Contents lists available at ScienceDirect





journal homepage: www.elsevier.com/locate/tra



Acceptance of electric passenger cars in commercial fleets

Joachim Globisch^{a,d,*}, Elisabeth Dütschke^a, Joachim Schleich^{a,b,c}

^a Fraunhofer Institute for Systems and Innovation Research ISI, Breslauer Str. 48, 76139 Karlsruhe, Germany

^b Grenoble Ecole de Management, 12 Rue Pierre Semard, 38000 Grenoble, France

^c Virginia Polytechnic Institute & State University, Blacksburg, VA 24061, United States

^d Karlsruhe Institute of Technology, Hertzstr. 16, 76187 Karlsruhe, Germany

ARTICLE INFO

Keywords: Electric vehicle User acceptance Technology acceptance model Commercial fleet Organizational innovation adoption Structural equation model

ABSTRACT

This paper explores the antecedents of the acceptance of electric vehicles (EVs) in commercial pool car fleets. Conceptually, the analysis draws on the technology acceptance model (TAM). To test the model, structural equation modelling is employed, relying on unique survey-based data of actual users of electric vehicles (N = 575), i.e. from early adopter organisations. In general, the empirical findings support the model. In particular, variables at the organisational level (perceived organisational usefulness) and the organisation members' reactions to the introduction of EVs (subjective norms) are found to be highly important in supporting the acquisition of EVs in commercial benefits and perceived ease of use are identified as relevant antecedents to EV acceptance (support for acquiring EVs). Unlike the results from the literature that concern private households and company car users, we found a very low effect of the evaluation of the vehicles' driving range.

1. Introduction

Lowering CO_2 emissions to limit the ongoing average global temperature increase to the official United Nations' target of 2 °C poses a major challenge, in particular for the transport sector. To achieve this target, the International Energy Agency (IEA, 2013) estimates that, by 2050, three-quarters of all the vehicles sold must be electric vehicles (EVs). These include battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs). The latter have both an electric and a conventional power train, which provides propulsion even if the battery is depleted.

EVs also help to reduce the dependency on foreign oil and are therefore being strongly promoted by politicians and industry leaders in many countries. So far, however, the uptake of EVs has been rather slow in most countries.

In Germany, about 60% of all new passenger cars are purchased by private or public organisations (companies, NGOs, and public or semi-public entities). About half of the cars owned by organisations are used in commercial fleets, i.e. are used solely for business purposes and are often driven by several employees in a pool car fleet. Since commercially owned cars are resold more quickly than privately owned ones, they diffuse more rapidly through the used car market (NPE, 2012). This highlights the importance of commercial fleets for the diffusion of new car technologies through the vehicle stock and for meeting global climate targets (Gnann, 2015). Our paper therefore focuses on the intra-organisational processes underlying the adoption of EVs by organisations.

Akin to the adoption of innovations in organisations in general, the adoption of EVs in companies can be described as a process involving multiple individuals with different roles. This reflects a major difference between organisations' and private households'

Received 11 May 2016; Received in revised form 30 March 2018; Accepted 7 June 2018 0965-8564/@ 2018 Published by Elsevier Ltd.

^{*} Corresponding author at: Fraunhofer Institute for Systems and Innovation Research ISI, Breslauer Str. 48, 76139 Karlsruhe, Germany. *E-mail address*: joachim.globisch@isi.fraunhofer.de (J. Globisch).

adoption of innovations. To analyse EV adoption by organisations, it is useful to distinguish between fleet decision-makers (acceptance at the organisational level) and car users (acceptance at the individual level). Earlier research on EV adoption in commercial fleets found that car users and decision-makers employ different criteria when evaluating EVs. Nesbitt and Davies (2013) conclude that user acceptance is primarily determined by vehicle comfort and performance, while organisational decision-makers value the benefits of EVs for the environment and for their corporate image, in particular. Therefore, our comprehensive conceptual and empirical analysis of the acceptance of EVs in organisations takes the preferences of both groups into account.

Empirical studies of the acceptance of EVs focus almost exclusively on private car users (cf. Hjorthol, 2013; Rezvani et al., 2015). The few notable exceptions include Koetse and Hoen (2014), Wikström et al. (2014), (2016), Seitz et al. (2015), and Sierzchula (2014). Based on the findings of a choice experiment, Koetse and Hoen (2014) conclude that company car drivers prefer conventional cars and other alternative fuel types such as biogas or bioethanol to EVs because the latter suffer from a limited driving range, long recharging times, and scant refuelling opportunities. Wikström et al. (2014) combined tracking data on driving patterns associated with EVs in commercial pool car fleets with a survey of the EV users and found that more experienced EV users charge the vehicles less frequently and make longer trips than less experienced EV users. The reduced range due to the use of heating systems during the winter was found to be the major barrier to EV usage. Based on focus group discussions, Wikström et al. (2016) conclude that inner organisational advertising during EV deployment is important. This includes word-of-mouth recommendation as well as organisational promotion of EV usage. Furthermore, supporting users by providing information about the capabilities of EVs and assistance in case of technical failures are identified as important factors for EV acceptance.

Analysing EV adoption in organisations where the (heavy-duty) vehicle fleet is part of the core business (e.g., logistics companies), Seitz et al. (2015) find pro-environmental organisational values to be the main driver of adoption, while the operational capabilities of EVs are the main barrier. Finally, based on interviews with fleet managers and using documented information from pilot projects, Sierzchula (2014) concludes that pool car fleet managers adopt EVs to gain experience with a new technology, lower their organisations' environmental impact, improve corporate image, and gain economic benefits (e.g. via public subsidies).

Thus, only Sierzchula (2014) and Seitz et al. (2015) actually address the support for EV acquisitions in commercial fleets. Further, we are not aware of any quantitative analyses of the antecedents of support for EV adoption in commercial pool car fleets that address EV acceptance at both the individual (i.e. pool car users) and organisational level (i.e. those with the power to decide on EV acquisition in organisations). This paper aims to close this gap. We first present a conceptual framework based on the technology acceptance model (TAM3; Venkatesh and Bala, 2008) that can be applied to pool car users and decision-makers in a coherent way to explain support for EV acquisitions.

Our empirical analysis therefore relies on unique primary survey data from an early adopter sample of 575 users of EVs in commercial fleets. To our knowledge, this is the largest sample available of evaluations provided by actual EV users in commercial fleets. Due to the users' real-world experience with EVs, our methodological approach provides unique insights into those aspects that influence the acceptance of the adoption of EVs.

While Seitz et al. (2015) studied heavy-duty vehicles, our analysis focuses on electric passenger cars in commercial pool car fleets. Our targeted users are typically not professional drivers and the vehicles are not involved in the organisations' core businesses. In contrast to Koetse and Hoen (2014), we focus on commercial pool car users and our analysis does not rely on hypothetical choices in an experimental setting, but is instead based on the stated perceptions of early EV adopters who are familiar with the technology.

The remainder of the paper is organised as follows. Section 2 develops the conceptual framework. Section 3 presents the data and the methodology. The results are shown in Section 4. We discuss the main findings and conclusions in Section 5.

2. Conceptual framework

For our conceptual framework, we develop a hypothetical model drawing on a recent version of the frequently used technology acceptance model (TAM), i.e. TAM3, which was developed by Venkatesh and Bala (2008). The TAM approach was originally developed to analyse the acceptance of IT innovations but has since been applied to several other technologies, including quantitative analyses of the acceptance of EVs (Dudenhöffer, 2013) and environmentally-friendly transportation systems (Chen and Lu, 2016) by private households. Furthermore, Wikström et al. (2016) have used the TAM as theoretical foundation for a qualitative analysis of EV acceptance in commercial fleets. In general, the original TAM focused on technology acceptance by individuals. Nonetheless, the TAM is the only theoretical framework in the domain of IT innovation adoption research that is commonly applied in studies that address acceptance on both the individual and the organisational level (Hameed et al., 2012). This implies that the framework applies to both levels in principle, which makes it especially well-suited for our analysis. To adequately reflect potential antecedents of the acceptance of EVs in commercial fleets, we modify the TAM3 by introducing theoretical constructs that address the repercussions of EV usage that are relevant for organisations. The theoretical model derived from TAM3 is depicted in Fig. 1 (in the following paragraphs we render theoretical constructs in italics for better readability).

Based on TAM3, we include *perceived individual usefulness* and *perceived ease of use* in our theoretical model as antecedents of *support for EV acquisitions*. *Perceived individual usefulness* concerns an individual's belief about the degree to which the use of an innovation will enhance the individual's own job performance, and *perceived ease of use* reflects the individual's belief regarding the effort required to use an innovation (Davis, 1989). Analogous to TAM3, *perceived ease of use* has a direct influence on *support for EV acquisitions* as well as an indirect influence via *perceived individual usefulness*. This reflects the notion that innovations that are easy to use are perceived as more useful.

We add perceived organisational usefulness as a new construct that influences the support for EV acquisitions. "We expect perceived individual usefulness to influence perceived organisational usefulness" as we assume that users infer from their individual experience Download English Version:

https://daneshyari.com/en/article/6779691

Download Persian Version:

https://daneshyari.com/article/6779691

Daneshyari.com