Transportation Research Interdisciplinary Perspectives 11 (2021) 100439

Contents lists available at ScienceDirect

Transportation Research Interdisciplinary Perspectives

journal homepage: www.sciencedirect.com/journal/transportation-research-interdisciplinary-perspectives

Assessment of electric vehicle repurchase intention: A survey-based study on the Norwegian EV market

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ARTICLE INFO

Keywords:
Electric vehicle
Planned behaviour theory
Behaviour analysis
Consumer satisfaction
Structural equation model
Repurchase intention

ABSTRACT

Electrification of vehicles is one of the most promising measures for decarbonising the transport system. Several countries worldwide have implemented policy incentives to promote mass electric vehicle (EV) adoption to mitigate the environmental and energy-related challenges caused by the increased demand for road transportation. As a result, the number of EVs on the road is growing in several countries. However, despite the growing demand, many consumers are still sceptical about EVs. The aim of this study is to evaluate consumers' EV repurchase intention by using an extended theory of planned behaviour (TPB). Studies on EV adoption have found TPB determinants of intention to be relevant. Additionally, this study argues that the effects of satisfaction should be considered in addition to the TPB elements to better understand repurchase intentions. Consequently, this study includes EV users' satisfaction with relevant aspects such as range-recharge, environmental attributes, cost, availability, symbolic attributes, and use-based policy measures. A structural equation model (SEM) was established to analyse a survey dataset consisting of 278 Norwegian EV owners. To assess satisfaction with EV use and the behavioural intention of EV repurchases, only the responses from actual EV users were studied. This is important because consumers with no prior experience with EVs tend to inaccurately portray their interest in a new product or service. The findings are of interest for both policymakers and EV manufacturers seeking to gain actionable insights into EV owners' needs and perceptions concerning EV attributes, thus developing and implementing better strategies to increase EV attractiveness and performance.

1. Introduction

Electric vehicles (EVs) have shown great potential in ensuring energy security and reducing tailpipe emissions and local pollution caused by increased road transportation (Hardman et al., 2017; Mersky et al., 2016; Wu et al., 2021). Therefore, policymakers worldwide are supporting EV adoption through monetary and nonmonetary policy measures to boost both supply and demand. However, widespread EV adoption is still hindered by economic, institutional, and behavioural barriers (Contestabile et al., 2017; Sykes and Axsen, 2017). As of 2019, approximately 7.2 million EVs were on the road, which was a massive increase from approximately 17,000 in 2010 (IEA, 2020), but only 20 countries had EV market shares above 1% (IEA, 2020). Norway has been the leader for EV market share over the past several years. Almost 75% of all new cars sold in 2020 in Norway were EVs (Norsk Elbilforening, 2020).

Various types of EVs are available on the market—battery EVs (BEVs), hybrid EVs (HEVs), and plug-in HEVs (PHEVs). Among them, only BEVs (e.g. Tesla, Audi e-tron, Nissan LEAF) operate solely on electricity stored in an onboard battery pack. These vehicles are therefore frequently known as 'pure- or all-EVs' (Campanari et al., 2009). By contrast, HEVs (e.g. Toyota Camry Hybrid, Honda Civic Hybrid) combine an internal combustion engine (ICE) with an electric motor and are more fuel-efficient than similar-sized ICE vehicles (Egbue and Long, 2012; Schuitema et al., 2013). The battery on board an HEV is recharged through regenerating braking and by the ICE (Rezvani et al., 2015). PHEVs (e.g. Mitsubishi Outlander, Volkswagen Golf GTE) are equipped with more powerful electric batteries than HEVs and can be recharged via electricity grids (Schuitema et al., 2013). Consequently, only BEVs have zero tailpipe emissions and are therefore considered better at mitigating the environmental challenges caused by road transportation (Liu and Wang, 2017). Finally, it should be noted that BEVs and PHEVs are frequently called 'plug-in vehicles' because they can be plugged into the electricity grid to recharge the batteries.

Several countries have promised to sell only EVs in the near future. For instance, according to Wappelhorst (2020) and Wappelhorst and Cui (2020), Norway aims to phase out ICEVs by 2025; Iceland, Ireland, the Netherlands, and Sweden, by 2030; Scotland, by 2032; Denmark and the

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https://doi.org/10.1016/j.trip.2021.100439
Received 14 March 2021; Received in revised form 25 July 2021; Accepted 3 August 2021
Available online 2 September 2021

United Kingdom, by 2035; France and Spain, by 2040; and Costa Rica, by 2050. Hardman and Tal (2021) claimed that to achieve a large market share for any new product, consumers must make the initial purchase, continue to purchase it, and not purchase back the other product whenever they replace their initial purchase. Moreover, consumers are the key participants in the EV diffusion process because it is they who must ultimately accept this technological innovation (Hoeft, 2021; Daziano and Chiew, 2012). In line with this, it is necessary to encourage the non-EV owners to purchase EVs as their next car and existing EV owners to keep using their EVs and/or to choose EVs again when they replace their old ones. Further, automotive retail markets are among the most mature and developed markets (Jørgensen et al., 2016), and, therefore, repurchases and loyalty are also crucial from carmakers' economic perspective. Loyal customers are less price-sensitive and more likely to pay higher prices than other customers (Krishnamurthi and Raj, 1991). Mellens et al. (1996) posit that the marketing cost of attracting new customers is much lower than that of retaining existing customers. However, a few studies have endeavoured to investigate consumers' EV repurchase intention.

Several studies have used the theory of planned behaviour (TPB) to investigate EV purchase intentions (e.g. Abrahamse et al., 2009; Degirmenci and Breitner, 2017; Haustein and Jensen, 2018). The TPB framework explains behavioural intention and behaviour by means of social norms, perceived behaviour control, and attitudes (Ajzen, 1991). Consequently, these TPB constructs are also relevant for studies assessing EV repurchase intention. We argue that expanding this TPB framework by including consumers' overall satisfaction with EV use would produce in-depth insights. Consumer satisfaction is one of the main drivers of consumer loyalty and behaviour (Mittal and Kamakura, 2001; Szymanski and Henard, 2001). Nevertheless, the direct effect of satisfaction on repurchase and loyalty varies between industries (Olsen, 2007). The inconsistent relationship between satisfaction and repurchase loyalty varies depending on additional elements such as personal characteristics, social norms, and intention (Fournier and Mick, 1999; Homburg and Giering, 2001; Mittal and Kamakura, 2001).

For transport innovations such as EVs, actual EV users could plausibly have different attitudes towards EVs than consumers who do not have any real-life experience with EV use. Hoeffler (2003) posits that consumers have more significant uncertainty when they try to estimate the future utility of a truly new product. With that said, it seems promising to study the responses from actual EV users to obtain an in-depth understanding of consumer satisfaction with EVs, their behaviour, and intention to purchase EVs (Chu et al., 2019). Moreover, Okada et al. (2019) and Schmalfuß et al. (2017) identify differences in purchase intention and satisfaction with EV attributes between post-purchase EV users and non-EV users. However, most EV studies are on the data of intended EV users rather than the actual EV user. Therefore, we argue that more studies on actual EV users are necessary for obtaining insights about the behaviour of consumers in the market.

Subsequently, the overall objective of this study is to generate knowledge of EV owners' repurchase intention, a topic few studies have investigated. More specifically, the primary aim of this study is twofold. First, this study explains EV owners' repurchase intentions using a TPB model integrated with post-purchase consumer satisfaction. According to TPB, assessing behavioural intention is a practical way to predict ultimate actions. Huang and Ge (2019) noted that a stronger purchase intention is associated with a greater purchase likelihood by individuals. Second, this study identifies the attributes of EVs that most strongly influence overall consumer satisfaction with EVs. This study analysed Norwegian EV users' data collected by a survey questionnaire method. The exemplary growth of EV market share over the last several years in Norway provides an ideal environment for analysing EV users' repurchase intention. A structural equation model (SEM) was used to investigate the relationships among the factors.

This study contributes to the EV literature in multiple ways. First, this study anchors consumers' EV repurchase intention in a rigorous behavioural framework based on the TPB expanded by consumers' overall satisfaction with EV use. Thus, it produces in-depth knowledge about the factors playing critical roles in their behavioural intention around EV repurchase. Second, this study integrates multiple EV attributes such as cost aspects, range-recharge, policy measures, environmental attributes, symbolic attributes, and availability of EV models to measure their impacts on consumers' overall satisfaction with EV use. It is helpful to realise the strengths and weaknesses of the current EV market policies and advancements. In addition, this study uses SEM to learn how factors are interrelated so as to comprehend the complete pathways of their influences. Lastly, this study analyses survey responses of actual EV users from a country with the highest EV market share. Thus, insights from this study can inform the broader EV diffusion process. The findings are of interest for assisting both policymakers and manufacturers to realise what needs to be improved to retain and repeat consumers' purchases, which, in turn, helps improve resource allocation. Furthermore, we argue that insights derived from a study on consumers' repeated EV purchase intention would also be somewhat crucial to comprehending consumers' acceptance of autonomous vehicles. Alsalman et al. (2021) claimed that insights from current technological issues (e.g. charging time, charging type, and driving range) related to EVs are critical to reasonably comprehending the transition towards autonomous vehicles (AVs) as the fuel system of AVs is expected to be electrical. In line with this, factors playing a significant role in EV repurchase intention, attributes contributing to consumers' overall satisfaction with EV use, and understanding of the complete pathways of the effects among factors are relevant for analysing the market of AVs as well.

The remainder of this paper is organised as follows. Section 2 provides a comprehensive literature review of the TPB, consumer satisfaction, and the relevant factors influencing EV usage and purchase intention. Section 3 describes the methodology used to conduct the empirical analysis. Section 4 details the results of the empirical analysis. Section 5 includes the discussion and implications, and Section 6 provides some concluding remarks.

2. Literature review

2.1. Theory of planned behaviour (TPB)

This study uses the TPB (Ajzen, 1991) to understand the repurchase intention of EV users. The TPB is a useful and robust framework to explain individuals' intention and behaviour. This can explain why it has been used in several studies to explore consumer intentions to purchase EVs (e.g. Abrahamse et al., 2009; Degirmenci and Breitner, 2017; Haustein and Jensen, 2018; Moons and Pelsmacker, 2015; Schmalfuß et al., 2017; Simsekoglu and Nayum, 2019; Wang et al., 2016). The TPB framework assumes that behavioural intention is determined by an individual's attitude (e.g. purchasing EVs, purchasing ICEVs, riding the bus), perceived social pressure to engage or not to engage in a behaviour (e.g. people who are important to me are considering buying electric cars), and perceived ability to engage or not to engage in a behaviour (e.g. it is difficult to reach my destination with EVs because of their low battery range) (Ajzen, 1991). Therefore, all TPB determinants of behavioural intention—attitude, subjective norms, and perceived behavioural control—are relevant in studies on EV purchase intention. However, studies have reached mixed findings about their effects on EV use intention. Simsekoglu and Nayum (2019) find that subjective norms and perceived behavioural control are significantly and positively related to EV purchase intention among ICEV users. In addition, Kaplan et al. (2016) established a model that finds the expected linkage between electric commercial vehicle procurement intention and TPB constructs. In contrast, Huang and Ge (2019) find no statistically significant effect of subjective norms on purchase intention in a study of EV development in Beijing, while Asadi et al. (2021) find no statistically significant effect of perceived behavioural control on behavioural intention of EV use after analysing EV development in Malaysia.

According to the TPB framework, individuals systematically consider, process, and use the information available to them to decide any behavioural acts, which is a rational process of a sequence leading from beliefs to behaviour (Donald et al., 2014). However, although widely used, this framework has faced criticism over the years for estimating low predictive efficacy to explain an individual's behavioural intention and behaviour, which is apparently the result of insufficient determinants (Tommasetti et al., 2018). Notably, scholars from different fields of study, including transportation, exploited an extended theory of planned behaviour to account for additional determinants, such as moral norms and anticipated regrets (Wang and Xu, 2021); descriptive norms, environmental concerns, and habits (Donald et al., 2014); and moral obligations, awareness of consequences, and sustainable usage behaviour (Si et al., 2020). Given this tendency, the TPB framework was previously extended to include emotions (Moons and Pelsmacker, 2015); perceived mobility necessity, personal norms, and BEV experiences (Haustein and Jensen, 2018); environmental concerns and personal moral norms (Wang et al., 2016); perceived EV attributes, perceived accidental risk, and knowledge about EVs (Simsekoglu and Nayum, 2019); user experience (Schmalfuß et al., 2017); and cognitive status, product perception, and monetary and nonmonetary policy incentives (Huang and Ge, 2019) to examine the willingness to purchase EVs.

EVs are a technological innovation, given their physical and functional differences from conventional vehicles (Axsen and Kurani, 2012). Consequently, the vast majority of consumers are still sceptical about the performance and use of EVs. Thus, they frequently associate EVs with negative functional perceptions related to having a lower battery range, long recharging time, and lower driving performance at low temperatures (Haustein and Jensen, 2018). However, Haustein and Jensen (2018) argued that the perceived difficulties in using EVs (e.g. BEVs have too low a driving range) are difficult to differentiate from the TPB construct of perceived behavioural control (e.g. it is difficult to reach my destination with BEVs). Because of conceptual similarities, studies have operationalised such negative functional perceptions as perceived functional barriers (Haustein and Jensen, 2018) and operational ease of EV use (Kaplan et al., 2016). In line with this, the present study operationalises consumers' negative attitudes or negative perceived perceptions of EV use as perceived functional barriers and refers to the positive attitudes towards EV use as 'attitudes'.

2.2. Consumers' overall satisfaction

The present study extended the framework of TPB by including consumers' overall satisfaction with EV use, presuming its importance in their next purchase decision. The role of customer satisfaction in repurchase intention is critical. Generally, satisfaction is referred to as the evaluation outcome of related experiences and exchanges realised after consumption behaviour (Fang et al., 2016; Holmes, 1991; Kim, 2012; Liang et al., 2018). Although satisfaction and attitude are commonly considered as synonymous, their conceptual definitions are different (Fu and Juan, 2017). Hunt (1977) argues that attitude is an emotion and that satisfaction is the evaluation of that emotion. Customer satisfaction with a product or service is a strong determinant of repeated purchase intention and word-of-mouth recommendations, which, in turn, increase customer loyalty, profitability, and market share of that product or service (Anderson et al., 1994; Bernhardt et al., 2000; Nadiri et al., 2008; Su et al., 2016; Walsh and Bartikowski, 2013). Studies suggest that satisfaction positively influences intentions regarding both EV repurchases and EV recommendations to others (Gyesoo, 2016; Koklic et al., 2017; Kwon et al., 2020; Liang et al., 2018).

Fu and Juan (2017) found a statistically significant influence of satisfaction on attitude while investigating the motivations underlying transport mode choice using TPB and customer satisfaction theory. It has been argued that satisfaction increases the likelihood of a target product or service being included in the list evoked by consumers as well as the favourability of attitude towards it. It also increases the degree of repurchase intention (Fu and Juan, 2017; Oliver, 1980). In line with this, we argue that consumers' satisfaction with EV use should affect their attitudes and perceived functional barriers to EV use. Thus, we assume that it is relevant to also examine these connections in our study. However, Bakti et al. (2020) did not find a statistically significant influence of satisfaction with attitudes when studying survey responses from three Indonesian cities to research public transport passengers' word-of-mouth communication using TPB, consumer satisfaction theory, and personal norm theory. In addition, findings about the influence of subjective norms on overall satisfaction have been inconclusive. This was confirmed in Fu and Juan (2017), although Bakti et al. (2020) could not confirm the influence as statistically significant.

2.3. Potential factors influencing consumer satisfaction with EV use

The overall satisfaction with EV use depends on users' evaluation of different EV attributes. Studies (Caber et al., 2013; Matzler et al., 2003) have identified the critical relationship between the performance of product or service attributes and overall consumer satisfaction. Huang and Ge (2019) used consumers' satisfaction with different EV attributes to measure product perception in order to examine its influence on EV purchase intention. Kwon et al. (2020) found that range satisfaction, charging satisfaction, and cost-saving intention have a statistically significant influence on overall satisfaction with BEV use based on an analysis of survey responses from actual BEV owners in South Korea.

To assess consumer acceptance of EVs, researchers have investigated the role of several factors, such as higher front costs and lower operation costs (Caperello and Kurani, 2012; Egbue and Long, 2012; Graham-Rowea et al., 2012; Sovacool and Hirsh, 2009; Zhang et al., 2011), the importance of consumers' environmental values and perceptions (Egbue and Long, 2012; J. Kim et al., 2014; Lane and Potter, 2007; Simsekoglu, 2018; Skippon and Garwood, 2011), instrumental attributes (Azadfar et al., 2015; Neubauer and Wood, 2014), policy incentives (Langbroek et al., 2016; Lévay et al., 2017), symbolic attributes (Gjøen and Hård, 2002; Heffner et al., 2007), and the availability of EV models (Hasan & Mathisen, 2021; Hoen and Koetse, 2014) in widespread EV adoption. Thus, previous findings provide a clearer picture of the potential attributes that influence EV usage and, in turn, play a role in formulating overall satisfaction after usage.

Policymakers are introducing incentive packages to motivate consumers to buy and use EVs. In Norway, the first EV policy to make EVs more attractive (temporary exemption from import tax) was introduced in 1990, and then, gradually, more incentives were added to achieve mass EV adoption (Figenbaum et al., 2015; Norsk Elbilforening, 2018). In addition to purchase incentives, Norway implemented use-based policy measures to benefit BEV users, such as bus-lane access and exemption from road tolls, parking fees, and ferry fees. Studies have found that these perks influence EV adoption in Norway (Aasness and Odeck, 2015; Bjerkan et al., 2016; Fearnley et al., 2015; Figenbaum, 2017). In Norway, the market share of EVs increased from 5.7% in 2013 to almost 75% in 2020 (Statista, 2021). The effect of policy measures has been prominent in other countries as well. Huang and Ge (2019) find that monetary policy incentives have significantly influenced EV purchase intention among consumers in Beijing. However, they find that nonmonetary incentives (e.g. right to use bus lanes, separate allocation of EV license plates, and abolishment of restrictions on traffic of EVs) have no significant influence on EV purchase intention. Santos and Rembalski (2021) posit that purchase incentives that reduce EV purchase cost are effective in accelerating the mass-market penetration of BEVs in the UK.

In addition, technological differences mean that EVs require less maintenance than ICE vehicles (Palmer et al., 2018). Moreover, increased energy efficiency (Helmers and Marx, 2012; Larminie and

Lowry, 2003), combined with a lower tax rate on electricity (Palmer et al., 2018), reduces the operating costs of driving EVs. Krishna (2021) noted that running costs of EVs are highly dependent on the local electricity costs.

Low battery range, lengthy recharging duration, and lack of charging infrastructures hinder the widespread adoption of EVs (Greene et al., 2020; Rommel and Sagebiel, 2021)—such limitations of EVs cause psychological stress known as ‘range anxiety’ (Melliger et Al., 2018). Franke et al. (2017) claim that consumers’ psychological range or subjectively available ranges play a significant role in range satisfaction, which, in turn, influences EV purchase intention. Greene et al. (2020) indicate that the availability of charging infrastructures can reduce consumers’ range anxiety and thus offset a significant fraction of perceived cost penalty triggered by BEVs’ low range and long recharging time. Recently, in another study on California’s EV owners, Hardman and Tal (2021) reveal that dissatisfaction with the convenience of charging is one of the significant factors in discontinuation of EV use. Previously, Chu et al. (2019) found that battery charging and battery range are the two greatest causes of dissatisfaction among both Chinese and Korean EV users. However, Rauh et al. (2017) and Franke and Krems (2013) found that vehicle owners tend to overestimate their range needs for their day-to-day driving patterns. EV users’ attitudes change as a result of the practical driving experience. Study shows that BEV users gradually adopt the range through modifying their behaviour and view BEVs more positively after driving for a few weeks (Bühler et al., 2014; Bunce et al., 2014; Franke and Krems, 2013; Labeye et al., 2016). However, in a study on Canadian new vehicle buyers, Miele et al. (2020) find that charging and refuelling station availability plays a minimal role in stimulating new EV sales.

EVs are transport innovations with better fuel efficiency than conventional cars with ICEs, have fewer or zero local carbon emissions, and generate little engine noise, thus improving the overall driving experience (Axsen and Kurani, 2012; Degirmenci and Breitner, 2017; Zhao and Heywood, 2017). Kim et al. (2014) posit that the intention to purchase an EV is encouraged by environmental concerns and technological acceptance. Regarding environmental awareness, Okada et al. (2019) claimed that, despite posing a significant direct influence on satisfaction ratings for those who do not own or use EVs, environmental awareness does not have a significant direct influence on post-purchase satisfaction ratings for those who own and use EVs. However, environmental concerns and economic motives are the most important indicators for the overall satisfaction of Chinese and Korean EV users, respectively (Chu et al., 2019).

Symbolic attributes were important to early consumers of BEVs in Norway and Austria as well as to first-time buyers of HEVs in California (Gjøen and Hård, 2002; Turrentine and Kurani, 2007). Schuitema et al. (2013) posit that the likelihood of EV adoption is influenced by perceptions of instrumental, hedonic, and symbolic attributes. Moreover, in a study on Norwegian EV users, Ingeborgrud and Ryghaug (2019) argue that a successful penetration of BEVs in the market requires both

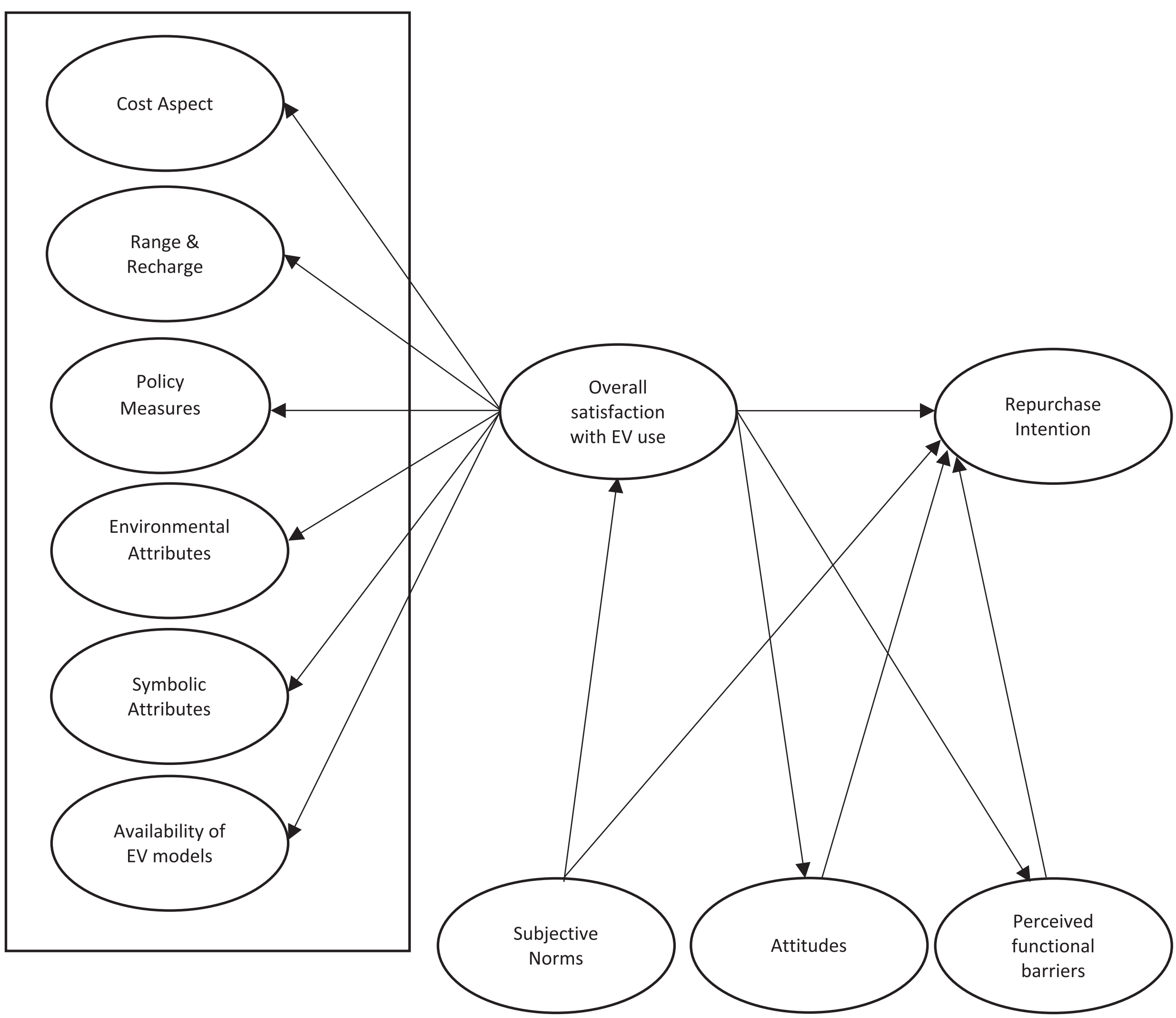

Fig. 1. The hypothesised extended TPB model to assess EV repurchase intention.

material and symbolic dimensions of ownership and use.

The availability of multiple EV models is essential so that prospective buyers can choose the most desirable model. In a study on Dutch private car owners using choice experiments, Hoen and Koetse (2014) find that the availability of models in the market positively affects EV acceptance but to a significantly lesser extent. Moreover, among other factors, brand image, perception, and loyalty influence car buyers' purchasing process (Devaraj et al., 2001; Helveston et al., 2015; Hirsh et al., 2016). A consumer survey analysis on Chinese consumers' willingness to pay for a car brand based on its country of origin reckoned that Chinese people mostly prefer cars manufactured in Germany. Korean, Japanese, American, and Chinese brands rank second, third, fourth, and fifth, respectively (iCET, 2016).

Based on the above reviewed literature, Fig. 1 presents the hypothesised model to analyse the EV repurchase intention of EV users. This illustrates that EV users' satisfaction with EV attributes reflects their overall satisfaction, which is measured using second-order factor analysis. The model includes the following EV attributes: range-recharge, cost, environmental attributes, symbolic attributes, availability of EV models, and policy measures. Moreover, based on the reviewed literature, the model hypothesised that the direct influences from consumers' overall satisfaction, subjective norms, attitude, and perceived functional barriers manipulate their behavioural intention of EV repurchase. Furthermore, in line with previous studies, the model tested the effect of subjective norms on overall satisfaction and the effects of overall satisfaction on attitude and perceived functional barriers.

Although our study focuses on behavioural intention, it also provides insights for predicting actual behaviour. Studies show the correlation between intention and behaviour. In a meta-analysis study, Sheeran (2002) showed that the correlation between behavioural intention and actual behaviour varies between 0.42 and 0.82, while the average correlation between intention and behaviour is 0.53, which is considered a strong covariation (Cohen, 1992).

3. Method

3.1. Sampling

For the purpose of this study, a web-based questionnaire was developed. The data were collected between March and May 2019. The invitation to participate in the survey was mailed to 4,330 car owners who were drawn from a dataset of randomly selected registered owners of EVs and ICEVs provided by the Norwegian Public Roads Administration. The invitation letter included a web address where they could find the questionnaire. A total of 451 respondents filled out the questionnaire, yielding a response rate of 10.42%. Among them, 278 (62%) participants owned EVs. As this study focuses on satisfaction with EV use and EV repurchase intention, only the questionnaires completed by the 278 respondents owning EVs were used in the analysis. Among the EV owners, there were 256 (92%) BEV owners, 15 (5%) PHEV owners, and only 7 (3%) HEV owners. The statistical distribution of the sample is shown in section 4.1.

3.2. Measures

To investigate the intention to repurchase EVs, this study applied, as previously mentioned, a web-based questionnaire. At the beginning of the questionnaire, the respondents were asked what type of car (i.e. BEV, PHEV, HEV, or ICEV) they had bought most recently, the model of that particular car, how long they had owned it, the total number of vehicles in the household, and their driving habits. For the purpose of this study, only responses given by owners of BEVs, PHEVs, and HEVs were included in the analysis.

In the demographic section of the survey, the respondents were asked to reveal their gender and marital status, their annual income before tax and academic qualifications, and the number of inhabitants in the municipality where they lived.

The respondents were asked to state their satisfaction with relevant EV attributes using a 5-point Likert scale ranging from 1 (not satisfied) to 5 (extremely satisfied) based on their experience with their EV. Respondents stated their satisfaction with six EV attributes: range-recharge, symbolic attribute, use-based policy measures, cost aspects, environmental attribute, and availability. Each of these attributes comprised various items and was chosen based on studies that examined the relevant attributes for EVs (e.g. Bakker and Trip, 2013; Chorus et al., 2013; Egbue and Long, 2012; Langbroek et al., 2016; Schuitema et al., 2013; Simsekoglu, 2018; Solvoll et al., 2010). The range-recharge attributes were assessed using three items (e.g. battery range and battery range during winter). Both use-based policy measures and cost aspects encompass the economic elements of EV use. Use-based policy measures have focused only on the local incentives that benefit EV users. Thus, the items measuring this attribute were formulated as follows: exemption from road tolls, ferry fees, and parking fees, and access to bus lanes. Consumers' satisfaction with cost aspects was measured using three items (e.g. EV purchase cost and recharging cost). Environmental attributes were assessed using four items that address EVs' environmental benefits at local and national levels (e.g. tailpipe emissions and traffic noise). Four items focusing on the availability of EV models, brands, and nearby local EV dealers were used to measure consumers' satisfaction with EV availability. Symbolic attributes were assessed employing five items (e.g. 'EV is a car that shows who I am').

In the third section of the survey, participants graded their degree of approval for 12 items using a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) to measure their subjective norms, perceived functional barriers, and attitudes towards EV use. To assess subjective norms, respondents answered questions about five items (e.g. 'people who are important to me recommended that I buy EVs'). Perceived behavioural barriers were measured by addressing the functional difficulties of EV use using four items (e.g. 'I am worried about running out of charge while driving EVs'). Participants answered questions about three items (e.g. 'I believe my EV saves me money in the long run'), which were formulated to measure their attitudes towards EV use. Repurchase intention was measured using three items (e.g. 'I am planning to buy EVs' and 'I am determined that my next car will be an EV'). These constructs were developed based on studies (Degirmenci and Breitner, 2017; Haustein and Jensen, 2018; Kaplan et al., 2016; Schmalfuß et al., 2017) that investigated the role of TPB in EV acceptance. The measurement items for all the constructs are presented in Table 3 in the Results section.

3.3. Statistical analysis

After the descriptive analysis was performed on the sample demographic characteristics, as a second step, Cronbach's alpha coefficient, Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy, and Bartlett's test of sphericity were calculated to examine the reliability and validity of the scales. Finally, the EV users' behavioural framework was investigated by formulating an SEM considering its beneficial feature of assessing the relationships between multiple factors. SEM combines both confirmatory factor analysis (CFA) and path analysis with simultaneous inclusion of both observed and hidden variables (Kiraz et al., 2020).

In the process of formulating the SEM approach, initially, measurement models for the latent constructs were tested. The latent constructs are 'range-recharge satisfaction' (RRS), 'symbolic-attribute satisfaction' (SAS), 'policy-measures satisfaction' (PMS), 'environmental-attribute satisfaction' (EAS), 'cost satisfaction' (CS), 'availability satisfaction' (AS), 'subjective norms' (SN), 'perceived functional barriers' (FB), 'attitudes' (ATT) and 'repurchase intention' (RI). After well-fitting measurement models were established, in line with the reviewed literature in Section 2, the structural model was specified as in Fig. 1. Based on the six components RRS, SAS, PMS, EAS, CS, and AS, a second-order construct, 'overall satisfaction with EV' (OSE), was established to capture the shared variance of the six separate facets of satisfaction related to EV use. In other words, the latent variable 'overall satisfaction with EVs' represents the overarching satisfaction with EVs across all six components. Finally, the construct RI was expected to be predicted by the constructs of OSE, SN, ATT, and FB. In addition, on the basis of the reviewed literature, we also tested the relationship of OSE with SN, ATT, and PFC in the same model.

4. Results

4.1. Descriptive statistics

Table 1 shows that there were more males than females in our sample. Of 278 respondents, the majority (71%) were male; 29% were female; and only one respondent preferred not to mention gender. Eighty-one percent of the respondents were over 40 years old, and a majority (32%) were between 51 and 60. More than three-quarters (78%) of respondents earned more than 500,000 kroner (≈ $54,000), while a majority of them (32%) earned more than 800,000 kroner. Regarding educational qualifications, nearly half (44%) of the respondents had completed more than three years of university study.

Table 1
Descriptive statistics of the sample (n = 278).

	Count	Percentage
Gender:		
Male	197	71%
Female	80	29%
Age:		
18–30	4	1%
31–40	50	18%
41–50	75	27%
51–60	88	32%
61–70	46	17%
>70	15	5%
Annual Income before tax:		
<250 000 kroner	3	1%
250 000 – 350 000 kroner	13	5%
350 000 – 500 000 kroner	46	17%
500 000 – 650 000 kroner	80	29%
650 000 – 800 000 kroner	48	17%
>800 000 kroner	88	32%
Education:		
Primary	7	3%
High School, vocational	35	13%
High School, general education	36	13%
≤ 3 years of college/university	77	28%
>3 years of college/university	123	44%
Household numbers:		
1 member	23	8%
2 members	114	41%
3 members	57	21%
4 members	54	19%
5 members	2	9%
6 members	4	1%
7 members	2	1%
Marital Status:		
Married/Cohabiting	238	86%
Single	36	13%
Kilometres travelled on average day		
Less than 10 km	24	9%
10–20 km	47	17%
21–30 km	42	15%
31–40 km	43	15%
41–50 km	49	18%
More than 50 km	73	26%
Number of cars in households		
1	82	29%
2	157	56%
3	32	12%
4	5	2%
More than 4	3	1%

Eighty-six percent of the respondents were married or living with cohabitants, and 41% of the respondents' households consisted of two people. Four respondents preferred not to mention their marital status.

On the basis of an extensive survey among Norwegian BEV owners, Fevang et al. (2020) reported that men made up 72% of the respondents, that their average age was 51, that the majority of them earned more than one million kroner, and that 88% a college or university education. These findings indicate that our sample broadly resembles that of Norwegian owners of BEVs.

According to the data, 9% of respondents stated that they travelled on average less than 10 km a day, and 56% of respondents did not travel on average more than 40 km a day. This indicates that, on average, they travel within the battery range of a fully charged EV. Statistics Norway (2017) reports that a Norwegian drives, on average, 34 km (21 miles) a day.

Furthermore, for 29% of respondents, an EV is the only car in the household, and 56% of respondents claimed to have two cars in their household. This suggests that most EV owners have more than one car in their household. This is consistent with the findings of Holtsmark and Skonhoft (2014), which indicates that the policy measures in Norway are motivating high-income families to purchase an EV as a second car.

Table 2 presents the mean and median values for EV users' stated satisfaction with each of the EV attributes, and Table 3 presents the mean and median scores for each item of the TPB constructs and repurchase intention. The results show that, on average, the respondents are most satisfied with items related to environmental attributes and less satisfied with symbolic attributes, which could be because they are less concerned about the symbolic attributes of EV use. Relatively high mean values for attitude and lower perceived functional barriers suggest that the respondents have more positive impressions and attitudes about EV use. The median scores represent the satisfaction level of 50% of respondents for respective attributes. For instance, the scores for battery

Table 2
Mean and median values of stated satisfaction with EV attributes.

EV attributes	Satisfaction Mean	50th percentile (Median)
Range-Recharge satisfaction (RRS)		
Battery range	3.54	4
Battery range during winter	3.90	3
Recharging duration	3.29	4
Cost satisfaction (CS)		
Purchase cost	3.83	4
Maintenance cost	3.95	4
Recharging cost	4.22	4
Policy measures satisfaction (PMS)		
Road toll exemption/reduction	4.40	5
Ferry fee exemption/reduction	3.62	0
Parking fee exemption/reduction	3.65	3
Access to bus lane (time-saving)	3.71	1
Environmental-attributes satisfaction (EAS)		
Tailpipe emission	4.59	5
Traffic noise	4.30	4
Type of energy usage	4.64	5
Other environmental consequences	4.24	4
Availability satisfaction (AS)		
Availability of dealers nearby	3.98	4
Availability of different EV models	3.62	3
Country of manufacturer	3.70	3
Manufacturer's reputation	3.99	4
Symbolic-attribute satisfaction (SAS)		
A car that shows who I am	3.01	2
A car that says something about me	3.00	2
A car that says something about my status	2.84	1
A car that distinguishes me from others	2.81	1.5
A car that makes me feel good	3.69	3

Table 3
Mean and median values for each item of TPB constructs.

TPB Constructs	Mean	50th percentile (Median)
Subjective Norms (SN)		
People who are important to me are considering buying electric cars.	3.39	3
People who are important to me already own electric cars.	3.53	4
People who are important to me recommended that I buy an electric car.	3.28	3
People who are important to me support my interest in buying an electric car.	3.68	4
People who are important to me think electric cars promote a sustainable transportation system.	3.43	3
Perceived Functional Barriers (FB)		
I think that the driving performance of an electric car is inferior to that of conventional cars.	1.82	2
I think that an electric car has a lower maximum speed than conventional cars.	1.81	2
I consider conventional cars to be safer to drive than electric cars.	2.00	2
I am worried about running out of a charge while driving an electric car.	2.74	3
Attitude (ATT)		
I believe driving an electric car reduces (would reduce) the local air pollution in my residential area.	4.12	4
I believe driving an electric car saves (would save) money in the long term.	4.18	4
I believe driving an electric car reduces (would reduce) traffic noise.	3.91	4
Repurchase Intention (RI)		
I am interested in battery-electric car/s.	4.48	5
I am planning to buy a battery-electric car.	3.56	4
I am determined that my next car will be a battery-electric car.	4.08	5

range indicate that 50% of the respondents are satisfied (we coded 4 as 'satisfied' on a 5-point Likert scale, while 5 was coded as 'very satisfied') with their cars' battery range. The median score for ferry fee exemption (0) indicates that for 50% of respondents, this policy is irrelevant, meaning that they do not use ferries, or their cities/municipalities do not have the ferry facilities.

4.2. Assessment of scale reliability and validity

This study used Cronbach's alpha to examine the reliability and internal consistency of previously validated measurement scales (Table 4). In addition, KMO was calculated to measure sampling adequacy, and Bartlett's sphericity test was used to examine the scale's validity (Mooi et al., 2018; Tommasetti et al., 2018). KMO and Bartlett's sphericity tests were used to indicate whether conducting factor analysis was feasible. In our study, a higher value of KMO (greater than 0.65) and small values of Bartlett's sphericity test's significance level (1%) indicate factor analysis feasibility. Cronbach's coefficient alpha is widely used in studies to assess the psychometric scale's rightness and reliability for independent variables (Panayides, 2013; Peterson, 1994). Thresholds for Cronbach's coefficient alpha are debated, with different authors suggesting different thresholds. Nunnally (1978) recommends a reliability coefficient value of 0.7 or more. However, other researchers suggest that Cronbach's alpha coefficients in the range of 0.60 to 0.70 are good or adequate (Deković et al., 1991; Holden et al., 1991; Mooi et al., 2018). In our study, the Cronbach's alpha for all the constructs was above 0.65.

Table 4
Validity and reliability of the measurement scales for the components of consumer satisfaction with EV use and TPB.

Latent Variables	Cronbach's Alpha	KMO test	Bartlett Sphericity (sig.)
RRS	0.66	0.66	0.00
SAS	0.94	0.89	0.00
EAS	0.82	0.79	0.00
PMS	0.66	0.68	0.00
CS	0.70	0.66	0.00
AS	0.71	0.71	0.00
SN	0.90	0.88	0.00
FB	0.79	0.78	0.00
ATT	0.82	0.72	0.00
RI	0.86	0.72	0.00

4.3. SEM analysis

The model (Fig. 2) analysis used the maximum likelihood estimation method and included 10 latent variables: PMS, RRS, EAS, AS, CS, SAS, ATT, FB, SUB, OSE, and RI. Table 5 presents the standardised coefficient of the paths of the model.

The path coefficients presented in Table 5 and Fig. 2 are standardised solutions. Standardised coefficients are comparable for making inferences about the relative strength of relationships, particularly when the variables or constructs are originally measured using different scales. Further evaluated indices were root mean square error of approximation (RMSEA), normed chi-square, standardised root mean square residual (SRMR), and comparative fit index (CFI). STATA 15 was used for the data analysis.

The RMSEA is a goodness-of-fit measure, yielding lower values for a better fitting model. A model with an RMSEA value of 0.06 or less is considered acceptable, whereas 0.10 is suggested as the cut-off for a poorly fitting model (Browne and Cudeck, 1992; Hu and Bentler, 1999; Xia and Yang, 2019). In our study, the model reports an RMSEA of 0.053. The RMSEA is reported with the lower and upper bounds of its 90% confidence interval (CI). The model generates a lower bound of 0.48 and an upper bound of 0.58 of its 90% CI, confirming the hypothesis that the model fit is close. The P close value (0.129) also indicates that the model fit is close. SRMR is another goodness-of-fit statistic, and a value less than 0.80 is usually considered a good fit (Hu and Bentler, 1999). Our model generates an acceptable SRMR value of 0.079. In addition, the model generates a normed chi-square (chi-square/df) value of 1.75, which is also an indicator of good model fit (Kiraz et al., 2020; Tiglao et al., 2020). The CFI metric was used to evaluate the incremental fitness of the model. The value of this index ranges from 0 to 1, and a value above 0.90 (or even above 0.95) is desirable (Raykov and Marcoulides, 2011; Tiglao et al., 2020). The model generated a CFI value of 0.88. The model also generated a coefficient of determination (CD) of 0.89, which is represented as an R^2 for the whole model.

The satisfactory indices of the model suggest that the model fits well. This indicates that the TPB model, extended with overall satisfaction, is useful for examining EV repurchase intentions.

The model (see Fig. 2) suggests that subjective norms, perceived functional barriers, and attitudes towards EVs play statistically significant roles in EV repurchase intention (RI). The standardised coefficients of attitude, subjective norm, and functional barriers are 0.49, 0.22 and − 0.24, respectively. The result indicates that approximately 50% of the variance ($R^2 = 0.50$) in repurchase intention is explained by overall satisfaction (OSE), subjective norms (SNs), perceived functional barriers (FBs), and attitudes (ATTs) towards EV use. The model also suggests that EV users' satisfaction with range-recharge, use-based policy incentives, environmental attributes, cost aspects, availability of EV models, and symbolic attributes indicate their overall satisfaction with EV use at the 1% significance level. Unsurprisingly, the findings reveal that consumers' perceived functional barriers to EV use decrease repeated EV purchase intention. However, surprisingly, overall satisfaction does not have a statistically significant direct effect on repurchase intention; instead, it shows a significant effect on consumers' attitudes and perceived functional barriers to EV use. In addition, SEM output suggests that subjective norms have a positive impact on consumers' overall

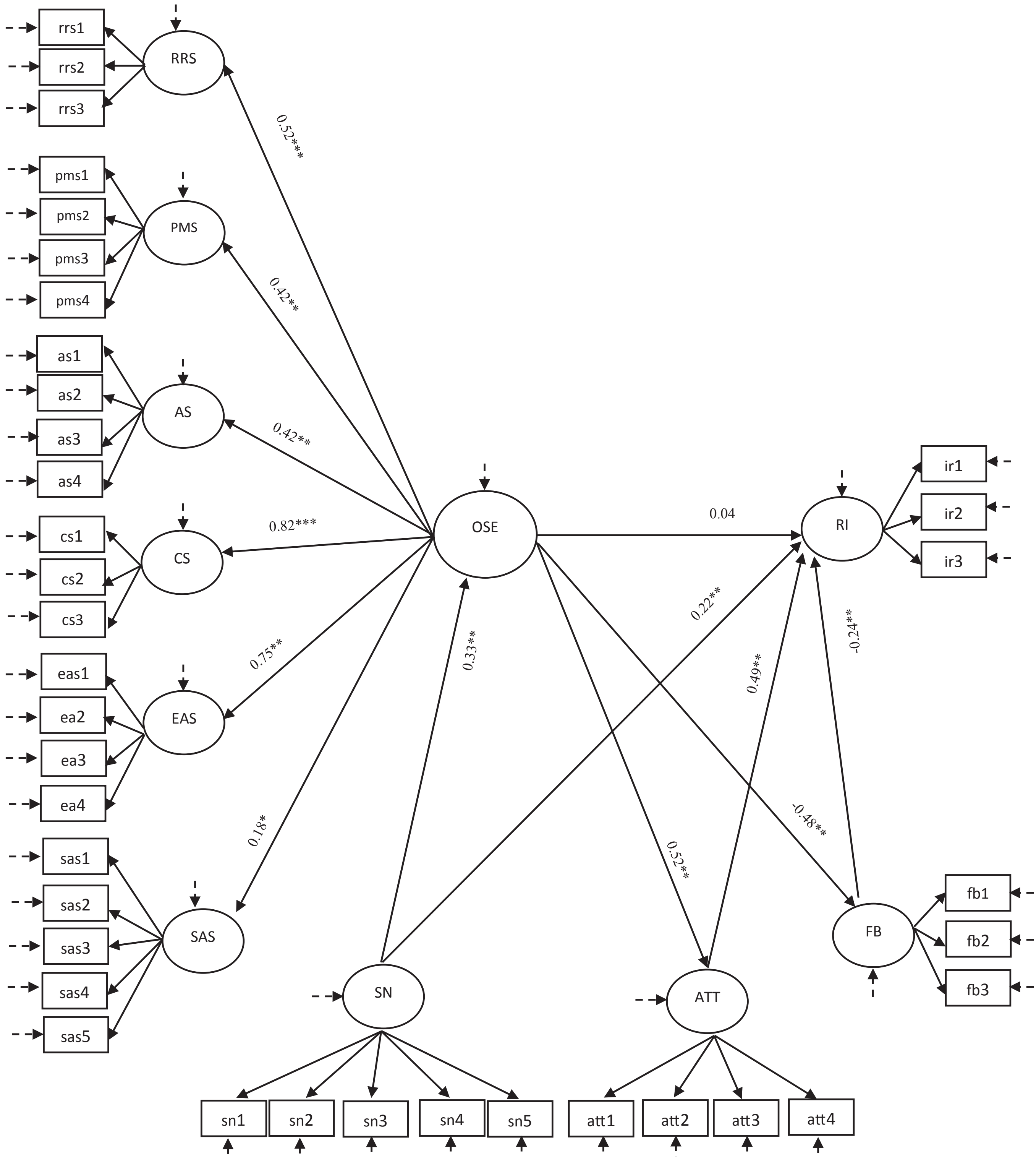

Fig. 2. Results of the structural model with standardised estimates. Model fit (n = 278; Chi^2 /df = 1.75; RMSEA = 0.053 [0.048, 0.058]; CFI = 0.88, CD = 0.89); *Note: Path: →; Error: -→.*

satisfaction with EV use at the 1% significance level. Furthermore, the second-order construct, 'overall satisfaction with EV use' (OSE), is associated, at a statistically significant level, with the variance of the six separate facets (RRS, SAS, PMS, EAS, CS, and AS) of satisfaction related to EV use.

At the structural level, consumers' overall satisfaction (0.38) and subjective norms (0.82) have an indirect effect on repurchase intention. Both indirect effects were significant at the 1% significance level. Moreover, subjective norms have a statistically significant indirect effect on both attitude and perceived functional barriers (at the 1% level). The total effect of a variable on another variable equals to the sum of its direct effect and indirect effect. However, in line with the TPB framework, our model (see Fig. 2) did not measure the direct effects from subjective norm to attitude and perceived functional barrier. Therefore,

Table 5
Standardised model estimates.

	Coefficient	SE	p	R^2
PMS				**0.18**
PMS → pms1	0.57	0.07	0.00	
PMS → pms2	0.39	0.07	0.00	
PMS → pms3	0.67	0.07	0.00	
PMS → pms4	0.51	0.06	0.00	
EAS				**0.56**
EAS → eas1	0.61	0.05	0.00	
EAS → eas2	0.69	0.05	0.00	
EAS → eas3	0.67	0.05	0.00	
EAS → eas4	0.58	0.05	0.00	
RRS				**0.27**
RRS → rrs1	0.81	0.04	0.00	
RRS → rrs2	0.56	0.05	0.00	
RRS → rrs3	0.80	0.04	0.00	
SAS				**0.03**
SAS → sas1	0.93	0.01	0.00	
SAS → sas2	0.94	0.01	0.00	
SAS → sas3	0.92	0.01	0.00	
SAS → sas4	0.85	0.02	0.00	
SAS → sas5	0. 64	0.04	0.00	
CS				**0.67**
CS → cs1	0.37	0.07	0.00	
CS → cs2	0.28	0.07	0.00	
CS → cs3	0.80	0.07	0.00	
AS				**0.18**
AS → as1	0.54	0.06	0.00	
AS → as2	0.68	0.06	0.00	
AS → as3	0. 63	0.06	0.00	
AS → as4	0.56	0.06	0.00	
SN				
SN → sn1	0.75	0.03	0.00	
SN → sn2	0.80	0.03	0.00	
SN → sn3	0.81	0.03	0.00	
SN → sn4	0.81	0.03	0.00	
SN → sn5	0.67	0.04	0.00	
FB				**0.23**
FB → fb1	0.62	0.05	0.00	
FB → fb2	0.61	0.05	0.00	
FB → fb3	0.72	0.05	0.00	
FB → fb4	0.55	0.05	0.00	
ATT				**0.27**
ATT → att1	0.76	0.04	0.00	
ATT → att2	0.65	0.05	0.00	
ATT → att3	0.73	0.04	0.00	
RI				**0.50**
RI → ri1	0.65	0.05	0.00	
RI → ri2	0.49	0.06	0.00	
RI → ri3	0.77	0.05	0.00	
OSE				**0.10**
OSE → PMS	0.42	0.08	0.00	
OSE → EAS	0.75	0.06	0.00	
OSE → RRS	0.52	0.07	0.00	
OSE → SAS	0.18	0.07	0.01	
OSE → CS	0.82	0.07	0.00	
OSE → AS	0.42	0.08	0.00	
Structural Model				
SN → OSE	0.33	0.07	0.00	
SN → RI	0.22	0.07	0.00	
FB → RI	−0.24	0.09	0.00	
ATT → RI	0.49	0.09	0.00	
OSE → RI	0.04	0.11	0.75	
OSE → ATT	0.52	0.07	0.00	
OSE → FB	−0.48	0.07	0.00	

according to our model, the total effects of subjective norms on attitude and perceived functional barriers are equivalent to their indirect effects only.

This study further evaluated the mediation effect using approaches described by Gunzler et al. (2013) to examine whether overall satisfaction with EV use affects repurchase intention through mediators' attitude and perceived functional barriers. In the bivariate regression model, overall satisfaction has a statistically significant effect on repurchase intention ($\beta = 0.41$ at $p = 0.00$). However, in path analysis breakdown, the estimated paths for indirect effects were statistically significant, but the estimated direct path was not significant. These findings indicate that attitudes and perceived functional barriers fully mediate the path between overall satisfaction with EV use and EV repurchase intention.

5. Discussion

The estimated model reveals the role of an individual's satisfaction with EV use in their EV repurchase intention. In addition, the findings indicate the effects of various EV attributes on overall satisfaction. As expected, all TPB constructs (attitudes, perceived functional barriers, subjective norms) were found to be related to repurchase intention. This is consistent with studies (e.g., Haustein and Jensen, 2018; Kaplan et al., 2016) that determined the relevance of these constructs for EV acceptance.

Perhaps surprisingly, this study is unable to find a significant direct effect of overall satisfaction on repurchase intention. However, we cannot reject its impact on attitude and perceived functional barriers to EV use. It is plausible that overall satisfaction maintains an inverse relationship with consumers' negative attitudes and a positive relationship with consumers' positive attitudes towards EV use. This indicates that after consumers experience EV use, their satisfaction levels tend to have a positive influence on their emotions or perceptions about EV use. Highly satisfied consumers seem to have fewer negative attitudes and perceived functional barriers to EV use. Moreover, a higher satisfaction level boosts consumers' positive attitudes towards EV use.

Evidently, more favourable perceptions increase the likelihood of repurchase intention. In addition, our findings indicate full mediation of overall satisfaction effect on repurchase intention through attitude and perceived functional barriers. Our model demonstrates that attitudes towards EV use play the strongest role of the three TPB constructs. This is consistent with the previous study (e.g., Munnukka and Järvi, 2011) that emphasised that consumers tend to be more influenced by their personal considerations. In this study, the items of attitude construct include the economic and environmental benefits of EV use such as its contribution to saving money in the long term and to mitigating air pollution and traffic noise. Thus, it emphasises the importance of economic and environmental benefits. These aspects could be used for promotional campaigns by trying to relate EV use benefits to environmental and economic values. To benefit the EV users financially in the long run, initially, policymakers need to implement incentives to purchase and use EVs.

Subsequently, individual beliefs about whether peers and people of importance approve or disapprove of EV purchases have been found to play a role in purchase decisions. Individuals' subjective norms influence not only repurchase intention but also satisfaction with EV use. This is consistent with previous studies. Habich-Sobiegalla et al. (2018)'s study based on a cross-national dataset from China, Brazil, and Russia found that online networks and personal relations, particularly knowing someone who already owns an EV, play a statistically significant role in EV purchase decisions. Moreover, the effects of subjective norms on satisfaction levels indicate that satisfaction with EV use increases if peers are expected to support EV use. The negative impact of perceived functional barriers on repurchase intention is consistent with Haustein and Jensen's (2018) findings. This is expected because the items of this construct represent the adverse assessments of EV use and thus reasonably affect the repurchase intention adversely. EV users indicate adverse assessments regarding the performance, safety, speed, and low charging of EVs. Although EVs initially had several limitations, over the years their quality and performance have improved with the help of advanced technologies. However, to make EVs attractive, policymakers and carmakers need to maintain their consistency to improve the quality and performance of EVs as well as to promote them to consumers so as to improve their image.

As overall satisfaction plays a critical role in increasing the likelihood of repurchase intention via attitude and perceived functional barriers, it is important to understand which attributes of EVs actually influence overall satisfaction with EV use. Our model reveals that range-recharge, environmental attributes, cost aspects, symbolic attributes, availability of EVs, and use-based policy incentives all play a role in satisfying EV users. The standardised coefficients of the paths suggest that consumers' satisfaction with cost aspects, including purchase cost, maintenance cost, and refuelling cost, play a major role. It is well documented that the maintenance costs of EVs are lower than those of traditional vehicles. However, the purchase cost of EVs heavily depends on policy incentives, and the refuelling cost depends on both EV policy incentives and energy policies. In Norway, EV users benefit from generous purchase incentives and cheap electricity, which is generated mostly by renewable energy (Fridstrøm, 2020). However, for most other countries, the EV purchase price is still higher than that of conventional vehicles, and electricity prices are higher (Harvey, 2020). In a study comparing the total cost of ownership (TCO) between Norway and Italy, Scorrano et al. (2019) found that BEVs are more competitive in Norway than in Italy because the average value for annualised TCO/km is lower in Norway. Thus, countries need to invest heavily to lower the cost aspects of EV use to keep users satisfied and increase the likelihood of their repurchase intention. In addition to imposing various purchase incentives (such as exemption from registration tax, import tax, VAT), countries could subsidise the electricity price for EV users until it becomes competitive with the cost of fossil fuels.

Although the efficacy of policy measures on EV adoption is still not conclusive, our findings indicate that use-based policy incentives contribute to consumers' overall satisfaction with EV use. Use-based policy measures, such as bus-lane access and exemption from road tolls, parking fees, and ferry fees, reduce the operating cost of EV use. However, despite their potential benefits, financial incentives are sometimes criticised. It is argued that financial incentives drive financial pressure on local government and might have a rebound effect (Langbroek et al., 2016) as they reduce the operating cost of EV use—leading to an increased level of travel activities. However, this study suggests that considering its contribution to consumers' overall satisfaction with EV use, implementation of various use-based policy incentives could be a potential measure to make EVs attractive to consumers. Moreover, it is suggested that proposing different policy incentives for different types of EVs rather than providing homogeneous policy incentives is necessary to achieve substantial EV market growth (Hardman et al., 2017).

Potential buyers and existing users are satisfied if EVs are available in nearby EV dealers and various models are offered by their favourite carmakers. Introducing new EV models and making them available in the market is thus necessary to give consumers options to choose their desired EV. Supporting the carmakers by incentives and imposing market regulations is critical in making EVs widely available in the market.

Moreover, this study suggests that environmental construct, including items such as lower tailpipe emissions, traffic noise, and the energy EVs use to operate, satisfy the EV users. In Norway, hydropower is the source of most electricity production (Ministry of Petroleum and Energy, 2016). This could play a role in Norwegian EV users' stated satisfaction with EV energy and other environmental benefits. This is consistent with Table 2, which shows that participants' average satisfaction with environmental attributes was higher than their average satisfaction with other attributes, and the item 'type of energy usage' stood out with the greatest value. Moreover, consumers' satisfaction with EV's environmental attributes indicates that consumers pay attention to both local- and national-level contributions of their EV use. This is an insight for those countries whose electricity generation still heavily depends on fossil fuels. Casals et al. (2016) noted that all European countries are already putting considerable efforts into decarbonising their electricity generation sectors.

According to the findings, the importance of EV range and recharge is followed by cost satisfaction and environmental attribute satisfaction. Although technological advancements have improved battery capacity and charging speed (IEA, 2020), improvements are still needed to compete with conventional vehicles, particularly at low temperatures. Respondents voice relatively low satisfaction (followed by symbolic attributes) with items related to range-recharge constructs, which supports a need for further improvements. The limited battery range at low temperatures is relevant for cold regions as well as for many countries during the winter period. Countries need to install publicly accessible charging infrastructures and support installing charging facilities at home or workplaces where possible to mitigate consumers' range anxiety and overcome the low battery range issues. In addition to installing fast charging stations, recharging options at home or workplaces also offset challenges related to longer recharging duration as they facilitate recharging the car at night and/or during work hours when the cars usually stay idle.

6. Conclusions and implications

This study adds to the current literature on attitudes towards EVs in multiple ways: first, by extending the theory of planned behaviour through including satisfaction; second, by highlighting Norway's maturing EV market to study repurchase intentions rather than first purchase only; third, by establishing a model to comprehend interrelations among relevant factors and complete pathway of their influences; and, finally, by identifying the attributes of EVs that manipulate EV users' satisfaction with EV use.

According to the findings, all three constructs - attitudes, perceived functional barriers, subjective norms influence consumer's repurchase intention. In this study, attitude includes consumer's perception about EV's economic and environmental values; perceived functional barriers include consumer's perception about EV's functional attributes and subjective norm includes consumer's perceived social pressure about buying an EV. This study finds that EV users' attitudes towards economic and environmental values of EV use (e.g., EV reduces local air pollution, traffic noise, and saves money in the long term) have a stronger impact on their behavioural intention to repurchase EVs than subjective norms and perceived functional barriers. In line with this, our study argues that economic and environmental benefits of EVs are likely to dominate consumers' behavioural intention. Further, EV users' overall satisfaction significantly affects consumers' attitude and perceived functional barriers. The findings implies that a higher satisfaction level is likely to develop positive attitude and lessen adverse impressions about EV use. In addition, consumers' attitudes partly stem from their peers' influences. Interestingly, this study finds that the effects of EV users' overall satisfaction is mediated through their attitude and perceived functional barriers to repurchase intention.

This study also identifies the attributes of EVs actually influence consumers' overall satisfaction with EV use. The findings posits that cost aspects have the strongest effects on manipulating overall satisfaction. The construct items indicate that policymakers and carmakers need to focus more on reducing costs related to purchases, recharging, and maintenance when allocating their limited resources. Implementing generous financial incentives is likely to reduce the purchase cost and recharging cost until technological advancement make EVs competitive with conventional vehicles. Although cost aspects turn out to be the most influential attributes, policymakers and carmakers also need to prioritise other statistically significant attributes such as range-recharge, environmental attributes, use-based policy incentives, symbolic attributes, and availability of EV models.

Finally, it should be noted that our study, like all empirical studies, has some limitations. The survey data analysed in the present study are from the Norwegian EV market, which has a higher EV penetration rate than most other car markets and numerous policy measures to make EVs more attractive. In markets where the preferences of car owners and purchasers differ or where some EV functions are considered less important (e.g. winter-driving battery range in regions with comparatively high temperature), the effects of the factors could differ. However, in general, the insights from this study are of interest for other countries as well. Second, some respondents might have answered tactically, which might be, for instance, the case concerning the perceived functional barriers. Third, subgroups of EV owners (i.e. sole EV users, users who have both ICEVs and EVs) could be helpful for a more in-depth understanding of EV users' repeated purchase intentions and behaviour. Future research can include other relevant factors (e.g. sociodemographic factors, geographical locations, personality traits) in the model to expand our understanding even further.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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