Predictors of intention to buy a battery electric vehicle among conventional car drivers

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Abstract

Despite rapid increase of battery electric vehicles (BEV) in many countries, there are still concerns related to technology, usability and safety aspects of BEVs. The present study examines the role of perceived accident risk, knowledge, perceived car attributes, subjective norm and perceived behavioral control, together with demographic variables, on intention to buy a BEV among conventional car drivers. A web-survey is used to collect data from 205 conventional car drivers (76.5% male) living in different parts of Norway. A regression analysis is conducted to investigate the predictive role of the measured constructs for the intention to buy a BEV. Results show that environmental-economic attributes of BEVs, subjective norm and perceived behavioral control are positively related to the intention. Meanwhile, being male is negatively related to the intention. Neither perceived accident risk nor the knowledge about BEVs has a direct effect on the intention. However, further mediation analysis shows that both perceived accident risk and knowledge have an indirect effect on the intention through the perceived attributes of BEVs. Implications of the results for interventions aiming to increase BEV adoption are discussed.

Keywords: Battery electric vehicles; perceived accident risk; knowledge; perceived car attributes; Theory of Planned Behavior; Norway

1. Introduction

Electric vehicles are considered as effective technological innovations that contribute to the reduction of environmental problems due to road traffic emissions. Among different types of electric vehicles, battery electric vehicles (BEV) are the most pro-environmental option. BEVs are powered solely by chemical energy stored in rechargeable battery packs, and they have zero tailpipe emissions (Thomas, 2009). In addition to environmental benefits, BEVs also provide economic benefits due to purchase incentives and lower operational costs (e.g. Figenbaum, 2017; Hardman et al., 2017; Zhou et al., 2015).

Despite environmental and economic benefits of BEVs and rapidly increasing interest to them, the market share of BEVs among the other motor vehicles is still small in many countries (Sierzchula et al., 2014; Zhou et al., 2015). In order to identify barriers and facilitators for adoption of BEVs, researchers have investigated a wide array of factors using various methods ranging from revealed preference to stated preference (e.g. Figenbaum, 2017; Figenbaum et al., 2015; Figenbaum et al., 2014; Graham-Rowe et al., 2012; Noppers et al., 2015; Mersky et al., 2016; Schuitema et al., 2013; Wang et al., 2016). Safety aspects related to BEVs, such as accident risk due to low level of noise and reliability of the car, were examined in some previous studies (e.g., Cocron and Krems, 2013; Graham-Rowe et al., 2012; Hanna, 2009), however, the role of perceived safety in predicting the intention to purchase a BEV is rarely examined (Schmalfuß et al., 2017). The present study focuses on the role of perceived accident risks as well some other psychological constructs for predicting the intention to buy a BEV in a Norwegian sample.

1.1. Perceived accident risk related to electric vehicles

Perceived accident risk and uncertainty associated with the electric vehicles constitute a major barrier to adoption of them (Egbue and Long, 2012; Graham-Rowe et al., 2012;

Krause et al., 2013; Oliver and Rosen, 2010). Consumer research shows that consumers perceive higher risks related to performance and financial aspects of new products and consequently, they become less willing to adopt the new products (Aggarwal et al., 1998, Shimp and Bearden, 1982). Since BEVs are relatively new, less is known about the history and characteristics of these types of cars compared to the conventional cars. Therefore, drivers are likely to be uncertain about performance and safety of BEVs and to perceive higher risks related to BEVs. There is a lack of research especially focusing on role of perceived accident risk for adoption of BEVs. Higher accident risk with vulnerable road users, such as pedestrians and bicyclists, due to a low level of vehicle noise, especially at low speeds, has been reported as the major safety concern related to electric vehicles by a few previous studies (Cocron and Krems, 2013; Hanna, 2009). However, such risks arising from the low level of noise of electric vehicles diminish with increased driver experience and use of some vehicle modifications, such as producing artificial vehicle noise (Cocron and Krems, 2013). Except for the increased accident risk with vulnerable road users, there is no evidence that electric vehicles are involved in accidents more often than the conventional vehicles. However, compared to the objective risk, the perceived risk related BEVs is more critical for adoption of BEVs. Therefore, it is important to understand perceived accident risks related to BEVs in a broad context.

Previous research examining risk perception in transport has shown that individuals' perception of accident risk is associated with their transport behaviors (e.g. Fyhri and Backer-Grøndahl, 2012; Nordfjærn et al., 2014; Rundmo and Moen, 2006). In previous studies, perceived accident risk was often based on the perceived probability of being involved in a traffic accident and severity of the consequences of the accident while using a certain travel mode (Lund et al., 2012; Nordfjærn and Rundmo, 2010; Rundmo et al., 2011). As people perceive accident probability as high and consequences as severe when traveling by a

particular travel mode, they tend to decrease this risk by reducing or avoiding using the travel mode (e.g. Fyhri and Backer-Grøndahl, 2012; Nordfjærn et al., 2014; Rundmo and Moen, 2006). Some previous studies found that perceived accident risk predicted feeling of worry, which in turn directly predicted risk-reducing behaviors (Rundmo and Moen, 2006; Rundmo and Nordfjærn. 2013). Hence, perceived accident risk for BEVs might influence adoption of BEVs indirectly as well as directly.

1.2. Perceived attributes of electric vehicles

Although the case of perceived accident risk and uncertainty relating to the adoption of battery electric vehicles gets considerable attention from the consumers, most of the research on individual's purchase decision still relies on choice modeling studies using disaggregated data (see Jong et al., 2004). These studies often use relative preferences among car attributes, together with purchase price and sociodemographic, to predict household ownership of cleaner vehicles (Axsen et al., 2013; Caulfield et al., 2010; Egbue & Long, 2012; Figenbaum & Kolbenstvedt, 2016; Graham-Rowe et al., 2012; Helveston et al., 2015; Hidrue et al., 2011; Jensen et al., 2013; Nayum & Klöckner, 2014; Potoglou & Kanaroglou, 2007; Schuitema et al., 2013; Skippon & Garwood, 2011). Most of these studies show that how people perceive different attributes of vehicles, especially instrumental attributes related to usability and functionality, is critical for adoption these vehicles. For example, limited driving range and charging infrastructure, and higher purchase prices are among the frequently reported negative attributes of electric vehicles; whereas, environmental and economic benefits of electric vehicles are among the common positive attributes (Axsen &Kurani, 2013; Figenbaum & Kolbensvedt, 2016; Graham-Rowe et al., 2012; Hardman et al., 2017; Hjorthol, 2013; Rezvani et al., 2015; Skippon and Garwood, 2011). In addition, previous research has shown that symbolic attributes of electric vehicles (e.g. status enhancement, differentiating from others), which are related with social and self-identity reflected by driving an electric

vehicle, are also important for adoption electric vehicles (e.g. Nayum and Klöckner, 2014; Noppers et al., 2015; Schuitema et al., 2013; Skippon and Garwood, 2011).

1.3. Constructs from the Theory of Planned Behavior (TPB)

In addition to revealed and stated preferences among car attributes, several studies have also examined the role of psychological and social factors for adoption of cleaner vehicles using the Theory of Planned Behavior (TPB) (Ajzen, 1991) as a theoretical framework (Egbue and Long, 2012; Lane and Potter, 2007; Moons and De Pelsmacker, 2012, Wang et al., 2016). According to TPB, people make rational decisions based on their evaluations of the alternative actions, and the immediate predictor of behavior is intentions, which are determined by attitudes (i.e. overall evaluations), subjective norm (i.e. what significant others think) and perceived behavioral control (i.e. to what extent it is easy/difficult to engage in a specific behavior) (Ajzen, 1991). Determinants of the intention in the TPB, especially the attitudes, were the significant predictor of intentions to adopt an electric vehicle in several previous studies (e.g. Moons and De Pelsmacker, 2012, Wang et al., 2016).

1.4. Knowledge about electric vehicles

Besides rational evaluation of consequences and own capabilities necessary to perform the action, knowledge about current evaluation object or action is also important for intention to carry out the action (Stern, 2000). Previous research has shown that personal knowledge and experience increases electric vehicle acceptance (Barth et al., 2016; Schmalfuß et al., 2017), whereas lack of knowledge and lack of experience with electric vehicles constitute a barrier against use of electric vehicles (Egbue and Long, 2012; Graham-Rowe et al., 2012; Krause et al., 2013). In the Theory of Planned Behavior, attitudes towards the behavior are determined by the behavioral beliefs, which are influenced by the level of knowledge (Ajzen

et al, 2011). However, it should be noted that there is often a weak relationship between knowledge and intentions. For example, knowledge and intentions related to some pro-environmental behaviors, such as energy conservation and use of pro-environmental vehicles, were weakly correlated in some previous studies (Ajzen et al., 2011; Nayum et al., 2016). This indicates that having accurate information related to a specific behavior is not sufficient for decision-making, and underlying attitudes and beliefs related to a behavior might be more important than the knowledge for predicting behavioral intentions (Ajzen et al., 2011).

1.5. Demographic characteristics and decision to adopt electric vehicle

Sociodemographic characteristics have been one of the main clusters of predictors of car purchase and ownership in various choice modeling studies. It is also valid with adoption and use of BEVs. For example, being middle-aged (30-50 years), having a higher education and high-income level are some demographic characteristics positively associated with electric car adoption and use (Hjorthol, 2013; Nayum et al., 2016; Plötz et al., 2014). Gender is also associated with adoption of electric vehicles in previous studies (Wang et al., 2016).

1.6 Aims of the study

The main aim of the present study is to examine the role of perceived accident risk, perceived car attributes, TPB constructs (i.e., attitudes, subjective norm, and perceived behavioral control), knowledge about BEVs, and demographic variables in predicting intention to buy a BEV among conventional car drivers. Based on the findings from previous studies (e.g., Moons and De Pelsmacker, 2012; Nayum & Klöckner, 2014; Noppers et al., 2015; Schuitema et al., 2013; Wang et al., 2016), it is hypothesized that favorable rating with environmental-economic attributes of BEVs, and high subjective norm and perceived behavioral control, will significantly and positively relate with the intention to buy a BEV. In line with previous studies showing an indirect relationship between perceived risk and behavior (e.g., Rundmo and Moen, 2006; Rundmo and Nordfjærn. 2013) and a weak

relationship between knowledge and behavior (Nayum et al., 2016), it is also hypothesized that perceived accident risk and knowledge about battery electric cars do not directly predict the intention to buy a BEV. However, perceived accident risk and knowledge are suggested to have indirect effects on the intention to buy a BEV through the perceived car attributes, namely instrumental and environmental attributes of BEVs (see the hypothesized model in Figure 1).

2. Methods

2.1. Sampling and procedure

Since the focus of the study is to investigate factors predicting the intention to buy a BEV among conventional car drivers, only the drivers who do not own a BEV is the target group of the present study. Addresses of conventional car owners living in different parts of Norway were obtained from the Norwegian Public Roads Administration database. An invitation letter asking for participation in a web-survey was sent to 3000 of them by post. The web-survey was preferred as it allows us to gather information related to drivers' plans about buying a BEV within a reasonable time and acceptable cost. By the time of survey closure, 205 car owners responded to the web-survey. This resulted in response rate of 6.8%. As shown in Table 1, majority of the respondents were male and had a higher education (i.e., university education until 3 years or more).

2.2. Measures

The web-survey consisted of a self-administered questionnaire, which includes items measuring perceived accident risk, knowledge about BEVs, perceived car attributes, subjective norm, perceived behavioral control and intention to buy a BEV. In addition, demographic variables, such as age, gender, and education level, were measured.

Perceived accident risk of BEVs was measured by two items. The first item asked about the probability of having an accident with a BEV (1=very unlikely, 7=very likely), whereas the second item asked how severe the consequences would be if an accident happens with a BEV (1= no personal injury, 7=severe personal injury). Perceived accident risk was then calculated by multiplying the scores from these two questions.

Knowledge about BEVs was measured using 11 items (see Appendix), which included both true (e.g. BEVs do not emit exhaust gas) and false statements (e.g. BEVs can only be charged at special charging stations) about the BEVs. The participants responded to the items using three response options (1=true, 2=false, 3=I do not know). These items were later made dichotomous by assigning "1" to the right answers and "0" to the wrong and "do not know" answers. A total knowledge score was then obtained by applying the one-parameter logistic model of item response theory (IRT).

Sixteen items were used to measure perceived attributes of BEVs, which were related to environmental (e.g. "Use of BEVs contributes to reduction of environmental problems"), economic (e.g. "One can save money by using a BEV") and practical aspects of BEVs (e.g. "Long time required for charging the BEVs makes it unpractical to use"). They were developed based on previous studies measuring different attributes of electric cars (Graham-Rowe et al., 2012; Schuitema et al., 2013). In addition, symbolic attributes related to BEV use were measured by 5 items (e.g. "Driving a BEV gives me status"), which were adapted from a previous study measuring symbolic attributes of car use (Noppers et al., 2014). The attribute items were measured using a 5-point Likert type scale (1=completely disagree, 5=completely agree).

Similar to previous studies applying the TPB to transport mode use (Bamberg et al., 2003), subjective norm was measured by two items related to opinions of significant others about buying a BEV (e.g. "People who are important to me would support me if I buy a

BEV"); perceived behavioral control was measured by two items measuring how easy it is to buy a BEV (e.g. "Higher purchase prices make it difficult to purchase a BEV"); and intention to buy a BEV was measured by two items (e.g. "If I buy a car in future, it will be a BEV"). All items related to TPB constructs were rated by the respondents using a 5-point Likert type scale (1=completely disagree, 5=completely agree).

2.3. Statistical Analyses

First, a principal component analysis (PCA) was conducted to identify the dimensional structure of the items measuring perceived attributes of battery electric cars. Kaiser's ''eigenvalue >1" criterion and visual inspection of scree plot were used to decide the number of dimensions. Characteristics of all psychological measures were then examined. Second, a hierarchical multiple regression analysis was performed to investigate the predictors of intentions to buy a BEV among the conventional car drivers. Demographic variables were entered into the analysis in the first step; mean scores of the perceived car attributes and the TPB constructs (i.e., subjective norm and perceived behavioral control) were entered in the second step; total knowledge score was entered in the third step; and perceived accident risk of BEVs was entered in the final step. Before conducting the regression analysis, the data were examined for assumptions of the regression analyses. There were no outliers, multicollinearity or singularity. Finally, a mediation model (see in Figure 1), where the perceived accident risk and the knowledge influence the perceived car attributes, which in turn influence the intention to buy a BEV, was tested using Stata's sem command. A mediation analysis based on the model results was then performed by using Stata's medsem command (Mehmetoglu, 2017).

3. Results

3.1. Dimensional structure and characteristics of the measures

The results of PCA indicated three components solution, which accounts for 50.75% of the variance. These three components were labelled as “environmental-economic attributes” (e.g. “Use of BEV contributes to reduction air pollution”, “one can save money in the long run by driving a BEV”), “instrumental attributes” (e.g. “It is not practical to drive a BEV because of limited charging stations”, “Long time required for charging the BEVs makes it unpractical to use”), and “symbolic attributes” (e.g. “Driving a BEV shows something about me”, “Driving a BEV gives me status”).

Characteristics of all measurements including the number of items, mean scores for the measured constructs, the reliability of measures (i.e., Cronbach´s alphas coefficients) and inter-item correlations can be seen in Table 2. All measures, except for subjective norm and perceived behavioral control, have alphas coefficients above 0.70, which is satisfactory. Relatively low alphas coefficients for the subjective norm and perceived behavioral control could be resulted from measuring them only by two items. All measures have a corrected inter-item correlation above 0.40, which can be considered as satisfactory (Nunnally, 1978). Mean scores were then obtained and used in subsequent analyses.

3.2. Predictors of intention to buy a BEV among conventional car drivers

Results of the multiple hierarchical regression analysis show that subjective norm, perceived behavioral control and environmental-economic attributes are positively related to intention to buy a BEV, whereas, being male is negatively related to intention to buy a BEV (see Table 3). The TPB constructs explain most of the variance in intention buy a BEV. In particular, the perceived behavioral control is the strongest predictor of intention to buy a BEV. Neither perceived accident risk nor knowledge has a significant direct effect on the intention to buy a BEV.

3.3. Mediation effects of perceived car attributes on the relationship between perceived accident risk, knowledge and intention to buy a BEV

Although the results of the hierarchical regression analysis indicate no direct effect of perceived accident risk and knowledge about BEVs on the intention to buy a BEV, they may have influence on the intention via the perceived car attributes reflecting benefits of BEVs. In order to test this hypothesis, a mediation analysis was performed. In the mediation model (see Figure 2), the dependent variable is the intention to buy a BEV and the independent variables are perceived accident risk of BEVs and the knowledge about BEVs, while the instrumental and environmental-economic attributes of BEVs are the mediators. Since the perceived instrumental and environmental-economic attributes of BEVs are related constructs, the covariance between their residual terms was included in the path analysis. Symbolic attributes of BEVs are not included in the mediation analysis, as they are not directly related to benefits and functionality of BEVs.

The results show that the path from perceived accident risk to environmental-economic attributes and the path from environmental-economic attributes to the intention are significant. However, the direct path from the perceived accident risk to the intention is non-significant. In addition, the Sobel's test is significant (Sobel's test=-0.07, $p<0.05$). Therefore, it is concluded that environmental-economic attributes fully mediate the relationship between perceived accident risk and intention to buy a BEV. Similarly, the path from the perceived accident risk to instrumental attributes and the path from instrumental attributes to the intention are significant. Again, the path from the perceived accident risk to the intention is not significant. Besides, the Sobel's test is significant (Sobel's test=-0.04, $p<0.05$). Therefore, in addition to environmental-economic attributes, instrumental attributes also fully mediate the relationship between perceived accident risk and intention to buy a BEV. When it comes to the mediation effects of perceived car attributes on the relationship between knowledge

about BEVs and the intention to buy a BEV, environmental-economic attributes fully mediate the relationship (Sobel's test=0.06, $p<0.05$). Instrumental attributes, on the other hand, have no mediation effect on the relationship between the knowledge and the intention since the path from the knowledge to the instrumental attributes is not significant (see Figure 2)

4. Discussion

Although socio-demographic and attitudinal factors related to BEV adoption have been examined substantially in previous research (Axsen &Kurani, 2013; Figenbaum & Kolbensvedt, 2016; Graham-Rowe et al., 2012; Hjorthol, 2013; Rezvani et al., 2015; Skippon and Garwood, 2011Schuitema et al., 2013), there is a lack of studies focusing on the role of perceived accident risk of BEVs as a predictor variable. The present study aimed to fill in this research gap by examining the role of perceived accident risk, together with well-investigated psychological constructs, in predicting the intention to buy a BEV among conventional car drivers.

Among the demographic variables investigated in the hierarchical regression analysis, gender is the only one that significantly predicts intention to buy a BEV among conventional car drivers. More specifically, women car drivers show more interest to buy a BEV than men do. This is in line with some of the previous findings showing that women are inclined to adopt electric vehicles more than men (Wang et al., 2016), and women have a weaker habit for conventional car use than men do (e.g. Lind et al., 2015; Matthies et al., 2002). However, this finding should be interpreted with caution due to underrepresented female sample. The unequal variances between males and females might have affected statistical power and Type I error rates (Rusticus & Lovato, 2014).

As expected, both perceived behavioral control and subjective norm are significantly and positively related with the intention to buy a BEV. The strongest predictor is the

perceived behavioral control, which is measured by items asking about how easy it is to buy a BEV, especially financially. The finding indicates that whether people can easily afford to buy a BEV or not strongly determines their intention to buy a BEV. This is in line with the previous findings reporting higher costs for purchasing electric vehicles as one of the major barriers against purchasing an electric vehicle (e.g. Egbue and Long, 2012; Graham-Rowe et al., 2012). The second strongest predictor of intention is the subjective norm, which shows that what significant others think about their use of BEVs is important for determining respondent's intention to buy a BEV. Some previous studies examining the role of TPB constructs for predicting intentions to buy electric vehicles also found that both perceived behavioral control and subjective norm are positively related with the intentions (Moons and Pelsmacker, 2012; Nayum et al., 2016; Wang et al., 2016).

Regarding perceived attributes of BEVs, the environmental-economic attributes are significantly and positively related with the intention to buy a BEV, whereas the instrumental and symbolic attributes have no significant effect on the intention. The relatively bigger role of environmental attributes than instrumental attributes for the adoption of sustainable innovations has been demonstrated by previous research (Noppers et al., 2014). Since being environmentally friendly and economical are the main characteristic associated with BEVs, it is not surprising that environmental-economic attributes are the significant determinants of intention in the current study. However, it should also be noted that many Norwegians buy a BEV as their second car instead of replacing a conventional car with a BEV (Klöckner et al., 2013). Therefore, it is likely that instrumental and symbolic aspects are less critical compared to the environmental and economic aspects, especially for the respondents who intend to buy a BEV as their second car.

Neither the perceived accident risk nor the knowledge about BEVs had an effect on the intention to buy a BEV in the hierarchical regression analysis. However, mediation

analysis results show that both perceived accident risk and the knowledge have some indirect effects on the intention through the perceived car attributes. The relationship between the perceived accident risk and the intention is fully mediated by the instrumental and environmental-economic attributes of BEVs. There is a negative relationship between the perceived accident risk and the perceived instrumental and environmental-economic attributes of BEVS. This indicates that as the respondents perceive fewer accident risks related to BEVs, they report more positive attributes about BEVs. This finding is in line with the previous findings showing a negative relationship between perceived risks and benefits of new products (Alhakami and Slovic, 1994; Siegrist and Cvethkovic, 2000).

The relationship between the knowledge about BEVs and the intention is fully mediated only by the environmental-economic attributes. Meanwhile, the instrumental attributes have no significant mediation effect on this relationship. This might be the results of information campaigns and the advertisements about BEVs, which often make environmental and economic aspects of BEVs more salient than technical or practical aspects. Therefore, it is likely that people know more about environmental and economic aspects of BEVs compared to other aspects. Moreover, the positive relationship between the knowledge and the perceived environmental-economic attributes in the mediation model indicates that respondents' knowledge about environmental-economic benefits of BEVs leads to positive evaluations about these attributes. In short, it appears that knowledge about BEVs affect how people evaluate attributes of BEV, especially environmental and economic attributes, rather than affecting the intention directly.

There are some implications of the present study that can be useful for the design of interventions aiming to increase adoption of BEVs among the car drivers. The findings point out the importance of economic aspects for intention to buy a BEV. Perceived behavioral control, which mainly reflects how easy it is financially to buy a BEV, is the strongest

predictor of the intention. In addition, attributes related to environmental and economic aspects of BEV are the only significant group of attributes predicting the intention. Therefore, emphasizing economic benefits of BEVs and making adoption of BEV easy by decreasing the purchase prices might be helpful. The present findings also show that perceived accident risk and knowledge related to BEVs influence how drivers perceive attributes of BEVs. It seems that low perceived accident risk related to BEVs leads to more positive evaluations of instrumental and environmental-economic attributes of BEVs. Therefore, besides technical and safety improvements, measures and information campaign conveying BEVs as safe transport option are useful for further diffusion of BEVs among the population. The findings regarding the knowledge about BEVs implies that drivers interpret knowledge about environmental-economic aspects of BEVs more positively than the knowledge about instrumental attributes. Many people share concerns related to some practical aspects BEVs, such as limited driving range and availability of charging stations, which might lead to a more negative picture about instrumental aspects of BEVs. Hence, in addition to emphasizing economic and environmental benefits of BEVs, emphasizing the improvements in electric vehicle technology and infrastructure might help to create a more positive picture about instrumental aspects of BEVs and hence a wider adoption of them.

Having a relatively low sample size might be considered as a major limitation of the present study. Although a relatively large target group was invited to participate in the study, the low response rate resulted in a relatively low sample size. The low response rate might have been caused by the characteristics of the web-survey, which mainly consisted of items related to BEVs. It is possible that conventional car divers did not find the survey relevant for themselves and consequently were unwilling to respond to it. In addition, it is generally common to achieve a lower response rate to online surveys compared to paper-based surveys (Nulty, 2008). Bearing in mind that the low sample size is a limitation of the present study,

the generalization of the results should be made in caution. Nevertheless, the statistical power of the results is not largely compromised as the number of predictor variables included in the analyses was not high. Another limitation might be related to the measurement of the perceived accident risk. In the present study, it was measured in general without specifying types of accidents, such as an accident with the other motor vehicles or accidents with pedestrians or bicyclists. In future studies, refined measures of perceived accident risk may result in a more detailed picture of the drivers' risk perception related to different types of accidents with BEVs.

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Tables and Figures

Table 1. Sample characteristics

Variables	
Mean age (SD)	55.5 (13.39)
Gender (%)	
Male	76.5
Female	23.5
Education (%)	
Basic education	2
Secondary education (vocational)	16.7
Secondary education (general)	8.8
Bachelor degree or equivalent	26.5
Master's degree or equivalent	46.1
Income (%)	
Under 250 000 kr.	2
250000-350 000 kr.	6.4
350000-500 000 kr.	26.1
500000-900 000 kr.	46.8
Over 900 000 kr.	18.7

Table 2. Scale characteristics

Scales	Mean (SD)	Number of items	α	Average corrected Item-total correlation
Attributes				
Environmental-economic attributes	3.65 (0.59)	8	0.84	0.57
Instrumental attributes	2.84 (0.53)	8	0.79	0.49
Symbolic attributes	2.56 (0.67)	5	0.84	0.66
Subjective Norm	2.94 (0.80)	2	0.64	0.47
Perceived Behavioral Control	3.21 (0.73)	2	0.62	0.45
Intention	2.66 (0.95)	2	0.93	0.86
Perceived accident risk*	14.99 (6.67)	1	-	-
Knowledge about electric cars**	8.02(1.37)	1	-	-

*Perceived accident risk was calculated by multiplying the scores from the items measuring accident probability and severity of the consequences.

** A total knowledge score was obtained by applying the one-parameter logistic model of item response theory (IRT) on 11 true/false statements.

Table 3. Predictors of intention to buy an electric car

Step	Variable	Beta	R^2	R^2 change	F
1			0.147	0.147	3.17***
	Gender (male)	-0.14*			
	Basic education	-0.07			
	Secondary education (vocational)	-0.04			
	Secondary education (general)	-0-06			
	Bachelor's degree	-0-02			
	Income (under 250000)	-0.01			
	Income (250000-300000)	-0-02			
	Income (350000-500000)	0.01			
	Income (500000-900000)	-0-04			
	Age	-0.08			
2			0.608	0.461	18.49***
	Environmental-economic attributes	0.20***			
	Instrumental attributes	0.06			
	Symbolic attributes	0.11			
	Subjective Norm	0.23***			
	Perceived Behavioral Control	0.38***			
3			0.608	0.000	17.26***
	Knowledge about electric cars	-0.02			
4			0.612	0.004	16.43***
	Perceived accident risk	-0.07			

*p<0.05, ***p<0.001

Dependent variable is the mean score for intention to use an electric car (1=completely disagree, 5=completely agree)

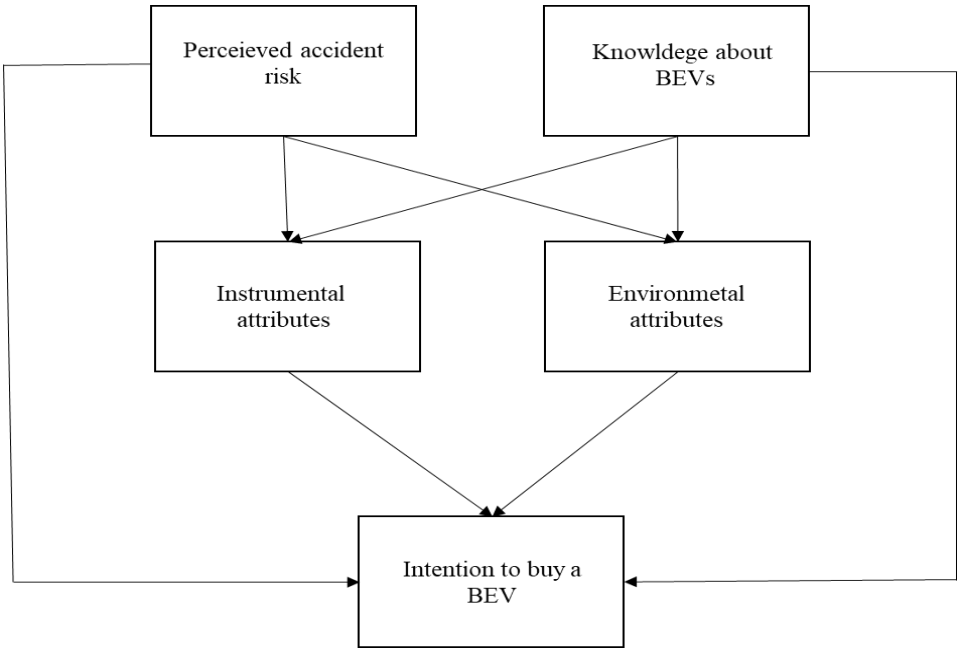
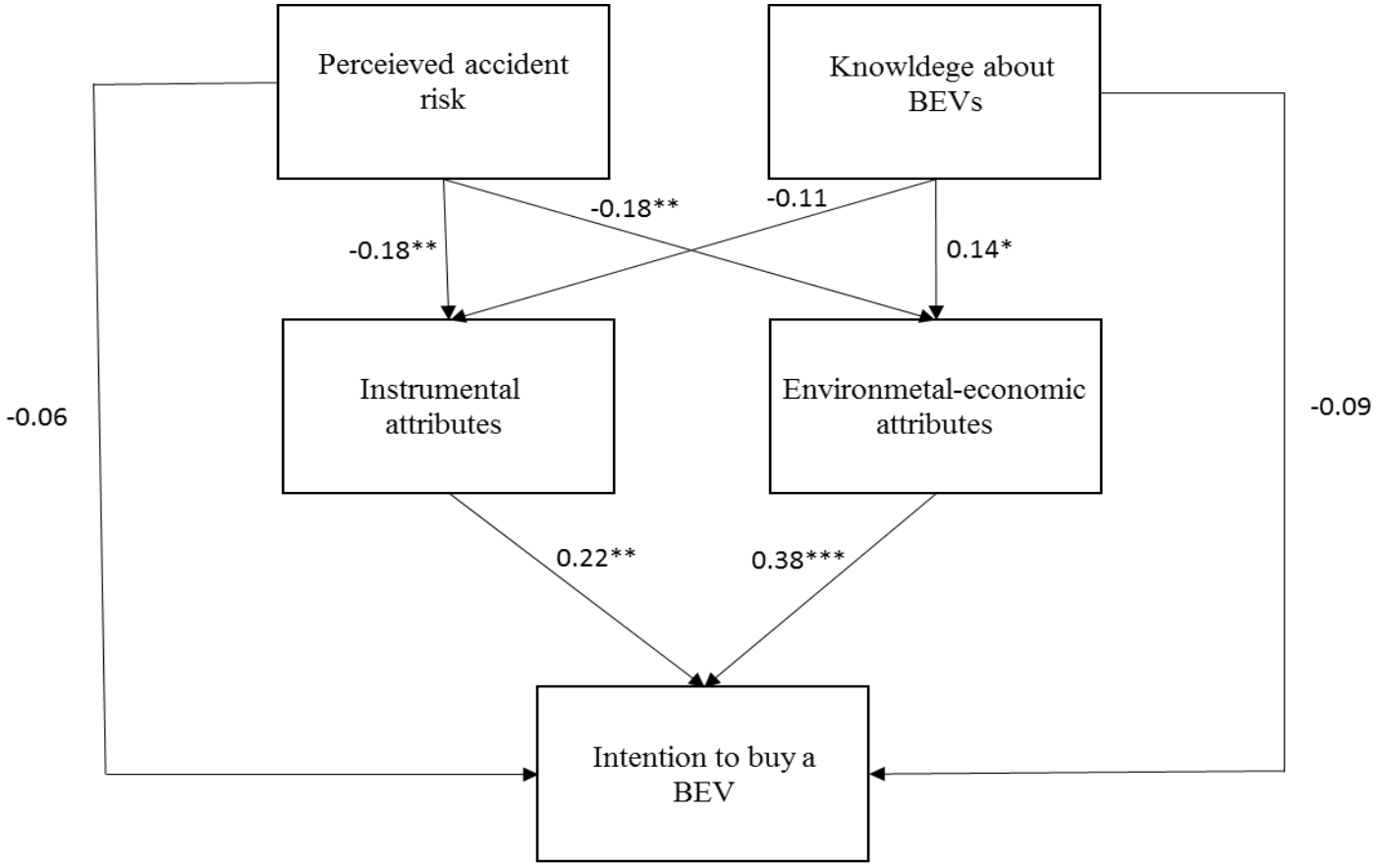


Figure 1. Hypothesized mediation model showing the process underlying the relationships between perceived accident risk, knowledge, perceived car attributes and the intention to buy a BEV



*p<0.05; **p<0.05, ***p<0.001

Figure 2. The results of the hypothesized mediation model

APPENDIX

Knowledge scale

Below there are statements about plug-in fully electric cars (i.e. ***electric cars that are powered only by a battery which is charged by plugging it into an electrical socket***). Please indicate whether these statements are true or false. If you do not have an idea about the statement, then please choose "I do not know" option.

A plug-in fully electric car…	True	False	I do not know
can only be charged at dedicated charging points.			
generates less CO_2 emissions than the conventional cars.			
is generally cheaper to buy than a conventional car.			
is cheaper to operate than conventional cars in the long run.			
does not emit tailpipe pollutants (i.e. exhaust gas).			
has mostly a lower maximum speed than conventional cars.			
can be charged in a longer time than a conventional car.			
is mostly smaller than a conventional car.			
produces more sound than a conventional car.			
has a manual gearbox.			
are exempt from paying some fees including purchase taxes and annual road tax in Norway.			