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Adoption of electric vehicles in commercial fleets: Why do car pool managers campaign for BEV procurement?

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ABSTRACT

We use regression analysis to study what motivates car pool managers to campaign for BEV procurement using primary data from 229 car pool managers including adopters and non-adopters of EVs. Key findings are that a personal interest in EVs due to technophilia increases the intention to start procurement initiatives for BEVs. These findings underpin the fact that the attitudes of single individuals can influence internal organizational decision processes and therefore play an important role in explaining BEV adoption in commercial fleets. Other factors that foster initiatives for BEV procurement are organizational innovativeness, and the expectation of environmental benefits and positive effects on employee motivation. The fear of mobility constraints and doubts about the reliability of BEVs counteract the intention to campaign for their procurement.

1. Introduction

Replacing conventional passenger vehicles by electric vehicles (EVs) is one of the main options to make our cities and transport system more sustainable. Commercial vehicle fleets play a crucial role in achieving a wider diffusion and positive environmental impact of EVs: First, these have a higher annual mileage than privately used vehicles bringing to bear their low running costs and, if charged by electricity from sources with low carbon intensity like renewable energies, environmental benefits (NHTS, 2009; Plötz et al., 2014). Second, at least for countries where respective data is available, they account for a high share of newly registered passenger cars (60% for Germany, KBA, 2014; 54% for the UK, Department for Transport, 2013). Third, they are resold more quickly than privately owned cars and diffuse through the second-hand car market (Plötz et al., 2013; Gnann, 2015), i.e. commercial adoption is also likely to trigger private adoption.

Therefore, the focus of this paper is on the factors that influence the uptake, i.e. the acceptance of EVs in commercial fleets – a topic that has been largely neglected so far (cf. Rezvani et al., 2015). The few papers that have studied the adoption decision of EVs in commercial fleets have mainly identified drivers and barriers. Kaplan et al. (2016) conclude that ease of use of EVs is evaluated more favourable in organizations which already adopted such vehicles. The authors point out that more research is needed to assess the directionality of this relation. Furthermore Kaplan et al. find that managers of larger fleets consider themselves as more familiar with EVs and Sierzchula (2014) states that high costs can deter especially smaller organizations from converting larger numbers of their pool car fleet to EVs. I.e. the size of the car pool or organization might influence EV adoption. Sierzchula (2014) further concludes that improving corporate image and the organizational desire to be in the vanguard are perceived as advantages of EVs, while their comparatively high costs and limited driving range are the main drawbacks (see Sierzchula 2014 for determinants of the

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organizations' decision to adopt electrical pool cars and Koetse and Hoen 2014 for determinants of the employees' decision to adopt electrical company cars).

Sierzchula (2014) also mentions the importance of the attitudes and preferences of influential individuals for the organization's stance towards EV adoption. However, neither of these studies explored the internal organizational processes that precede the adoption decision in depth. Instead, the focus on the interests of the organization or its top management implies that organizations are perceived as unitary actors with a homogenous set of preferences. In contrast, Nesbitt and Davies (2013) conclude that preferences and priorities with regard to EV adoption can differ between actors in an organization. E.g., car pool managers focus more on reliability whereas the top management gives more weight to image and environmental officers attach value to the CO_2-emissions. While these differences seem to be tied to the professional roles that these actors play in their organization Kaplan et al. (2016) point out that personal attitudes, familiarity with EVs and subjective norm can be very influential for the decision about EV adoption. In the light of these results it seems promising to dig deeper into the process that precedes the actual adoption decision.

Well-established theories in the field of organizational innovation adoption emphasise the importance of (not necessarily high-level) individuals who act as so called innovation champions. In this regard Rogers (2003: 414) describes an innovation champion as a "…charismatic individual who throws his or her weight behind an innovation, thus overcoming indifference or resistance that the new idea may provoke in an organization" and refers to Schön (1963: 84), who states that a "…new idea either finds a champion or dies." With regard to the phase of agenda-setting (the first step in the process of organizational innovation adoption) Rogers (2003: 422) further quotes March (1981) who concludes: "[Innovation in organizations] often seems to be driven less by problems than by solutions. Answers often precede questions.". In this regard an innovation champion is someone who has the answer ready and puts it forth when there opens an occasion. So an innovation champion can be especially important to bring an organizational policy forth where no policy has been in existence before. There is evidence that championing the initiation of an EV adoption is a crucial point in the organizational adoption process as there is usually no urgent need for adopting EVs (Nesbitt, 1996). I.e., the initiation of an EV adoption will not take care of itself and its success therefore depends on patronization. Therefore, the focus of this paper is on innovation champions for EVs. More specifically, this paper empirically analyses to what extent car pool managers' campaigning for EV adoption is shaped by their own individual and/or organizational values and interests. The study is based on primary data from a survey of car pool managers (N = 229).

The remainder of this paper is organized as follows. In Section 2 we explain why the Organismic Integration Theory (OIT), a motivational theory approach, is especially suited to forming the theoretical foundation of our analysis and outline the derived theoretical model. Section 3 describes how the theoretical model guides the empirical analysis and presents the data and methodology. We report the results of the analysis in Section 4 and discuss them in Section 5.

2. Theoretical framework

Organizational innovation adoption is usually considered as a process with three phases: initiation, (organizational) adoption-decision, and implementation (Hameed et al., 2012). The review of organizational innovation adoption research by Hameed et al. (2012) shows, that analyses of the initiation of innovation adoption in organizations are scarce. Thus, there is no legacy of theoretical models potentially suited for analysing the factors that drive the initiation of innovation adoption in organizations. We base our analysis on the OIT, a motivational approach developed by Deci and Ryan (1985) as part of self-determination theory (SDT). SDT is a well-established psychological theory and has been used in a wide range of studies and fields of application (Vallerand et al., 2008).

OITs suitability for our analysis arises from its ability to depict different forms of motivation: on the one hand, OIT describes intrinsic motivation (e.g. doing something because it is fun or interesting) or autonomous forms of extrinsic motivation (e.g. doing something because it is a good cause; cf. Gagné and Deci (2005). These forms of motivation can facilitate proactive behaviour, which comprises actions like promoting a particular issue in order to influence an organization's course of action (Parker et al., 2010). Thus, it closely matches Rogers's (2003) definition of innovation champions.

On the other hand, OIT comprises controlled forms of extrinsic motivation. Therefore, it is able to embrace the motivation of car pool managers who act (exclusively) as an agent on behalf of the organization (i.e., the individual's behaviour aims to achieve externally imposed goals; cf. Gagné and Deci, 2005). Thus, OIT is able to reflect adoption processes like those described by Sierzchula (2014) where the car pool manager is driven either by cost-benefit-considerations or the personal preferences of the top management.

In other words, one and the same action (e.g. campaigning for EV procurement) can be driven by different forms of motivation. Our analysis aims to identify to what extent the intention to campaign for EV procurement is driven by controlled extrinsic motivation, autonomous extrinsic motivation, and/or intrinsic motivation.

To do so we develop a theoretical model based on OIT (see Fig. 1). The construct that the model aims to explain is the *intention to campaign for EV procurement* (hereafter the names of theoretical constructs are printed in italics for better readability). The formation of an intention to act is the precursor of an action (Venkatesh et al., 2003). The decision to focus on the intention to act instead of the specific action is based on methodological and conceptual considerations. Vehicle procurement (especially in smaller car pools) does not occur every day, so that the lack of actual campaigning for EV procurement can either be due to a lack of intention or to a lack of opportunity (e.g. because there currently is no need to purchase a vehicle, as other tasks are of higher priority in the next weeks). Nonetheless, intention is a necessary precondition in this case to act. We therefore expect more valuable and concise results from surveying the *intention to campaign for EV procurement*.

Nevertheless, as acknowledged before, intentions do not necessarily translate into actions, the so called 'intention-behaviour gap' or as a related challenge 'attitude-action gap' – an issue that has been repeatedly subject to research especially in the field of car acquisition (cf. Lane and Potter, 2007; Mairesse et al., 2012). In the literature (cf. deHaan and Kuckartz, 1996; Homburg and

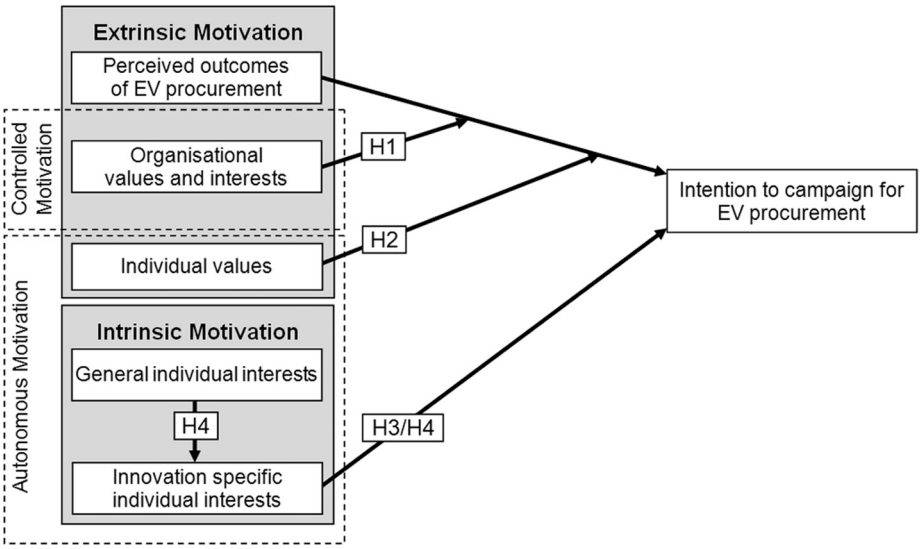

Fig. 1. Theoretical model based on OIT.

Matthies, 1998; Bamberg and Möser, 2007) several factors have been identified which contribute to enlarging the intention-behaviour gap, including amongst others the lack of specificity of measurement, the neglect of multiple motives related to a certain behaviour and the relevance of situational variables as the above mentioned lack of opportunity. In our study, by drawing on OIT we try to address these shortcomings by explicitly covering multiple motives (e.g. to comply with organizational values) as well as potentially relevant situational conditions (cf. description of variables that address perceived consequences of EV adoption in Section 3.2).

To decisively accelerate the diffusion of EVs by procurements by commercial fleets necessitates that EV adoption is not limited to solitary vehicles per organizational car pool. Thus, our study aims to contribute to the explanation of antecedents for large scale adoption of BEVs by organizations. Currently even the car pools of organizations which have already adopted EVs still consist predominantly of conventional vehicles (cf. Section 3.1). I.e. large scale adoption has not taken place in most organizations and depends on future actions and decisions. Thus to analyse the antecedents of the intention to campaign for (additional) EV procurement can lead to results which are of high practical relevance for supporting EV diffusion.

As potential determinants for the *intention to campaign for EV procurement* we hypothesize components of controlled extrinsic motivation as well as autonomous extrinsic and intrinsic motivation. To represent (controlled and autonomous) extrinsic motivation, we first include the *perceived outcomes of EV procurement* in the model. This is because by definition extrinsically motivated actions aim to achieve desired outcomes and avoid undesired ones (cf. Vroom, 1964; Gagné and Deci, 2005). The *perceived outcomes of EV procurement* refer to the concept of cognized instrumentality. The cognized instrumentality represents the anticipated consequences of an action. Cognized instrumentality does not comprise a valuation of the anticipated consequences by the individual (Vroom, 1964). OIT provides a theoretical framework that comprises explanations for the positive or negative valuation of anticipated consequences.

According to OIT, the expectations of others can determine the desirability of perceived outcomes (e.g. campaigning for EVs because they are perceived as good for the environment and the management is looking for ways to improve the organization's environmental record or image). Therefore, we theorise in hypothesis 1 the existence of interactions between *organizational values and interests* and the *perceived outcomes of EV procurement* to reflect controlled extrinsic motivation.

H1. The influence of the *perceived outcomes of EV procurement* on the *intention to campaign for EV procurement* depends on *organizational values and interests.*

The desirability of outcomes can also be determined by an individual's own personality (e.g. campaigning for EV procurement because he/she feels strongly about environmental issues). Therefore, we theorise in hypothesis 2 the existence of interactions between *individual values* and the *perceived outcomes of EV procurement* to reflect autonomous extrinsic motivation.

H2. The influence of the *perceived outcomes of EV procurement* on the *intention to campaign for EV procurement* depends on *individual values.*

An intrinsically motivated action is by definition an end in itself, i.e. the outcomes of the action do not matter (Gagné and Deci, 2005). Accordingly, the model does not include interactions between the constructs of intrinsic motivation and the *perceived outcomes of EV procurement*. Furthermore, intrinsic motivation can be seen as a hierarchical construct; whether a specific action is intrinsically motivated depends on the personality determining the general fields of interests of the acting person (Vallerand, 2000, 2007). Therefore we include two constructs in the model to represent intrinsic motivation: the first is *general individual interests* and represents partialities that have global importance for the individual (i.e. are part of the individual's personality). These global

partialities determine the *innovation specific individual interest* which in turn influences the *intention to campaign for EV procurement*. These considerations are reflected in the following hypotheses:

H3. The *intention to campaign for EV procurement is influenced* by *innovation specific individual interests.*

H4. The influence of *general individual interests* on the *intention to campaign for EV procurement* is mediated by the *innovation specific individual interests*.

The following sections outline how we test these hypotheses, the results obtained and which conclusions can be drawn with regard to the adoption of EVs in commercial fleets.

3. Material and methods

In this section we describe the basic considerations of our research design and the course of action for data collection. We detail the properties of the sample obtained from the data collection and outline which variables are measured in order to operationalise the theoretical model. Finally, we describe the statistical methods that we use to prepare and analyse the collected data.

3.1. Research design, data collection and sample description

Rezvani et al. (2015) point out that prior studies of EV acceptance (including those that focus on private households) have either conducted representative surveys that do not contain actual adopters of EVs or have based their analyses on adopter samples. Both approaches are considered to have limitations regarding the external validity: non-adopters' assessments of EVs may lack validity and adopter samples do not provide representative results. Therefore, our research design aims to cover adopters and non-adopters of EVs.

In order to gather sufficient data we combine two samples collected in Germany. The first sample is based on an online survey of car pool managers from organizations participating in a field trial within the project "Get eReady" (2013–2016). In order to obtain public funding for EVs (on average €8100 per EV), it was obligatory to take part in the survey. This ensures a sufficient number of actual EV adopters for our analysis – the resulting sample contains data from 109 respondents.

The second sample is also based on an online questionnaire that addressed non-adopters. The link to the survey was distributed in three ways: (1) via multipliers like the federal association of car pool managers and local chambers of commerce and industry; (2) via the social networks Xing and LinkedIn; (3) we also contacted potential participants by phone – contact data were taken from the Hoppenstedt company database by random sampling from a list of approximately 600,000 companies. In total, we obtained data from 278 respondents.

The questionnaires for the two sub-samples are identical with regard to the items relevant for this study. Therefore, we are able to combine them into one. The combined sample contains 387 cases. In order to ensure sufficient data quality, we exclude all cases that lack valid data for more than 30 per cent of the variables. This clean-up results in a final combined sample of 229 cases – 106 are from the first sample and 123 from the second one. Because some respondents of the second sample also stated that their organization uses EVs, the final sample contains 138 adopters and 91 non-adopters of EVs. 85% of the EVs used by the adopters are battery electric vehicles (BEVs). BEVs are powered solely by electricity in contrast to plug-in hybrid electric vehicles (PHEVs) that have an electric and a conventional powertrain and account for the remaining 15% of EVs. Other properties of the final sample are depicted in Table 1.

The sample description shows that the shares of male respondents and academics are higher for adopter organizations than non-adopter organizations. There are only minor differences with regard to the age of the respondents and the share of top management members. Furthermore, organizations that have already adopted EVs have more employees than non-adopter organizations. In contrast, the car pools of adopter organizations are smaller on average than those of non-adopter organizations. The car pools of adopter and non-adopter organizations also differ with regard to the usage scenarios: the average share of vehicles used as company cars is lower for adopter organizations than for non-adopter organizations. The differences between the average and the median values result from the participation of some large companies by which the average numbers are raised.

Most of the adopter organizations (49%) use only one EV in their car pool. 82% of the adopter organizations have up to three EVs in their car pool, while only 18% deployed more than three EVs. In comparison to conventional vehicles, EVs are used more often as pool cars and relatively rarely as company cars. These numbers equate to a relatively low share of EVs in the car pools of most of the organizations: 25% of the 138 adopter organizations have less than 4% EVs in their fleet. 50% of the adopters (median) have an EV-share of less than 11% and 75% of the adopters have a car pool that consists to less than 22% of EVs.

Although we put extended effort into recruiting respondents via random sampling from the Hoppenstedt company database the fact that around 26% of the 123 respondents from the second subsample are adopters of EVs points to a bias. I.e. persons who are more involved in the topic of the study seem to be more willing to participate in the survey. However, as there is a lack of information about the actual composition of the relevant basic population (companies with pool car fleets in Germany) it is hard to estimate to what extent our sample is biased compared to the basic population.

3.2. Variable description

The constructs of our theoretical model (cf. Section 2) are operationalised using variables measured by questionnaire items. All

Table 1
Properties of the final sample.

		Final sample	Adopters of EVs (n = 138)	Non-adopters of EVs (n = 91)
Demographics of respondents				
Gender		21% female 79% male	11% female 89% male	36% female 64% male
Ø Age		46 years	45 years	47 years
Education (share of academics)		33% academics	46% academics	14% academics
Member of top management		38% top manager	41% top manger	33% top manager
Structural properties of the organization and its car pool				
Employees (Ø/median)		1430/100	2671/175	273/80
Number of conventional vehicles (Ø/median)		225/15	319/14	82/22
Conventional vehiclés usage scenarios (Ø share of all conventional vehicles in the car pool)	Pool cars	22%	25%	18%
	Company cars	54%	47%	64%
	Field service cars	20%	22%	17%
	Other ways of utilisation	4%	6%	1%
EVs in the car pool				
Number of EVs in the car pool		40% no EVs 60% at least one EV	1 EV: 49% 2 EVs: 23% 3 EVs: 10% > 3 EVs: 18%	N/A
EV's usage scenarios (Ø share of all EVs in the car pool)	EVs as pool cars	N/A	56%	N/A
	EVs as company cars		21%	
	EVs as field service cars		14%	
	Other ways of utilisation		9%	

the variables in our analysis are based on Likert scales, i.e. the items in the questionnaire are formulated as statements with six grades of (dis-) agreement ranging from “applies not at all” (coded as 1) to “fully applies” (coded as 6) as recommended by methodological studies. Using six response options in combination with a seventh option “I do not know/not specified” provides the advantage that respondents have to state a tendency or have to explicitly decide for making no statement. In contrast scales with an uneven number of response options are at risk to produce ambiguous results as respondents might choose the central option if they have no clear opinion (Weiber and Mühlhaus, 2014; Trommsdorff, 1975; Green and Rao, 1970). The inclusion of a response option “I do not know/not specified” provides the further advantage that there are no forced statements despite the obligatory participation of the respondents whose EVs were funded via the project “Get eReady”. We treat these variables as quasi-interval scales for further analysis (Norman, 2010). Tables 2–4 summarise the description and numbering of variables that we use in our analysis (first column) and the operationalisation of the items (second column). The mean and the standard deviation of the variables are provided in the third and fourth columns, respectively. The last column reports the share of missing values for the respective item. The subtitles in the grey shaded lines indicate how the variables relate to the constructs of the theoretical model.

In general the items focus on BEVs for two reasons: (1) Prior to the finalisation of the questionnaire it became apparent that BEV

Table 2
Measurement of the perceived outcomes of EV procurement and the intention to campaign for EV procurement.

Variable	Item text	M	SD	Missing values
Intention to campaign for EV procurement				
Intention to campaign for BEV procurement (V1)	I will champion my organization procuring (additional) BEVs within the next five years	4.3	1.5	2.6%
Perceived outcomes of EV procurement; Items start with “By replacing 1/3 of the car pool vehicles by BEVs my organization would…”				
Total costs (V2)	…increase the total costs of the car pool	4.3	1.4	9.9%
Increased effort (V3)	…make car pool management more complex	3.8	1.5	4.5%
Reduced reliability (V4)	…accept reduced vehicle reliability	3.0	1.5	12.0%
Improved image (V5)	…improve its image	4.8	1.2	2.6%
Experience gains (V6)	…acquire a first-mover advantage by gaining experience with EVs	4.4	1.4	4.5%
Climate protection (V7)	…protect the climate	5.0	1.2	3.5%
Reduced traffic noise (V8)	…avoid traffic noise	5.3	1.1	1.7%
Reduced air pollution (V9)	…avoid local air pollution	5.4	1.0	1.7%
Mobility constraints (V10)	…limit the mobility of employees	3.9	1.5	1.7%
Reduced comfort (V11)	…accept reduced vehicle comfort	3.4	1.5	5.9%
Reduced safety (V12)	…accept reduced road safety	2.1	1.2	5.9%
Negative reactions (V13)	…provoke negative reactions of the car pool users	3.3	1.4	5.4%
Improved motivation (V14)	…improve employee motivation	3.4	1.3	6.8%

Table 3
Measurement of variables to test for controlled extrinsic motivation.

Variable	Item text	M	SD	Missing values
Organizational values and interests				
Organizational image cultivation (V15) moderates V5	My organization wants to be linked to certain values.	5.0	1.1	7.8%
	My organization pays attention to its external image.	5.0	1.1	3.5%
General organizational innovativeness (V16) moderates V6	My organization is often part of the vanguard with regard to new technologies.	4.4	1.4	3.5%
	My organization is eager to try out new things.	4.2	1.4	2.6%
Organizational environmentalism (V17) moderates V7 to V9	My organization is environmentally conscious.	4.8	1.1	4.0%
	My organization acts in an ecologically sustainable way.	4.6	1.2	5.4%

Table 4
Measurement of variables to test for autonomous (extrinsic) motivation.

Variable	Item text	M	SD	Missing values
Individual values				
Individual environmentalism (V18) moderates V7 to V9	It worries me when I think about the environmental conditions our children and grandchildren will have to live with	4.7	1.3	3.5%
	If we just carry on as before, we are heading for an environmental catastrophe	4.5	1.2	4.0%
General individual interests and *innovation specific individual interests*				
Technophilia (V19)	I get very enthusiastic about technology	4.3	1.5	3.1%
	I keep up to date with new technological developments.	5.1	1.0	4.0%
	I am often the first in my group of friends to acquire a new technology	4.8	1.2	4.9%
Interest in EVs (V20) mediates V19	Personally I am very interested in EVs	4.0	1.3	1.3%

users dominate the adopter sample. Therefore, it is necessary to focus on BEVs in order to benefit from the more valid evaluations that result from the hands-on experience of BEV-adopters. (2) The first EVs that might trigger a mass market for EVs are battery electric vehicles: the Tesla Model 3 and the Chevrolet Bolt (DeBord, 2016). Therefore, the focus on BEVs enhances the practical relevance of our results.

The first component of the measurement model is the variable block V2 to V14 that represents the *perceived outcomes of EV procurement.* These independent variables determine the dependent variable (V1) that reflects the *intention to champion EV procurement* (cf. Table 2). The *intention to campaign for EV procurement* is operationalised by a generic item. For respondents without BEVs in the organizational car pool, the item text is "I will champion my organization procuring BEVs within the next five years." Respondents who already have BEVs in their car pool were asked about their intention to champion additional BEV procurements.

The selection of the aspects that we survey as the *perceived outcomes of EV procurement* is primarily based on literature about EVs in commercial fleets (Golob et al., 1997; Koetse and Hoen, 2014; Sierzchula, 2014; Wikström et al., 2014). In addition, some of the variables originate from our own prior research – namely reduced safety (V12), reduced comfort (V11), and the reactions of other organizational members (V13; Globisch et al., 2013). Not derived from the existing literature or our own prior research is the improved motivation of employees (V14) as a possible outcome of BEV procurement. It makes sense to include this aspect, because company cars are often a way to motivate employees and account for a substantial share of the vehicles in commercial fleets in Germany (Diekmann et al., 2011).

The results of Sierzchula (2014) indicate that the (experimental) adoption of single BEVs might be different from replacing conventional vehicles by BEVs on a larger scale in car pools, i.e. the importance of certain barriers to and drivers for the adoption of BEVs may change with the number of procured BEVs. We analyse the research question in the context of a large-scale adoption of BEVs and aim to provide results that are of relevance for (supporting) the pending rollout phase of BEV diffusion throughout the vehicle stock. Therefore, we operationalise the *perceived outcomes of EV procurement* using items that survey the perceived outcomes of replacing at least one third of the conventional vehicles in the organization's car pool by BEVs.

In a second step we include variables which cover *organizational values and interests* and enable testing of hypothesis 1 (V15 to V17; cf. Table 3). These variables are organizational image cultivation (V15), general organizational innovativeness (V16), and organizational environmentalism (V17) as moderator variables. These variables are selected based on the findings of Sierzchula (2014) that the adoption decision is mainly influenced by environmental benefits, the improvement of the corporate image and the organization's desire to be part of the vanguard. In the context of OIT, we therefore focus on *organizational values and interests* that are related to these aspects and might constitute a controlled extrinsic motivation for car pool managers to campaign for BEVs. We do not include organizational interests that relate to barriers to BEV adoption (e.g. organizational thriftiness) as moderator variables. This is because organizational interests that are an obstacle to BEV adoption cannot facilitate a (controlled extrinsic) motivation to campaign for BEV procurement.

To reproduce the theorised interacting nature of *organizational values and interests* with the *perceived outcomes of EV procurement,* we include V15 to V17 as moderator variables. Moderator variables determine the strength and direction of the influence that an independent variable exerts on the dependent variable. In a regression analysis they are represented by interaction terms, i.e. along

with (the moderated) independent variable and its moderator variable, the product of both variables is included as a predictor of the dependent variable (Hayes, 2013).

Variables 15–17 are theorised to moderate the influence of the thematically corresponding independent variables: organizational image cultivation is included as a moderator of improved image (V5). General organizational innovativeness is theorised to moderate the influence of experience gains (V6). Organizational environmentalism is included as a moderator of climate protection, reduced traffic noise, and reduced air pollution (V7 to V9).

In a third step we add variables that represent *individual values* to test for autonomous extrinsic motivation (hypothesis 2) as well as variables corresponding to *general* and *innovation specific individual interests* to test for intrinsic motivation (hypotheses 3 and 4, cf. Table 4). *Individual values* are represented in our model by individual environmentalism (V18). The items we use originate from the validated scale "general environmentalism" (Wingerter, 2014). The selection of this variable is based on the findings of Wikström et al. (2014). They identify environmental friendliness and low noise emissions as the main advantages of BEVs from the point of view of individual commercial users. Therefore, we conclude by analogy that these aspects may also be seen as advantages that fuel the individual's willingness to campaign for BEVs. In the context of OIT we include individual environmentalism as *individual values* that refer to such advantages.

The decision to operationalise *general individual interests* using technophilia (V20) is based on findings with regard to private consumers' acceptance of electric and other alternative fuel vehicles (Jansson et al., 2009; Axsen et al., 2012). These results indicate that technophilia may foster the interest in EVs, i.e. *innovation specific individual interest*.

Analogously to organizational environmentalism we include individual environmentalism as a moderator for climate protection, reduced traffic noise, and reduced air pollution (V7–V9). In order to reflect the theoretical model, interest in EVs is included as a mediator variable for technophilia; i.e. technophilia is expected to influence interest in EVs, which in turn influences the intention to campaign for BEV procurement. Technophilia is operationalised by items which proved to be a valid measurement of the construct in surveys which were conducted earlier by our institute.

3.3. Methods used for data preparation and analysis

Our sample is not big enough in relation to the number of coefficients that need to be estimated in our model to be able to use structural equation modelling (SEM; cf. Hair, 2010). Therefore, we use ordinary least square regression (OLS) to test the moderation and mediation effects expressed in our hypotheses. We use SPSS (Version 21) and the PROCESS-macro for SPSS. This offers advantages as the PROCESS-macro allows the estimation of indirect effects and provides bootstrap confidence intervals to assess their statistical significance (Hayes, 2013).

To prepare the data for our analysis we perform an imputation of missing values using the expectation–maximisation-algorithm (EM-imputation; Allison, 2002). This is necessary for two reasons: (1) as the number of items in our analysis is quite high, list wise deletion would reduce our sample to an unacceptable size (n = 45) and is therefore not an option. There is no single variable with a high share of missing values. Instead, the missing values are distributed rather evenly amongst the variables. Thus, the problem cannot be solved by excluding certain variables. (2) Other methods to deal with missing data are not applicable: In general, alternatives to EM-imputation include parameter estimation using the full information maximum likelihood procedure (FIML) and estimating missing values using multiple imputation (MI). In contrast to FIML and MI, EM-imputation can decrease the standard errors of the coefficients. However, FIML is only available for SEM, which is not applicable due to the size of the sample. Datasets generated by MI are not compatible with the PROCESS-macro and the application of MI is problematic for models that contain interaction effects, which is the case for our analysis (Allison, 2002).

Because OLS-regression cannot deal with latent variables, we use average scores for variables that are measured by more than one item as suggested by Hayes (2013). E.g., the value for technophilia (V19) for a respondent is the average of the three values that result from the answers of this respondent to the three items that measure technophilia. This posits that the items measure the underlying latent variable in a reliable way that also features construct validity. To assess the reliability and validity of constructs measured by more than one item we conduct a confirmatory factor analysis (CFA). For a CFA that contains only the multi-item constructs of our model less parameters have to be estimated compared to a model that includes all variables. Thus, a SEM approach can be applied (cf. Hair, 2010). To do so we use AMOS 21. The CFA shows that the empirically observed covariance structure sufficiently fits the covariance structure postulated by our factor model – all parameters indicate a good global fit (cf. Table 5). In particular the deviations between the expected and empirical observed covariance structure are not significant (p = .062). Furthermore, the Comparative Fit Index (CFI) and the Root-Mean-Square-Error of Approximation (RMSEA) are above or below their cut-off values respectively. In addition, PCLOSE indicates that the hypothesis of a RMSEA value above .05 can be rejected and the upper bound of the confidence interval of RMSEA (HI90) is below .10, i.e. a poor fit of the model can be ruled out.

Table 5
Global fit of the factor model.

Global fit of the model	χ^2	df	χ^2/df	p	CFI	RMSEA	PCLOSE	HI90
Acceptable fit*	n.a.	n.a.	2	n.a.	> .95	< .08	> .05	≤.10
Good fit*	n.a.	n.a.	1.5	> .05	> .97	< .05	n.a.	n.a.
*cf. Kline (2011), Hair et al. (2010)	52.248	38	1.375	.062	.989	.041	.705	.066

Table 6
Results of CFA to assess construct validity of multi-item constructs.

Variable	Indicator	Indicator reliability	Factor reliability	Average variance extracted	Squared max. intercorrelation
Threshold for acceptable local fit *Bagozzi and Yi (1988) **Fornell and Larcker (1981)		≥.4*	> .6*	> .5**	< AVE**
Organizational image cultivation	My organization wants to be linked to certain values.	.679	.804	.672	.454
	My organization pays attention to its external image.	.669			
General organizational innovativeness	My organization is often part of the vanguard with regard to new technologies.	.849	.870	.770	.370
	My organization is eager to try out new things.	.705			
Organizational environmentalism	My organization is environmentally conscious.	.876	.911	.836	.454
	My organization acts in an ecologically sustainable way.	.795			
Individual environmentalism	It worries me when I think about the environmental conditions our children and grandchildren will have to live with.	.679	.810	.680	.050
	If we just carry on as before, we are heading for an environmental catastrophe.	.682			
Technophilia	I get very enthusiastic about technology.	.863	.840	.639	.134
	I keep up to date with new technological developments.	.757			
	I am often the first in my group of friends to acquire a new technology.	.409			

Table 7
Refinement of the initial model.

R^2 (adjusted R^2)	Initial model (step 1) .535 (.464)		Model after exclusion of coefficients with p > .1 (step 2) .461 (.442)	
Variable	Standardised effect	p-value	Standardised effect	p-value
Perceived outcomes of BEV procurement				
Reduced reliability (V4)	−.159	.013	−.156	.003
Climate protection (V7)	(.101)	(.127)	.173	.001
Mobility constraints (V10)	−.112	.086	−.174	.002
Improved motivation (V14)	.118	.005	.213	.000
Organizational values and interests (and respective interaction terms)				
General organizational innovativeness (V17)	.128	.062	.147	.015
Organizational environmentalism (V18)	(−.008)	(.909)	(−.007)	(.901)
Interaction (organizational environmentalism*climate protection)	−.162	.020	(−.069)	(.134)
Individual interests				
Interest in EVs (V21)	.195	.004	.346	.000

The results of the CFA with regard to the reliability and validity of the multi-item constructs in our model are displayed in Table 6. It can be assumed that reliability and convergent validity as a precondition for construct validity are at hand if indicator and factor reliability and the Average Variance Extracted (AVE) are above their cut-off values. In addition, the square of the highest inter-correlation of a factor should be lower than its AVE so that discriminant validity as a precondition of construct validity can be taken for granted. The results of the CFA indicate that the multi-item constructs of our model are reliable measures and feature construct validity.

The actual analysis consists of three steps: (1) constructing the model that includes all the above described variables and interaction terms. (2) Refining our model by excluding all the variables and interaction terms with a p-value above .1. (3) Removing all the variables and interaction terms that have a p-value above .05. The reason for the second step is that the initial model contains several interaction terms and also several variables that are thematically related. This fosters collinearity, which results in increased confidence intervals for the parameters (Cohen et al., 2010). Excluding variables with a p-value above .05 from the outset would risk abandoning variables prematurely. To apply the cut-off value of .1 in the second step seems reasonable as the interaction effects result from our (generic formulated) hypotheses can be considered as directional, e.g. a more environmental conscious respondent is expected to attach more importance to mitigation of climate change by EV adoption.

4. Results

The initial model (step 1) contains five variables and one interaction term (interaction between organizational environmentalism and climate protection) with p-values below .1. Table 7 provides the standardised effects and p-values of these variables, the interaction terms and the variables that the interaction term contains (for improved clarity the effects and p-values of variables and interaction terms with p-values above .1 are not reported).

As the products of an interaction term have to be included in a model irrespective of the significance of their effects, seven independent variables and one interaction term remain in the model after the first refinement (step 2; Hayes, 2013). As a result of excluding variables and interaction terms with p-values above .1, the interaction between organizational environmentalism and climate protection becomes insignificant. Simultaneously the direct effect of climate protection on the intention to campaign for BEV procurement becomes significant. Therefore organizational environmentalism and its interaction term with climate protection are excluded from the analysis.

To assess if the effects in our model are valid for the whole sample we subsequently test if interactions with four control variables are at hand. These control variables are the adopter status of the organization (adopter organization vs. non-adopter organization), hierarchic position of the respondent (top management vs. not top management), car pool size (number of vehicles) and size of the organization (number of employees). The latter two variables show neither significant direct effects nor significant interaction effects. The adopter status of the organization shows significant interactions with the effects of reduced reliability and mobility constraints. The hierarchic position of the respondent interacts significantly with the effect of general organizational innovativeness. The effects of this final model are depicted in Fig. 2. As the effects of reduced reliability, mobility constraints and general organizational innovativeness are conditional on adopter status or the hierarchic position of the respondent respectively it is specified in brackets to which subsample the reported effects refer.

Overall, the final model explains 50.1% (R^2 = .501) of the variance of the intention to campaign for BEV procurement. Climate protection (.194) and improved motivation (.192) exert positive influences.

The expectancy of mobility constraints exerts a negative influence if the organization of the respondent has already adopted EVs (−.236) while there is no significant effect for respondents from non-adopter organizations. Vice versa the effect of reduced reliability is only significant for respondents from non-adopter organizations (−.271) and not significant for those whose organizations have already adopted EVs. Furthermore, general organizational innovativeness only has a significant effect if the respondent belongs

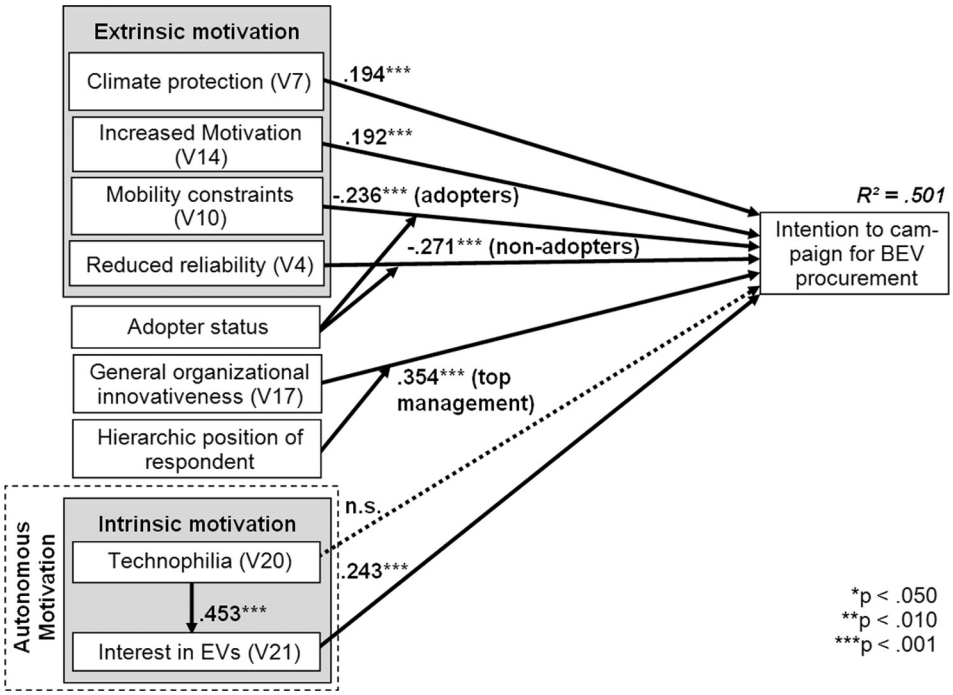

Fig. 2. Standardised effects of the final model.

to the top management of their organization (.354) while the effect is not significant for participants from lower hierarchical levels. Except from these findings there are no significant direct or interaction effects of the control variables with other variables of the model including technophilia and interest in EVs.

None of the theoretical postulated interaction effects are significant. Nor have organizational image cultivation or organizational and individual environmentalism significant direct effects. Thus, these variables are not present in the final model. The strongest unconditional effect on the intention to campaign for BEV procurement is exerted by interest in EVs (.243), although it has to be noted that the coefficients' confidence intervals show that the effect sizes in the model do not differ significantly.

Technophilia (.453) has a significant positive effect on interest in EVs. The direct effect of technophilia on the intention to campaign for BEV procurement turns out to be insignificant. The standardised indirect effect (not depicted Fig. 2) that technophilia exerts on the intention to campaign for BEV procurement via interest in EVs is .110. The bootstrap confidence interval for the non-standardised indirect effect (.146) ranges from .064 to .258.

5. Discussion and conclusions

The share of the variance in the intention to campaign for BEV procurement that is explained by our model is quite high (50.1%). Thus, it can be assumed that the model covers relevant factors that influence the intention to campaign for BEV procurement.

The results of our analysis support hypotheses 3 and 4 while hypotheses 1 and 2 are not supported due to the lack of significant interaction effects. With regard to the main motivation of procurement initiatives for BEVs several conclusions can be drawn: our findings indicate that intrinsic motivation drives initiatives for BEV procurement. There are no indications that controlled or autonomous extrinsic motivation lead to the occurrence of procurement initiatives. In other words, the personal enthusiasm of individual (not necessarily high-level) members of the organization for BEVs seems to be crucial for whether the question to adopt BEVs makes it onto the organizations' agenda. These findings make it clear that we should not think of organizations as unitary actors with coherent preferences when it comes to BEV adoption. Efforts to accelerate the adoption of BEVs by organizations should therefore aim at identifying individuals who are enthusiastic about BEVs and then support these individuals in their efforts to make BEVs attractive to other organizational members.

The finding that the general organizational innovativeness has only a significant effect for respondents belonging to the top management may also be seen as support for the importance of personal interests like technophilia. Such an interpretation is based on the assumption that members of the top management put their own attitudes on level with their perception of organizational characteristics, e.g. especially technophile top managers also might evaluate their organization as more innovative.

With regard to the perceived outcomes of BEV procurement, the analysis shows a significant positive effect for climate protection – the better the environmental record of BEVs is perceived, the stronger is the intention to launch an individual procurement initiative. The absence of a significant interaction with individual or organizational environmentalism indicates that the environmental record of BEVs is of general relevance, i.e. how the environmental record of BEVs is perceived is generally important for all

kinds of organizations and individuals, not only for especially environmentally conscious ones. As a consequence, it can be concluded that demonstrating and emphasising the environmental benefits of BEVs should be part of all marketing efforts aiming to accelerate BEV diffusion.

Furthermore, the respondents' perceptions with regard to reduced reliability and mobility constrains are important. The result that only procurement initiatives in non-adopter organizations are discouraged by concerns about reliability illustrates that this aspect should be a central element of promoting efforts. The finding that reduced reliability has no significant effect on personal procurement initiatives in adopter organizations suggests that reliability is not a major issue in practice. Thus improving trialability of EVs (cf. Rogers, 2003) by ceding demonstrator vehicles to non-adopter organizations for some time might be an effective way to overcome concerns.

The finding that concerns about mobility constraints can inhibit the occurrence of individual procurement initiatives in adopter organizations highlights that the limited range of BEVs can impede EV diffusion by discouraging organizations from follow-up EV-procurements after an initial EV adoption took place. Therefore, the development of BEVs with higher ranges, like the Tesla Model 3 and the Chevrolet Bolt, might be a promising step to accelerate large scale adoption of BEVs by commercial fleets. This result also might indicate that absence of range restrictions in the case of PHEVs is an advantage. I.e. PHEVs might accelerate the diffusion of EVs through commercial fleets as long as their twofold power train does not result in lower reliability due to its higher complexity or doubts about their environmental record due to the partial use of conventional propellants.

The result concerning improved motivation is striking: it is the only variable that represents a perceived outcome of BEV procurement that has a significant influence and possibly constitutes a potential benefit for the organization. There are different possible reasons for the influence of improved motivation on the intention to campaign for BEV procurement: one possibility is the respondent campaigns for BEV procurement on behalf of an organizational interest for employee motivation. Another possibility is that the influence of improved motivation springs from the social context, e.g. organizational members are more inclined to campaign for BEV procurement if they expect positive reactions from their colleagues. Both ad-hoc explanations imply a controlled extrinsic motivation. The first explanation assumes a response to organizational interests (e.g. campaigning for BEVs because management is eager to improve employees' motivation). The second explanation assumes a reaction to the social environment (e.g. campaigning for BEVs because this will be appreciated by one's colleagues).

Overall our results provide some novel insights into the inner organizational processes that precede a decision about BEV adoption. However, there is a need for further research: to promote the diffusion of EVs, greater efforts should be dedicated to identifying (potential) innovation champions, how these champions can be persuaded to get involved in marketing efforts and effectively supported. More research should also be done on the acceptance of EVs by company car users and car pools that serve primarily to motivate employees by providing them with company cars.

Some limitations of our study should also be mentioned: our sample is relatively small, and rules out the application of advanced analytical methods like SEM. Although our efforts to include both adopters and non-adopters of EVs in our sample address the methodological limitations of previous studies, there is still room for improvement, e.g. the number of non-adopters is relatively small and mainly based on convenience sampling. Combining adopter samples and large representative samples of non-adopters in future studies would reduce the uncertainties with regard to generalisability.

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