The Try-e-Project

Final Report

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***Abstract*—The Try-e-Project was an electric car promotion project at the University of Applied Sciences Ludwigshafen am Rhein, Germany. All students, staff members as well as the teaching staff members were given the opportunity to rent a project car – a full electric Nissan Leaf II – completely free of charge for three or four days. The project stretched over a period of four months during the winter semester of the university from October 2015 to January 2016. All in all, 256 valid applications were collected by means of an online survey for 30 rental slots. The data records are used for evaluating the benefits of such projects as well as their influence on fostering the distribution of electric mobility.**

The analysis of the applicant data set (n=256) shows that such promotion projects activate people with above-average interest in electric mobility; 89 % of all applicants expressed high or very high interest in electric mobility. The opportunity of hiring a project car proved to be highly attractive particularly for employees; this group reaches a user rate of 31.1 %, which is significantly higher than the shares of students or teaching staff. Results for the renter data set (n=29) show that this kind of car rental leaves a very positive overall impression; 72 % of the renters were remarkably satisfied. Furthermore, multiplier effects can be estimated: at the end of the Try-e-Project approx. 78 individuals had experienced electric driving in the passenger seat, while 186 people had already been involved in discussions or talks related to electric mobility.

Additional fields of research within the Try-e-Project were several short rides, taking place on two specific days and using various electric vehicles, such as a BMW i3, a Nissan e-NV200 or a Tesla Model S, the public conference event "Electric Talk" and finally a special lecture for children.

Keywords—BEV, data acquisition, promotion

I. INTRODUCTION

The common goal of the industry, politics, science, civil society and trade unions is to make Germany the leading supplier and lead market in the field of electric mobility by 2020. The aim is to achieve one million electric vehicles on Germany's roads by 2020.

Germany currently faces the challenge of the second phase of the market development model for electric mobility [1], the ramp-up phase. The first phase, the pre-market phase, was needed to develop electric vehicles which can be built in serial production. The result of this phase are 29 models from German car manufacturers, available by the end of 2015 [2]. Taking into account German cars and models produced by foreign manufacturers, such as Mitsubishi, Nissan, Renault, Tesla or Toyota, one can say that German buyers can currently rely on a broad supply of electric vehicles.

With that said, it is necessary to persuade potential car users to buy and drive electric vehicles. Car experts agree that the best way to inspire people to use electric mobility is to give them the opportunity to experience it themselves. Dr. Dieter Zetsche, chairman of the Daimler Board of Management, underlined the necessity of this first-hand experience during his speech at the 5th Berlin eMobility summit of the Tagesspiegel (04 & 05 May 2015), when he pointed out: „The best promotion for electric vehicles is to drive electric vehicles".

II. THE TRY-E-PROJECT

The apt and clever remark by Dr. Zetsche might become the motto of the Try-e-Project, as this project opens up the opportunity to drive an electric car (to be exact: a full electric Nissan Leaf II) to all members and students of the University of Applied Sciences, Ludwigshafen am Rhein, Germany [3] throughout the winter semester of 2015/2016. At this time, the University of Applied Sciences, Ludwigshafen am Rhein, had 4,295 students, employed a staff of 135 employees as well as a teaching staff of 408 professors, scientific assistants and assistant lecturers. Every single person could apply for a maximum of three rental-slots via an online application form. There were two types of rental-slots: slot 1 from Monday to Thursday (workday slot) and slot 2 from Thursday to Monday (weekend slot). From October 2015 to January 2016, the Try-e-Project offered a total of 30 rental-slots. The Try-e-Project itself was sponsored by the local energy provider Technische Werke Ludwigshafen AG [4]; therefore the use of the car was completely free of charge.

The Try-e-Project was managed and scientifically supervised by Professor Dr. Stefan Bongard, professor for Business Administration and Logistics at the University of Applied Sciences, Ludwigshafen am Rhein, Germany. The research on electric mobility started in 2012 with lectures in environmental logistics, followed by the publication of the monograph „Electric Mobility in Motorized Private Transport", published in 2014 in German by Mathias Bertram and Stefan Bongard [5]. To complement the research basis, two ECAR-studies (ECAR1 and ECAR2) dealing with the acceptance of

electric mobility have been conducted since 2014 [6]. For the ECAR-studies an explorative research approach has been used, which is useful to analyze new market structures and their influencing factors [7]. More user-based studies concerning electric mobility can be found under [8], [9] and [10]. The respective results of the studies may be found on www.elecarda.com, which is an Internet based database for electric vehicles. All activities concerning research on electric mobility are consolidated in the Ludwigshafen Research Center for Electric Mobility (LUcem).

A. Project aim

The key aim of the Try-e-Project was to allow potential users of electric vehicles to experience electric driving for several days in a row for private purposes. Thus, prospective users may form their own opinions about electric mobility without typical constraints, since using the car remains free of charge and restrictions to mileage are not made. Typical members of institutions – such as universities – as well as students usually have to commute to their workplace or place of study; they are therefore the most ideal target group for electric vehicles [11].

Another objective of the Try-e-Project is to raise attention for the forthcoming age of electric mobility. Therefore, specific project web pages [12] have been created, offering important information concerning application, current application numbers and crucial processes (e.g. car return). In addition to the project web page, well-established social media channels have been integrated. To be more precise, facebook [13], Twitter [14] and a YouTube-Channel [15] have been used for communication purposes.

One major activity within the Try-e-Project was the implementation of the event „Electric Days“, which took place from December 14 to December 16, 2015. For applicants that could not be considered for one of the 30 rental slots mentioned above, the Try-e-Project-Team organized extra short rides from December 14 to December 15, 2015. The car pool for the said short drives consisted of different cars (including two BMW i3's, a Mitsubishi Outlander, a Volkswagen GTE, another Nissan Leaf and a Nissan e-NV200), which were provided by the project sponsor and other supporting companies, such as Nissan Germany or SAP. A sure highlight for the short drive event was the appearance of two Tesla Model S from the car pool of the nearby software-company BridgingIT [16]. To wrap up the short drive days and the half-time of the project, the project team organized a so-called "Electric Talk", following the end of the short drives on 15 December 2015. This format, comparable to a public conference, offered different speakers the opportunity to express within 10 minutes' speeches their personal views formed from their experiences with job-related electric mobility [17]. The contribution of ideas, attitudes and opinions was intended to be the starting point of a subsequent discussion with all attendees. Finally, a lecture for children during the kid's college on December 16, 2015 (exciting test drives with the project car included) concluded the Electric Days.

Current results of the ECAR-studies were the initial point for further questions in the field of research for the distribution of electric mobility.

One of the key findings of the ECAR1-study, conducted in 2014, was a high interest and a high positive attitude towards electric mobility.

Question: Do you have a rather positive or negative attitude towards e-mobility?

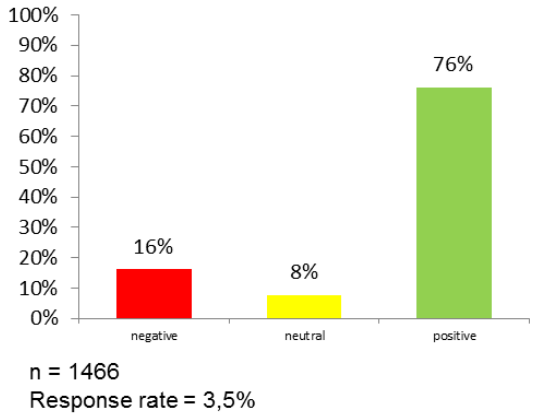

Fig. 1. ECAR1 – Question: Attitude towards e-mobility

Fig. 1 above shows the impressive result stating that 76 % of all participants have a positive attitude toward electric mobility. With the Try-e-Project, empiric evidence can be researched as to whether this high interest and positive attitude lead to a high number of applications for the limited rental-slots on the one hand, and if people are more prepared to buy an electric vehicle after having used one for several days on the other.

The Try-e-Project goes along with additional research, focusing on the following questions:

- How many people get in contact with the electric car during the rental period (e.g. family members, friends, colleagues)?
- How many people are more prepared to buy an electric vehicle car after using it?
- Can projects like the Try-e-Project (or comparable projects [18, 19]) foster the diffusion of electric mobility?
- Do people change their attitude towards electric car specific peculiarities (e.g. charging or limitations in daily life)?

A recent study with 573 participants within the scope of Germany's Showcase Projects [20] proved that there is a clear difference between people with no experience and people with little experience with electric vehicles. Concerning restrictions of daily life it was obvious that users who have no experience with electric vehicles expect more restrictions (53 % expected extensive problems) in daily life than experienced users (only 36 % expected extensive problems). The comparison of both groups (people with no experience and people with little

experience) shows that people with no experience with electric vehicles expect extensive problems regarding the charging procedure. With 67 % this opinion is nearly twice as frequent as in the results within the group of experienced users, who responded by only 34 % that they expect extensive problems regarding the charging procedure.

B. Theory on user/buyer behaviour

A brief look at the theory of user/buyer behavior immediately shows, that one of the biggest challenges is to deal with the complexity of the decision process [21]. Approaches for theoretical explanations can be found in Unger [22], who includes an empiric verification and an overview of other studies concerning buyer behavior, in Menon/Raj [23] or in Achtnicht/Bühler/Hermeling [24], who focus on the impact of service station networks on purchase decisions of alternative-fuel vehicles. The papers of Lee/Govindan [25] and Shende [26] explore buying behavior and decisions against the background of country-specific economics for Malaysia and India, respectively.

Theoretical research for electric mobility is even more complex, as lines between buying and/or using a car have become more and more blurred. One key driving factor is represented by share economy concepts, such as car sharing, where more and more car fleets are complemented with electric cars [e.g. 27]. Hence, it is possible to own a private combustion engine car on the one hand, and to use an electric car sharing car for business purposes on the other (or vice versa).

Recent surveys have shown evidence that present explanatory approaches may not be suitable for the field of electric mobility and therefore need to be adapted. In a recent survey [20], non-owners of electric cars could rate the importance of different electric car-related features. Surprisingly, features such as high speed, image and individualization options ranked last. Top features were quality and reliability, fast charging and safety. The ECAR1-study [6] validates these results. Within the list of factors influencing buying decisions, design and image ranked last, whereas quality, reliability and economy ranked first.

III. Analytical Framework

The key aim of the Try-e-Project was to convey experiences in driving a full electric car. An advanced target was the collection of data to analyze the effects and benefits of such a project.

In order to collect such data, every member of the university could apply for a rental slot using an online survey. A link to this application survey was directly accessible via the project webpage [12]. Besides questions on basic data such as name and email address, the survey contained questions on demographic information including age and gender as well as questions related to electric mobility, as for example „What is your attitude toward electric mobility?“. The application period started with the announcement of the project in the last week of the summer semester at the beginning of July 2015. The members of the university were informed via email; this process was repeated at the beginning of the winter semester 2015/16 in October. Due to the unexpected high number of applications, the application period ended on October 31, 2015.

In total, 325 applications from university members had been collected. After a validation process in which first names, surnames and email addresses were checked, the numbers of validated applications decreased to a total of 256. This data set of valid applications was named “applicant data set”. Proportional to the number of 4,838 members of the university, this equates to a mean application rate of 5.3 %.

The application rates of the three different member groups (students, employees and teaching staff) differ significantly. The lowest rates were reached in the group of the teaching staff with 3.7 % (15 of 408) and in the students’ group with 4.6 % (199 of 4,295). Substantial higher rates were reached within the employee group with impressive 31.1 % (42 of 135).

Due to organizational restrictions, 29 persons were selected from the validated applicant data set and were then notified that they were eligible to use the project car. The selection process was performed manually by the project leader. The applicants’ requests for rental slots served as a first criterion for selection. Another criterion was represented by the requirement for a reasonably equal number of female and male participants as well as equal contingents of students, employees and teaching staff members, respectively. The applicants’ answers to questions related to electric mobility had no influence on this selection process. The following were selected:

TABLE I. Structure of renter data set

	Female	**Male**	**Total**
Students	4	7	11
Employees	7	5	12
Teaching staff	1	5	6
Total	**12**	**17**	**29**

This data set of 29 selected persons was referred to as “renter data set” and is therefore a subset of the applicant data set.

A few days after the car had been returned, every renter received an individual link to the renter online survey via email. This special feature of the survey software allowed to automatically save the participants’ names, email addresses and other information along with their survey data. Hence, it was possible to conduct before-after comparisons per capita and for the whole group of renters as well. The renter survey contained questions concerning the test drive period on the one hand and duplicated questions from the initial application survey on the other. Before-after comparisons were conducted with these last-mentioned duplicated questions.

Before-after comparisons are very useful to measure the effects of promotion projects. Therefore it is recommendable for further promotion projects to collect relevant data not only after, but before the test drives as well. The renter data set was completed in February 2016 and contains 29 high quality data records from all 29 renters of the project car.

Hence, all results based on the renter data set provide only first hints and are far from authoritative conclusions due to the small number of data records.

A. Results for applicants

The applicant data set consists of 256 high quality data records. The validation criterion consisted of the completeness of relevant questions of the applicant survey. One might conclude that the applicants were highly motivated to fill out the complete survey, as the reward could be a rental slot for the project car. Therefore, promotion projects are an ideal way to collect high quality data in terms of completeness. However, a disadvantage might reside in the fact that applicants think their answer to questions related to electric mobility could possibly influence their chances to receive a rental slot.

With the total number of data records in the applicant data set, one can calculate an overbooking factor of 8.5; which is the number of valid applicants divided by the number of rental slots. This number exceeded the expectations by far (and led to the idea of short drives in the course of the electric days for the "disappointed" and unlucky applicants). Such a high overbooking factor is a very strong signal for high interest in electric mobility.

When asked for their attitude towards electric mobility (n=247), 85 % expressed a positive vote. Similarly, the estimation for future relevance of e-mobility is equally positive (n=256). 57 % rated the future relevance high or very high, whereas only 5 % rated this item low or very low (38 % belongs to the estimation middle). Not surprising, but nevertheless very impressive seems the score for curiosity or interest in electric mobility (n=256). 89 % express high or very high interest and 9 % medium interest. Only 2 % confirmed a low interest. Compared to results of the ECAR-studies [6], it is obvious that such promotion projects activate people with above-average interest in electric mobility.

TABLE II. SURVEY RESULTS FOR INTEREST IN ELECTRIC MOBILITY

	n	Value for high or very high interest
ECAR1	1,511	57 %
ECAR2	1,497	72 %
Try-e	256	89 %

Unfortunately (for electric car manufacturer) the applicants are not characterized with an above-average value concerning the preparedness to buy an electric car (n=254).

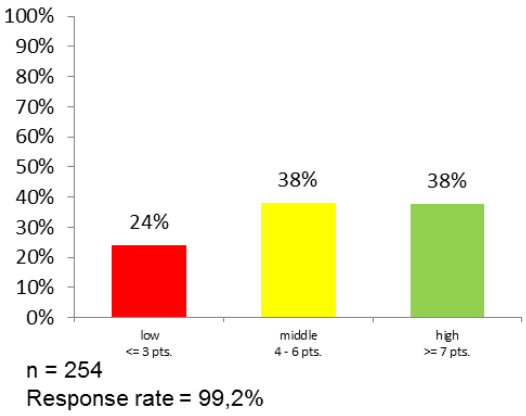

Fig. 2. Figure2 – Question: Preparedness to buy an electric car

This outcome corresponds to the results of the ECAR2-study, conducted in 2014, with values of 35 % for high and 32 % for medium preparedness (n=1,398).

The rating of knowledge concerning electric mobility (n=253) reflects the fact that solutions for electric mobility such as cars or charging system equipment are relatively new. Only 20 % rate their knowledge high or very high. A majority of 79 % rated their knowledge medium (54 %) respectively low or very low (25 %).

The question regarding private reasons (n=255) for not possessing an electric car reveals that at least four obstacles are on a similar level (charging 21 %, everyday usefulness 20 %, technology 19 % and economy 18 %). A slightly lower level could be seen for market supply at 15 %. No need for a car ranked last at 8 %.

Using the different items of the applicant data set one is able to separate different sub-groups. The comparison between students (n=199, average age 24.7 years) and the group of professionals, employees and teaching staff (n=57, average age 41.6 years), shows that the results for attitude, interest and knowledge are nearly on a similar level. Future relevance is rated higher by the group of professionals (7.4 %) whereas preparedness to buy is rated lower compared to the students group (-3.6 %). This can be interpreted that middle aged or older people are more convinced than younger people when it comes to the future relevance of electric mobility; but younger people are more willing to buy those new technology cars.

TABLE III. COMPARISON OF SUB-GROUPS

	students mean	professionals mean	Δ in %
attitude	4.25	4.23	-0.5 %
future relevance	2.30	2.47	7.4 %
interest	8.16	8.19	0.4 %
preparedness to buy	5.62	5.42	-3.6 %
knowledge	3.1	3.1	0.0 %

B. Results for renters

The renter online survey was sent to 29 renters of the project car right after the particular car return. 29 renters responded until February 02, 2016, which amounts to a current renter response rate of 100 %.

Another interesting rate might be the unrequested feedback rate. Eight out of twenty-nine renters (28 %) sent their feedback voluntarily by email with an average word count of 172 words. The overall impression for a rental of the project car for several days was impressively positive (n=29). 72 % of the renters were remarkably satisfied (7 or more points on a scale up to 10 points).

The next question was based on the assumption that the renters possess a comparable combustion car (with "comparable" referring to the size of the car or the number of seats). The question aimed at finding out whether the renter would exchange his combustion car for an electric car (n=29). Six answers applied to "Yes, straight away and without restrictions." All in all, in this case one may assume an exchange rate of 21 %. Fourteen respondents selected the answer "No, that's out of the question." and nine participants chose "Yes, but only with an extra payment." This answer led to a conditional question concerning the required amount of an extra payment. The respondents chose a mean amount of 4,295.70 Euros for the required extra payment. This number can be useful for governmental and company decisions concerning the amount of subsidies; e.g. Renaults grants currently (Feb. 2016) in Germany a sales discount of 5,000 Euro for the Zoe [28].

The mean value for the number of charging processes was 2.7 (n=27), the lowest value being 1, the highest being 5. This result shows that such kind of promotion projects (in which users can experience the benefits of a car for several days in a row) allow the users to face the peculiarities of electric mobility; in this particular case this would be the charging process. Restrictively one must say, that the following question shows that such projects do not necessarily lead to in-depth charging experience (n=22). Only three persons used DC fast charging during the rental period.

On average, each renter drove 172.6 km with the project car. The highest value was 317 km; the lowest 27 km. The average mileage per day amounted to 50.7 km. This equates roughly to a quarter of the regular range of the Nissan Leaf with approx. 200 km. The mean value for the longest total distance between two charging processes reached the total of 80.2 km, the highest value being 123 km; the lowest 25 km.

Obviously, the charging process and the range (maximum distance) represent two critical factors regarding the future success of electric mobility. For this reason, the renters were asked which trips they didn't make due to range restrictions of the electric vehicle.

The answers to the rating of "applies strongly to" to a given statement were the following (in descending order, n=29):

- I fear to break down (range anxiety) (38 %).
- I don't trust the range respectively the range meter (34 %).
- I don't know charging stations near my route (17 %).
- The search for charging stations is too time-consuming (10 %).
- I'm afraid to do something wrong when charging at a charging station (0 %).
- I expect trouble with the payment process after charging (0 %).

One of the key research subjects of this project considers the opportunity of multiplying effects. This means that not only the renter gets in contact with electric mobility, but other people such as family members, colleagues or friends do, too.

The mean value for passengers is 2.7 persons (n=29). The average value for the number of people who discussed or talked to the renter about the project, the project car or electric mobility was more than twice as high with 6.4 persons (n=29). Considering these figures, one can forecast roughly multiplying effects of similar electric car promotion projects. For 100 test drives one can assume that approx. 270 people will be passengers and approx. 640 people might be involved in discussions or talks about electric mobility.

The responses to the question as to whether such project influences buying decisions depend on the renters' willingness to buy a new car in the near future. Nine renters plan to buy a new car within the next twelve months. From these nine renters four renters (44 %) disagreed to the statement, that this driving experience will influence their coming buying decision whereas five respondents (56 %) agreed. Those five renters, that saw an influence on their buying decision, were asked whether they think about buying a battery-electric vehicle (BEV), a hybrid car or a conventional car with a combustion engine. Only one person chose a BEV, two respondents preferred a hybrid car and another two a conventional car.

However, (a few) renters are willing to consider the experiences of this project in deciding between a combustion engine car or electric car, e.g. choosing a car fleet or a rental car (n=20). The question remained whether the renters preferred the usage of an electric car. Six participants (30 %) answered "Yes, definitely", seven (35 %) selected "Yes, occasionally", and another seven (35 %) responded "No, at most in exceptional cases".

The development of electric mobility is highly related to the supply of charging infrastructure. Therefore, one question aimed at the responsibility for the development of charging infrastructure. The result was not distinct and lead to the interpretation, that the task of building an appropriate infrastructure belongs to all stakeholders of electric mobility (n=29, 74 answers), such as energy providers (27 %), government (26 %), private companies (23 %), car manufacturers (19 %) or other institutions (5 %).

The fact, that renters are willing to pay for charging (n=29) with 86 % considering paying for charging energy, seems to be good news for infrastructure operators.

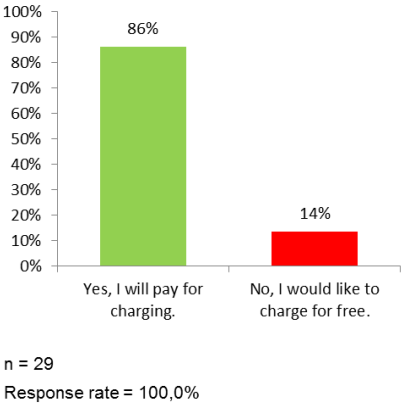

Fig. 3. Figure3: ECAR1 – Question: Willingness to pay for charging

C. *Renter group special results*

The renter data set can be used for the purpose of a before-after analysis for the items attitude, future relevance, interest, preparedness to buy and knowledge.

1) *Renter group results – before vs. after*

With the before-after analysis of the renter group the mean values of the five aforementioned items can be compared with their values before the car rental and after the car return. In order to compare the results, all scales have been transformed to a range from 1 (lowest value) to 11 (highest value).

TABLE IV. BEFORE-AFTER COMPARISON OF THE RENTER GROUP (N=29)

	mean before	**mean after**	**Δ in %**
attitude	9.1	8.5	-6.6 %
future relevance	7.6	6.9	-9.2 %
interest	9.1	8.6	-5.5 %
preparedness to buy	6.4	5.6	-12.5 %
knowledge	6.3	7.5	19.0 %

One can see clearly that such projects affect people in their rating of critical aspects of electric mobility. For this project, a positive influence can only be detected for knowledge. For the rest of the items such as attitude, future relevance, interest as well as preparedness to buy one can determine a negative influence.

2) *Renter per capita results – before vs. after*

With the analysis per capita it is possible to identify users with peculiar characteristics. This may be users showing a significant change (positive or negative) as well as users with no significant change at all in their ratings. For the renter data set, three users could be identified who lowered their rating regarding preparedness to buy by 4 points, one user by 5 points and another user by even 6 points (on a scale from 1 to 11 points). However, seven users increased their preparedness to buy with one user who increased his rating for preparedness to buy by 5 points. This information could be helpful for car manufacturers and their marketing/sales forces for identifying and addressing target groups. Nonetheless, as already mentioned before, a much broader data base would be a precondition for further analysis.

IV. CONCLUSION AND OUTLOOK

Firstly, it can be said that the Try-e-Project was a complete success. More people than expected applied for the limited number of 30 rental slots. Secondly, it seems that the renters have been very satisfied with the car rental offer. Thirdly it is obvious that those projects affect people in their evaluation and perception of electric mobility. A positive influence can be seen for several issues, such as the "exchange rate" with 21 %, the willingness to prefer electric cars in car fleets/car rentals or the increase of knowledge about electric mobility by nearly 20 %. Nevertheless, this project shows clearly that using an electric car for several days also discloses negative effects. One of the important findings on this subject is that – after using the car – the rating of four relevant items such as attitude, future relevance and interest in electric mobility or preparedness to buy an electric car decreased significantly. Yet, these results cannot be generalized, as they refer to this unique project using a Nissan Leaf II as a project car.

With the assumption, that in the near future the supply of more powerful electric cars will increase as well as the development of infrastructure will make progress, it will be interesting to compare future analysis results of promotion projects with the results of the Try-e-project to find out more about the tipping point labeling the rising age of electric mobility.

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