Carsharing

As of 2019, carsharing was offered in over 50 countries, and over 200 carsharing providers were operating in over 3000 cities. Approximately 2.5 million carsharing users were registered in Germany in 2019. These users are given access to vehicles on an "as-needed" basis, which underlies a pay per use and/or membership-based pricing model.

1. Introduction

Existing studies on the usage and using intention of carsharing can be roughly classified as 1. studies on functional attributes and usage patterns of carsharing; 2. studies on carsharing user segments; 3. studies on user acceptance of carsharing.

Studies on functional attributes and usage patterns of carsharing analyze the actual usage behavior of consumers that are members of carsharing services, in addition to the functional aspects and attributes that influence that behavior. Efthymiou, Antoniou and Waddell [1] conducted a comparison study to determine the functional factors that customers consider when using either shared bikes, shared cars, or shared electric cars. Zoepf and Keith [2] conducted a discrete choice survey in North America. They analyzed the potential decision behavior of customers for different cars based on vehicle type and distance to the parked vehicle, referring on a station-based carsharing setting. Wang et al. [3] investigated average trip distances of Chinese customers of free-floating services, in addition to the influence of policies that restrain the purchase of cars on that behavior.

Studies on carsharing user segments aim to classify customers according to personal or behavior-oriented criteria. Schmöller et al. [4] analyzed the booking data of a German free-floating operator to identify booking patterns and requirements of fleets and supply management. Accordingly, they segmented customers with regard to booking behavior, sociodemographic variables, and external framing conditions, such as weather in potential booking timeslots. Greenblatt and Shaheen [5] described and segmented users of station-based carsharing according to owning structures of different mobility devices. Burghard and Dütschke [6] found that carsharers were a sociodemographic specific group. Their segmentation revealed that carsharing with electric vehicles is particularly highly appreciated by younger people who live as couples without owning a car, or young families using carsharing in addition to a privately owned car [6].

Studies on user acceptance of carsharing focus on the antecedents and determinants of the intention to use, and using behavior of different types of carsharing business models. Kilbourne and Pickett [7] addressed the potential effects of environmental beliefs and environmental concerns on different forms of direct and indirect behavior. This effect has been widely examined in studies on mobility services in general and, in particular, on carsharing approaches. Schaefers [8] investigated the motives of carsharing usage based on a qualitative means-end chain analysis among members of U.S. carsharing services. He derived a motive pattern with four potential motive categories, namely, value seeking, convenience, lifestyle, and environment. In addition, Hamari, Sjöklint and Ukkonen [9] identified motive categories to explain why people participate in collaborative consumption such as carsharing. Their identified categories were sustainability, enjoyment, reputation, and economic benefits. Balck and Cracau [10] conducted a comparative analysis of motives to share different assets. Their results recognized the general dominance of costs and the relative dominance of the environmental motive with respect to carsharing compared to sharing accommodation, commodities, or clothes. Gao, Jing and Guo [11] emphasized the role of trust in the acceptance and using intention of carsharing services. They stated that trust can help consumers to overcome perceived risks and uncertainty when using carsharing. A similar study on the effect of trust on carsharing usage was conducted by Liang, Li and Xu [12]. Fleury et al. [13] applied the Unified Theory of Acceptance and Use of Technology (UTAUT), which they extended using perceived environmental friendliness, to evaluate the acceptance of corporate carsharing services in France. Burghard and Dütschke [6] found that compatibility with daily life is a highly important construct that influences carsharing acceptance. Müller [14] compared the acceptance determinants of electric vehicles, autonomous vehicles, and carsharing. Applying an extended Technology Acceptance

Model (TAM) to customers in China, U.S., and Europe, he identified a relatively high influence of perceived ease of use on the usage intention of carsharing [14]. Wang et al. [15] focused on the effect of environmental awareness and perceived usefulness on the acceptance of ride-sharing.

In addition to TAM and UTAUT, most researchers analyzing the intention to use carsharing services have based their investigations on adapted frameworks of the Theory of Planned Behavior (ToPB) [16][17]. ToPB is a basic psychological framework that explains behavioral intentions in general, and is a suitable framework for the analysis of the antecedents of the intention to use carsharing services. Witzke [18] applied ToPB to analyze carsharing acceptance among young consumers in Germany. Using the ToPB, Kaplan et al. [19] explored behavioral factors that underlie tourists' intentions to use urban bike-sharing in Denmark. Haldar and Goel [20] applied the framework to an acceptance analysis of carsharing apps. Zhang and Park [21] used ToPB to identify the factors that affect the usage intention of carsharing services in South Korea.

Taking these contributions into account, an extended version of the ToPB model proposed by Chen and Tung [22], which specifically emphasizes the role of environmental concern (EC) in the usage intention (IN) of sustainable services, was used in the current study. This model provides a suitable framework for this study. Environmental concern is highly discussed in the literature as a potential personal and external antecedent of carsharing usage [23][7]. This model is complemented by the construct of trust. The literature indicates that trust is another key construct that affects acceptance and usage intentions of mobility concepts [24][11]. Trust is basically understood to be an evolving construct, which develops dynamically during an interaction [25]. The previous research did not conduct a user experience study in which the experiential carsharing setting may influence the level of trust; furthermore, the survey design also involved subjects without practical carsharing experience. Therefore, we consider trust to be a more "long-lasting" variable, and an initial parameter that determines the view of specific carsharing business models. We labeled this parameter initial trust (INITIAL TRUST), which mediates between personal environmental concern and the established ToPB variables in the model [26][27][28]. Considering the characteristics of carsharing services, the four constructs directly determining the intention to use in the ToPB model of Chen and Tung [22] were further specified as follows. Based on the attitude towards carsharing (ATT), Han, Hsu and Sheu [29] evaluated the extent to which users considered the carsharing services to be favorable, enjoyable, and desirable. Subjective norms (SN) have been used to investigate how the social environment of a single person affects the value of her/his usage of a certain carsharing business model [17]. Referring to scales developed by Dean, Raats and Shepherd [16], and Chen and Peng [17], the perceived behavioral control (PBC) was analyzed as the personal ability and opportunity to use a specific carsharing service. Finally, the perceived moral obligation related to an individual's perception of the need to treasure natural resources was integrated [30]. We applied the conceptual model (see **Figure 1**) to the investigation of the usage intentions for station-based and free-floating carsharing.
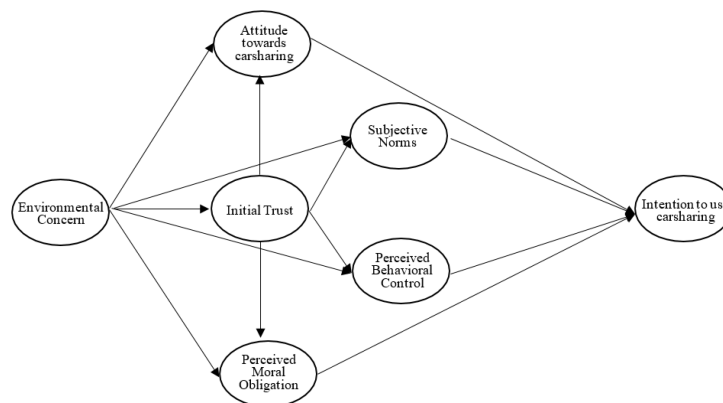

Figure 1. Conceptual model. Source: own study based on Chen and Tung [22].

2. The Role of Environmental Concern and Trust Reflecting Usage Intention of "Station-Based" and "Free-Floating", Take Germany as An Example

The aim was to examine whether there are differences in the factors influencing the usage intention of free-floating carsharing in comparison to station-based carsharing, with a particular focus on the effect of environmental concern and initial trust. For this purpose, two standardized online surveys were conducted among consumers within Germany, referring either to Share Now, the biggest free-floating operator in Germany, or to Stadtmobil, the biggest station-based operator in Germany. The final data set contained 262 observations ($n_{Share Now} = 98$, $n_{Stadtmobil} = 164$). The results showed a significantly stronger correlation between the attitude towards the carsharing business model and the usage intention of

free-floating compared to station-based services. It was shown that the effect of perceived behavioral control on usage intention was significantly smaller for the Share Now consumers. Although not significant, results appear to indicate slightly higher total effects of environmental concern and initial trust on the usage intention of station-based compared to free-floating carsharing.

It clearly showed that the effects of antecedents on usage intentions for carsharing services can substantially differ depending on the related business model. This interesting difference arises, for example, for the relationship between ATT and IN. In the case of Share Now, positive attitudes thus lead to a significantly higher intention to use. For the station-based Stadtmobil sample, however, the effect is minimal and not significant. One reason for this could be that the construct addresses aspects such as enjoyment or pleasantness. These appear to be issues that are fundamentally more strongly addressed by free-floating carsharing. The business model interacts in a more "modern" way, for example, due to the general significance of the use of mobile phones or specific gadgets, and the integration of human–machine interface approaches. Station-based carsharing, by comparison, focuses on the primary use of a vehicle, and interactions with the customer are more traditional.

Interestingly, the relationship between PBC and IN showed an initially unexpected result. A more pronounced effect was seen in the case of station-based carsharing. Due to the respective utilization structures, however, the PBC would be expected to be higher in the case of free-floating carsharing. Objectively, this concept is comparatively simpler. An app is the central mediator for all relevant aspects, such as booking options, access to the vehicle, or payment functions. Station-based carsharing structures are usually more complicated. For example, traditional key boxes are the only means of access to the vehicle. One possible explanation for this result could be that, due to the strong similarity to other everyday offers, access to free-floating carsharing is generally less questioned. Accordingly, controllability and usability of the concept may play a subordinate role and are therefore not questioned in detail by (potential) users.

3. Conclusions

The findings provide valuable insights for future theoretical developments. Many research statements regarding variables that determine usage intentions have been made for carsharing in general, without respect to the individual specifics of a business model. These distinguishing criteria could be used to describe the segment users in more detail. Contributions therefore could serve as a direction for future context-related research on carsharing acceptance and adoption within a certain business model context. In the current study, the models explained different amount of variance regarding the target constructs at Stadtmobil and Share Now. This suggests greater potential for business model-related development of constructs that could explain the acceptance and usage intentions of a specific carsharing service. This could be even more relevant in regard to other mobility services, such as shared e-scooters, or the future usage potential of services, such as automated ridesharing or robotaxis.

In line with existing research [24][31][26][32], however, the available data also show that the initial trust factor is a significant influencing variable with regard to the acceptance and intentions to use mobility concepts. This applies equally to the free-floating and station-based concepts. Offering a reliable and trustworthy product is therefore of particular importance to be able to attract customer groups to a particular range of products. In the mobility sector, safety aspects appear to be particularly relevant in this respect; for example, vehicle fleets should meet the highest safety standards.

Although the calculation of the absolute differences between the total effects did not show significance, it is nevertheless clear that the total effect of both the EC and INITIALTRUST constructs tends to be less pronounced in the Share Now group. This tendency corresponds well with existing research results. These results show that environmental awareness is more important in the case of station-based carsharing users [33]. The more noticeable tendency of the trust factor in the case of the Stadtmobil group could be based on the fact that users of traditional carsharing are more convinced about the idea of the concept rather than its individual advantages, such as spontaneous car trips instead of using public transport, for example. The fundamental trustworthiness of a concept, therefore, appears to be an important prerequisite for traditional carsharing customers.

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