



Electrifying the company car: Identifying hard and soft barriers among fleet managers in Switzerland

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ABSTRACT

Electric mobility has an important role to play in the transition to a more sustainable transportation system. However, adoption is still relatively slow in most countries, also within organizations and their corporate fleets. Much cited hard barriers such as the limited availability of charging infrastructure do not fully explain this slow uptake. Consequently, the research field of social acceptance of electric mobility with a focus on acceptance related soft barriers has emerged. This paper adds new theoretical as well as practical insights to the debate. Methodologically, the paper is based on a multi-method approach. Firstly, an online survey with Swiss fleet managers ($n = 30$) supports the importance of acceptance related soft barriers. 63% of the participants assessed the lack of knowledge as an important barrier and the lack of demand from employees was considered an important barrier by 56% of the participants. Secondly, a behavioral intervention campaign to address those barriers was developed and assessed in a field experiment with carpool users ($n = 10$) in the city of St. Gallen. The behavioral intervention campaign consisted of a one-week trial period with EVs in the normal course of business life, free of charge, and without obligation. The results of the field experiment indicate that acceptance levels of both hard and soft barriers evolved positively from before (T0) to after (T1) the trial period. This suggests that designing a campaign to address acceptance related soft barriers might help increase social acceptance and the adoption of EVs in corporate fleets.

1. Introduction

Transitioning away from our present transportation system may well be one of the hardest tasks of our generation [1,2]. In order to achieve this transition, the IEA [3] states that at least 20% of all road transport vehicles globally need to be electric by 2030. Electric mobility in general plays an important role in reducing greenhouse gas emissions, as electric vehicles operate more efficiently than vehicles with internal combustion engines and rely on electricity which can be sourced sustainably [4,5]. As a result, many countries and organizations have introduced roadmaps and scenarios, such as the IEA EV30@30 Scenario which targets a 30% share for electric vehicles in the vehicle fleet (except for two-wheelers) by 2030 for all participating parties [6]. On an individual country basis, roadmaps have also been drafted and signed. Switzerland, for instance, foresees in its roadmap an increase in the share of EVs for newly registered passenger cars to 15% by 2022. However, the adoption of electric mobility is still relatively slow – for private individuals as well as for corporate fleets which are of particular importance in relation to the further expansion of electric mobility given the fact that corporate

vehicles have higher annual mileage than privately owned and used vehicles [7,8,9,10] and are also resold more quickly than private cars and thus diffuse faster via the used car market [11,12,13].

Literature states several *hard barriers* (such as a limited availability of charging infrastructure or the higher upfront investment cost) and *soft barriers* (such as the lack of knowledge or low perception of ease of use) for the slow uptake of electric mobility [14,15,16,17]. Consequently, many countries have introduced policy instruments to reduce the barriers and to accelerate the adoption of EVs [18]. The most widely implemented policy instruments are monetary incentives (e.g., cash grants, road tax exemptions), traffic regulation incentives (such as free use of downtown parking spaces, or free use of bus/priority lanes) or incentives for building charging stations [18,19]. Despite the introduction of these policy instruments, the aforementioned barriers prevail [13,20]. Recently, a new field of research has emerged with a focus on social acceptance of electric mobility [10,13,21], arguing that a better understanding of the acceptance of electric mobility especially also within organizations is crucial for its further adoption [13,22].

Based on these considerations, this paper is written to add to the

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topic of social acceptance of electric mobility within organizations. The objective of this paper is to investigate whether the importance of prevailing acceptance related barriers can be confirmed (*Study 1*) and how a behavioral intervention campaign that addresses such barriers (*Study 2*) could influence the social acceptance of electric mobility by key people within organizations and consequently, also the adoption of EVs in corporate fleets. For this purpose, I opted for a multi-method approach: *Study 1* consists of a survey with fleet managers and *Study 2* conducts a field experiment with carpool users including the specific behavioral intervention campaign. This resulted in the following three main research questions:

1. *What are the biggest sources of motivation and barriers for Swiss fleet managers with regard to the electrification of corporate fleets?*
2. *To what extent do acceptance related barriers influence the electrification of corporate fleets?*
3. *How does a behavioral intervention campaign that addresses acceptance related barriers affect the likelihood to opt for electric mobility in corporate fleets?*

The rest of this paper is structured thus: The next section reviews and discusses the relevant literature concerning social acceptance and the adoption of electric mobility in corporate fleets as well as the topic of organizational buying decisions. [Section 3](#) presents the methodology used for this research paper. [Section 4](#) includes a presentation of the results of the two studies that were undertaken to address the research questions followed by the discussion in [Section 5](#). The paper concludes with [Section 6](#), which presents general conclusions, suggests related implications for policy and practice and adds a definition of limitations as well as a description of opportunities for further research.

2. Theoretical background

2.1. Motivators and barriers to EV adoption in organizations

Previous scholars have extensively studied the sources of motivation as well as barriers to the adoption of electric mobility. In previous years, most of these studies have focused on understanding the private consumer perspective, including demand preferences, forecasting, and related policies [23]. However, as discussed by Sierchula [10] and Klauenberg et al. [24], organizations are likely to be at the forefront of adopting electric mobility. This is mainly due to their high vehicle-purchasing rate (company vehicles account for a significant proportion of newly registered passenger cars – 64% for Germany [25] and 57% for Great Britain [26]) and the more intense use of vehicles compared to privately owned ones [17,27,28,29]. In what follows; therefore, the paper focuses on *motivators* and *barriers* from an organizational point of view.

Important *motivators* for electric mobility adoption in corporate fleets center on environmental aspects such as the positive impact of electric mobility on reducing CO₂ emissions, their low noise level compared to conventional combustion engine vehicles, and their positive effect on reducing air pollution [17,30,31]. From an economic perspective, lower fuel costs and higher efficiency, thus lower overall operating costs, are the main drivers for adopting electric mobility in corporate fleets. In the regulatory domain, incentives that reduce the tax levy on EVs (or increase them for conventional vehicles) can further increase the acceptance of electric mobility in fleets and consequently serve as a source of motivation [32]. In addition, incorporating electric vehicles into the corporate fleet can promote a positive corporate image due to their high level of general acceptance by the public [10,22,31].

On the other hand, the literature has also identified several *hard* and *soft barriers* to the further expansion of electric mobility in corporate fleets. Hard barriers to the further adoption include the lack of sufficient charging infrastructure [10,17,33] and economic factors such as the higher upfront investment cost [31,34,35]. Sierchula [10] shows in a

study that higher investment costs could discourage smaller companies in particular from integrating electric vehicles into their fleets. Other hard barriers include more technical aspects such as grid-related issues that may play a role when simultaneously charging large fleets. Additionally, the limited availability of electric vehicles tailored to the needs of organizations [31,36] can be a further limiting factor especially when considering the adoption of electric vehicles for goods transport [37]. This is further complicated by the fact that different aspects of an electric vehicle are considered to different degrees depending on the type of electric vehicle (electric car versus electric van) that the buyer wishes to purchase. For example, a possibly reduced payload capacity which influences the operational suitability of an electric vehicle is clearly more important when buying an electric van for freight transport than when buying a regular electric car and may affect the final purchasing decision [37]. Soft barriers, on the other hand, include issues such as a lack of trust, the role of information and knowledge, and the perception of the ease of use of electric vehicles [13,17,34]. Shao et al. [34] show in their study that the gap between customers' expectations and perceptions can influence the acceptance of electric mobility within organizations. Biresselioglu et al. [17] add further evidence to support the claim of the importance of soft barriers by showing that a lack of knowledge about electric vehicles that are already available on the market (for example, about their environmental performance, the total cost of ownership or the ease of use of electric vehicles in general) may be a significant barrier to the further adoption of EVs [17]. These findings about soft barriers are also supported by the study of Globisch et al. [13] which revealed the importance of social aspects such as the role of the motivation of carpool users in the adoption of electric mobility within organizations, as well as findings by Axsen and Kurani [38] that showed that interpersonal influence plays an important role in whether specific technologies are favorably assessed in a company (in this case, plug-in hybrid vehicle technology). Additionally, Skippon and Garwood [39] found that technologies with which members of an organization have no, or limited experience are perceived as abstract and their further expansion is therefore limited.

2.2. The role of policy instruments in adopting EVs in organizations

Policy instruments can help to address the aforementioned prevailing barriers to the adoption of EVs in corporate fleets. Bjerkan et al. [40] categorized the existing policy instruments into four general *areas*. Within the *regulatory area* are included restrictions such as obligatory emission targets for new vehicles or production standards. Within the *economic area* market outcomes are influenced by price or quantity changes through tax reductions or direct subsidies [41,42]. Within the *organizational area* hurdles for developing the necessary infrastructure are reduced, such as by developing the charging infrastructure network, or creating free parking spaces in city centers. Finally, within the *suasive area* are classified measures for persuading buyers through information and education [41,42].

Of all these general policy areas, the *economic area* is seen as being of particular relevance at the early stage of commercialization [43] and has also been researched most intensively [10,18,20,40,44]. Nonetheless, the results of studies show that the effectiveness of financial incentives is not straightforward. Zhang et al. [45], for example, reports to finding a very weak association between (purchase-related) subsidies and the willingness of consumers to buy EVs. Furthermore, financial incentives may have less of an effect on the further uptake of electric mobility if customers are also exposed to *soft barriers* such as a high degree of unfamiliarity with the technology (i.e., display a lack of trust or knowledge) [46,47], or have low exposure to electric vehicles in the fleet around them (misperceptions about ease of usability) [48]. This indicates that the mix of policy instruments should treat the adoption of electric mobility in a more holistic way [49], addressing both *hard* and *soft barriers*.

In a practical case for the adoption of EVs in corporate fleets,

Wikström et al. [21] show that it requires three prerequisites for adopting EVs: on the one hand, the transport requirements and expectations of drivers and/or operators must be fulfilled, and, on the other, that the EVs must be economically competitive or even more attractive than comparable conventional vehicles in terms of life-cycle costs. The third prerequisite is the social acceptance of electric mobility within the company [21,22]. To meet these prerequisites a holistic mix of policy instruments is needed. The first two prerequisites can be fulfilled by further reducing hard barriers through technological development and the deployment of policy instruments in the economic, regulatory, and organizational domains. To fulfill the third prerequisite – a high level of social acceptance – further research is needed on how acceptance related soft barriers such as a low level of usability or a lack of trust and knowledge can be reduced. This again underlies the fact that a better understanding of the social acceptance of electric mobility within organizations is crucial for its further adoption [13,20].

2.3. Social acceptance of electric mobility within organizations

The adoption of electric mobility is increasing only slowly in most countries despite different studies that indicate high general social acceptance levels for electric mobility [22,31,50]. Within the concept of social acceptance, Wüstenhagen et al. [51] differ between three different levels of social acceptance: socio-political acceptance (i.e., general acceptance, public opinion with regard to a technological development), market acceptance (i.e., the willingness of organizations to invest into the technology and consumers to engage in markets created by the technology), and community acceptance (i.e., acceptance of specific projects by residents, organizations and/or local authorities). For the topic of electric mobility, fostering market acceptance is still seen as a major challenge [52]. A high level of market acceptance both of important stakeholders such as fleet managers as well as individual end-users such as carpool users is a prerequisite for the successful expansion of electric mobility [13,53]. So far, organizations have been reluctant to fully embrace electric mobility, despite the fact that EVs are associated with lower operating costs and are already competitive with conventional vehicles in terms of total cost of ownership [6,54]. In Section 2.1 various hard and soft barriers that influence this reluctance and low level of market acceptance have been discussed [15,16,17], with hard barriers still being seen as the main means of explaining the slow growth of electric mobility in corporate fleets. However, the role of reducing soft barriers in order to achieve a high level of market acceptance should not be underestimated [17,52]:

Globisch et al. [13] as well as Sierczula [10] point out the importance of social aspects and emotional attitudes of employees such as the role of the motivation of carpool users in the adoption of electric mobility within organizations. Kaplan et al. [22] come to the conclusion that the acceptance of EVs in companies that have already introduced a number of EVs is higher than in companies without EVs – positive experience with an earlier (conventional) vehicle and consequently a lack of experience with a new technology can be a limiting factor [39,52]. In line with these findings, Shao et al. [34] and Biresselioglu et al. [17] argue based on insights from industry experts that whether electric mobility in organizations is favorably assessed significantly depends on its perceived ease of use, user-friendliness, and perceived utility. Finally, Anable et al. [55], Bakker & Trip [56] and Ziefle et al. [52] highlight that market acceptance of electric mobility (and thus also purchasing-related intentions) may be affected by the way in which information is presented and how access to information about the new technology is ensured. Next to achieving a high overall level of market acceptance for EVs in corporate fleets, Nesbitt & Davies [57] add another important element by indicating that preferences and priorities for EV deployment can vary between actors *within* an organization. The next chapter therefore discusses the typology of the buying centre for EV adoption in corporate fleets and the different roles and levels of influence of individuals within an organization.

2.4. A typology of the buying centre for EV adoption in corporate fleets

Organizations should not be regarded as single actors with coherent acceptance levels for the introduction of EVs; consequently, the decision-making process in fleet management plays an important role for the adoption of electric mobility in organizations [13,58]. The literature stream of technology acceptance offers insights in order to explain the adoption of electric vehicles in corporate fleets. For example, the theoretical framework of the Technology Acceptance Model (TAM) developed by Davis [59,60] suggests that when a person is presented with a new technology, several factors such as ‘perceived usefulness’ and ‘perceived ease of use’ influence his or her decision about it, and how and when it will be used [29]. Further publications have found that intrinsic motivations [61] as well as extrinsic motivations such as subjective norms [62] have an impact on users’ acceptance of new technologies.

However, the TAM framework focuses on employees’ individual decisions to use a new technology and not so much on management’s prior decision to purchase and integrate the new technology into the organization. The buying centre model by Webster & Wind [63] provides an opportunity for a deeper understanding of the roles involved in organizational buying decisions. The model of Webster & Wind [63] identified various roles such as decider, buyer, user, influencer and gatekeeper, all of whom are involved in the decision-making process. The model is descriptive in nature. According to Globisch et al. [13] and Wikström et al. [29] different persons are involved in the decision to adopt electric vehicles in corporate fleets. These individuals could be related to different roles taken from the buying centre model as suggested by Webster & Wind [63]. In particular, the decider (e.g., the management or the owner), the buyer (e.g., fleet manager) and the user (e.g., carpool users) could be identified as playing a pivotal role in the adoption process. Moreover, the roles of initiators (e.g., CSR department), influencers (e.g., network partners) and gatekeeper could be identified. Several individuals may occupy the same role (e.g., there may be several influencers). Further, one person may occupy more than one role at the same time (fleet manager can be buyer and gatekeeper) [63].

In order to explore the role of the different actors within the buying centre for EVs in corporate fleets and to investigate how to increase social acceptance and reduce acceptance related soft barriers, this research paper applied a multi-method approach, combining a quantitative online survey (Study 1) with a field experiment (Study 2) including a behavioral intervention campaign.

3. Methodology

3.1. Study 1

Study 1, an online survey with Swiss fleet managers, was conducted with the aim to investigate the preferences of corporate fleet managers in the areas of motivators for and barriers against adopting electric mobility in corporate fleets, as well as to identify preferences for different policy instruments.

3.1.1. Data & sample

Study 1 was based on an online survey with Swiss organizations with corporate fleets (e.g., fleets consisting of different types of vehicles such as cars and vans) and was specifically targeted at fleet managers. A two-step procedure was used in the design of the survey: First, relevant survey elements were identified in line with feedback obtained from four expert interviews (see Appendix A) and a literature review (i.e., qualitative pre-study). The expert interviews were implemented with fleet managers from large-sized Swiss companies between October 2017 and November 2017. Second, we identified potential survey participants (i.e., fleet managers of large Swiss organizations) using keyword searches related to fleet management, as applied to company lists and the websites of umbrella organizations. These individuals ($n = 125$)

were then contacted twice by e-mail (a first mailing and reminder) and asked to participate in the survey through accessing a link to the online survey.

Data were collected between December 11, 2017 and January 21, 2018. In total, 85 fleet managers accessed the survey. Sample cleaning eliminated double entries and incomplete responses, leaving a final sample containing data from 30 fleet managers for in-depth analysis. The average fleet size managed by the participants of the final sample was 51.33 vehicles. This is nearly the average size of a company fleet in Switzerland, which averages 54 vehicles [64]. The standard deviation of the number of vehicles was 97.69, with the sample composed as follows: 30% of the companies operated between 1 and 9 vehicles in their fleet, 53.33% between 10 and 99 vehicles, 13.33% had between 100 and 499 vehicles and 3.33% more than 500 vehicles. Additionally, the sample of 30 fleets was composed in terms of industry origin as follows: retail (20%), financial services (26.66%), construction (33.33%), energy (13.33%), consumer goods (13.33%). In terms of the average number of kilometers travelled per day and vehicle, the average of the sample amounted to 55 km per day (SD = 18.75). The final sample of 30 fleet managers corresponds to a response rate of 24%. In online surveys with decision-makers from a specialized target group (in this case fleet managers of large Swiss companies), the sample sizes are typically rather small [65,66]. In addition, the decision-makers of the chosen target audience tend to be very busy and have difficulties to deduct 15–20 min from their schedule to participate in a survey, which explains the rather low response rate.

3.1.2. Survey & measurement

Respondents were first introduced to the project and the topic of electric mobility in corporate fleets. Subsequently, several survey questions followed, grouped into three sections:

- **Section 1:** Fleet management criteria and roles
- **Section 2:** Motivators and barriers to the adoption of electric mobility in corporate fleets
- **Section 3:** Preference for policy instruments to increase the adoption of EVs

The survey questions were selected on the basis of a literature review and insights from the four expert interviews conducted prior to the survey (see Appendix B). The first set of questions in **Section 1** analyzed the different criteria organizations apply in their fleet renewal processes as well as the role that fleet managers adopt in relation to the roles of the buying centre by Webster & Wind [63]. In **Section 2**, fleet managers were asked to indicate the most important motivators and barriers in relation to the introduction of electric vehicles in corporate fleets. Finally, **Section 3** identified preferences for different policy instruments (local vs. national, monetary vs. non-monetary). Question types were mainly designed as single or multiple-choice questions with responses given on a four-point Likert-scale.

3.2. Study 2

Study 2, a field experiment with a behavioral intervention campaign, aimed to further explore the role of acceptance related barriers to the adoption of electric mobility in corporate fleets and how to reduce such barriers in order to increase acceptance and also purchasing intentions.

3.2.1. Behavioral intervention campaign for addressing acceptance related soft barriers

Currently, only a very limited number of campaigns that address

acceptance related soft barriers are in place.¹ Therefore, a specific campaign was created in collaboration with the Office for Environment and Energy of the city of St. Gallen.² The behavioral intervention campaign that was developed ("*Wirtschaft unter Strom*"³) was designed to provide test drives with electric vehicles to professional users in the normal course of business life in a simple and unbureaucratic way, free of charge, and without obligation (see Appendix C). Companies were able to reserve an electric vehicle of choice (electric car or electric van) for the desired week via a reservation platform. The EV was delivered to the company and its functioning explained to the carpool users: the company and thus the carpool users could then test the electric vehicle on a daily basis for one week. Temporary charging infrastructure was also provided as part of the campaign (the municipal utility of St. Gallen was in charge of installing the necessary temporary infrastructure directly on site⁴). After the trial week, the company returned the vehicle. No further costs, consequences, or liabilities were assumed by the company.

3.2.2. Field experiment

The share of electric vehicles in the overall vehicle fleet is still low in most countries⁵. This has important implications for the methodological approach. Skippon & Garwood [39] report that newer forms of technology with which consumers lack experience may be perceived as more abstract. Therefore, applying a methodological approach of asking carpool users to evaluate new products without the necessary experience can hardly lead to valid predictions of likely future behavior [10,13,67]. This research paper therefore focuses on a field experiment during which consumers can test electric vehicles over a longer period of time.

The field experiment as a research method offers several advantages. First, field experiments take place in the natural environment hence they are more generalizable to the real-world [68]. In addition, field experiments can help to reduce concerns of a social desirability bias [69]. Field experiments are also suited to find out more information about complicated relationships, perceptions or roles compared to survey research methods or laboratory experiments [68]. This makes field experiments particularly useful when the topic has only been studied to a limited extent [69]. On the other hand, there are also concerns to consider which are associated with the experimental design, the manipulation and other limitations such as the Hawthorne Effect or history effects. In order to counteract these concerns, a clear and well-structured design as well as intervention is required [68].

Accordingly, a field experiment with the above outlined behavioral intervention campaign was applied. This allowed to examine how the perceptions of key individuals (carpool users) for different elements of electric mobility changed, and subsequently also how the level of acceptance changed when carpool users were exposed to the campaign and had gained experience with electric vehicles. Several research papers reflect on how to address such temporal dimensions of climate and energy policy [70]. This particular field experiment included a temporal dimension by including a two-stage interview process in order to identify potential changes in acceptance levels for different EV elements over time:

¹ One example in the Swiss context: Trade association of the city of Basel – EVs for your organization: <https://gewerbe-basel.ch/themen/umwelt-energie/wirtschaft-strom/>

² The developed campaign is based on the campaign implemented by the trade association of the city of Basel

³ See Appendix B, and for more information: www.wirtschaftunterstrom.ch

⁴ The costs for this were negligible, as the municipal utility provided mobile charging stations which could be set up and dismantled on site without much effort.

⁵ In 2019 electric vehicles accounted for 4.2% of newly registered passenger vehicles in Switzerland. Overall, electric vehicles represent 0.6% of the Swiss overall passenger vehicle fleet [84].

- At **T0**, the expectations and assessments of the carpool user with regard to electric mobility were determined **prior** to trial period.
- At **T1**, the expectations and assessments of the carpool user with regard to electric mobility were determined **after** the trial period.

3.2.3. Variables & measurement

In order to measure the dependent variable (degree of acceptance for various EV related elements) participants were asked to answer 17 questions (based on Globisch et al. [13]), which were classified into eight categories (ease of use/usefulness, environmental friendliness, enthusiasm, range, charging infrastructure and process, price competitiveness, information intentions, and purchase intentions) and measured on a seven-point Likert scale ranging from “1”=“entirely disagree” to “7”=“entirely agree”. The behavioral intervention campaign acted as independent variable. The interviews included questions about the expected advantages and disadvantages of electric vehicles and included general acceptance related elements, as well as more detailed questions about the specific characteristics of electric vehicles and related infrastructure (see Appendix E).

3.2.4. Sample & procedure

In order to include a sufficient number of companies participating in the field experiment, the following procedure was implemented after the campaign was finalized:

- The city of St. Gallen launched the new campaign “*Wirtschaft unter Strom*” with an official media release and subsequently sent an additional newsletter to all companies located within the city boundaries of St. Gallen.
- Within three weeks, 13 companies registered for the new offer. They were all contacted individually and asked whether they would be willing to take part in a two-stage interview process as part of the campaign. Of the 13 companies, 10 agreed to participate in the interviews.

For each company participating in the field experiment, the two-stage interview process was implemented. The ten companies operate in various sectors and are of different sizes and thus represent a broad spectrum (a description of all companies who participated in the field experiment can be found in Appendix D). As in Study 1, the corporate fleets of the companies participating in the field experiment were composed of different types of vehicles such as cars or vans. In terms of the type of electric vehicle tested in the campaign, eight companies tested an electric car, and two companies tested an electric van (see Appendix D). In general, the interviews ranged from 20 to 30 min for

each stage and were conducted in person. Pre-testing with industry experts as well as with a trial company to verify and adapt the interview questions and guidelines was carried out in advance. After the pre-test, the interview questions and guidelines were maintained for all ten companies. Notes were taken by the interviewer during the interviews which were then transcribed and documented in a standardized format to increase overall analytical validity.

4. Results

4.1. Study 1

Fig. 1 shows how fleet manager rank various fleet management criteria according to their importance. Not surprisingly, the criteria of reducing operating costs and purchasing prices are of high importance within fleet management, with both criteria being evaluated as “important” or “very important” by 80% of respondents. Environmental considerations in fleet management (66% “important” or “very important”) as well as the possibility to service vehicles in the region (67% “important” or “very important”) are also highly relevant, whereas employee brand preferences (56% “not important” or “less important”) as well as the need to reduce the number of vehicles in the fleet (74% “not important” or “less important”) are of less relevance to fleet managers.

With regard to the aspect of the role of fleet managers in the fleet renewal process, fleet managers were asked to what extent they were involved in the decision to purchase new fleet vehicles. The possible answers on the five-point Likert scale ranged from “1: not involved at all” to “5: main decision-makers”. The results show that 80% of fleet managers are strongly involved in the final purchase decision for new vehicles (answer level 4 and 5 on the Likert scale). Only 10% are marginally involved in the final decision (answer level 1 and 2 on the Likert scale).

Fig. 2 refers to the main motivators for introducing electric mobility in corporate fleets. In accordance with findings from previous literature, the motivators “image gain” (77% “important” or “very important”) as well as “environmental friendliness” (70% “important” or “very important”) are seen as significant motivators of electric mobility in corporate fleets in Switzerland. Only to a lesser extent are the need to motivate employees (44% “important” or “very important”) and reduce operating costs (43% “important” or “very important”) by introducing EVs seen as potential motivators. No evidence could be found that technical elements such as better fleet control (13% “important” or “very important”) or further sharing opportunities (17% “important” or “very important”) are currently seen as significant sources of motivation; consequently, to generate a competitive advantage through a fleet management focused on electric mobility is only perceived as being an

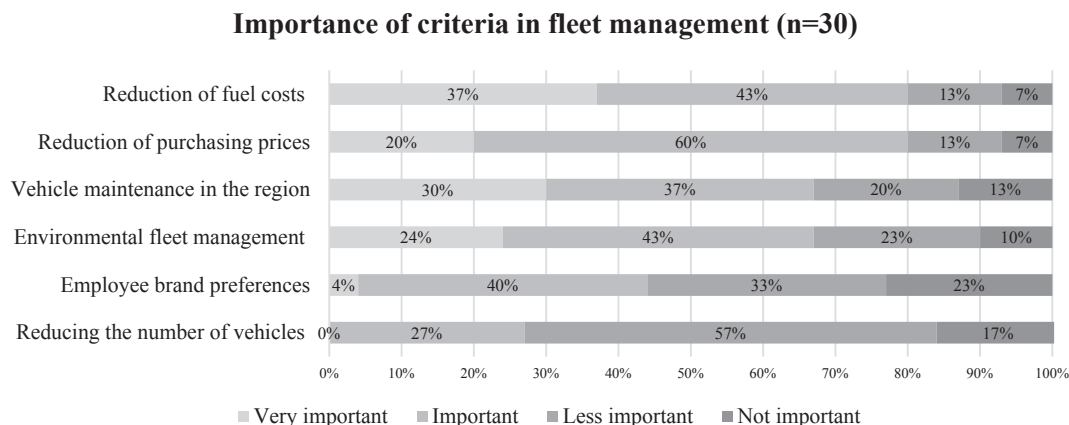


Fig. 1. Importance of criteria in fleet management.

Importance of motivators for electric mobility (n=30)

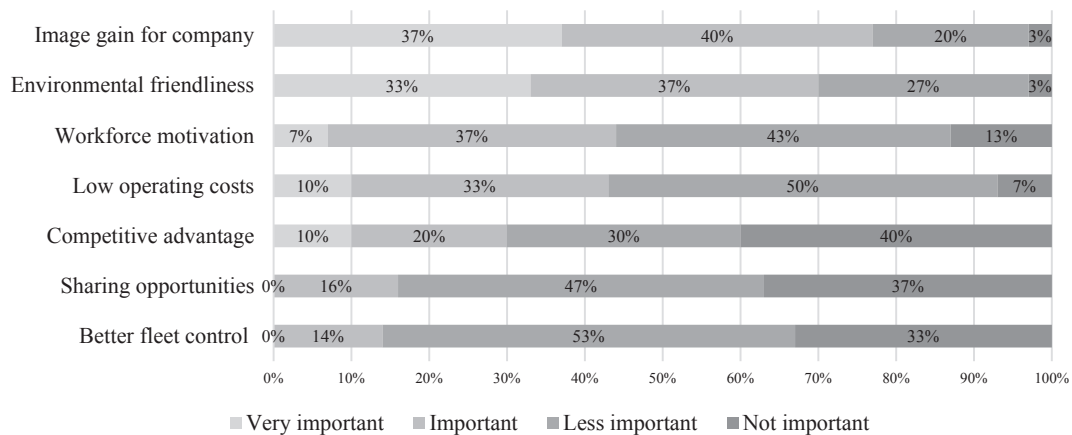


Fig. 2. Importance of motivators for electric mobility.

important motivator by 30% of respondents.

Fig. 3 illustrates several significant barriers to electric mobility in corporate fleets. Supporting evidence for barriers such as the limited availability of charging infrastructure (76% “important” or “very important”), the limited range and product portfolio of EVs (77% and 80% “important” or “very important”) as well as the higher upfront investment cost of EVs (80% “important” or “very important”) were identified. Further, the results show that, in addition to the above-mentioned prevailing hard barriers, *soft barriers* should not be neglected. Acceptance related soft barriers such as a lack of knowledge (63% “important” or “very important”) as well as the lack of demand of employees (56% “important” or “very important”) are seen as important. A lack of management support does not seem to be a relevant factor, as only 27% of the respondents indicated it to be an important or very important barrier.

In the area of preferences for policy instruments (Fig. 4), respondents indicate a preference for increased federal commitment to the installation of charging infrastructure along highways. This is in line with findings related to the different barriers, where one main hard barrier is identified to be insufficient charging infrastructure density. Free parking spaces on a municipal level are not seen as an important policy

Preferences for policy instruments (n=30)

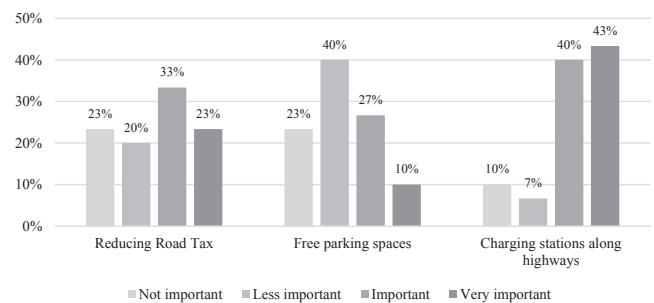


Fig. 4. Preferences for policy instruments.

instrument (63% “not important” or “less important”). A reduction of motor vehicle tax at the state level is perceived differently: 56% of respondents consider this to be important or very important, whereas 43% consider it to be less or not at all important.

Importance of barriers for electric mobility (n=30)

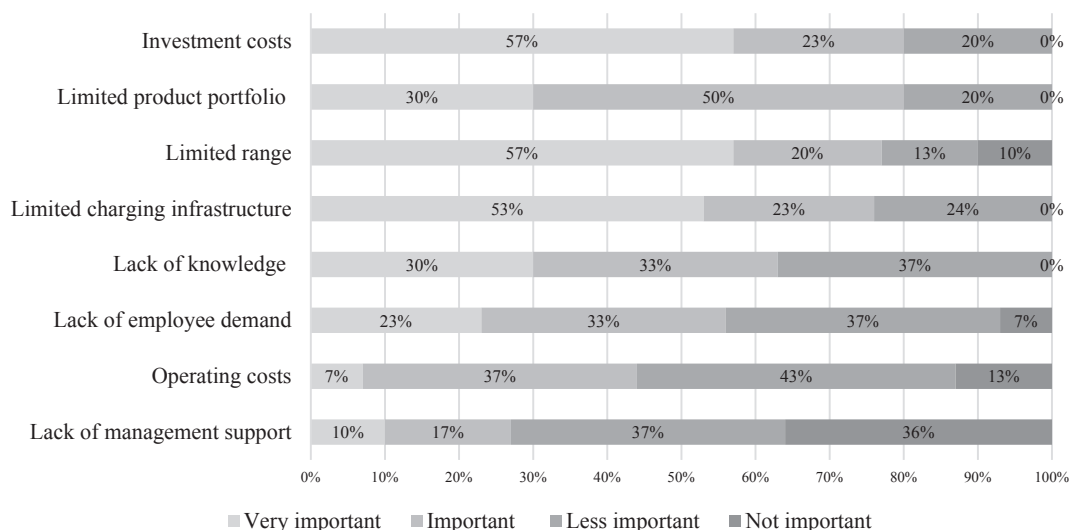


Fig. 3. Importance of barriers for electric mobility.

4.2. Study 2

Fig. 5 shows the extent to which the levels of acceptance of the different categories changed from before (T0) to after (T1) the trial period with the behavioral intervention campaign. The results of the field experiment show that the level of acceptance rose in all categories. Therefore, the behavioral intervention campaign appears to have had a positive effect on the social acceptance of electric mobility for key people within the organizations (carpool users).

A closer look at the individual categories reveals further interesting findings: Categories with a focus on acceptance related soft barriers such as “Ease of use / usefulness” (increase from 5.00 in T0 to 6.17 in T1) or “Enthusiasm” (motivation to adopt electric mobility within organizations; from 4.83 in T0 to 6.17 in T1) show a strong increase in acceptance.

The results further indicate that the perception of prevailing *hard barriers* such as limited range (increase from 3.75 in T0 to 4.30 in T1), the limited availability of charging infrastructure (assessment of sufficient charging infrastructure increased from 3.93 in T0 to 4.87 in T1) and higher upfront investment costs (assessed via question asking whether EVs are financially competitive with conventional vehicles; increased from 4.00 in T0 to 4.60 in T1) could also be addressed with the introduction of such a campaign, although to a lesser extent than categories with acceptance related elements (*soft barriers*). Finally, categories concerning future behavior (information as well as purchase intentions) also indicate a strong increase in acceptance. “Information intentions” (assessment as to whether carpool user will become more informed about electric mobility in the future) increased from 5.50 (T0) to 6.90 (T1). “Purchase intentions,” (assessed using the question whether the carpool user today would recommend that others buy an electric vehicle and to what extent they would consider buying an electric vehicle at the time of next vehicle purchase or replacement) increased from 4.35 (T0) to 5.85 (T1). These results suggest that the effect of the behavioral intervention campaign not only had a positive effect on the social acceptance level of electric mobility by carpool user, but also in relation to their future information and purchasing intentions.

5. Discussion

The results of Study 1 support findings from other scholars: Barisa et al. [30], Quak et al. [31] or Degirmenci & Breitner [71], for example, also show that important motivators for electric mobility center on their positive impact on the environment, as well as their positive contribution to corporate image. In line with their findings, the results of Study 1 suggest that the motivators “image gain” as well as “environmental friendliness” are seen as most important for the further expansion of electric mobility also for large Swiss organizations with corporate fleets. Interestingly, the literature also states that the lower fuel costs and high efficiency (i.e., low operating costs) of EVs are an important source of motivation [32]. The results of Study 1 also suggest that reducing operating costs is one of the main criteria in the fleet management process of large Swiss organizations in general (80% of respondents indicated this as being “important” or “very important”); however, only 43% of fleet managers surveyed consider the ability to reduce operating costs through the introduction of EVs to corporate fleets as an important motivator. This indicates that the barrier of lack of knowledge also represents a major hurdle at fleet manager level in large Swiss organizations with corporate fleets - EVs not only benefit from lower operating costs but are already competitive with conventional vehicles in terms of total cost of ownership [6,54].

In terms of *hard barriers* that limit the uptake of EVs in corporate fleets, the present results support the findings of scholars such as Bireslioglu et al. [17] and Newbery & Strbac [35] who also show that barriers such as a limited charging infrastructure, a limited range and product portfolio, as well as the higher upfront investment costs of EVs

still prevail.

Most interesting, however, is the confirmation of the importance of *soft barriers*, as already identified by scholars such as Ziefle et al. [52], Shao et al. [34] or Globisch et al. [13], for a further uptake of electric mobility also within Swiss organizations with corporate fleets. Acceptance related aspects such as a lack of knowledge (indicated to be “important” or “very important” by 63% of respondents), as well as, to a lesser extent, the lack of demand of employees (56% “important” or “very important”) are seen as significant barriers to the further uptake of electric mobility within organizations. Therefore, acceptance related soft barriers might be important and could pose a limiting factor in the further uptake of electric mobility.

Consequently, the field experiment aimed to further explore acceptance related soft barriers and whether the developed behavioral intervention campaign would be able to address them and increase the social acceptance as well as the likelihood of adopting electric vehicles (electric cars or electric vans) within organizations. The results of the field experiment indicate a generally positive effect of the campaign on various social acceptance related elements, especially *soft barriers*, and to a lesser extent also *hard barriers*. Thus, overall, the campaign appears capable to contribute to one of the prerequisites for the further expansion of electric mobility; namely, the establishment of a high level of social acceptance for electric mobility within Swiss organizations. This result provides evidence to findings from scholars such as Held and Gerrits [49] who advocate for a more holistic way of addressing the adoption of EVs by especially also addressing soft barriers, next to the prevailing hard barriers as well as Bühler et al. [72] who were able to show in their case study that experience exerts a positive effect on the general acceptance for EVs. More particularly, the results of the field experiment indicate that specific acceptance related soft barriers could be addressed. In all categories, the degree of acceptance and also the increase in knowledge about specific elements (range, price, ease of use, enthusiasm, charging infrastructure, environmental friendliness) was observable (see Fig. 5). It seems that the barrier “Lack of knowledge”, which was identified as an important barrier in Study 1, could be reduced with the introduction of such a campaign.

These observations also relate to the buying centre model and its different roles by Webster & Wind [63]: Various people are involved in the decision to adopt electric mobility in corporate fleets. These people can be assigned to different roles from the buying centre model of Webster & Wind [63]. In particular, the buyer (e.g., fleet manager) and the user (e.g., carpool users) can be identified as central roles in the adoption process. The results of Study 1 show that the fleet manager often occupies more than one role in the fleet renewal process. 80% of the surveyed fleet managers stated that they are also to a large extent responsible for the final purchasing decision whether to include electric mobility in their corporate fleet (and thus additionally take on the role of the decider). It is therefore particularly important for fleet managers to hold a positive attitude towards adopting electric mobility in corporate fleets. The findings from Study 2 indicate that carpool users (occupying the role of the user in the buying centre model) can play an important role in this respect. Namely, the results show that the campaign positively influences the level of “Enthusiasm” and thus could motivate key people (carpool users) within organizations to become more enthusiastic about electric mobility. By additionally occupying the role of influencer within the buying centre model, carpool users could spread this positive attitude and enthusiasm for electric mobility in corporate fleets within the organization (e.g., with fleet managers). Additionally, the strong increase in future information intentions after the trial period could potentially contribute to carpool users taking on yet another role as initiators within the organization and – next to spreading the enthusiasm – to providing relevant information to other members in the buying centre such as to the decider/buyer (fleet manager and/or management board) and thus reducing potential gatekeepers to a further adoption of EVs in corporate fleets.

Finally, the results of this research project lend support to Anable

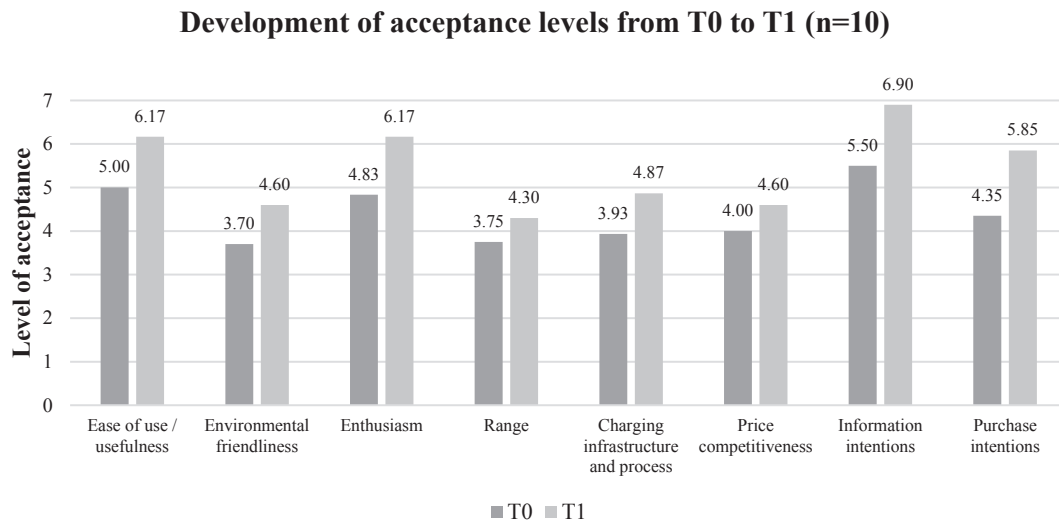


Fig. 5. Development of acceptance levels of EVs from T0 to T1.

et al.'s [55] and Schmalfuß et al.'s [73] claim that having more information and experience about a new technology such as electric mobility can increase the intention to purchase: obtaining first-hand experience of electric mobility in the workplace environment over an extended duration, and thus obtaining more information about the technology, was shown to positively affect not only information related but also purchasing intentions – thus exerting a positive effect on market acceptance. This is in line with Rogers' diffusion theory [74]: the trialability - the degree to which the new technology can be experimented with – is positively correlated with the adoption rate. The more an innovation can be tried out, the faster it can spread [74]. Overall, the campaign “Wirtschaft unter Strom” seems capable of helping close the gap between expectations and actual perceptions of electric mobility in corporate fleets in Switzerland.

6. Conclusions

6.1. General conclusion

This paper adds to the research stream that examines the social acceptance of electric mobility – namely, that of electric mobility in corporate fleets. It adds theoretical as well as practical value by confirming the importance of acceptance related soft barriers and by designing, applying and evaluating a behavioral intervention campaign that addresses such barriers. The research described in this paper was designed to answer three research questions:

(1) What are the biggest sources of motivation and barriers for Swiss fleet managers with regard to the electrification of corporate fleets, (2) To what extent do acceptance related barriers influence the electrification of corporate fleets, and (3) How does a behavioral intervention campaign that addresses acceptance related barriers affect the likelihood to opt for electric mobility in corporate fleets?

Based on an online survey with Swiss fleet managers and a field experiment including a behavioral intervention campaign, the present results indicate that several *hard barriers* to the further expansion of electric mobility, especially in corporate fleets, still prevail also in Swiss organizations with corporate fleets. The results further confirm the importance of acceptance related *soft barriers*: a lack of knowledge was identified by 63% of respondents to be an important or a very important barrier, and a lack of demand from employees by 56% of respondents.

The results of the field experiment based on carpool users in the city of St. Gallen suggest that the behavioral intervention campaign might be able to address acceptance related barriers, being associated with a significant positive increase in the acceptance levels of different EV-

related variables. An increase in the acceptance level for different EV-related elements (range, price, ease of use, charging infrastructure, environmental friendliness, and enthusiasm) due to the increase in experience and knowledge can be observed at T1 (after the trial offer). Furthermore, positive intentions relating to future behavior were also identified. These results lend support to findings of other researchers concerning the fact that reducing exposure to *soft barriers* such as lack of knowledge or the perceived low level of EV usability can help to increase the effectiveness of other policy instruments such as financial incentives [75]. This research paper therefore suggests tackling *soft barriers* alongside *hard barriers* in order to ensure that current policy instruments that focus on overcoming hard barriers have the intended effect [49].

6.2. Implications for policy & practice

Several implications for policy and practice can be derived based on the findings. Authorities at the national level would be well advised to consider introducing campaigns that target acceptance related *soft barriers* as an element of their policy mix and consequently also as an integral part of their roadmaps, especially for corporate fleets. Further institutionalizing acceptance related features within the policy mix, might help to increase the share of electric mobility. Thereby it is crucial to be aware of the different roles and levels of influence of individuals within organizations and their corporate fleets – identifying and enabling influencers within organizations with the goal of reducing the influence of existing gatekeepers would be a possible way forward. Swiss policy, for instance, envisages different instruments for corporate fleets but aims at overcoming acceptance related soft barriers only at a later phase of its electric mobility roadmap [76]. Establishing a more behavior-oriented communication with campaigns that target acceptance related soft barriers as a central pillar of the policy mix, alongside the pillars that address hard barriers, could be beneficial for the further adoption of electric mobility. The continuing use of such campaigns targeted at corporate fleets not only has the benefit of providing carpool users with direct experience of electric vehicles, but also increases the general public's exposure to electric vehicles as they increasingly encounter them in use. Complementary to campaigns targeted at corporate fleets, authorities at the different levels could run awareness and information campaigns to increase this benefit.

On a local level, city and municipal authorities could replicate or adapt the campaign “Wirtschaft unter Strom” and include it in their local mobility concepts as part of the local policy mix to reach their mobility targets - this may be of particular interest as local policy measures have so far mainly targeted private consumers. However, in order to achieve

local mobility targets, it is also important to target corporate fleets at local level. Alternatively, different municipalities within a region could partner up and launch the corresponding campaign in cooperation with local car dealers. Adding a campaign such as “*Wirtschaft unter Strom*” as an additional element to the overall policy mix could represent a successful element to further promote the adoption of electric mobility in corporate fleets. The results of this research paper also serve as a guideline for car dealers. To include a company-focused test drive programme of several days, in addition to financial incentives, could help to increase the sales of electric vehicles by increasing the level of knowledge and thus also purchase intentions of potential buyers. This is particularly relevant as car dealers represent one of the most important touchpoints in the purchasing process for electric vehicles [77]. Another recommendation at the local level would be to involve trade organizations⁶ or chambers of commerce - organizations whose membership base is mainly composed of local businesses - and jointly conduct campaigns targeted at companies with corporate fleets to increase the adoption of electric vehicles. The involvement of trade organizations or chambers of commerce could help to increase the credibility of the campaign and its reach.

6.3. Limitations & further research

Naturally, this research paper also involves limitations that suggest further research opportunities. First, the results of the field experiment are based on the chosen elements of the campaign “*Wirtschaft unter Strom*”. Further research could replicate the field experiment but vary the components and its geographical scope. For example, the free-trial test offer was limited to one week of normal business. It would be interesting to see whether the effects changed if the duration were increased or decreased (for example, trial day vs. trial month). Especially the longitudinal element is of high interest within the research field of climate change related topics. Further research which investigates the topic of electrifying corporate fleets could do so by gathering data before during and after an implemented campaign thereby tracking changing responses over time. By doing so, scholars could move iteratively to deeper forms of analysis enabling participants to ‘make meaning’ of the descriptive data [70]. Enlarging the geographical scope could represent an additional avenue for further research. While Switzerland - and the city of St. Gallen in particular - has many similarities with other industrialised countries and cities that have initiated the shift towards a low-carbon transport system, there are also particularities such as a relatively high per capita income or the low-carbon domestic electricity generation. Replicating the study in other geographical contexts, such as other countries and cities in Europe, could also be fruitful.

However, it is important to be aware of the methodological challenges and limitations of a field experiment as applied in Study 2. One of the limitations concerns the Hawthorne effect - the feeling of being observed and its effect on the results [78,79]. The fact that the participants of the field experiment were aware that the campaign “*Wirtschaft unter Strom*” was scientifically monitored could have affected the individuals’ behaviour and consequently could also have confounded the interpretation of the experimental manipulation. Schwartz et al. [80] show in a field experiment focusing on residential consumers’ electricity use that the Hawthorne effect can lead to a heightened awareness of energy consumption and can therefore also manipulate the results - especially when applying a two-stage approach. An interesting approach for further research to mitigate potential effects of a Hawthorne effect would be to use controlled research designs such as randomised

controlled trials (RCT) [81,82]. For instance, it might be possible to directly observe participants during the field experiment which can lead to a reduction of the number of participants altering their behaviour [82] and could generate additional interesting observational data.

In addition, a field experiment with a longitudinal effect, such as this one, can also be affected by history effects. History effects are another important limitation linked to field experiments and are a potential threat to validity for any nonlaboratory study which last more than a few hours [83]. History effects refer to events that happen in the environment that change the conditions of the field experiment, ultimately affecting its results. Such a history event can happen before the start of an experiment, or between the pre-test and post-test (e.g., T0 and T1 in the case of Study 2) [83]. To overcome history effects, more observational data during the field experiment can again be a way forward.

Secondly, the unique part of this research project is the combination of an online survey and a field experiment with a behavioral intervention campaign. Both the online survey (Swiss fleet managers) and the field experiment (carpool users from companies within the city boundaries of St. Gallen) were limited in terms of the number of participants and geographical scope. The results cannot be interpreted as a general reflection of what the behavior of fleet managers or carpool users will lead to. Additionally, the Swiss context resembles the situation of many developed countries in terms of the adoption of electric mobility, however, it certainly does not represent the situation in all countries. A second promising research initiative might therefore be a scaling of both parts, online survey and field experiment as well as enlarging the geographical scope. For the field experiment one could for example cooperate with a car rental companies in different countries in order to achieve a multiplication effect.

Finally, the focus on the business-to-business context is one of the elements that make this study distinctive - it would thus be interesting to explore the topic of intra-firm diffusion dynamics in a further research project - i.e., to conduct interviews with colleagues (fellow carpool user, fleet manager or management board members) of the carpool users who were exposed to the behavioral intervention campaign in order to see to what extent peer effects within the buying centre have emerged.

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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References

- [1] Geels, F. W., Kemp, R., Dudley, G. & Lyons, G. (2011). *Automobility in transition?: A socio-technical analysis of sustainable transport*. Routledge.
- [2] B.K. Sovacool, Experts, theories, and electric mobility transitions: Toward an integrated conceptual framework for the adoption of electric vehicles, *Energy Res. Social Sci.* 27 (2017) 78–95.
- [3] IEA (2017). *Global EV Outlook 2017: Two million and counting*. [Online] Available from: <https://www.iea.org/publications/freepublications/publication/GlobalEVOutlook2017.pdf> [Accessed 10 Aug 2019].
- [4] M. Tran, D. Banister, J.D.K. Bishop, M.D. McCulloch, *Simulating early adoption of alternative fuel vehicles for sustainability*, *Technol. Forecast. Soc. Chang.* 80 (5) (2013) 865–875.
- [5] Schweizerische Energiestiftung (SES). (2017). *Elektromobilität*. [Online] Available from: <https://www.energiestiftung.ch/energieeffizienz-elektromobilitaet.html> [Accessed 14 Nov 2019].

⁶ One example of this is the joint campaign for more electric vehicles in corporate fleets by the Trade Association and the Office for the Environment and Energy in the city of Basel: <https://gewerbe-basel.ch/themen/umwelt-energie/wirtschaft-strom/>

- [6] IEA (2019). Global EV Outlook 2019: Scaling up the transition to electric mobility. [Online] Available from: <https://www.iea.org/gevo2019/> [Accessed 25 Aug 2019].
- [7] R.J. Orsato, M. Dijk, R. Kemp, M. Yarime, Car Mobility in Transition? in: R. Kemp (Ed.), The bumpy ride of electric vehicles towards regime transition Routledge, New York, 2011.
- [8] M. Dijk, R.J. Orsato, R. Kemp, The emergence of an electric mobility trajectory, *Energy Policy* 52 (2013) 135–145.
- [9] P. Plötz, U. Schneider, J. Globisch, E. Dütschke, Who will buy electric vehicles? Identifying early adopters in Germany, *Transportation Research Part A: Policy and Practice* 67 (2014) 96–109.
- [10] W. Sierczula, Factors influencing fleet manager adoption of electric vehicles, *Transportation Research Part D: Transport and Environment* 31 (2014) 126–134.
- [11] P. Plötz, T. Gnann, A. Kühn, M. Wietschel, Markthochlaufszenarien für Elektrofahrzeuge, in: Study commissioned by the National Academy of Science and Engineering and Working Group, 2013, p. 7.
- [12] T. Gnann, P. Plötz, A. Kühn, M. Wietschel, Modelling market diffusion of electric vehicles with real world driving data - German market and policy options, *Transportation Research Part A: Policy and Practice* 77 (2015) 95–112.
- [13] J. Globisch, E. Dütschke, M. Wietschel, Adoption of electric vehicles in commercial fleets: Why do car pool managers campaign for BEV procurement? *Transportation Research Part D: Transport and Environment* 64 (2018) 122–133.
- [14] R. Hjorthol, Attitudes, ownership and use of Electric Vehicles—a review of literature, *TØI report* 1261 (2013) 2013.
- [15] M.J. Koetse, A. Hoen, Preferences for alternative fuel vehicles of company car drivers, *Resource and Energy Economics* 37 (2014) 279–301.
- [16] Z. Rezvani, J. Jansson, J. Bodin, Advances in consumer electric vehicle adoption research: A review and research agenda, *Transportation Research Part D: Transport and Environment* 34 (2015) 122–136.
- [17] M.E. Biresselioglu, M. Demirbal Kaplan, B.K. Yilmaz, Electric mobility in Europe: A comprehensive review of motivators and barriers in decision making processes, *Transportation Research Part A: Policy and Practice* 109 (2018) 1–13.
- [18] T. Lieven, Policy measures to promote electric mobility – A global perspective, *Transportation Research Part A: Policy and Practice* 82 (2015) 78–93.
- [19] Z. Lin, D.L. Greene, Promoting the market for plug-in hybrid and battery electric vehicles: role of recharge availability, *Transp. Res. Rec.* 2252 (1) (2011) 49–56.
- [20] N. Rietmann, T. Lieven, How policy measures succeeded to promote electric mobility—Worldwide review and outlook, *J. Cleaner Prod.* 206 (2019) 66–75.
- [21] M. Wikström, L. Hansson, P. Alfvors, Socio-technical experiences from electric vehicle utilisation in commercial fleets, *Appl. Energy* 123 (2014) 82–93.
- [22] S. Kaplan, J. Gruber, M. Reinthaler, J. Klauenberg, Intentions to introduce electric vehicles in the commercial sector: A model based on the theory of planned behaviour, *Research in Transportation Economics* 55 (2016) 12–19.
- [23] Y. Zhang, Y. Yu, B. Zou, Analyzing public awareness and acceptance of alternative fuel vehicles in China: The case of EV, *Energy Policy* 39 (11) (2011) 7015–7024.
- [24] J. Klauenberg, C. Rudolph, J. Zajicek, Potential users of electric mobility in commercial transport—identification and recommendations, *Transp. Res. Procedia* 16 (2016) 202–216.
- [25] KBA (2018). Neuzulassungen von Pkw im Jahr 2017 nach privaten und gewerblichen Haltern. [Online] Available from: https://www.kba.de/DE/Statistik/Fahrzeuge/Neuzulassungen/Halter/2017_n_halter_dusl.html?nn=652344 [Accessed 5 Sep 2019].
- [26] Department for Transport (2018). Vehicle Licensing Statistics: Annual 2018. [Online] Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/800502/vehicle-licensing-statistics-2018.pdf [Accessed 10 Nov 2019].
- [27] B. Lane, S. Potter, The adoption of cleaner vehicles in the UK: exploring the consumer attitude–action gap, *J. Cleaner Prod.* 15 (11–12) (2007) 1085–1092.
- [28] B.K. Sovacool, R.F. Hirsh, Beyond batteries: An examination of the benefits and barriers to plug-in hybrid electric vehicles (PHEVs) and a vehicle-to-grid (V2G) transition, *Energy Policy* 37 (3) (2009) 1095–1103.
- [29] M. Wikström, L. Hansson, P. Alfvors, An end has a start—investigating the usage of electric vehicles in commercial fleets, *Energy Procedia* 75 (2015) 1932–1937.
- [30] A. Barisa, M. Rosa, A. Kisele, Introducing electric mobility in Latvian municipalities: results of a survey, *Energy Procedia* 95 (2016) 50–57.
- [31] H. Quak, N. Nesterova, T. van Rooijen, Possibilities and barriers for using electric-powered vehicles in city logistics practice, *Transp. Res. Procedia* 12 (2016) 157–169.
- [32] G. Haddadian, M. Khodayar, M. Shahidepour, Accelerating the global adoption of electric vehicles: barriers and drivers, *The Electricity Journal* 28 (10) (2015) 53–68.
- [33] K. Laurischkat, A. Viertelhausen, D. Jandt, Business models for electric mobility, *Procedia CIRP* 47 (2016) 483–488.
- [34] J. Shao, M. Taisch, M. Ortega-Mier, A grey-DECISION-MAKING Trial and Evaluation Laboratory (DEMATEL) analysis on the barriers between environmentally friendly products and consumers: practitioners' viewpoints on the European automobile industry, *J. Cleaner Prod.* 112 (2016) 3185–3194.
- [35] D. Newbery, G. Strbac, What is needed for battery electric vehicles to become socially cost competitive? *Economics of Transportation* 5 (2016) 1–11.
- [36] L. Matthews, J. Lynes, M. Riemer, T. Del Matto, N. Cloet, Do we have a car for you? Encouraging the uptake of electric vehicles at point of sale, *Energy Policy* 100 (2017) 79–88.
- [37] Teoh, T., Kunze, O. & Teo, C. C. (2016). Methodology to evaluate the operational suitability of electromobility systems for urban logistics operations.
- [38] J. Axsen, K.S. Kurani, Interpersonal influence in the early plug-in hybrid market: Observing social interactions with an exploratory multi-method approach, *Transportation Research Part D: Transport and Environment* 16 (2) (2011) 150–159.
- [39] S. Skippon, M. Garwood, Responses to battery electric vehicles: UK consumer attitudes and attributions of symbolic meaning following direct experience to reduce psychological distance, *Transportation Research Part D: Transport and Environment* 16 (7) (2011) 525–531.
- [40] K.Y. Bjerkkan, T.E. Nørbech, M.E. Nordtømme, Incentives for promoting battery electric vehicle (BEV) adoption in Norway, *Transportation Research Part D: Transport and Environment* 43 (2016) 169–180.
- [41] F. Leurent, E. Windisch, Triggering the development of electric mobility: a review of public policies, *European Transport Research Review* 3 (4) (2011) 221–235.
- [42] F. Kley, M. Wietschel, D. Dallinger, Evaluation of European electric vehicle support schemes, Routledge, Paving the Road to Sustainable Transport. New York, 2012, pp. 75–95.
- [43] IEA (2020). Global EV Outlook: Understanding the Electric Vehicle Landscape to 2020. [Online] Available from: https://www.ourenergypolicy.org/wp-content/uploads/2013/09/GlobalEVOutlook_2013.pdf [Accessed 25 Aug 2019].
- [44] P.D. Larson, J. Viáfara, R.V. Parsons, A. Elias, Consumer attitudes about electric cars: Pricing analysis and policy implications, *Transportation Research Part A: Policy and Practice* 69 (2014) 299–314.
- [45] X. Zhang, R. Rao, J. Xie, Y. Liang, The current dilemma and future path of China's electric vehicles, *Sustainability* 6 (3) (2014) 1567–1593.
- [46] O. Egbue, S. Long, Barriers to widespread adoption of electric vehicles: An analysis of consumer attitudes and perceptions, *Energy Policy* 48 (2012) 717–729.
- [47] W. Sierczula, S. Bakker, K. Maat, B. van Wee, The influence of financial incentives and other socio-economic factors on electric vehicle adoption, *Energy Policy* 68 (2014) 183–194.
- [48] M.J. Eppstein, D.K. Grover, J.S. Marshall, D.M. Rizzo, An agent-based model to study market penetration of plug-in hybrid electric vehicles, *Energy Policy* 39 (6) (2011) 3789–3802.
- [49] T. Held, L. Gerrits, On the road to electrification—A qualitative comparative analysis of urban e-mobility policies in 15 European cities, *Transp. Policy* 81 (2019) 12–23.
- [50] Cousse, J. & Wüstenhagen, R. (2018). 8th Consumer Barometer of Renewable Energy. [Online] Available from: <https://iwoe.unisg.ch/de/lehrstuhlmanagement/publikationen/kundenbarometer> [Accessed 2 Jan 2020].
- [51] R. Wüstenhagen, M. Wolsink, M.J. Bürer, Social acceptance of renewable energy innovation: An introduction to the concept, *Energy Policy* 35 (5) (2007) 2683–2691.
- [52] M. Ziefle, S. Beul-Leusmann, K. Kasugai, M. Schwalm, Public perception and acceptance of electric vehicles: exploring users' perceived benefits and drawbacks. In *International conference of design, user experience, and usability*, Springer, Cham, 2014, pp. 628–639.
- [53] S. Steinhilber, P. Wells, S. Thankappan, Socio-technical inertia: Understanding the barriers to electric vehicles, *Energy Policy* 60 (2013) 531–539.
- [54] K. Palmer, J.E. Tate, Z. Wadud, J. Nellthorpe, Total cost of ownership and market share for hybrid and electric vehicles in the UK, US and Japan, *Appl. Energy* 209 (2018) 108–119.
- [55] Anable, J., Skippon, S., Schuitema, G. & Kinnear, N. (2011). Who will adopt electric vehicles? A segmentation approach of UK consumers. In *European Council for an Energy Efficient Economy*.
- [56] S. Bakker, J. Jacob Trip, Policy options to support the adoption of electric vehicles in the urban environment, *Transportation Research Part D: Transport and Environment* 25 (2013) 18–23.
- [57] Nesbitt, K. & Davies, J. (2013). From the top of the organization to the bottom line: Understanding the fleet market for plug-in electric vehicles. In *2013 World Electric Vehicle Symposium and Exhibition (EVS27)* (pp. 1–14). IEEE.
- [58] K. Nesbitt, D. Sperling, Fleet purchase behavior: decision processes and implications for new vehicle technologies and fuels, *Transportation Research Part C: Emerging Technologies* 9 (5) (2001) 297–318.
- [59] F.D. Davis, Perceived usefulness, perceived ease of use, and user acceptance of information technology, *MIS Quarterly* 13 (3) (1989) 319, <https://doi.org/10.2307/249008>.
- [60] F.D. Davis, User acceptance of information technology: system characteristics, user perceptions and behavioral impacts, *Int. J. Man Mach. Stud.* 38 (3) (1993) 475–487.
- [61] V. Venkatesh, Determinants of perceived ease of use: Integrating control, intrinsic motivation, and emotion into the technology acceptance model, *Information Systems Research* 11 (4) (2000) 342–365.
- [62] V. Venkatesh, M.G. Morris, G.B. Davis, F.D. Davis, User acceptance of information technology: Toward a unified view, *MIS Quarterly* (2003) 425–478.
- [63] F.E. Webster, Y. Wind, A general model for understanding organizational buying behavior, *Journal of Marketing* 36 (2) (1972) 12–19.
- [64] About Fleet (2020). Arval Fleet Barometer 2020. [Online] Available from: <https://aboutfleet.ch/news/3606-arval-fleet-barometer-2020-schweizer-unternehmen-sind-europaweit-fuehrend-bei-mobilitaetsalternativen> [Accessed 18 Nov 2020].
- [65] S. Chassot, N. Hampl, R. Wüstenhagen, When energy policy meets free-market capitalists: The moderating influence of worldviews on risk perception and renewable energy investment decisions, *Energy Res. Social Sci.* 3 (2014) 143–151.
- [66] S. Salm, The investor-specific price of renewable energy project risk—A choice experiment with incumbent utilities and institutional investors, *Renew. Sustain. Energy Rev.* 82 (2018) 1364–1375.
- [67] U. Schneider, E. Dütschke, A. Peters, How does the actual usage of electric vehicles influence consumer acceptance?, in: *Evolutionary Paths Towards the Mobility Patterns of the Future* Springer, Berlin, Heidelberg, 2014, pp. 49–66.

- [68] M. Allen, The sage encyclopedia of communication research methods, SAGE Publications, Thousand Oaks, CA, 2017.
- [69] D. Baldassarri, M. Abascal, Field experiments across the social sciences, *Annual Review of Sociology* 43 (1) (2017) 41–73.
- [70] J. Goodman, J.P. Marshall, Problems of methodology and method in climate and energy research: Socialising climate change? *Energy Res. Social Sci.* 45 (2018) 1–11.
- [71] K. Degirmenci, M.H. Breitner, Consumer purchase intentions for electric vehicles: Is green more important than price and range? *Transportation Research Part D: Transport and Environment* 51 (2017) 250–260.
- [72] F. Bühler, P. Cocron, I. Neumann, T. Franke, J.F. Krems, Is EV experience related to EV acceptance? Results from a German field study, *Transportation Research Part F: Traffic Psychology and Behaviour* 25 (2014) 34–49.
- [73] F. Schmalfuß, K. Mühl, J.F. Krems, Direct experience with battery electric vehicles (BEVs) matters when evaluating vehicle attributes, attitude and purchase intention, *Transportation Research Part F: Traffic Psychology and Behaviour* 46 (2017) 47–69.
- [74] E. Rogers, *The Diffusion of Innovations*, Fifth Edition, The Free Press, New York, 2003.
- [75] N. Wang, L. Tang, H. Pan, A global comparison and assessment of incentive policy on electric vehicle promotion, *Sustainable Cities and Society* 44 (2019) 597–603.
- [76] UVEK (2019). Roadmap Elektromobilität 2022. [Online] Available from: <https://www.admin.ch/gov/de/start/dokumentation/medienmitteilungen.msg-id-73457.html> [Accessed 13 Oct 2019].
- [77] J. Plananska, Touchpoints for electric mobility: Investigating the purchase process for promoting sales of electric vehicles in Switzerland, *Energy Res. Social Sci.* 69 (2020) 101745, <https://doi.org/10.1016/j.erss.2020.101745>.
- [78] J.G. Adair, The Hawthorne effect: a reconsideration of the methodological artifact, *J. Appl. Psychol.* 69 (2) (1984) 334–345.
- [79] S.R. Jones, Was there a Hawthorne effect? *Am. J. Sociol.* 98 (3) (1992) 451–468.
- [80] D. Schwartz, B. Fischhoff, T. Krishnamurti, F. Sowell, The Hawthorne effect and energy awareness, *Proc. Natl. Acad. Sci.* 110 (38) (2013) 15242–15246.
- [81] A. Bryman, *Quantity and quality in social research*, Routledge, 2003.
- [82] D. Oswald, F. Sherratt, S. Smith, Handling the Hawthorne effect: The challenges surrounding a participant observer, *Review of Social Studies* 1 (1) (2014) 53–74.
- [83] W.P. Vogt, R.B. Johnson, *The SAGE dictionary of statistics & methodology: A nontechnical guide for the social sciences*, Sage publications, 2015.
- [84] BFS (2020). Strassenfahrzeuge – neue Inverkehrsetzungen. [Online] Available from: <https://www.bfs.admin.ch/bfs/de/home/statistiken/mobilitaet-verkehr/verkehrsinfrastruktur-fahrzeuge/fahrzeuge/strassen-neu-inverkehrsetzungen.html> [Accessed 31 Jan 2020].