

Research Article

Acceptance of Electric Car Sharing in Rural Areas

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Car sharing helps promote new drive systems to early adopters, and its market share has grown continuously worldwide. However, in rural areas, car sharing still faces challenges, such as sparse populations. In urban areas, previous research has identified underlying factors in the use of car sharing. However, these findings are yet to be transferred to rural areas. Three different methodological approaches were applied in a rural municipality in southern Germany to better understand the acceptance of electric car sharing in rural areas. Firstly, a survey was conducted with 190 participants to provide an overview of underlying factors in the acceptance of electric car sharing. Secondly, interviews were conducted with 21 participants to obtain a deeper insight into these factors. Finally, a cocreation workshop was conducted with 17 participants to identify an electric car sharing model for rural areas. The results showed that performance expectancy, hedonic motivation, and facilitating conditions were the most important factors in the use of electric car sharing in rural areas, at least when presented at a conceptual level. Furthermore, an electric car sharing service with a station-based system and a service provider to distribute vehicles to stations across the municipality's districts was voted as the most suitable model by participants. As the car sharing system was not yet implemented at the time of the survey, future studies should examine the underlying factors in the use of electric car sharing systems in rural areas at later stages of development. Moreover, the economic and technical viability of the developed electric car sharing service should be tested.

1. Introduction

Car sharing plays a major role in promoting innovative new drive systems (e.g., electric or hybrid) as it allows consumers to test these systems without making large investments. The opportunity to trial a new system is called trialability, and it is important for promoting electric vehicles to early adopters [1]. The market for car sharing has grown worldwide over the last few years [2], and car sharing fleets have increasingly become electrified [3]. Globally, many metropolitan areas already offer car sharing. However, electric car sharing faces additional challenges in rural areas, such as a sparse population and a high level of car ownership [4]. Nevertheless, rural residents appear to be as open to electric car sharing as urban residents [4]. A stronger sense of community in rural areas could also be a positive precondition for car sharing, in addition to other unidentified factors. To identify the underlying factors in car sharing acceptance in urban areas, Müller [5] conducted a study that revealed that performance

expectancy was the most relevant factor in people's attitudes toward car sharing. Whether these findings are transferrable to electric car sharing in rural areas remains an open question. Differences between rural and urban populations may be expected because of different preconditions, including a strong sense of community and higher car ownership in rural areas. The current article aims to identify and explain the underlying factors in electric car sharing acceptance in rural areas in depth and present an electric car sharing model developed as part of a cocreation process with rural participants. A multimethod approach was used, which incorporated a survey, interviews, and a cocreation workshop to include different perspectives on consumers' needs regarding electric car sharing in rural areas. The survey results showed that when electric car sharing is presented at a conceptual level, performance expectancy, hedonic motivation, and facilitating conditions were the most relevant factors in predicting electric car sharing use in rural areas. In addition, the interviews revealed deeper insights into these

factors and ways to influence them. For example, performance expectancy strongly depends on the individual context. Participants stated that performance expectancy was low if their household owned a second or third car. Thus, this factor could be influenced by tailoring an electric car sharing model to the needs of families that do not own a second or third car. In the workshop, participants developed four car sharing models and voted on the best option. An electric car sharing model that included car sharing stations in all districts of the municipality and a service provider to return the vehicles to the stations after usage was voted the most suitable. A service provider returning the vehicles to the station after usage could, for example, increase the performance expectancy of electric car sharing to families that do not own a second or third car, as they can leave the vehicle at the supermarket in the use context of grocery shopping.

2. Literature Review

2.1. General Acceptance of Car Sharing. In 2019, the size of the global car sharing market exceeded 2.5 billion USD. It is expected to grow at a compound annual growth rate of 24% (CAGR), resulting in a market size of 9 billion USD by 2026 [2]. Additionally, car sharing fleets are increasingly electrified because of governmental pressure to promote sustainable living and mobility and an increasing number of limited traffic and no-emission zones [3]. Germany boasts Europe's largest car sharing market, with 2.29 million users and 226 providers offering car sharing services at 840 locations around the country [6]. Overall, 95% of large cities with more than 100,000 inhabitants offer car sharing in Germany compared to only 4% of municipalities with fewer than 20,000 inhabitants [6]. Thus, relevant factors in the use of car sharing must be identified to increase the proportion and viability of electric car sharing in rural areas. Moreover, a successful electric car sharing service could be developed for rural areas by building on these factors.

2.2. Underlying Factors in Car Sharing Acceptance. The unified theory of acceptance and use of technology (UTAUT 2) [7] was adopted as the basis for the current research to systematically identify relevant factors in the acceptance of electric car sharing in rural areas. In a consumer context, UTAUT 2 is a commonly used technology acceptance model [7]. It proposes that performance expectancy, effort expectancy, social norms, facilitating conditions, hedonic motivation, price value, and habit directly influence the intention to use a technology [7]. Previous research on car sharing has mainly identified performance expectancy, effort expectancy, hedonic motivation, facilitating conditions, and social norms as important factors for car sharing acceptance.

Performance expectancy refers to how useful consumers perceive a product to be, whereas hedonic motivation refers to how enjoyable they perceive a product to be [7]. Müller [5] reported that performance expectancy was the most important factor in participants' attitudes toward regular car sharing services. For electric car sharing, Curtale et al. [8]

found that performance expectancy was the third most important factor for the intention to use. According to Weiß et al. [9], performance expectancy and hedonic motivation are the two most important factors for the intention to register with an electric car sharing service. Accordingly, Tran et al. [10] reported that performance expectancy and hedonic motivation are among the three most important factors for the intention to use an electric car sharing service. Another factor discussed in the literature on electric car sharing is effort expectancy. Effort expectancy describes the ease with which consumers can use a product [7]. In the context of electric car sharing, Zhang et al. [3] reported that effort expectancy is an important factor in the intention to use electric car sharing, and Tran et al. [10] reported that it was the second most important factor. Moreover, social norms [3, 8, 11] and facilitating conditions [3] have also been identified as important factors influencing the intention to use car sharing. Social norms describe how consumers perceive the attitudes of relevant others, such as friends or family, while facilitating conditions relate to consumers' perceptions of whether they have the resources and support needed to use a technology [7]. In a study by Zhang et al. [3], relevant resources for using an electric car sharing service can be interpreted as policy support for low-emission electric car sharing. As shown in available research, the relevance of variables in UTAUT 2 also depends on the research context.

Other studies on electric car sharing have shown that the knowledge of an electric car sharing service is an important factor for the intention to use [12, 13]. Moreover, if potential users are insufficiently informed about a technology, their trust toward the provider anchors their judgement [14]. In the context of car sharing, Möhlmann [15] showed that trust is an important factor in the satisfaction with car sharing services. Additionally, car sharing has often been researched as a personal norm under the topic of sustainability [16, 17]. It has been reported that people with a high level of environmental awareness are more attracted to car sharing than those with a low level of environmental awareness [18–20]. However, the need for a car and economic savings are more relevant factors than environmental awareness for using a car sharing service [18, 21]. In addition, experience has been reported as an important factor in several outcomes related to car sharing. Consumers with experience in car sharing perceive electric cars as more useful and have a higher intention to buy electric cars than those without experience [20]. In addition, car sharing experience is related to years of possession of a car driving license [22] and to the acceptance of electric cars when the experienced car sharing was operated with electric cars [23].

However, all the above-mentioned studies were conducted in an urban context. Therefore, a detailed examination of underlying factors in electric car sharing in rural areas is needed to determine whether these factors differ in sparsely populated rural communities. This study aimed to assess the general acceptance of electric car sharing in rural areas by identifying the underlying factors of acceptance and by designing an individualized solution for an electric car sharing model. It was achieved via a multimethod approach

that comprised a quantitative survey to provide an overview of the underlying factors in electric car sharing acceptance, qualitative interviews to garner deeper insights into these factors, and a cocreation workshop to develop an electric car sharing model for rural areas. Conducting the survey first ensured that the subsequent interviews focused on the most important factors in the acceptance of electric car sharing for surveyed respondents from rural areas. After the interviews were conducted, the results of the survey and interviews were presented to participants in the cocreation workshop to ensure that they focused on the factors with the highest importance for the acceptance of electric car sharing among rural citizens. Employing this three-step process ensured that consumer needs were viewed from different perspectives and were comprehensively integrated into the final individualized electric car sharing model for rural areas. The multimethod approach used in this study is depicted in Figure 1 and explained in greater detail in the following section. The underlying model of the research presented in this article was derived from the aforementioned studies and is shown in Figure 2.

3. Online Survey

3.1. Methodology. The research was conducted in Wüstenrot—a sparsely populated rural municipality in southern Germany with a total of 6,600 inhabitants. An electric car sharing service is currently being planned for the municipality, which will offer electric and hybrid vehicles. Hybrid vehicles that have both internal combustion and electric engines are integrated into the service. According to Wang et al. [13], they can also play a role in reducing emissions and are currently more practical to use than fully electric vehicles. The first methodological approach comprised a quantitative questionnaire that aimed to provide an overview of the factors underlying the acceptance of electric car sharing. The planned electric car sharing service was described in the questionnaire, and the scheduled implementation in Wüstenrot was mentioned. All 3,600 households in Wüstenrot received the questionnaire in a prepaid envelope. The questionnaire items were based on UTAUT 2 by Venkatesh et al. [7], and the additional factors of trust and personal norms were derived from the literature on car sharing acceptance [15, 18, 19]. The moderators of age, gender, and experience were not included in the model for simplicity. Habits and price value could not be considered because the electric car sharing did not yet exist, and prices were not determined at the time. Figure 3 shows a map of the study area. Table 1 presents the items used in the survey. Scales ranged from 1 (strongly disagree) to 5 (strongly agree) for all constructs, except knowledge. For this construct, the scale was 1 (very low) to 5 (very high).

3.2. Results. A total of 190 households participated in the survey. 68% percent of the sample were male, 31% were female, and 1% were nonbinary. The mean age was 53.6 years ($SD = 14.6$, range = 17–87). The distribution of age groups was as follows: 1.1% were 18–19 years of age, 6.6% were

20–29, 11% were 30–39, 14.3% were 40–49, 29.7% were 50–59, 25.8% were 60–69, 9.3% were 70–79, and 2.2% were 80–89. According to [24], the population of Wüstenrot is 48% male and 52% female, with a mean age of 45.6 years. Thus, the sample was not representative of the population of Wüstenrot. However, it substantially represented many age groups that are relevant to car sharing, and thus potential users, as evidenced by the means of transport currently used by respondents for commuting and travelling in their free time. More specifically, 82% of participants indicated that they used a car with an internal combustion engine for commuting, while 83% indicated that they used a car with an internal combustion engine for travelling in their free time. Table 2 summarizes the sample characteristics.

The internal consistency of all items was in the range of $\alpha = 0.78$ – 0.90 and was thus considered adequate. Of the respondents, 15% indicated a high interest in using the electric car sharing service (4 or 5 on a Likert scale ranging from 1 = strongly disagree to 5 = strongly agree). Over the entire sample, the intention to use electric car sharing was low on average at 2.2 ($SD = 1.3$), as were performance expectancy at 2.2 ($SD = 1.2$), hedonic motivation at 2.6 ($SD = 1.4$), and social norms at 2.2 ($SD = 1.2$). Effort expectancy at 3.0 ($SD = 1.4$), knowledge at 3.0 ($SD = 1.1$), trust at 3.0 ($SD = 1.1$), and facilitating conditions at 2.9 ($SD = 1.7$) were medium on average. Within the sample, respondents scored highly on personal norms at 4.2 on average ($SD = 1.0$). Overall, the results indicated that participants in Wüstenrot had high expectations regarding increasing the sustainability of mobility options. However, citizens remained skeptical of the usefulness of car sharing.

A linear regression analysis was conducted to use car sharing as a criterion to prioritize the factors assessed in the survey. The results showed that performance expectancy ($\beta = 0.617$, $p < 0.01$) had a strong influence—the highest of any factor—on the intention to use electric car sharing in Wüstenrot. Although it was the second most influential factor, hedonic motivation ($\beta = 0.206$, $p < 0.01$) had a weak overall influence on intention to use electric car sharing. Facilitating conditions ($\beta = 0.079$, $p < 0.01$) were the third most important factor with a weak but significant influence. Trust ($\beta = 0.088$, $p < 0.10$), social norms ($\beta = 0.090$, $p < 0.10$), and personal norms ($\beta = -0.005$, $p < 0.10$) also had a weak and marginally significant effect on intention to use car sharing. Effort expectancy and knowledge did not significantly influence the intention to use electric car sharing. The overall model fit was $R^2 = 0.81$. Table 3 summarizes the regression results of the first study.

3.3. Discussion. Overall, 15% of survey participants indicated a high interest in electric car sharing services. Although this value initially seemed low, it was slightly above the German national average (13%) [25]. As Wüstenrot is involved in many sustainability projects, general openness to sustainable mobility is likely. Regarding the underlying factors in car sharing acceptance, Müller [5] reported that performance expectancy had the greatest influence on the intention to use car sharing. Other studies have reported that

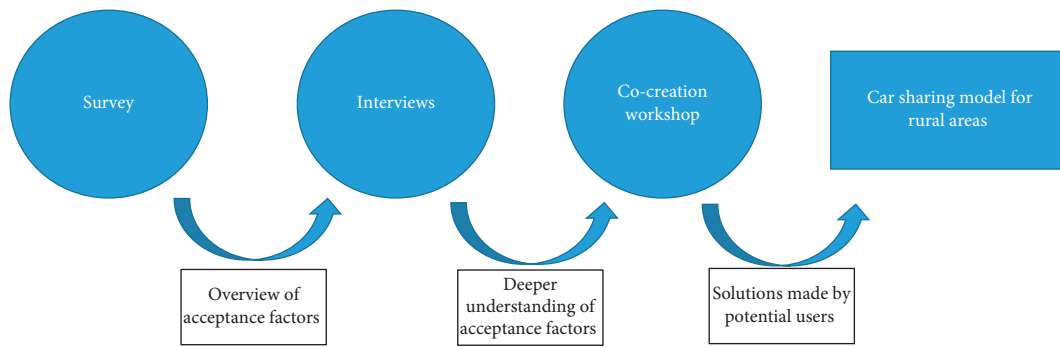


FIGURE 1: Diagram of the methodological approach used.

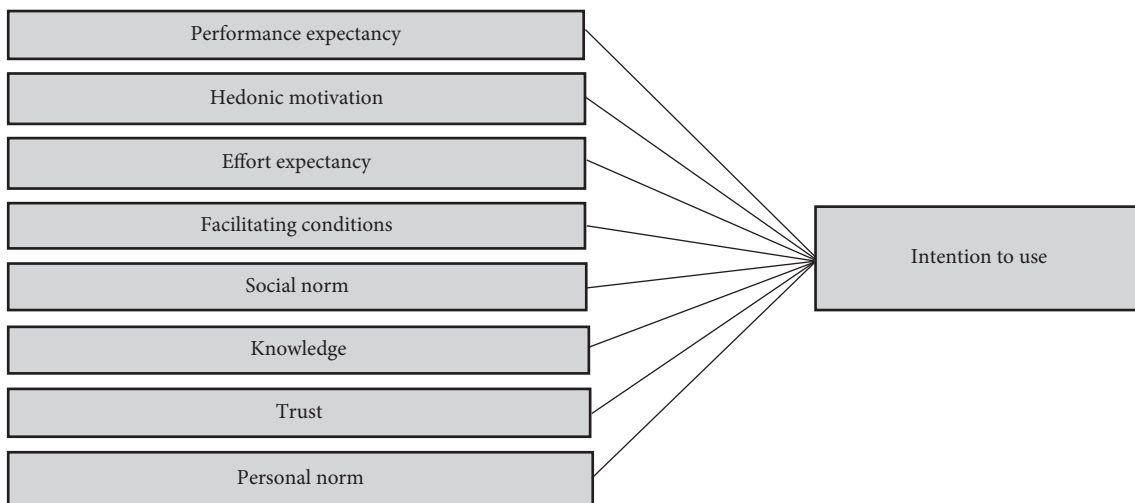


FIGURE 2: Research model for the online survey.

performance expectancy is one of the three most influential factors in the intention to use electric car sharing [8, 10]. The results of this study confirmed the importance of performance expectancy in electric car sharing in rural areas. Moreover, Weiß et al. [9] emphasized the high influence of hedonic motivation on the intention to register for a car sharing service. Tran et al. [10] reported that hedonic motivation is the most influential factor in the intention to use electric car sharing. The results of this survey confirmed the importance of performance expectancy and hedonic motivation in the intention to use electric car sharing in a rural context. They indicated that for the citizens of rural communities to find car sharing services useful, use contexts should be found for them, and accordingly, they should also fit into people's daily routines. As electric car sharing presents a new mobility alternative in Wüstenrot, local residents should be integrated into the process of identifying and developing contexts in which the services could be useful. Moreover, test events could enable prospective users to experience the fun associated with using electric car sharing systems and thus positively impact hedonic motivation and acceptance. Following Zhang's [3] results, facilitating conditions were also found to positively influence the intention to use electric car sharing. However, the construct had a far lower influence than performance expectancy and hedonic motivation. Furthermore, trust was

found to have a positive influence on the intention to use electric car sharing, as in Möhlmann's [15] study. However, in contrast to Möhlmann [15], trust was not one of the most important factors. Facilitating conditions can be improved by integrating local people into the process of identifying appropriate locations for electric car sharing stations. It may also increase trust in providers as they consider potential users' wishes in doing so. Consistent with Zhang et al. [3], Curtale et al. [8], and Burghard and Dütschke [11], social norms significantly influenced the intention to use car sharing. However, this influence was only marginally significant and smaller in our study. It may be because social norms develop in time after the implementation of a new transport system. In contrast to previous research, effort expectancy did not have a significant influence on the intention to use electric car sharing in our study. It may be because the electric car sharing service examined in our study had not yet been implemented, while Zhang et al. [3] researched an existing service. Although Tran et al. [10] also researched a car sharing service that had not yet been implemented, they distributed a brochure describing the car sharing concept. In the current study, less information may have been provided to participants, as the car sharing concept had yet to be developed with the citizens of Wüstenrot. Accordingly, it may have been difficult for participants to imagine the effort associated with electric car

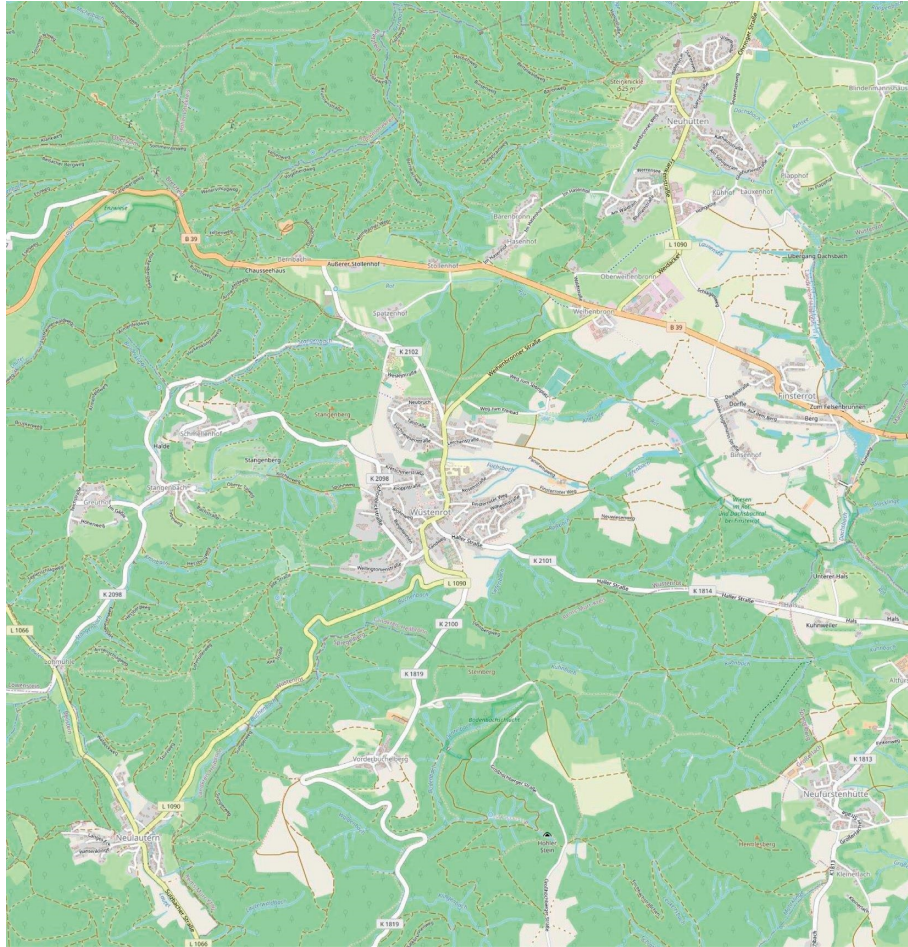


FIGURE 3: Map of the study area Wüstenrot [24], © openstreetmap-contributors.

TABLE 1: Items used in the survey.

Construct	Items
Intention to use	
Performance expectancy	“I could imagine using the electric car sharing service in [Wüstenrot] with an electric car regularly in my daily life in the future.”
Effort expectancy	
Social norms	“I could imagine using the electric car sharing service in [Wüstenrot] with an electric car regularly on the weekend in the future.” “I could imagine using the electric car sharing service in [Wüstenrot] with a hybrid car regularly in my daily life in the future.”
Trust	“I would trust that enough vehicles would be available in the electric car sharing service in [Wüstenrot].” “I would trust that the stated range of the electric vehicles would be precise in the electric car sharing service in [Wüstenrot].” “I would trust that the stated charging time of the electric vehicles would be precise in the electric car sharing service in [Wüstenrot].”
Facilitating conditions	“The electric car sharing service in [Wüstenrot] at the local school would be easy to reach for me.”
Hedonic motivation	“Using the electric car sharing service in [Wüstenrot] with an electric car would be fun.” “Using the electric car sharing service in [Wüstenrot] with a hybrid car would be fun.”
Knowledge	“How do you rate your knowledge of car sharing?” “How do you rate your knowledge of electric cars?” “How do you rate your knowledge of hybrid cars?”
Personal norms	“Sustainability is an important topic to me.” “Sustainable mobility is an important topic to me.”

TABLE 2: Summary of sample characteristics from the survey.

Variable	<i>n</i>	Options	Frequency (%)
Gender	190	Female	31.0
		Male	68.0
		Nonbinary	1.0
Means of transport (commuting)	126	Car with combustion engine	82.0
		Car with electric powertrain	6.0
		Public transport	6.0
		Other	6.0
Means of transport (free time)	132	Car with combustion engine	83.0
		Cycling	5.0
		Walking	4.0
		Other	8.0

Note. Character *n* denotes the number of subjects, with the total sample being *n* = 190. Under the means of transport for commuting and free time, the variations in *n* are because of missing responses.

TABLE 3: Results of multiple linear regression model to predict the intention to use electric car sharing (*n* = 190).

		β	<i>t</i>	<i>p</i>
Intention to use electric car sharing	Constant	0.203	0.112	0.911***
Individual factors	Performance expectancy	-0.617	-9.487	0.001***
	Hedonic motivation	-0.206	-3.717	0.001***
	Effort expectancy	-0.052	-1.318	0.189*
	Facilitating conditions	-0.079	-2.680	0.008****
	Social norms	-0.090	-1.883	0.061†***
	Knowledge	-0.055	-1.382	0.169**
	Trust	-0.088	-1.969	0.051†
	Personal norms	-0.005	-0.124	0.091†

Note. Overall model fit was $R^2 = 0.81$, $F(2) = 46.45$, and $p = 0.001$. Significance levels: *** $p < 0.001$, ** $p < 0.01$, and † $p < 0.10$.

sharing. In addition, personal norms had a weak and marginally significant influence on the intention to use electric car sharing. This contrasts with the previous findings that personal norms have an important influence on the intention to use car sharing [18, 20, 21]. However, in other studies, personal norms were less important for the intention to use electric car sharing than other factors, such as the need for a car and economic savings [18, 21]. In summary, the results of the quantitative survey were mainly consistent with previous findings, despite the survey being conducted in a rural area. Additionally, the survey results underlined the importance of integrating the ideas of prospective users in a cocreation process to develop an electric car sharing service. It could facilitate the implementation of a service perceived as useful and trustworthy. The survey results provided an overview of the relevance of underlying factors in electric car sharing acceptance among the citizens of a rural community. Next, qualitative interviews were conducted to achieve a more detailed and deeper understanding of people's opinions on electric car sharing, especially regarding the most relevant factors.

4. Qualitative Interviews

4.1. Methodology. Semistructured interviews were conducted via telephone to qualitatively evaluate electric car sharing in rural areas and to examine previously identified motivational factors in detail. After being introduced to the

planned electric car sharing model in their municipality, participants were asked openended questions based on UTAUT 2 [7]. The questions focused on the UTAUT 2 factors that were found to be significant or marginally significant in the quantitative study: performance expectancy, hedonic motivation, facilitating conditions, social norms, trust, and personal norms. The interview questions included, "What do you think about the planned electric car sharing service?," "What would motivate you to use the electric car sharing service in your municipality?," and "What would keep you from using the electric car sharing service?" Questions were developed based on the aforementioned research model. To examine the trust factor, criteria such as electric range, charging time, and vehicle availability were analyzed. The personal norm factor was examined with questions, such as "How important is sustainability to you?" The semistructured interview guide further examined the previously identified motivational factors and allowed space for new ideas to emerge from the interviewees. The respondents were recruited via telephone, and attention was given to ensuring heterogeneity in their jobs and ages to gather diverse opinions on electric car sharing in rural areas.

4.2. Results. The interviewees consisted of ten residents of Wüstenrot, seven employees of the municipality, and four employees and owners of local businesses. In total, 21 interviews were conducted. The average age of the interviewees

TABLE 4: Summary of the results from the interviews.

Summary of the results from the interviews	Performance expectancy	Hedonic motivation	Facilitating conditions
Drivers	Temporary need for a car	Interest in drive system	Car sharing station within walking distance
Barriers	Car ownership	NA	Operating frequency of public transport

was 44 years ($SD = 11.12$, range = 21–62). The sampling provided an opportunity to collect various perspectives on electric car sharing by including participants from different professional backgrounds and age groups. Table 4 summarizes the interview results.

Overall, the interviews revealed that performance expectancy strongly depended on the residents' individual circumstances. As Wüstenrot is a rural area, all participants' households had at least one private car, and therefore, they did not necessarily need an electric car sharing service. However, the interviewees identified several use cases for electric car sharing. For example, a service might be especially useful for young people who have a driver's license but do not own a car. In addition, it may be an option for households that consider a second or third vehicle. An electric car sharing service could lead them to reconsider the purchase and prevent them from spending significant financial resources on a vehicle when their needs could be fulfilled through other means. It appears to be a suitable option for households that require another vehicle for a short period. One interviewee stated that apart from local residents, car sharing vehicles could be a useful mode of transport for tourists and business professionals who stayed in Wüstenrot for a limited time. For most interviewees, hedonic motivation was the primary driver in testing electric car sharing. The main reason was interest in alternative driving systems and curiosity about driving an electric vehicle. One participant (I4) said, "The drive system is the thing that motivates me to try out the electric car sharing service because, from a technical perspective, this is really exciting." However, most participants indicated that they did not see themselves regularly opting for the electric car sharing service, mostly because of accessibility. It highlights the relevance of facilitating conditions. Most participants considered the planned locations for electric car sharing stations to be insufficiently flexible and difficult to reach. Since the municipality comprises several smaller districts and is relatively spread out, the inhabitants of districts other than the main locality would need to use bicycles, cars, or public transport to reach electric car sharing stations. It constitutes a significant barrier to the use of electric car sharing and conflicts with the sustainable and flexible nature of the concept. However, participants acknowledged that the location of the electric car sharing central station was reasonable because it would be at the center of the municipality. One interviewee (I14) stated, "If the distance to the station was shorter and if public transport operated more frequently, the probability of me using electric car sharing in Wüstenrot would increase." Overall, respondents had a positive attitude toward the factor of trust. Most of them were confident that sufficient vehicles would be available and

considered this availability as a matter of course. When asked about the average distance that they could travel with an electric vehicle, they estimated around 300 km. Overall, interviewees also trusted available data on the range of electric vehicles and loading time provided by manufacturers, although they considered that they might be "slightly sugar-coated," as indicated by several participants. Regarding social norms, participants stated that cohesion was generally strong in the municipality. However, only a few participants specifically mentioned that alternative drive systems were part of their conversations with friends and family. However, all participants who knew someone who owned an electric vehicle appeared to have a positive impression. As a personal norm, sustainability was found to be a key asset of Wüstenrot and its inhabitants. One participant noted a sense of pride in Wüstenrot because it is an exemplary municipality for sustainability. Almost all interviewees indicated that sustainability was an important aspect of their lives, especially the desire to leave a liveable planet for future generations. However, one issue emerged in several interviews that was summarized by one participant (I11) as, "In theory, sustainability is important, however, in practice, it can be difficult. I do not want to restrict myself, and therefore, I do things that are not sustainable."

4.3. Discussion. The qualitative interviews confirmed the findings of the quantitative study and revealed additional information about why certain factors were crucial for the potential users of electric car sharing in rural municipalities. Most respondents believed that the planned electric car sharing service would not be useful, because they did not need it. It explains the low value of performance expectancy in this quantitative study. However, the findings of previous research highlight the importance of performance expectancy in the intention to use an electric car sharing service [5, 8, 10]. Methods to deal with this problem could lie in addressing specific target groups. Even though the participants did not expect the service to be highly useful for themselves, they could imagine several cases in which it could be useful to other inhabitants. More specifically, they identified young residents who do not yet own a car, households that are considering acquiring another car, older couples who temporarily need a car, and tourists and business professionals as target groups for the car sharing service. Furthermore, the measures addressing hedonic motivation could move the inhabitants of the municipality to try out an electric car sharing service and may make them reconsider certain use contexts. For participants who did not consider themselves the target group for an electric car sharing service, hedonic motivation played an important

role. Although not everyone needs an electric car sharing service, most interviewees were likely to test it out of curiosity about alternative drive systems. It highlights the findings of Weiß et al. [9], which demonstrate that hedonic motivation is a key factor in registering for car sharing services. However, it should be validated once an electric car-sharing station is implemented. Schneider et al. [26] showed that the exposure to and use of electric vehicles could positively influence electric vehicle acceptance. It indicates that offering test drives to residents and promoting vehicles may be effective in increasing the overall acceptance of electric car sharing in Wüstenrot. However, facilitating conditions must be improved to make car sharing attractive to target groups in the long term. Therefore, the accessibility of the car sharing station is crucial, and the aforementioned finding calls for the reconsideration or extension of the current plan, as it poses a significant barrier to the intention to use the electric car sharing service in Wüstenrot because of a lack of public transport. This issue is specific to rural areas as they are less densely populated than urban areas and require a different car sharing system, as suggested by Rotaris and Danielis [12]. Improvements to facilitating conditions may involve adjusting public transport schedules and increasing the number of electric car sharing stations across the municipality. An assessment is required to determine which options are most suitable for Wüstenrot. The remaining three factors—social norms, trust, and personal norms—do not appear to play a considerable role in the acceptance of rural electric car sharing. The low importance of social norms is consistent with findings from the previously conducted quantitative study but contradicts Zhang et al. [3] and Curtale et al. [8] results. As previously explained, social norms may not have affected participants since the car sharing service had not yet been implemented, and social norms would most likely form in time once the car sharing service has been implemented. In addition, trust in the vehicles and data provided by the manufacturers was relatively high among participants. The expected travel distance for electric vehicles was consistent with the maximum distance provided by the vehicles that will be integrated into the planned car sharing service. As shown in the quantitative study, trust was a factor in the acceptance of car sharing among participants, however, it was less important than that in Möhlmann's [15] research. As expected, the importance of personal norms in Wüstenrot was high because of local authorities' previous endeavors in this area. The importance of personal norms for participants' intention to use the electric car sharing service constitutes an appropriate basis for a new sustainability concept in the municipality. In conclusion, the findings from the qualitative interviews were consistent with those from the quantitative study and confirmed that the most important factors for the acceptance of electric car sharing in a rural municipality were performance expectancy, hedonic motivation, and facilitating conditions. Furthermore, the interviews revealed potential target groups for an electric car sharing service and confirmed that it must be more useful, engaging, and flexible to be regularly used. Thus, the planned electric car sharing service for the municipality requires adjustments

and measures that will affect citizen's perceived performance expectancy and hedonic motivation and the facilitating conditions for it to be used. To achieve this target, a cocreation workshop was conducted with the residents of Wüstenrot to develop a new car sharing model for rural municipalities.

5. Cocreation Workshop

5.1. Methodology. The cocreation workshop aimed to develop different car sharing models that positively influenced the previously identified factors of performance expectancy, hedonic motivation, and facilitating conditions. Cocreation is defined as "the joint creation of value by the company and the customer" [27]. Involving potential users in creating an electric car sharing service might have several benefits. For instance, users can bring new perspectives to the topic, thereby increasing the innovation potential of a new product or concept. Additionally, solutions can be customized based on actual needs rather than those anticipated by the provider. Furthermore, this exchange can foster relationships between the provider and future customers and increase trust in and acceptance of the final electric car sharing solution. For this study, participants in the cocreation workshop were directly approached via telephone. Regarding the interviews, job heterogeneity and a wide age range were considered during recruitment to ensure the inclusion of diverse perspectives on the development of a car sharing system that would be suitable for Wüstenrot. The cocreation workshop comprised two parts. During the first half, participants were asked to consider how mobility could be made more sustainable without sacrificing comfort. This stage was intended to sensitize participants to the topic of sustainable mobility and prepare them for a discussion on car sharing systems. The second task involved developing a car sharing model for Wüstenrot. Firstly, participants individually developed a car sharing model that they believed to be suitable. Secondly, they were assigned to one of four groups. Within these groups, participants discussed the car sharing systems that they developed and merged their ideas into a single car sharing system. For example, one car sharing model was station-based and included test drives, while the other model was station-based and included different types of vehicles. Thirdly, participants presented four car sharing systems developed in their groups. Finally, they voted for their favorite system.

5.2. Results. Overall, there were 17 participants in the cocreation workshop. They included the employees and graduates of the local comprehensive school, employees and owners of local businesses, municipality employees, representatives of the electric mobility association, owners of electric vehicles, commuters, and pensioners. Their ages ranged from 20 to 76 years. The participants developed four different car sharing models for Wüstenrot, as shown in Table 5.

All groups agreed that the car sharing service should be booked via an app. The latter should also show the vehicle's

TABLE 5: Results from cocreation workshop to develop an electric car sharing model ($n = 17$).

	Model 1	Model 2	Model 3	Model 4
Car sharing type	Station-based car sharing	Area-based car sharing	Hosted car sharing	Station-based car sharing
	(i) Vehicle pickup and delivery service	n.a.	Video application challenge for interested hosts	(i) Test drives
Additional features	(ii) Different types of vehicles			(ii) Discounts (iii) Reward points programme (iv) Vehicle pickup service (v) Ridesharing feature

charging status, availability, and estimated cost for the trip. However, the models differed in terms of station setups. Model 1 involved station-based car sharing with a station in every submunicipality. A pickup and delivery service was also recommended in case customers wanted the vehicles to be brought to their home or another designated location to increase the convenience of the car sharing model. Moreover, the system should include different types of electric vehicles that could be selected according to the purpose of the trip and number of passengers. Model 2 was an area-based car sharing system, meaning that vehicles can be parked at any free parking space within a narrowly defined area, such as a street or a residential area. In Model 3, private households would be able to register as “hosts” for a car sharing vehicle and provide it with a parking space. In return, the hosts would receive discounts when using the vehicle. Restaurants, businesses, and associations could also participate in this hosted model. Residents who were willing to host a car would apply to the local authorities for a car sharing station. The application would be done through a video message in which citizens explain why their desired location was the most suitable in the municipality. Finally, model 4 was a station-based model with car sharing stations in all the municipality’s districts that would make car sharing accessible to more residents. If the vehicles were not left at a designated station, the service provider would ensure that the vehicles were correctly distributed. Moreover, in the cocreation workshop, participants suggested including a ridesharing feature for the app to lower the environmental impact of car sharing services and foster social connections within the community. Additional incentives for car sharing, such as test drives, discounts, or reward point programs, were suggested to increase the acceptance of the electric car sharing service. Participants voted model 4 as the best car sharing model.

5.3. Discussion. The cocreation workshop revealed ways in which the initially planned electric car sharing system, which included one station in the main locality of Wüstenrot, could be altered to better serve the municipality’s rural residents. All models focused on improving facilitating conditions through the installation of several electric car sharing stations. In addition, having a service provider correctly distribute vehicles or deliver them to the desired areas could increase performance expectancy. The proposed systems

could improve flexibility, and thus facilitating conditions and performance expectancy, which have been identified as critical factors in previous studies and the literature on electric car sharing in rural areas. Participants had numerous ideas to incentivize the use of car sharing and increase hedonic motivation, such as reward-points programs and discounts. Under model 3, eliciting video applications from households that wanted to host a car sharing vehicle could encourage participation in creating a concept for electric car sharing in Wüstenrot. As proposed in model 4, the integration of a ridesharing feature in the car sharing app could also raise hedonic motivation, as it could be fun to talk to other citizens of the municipality while using the car sharing service. Furthermore, it could increase performance expectancy by revealing a new use case: the car sharing service could also be used by individuals without a driver’s license, which would increase the pool of potential car sharing users. The inclusion of a ridesharing feature might be especially suitable for rural areas because of the strong cohesion and trust within communities. The participants expressed a desire to book an electric vehicle through a car sharing app that displayed the fleet’s availability and battery status. These features are currently being planned. The car sharing app is expected to positively influence effort expectancy as soon as a car sharing service becomes available. The results of the cocreation workshop were consistent with the findings of the first and second studies. Moreover, they offered concrete ideas for positively influencing performance expectancy, facilitating conditions, and hedonic motivation to adapt the car sharing system to rural areas. However, the economic and technical viability of these alterations must be assessed.

6. General Discussion

An electric car sharing service is currently being planned in the municipality of Wüstenrot, a small town in southern Germany. Three different methodological approaches were applied to consider the needs of local residents: a quantitative survey to provide an overview of underlying factors in car sharing acceptance in rural areas, qualitative interviews to investigate these factors in greater detail, and a cocreation workshop to develop solutions adapted to the needs of consumers. In all three methodological approaches, performance expectancy was identified as a very important factor in electric car sharing acceptance in rural areas, which aligns with previous research [5, 8, 10]. Moreover, hedonic

motivation was very important in all three methodological approaches, aligned with previous research [9, 10]. Furthermore, facilitating conditions were important in the current study and Zhang et al.'s [3] study. Trust was only marginally significant in this study. Midden and Huijts [14] found trust to be a significant factor. Similarly, social norms were only marginally significant, whereas, in Zhang et al.'s [3] study, social norms were a significant factor. The following conclusions for electric car sharing in rural areas can be derived from our three-step methodological approach: firstly, the quantitative study showed that the citizens of Wüstenrot remained skeptical about the usefulness of the planned car sharing service. Secondly, the interviews revealed that young residents who do not yet own a car, households that are considering acquiring another car, older couples who temporarily need a car, and tourists and business professionals could be the main target groups for the car sharing system. Thirdly, the cocreation workshop suggested that residents who were interested in electric car sharing and considered it useful could potentially be identified by eliciting video applications for an electric car sharing station in their desired location. In addition, concerning hedonic motivation, the quantitative study showed that most participants did not believe that electric car sharing could be fun. However, the interviews revealed that trying out the electric drive system could change that. The idea of test events was developed during the cocreation workshop. Finally, regarding facilitating conditions, the quantitative study showed that the planned electric car sharing station had moderate accessibility. The interviews revealed that citizens wanted car sharing stations in different districts of the municipality, while the cocreation workshop yielded potential solutions to this issue, including a service provider to distribute the vehicles. Theoretically, this study shows the underlying factors in the acceptance of electric car sharing systems in the early stages of development. Future research should examine electric car sharing models in rural areas at later stages of development to gain further insight into the underlying factors that affect acceptance. In addition, future studies should consider experience with electric car sharing, as this factor has been described as important in previous studies [20–22]. Practically, the present study shows that hedonic motivation regarding an electric car sharing service can be influenced by letting people try the electric drive system. This information should be considered in marketing activities, such as offering test drives to prospective customers. Moreover, performance expectancy and facilitating conditions should be improved to make car sharing services attractive in the long term, not only for test use. The favored electric car sharing model from the cocreation workshop emphasizes the importance of installing multiple electric car sharing stations across the municipality. One may assume that without decent accessibility, car sharing in widespread rural areas would not offer sufficient value to residents. The idea of including a ridesharing feature in a car sharing app is consistent with the findings of Rotaris and Danielis [12], who suggested that rural car sharing must be more socially oriented than in urban areas. This idea also echoes the findings of Dorner and Berger [28], who

proposed combining car sharing and ridesharing in rural areas to simultaneously increase mobility offerings for two target groups: those who did not own a car and those who could not drive. In addition to ridesharing, car sharing could be combined with demand-responsive transit (DRT) models. The latter is a traffic concept in which vehicles operate on (partially or fully) flexible schedules and routes that are adjusted based on the demand in their area of operation [28]. As public transport in rural areas tends to have a low frequency of service, DRT models could connect people to a car sharing service that lives a long distance from it. Nevertheless, rural areas differ in their geographical, social, and economic structure. Therefore, electric car sharing services must be tailored to each area [29].

7. Conclusion

Consumers in rural areas are open to car sharing. By addressing specific target groups (e.g., families that do not own a second or third car), organizing test events to attract people who are curious about new drive systems, and ensuring that car sharing stations are located near people's homes, car sharing can be made attractive to consumers in rural areas.

In terms of limitations, it should be noted that the planned car sharing system is not in existence yet, and people's attitudes could change after interacting with a prototype or product [30, 31]. At later stages of development, effort expectancy, social norms, trust, personal norms, and knowledge may become relevant. Furthermore, the sample in the quantitative study was not representative of the municipality under study. Moreover, sample sizes in the interviews and cocreation workshops were relatively small. With more participants, a broader opinion could have been generated, and more ideas could have been created in both settings. Additionally, the present study was conducted in a municipality in which the local authority that has prioritized sustainability for many years. Thus, residents are likely to be sensitized to sustainable behavior, although the most used means of transport remain private cars with internal combustion engines. In addition, economic and technical viability must be considered when implementing a car sharing service, and a compromise must be found with consumers' needs to ensure long-term success [32, 33].

Data Availability

The data can be requested from the authors via e-mail.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this article.

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