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Electric vehicles in commercial fleets: Potentials and challenges from the user perspective in Germany

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Abstract

Electric vehicles (EVs) have been discussed as a promising alternative to conventional cars and as a potential solution for mitigating environmental problems caused by road transport. This study analyzes the potential of the commercial use of EVs and the factors influencing user acceptance in commercial fleets. Empirical data on the daily use of EVs was collected by conducting online surveys, interviews, and workshops with the users. This paper summarizes the insights on potential advances and challenges related to the use of the vehicles in commercial fleets from a user perspective. The results suggest that EVs meet the mobility needs of different commercial users, bringing reputational and environmental related benefits for the companies. Main challenges for the deployment of EVs are related rather to the periphery of the EVs (e.g., infrastructure, market characteristics, and lack of experts in related service sectors as well as psychological barriers). Finally, policy and management recommendations in different fields drawn from a synthesis of the data collected within the study are introduced in this paper.

Keywords: electric vehicles, commercial fleets, online survey, user acceptance, purchase motives, policy recommendations

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1. Introduction and motivation

Electric vehicles (EVs) have been discussed as a promising alternative to conventional cars and hence a potential solution for mitigating environmental problems caused by the transportation sector. There is a high potential for the deployment of EVs especially in commercial fleets since over 60% of the registered new vehicles in Germany are commercially used (KBA, 2017). Accordingly, there are government and regional-level efforts to support EVs purchase and use. The German government has been subsidizing the purchase of EVs since May 2016 aiming to speed up the transition to more environmental friendly mobility (Bundesregierung, 2016). At the same time, despite the activities in this area, the market share of EVs in Germany is still low. The number of EVs registered in Germany has increased from 7,614 vehicles in 2013 to 54,985 vehicles in 2017. However, EVs make up only 2% of all yearly new registered vehicles in Germany (KBA, 2017). This raises the question which factors influence the acceptance of the EVs and how current challenges can be addressed in order to facilitate the deployment of these vehicles on the market.

Previously studies examine the characteristics of commercial users as well as their motives and barriers for purchasing EVs. Study on the early adopters of EVs in Germany found that two thirds of the companies are small companies that have not more than 49 employees (Frenzel et al., 2015). About 25% of the early adopter companies are operating in the service activities sector, 13% in public administration, 12% in building construction, and further 11% in the electricity supply. Main purchase motives for the early adopters are the reputational benefits that come from using the vehicles. On the other hand, limitations of using EVs reported by the first users are related to limited range and payload capacity. Other government funded projects in Germany also focus on the characteristics and needs of commercial users by analyzing which users are most apt to use EVs. The results suggest that the potential of EVs is higher in commercial fleets than in private households. Main arguments for this include higher annual mileage, fixed driving patterns, the option for having a mixed fleet, including also conventional vehicles, as well as tax related benefits for commercial users (BuW, 2016, Fraunhofer ISI, 2014). The results of an expert survey suggest that main factors influencing the acceptance of EVs in commercial fleets include reliability of the vehicle, ease of use as well as guarantees regarding battery lifecycles and fast charging functions. Moreover, experts suggest that monetary incentives, such as exempting EVs from the annual circulation tax or environmental bonus programs can be effective measures for supporting the uptake of EVs in commercial fleets. Also, total cost of ownership is discussed as more important than purchase cost (BuW, 2015, Fraunhofer ISI, 2014). An analysis of mobility characteristics and the needs of different commercial vehicle users show that aside from the economic sectors mentioned above, mobile nursing services, wholesale and retail trade companies as well as companies operating in the field of transportation and storage are suitable and economic viable use cases of EVs (Klauenberg et al., 2015, BuW, 2016).

The following example, including the present study, also address the potential and current challenges related to the use of EVs in commercial fleets. In contrast to previous works, this research project contains large scale test fleets that were set up in different companies and regions. This study is accompanied by research project partners that analyze the use of the electric vehicle over a longer period of time. This enables more detailed analyses under real-world conditions, helping to address different stages of the use of the vehicles. These include the decision making phase of vehicle purchase, the introduction of the vehicles into the company´s fleet and vehicle use during the leasing period. The focus of this paper is the evaluation of the use of EVs in commercial fleets from user and expert perspectives.

2. Study design and methodology

In order to analyze the potential environmental and economic use of EVs, as well as the factors influencing the user acceptance, a field test with almost 800 vehicles was set up in two regions in Germany between 2014 and 2016 (Kolarova & Trommer, 2017, Philips et al., 2017). The first region was the capital city Berlin and the surrounding area belonging to the federal state Brandenburg. The second test site was the Baden-Württemberg region in southern Germany. The vehicles were used by small- and medium sized companies or government authorities whose additional costs for the purchase of an EV were partly covered as an incentive to participate to the study.

During the field test, the vehicles´ users, as well as the fleet managers, participated in online surveys conducted at the beginning of the vehicle usage and after around one year of regular use. The first survey focused on their expectations and purchase motives while the second one examined the evaluation of the EV use based on the experience gained. The surveys included questions on the companies´ mobility needs, driving and charging

patterns, evaluation of vehicles characteristics, as well as usage-related constraints and user acceptance. Additional insights on challenges and recommendations related to purchase and use of EVs in commercial fleets were drawn from interviews and groups discussions with the fleet managers and other stakeholders, such as car leasing companies. The collected empirical data were analyzed using descriptive and multivariate statistical methods. Additionally, the results of the analysis were compared with data on the vehicle market in Germany, including the number of registered passenger cars, as well as representative data on travel behavior of conventional commercial vehicles. In the following paper section the characteristics of the sample as well as the results from the quantitative analysis are presented. In the last part of the section, policy and management recommendations drawn from the interviews and group discussions are briefly summarized. These recommendations consider also some of the results from the quantitative analysis of the vehicles´ driving and charging patterns.

3. Results and discussion

3.1. Characteristics of EV users

The study samples from the two project regions differ depending on which companies were interested to include EVs in their fleets. In the Berlin-Brandenburg (BB) region, overall 133 companies or government authorities participated in the project, in Baden-Württemberg (BW) there were 184, respectively. Looking at the characteristics of the companies shows notable differences in their spatial distributions (see Figure 1). Most of the participants in the BB region (67%) are located in the urban area, i.e. in Berlin, and only 33% of the sample is located in smaller cities in the region of Brandenburg. In contrast to this, most of the users in BW (71%) are located in less dense areas, i.e. in cities having less than 100,000 residents. At the same time, companies´ size and fleets size hardly show a difference between the companies located in the different regions. According to the self-reported number of employees, most of the companies in both regions are small, having less than 50 employees (64% in BB, 68% in BW); about 9-10% of the users were self-employed. The results from the workshops conducted in the project suggest that including EVs in a company fleet depends, among other factors, on decision-making structures in the company. The decision for purchasing EVs made by self-employed persons or within small size companies depends usually on personal judgement, while bigger companies have to decide on the purchase of vehicles based on objective criteria, such as cost and involve more decision makers. A trend can be observed that when bigger companies in the project decided to purchase an EV, they mostly purchased a fleet including more than one vehicle.

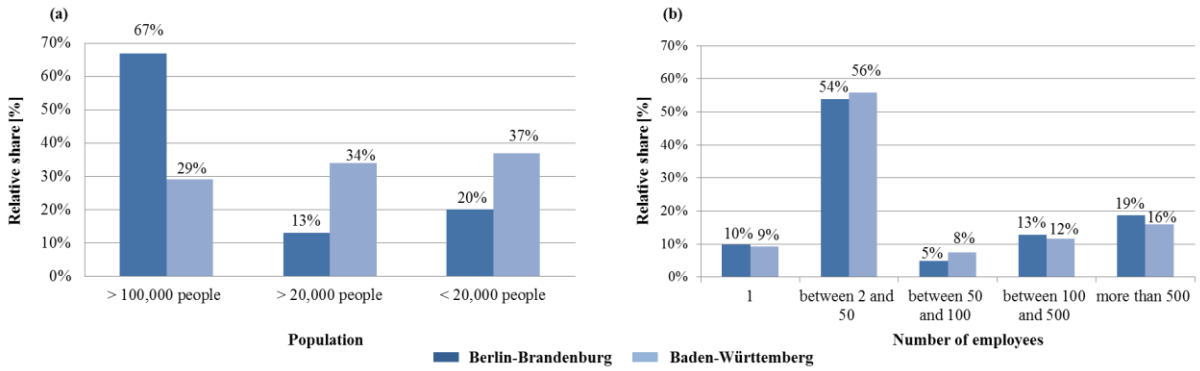

Fig. 1 (a) resident location; (b) number of employees

In BB, the majority of the companies (69%) purchased a single EV, while in BW, 68% have leased more than one EV. In BB, 49% of the EVs were used by 4 companies. In BW, 47% of the EV were driven by 5 companies, of which 61% alone were used by one company. In both regions, most of the vehicles were passenger cars; only 8% in BB and 10% in BW were light utility vehicles (see Figure 2). One reason for this was mentioned in workshops with the users was the lack of availability of suitable vehicle models on the market. Also, even if the share of small and medium size vehicles is similar in both regions, the chosen vehicle models differ between the regions, depending, among other factors, on leasing conditions of the different leasing project partners in both regions.

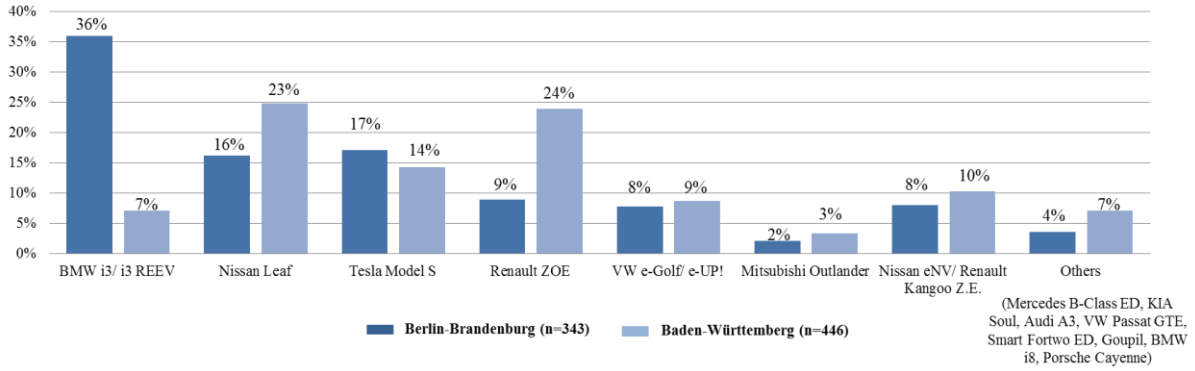

Fig. 2 Share of EV models in the study sample

When comparing the economic sectors the companies belong to, it shows a high share of vehicles operating in the service activities sector[†] (see Figure 3). Many of these companies were working in the field of consulting, marketing, real estate sale and management, IT development, craftsman services as well as security service. The main motives for them to use EVs were reputational aspects, including positioning them as an innovative and sustainable company. The same motives can be suggested for companies operating in the field of electricity supply, making up 5% of the project fleet in BB and 4% of the fleet in BW. The highest shares of vehicles in both regions are related to vehicles belonging to two single company fleets – a company operating in the industry and manufacturing sector in BW, and a company involved in transportation in BB. Similarly to this, 8% of the vehicles in BB were used by one company operating in the waste management; in BW one car sharing provider included 14% of the project vehicles in its fleet. Despite the differences in the economic sectors that the companies belong to, an analysis of the trip purposes in both companies shows that the vehicles are used similarly as vehicles operating in the service sector. For instance, the EVs belonging to the transportation sector in BB are used by employees for trips related to the maintenance and management of public transport facilities.

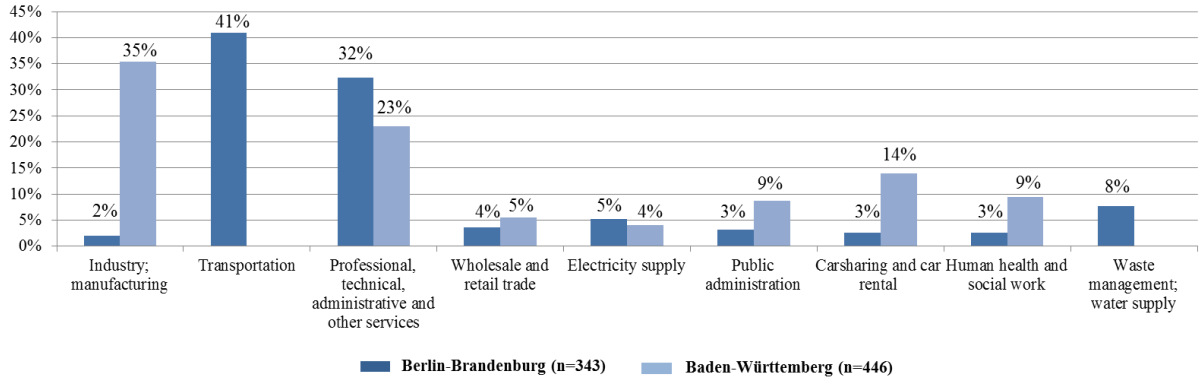

Fig. 3 Share of EVs in the project by economic sector

Another notable difference between the regions is the higher share of EVs used in the sectors human health and social work and public administration in BW compared to BB. Looking at the share of conventional commercial vehicles registered in both regions, it shows the opposite trend in both economic sectors (see Figure 4). This suggests that the potential for using EVs in social work and public transportation in BB needs to be examined further. Moreover, the higher share of conventional passenger cars operating in the wholesale and retail trade sector compared to the EVs used in the project can be explained through the fact that vehicle retail companies also belong to this sector. Thus, the fact that many new vehicles are first registered by vehicle retailers may explain the high number of vehicles registered in this sector. Last but not least, the share of EVs used by the companies operating in the sector transportation or waste management in BB is much higher than the share of conventional vehicles in these sectors (see Figure 3 and Figure 4). This suggests that there is also a potential for using EVs in companies that don´t belong to sectors that are at first glance among the companies that are most likely to use such vehicles.

[†] The economic sector classification is drawn from the German Office of Statistic (Statistisches Bundesamt, 2008)

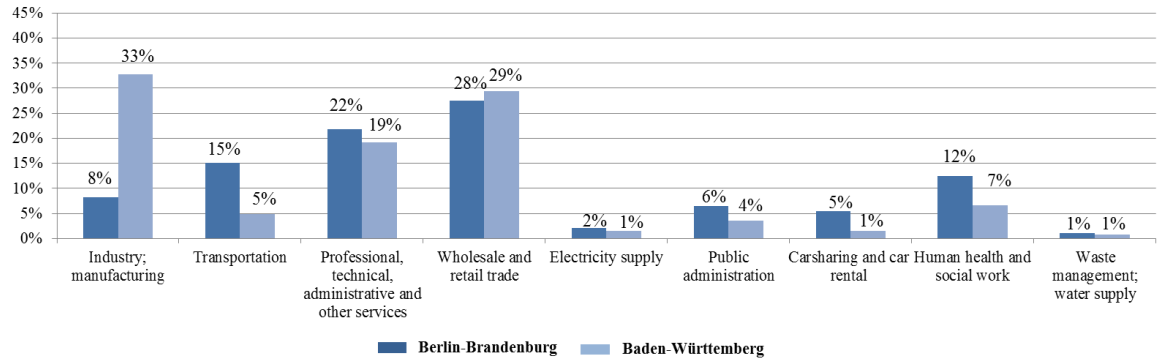

Fig. 4 Share of registered passenger cars in Germany by selected economic sectors (KBA, 2017)

3.2. Driving patterns of EVs

The results show that there are some regional and company related differences in the usage patterns. Overall, due to the high share of passenger cars operating in the field of service activities in both regions, the main trip usage is for trips for visiting customers, i.e. providing professional services, such as consulting, craftsmanship, or other services. Also, many of the vehicles are used also for private trips, such as commuting to and from work. An analysis of the self-reported daily distance driven suggests that EVs in the region BB are used similarly as conventional vehicles in the region (see Table 1). In contrast to this, the vehicles in the BW region have shorter daily distance than the conventional commercial vehicles in the region. At the same time, the results should be interpreted with caution since the values for both regions are based on self-reported average values.

Table 1. Daily kilometers driven (self-reported) compared to representative data for commercial vehicles in Germany

	Mean (Std. dev.)	1st quartile | median | 3rd quartile
Berlin-Brandenburg (study sample; n=101) [1]	68 (65)	25 | 50 | 97
Baden-Württemberg (study sample; n=105) [1]	66 (51)	30 | 60 | 80
Commercial passenger cars in Germany[2]	72.2	-
Commercial passenger cars in Berlin; Brandenburg[2]	53.2; 75	-
Commercial passenger cars in Baden-Württemberg[2]	78.4	-

[1] *Self-reported average daily distance driven (both region together)*
[2] *Data on daily kilometers driven for commercial passenger cars in Germany are drawn from the representative German travel survey on commercial vehicles KiD, 2010 (WVI et al., 2012); average values for Monday to Sunday*

Comparing the average distance travelled by the EVs with the distance travelled by conventional vehicles in selected economic sector shows that EVs are used in sectors with a higher amount of daily kilometres driven (see Table 2). The average kilometres driven by the EVs are presented for the whole study sample and not according to the economic sector classification. This is because within some of the economic sectors over 90% of the EVs were used by a single company (e.g. within the industry, manufacturing and in the social work sector) which might bias the results.

Table 2. Average daily distance driven for the study sample (self-reported) and for representative commercial vehicles (KiD, 2010)

Sample	Average daily distance driven [vehicle km/day]
Study sample (BB and BW)[1]	66.7
Professional, technical, administrative and other services[2]	70.3
Industry, manufacturing[2]	75.0
Public administration[2]	41.3
Human health and social work[2]	42.7
Wholesale and retail trade, incl. vehicle retail and maintaining[2]	57.2

[1] *Self-reported average daily distance driven (both region together)*
[2] *Data on the average daily kilometers driven for commercial passenger cars in Germany are drawn from the representative German travel survey on commercial vehicles KiD, 2010 (WVI et al., 2012); average values for Monday to Sunday*

3.2. Charging patterns of EVs

A comparison of the charging behaviour of commercial users in BB and BW shows some notable differences in the choice of charging locations between the two regions. Overall, commercial users in both regions charge the vehicles primarily at the workplace. However, the results also show that EV users in BB charge more frequently on public charging stations than the users in BW. Almost 70% of the commercial users in BW reported that they never charge on public charging stations, while in BB 34% reported that they use public charging stations at least on 1 to 3 days per month; 3% of them charge on such stations daily.

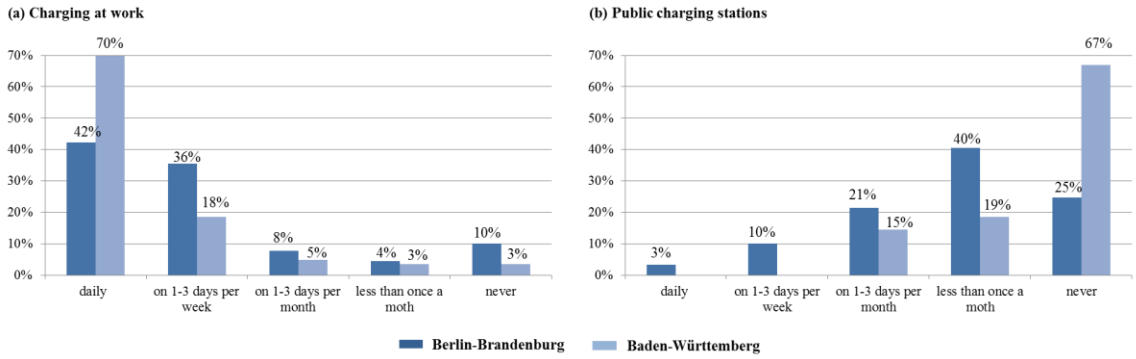

Fig. 5 Charging location (a) at work; (b) public charging stations

Further differences are related to charging facilities (e.g., different PV plant rate of ownership) with a direct impact on environmental and economic balance of the EVs use. A detailed analysis on the topic based on the data from this project is provided in Dittus et al. (2017). The results show that there is higher PV plant ownership rate in the BW region (53% of the companies) compared to the BB region (37% of the companies). Moreover, using PV for charging an EV is beneficial in terms of cost and CO_2-emissions (up to 18% emission savings).

3.3. Evaluation of the use of EVs from user perspective

To gain insight into EV expectations, acceptance and experiences from a user perspective, the results of the online surveys at the beginning of use versus the results after one year of EV usage were analyzed for each individual user per study region. The majority of the study participants evaluated EVs as significantly better than conventional cars in terms of driving pleasure and acceleration (Figure 6, top). In both regions, the user expectations regarding these vehicle parameters could be surpassed (median values at start of use were higher by one unit, respectively). In comparison to BW, users in BB seemed to be slightly more enthusiastic about driving their EV (higher median values, smaller spread of quartiles and higher minimum values). The driving noise of EVs is evaluated very positive in both regions and at both survey time points (median: 7; ≥6 for 75% of the users). Concerning the EV suitability for daily use as well as in summer and winter, user expectations were and experiences showed that they were comparable to conventional vehicles (median values at 4 in both regions and at both evaluation times). However, the minimum values and lower quartiles indicate room for improvement, especially for daily EV suitability and suitability in winter.

Most of the users in both regions are convinced that the EV would be a significant benefit for noise emissions, local air quality and climate protection (Fig. 6, middle). Users in BW are slightly more sceptic concerning the contribution of EV to climate change mitigation (lower quartile at 5 – slightly better than conventional vehicles). This might be due to the fact that the conventional electricity mix in Germany is still dominated by fossil sources, despite the ongoing transition to a more sustainable electricity supply in Germany and although the majority of users use electricity produced using renewable energy sources. The public perception of EVs is evaluated positively in both regions and at both evaluation time points (median at 6, respectively).

In both regions, 75% of the users are convinced that EVs would contribute to a positive ecological image of their company and also enhance their company's reputation (Fig. 6, bottom). Users are not as convinced that the possibility of using EVs would really strengthen the loyalty of the employees towards their company; the median values at the start of the project and after one year of use were at 4, "neutral", in both regions. Also, the spread of answers from minimum to maximum values are highly variable, including users fully agreeing and disagreeing.

How do you evaluate your EV versus a conventional vehicle?

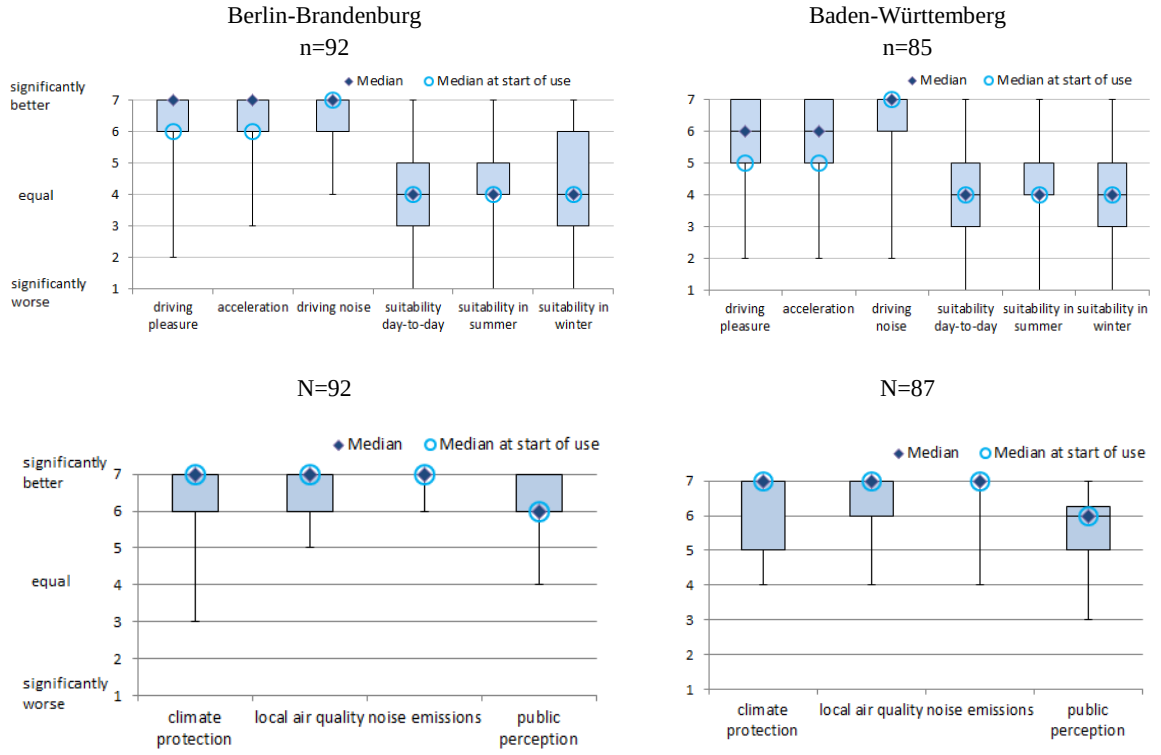

Fig. 6 Evaluation at start of use and after one year - EV vs. conventional vehicles. Values of vertical axis: 1 - significantly worse, 2 – mainly worse, 3 – slightly worse, 4 – equal, 5 – slightly better, 6 – mainly better, 7 – significantly better

Using EVs…?

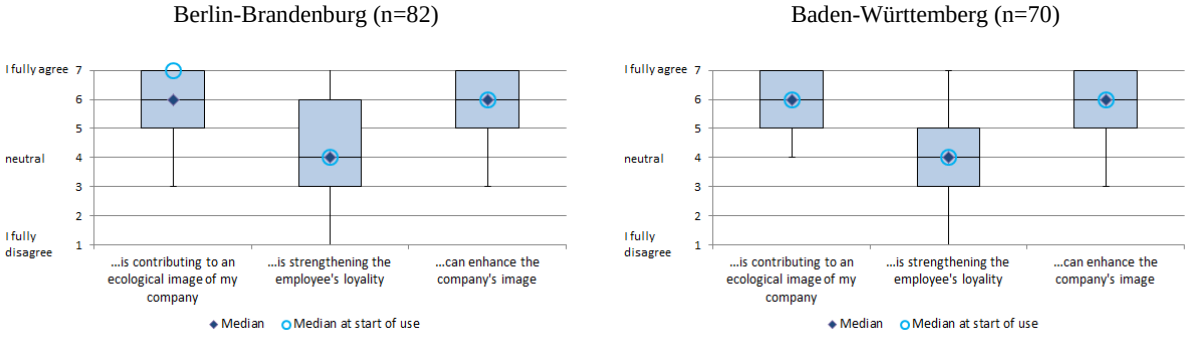

Fig. 7 Evaluation of vehicle parameters at start of use and after one year - EV vs. conventional vehicles. Values of vertical axis: 1 - I fully disagree, 2 – I mainly disagree, 3 – I slightly disagree, 4 – Neutral, 5 – I slightly agree, 6 – I mainly agree, 7 – I fully agree

When analyzing the economic viability of EVs, most of the participants evaluate their operational costs, such as energy costs or maintenance costs, to be lower than those for conventional vehicles. At the same time, purchase/ leasing costs are evaluated as higher than those of conventional vehicles. Additionally, high uncertainties of the EVs' resale values were reported. A case study on the total cost of ownership (TCO) of one of the fleet vehicles used in BW is introduced in Dittus et al. (2017). The results confirmed the users' perception that the EV purchase prices/leasing rates in Germany are substantially higher than purchase prices of conventional vehicles, even when including the purchase subsidies granted within the project. The (slightly) lower energy costs of EVs compared to conventional cars cannot compensate for this (see also Schimeczek et al., 2016). Main obstacles that could be deducted from the TCO analysis are:

- higher purchase prices of EVs plus a strong OEM discount policy for conventional cars,
- relatively high electricity prices in Germany and relatively moderate conventional fuel prices,

- extra costs for the set-up of EV charging infrastructure and
- relatively low motor vehicle taxation rates for (smaller) conventional cars.

In summary, the main benefits of the commercial use of EVs from a user perspective include reputational and environmental benefits as well as driving experience related aspects, such as driving pleasure, acceleration, and driving noise. An overview on the results of user evaluation of various other aspects of the EV use is provided in the final reports of both project regions (Kolarova & Trommer, 2017, Phillips et al., 2017).

3.4. Policy and management recommendations

The final step of the analysis includes development of policy and management recommendations for supporting the uptake of EVs into commercial fleets. Overall, we identified several fields of action that play a crucial role of paving the way for commercial EVs to become a mass-market in Germany. In the following, the main results on the challenges within each field of action are briefly summarized. The insights are drawn mainly from workshops and in-depth interviews conducted with users, fleet managers, and other relevant stakeholders.

3.4.1. Use of EVs in commercial fleets

The results of the study show that most of the potentially suitable economic sectors (industry and manufacturing, professional and administrative services, human health and social works) have actually proven to be adequate for using EVs. However, there are economic sectors, such as wholesale and retail trade, where EVs could not be introduced in fleets in significant numbers. Here, an individual analysis of mobility patterns and needs is required in order to identify beneficial EV use cases and to design sector specific policy instruments. An additional benefit of EVs includes supporting companies´ ecological image and creating new business models. Thus, these aspects should be an important part of the promotion of EVs. Also, we found that in some cases, one EV can fully replace a conventional one; in other cases EVs played a complementary role as part of the green mobility concept of a company. Current government measures, such as tax and environmental bonus programs can increase the attractiveness of EVs for commercial users. However, analysis of the current vehicle market situation in Germany shows that these are still not sufficient, suggesting that additional efforts in all related fields facilitating the use of EVs, such as further development of the charging infrastructure, are needed. The EVs are especially suitable for commercial fleets having small operational areas, consequentially short distances, fixed routes and that are operating in regions with well-developed charging infrastructure. For companies planning to restructure their fleets by including EVs, it is recommended to analyze their mobility patterns but also to consider employee needs and concerns. Involving the vehicle users in the early decision stage and enabling test drives with the EVs can increase employee acceptance and facilitate the usage of EVs in daily work.

3.4.2. Charging infrastructure

One major obstacle identified in this field was the set-up of charging facilities that is time consuming and cost intensive for most of the companies, especially smaller ones. Although a government program with subsidies for charging infrastructure has existed since 2016 in Germany, there are still legislative and technical barriers to overcome (e.g. real estate laws or capacities of local electricity grids). Furthermore, ICT solutions for fleet and charging management could enable or facilitate the use of EVs in commercial fleets. When considering the public charging infrastructure, it shows that the demand for public infrastructure is small in the case of commercial users, as most of the EVs are charged at work. However, for those users who are depending on public charging infrastructure, e.g. while being on longer trips, the high number of varying payment systems was reported to be an obstacle. Thus, there is a need for further and demand oriented development of the public charging infrastructure in Germany. Also, the availability of fast charging stations is found to be subjectively very important, mostly not because of the high demand for it, but rather as a measure for lowering psychological barriers toward EV use.

3.4.3. Business models

Business models for commercial fleets, such as corporate carsharing, can additionally increase the economic viability of the use of EVs. Some present research projects focus on developing and testing technical, management, or legal and liability solutions enabling and facilitating corporate carsharing. Another viable corporate carsharing concept discussed within the workshops with the fleet managers was sharing a small fleet of conventional vehicles which can be used on demand for longer, mostly rare trips.

3.4.3. Emissions and energy demand

To unfold the whole potential of EVs for mitigating air quality and climate change, it is important to combine the usage of EVs with renewable energy sources. In Germany, the transition to a renewable energy supply is ongoing within a national program ("Energiewende"). Currently about 2/3 of electricity is generated using conventional energy sources, such as coal, lignite, or nuclear. Thus, policy measures for the electricity sector and the road transport sector, considering the link between both are required in order to reach a more environmentally friendly electric mobility in the future. Another issue is the environmental burden linked to the production of traction batteries as analyzed in (Dittus et al., 2016). Here, policy measures are needed to support second-life concepts as well as R&D related to optimizing manufacturing processes and materials. While EVs are more energy efficient than conventional vehicles, EV efficiency optimizing potentials remain concerning e.g. charging losses and vehicle interior heating.

3.4.4. Service market

The growing market for EVs leads to a growing demand for experts in different fields related to the purchase and use of the vehicles as well as for custom-made services. It is expected that the service market will naturally grow together with the further market deployment of EVs. At the same time, service quality at the beginning of the market deployment of the vehicles plays a crucial role for the acceptance and the users´ overall experience and satisfaction with the use of the vehicles.

3.4.5. Vehicle market

Users have reported long delivery times for their EVs and have expressed the wish for a better vehicle portfolio (e.g. light utility vehicles or vehicles with higher range and payload capacities). Leasing companies have reported varying OEM support to enhance the market penetration of EVs. This concerns price discounts for conventional and EV models, available and competent EV car dealers and available EV garages.

3.4.6. Acceptance

Increasing visibility of electric vehicles on the street as well as higher media presence regarding the topic electric mobility in the last years has increased the social acceptance of the technology. Also, companies which have decided to include EVs in their fleets play an important role as a role model in their operational field. Success stories and experience exchanges encourage other companies operating in the same sector to consider EVs as alternatives to conventional vehicles. Thus, opportunities to learn from their own experience or from the experience of other companies plays a crucial role in increasing the acceptance of EVs and to cope with concerns regarding the vehicles´ performance. Furthermore, providing information and opportunity for test drives to the employees before including EVs in the company´s fleet is an important step to ensure acceptance of the vehicles. Fleet managers of companies which participated in the project reported that the acceptance of the commercial EVs among the employees was very low at the beginning, increasing first when the employees had the opportunity to test one of the vehicles.

3.4.7. Policy

Policy measures on a national and on regional level in all the fields of action mentioned above can accelerate the market deployment of EVs. On a national level, a regulation framework enabling supporting actions for EV deployment has to be established, e.g. by passing accordingly law amendments allowing incentivizing EV purchase. On a regional level, policy measures have to address local needs and requirements related to the use of EVs and the development of public infrastructure. An important step is also to involve relevant local stakeholders in the transition process. The first steps have been taken from the German government, including an environment bonus program and tax related benefits for using an EV. Further steps are needed supporting the use of EVs including not only focusing on increasing economic viability of the vehicles, but also facilitating their everyday use by addressing needs and demands in all fields mentioned above.

4. Conclusions and outlook

The aim of the presented study is to analyze the potential benefits and current challenges related to the use of EVs in commercial fleets from a user perspective. In this paper, the main results came from field studies with over 800 commercial vehicles that were set up in two regions in Germany.

The results suggest that EVs are suitable for companies operating in certain economic sectors, such as service activities, social work, and industry but also in public administration or as part of car sharing services. Other

important economic sectors, such as wholesale and retail trade as well as taxi services, can also be interesting use cases. However, company-specific needs in these operational fields could not be gained within the study. Overall, the results of the study suggest that EVs meet the mobility needs of various companies and also, in many cases one EV can fully replace a conventional vehicle, or at least play a complementary role in the fleet. Thus, individual analysis of the mobility demand and usage patterns, such as trip purposes, daily distance travelled, as well as charging demand and infrastructure, is important to identify potentials for including EVs in a company´s fleet. In addition, the use of EVs plays an important strategic role related to the positioning of a company as innovative and sustainable one.

Furthermore, the results of the study suggest that despite the differences in company characteristics and driving patterns between the regions, commercial users in both regions evaluate the benefits and challenges related to the use of EVs quite similar. The main benefits of EVs from a user perspective are related to environmental and reputational aspects, confirming the results of previous research studies. Moreover, the economic viability of the vehicles depends on many factors. Commercial users are aware that in many cases EVs are still less economically viable than conventional despite government environmental bonus programs.

Finally, policy and management recommendations in different fields and on different levels are drawn from the results. The main challenges for the deployment of EVs in commercial fleets are related to the periphery of the EVs (e.g., infrastructure, market characteristics, such as price policy and OEM vehicle model portfolios, lack of experts in related service sectors as well as psychology barriers). The results suggest that the evaluation of the use of EVs depends strongly on the whole system around the vehicles, including services and charging infrastructure. Thus, government and management measures have to focus rather on improving the overall experience by purchasing and using an EV rather than on single aspects, such as cost or infrastructure.

In summary, there is a high potential for the use of EVs in commercial fleets. Important for the identification of this potential is the individual analysis of how EVs can fit into the mobility and strategic concept of the company. The main challenges for including EVs in commercial fleet are on the one hand related to the vehicles´ characteristics, e.g. availability of vehicles in the light utility vehicle segment. On the other hand, there is still improvement demand in many fields related to the purchase and use of EVs. Since electric mobility in commercial fleets not only includes the EV, but also charging infrastructure and suitable fleet management, the use of EVs can only be attractive for commercial users when the purchase and the use of EVs is facilitated by improving identified aspects in all related fields.

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