behavioral intention. Furthermore, Marchewka and Kostiwa (2007), Cheng and Lam (2008), Wills et al. (2008) and Zhou, Horrey and Yo (2009) have found that subjective norms in different context and countries significantly affect people's behavioral intention to use various sets of technologies and systems. However, their findings were refuted by Al-Gahtani, Hubona and Wang (2007) and Curtis and Payne (2008). It can be observed that the contradictions occurred between 2006 and 2008, indicating that researchers were reaching contradictory conclusions within the same time frame, and the differences between their conclusions cannot be associated with technological advancement or time.

Perceived behavioral control is the factor that controls the negative or positive direction of behavior. It can be divided into two parts: the first, self-efficacy, or one's internal confidence to behave in a certain manner, and the second, conditions to facilitate a certain situation, or for the purposes of this study the availability of resources that are required to maintain a certain behavior (Tan & Teo, 2000). Gallaghar and Muehlegger (2008) also found that incentives and subsidies provided by the government have a great impact on the adoption of electric vehicles. Diamond (2009) found that the relationship between subsidies provided by the government and the adoption of EVs is weak. In the UK, the government provided aid and subsidies to the population to encourage people to opt for eco-friendly vehicles, but it was not strong enough to motivate them to change their behavior (Lane et al., 2006).

In research published in 2001, the Electric Power Research Institute (EPRI) showed that the prices of gasoline and other fuels greatly impact levels of interest in purchasing hybrid electric vehicles, whereas factors such as low maintenance cost, improved handling, and ecology do the same in the case of hybrid electric vehicles. A case study on hybrid vehicle consumers in the USA showed that this group was highly concerned about the green environment and preservation of energy resources. Musti and Kockelman (2011) studied the psychology of the buyer and showed that a person looks for three main factors when planning to purchase an electric vehicle: price, fuel economy, and reliability. Zhang, Tolbert, and Ozpineci (2010) performed an analysis of the development of EVs and found that several factors including the deficient policy of subsidy, local protectionism, and immaculate charging infrastructure. In their study on the Netherlands, Steg and Vlek (2009) conducted a survey and found that socio-demographic and socio-economic factors were important in motivating people to purchase and use EVs. Delang and Cheng (2012) showed that in Hong Kong, people considered the environmental benefits of EVs while losing behind economic and social benefits. Thus, the following hypothesis is formulated:

H_5: An individual's subjective norm (SN) has a positive influence on their purchase intention towards electric vehicles.

2.6 Research Gap

Several studies on the adoption of electric cars in society assumed that electric vehicles are eco-innovations that play a key role in reducing environmental problems, specifically in the transportation sector (Lane et al., 2006; Egbue & Long, 2012). Hence, people's behavior towards the adoption of electric vehicles is considered a pro-environmental behavior. The existing literature generally ties the factors associated with pro-environment behavior to the adoption of electric vehicles. Moreover, the literature related to the adoption of electric vehicles had primarily focused on the individual role in pro-environmental beliefs, attitudes, values, and norms and, particularly, their relationship with an intention to buy electric vehicles (Schuitema et al., 2013). Krupa et al. (2014) concluded that belief in and knowledge about environmental issues is among the motivating factors for potential buyers of electric vehicles. They further concluded that other types of pro-environmental behaviors, such as level of pro-environmental values, beliefs, norms, and attitudes, can predict the intention of a consumer or behavior to adopt electric vehicles.

Many researchers, including Lane et al. (2006), studied an attitude gap in this regard. They suggest that showing a positive attitude towards the adoption of electric vehicles does not necessarily guarantee that the consumer will buy an electric vehicle. It is possible that consumers' environmental self-efficacy concerning the adoption of electric vehicles can be increased by sharing the thoughts and views of current electric vehicle users. In short, existing work has made some interventions to cover the research gap in attitude-behavior for pro-environmental behaviors. However, most of the studies discussed above dealt with the pros and positive factors of electric vehicles whereas few studies highlighted the cons or negative factors. The Electric Power Research Institute (EPRI) studied various factors that arise as a barrier to the purchase of electric vehicles:

lack of electric vehicle infrastructure, rise in the cost of electricity, and lack of options in electric vehicle models (Neenan et al., 2010).

Klockner et al. (2013) showed thatin Norway psychological factors have a highly significant association with the use and purchase of electric vehicles. In another study, Nayum, Klockner, and Prugsamatz (2013) performed a test study to determine the impact of psychological and socio-psychological factors on the intentional and normative trend of electric vehicle purchases. Another type of vehicle in the market is hydrogen fuel cell vehicle (HFCV). Both HFCVs and EVs use electric motors to generate power. The only difference between them is that EVs use electric batteries that store electricity whereas HFCVs use hydrogen fuel cells. Tarigan and Bayer (2012) argued that factors such as knowledge and environmental concerns are primary in the acceptance of HFCVs.

Many studies have been conducted to determine the most suitable technology (hybrid versus electric) for reducing GHG emissions and to explore the variables contributing to consumers' behavioral intention toward the purchase of hybrid and electric vehicles, though with mixed results (Graham-Rowe et al., 2012). According to Collins and Chambers (2005), there are many factors, including social norms, regulatory environment, subjective norms, and economic aspects, that influence an individual's behavior regarding the purchase of vehicles. Laidley (2013) as well as Choo and Mokhtarian (2014) highlighted psychological factors such as personal attitude, beliefs, and mindsets as equally important. Although some studies have determined the antecedents of the consumer acceptance of hybrid vehicles (Musti & Kockelman, 2011; Graham-Rowe et al., 2012), there is very limited research focused on the individual's perception regarding electric vehicles, especially in Norway. Thus, we fill in this gap and investigate the potential consumer's intentions regarding the adoption of electric vehicles in Norway.

Table 1 provides a summary of the results of the studies made thus far on the factors impacting purchase attitudes toward EVs, BEVs, PHEVs, and HEVs.

Authors (year)	Factors	Method	Vehicles Type	Main Theory
Diamond (1995)	Green planning capacity, fuel cost occurred annually, income level, incentives by the government, and vehicle type	Quantitative method	HEV	Rationale Choice Theory
Lipman and Delucchi (2015)	Vehicle retail price, vehicle cost of manufacturing, maintenance costs, and lifecycle costs	Questionnaire-based study	HEV	Theory of Planned Behavior
Axsen and Kurani (2013)	Openness to change, technology-oriented lifestyle and pro-environmental lifestyle	Quantitative method	EV	Lifestyle Practices Theory
Sallee (2007)	Tax credits	Interviews	HEV	-
Chandra et al. (2013)	Tax rebates	Focus groups and Interviews	HEV	-
West (2009)	Gasoline prices	Quantitative study	Sport utility vehicles	-
Burgess et al. (2013)	Speed, performance, style, environmental attributes, purchase cost, running cost, look, and experience	Qualitative (interview-based study)	BEV	Model of Sign
Carley et al. (2013)	Purchase cost, range, recharging time, environmental beliefs, and demographic factors	Quantitative, online survey	PHEV, BEV	Rationale Choice Theory

Egbue and Long (2012)	Performance, cost of purchase, charging infrastructure, environmental awareness, interest in EVs, experience with EVs	Quantitative survey	PHEV, BEV	Theory of Planned Behavior
Jensen et al. (2013)	Carbon emissions, purchase cost, speed, range, fuel cost, and hands-on experience	Quantitative, online survey	BEV	Rationale Choice Theory
Berensteanu and Li (2011)	Government support, price of gasoline		HEV	-
Gallagher and Muehlegger (2011)	Incentives by government, tax rebates, price of gasoline, environmentalism preferences		HEV	Theory of Planned Behavior
Krupa et al. (2014)	Tax incentives, purchase cost, political beliefs, environmental concerns, climate change, fuel cost saving	Quantitative study	PHEV	Rationale Choice Theory
Lane and Potter (2007)	Ease of usage, performance, energy efficiency, reliability, purchase cost, government policies, environmental regulations, economic benefits, environmental concern, person moral and social norms, and pro-environmental identity and lifestyle	Qualitative and Quantitative research study	BEV	Theory of Planned Behavior and Innovative Diffusion Model
Nayum et al. (2013)	Social norms, other norm related factors, attitude, intention, type of car, brand loyalty, carbon emissions, environmental concerns, demographic variables, and perceived behavioral control		Environmentally friendly cars	

Lieven et al. (2011)	Performance, range, purchase price	Quantitative, online survey	EV	Rationale Choice Theory
Moons and De Pelsmacker (2012)	Performance, range, subjective social norms, purchase cost, concern for the environment, Individual education, age and perceived behavioral control	Quantitative, online survey	EV	Theory of Planned Behavior
Skippon and Garwood (2011)	Performance, purchase cost, environmental concern, availability of charging stations, the symbolic meaning of EV, and range	Qualitative and Quantitative research method	BEV	Signaling Theory
Zhang et al. (2011)	Performance, safety, fuel price, tax policies, maintenance cost, opinion of peers	Quantitative, survey	EV	Rationale Choice Theory
Kang and Park (2011)	HFCV experience, HFCV perception, policy experience, policy perception, and psychological needs		HFCV	
Tarigan and Bayer (2012)	Knowledge about hydrogen and pro-environmental attitudes		Hydrogen based vehicles	
Klockner et al. (2013)	Need awareness, social norms, personal and descriptive norms, attitude, behavioral intention, and ascription of responsibility		Normal and electric vehicles	
Schuitema et al. (2013)	Pro-environmental identity, symbolic, instrumental hedonic, symbolic, and car-authority identity		EV, HEV	
Bockarjova and Steg (2014)	Severity, vulnerability, rewards, self-efficacy, purchase costs		EV	

Klockner (2013)	Awareness of a need, responsibility, perceived behavioral control, knowledge, attitudes, planning ability, personal norms, intentions	EV
Peter and Dutschke (2014)	Compatibility, ease of usage, relative advantage, trialability, social norm, observability	EV

Table 1 Earlier Studies

2.7 Theoretical Framework

We aim to investigate the potential consumer's intentions regarding the adoption of electric vehicles in Norway, utilizing the theory of planned behavior proposed by Ajzen (1985). Within this theory, an adoption of an innovation or new technology by the consumer can be viewed as a behavioral response based on use of the innovation or purchase experience (Jansson et al., 2010; Schuitema et al., 2013).This behavioral response has been categorized into various antecedents or predictors that motivate an individual to make a buying decision. The main predictors are consumer readiness and willingness to adopt the innovations, which are considered proxy variables for the adoption behavior (Schuitema et al., 2013; Arts et al., 2011).Scholars have proposed various theories to analyze the factors that influence individual behavior towards the acceptance of various technologies (Vankatesh et al., 2003). These theories include the theory of planned behavior (TPB), the technology acceptance model (TAM), the theory of reasoned action (TRA), and the unified theory of acceptance and use of technology (UTAUT).

2.7.1 Theory of Planned Behavior

First proposed by Ajzen (1985), the Theory of Planned Behavior (TPB) is based on the earlier Theory of Reasoned Action (TRA).TPB, however, adds a new dimension, perceived behavioral control (PBC), to deal with the TRA's limitations.TPB assumes that individuals make decisions based on rational evaluations of stimuli and the possible consequences of their decisions (Ajzen, 1991). The main components of the TRA are Behavioral intention (BI) as well as attitude toward behavior and actual behavior (Fishbein, 1967). Later, a new dimension, subjective norms (SN), was added through continuous development and verification leading to a complete TRA model (Fishbein & Ajzen, 1975). Both the TRA and the TPB argued that individual behavior is determined by behavioral intention, which is affected simultaneously by the subjective norms and attitude of individuals regarding a specific behavior. Fishbein and Ajzen (1977) stated that the willingness of an individual to engage in a particular behavior is the behavioral intention, whereas the expected social pressure that an individual receives while performing a behavior is the subjective norm. If the subjective norm is influenced more strongly, it has a greater influence on behavioral intention. Furthermore, the PBC determines the individual's expected process control when participating in a behavior. Ajzen (1985) contends that this reflects an individual's resources and opportunities to engage in the behavior. Thus, the TPB advocates the notion that perceived behavioral control also affects behavioral intention as well as subjective norm and the attitude toward a particular behavior. Behavior is directly predicted by intentions (Bamberg & Möser, 2007).

2.7.2 Rational Choice Theory

Similarly, to TPB, Rational choice theory (RCT) asserts that utility maximization and benefits are the basis of human behavior. The consumers' adoption of electric vehicles was considered by many researchers as rational behavior. Thus, individual attitudes towards electric vehicles were measured to predict people's intentions to buy the electric vehicle (Zhang et al., 2011; Lieven et al., 2011; Egbue & Long, 2012; Carley et al., 2013; Krupa et al., 2014).These studies discussed dimensions such as alternative fuel vehicles, attitudes towards electric vehicles, driving, electric vehicle technical attributes (speed, range, etc.), operations costs of electric vehicles, up-front costs, electric vehicle policies, environmental issues, and cars in general. Electric vehicles are generally considered eco-friendly innovations and thus EV adoption behavior is considered a pro-environmental behavior.

2.7.3 Diffusion of Innovation Theory

First proposed by Rogers in 1962, the Diffusion of Innovation Theory (DOI) explains how ideas, products, and innovations spread (or diffuse) through a particular social group (Rogers, 1983; Agarwal & Prasad, 1988). Rogers (1983) believed that the diffusion of innovation is influenced by four items: communication channels, innovation, time, and social systems. Thus, members within a social system, who share a particular innovation message through time, use a certain process of communication. This process is called an innovative decision-making process. Rogers (1983) further posits that this process can be divided into four stages: persuasion, perception, decision-making, and implementation and confirmation. The theory also asserts that this innovative process is influenced by the organization's or the individual's perception of the innovation characteristics and their acceptance of innovation. Schwarzer (1999) delineates the following five points describing people's perception of the innovation characteristics: relative advantage (innovation advantage compared to existing products and technology), complexity (difficulty of using and understanding the innovation), compatibility (new technology or product match to the existing technology or product experience), trialability (the opportunity for consumers to test the effects of innovation through a trial that measures their acceptance or willingness to purchase the product or technology), and observability (possibility of observing the innovation after usage). Kotler and Keller (2002) argued that new products, services, ideas, and experiences are innovations for consumers and users.

2.7.4 Normative Theories and Environmental Attitudes

According to Bamberg and Moser (2007), normative theories, such as value-belief-norm theory (VBN), are used to explain the pro-environmental behavior in the second part of the motivational mix, concern for others and the ecosystem. Stern (2000) argued that such theories are derived from different assumptions compared to the RCT and the TPB, and thus they view internal normative beliefs and values as pro-environmental behavior motives. Consumer adoption behavior studies on the electric vehicle generally theorized that consumers' environmental beliefs, values, and norms affected their adoption behavior and purchase intentions. Stern's VBN theory explains these constructs and their relationship toadoption.VBN theory has been widely utilized to understand motivations for different types of purchase and non-purchase behaviors (such as car curtailment) and consumer pro-environmental behaviors (Jansson, 2011).Schwartz (1977) highlighted that personal moral norms, feelings of moral obligation, lead people to engage in pro-environmental behavior. These personal norms are activated by beliefs related to the biosphere and effects of human activities such as driving a car (Dunlap et al., 2000).

2.7.5 Technology Acceptance Model

The Technology Acceptance Model (TAM) was proposed by Davies (1986) to explain the acceptance of information technology by a user or consumer in an organizational context. The TAM is usually divided into two main components: perceived ease of use and usefulness. For instance, to join a block chain network, users may face governmental or social pressure to use the technology, but the TAM assumed that the person is free to choose the technology based on their own experience. This assumption could be assessed by asking people about their future intentions to use the technology knowing the factors that formed one's intentions would permit organizations to govern those factors in a way that reinforces acceptance.

Venkatesh (2000) introduced a new version of TAM called TAM2. The latter distinguishes between the optional and mandatory in the use of technology, with mandatory technology is less effective under social influence. Dian et al. (2001) distinguish between the accepted characteristics of the technology and the characteristics of those who adopt technology. He described acceptable technology as the following: a) compatibility –resistance to a system against the rules in general and social activities; b) complexity– ease of learning and use; c) optional –opportunity to test and evaluate the invention before being forced to operate it. The TAM is frequently employed in data technology studies, and it is renowned for being robust and helpful for identifying users' explanation for accepting, or not accepting technology.

Subsequently, Venkatesh et al. (2003) identified five shortcomings of the extant models. They conducted a longitudinal study to compare the eight models empirically. The findings of their study revealed seven variables out of the 32 variables from the eight theories as factors influencing behavioral intention and use behavior. These are performance expectancy, effort expectancy, social influences, facilitating conditions, attitude, computer self-efficacy, and anxiety. Although initially performance expectancy, effort expectancy, social influences, and facilitating conditions were proposed as direct determinants of intention and attitude, computer self-efficacy, and anxiety as determinants of user behavior, the results of the study rejected facilitating condition as a determinant of intention, seeing it instead as a direct determinant of user behavior. Attitude, computer self-efficacy, and anxiety were found to be insignificant determinants of intention; hence, they were dropped in the final model (Venkatesh et al., 2003).

2.7.6 Summary

The TRA posits that the beliefs, subjective norms, and behavior of individuals influence their adoption of technology (in our case, electric vehicles). The TPB and TAM models were developed to build on the TRA model. The theories focus on analyzing the factors that influence individual behavior and acceptance of the technology. To explain the behavior of individuals and their acceptance of technology, Venkatesh et al. (2003) proposed the UTAUT model. Applying this model, this study examines the selection factors for the intention to purchase full electric vehicles in Norway. The study also explores the role of the TPB, including a wide array of subjective norms and social norms, which was developed and tested by Thorbjornsen, Pedersen and Nysveen (2007).

Subjective norms are the third construct of the TPB that is the belief that other human beings may approve or disapprove of the behavior. This reflects an individual belief about its subordinates' peers and people that how they would react to the behavior. A review of the environmental factors indicates that global environmental issues are highly significant and must be taken into consideration when making a purchase decision. According to Faria et al. (2013), the argument of the public on global warming and emission of carbon has a vital impact on the purchasing decisions of car consumers. Conner and Armitage (1998) argued that the TPB was used effectively to explore the wide range of health behaviors and intentions in a specific time and place. According to Choma and Ugaya (2017), people are likely to adopt a technology that is considered green and has negligible negative effects on the environment. In the context of the electric vehicle, a lifecycle assessment of the vehicle from production to end of life has been adopted in the assessment of its environmental impact.

Figure 1.1 provides the theoretical framework proposed for this study.

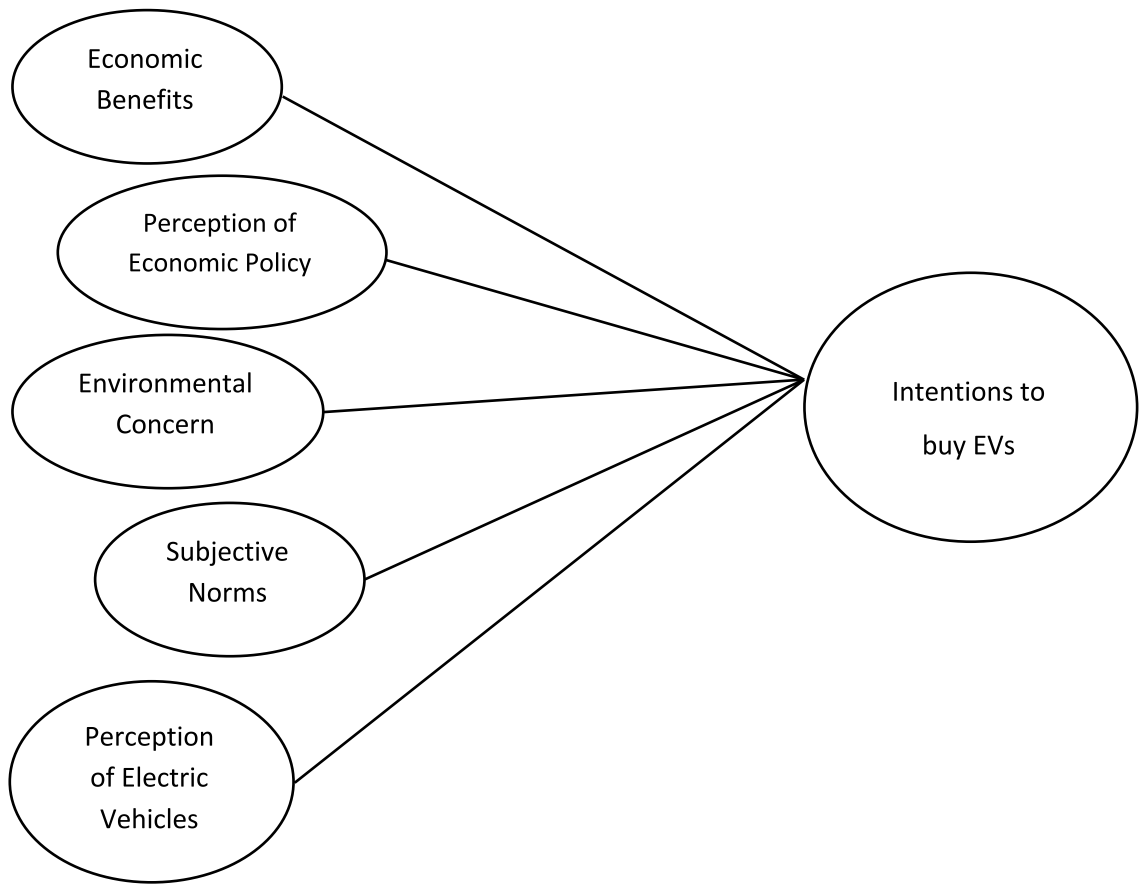

Figure 1 Model to be tested

3. Research Methodology

This chapter introduces and justifies the methodological approach of this study. The chapter presents the data and the approach to collecting it, including the choice of population and questionnaire. It also describes the methods that were used to analyze the data.

3.1 Research Process

The research process included several steps (Zikmund, 2003). It starts with the selection of the area of research and defining the research topic, purpose, and goals. The next step involves conducting a thorough literature review. The purpose of this review is to develop a theoretical framework for the study, leading to the development of hypotheses, which a can then verified, creating a basis for the research. The next step is to adopt a research methodology and collect data relevant to the research questions. The data-gathering phase leads to the analysis phase, which aids in determining the research question and meeting the goal and purposes of the research (Bryman & Bell, 2003).

The current study adopted the whole research process step by step. A detailed research design was drawn up and, to execute it properly, a research strategy was adopted. Next, a thorough, literature-based research instrument was developed for data collection and data was appropriately gathered and fed for analysis. Finally, the results were discussed including worthy findings and valuable recommendation to the stakeholders.

3.2 Research Goal

The goal of this research is to study the factors that affect an individual's intent to buy an electric vehicle in Norway within the sub-group of the population who are generally positively inclined towards electric vehicles. We divided this goal into five sub-questions that explore the influence of environmental concern, perception of environmental policy, perception of electric vehicles, reception of economic benefits, and subjective norms.

3.3 Methodological Approach

To this end, we needed to find a representative sample of Norwegians who are generally positively inclined towards electric vehicles. We then needed to measure the different factors affecting their attitudes towards electric vehicles. Because our main research question aimed to provide a quantitative description of Norwegian consumer attitudes towards EVs, we decided to use a quantitative method to collect our primary data.

To collect our data, we decided to survey our target population sample through an online questionnaire. Surveys are an efficient way of collecting responses from a large population sample. We constructed the set of questions after formulating what we wanted to find from our research and identifying our target population sample. Given the nature of our research, the choice of an online survey gave us flexibility in distributing and collecting the data in a reasonable time and at a low cost.

3.4 Data Collection

3.4.1 Data

We chose to use a questionnaire that collected cross-sectional data. The advantage of using questionnaires is that one can look at variations and similarities in the way the respondents answer the questions. Standardization allows one to generalize results from the population sample. It is also easy to collect data from many individuals in a short time. We built the actual survey using a leading online survey tool based in Norway called QuestBack (www.questback.com).

3.4.2 Population

We chose three Facebook groups in which to post our questions. The first group is called "Help with Everything, Norway," a group of people from all over Norway who are prone to helping other Norwegians with random things. The other two groups both brought together Norwegian electric vehicle enthusiasts from all over Norway. See Appendix C for a detailed list of the Facebook groups.

3.4.3 Timing

We posted the questionnaire to these Facebook groups for one month, from February 18, 2020 to March 10, 2020.The following chart shows the number of responses received during each day the survey was active as well as the cumulative number of responses.

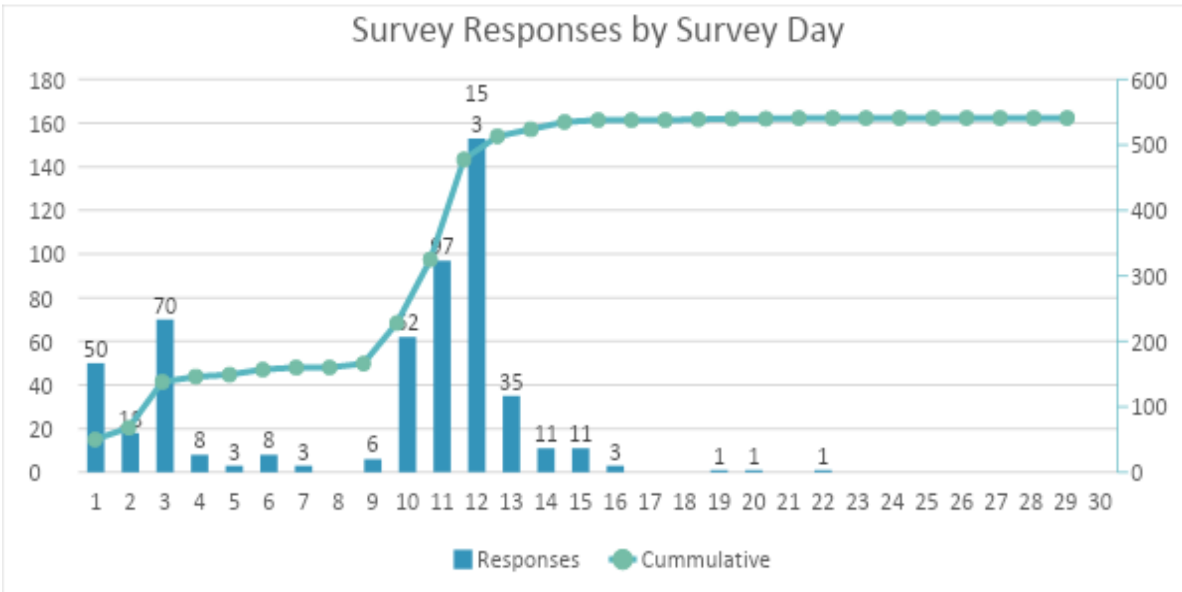

Figure 2. Survey responses by survey day

3.4.4 Sample size

During the period the survey was up, we collected a total of 541 respondents from the three Facebook groups. To verify that our sample size was sufficiently large, we used Yamane's formula for sample size (Yamane, 1967).

$$n = \frac{N}{1 + N(e^2)}$$

n = sample size

N = population size

e = level of precision (sample error).

According to SSB (2020), there are around 3.9 million adults (16 years and older) in Norway.

For a significance level of 5% (0.05), this gives us: $n = \frac{3900000}{1+3900000(0.05)^2} \approx 400$

Thus, our sample size is of 541that is sufficiently large at a 5% significance level.

3.5 Design of the Questionnaire

To be able to generalize our data, we chose to design the survey in such a way that everyone over18 years of age could answer the questions even though we were only interested in those who had an incentive to buy an EV soon.

To facilitate honest answers, we ensured our respondents that their identity would remain anonymous. The questionnaire was designed to take 5-10 minutes to ensure that we had the respondents' attention and focus throughout the survey. The questions were carefully formulated through an analysis of the existing literature and earlier questionnaires, as shown in Appendix - A. For the questions, we used simple, unambiguous Norwegian sentences.

Both Likert-styled ratings and multiple-choice questions were used. The respondents were asked to determine how much they agreed/disagreed with a series of given statements.

To ensure a high level of anonymity, the demographic category questions were designed as multiple-choice.

Category	**Contents**
Descriptive	Yes or no questions on owning and wanting to buy an electric vehicle soon.
Demographic profile	Age, gender, education level, marital status, yearly income, Number of children in the household
Environmental concern (EC)	Questions regarding the respondent's level of environmental concern and the impact of EVs on the environment.
Perception of government policy (GP)	Questions about the respondent's attitudes towards Government policies regarding EV's.
Reception of economic benefit (EB)	Questions checking the perception of how the respondents think to buy an EV will impact costs.
Perception of Electric Vehicles (EV)	Questions about the respondent's perception of EVs driving comfort.

Subjective Norms (SN)	Questions to understand how the opinions of the respondent's nearest relation on EVs affects the intention of wanting to buy an EV.
Behavioral Intention (BI)	Questions regarding the respondent's opinion on EVs.

Table 2 Overview of the survey's categories

3.6 Pilot Testing

One should do a pilot test before publishing a questionnaire. Such a test can ensure that respondents have no problems answering the questions and that there will be no problems when it comes time to collect the data. A number of at least 10 pilot testers should be sufficient when it comes to student questionnaires (Saunders, Thornhill & Lewis, 2019).

We had a total of 20 pilot testers, all whom are our friends and family members. Once the pilot was completed, we analyzed the results and gained some insights into our face validity. We concluded that the questionnaire made sense.

4. Results and Discussion

This chapter is comprised of four sections. Section I illustrates the respondents' demographics and descriptive statistics. It covers demographics related to the respondents' age, gender, marital status, level of education, and yearly earnings. It also covers questions about the respondents' intent to buy an electric vehicle in the coming years. Section II presents the correlation analysis of study constructs. Section III describes the regression model used to test the proposed hypotheses, while section IV provides a discussion of the regression estimates.

4.1 Frequency Statistics

Out of 541 surveyed respondents, 224 respondents (41.4%) already have an electric vehicle whereas 317 respondents (58.6%) do not have an electric vehicle. These figures indicate the availability of a high potential market of individuals who might buy an electric vehicle in the future. The findings of the survey further revealed that 281 respondents (51.9%) intend to buy electric vehicles in the coming few years, whereas 260 respondents (48.1%) do not have such a plan.

		Freq.	**%**
Do you already have an electric vehicle?	Yes	224	41.4
	No	317	58.6
	Total	541	100.0
Do you have an intention to buy an electric vehicle?	Yes	**281**	51.9
	No	260	48.1
	Total	541	100.0

Table 3Frequency statistics

Given that our target sample is people who are looking to buy an electric vehicle in the next few years, we only considered the respondents who are planning to buy an electric vehicle in the coming years (n = 281) as a final sample for the study and did not consider the remaining 260 questionnaires.

4.2 Demographics Characteristics

Table 4shows that out of the 281 sample individuals, 168 were male participants while the remaining 112 were female participants, all of whom voluntarily participated in the online survey. Approximately 30% belong to the below 29 age category, followed by the 30-39 category (26.3%) and the 40-49 years category (22.4%).Thus, around 56% of the respondents below 40 years old are looking to buy an electric vehicle in the nearby future. In addition, 15.7% of participants fall into the50-59 age group, 3.2% into the 60-64 age group, and only 2.5% into the 65 and above age group.

About 109 surveyed respondents have been attending university or college and have 0 to 4 years of education in these institutes, while 63 respondents have university or college education consisting of more than 4 years. Furthermore, out of 281 surveyed participants, 52 were from high school, 44 have vocational education, and only 8 have elementary school (including primary and secondary school).In other words, most of our respondents are educated to university/college degree.

Moreover, 122 respondents are married whereas 134 respondents are single. Only 19 respondents are divorced and 4 widowed. Regarding income level, 102 respondents have an income bracket of between 500,000 kr and 750,000 kr, followed by 80 who have 250,000 kr to 500,000 kr.36 respondents belong to the less than 250,000 kr and 750,000 kr to 1,000,000 kr income categories. Almost 50% of the respondents do not have any children.18% have one child, 25% have two children, and7% have 3 children.

Demographic Characteristics		**Freq.**	**%**
Gender	Male	168	59.8
	Female	112	39.9
Age	Below 29 years	83	29.5
	30 - 39 years	74	26.3
	40 - 49 years	63	22.4
	50 - 59 years	44	15.7
	60 - 64 years	9	3.2
	65 years or Older	7	2.5
Education	Elementary school, including primary and secondary school	8	2.8
	High school	52	18.5
	Vocational education	44	15.7
	University and college: 0-4 years	109	38.8
	University and college: more than 4 years	63	22.4
	Others	4	1.4
Marital Status	Single	134	47.7
	Married	122	43.4
	Divorced	19	6.8
	Widowed / Widower	4	1.4
Income	Less than 250 000 kr	36	12.8
	250 000 kr - 500 000 kr	80	28.5
	500 000 kr - 750 000 kr	102	36.3
	750 000 kr - 1 000 000kr	36	12.8
	More than 1 000 000 kr	23	8.2
Number of Children	0	138	49.1
	1	50	17.8
	2	70	24.9
	3	18	6.6
	4 and Above	2	.7

Table 4 Demographic Characteristics

4.3 Validity and Reliability Analysis

In research, reliability analysis is used to evaluate quality of research. Reliability analysis is used to assess the questionnaire scales quality using Cronbach's alpha value (Iacobucci & Duhachek, 2003). This value represents the consistency within a scale to which different respondents answer the questions/items (Fried & Ferris, 1987). A Cronbach's alpha value of survey instrument greater than or equal to 0.7 is usually considered acceptable by researchers and shows that the survey instrument is reliable to conduct the study (Stelltiz, Wrightsman & Cook, 1976; Nunnally, 1978; Hair, Black, Babin & Anderson, 2010).However, several scholars have contended that a Cronbach's alpha value of above 0.6 as satisfactory (Klein, 1986). Others regard a value greater than 0.50 as acceptable (Erdogan, 2009; Vashist, Wadhwa & Uppal, 2012).

To establish construct validity, we deployed a factor analysis technique. Factor analysis identifies the underlying factors based on highly inter correlated items by utilizing principal component analysis as the extraction method and varimax method as a rotation method. When scores obtained between two instruments that measure the same concept are highly correlated, convergent validity is established. The KMO value, using factor analysis, was found to be 0.844, whereas Bartlett's sphericity test significance (or alpha) value was found to be less than the 0.05 significance level, indicating that it is fair to extract the factors.

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin (KMO) Sampling Adequacy Measure.		.844
Bartlett's Test of Sphericity	Approx. Chi-Square	3085.762
	df	351
	Sig.	.000

Table 5 KMO and Bartlett's Test

The data sets were cleaned, and extreme outliers were removed. The factor loadings for each construct are given in Annexure-D. For factor loadings to be acceptable, it is a well-accepted rule that items factor loading must be above 0.5 and there should be no cross-loading detection for all the items. Annexure – D depicts that factor loadings for all the items was found to be above 0.5, indicating that measures used in this study have acceptable convergent validity.

The overall reliability of the survey instrument is .887, which is greater than the threshold of 0.60, as indicated by Kline (1986).In other words, the questionnaire is reliable to conduct the study. Similarly, the reliability score for each construct is above 0.60 or closer to 0.60 (in the case of the overall perception of electric vehicles), indicating that each construct is reliable.

Reliability Analysis of Constructs		
Variables	**No. of Items**	**Cronbach Alpha Value**
Environmental Concern (EC)	06	0.734
Perception of Government Policy (GP)	04	0.794
Perception of Economic Benefit (EB)	04	0.661
Overall Perception of Electric Vehicles (PEV)	04	0.589
Subjective Norms (SN)	04	0.629
Behavioral Intention to purchase an electric car (BI)	05	0.734
Overall	27	0.883

Table 6 Reliability analysis of constructs

4.4 Descriptive Statistics

Table 7 provides descriptive statistics for the studied variables.A total of 280 observations were used in the study.The mean value of environmental concern (EC) is 3.52 with a standard deviation value of .71; perception of government policy (GP) has a mean score of 3.99 with a deviation of .81; perception of economic benefits (EB) mean value is 4.70 with a deviation value of .68; overall perception of electric vehicles (PEV) has a mean score of 3.59 with a deviation value of .59, subjective norms (SN) has a mean score of 3.49 with a deviation value of .71; and behavioral intention (BI) has a mean value of 3.66 with a standard deviation value of .738.

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
EC	280	1.00	5.00	3.5293	.71293
GP	280	1.00	5.00	3.9964	.80516
EB	280	1.00	5.00	4.7000	.68372
PEV	280	1.00	5.00	3.5970	.56880
SN	280	1.00	5.00	3.4890	.70630
BI	280	1.00	5.00	3.6693	.73883

Table 7 Descriptive statistics

4.5 Correlation Analysis

Table 8 shows the correlation matrix. The table depicts that there is a strong, positive, and statistically significant correlation between the behavioral intention (BI) and environmental concern (EC), $r = .532$, $p < .01$; between the behavioral intention (BI) and perception of economic benefits (EB), $r = .577$, $p < .01$; between the behavioral intention (BI) and perception of electric vehicles, $r = .530$, $p < .01$; and between the behavioral intention (BI) and subjective norms (SN), $r = .560$, $p < .01$.Furthermore, the correlation analysis reveals that there is a moderate, positive, and statistically significant correlation between the behavioral intention (BI) and perception of government policy (GP) as the p-value is less than the 0.01 level of significance, $r = .381$, $p < .01$.

Construct Correlation Matrix						
	EC	**GP**	**EB**	**PEV**	**SN**	**BI**
EC	1	.429**	.375**	.351**	.364**	.532**
GP	.429**	1	.359**	.276**	.239**	.381**
EB	.375**	.359**	1	.442**	.361**	.577**
PEV	.351**	.276**	.442**	1	.428**	.530**
SN	.364**	.239**	.361**	.428**	1	.560**
BI	.532**	.381**	.577**	.530**	.560**	1
** p < 0.01 level (2-tailed).						

Table 8 Construct Correlation Matrix

4.6 Regression Analysis

Table 9 presents the result outputs for the simple and multiple regression analysis. The multiple regression models has an R-square value of 0.566, indicating that 56.6% variability in the predicted variable (behavioral intention) is explained by the predictors (or explanatory variables).

The study finds that all variables have a statistically significant influence on the behavioral intention (BI) of individuals to buy electric vehicles except the perception of government policy variable (GP).All variables exert a positive impact on the behavioral intention to purchase an electric vehicle in Norway. Environmental concern (EC) has an unstandardized beta coefficient of .241 (standardized beta coefficient = .233), implying that a 1% increase in its value significantly increases the BI value by 24.1%, keeping other variables constant. GP has an unstandardized beta coefficient of .056 (standardized beta coefficient = .061), implying that a 1% increase in its value increases the BI value by 5.6%, although this relationship was found to be statistically insignificant because the GP alpha value is greater than the 0.05 level of significance.

Similarly, the reception of economic benefits (EC) has an unstandardized beta coefficient of .309 (standardized beta coefficient = .286), implying that a 1% increase in EC value significantly increases the BI value by 30.9% and vice versa. The overall perception of electric vehicles (PEV) has an unstandardized beta coefficient of .241 (standardized beta coefficient = .185), implying that a 1% increase in its value significantly increases the BI value by 24.1%, keeping other variables constant. Lastly, subjective norms (SN) have an unstandardized beta coefficient of .291 (standardized beta coefficient = .278), implying that a 1% increase in SN value significantly increases the BI value by 29.1%, keeping other variables constant. The findings of the regression analysis also depict that the direct effect of the EB ($\beta = 0.309$) is larger than the direct effects of SN ($\beta = 0.291$) and the PEV ($\beta = 0.241$).Furthermore, we do not find any evidence that control variables (age and income) have any statistically significant impact on the BI, as given in Table 9.

	Dependent Variable: Behavioral Intention								
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
EC	0.531*							0.241*	0.363*
	(0.051)							(0.049)	(0.062)
GP		0.333*						0.056	0.041
		(0.050)						(0.042)	(0.045)
EB			0.601*					0.309*	0.267*
			(0.051)					(0.051)	(0.058)
EV				0.670*				0.241*	0.117**
				(0.063)				(0.062)	(0.068)
SN					0.571*			0.291*	0.365*
					(0.049)			(0.048)	(0.049)
Age						0.030			-0.007
						(0.035)			(0.026)
Income							-0.007		-0.024
							(0.041)		(0.031)
Constant	1.808*	2.352*	1.458*	1.274*	1.691*	3.592*	3.689*	-0.430***	-0.518***
	(0.183)	(0.203)	(0.191)	(0.229)	(0.176)	(0.095)	(0.121)	(0.229)	(0.287)
R^2	0.286	0.141	0.341	0.293	0.328	0.003	0.000	0.566	0.543
F-statistics	110.01*	44.13*	141.61*	113.42*	133.53*	0.756	0.026	71.49*	44.53*

* $p < 0.01$, ** $p < 0.05$, *** $p < 0.10$

Table 9 Regression analysis

We also estimate additional regressions on how EC, GP, EB, EV, and SN depend on age and income. Table 10 presents the results for regression estimates for EC, GP, EB, EV, and SN. These results indicate that age has a statistically significant influence on the EB at the 0.05 level of significance, while showing no influence on the EC, GP, EV, and SN. Moreover, income was found to have a significant influence on the EB at the 0.10 significant level while showing no influence on the EC, GP, EV, and SN. This means that older and richer individuals perceive higher economic benefits of electric vehicles. In contrast, perception of environmental concern, governmental policy, perception of electric vehicles, and subjective norms are unrelated to age and income.

Regression Estimates for EC, GP, EB, EV and SN										
	DV= EC		**DV = GP**		**DV = EB**		**DV = EV**		**DV = SN**	
	(1)	**(2)**	**(1)**	**(2)**	**(1)**	**(2)**	**(1)**	**(2)**	**(1)**	**(2)**
Age	0.032		0.024		0.062**		-0.007		0.053	
	(0.029)		(0.038)		(0.031)		(0.025)		(0.033)	
Income		-0.042		0.005		0.063***		-0.012		0.055
		(0.034)		(0.045)		(0.037)		(0.029)		(0.039)
Constant	3.52*	3.715*	3.778*	3.827*	3.929*	3.912*	3.783*	3.802*	3.368*	3.346*
	(0.078)	(0.099)	(0.104)	(0.132)	(0.086)	(0.109)	(0.068)	(0.086)	(0.091)	(0.055)
R^2	0.005	0.006	0.002	0.000	0.014	0.011	0.000	0.001	0.009	0.007
F-stat	1.229	1.569	0.413	0.014	3.906**	2.954***	0.072	0.170	2.576	1.981

* p < 0.01, ** p < 0.05, *** p < 0.10

Table 10 Regression analysis

4.7 Results Discussion

4.7.1 Behavioral Intention and Environmental Concern

Hypothesis 1 of the study states that environmental concern has a positive and statistically significant effect on the behavioral intention of individuals to purchase an electric vehicle, which means that the greater the value of environmental concern, the greater the intention of people to buy an electric vehicle in Norway. The regression results show a beta value of .241 and a p-value of .000, indicating that 1 unit increase in the value of environmental concern increases the behavioral intention by .241 (or 24.1%), keeping other factors constant. An individual is much more likely to buy an electric vehicle than an individual who does not have concerns related to the environment, a finding that is consistent with previous work by Garling and Thogersen (2001), Stephan and Sullivan (2008), Lai et al. (2015), and Yan, Qin, Zhang, and Xiao (2019). Wu et al. (2010) determined that the electric vehicle's compatibility is positively related to consumer's decision to purchase hydrogen-powered and bio-fuel cars because these days society is highly concerned about air pollution, climatic changes, and the environment. Thus, the industry should be keen to develop green products to cope with this trend in society. Oliver and Lee's (2010) study concluded that the influence of green environment information and social values self-image factors encourages people to purchase hybrid vehicles in the USA and Korean context. Several studies such as Lane, Potter and Warren (2006) and Egbue and Long (2012), which focused on the adoption of electric cars in society, assumed that electric vehicles are eco-innovations that are considered to play a key role in reducing environmental problems, specifically in the transportation sector. Hence, people's behavior towards the adoption of electric vehicles is considered pro-environmental behavior and in the existing literature the factors associated with such pro-environmental behavior are usually related to predictions of electric vehicle adoption. In addition, Krupa et al. (2014) concluded that belief and knowledge about environmental issues are among the motivating factors for potential buyers of electric vehicles to buy the vehicles.

4.7.2 Behavioral Intention and Perception of Government Policy

Hypothesis 2 states that the perception of government policy has a significant effect on people’s intention to buy an electric vehicle. Our finding is contradicted to earlier work of Byrne and Polonsky (2001), who found that the government is one of the biggest stakeholders able to affect the availability of electric vehicles. Tornatzky, Fleischer and Chakrabarti (1990) proposed that government policies and incentives tend to increase the trend of consumers towards electric vehicles. According to Soltani-Sobh et al. (2015), urban area roads and the benefits provided by the government were directly associated with the states’ market share for electric vehicles. Bjerkan et al. (2016) highlighted that more than 80% of the respondents believe that VAT and purchase tax exceptions are crucial incentives for promoting the sale of BEVs in Norway.

4.7.3 Behavioral Intention and Perception of Economic Benefits

Hypothesis 3 states that perception of economic benefits has a significant effect on people’s purchase intention towards electric vehicles. We find that the greater the perception of economic benefits values, the greater the intention towards buying an electric vehicle. The regression results show a beta value of .309 and a p-value of .000, indicating that 1 unit increase in the value of perception of economic benefits increases the behavioral intention by .309 (or 30.9%), keeping other factors constant. In studying the main determinants for hybrid and electric vehicles, Graham-

Rowe et al. (2012) found that impressive management, environmental beliefs, cost minimization, and perception of economic beliefs are vital components of people's buying decisions. Lai et al. (2015) suggested that the idea of being economical is one of the key factors in the adoption of full electric vehicles. Soltani-Sobh et al. (2015) argued that benefits provided by the government were positively correlated with states' electric vehicle market share whereas electricity prices were negatively associated with the use of electric vehicles. Rational choice theory, similar to the TPB, upholds utility maximization and benefits as the basis of human behavior. Many researchers have considered consumers' electric vehicles adoption behavior as rational behavior and have measured individual attitude towards electric vehicles using different dimensions to predict their intentions to buy the electric vehicles (Lieven et al., 2011; Egbue & Long, 2012; Carley et al., 2013).In these studies, different dimensions such as attitude towards electric vehicles, driving, electric vehicles technical attributes (speed, range, etc.), operation costs of electric vehicles, up-front costs, electric vehicle policies, environmental issues, and cars in general were discussed. Electric vehicles are generally considered eco-friendly innovations and thus EV adoption behavior is considered a pro-environmental behavior. The results of Daziano and Chiew's (2013) study indicate that perception of economic benefit is a vital factor in the consumer acceptance of full-electric vehicles.

4.7.4 Behavioral Intention and Overall Perception of Electric Vehicles

Hypothesis 4 states that electric vehicles' overall perception has a significant effect on people's purchase intention towards electric vehicles. We find that the greater the overall perception of electric vehicles' value, the greater the intention of buying an electric vehicle. The regression results show a beta value of .241 and a p-value of .000, indicating that 1 unit increase in the value of overall perception of electric vehicles increases the behavioral intention by .241 (or 24.1%), keeping other factors constant. A positive perception of a product can make a customer more likely to purchase it (Viardot, 2004). This idea is consistent with the earlier work of Axsen and Kurani (2013), who examined whether promoting green electricity and electric vehicles together would raise the percentage of consumers willing to adopt electric vehicles in the USA, whereas little is known about consumers' perceptions of electric vehicles in other countries. Studying the factors that influence the acceptance of HFCVs, Kang and Park (2011) found that perception of HFCV, perception of policy, experience with HFCVs, and psychological requirements were critical.

4.7.5 Behavioral Intention and Subjective Norms

Subjective norms refer to the state to which extent and how the society around him influences a person to perform a certain task or not (Ajzen, 1991). Hypothesis 5 states that subjective norms have a significant effect on people's purchase intention towards electric vehicles. The direction of subjective norms' influence on purchase intention is positive, which means the greater the value of subjective norms, the greater the intention of buying an electric vehicle. The regression results show a beta value of .291 and a p-value of .000, indicating that 1 unit increase in the value of subjective norms increases the behavioral intention by .291 (or 29.1%), keeping other factors constant. Subjective norms represent a positive or negative reaction of society towards a person's attitude or behavior. According to Fishbein and Aizen (1975), a subjective norm refers to an individual's perception that they should or should not do a certain task under the influence of people whom they think are very important and who cares for them the most. In a study conducted by Tan & Teo (2000) within the banking sector, the researchers found that the subjective norm was not a critical factor in the adoption of Internet banking among bank clients. Research performed in Norway by Klockner et al. (2013) showed that psychological results have a high correlation between the use of electric vehicles and their purchase. On the other hand, Jeon et al. (2012) showed in their research that the subjective norm had an impact on the buying attitude of the consumer regarding electric vehicles, whereas the results of the study showed that the link between subjective norm and intention to purchase an electric vehicle is only strong in the population of China but not in South Korea.

5. Conclusion

Consumers have progressively relied on the automobile and transportation system to meet their needs. A significant number of individuals or buyers worldwide use vehicles to facilitate their movement as they go to work and for various errands. While the use of these vehicles has made their movement more accessible, it has resulted in serious disadvantages, including the excessive release of GHG into the atmosphere. Reliance on vehicles, particularly those with a fossil fuel combustion engine and power, has increased environmental pollution and climate change. The introduction of hybrid and electric means of transportation is considered a significant development that can decrease carbon emissions and improve fuel efficiency.

The study aimed to give a quantitative description of Norwegian consumers' attitudes towards EVs. The study used a quantitative method to collect the primary data. The chosen research method contrasts with the qualitative research method, which would have focused on formulating a hypothesis or building a theory and used open-ended questions and collected opinions and experiences that cannot be measured by numbers. A questionnaire was used to collect the data from the target respondents. Both Likert-styled ratings and multiple-choice questions were used. The respondents were presented with a series of statements and were asked to choose how much they agreed/disagreed with each of them.

Regression analysis is used to check the relationship between the exploratory and explanatory variables. The regression model depicts an R-square value of 0.566, indicating that 56.6% variability in the predicted variable (BI) is explained by the predictors (or explanatory variables). The study finds that all variables have a statistically significant influence on the behavioral intention (BI) of individuals to buy an electric vehicle except the perception of government policy variable (GP). All variables exert a positive impact on people's behavioral intention to purchase an electric vehicle in Norway. Environmental concern (EC) has a beta coefficient of .241, implying that a 1% increase in its value significantly increases the BI value by 24.1%, keeping other variables constant.GP has a beta coefficient of .056, implying that a 1% increase in its value increases the BI value by 5.6%, although this relationship was found to be statistically insignificant because GP alpha value is greater than the 0.05 level of significance. Similarly, the reception of economic benefits (EC) has a beta coefficient of .309, implying that a 1% increase in EC value significantly increases the BI value by 30.9% and vice versa. Overall perception of electric vehicles (PEV) has a beta coefficient of .241, implying that a 1% increase in its value significantly increases the BI value by 24.1%, keeping other variables constant. Lastly, subjective norms (SN) have a beta coefficient of .291, implying that a 1% increase in SN value significantly increases the BI value by 29.1%, keeping other variables constant.

5.1 Research Limitations

There are theoretical and/or methodological issues that may have enhanced the reliability and validity of the research findings, but have not been fully taken care of, often because of factors beyond the control of the researcher. These limitations are hereby enumerated and discussed.

- First, we only cover Facebook groups to collect survey data from the target sample; it may have been beneficial to incorporate at least one other type of data collection source (e.g., social media platforms, survey websites, face to face surveys, etc.).Had that been done, the dataset would have had more credible and valid. In this way, it would enable the possibility of investigating similarities and differences across the data collection types.
- Second, the variance explained in behavioral intention in this study is 56.6%, thus less than the 70% variance found by Venkatesh et al. (2003). This finding implies that there might be another variable that can add the variance explained of the endogenous latent variable in the model.
- Third, the current study examined only the direct relationships between independent variables and behavioral intention. It did not consider whether there might be mechanisms through which these independent variables determine behavioral intention.
- Fourth, the period could have been longer to detect and extract more information about a wider range of different electric vehicles. Our research can present new knowledge about the full electric vehicles. The study is not able to produce unique information about any particular type of electric vehicle.

- Fifth, because the research study investigated determinants of behavioral intent towards full electric vehicles in Norway, it is worthwhile to compare these characteristics to other similar countries, providing a clear understanding of the main factors.
- Furthermore, this study used a questionnaire as a primary method to generate findings. Implementing quantitative standards restricted the range of the analysis because of the limitation of each method.
- Moreover, the present study involved the use of one primary method, which is a questionnaire, to gain insight into the research problem and a rich picture of the issues that hinder the adoption of full-electric vehicles in Norway. Accordingly, further research could adopt a mixed-method approach to testing the results of this research and the generalizability of the behavioral intention conceptual framework to other countries that have similar social-cultural behaviors.
- Although the total collected sample was above 500, some respondents were not reachable and couldn't participate in the study; it was worth following up on non-bias responses by using different methods such as face-to-face interviews.

5.2 Future Research

The limitations discussed in the previous section opens doors for future research. This section discusses these avenues and offers recommendations for future researchers to explore them.

- As the government is making efforts to ensure the significant diffusion of electric vehicles, through mass media campaigns and by adopting the findings and recommendations of scientific investigations such as the current study, the adoption of electric vehicles might grow significantly. Hence, researchers can examine behavioral intention and actual behavior in one study. With this in mind, this study recommends that future studies collect data in a longitudinal approach, which may enhance understanding of the phenomena by examining whether behavioral intention indeed leads to user behavior. Additionally, the respondents in the current study expressed their confidence that electric vehicle usage will decrease air pollution, enhance the green environment, and promote efficiency and overall economic benefits. Therefore, future studies should examine the impact of electric vehicle effectiveness on market performance.

- Because this is a master's thesis that cannot gather large sample sizes due to budget and logistics constraints, future scholars and researchers should limit such restrictions by obtaining substantial funding for their research and thereby increase the possibility of collecting large sample sizes that can sufficiently represent the population.
- Similarly, to maintain a parsimonious model, this study might have ignored some critical predictors of behavioral intention. This study recommends that future researchers expand the horizon of the current understanding of phenomena. This expansion could come in the form of theoretically and contextually driven factors that advance what is currently known and understood.
- Furthermore, the direct relationships explored in this study may be insufficient because the mechanisms through which these relationships existed are not known. Therefore, future researchers could investigate the intervening mechanism among the relationship between performance expectancy, social influence, facilitating conditions, customer concerns, facilitating conditions, and behavioral intention.
- Moreover, the present study involved the use of one primary method, a questionnaire, to gain insight into the research problem and obtain a rich picture of the issues that hinder the adoption of fully electric vehicles in Norway. Accordingly, further research could use a mixed-method approach to test the results of this research and the generalizability of the behavioral intention conceptual framework to other countries with similar social-cultural behaviors.
- The study's findings should be tested in other countries, especially countries with a similar culture and socio-demographic patterns.

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Appendix

Appendix – A (Questionnaire)

This questionnaire is a part of our data collection in our master's thesis in Business Administration at The University of Stavanger Business School. We are inviting you to take part in our research study **the behavioral intentions of consumers towards Electric Vehicles in Norway**. This study is conducted as a partial fulfillment of ourmaster's in business administration program at the University of Stavanger Business School and aimed at establishing the factors that impact an individual's intent to purchase an electric car. Your participation in the study makes you a party to a faster adoption of electric cars in Stavanger and, thus, a facet of environmental conservation. Any personal details collected during this survey will be safely stored, remain confidential and only be used for the purposes of this research. The survey will take approximately 10-15 minutes.

1) Gender:

○ Male

○ Female

2) Age:

○ Below 29 years

○ 30 - 39 years old

○ 40 - 49 years old

○ 50 - 59 years old

○ 60 - 64 years old

○ 65 years or older

3) Education qualification:

○ Elementary school, including primary and secondary school

○ High school

○ Vocational education

○ University and college: 0-4 years

○ University and college: more than 4 years

○ Other

4) Marital status

○ Single

○ Married

○ Widowed / widower

○ Divorced

5) Yearly income

○ Income between 0 - 250 000 kr

○ Income between 250 000 kr - 500 000 kr

○ Income between 500 000 kr - 750 000 kr

○ Income between 750 000 kr - 1 000 000 kr

○ Income over 1 000 000 kr

6) Check how many children under the age of 16 you live with and support:

○ 0

○ 1

○ 2

○ 3

○ 4 or more

7) * Do you already have an electric vehicle?

○ Yes

○ No

8) * Do you have an intention to buy an electric vehicle in the coming years?

○ Yes

○ No

Answer the following questions about your beliefs about electric vehicles, on a scale of 1-5 (1 strongly disagree, 5 strongly agree)

	Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
Environmental Concern					
	1	**2**	**3**	**4**	**5**
9. I am concerned about the impacts of global warming on the environment					
10. I care about energy saving					
11. I believe electric vehicles have the potential to reduce greenhouse gas emissions					
12. I am more likely to purchase an electric car if recharging stations drawing electricity from renewable sources (e.g. hydropower, wind power and solar power)					
13. I do not think electric vehicles emit harmful pollutants					
14. I think electric vehicles reduce the city air pollution level					
Perception of Government Policy					
	1	**2**	**3**	**4**	**5**
15. I support Norwegian government's offer of subsidies and perks to *electric vehicle* owners.					
16. I support the Norwegian government's no fee policy on electric vehicles purchase.					
17. I think that the Norwegian government should subsidize the construction of charging stations.					

18. I support Norwegian government's value-added tax incentives to electric vehicle customers*					
Perception of Economic Benefit					
	1	**2**	**3**	**4**	**5**
19. Electric vehicles have lower operating and maintenance cost					
20. I believe an electric car has lower rates of repair compared to the contemporary fuel engines					
21. I believe that buying an electric vehicle would reduce my operating costs 22. I think electric cars have a higher resale value					
Overall Perception of Electric Vehicles					
	1	**2**	**3**	**4**	**5**
23. I think electric vehicles are comfortable to drive.					
24. I think electric vehicles would provide a satisfactory driving experience					
25. Electric vehicles are more reliable for inter-city road trips					
26. I feel there are enough recharging stations in Norway for electric vehicles					
Subjective Norms on Electric vehicles					
	1	**2**	**3**	**4**	**5**
27. My family members prefer electric vehicles					
28. My friends own electric vehicles					
29. My friends recommend me to buy an electric vehicle					

30. An electric vehicle is compatible with my working style and lifestyle					
Behavioral Intention to purchase an electric car					
	1	**2**	**3**	**4**	**5**
31. I am saving to buy an electric car within the next year					
32. I would speak favorably about fully electric vehicles to others					
33. I would recommend my friends to buy a fully electric vehicle					
34. I am likely to purchase electric vehicle even without any subsidies and tax incentives					
35. If I have to buy a car again, I would buy an electric car					

Appendix – B (Overview of the Norwegian Electric Vehicles Events from 1990 - 2019)

Year	Key Events	Some EV models on the Norwegian Market	Incentives	Number of EVs
1990	PIVCO (Personal Independent Vehicle Company) started in Aurskog, Norway		Temporary exemption vehicle registration tax	Data not available
1992	NORSTART (later Norwegian Electric Vehicle Association)	KewetEljet 2 (later Buddy)		–
1993		Prototype PIV1 by PIVCO (Norwegian brand)	Free parking experiments	–
1994	Fleet of PIV2 (CityBee) demonstrated at Winter Olympics in Lillehammer, Norway			–
1995	50 CityBees by PIVCO sold to San Francisco's 'Station car program'			–
1996		CityBee (sold to sponsors/private owners and enterprises, in total 65 cars)	Permanent exemption vehicle registration tax Exemption yearly fee	–
1997			Exemption road toll	147

1998	Kollegabil in Oslo takes over production of Danish Kewet (later Buddy)			187
1999	Th!nk (former PIV/CityBee) established, bought by Ford	Renault, Volvo	‘EL’ (EV) on license plate for all EVs; Free parking on municipal parking spots	285
2000			Reduced tax company cars	468
2001			Exemption value added tax	625
2002		Nissan		871
2003			Trials with use of bus lanes in Oslo and Akershus County	1081
2004		Toyota, Chevrolet	Permanent access bus lanes	1183
2007		Buddy Electric		
2009		Tesla Roadster	No fee national road ferries	2753
2010		Mitsubishi i-MiEV		3347
2011	Sales of Nissan and Mitsubishi takes off	Nissan Leaf, Citroën C-Zero	Exemption congestion charge	5381

2012	Parliament enacts Climate Agreement and ensures fee exemptions until 2018 or when reaching 50.000 EVs in Norway	Tesla Model S	9565
2013	Positive attention to EVs in media. Sales of Tesla takes off	BMW i3, Ford Focus Electric	19,678
2014		Volkswagen e-Golf, Kia Soul, Renault Zoe	42,356
2015			73,312
2016		Chevrolet Bolt, Opel Ampera E	101,126
2017			138,477
2018		New Nissan Leaf, Tesla Model 3	194,900
2019			260,692

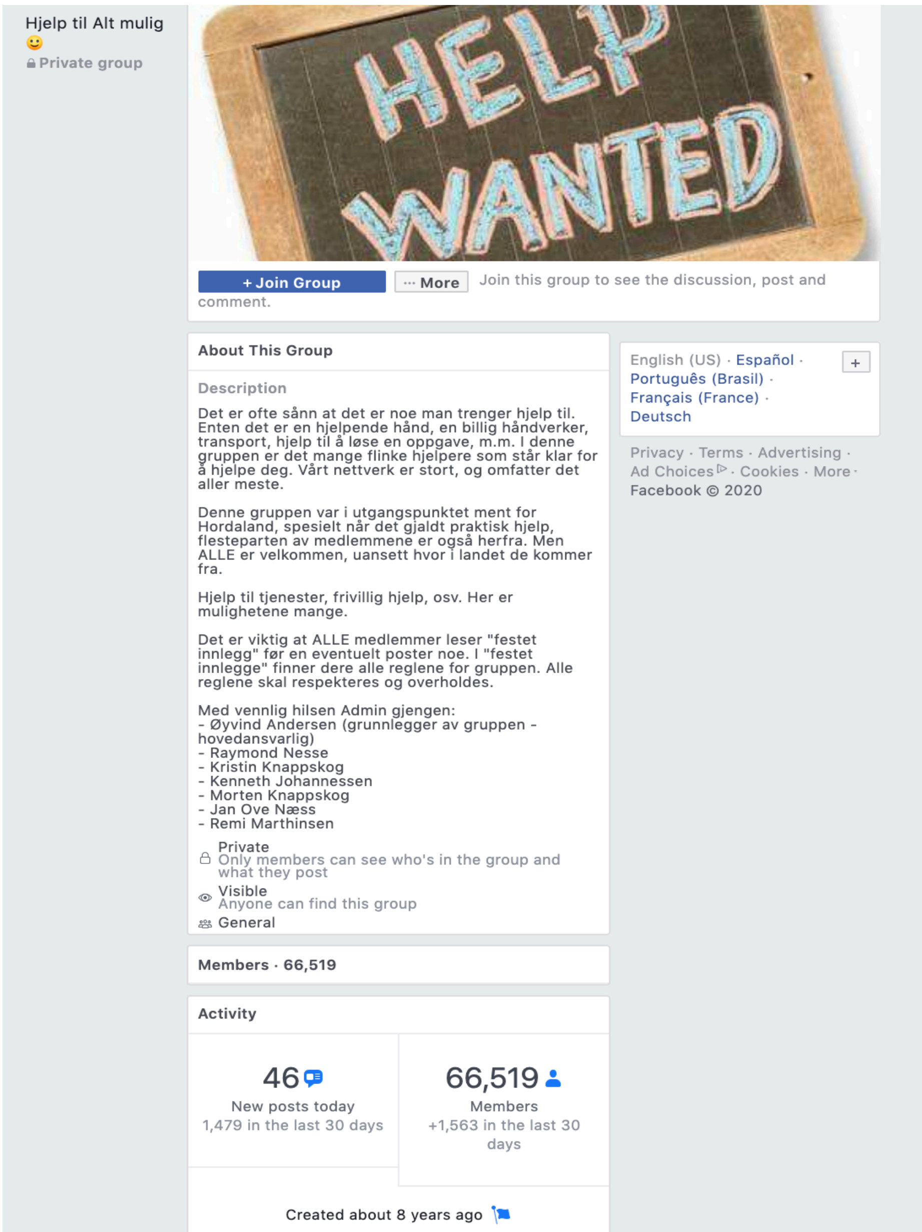
Sources: Ryghaug and Skjølsvold (2019), and Norwegian Electric Vehicle Association (2019)

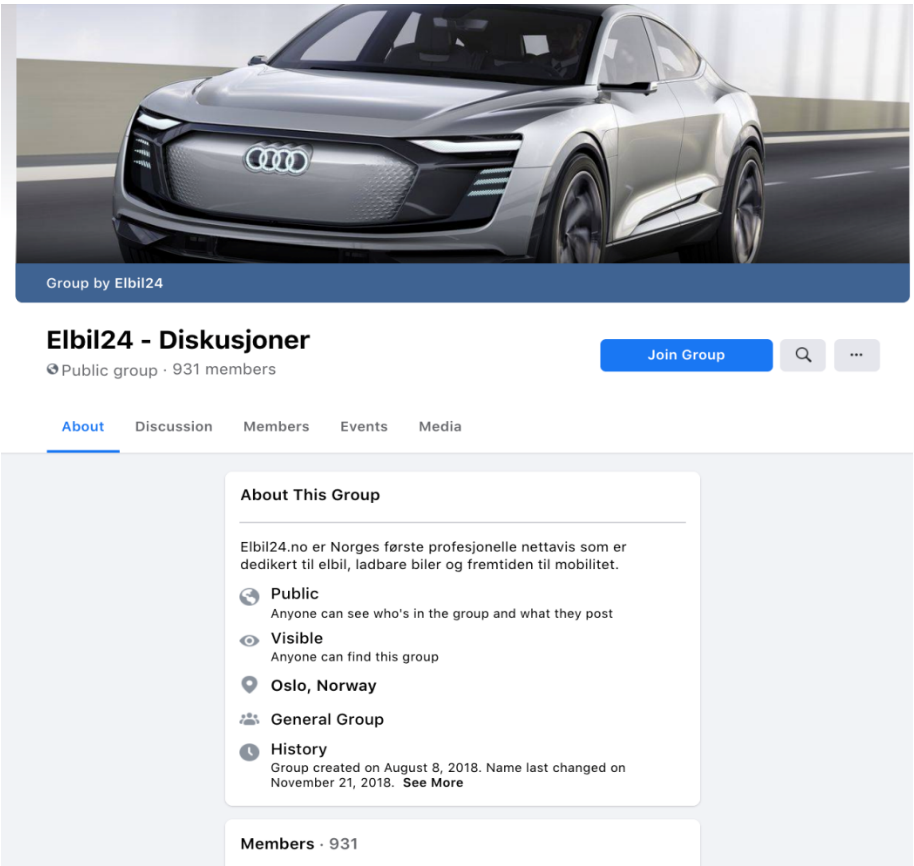
Appendix C – Facebook Groups

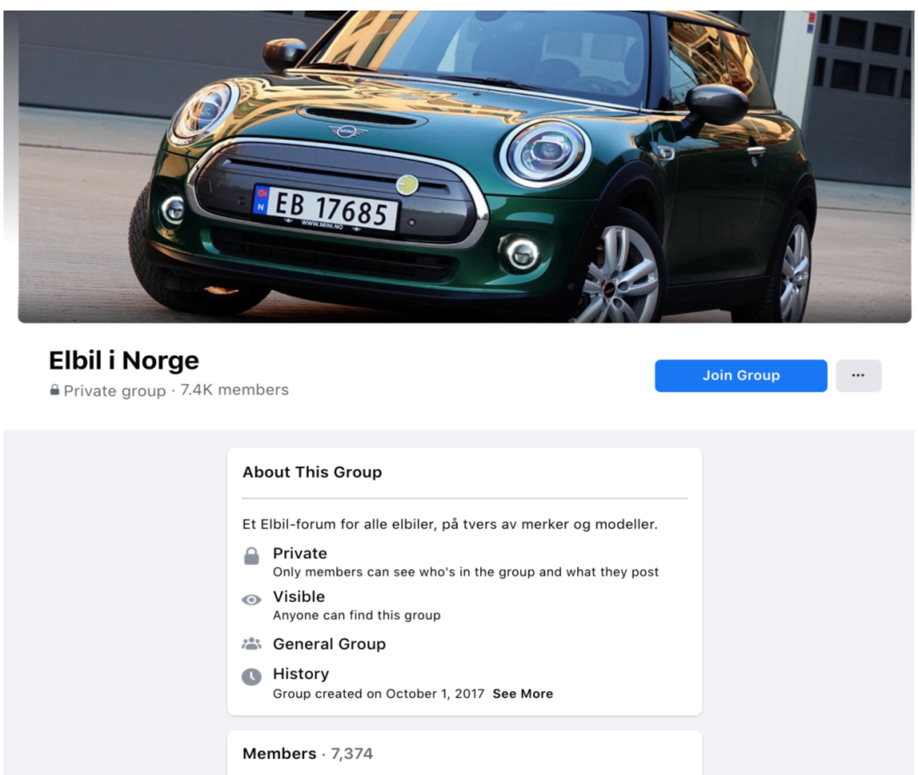
https://www.facebook.com/groups/hjelptilaltmulig/

https://www.facebook.com/groups/elbil24/

https://www.facebook.com/groups/179973709217772/




Group by Elbil24
Elbil24 - Diskusjoner
Public group · 931 members
Join Group
About
Discussion
Members
Events
Media
About This Group
Elbil24.no er Norges første profesjonelle nettavis som er dedikert til elbil, ladbare biler og fremtiden til mobilitet.
Public
Anyone can see who's in the group and what they post
Visible
Anyone can find this group
Oslo, Norway
General Group
History
Group created on August 8, 2018. Name last changed on November 21, 2018. See More
Members · 931


EB 17685
Elbil i Norge
Private group · 7.4K members
Join Group
About This Group
Et Elbil-forum for alle elbiler, på tvers av merker og modeller.
Private
Only members can see who's in the group and what they post
Visible
Anyone can find this group
General Group
History
Group created on October 1, 2017 See More
Members · 7,374

Appendix – D (Factor Loadings)

	EC	GP	EB	PEV	SN	BI
I am concerned about environmental problems	.977					
I care about energy conservation	.675					
I am more likely to purchase an electric car if recharging stations drawing electricity from renewable sources (e.g. hydropower, wind power and solar power)	.959					
I believe electric vehicles have the potential to reduce greenhouse gas emissions	.781					
I think electric vehicles do not emit harmful tailpipe pollutants	.936					
I think electric vehicles reduce the city air pollution level	.567					
I support the Norwegian government's no fee policy on electric vehicles purchase.		.942				
I think that the Norwegian government should continue with no fee policy on electric vehicles purchase.		.876				
I think that the Norwegian government should subsidize the construction of charging stations.		.507				
I think that the Norwegian government should keep value-added tax incentives to electric vehicle customers.		.836				
Electric vehicles have lower operating and maintenance cost.			.816			
I think less energy is required to operate an electric vehicle comparative to internal combustion engine vehicles.			.777			
I think purchasing an electric vehicle would lower my running costs.			.711			
I think electric cars have a higher resale value.			.507			
I think electric vehicles are comfortable to drive.				.790		

I think electric vehicles would provide a satisfactory driving experience.	.791		
Electric vehicles are more reliable for inter-city road trips.	.768		
I feel there are enough recharging stations in Norway for electric vehicles.	.889		
My family members prefer electric vehicles.		.875	
My friends own electric vehicles.		.911	
My friends recommend me to buy an electric vehicle.		.835	
An electric vehicle is compatible with my working style and lifestyle.		.773	
I plan to purchase an electric car in the forthcoming year.			.535
I would speak favorably about fully electric vehicles to others.			.630
I would recommend my friends to buy a fully electric vehicle.			.721
I am likely to purchase car electric vehicle even without any subsidies and tax incentives.			.864
If I have to buy a car again, I would buy an electric car.			.757

Appendix – E (Diagnostic Checks)

Normality Test

Histogram and P-P plot used to check the normality of the residuals along with descriptive measures. Histogram shows that residuals are almost normally distributed and have no issue of normality, thus not violating the regression assumption. Moreover, according to central limit theorem, data set having more than 30 observations considered to be normal.

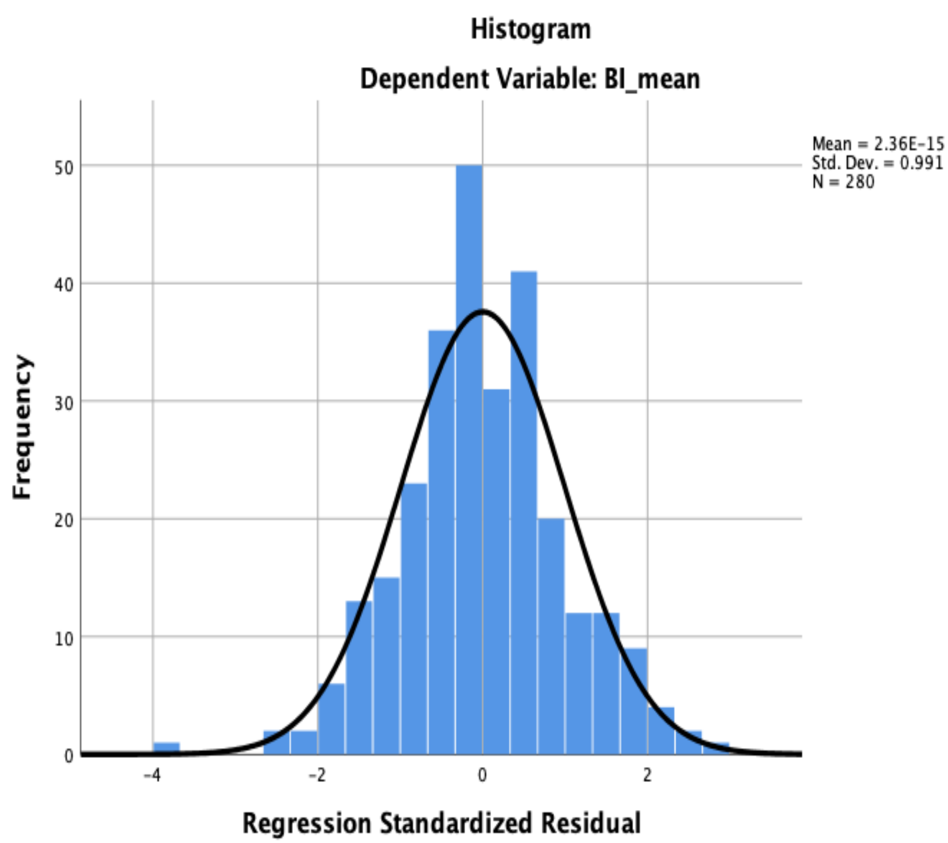


Figure 3 Histogram

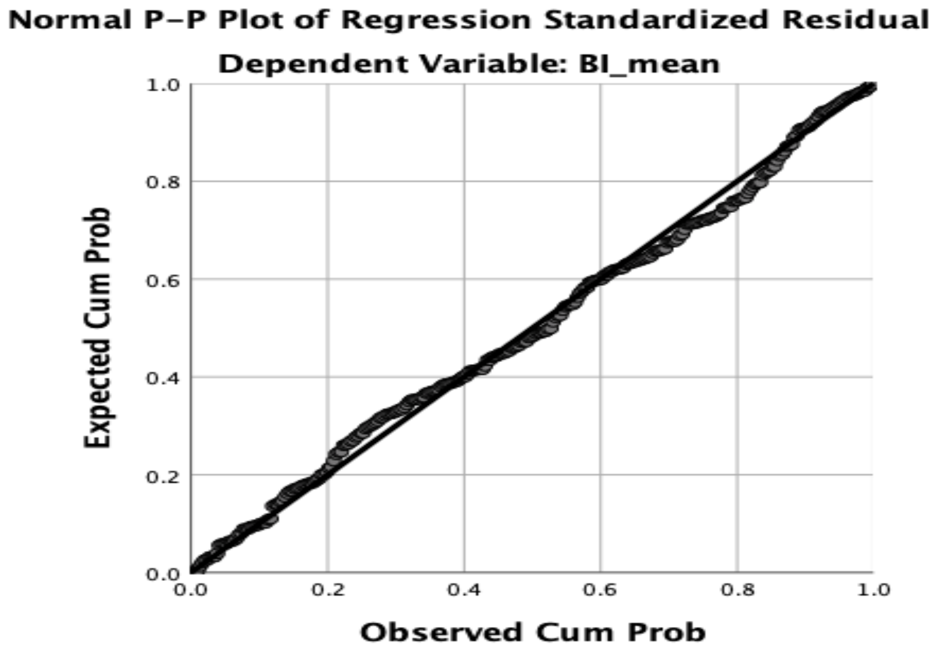


Figure 4 Normal p-p plot of regression standardized residual

Heteroskedasticity Test

The term "heteroskedasticity" indicates that unequal variances, that is, variances are not equally distributed across the residuals. Heteroskedasticity tells the reader that either variances across the residuals are equally distributed or not while conducting the regression analysis. This is a vital assumption of regression analysis and its violation leads to biased results and higher coefficient values of the independent variables.In order to examine the heteroskedasticity problem among the residuals, scatter plot is produced with the help of SPSS. According to Rigobon (2003), if the SPSS scatter plot graphs shows a particular pattern or the points that indicates a regular pattern, then it is assumed that there is a problem of a heteroskedasticity in the data. Based on the scatter plot output below, it appears that the spots are diffused almost equally from zero and do not form a clear specific pattern.

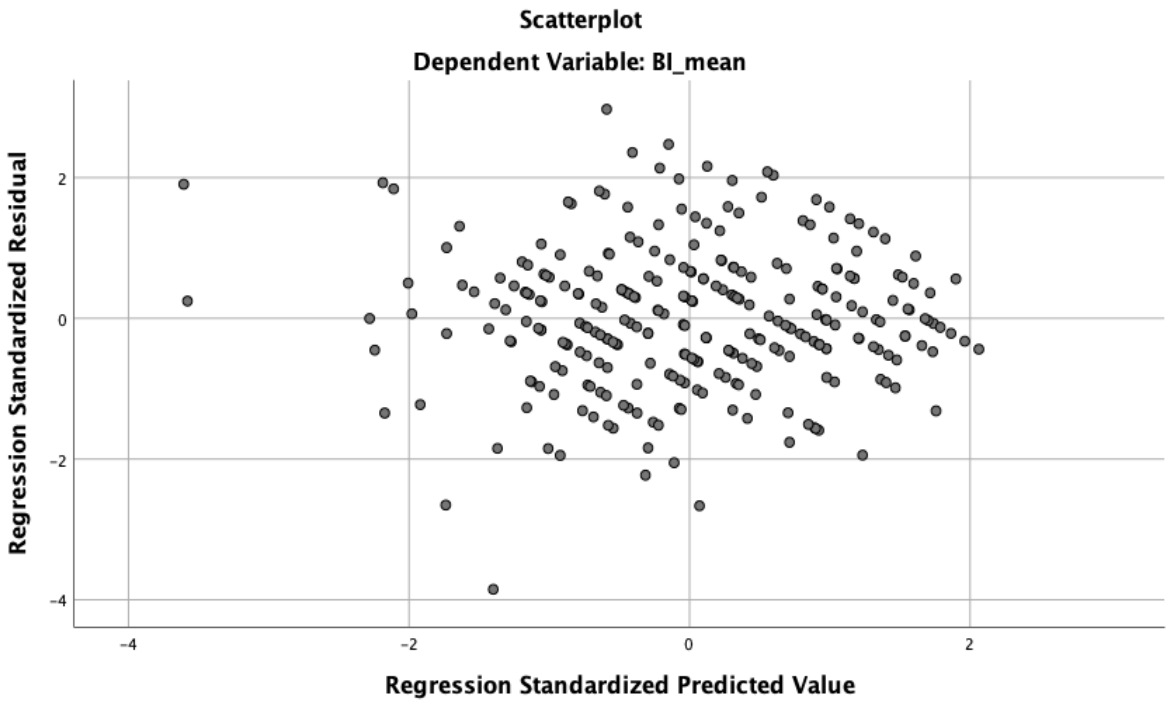


Figure 5 Scatterplot

Serial Correlation Test

Durbin Watson statistic determines the problem of serial correlation (or auto correlation) in the dataset (see Table 4.14). It tells whether the data set violated the auto correlation assumption or not. According to Field (2013), if the Durbin Watson statistic value is closer to 2.0, this means that there is no auto correlation exists within the dataset. However, a value far from the 2.0 indicates the presence of auto correlation in the dataset. Since, we have a Durbin-Watson statistics of 1.954, closer to the 2.0 value, indicating that there is no problem of serial correlation in the dataset.

Multicollinearity Test

In regression analysis, VIF is generally used to detect the multicollinearity problem between the predictor variables. It quantifies the extent to which one predictor is correlated with the other predictor in a model. Multicollinearity exists where there is correlation between the predictors or independent variables (Belsley&Kuh, 2015). According to Miles (2014), independent variables having a VIF value less than 10 or tolerance value less than 1.0 indicates that there is no issue of multicollinearity. Table below shows the VIF and tolerance values for all the independent variables used in the study. The results indicate that there is no problem of multicollinearity among the predictors.

Multi-collinearity Statistics		
	Collinearity Statistics	
Variables	**Tolerance**	**VIF**
EC	.706	1.416
GP	.766	1.305
EB	.704	1.420
PEV	.702	1.424
SN	.746	1.341