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Abstract. Result-oriented services that provide mobility on demand seem to be a promising means of meeting both societal trends and environmental sustainability targets. In this paper, we investigate the contribution of Information Systems (IS) to drive this substantial business model change towards sustainable mobility from a customer's perspective. While doing so, we focus on the specific case of carsharing – a result-oriented mobility service that has been known for decades, which is recently receiving more attention due to environmental concerns. Employing a choice-based conjoint analysis (n = 221), we explore and evaluate the role of IS for the perceived attractiveness of carsharing. With our investigation, we show how IS, by their three functions of information, automation and transformation, may improve this sustainable form of individual mobility and thus contribute to the shift towards sustainable mobility.

Keywords: Sustainable mobility, business model innovation, carsharing, product-service transition, conjoint analysis

1 Introduction

Mobility and transportation account for an enormous proportion of environmental degradation and are thus one of the most important fields of activity for achieving environmental sustainability [1-2]. Attaining sustainable mobility requires not only new technologies, e.g., electric vehicles, but also alternative business models different from the product- or ownership-based forms of individual mobility [3].

Thanks to pioneering research in recent years by, e.g., Watson et al., Melville, Elliot, Corbett et al., and vom Brocke et al., the topic of environmental sustainability has been introduced to the Information Systems (IS) community [4-8]. Within this area, both the potential decreasing of the environmental footprint of Information Technology (IT) as well as the possibility of using IS to enhance the environmental performance of other areas have been discussed [9]. However, the community's understanding of the ability of IS to increase the attractiveness of green practices, e.g., by driving business model innovations, for potential customers is still rather limited.

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When focusing on this potential in the mobility sector, it must be taken into account that the industry is undergoing major changes, as it is affected by contemporary mega-trends [10]. Besides the increasing environmental pressure, urbanization increases traffic and congestion in cities and strains limited parking space [11]. Therefore, future (passenger) transportation systems look for alternatives to privately owned cars in the form of flexibly provided mobility. The focus shifts from ownership of a vehicle to the use of mobility services to fulfill individual mobility demands [12]. “Mobility as a service (MaaS) is arguably an idea that has already arrived, via services such as carsharing and wider solutions involving multiple modes of transport booked through a single provider” [13]. Carsharing can be seen as one potential solution to transfer society from ownership to service use, and thus, to cope with a variety of environmental problems [11]. But, compared to owning a car, traditional carsharing results in a loss of convenience and certainty, which decreases its desirability for users [14]. IS have the potential to make such sustainable business models more attractive and thus drive the sustainable transformation of future mobility.

Along with these trends comes the increasing penetration of IS in everyday life [15]. In Western societies, large proportions of the population are equipped with smartphones or tablet PCs connected to the web. These digital devices lead to a changing role of consumers: They are more informed, are able to choose among more alternatives, and are generally more empowered with respect to the suppliers [16].

In this paper, we want to investigate the role of IS in service-oriented business models for sustainable mobility from a customer’s perspective, specifically for the case of carsharing – one of the most interesting and already deployed application areas of future sustainable mobility [11]. We assume that the recent developments in IS are a major reason for the recent expansion in carsharing [17-18]. New carsharing business models have a high degree of IS coverage, including locating, booking, and accessing the vehicle via smartphones; and collecting trip data. We further assume that with modern IS, carsharing has the potential to gain massively in attractiveness for customers and thus drive the transformation towards sustainable mobility. In order to investigate these assumptions, our study examines the following research question: *How do IS influence the attractiveness of service-oriented mobility business models from a customer’s perspective?* In order to answer this question, we employ a conjoint analysis based on a survey of 221 (final) carsharing customers to determine which application fields of IS they value most.

2 Theoretical Foundation

2.1 IS for Environmental Sustainability

Environmental sustainability, referred to as Green IS within the IS community, has become an interesting topic in recent years [e.g.,4]. Many new investigations have come into focus, but there is a strong need to catch up in order to counteract the magnitude of this problem [8]. Following Kossahl et al. [9], Green IS is composed of its two subfields: “Green by IS” and “Green in IS”. Research following the “Green in IS” stream analyzes and aims at minimizing the direct effects of IS on the environmental sustainability of businesses [9], [19]. In contrast, “Green by IS” research relies on businesses' overall environmental sustainability and thus focuses on the indirect contribution of IS [19]. The latter concept can, in general, be applied to all domains. As a starting point, Watson et al. describe the potential of IS for the sustainable transformation of the energy domain [4]. The authors introduce "Energy Informatics" as a new subfield in IS and demonstrate how the efficiency of energy systems can be increased by IS that, e.g., coordinate supply and demand.

In the mobility domain, the topic of electric mobility has gained some attention from the community [20]. Here, research has predominantly focused on the question of how vehicle charging interacts with the energy system [e.g., 20], though further investigations have been made, including research on decision support systems for the optimization of carsharing stations [21]. Hilpert et al. [22] develop a Green IS artifact that tracks the greenhouse gas (GHG) emissions of vehicles and supports knowledge gathering and decision making for sustainable business practices. Corbett et al. [7] investigate the connection between IS and environmental-sustainability measurement principles and point out that IS in the form of vehicle telematics can contribute to better environmental decision making. Furthermore, Ferreira et al. [23] propose a Multi-Modal Transportation Advisor system, based on the integration of various data sources, such as public transportation systems, car and bike sharing, and carpooling. Considering carsharing and carpooling, investigations have been conducted particularly in the form of optimization algorithms [24-26]. As these examples demonstrate, initial research in the field of Green IS focuses on how IS can contribute to designing greener, i.e., more environmentally sustainable, processes. While this is an extremely important perspective, research has largely left out – to the best of our knowledge – another facet: The role of IS in innovating green business models to make them more desirable. Research on sustainable business models from the perspective of the IS community is thus rather scarce, an exception being [27] who describe the use of mobile technology in electric vehicle carsharing.

2.2 Product–Service Transition of Mobility Business Models

Service-oriented business models are described as having advantages for both the customer and the supplying firm: The former may experience a higher degree of flexibility and fewer risks (e.g., vendor lock-in). Firms can differentiate themselves through services and develop a deeper relationship via the continuous contact involved in service business models and, thus, experience economic advantages in the long run compared to the punctual product-sale business [28-29].

The topic of product–service transition is directly connected to the business model perspective, as it concerns what kind of value is delivered in which way and under which conditions to target customers [30]. Amit and Zott [31] define the business model as "the content, structure, and governance of transactions designed so as to create value through the exploitation of opportunities". Business model innovation has recently been described as a promising strategy for sustainable development (e.g., [32]). In the domain of mobility, service business models that are able to substitute for the prior dominant product have been described as contributing to sustainability [3].Williams [33] has described three different service types in more detail for the automotive industry. According to the author, product-oriented services include services such as vehicle maintenance. Use-oriented models are services such as car-leasing or rental services (against a regular fee). Result-oriented services comprise sharing or leasing services with pay-per-use pricing or integrated mobility schemes including several means of transportation. In this last category, the key role of IS is explicitly mentioned, e.g., for providing users with information about their travel [33].

With respect to environmental sustainability, the use- and result-oriented services are of particular value, as they hold the potential to substitute for individual car ownership. Through pooled or shared use, a greater efficiency in vehicle deployment, and thus resources, can be achieved [34-35]. A slow product-to-service shift can be recognized in mobility demand, and car manufacturers have reacted by offering carsharing or rental services [12]. The increase in mobility's service proportion is recognized as being connected with IS [12]. Wagner and Shaheen [17] describe the mobility service of carsharing as "an alternative to satisfying the demand for individual mobility, while encouraging collective transportation when it is convenient and cost effective for the individual". It does not have to be seen as a substitute transportation mode, but rather as a complementary one [11]. Thus, carsharing aims at bridging the gap between individual transportation and existing, more sustainable modes of transportation by offering a flexible, short-term mobility solution. The idea of carsharing is not new. Early experiences with sharing cars in Europe were made by companies such as Sefage, which was established in Zurich, Switzerland, in 1948 [36]. Various other systems arose and disappeared during the 1970s and '80s [37]. Over the last decades, however, carsharing has undergone a massive expansion [38]. Nevertheless, convenience and flexibility remain critical success factors. Compared to outdated, manual instances of carsharing, equipping vehicles with modern IS allows providing more convenient and more flexible services to the users; facilitates provider's operation and management of services; and provides additional security, e.g. in terms of vehicle access or knowledge of vehicle locations [37].

2.3 IS as a Driver of Service-oriented Sustainable Business Models

In the manufacturing industry, Zolnowski et al. [39] describe the data connection that can be established between the provider and the customer through IS, enabling the monitoring and controlling of machines and resulting in new service-oriented business models. Just as in other industries, IS has the potential to drive the service-oriented transition in the mobility sector. The role of sensor data for new business models in the mobility sector has been described with respect to vehicle insurance [40]. In this context, a metering device collects data on the driving profile and transmits it to the insurance company so that the premium can be calculated [40]. King and Lyytinen [41] describe how IS enables new services in the mobility sector by combining geographic location, automobile performance monitoring, operator behavior, and time monitoring technologies in mobility service offerings.

These examples have been discussed in research under the theme of telematics [42]. Nevertheless, they describe rather product-oriented services [33]. Lenfle and Midler [43] claim that modern technologies recently boosted the development of car-related telematics services (navigation, remote diagnostics, etc.). But progress in IS, especially in digital technologies (e.g., smartphones), drives an even larger change: The move towards result-oriented mobility services that would have enormous positive impacts on the environment. This impact occurs as follows: Through digital consumer devices, not only is the connection between a vehicle and a service provider enabled by IS, but also the connection of the user and the vehicle. For example, vehicles can be located via smartphones drawing on GPS signals [41]. The combination of vehicle-related telematics, positioning data, and customer technology creates a digital eco-system that can have a truly disruptive effect on business models as it enables the major consumer trends found by Seeger and Bick [10] that will shape future mobility: "Ownerless, simplicity, eco-lifestyle and personalization". Mobility packages that are based on a variety of transportation modes must be offered to customers. In this context, Wagner and Shaheen as well as Barth et al. [17-18] emphasize a need for interoperability, both among carsharing service providers as well as transit operators, in order to reach higher customer satisfaction and use. Customers should not just be able to use vehicles belonging to one single mobility provider; they should be able to book any desired car (and other transportation systems) independent of provider and area. Furthermore, it is essential to facilitate intermodal changes between different transportation modes and reduce switching times, thus reducing customers' transaction costs [17].The attractiveness of such business models can be leveraged by advanced IS applications, i.e. by drawing on the three functions of IS that have been described in literature: (1) automating business processes, e.g., when locating the vehicle; (2) information for strategic purposes ("informate-up"), e.g., for business model design, ("informate-down"), e.g., for maintenance planning; (3) transformation of existing processes and relationships, e.g., pay-per-use mobility services [44-46].

3 Methodological Approach

As we aim to discover and evaluate the role of IS in future sustainable mobility business models from a customer's perspective and to better understand customers' preferences concerning the scope of IT integration in carsharing services, we conducted a conjoint analysis (CA). CA (with its variants) is a multi-attribute preference-measurement technique that has come into widespread use in marketing [47]. In IS, this technique has been carried out, e.g., to determine the value of privacy in online social networks [48], and to investigate consumers' preferences concerning platform as a service solutions [49]. CA follows the basic idea of presenting different product alternatives (stimuli) to the participants for evaluation. It is a decomposition approach that assumes the utility of a product is determined by its characteristics (attributes), which can take various values (levels) [50]. Thus, this method allows researchers to explore and quantify the underlying value system within a consumer's decision [51]. Since we aim to investigate consumers' preferences related to IT integration in carsharing services and to find out, in which application fields are valued most, CA is an appropriate means, since this method allows us to analyse trade-offs among consumer values [51]. The determination of an appropriate conjoint variant must be in line with the objective to be studied. Considering the high level of abstraction and the scope of IT integration in carsharing services, the complexity of the stimuli should be kept as low as possible. Based upon Orme [52], we found the choice-based conjoint analysis (CBC) to be most suitable. CBC has become the most frequently used variant of conjoint analysis [53]. This method combines conjoint analysis and discrete choice experiments, and it is assumed that consumers aim to maximize their utility within their purchase decisions. Thus, the preference structure is not determined by ratings or rankings as in the other CA variants but by discrete choice and non-choice decisions regarding the various stimuli. Applying the CBC for our survey delivers some advantages: First, the high cognitive load of the subjects by a ranking or rating can be reduced. Second, CBC allows us to integrate a non-purchase option into the choice experiment so that participants are not forced to select unacceptable alternatives.

3.1 Conjoint Design

One of the most critical parts of designing a conjoint experiment is the identification of proper product attributes and levels [54]. Therefore, we first analyzed scientific literature dealing with IT integration in carsharing (e.g., [17-18], [38], [55-56]) and evaluated the service offerings of various carsharing providers. We created an initial list of 14 attributes and 36 levels for our survey. In a second step, we carried out focus group discussions with two regional and two national carsharing providers in order to validate the initial list of attributes and levels. This also helped us with prioritizing attributes and reworking the attribute levels. Following the guidelines by Orme [54], a final list of 7 attributes and 14 attribute levels was determined (see *Table 1*).

Table 1. Explanation of Attributes and Levels

Attribute	*Explanation of the Attributes and Levels*	*Levels*
Reservation	Reservations can be made either by calling a reservation center or via the internet, which also includes mobile applications [18].	▪ via phone; ▪ online (website) or via app
Vehicle location	Two different approaches can be distinguished. First, there is stationary carsharing, in which users pick up a car at one of several stations [55]. Second, in free-floating carsharing, cars are spatially dispersed. Here, the user can locate the vehicle with his smartphone [56].	▪ vehicles are located at fixed stations; ▪ vehicles are spatially dispersed - location via app
Vehicle access	We differentiate between access via key and keyless access. In a key scenario, vehicle keys are normally stored in lockboxes. Keyless access encompasses locking and unlocking vehicles directly via smartcard [18].	▪ key has to be picked up at a station and needs to be returned there; ▪ access the vehicle with smartphone/membership card
Metering and accounting	In manual systems, users are usually encouraged to keep a trip logbook by writing down the time and mileage at the beginning and end of a trip. On-board data-acquisition hardware allows automated accounting by recording, storing and processing of relevant data [18].	▪ fixed hourly and mileage rate according to paper and pencil-trip logbook; ▪ automated usage-based accounting (time and mileage)
Online account	A personalized online account with information about trips and cost overview	▪ no online account available; ▪ online account with information about trips and cost overview
Incentive scheme	Following the idea of usage-based insurance, a monetary incentive scheme based on vehicle sensor data can be used to motivate consumers adopt a more sustainable driving behavior.	▪ no incentive scheme available; ▪ cautious driving is rewarded with cash premiums
Interoperability	As pointed out in *chapter 2.3*, we integrated the need for interoperability.	▪ customer account exclusively for a carsharing provider in one city; ▪ customer account allows using various carsharing offers in various cities

Our attributes encompass basic processes of using a carsharing service and the need for interoperability. We chose the attribute levels so that there is one case with low IT usage and one with advanced technology application. With respect to the cognitive load and reducing the drop-out-rate, the number of choice tasks was set to 10, each of which included three stimuli that were presented in text form and the none-option. We computed a randomized design by using the ‘complete enumeration’ method, which resulted in the highest strength (d-efficiency) for our design.[1]

3.2 Questionnaire Design and Study Realization

The online questionnaire was divided into three sections. The first section represented the introduction to welcome the participants, to provide them with necessary information concerning the following conjoint analysis. Since it was our goal to explore customer preferences concerning the scope of IT integration and thereby innovative processes enabled in carsharing services, we had to be sure to evaluate participants’ choices independently from other, possibly knock-out criteria [57]. Therefore, we asked participants to imagine a neutral position, separate from their own carsharing provider, automotive brands, pricing, purpose for the trip, etc. Intuitive and simple descriptions were used to assist participants’ understanding during the entire survey. The next section embodied our conjoint experiment which consisted of 10 choice decisions. In addition, the questionnaire contained elements focusing on selected socio-demographic data, respondents’ mobility behavior and general carsharing issues.

To increase the user acceptance and understanding of the questionnaire, a pre-test was carried out with 25 participants. The participants were partially observed in the processing of the questionnaire and had the opportunity to ask questions and make comments both during the questionnaire and after. Based on the observations and feedback, the survey was revised. In order to receive qualified responses, the distribution of invitations to participate in the online questionnaire was carried out via customer mailing lists of two carsharing providers. By observing the participants of our pre-test (as discussed above) and their feedback, it became clear that it is difficult for people to evaluate such a service when they have not used it previously. We did not want to bias our results with unqualified answers; therefore, we focused on people who have already used carsharing. This helped to ensure that participants understood the respective processes and could therefore evaluate our attribute levels properly.

3.3 Analysis Method

In CBC, the utility score of a stimulus is determined by the part-worth utilities of all attributes. Thus, a linear-additive, compensatory utility function is assumed [38]. In contrast to traditional CA, CBC requires an additional model to describe the discrete choice decisions based upon participants’ utility expectations. Thereby, the most commonly used method is the multinomial logit (MNL) model [53], [58]. For estimat-

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[1] This method considers all possible combinations of attribute levels and generates the most nearly orthogonal design for each participant, in terms of main effects; within each choice task, the presented stimuli are held as different as possible [53].

ing the part-worth utilities and the relative importance of the attributes, we conducted a logit choice analysis using Sawtooth Software. This estimation is an iterative approach for calculating the maximum likelihood solution for fitting an MNL model to the data [53]. According to the maximum-likelihood principle, estimations for the part-worths are determined in order to explain the observed participants' discrete choice decisions as precisely as possible [58],[38].

4 Results

During the survey period, a total of 287 respondent data records were gathered. Of these, 66 participants did not complete the questionnaire and were therefore excluded from the analysis. After exclusion of dropouts, 221 evaluable records remained (termination rate: 77%). The sample consists of 39% female and 61% male respondents. *Table 2* depicts the sample's age distribution.

Table 2. Age distribtion

<25	26-35	36-45	46-55	56-65	>65
3.50 %	24.00 %	19.00 %	32.00 %	18.50 %	3.00 %

In order to figure out whether these are occasional or steady carsharing users, respondents were asked how often they have used carsharing on total and how frequently they use this service. *Table 3* summarizes the answers given.

Table 3. Respondents' previous carsharing usage

Absolutely			
more than 15 times	10 – 15 times	Less than 10 times	
71 %	12.5 %	16.5 %	
Frequency of use			
every day	More than once a week	2-3 times per month	Less than once a month
1.42 %	11.37 %	31.28 %	55.93%

Concerning our conjoint experiment, we conducted logit estimation with a total of four iterations in order to generate a reliable solution. The model achieved a log-likelihood value of −2767.2. By comparing this value to the null model (log-likelihood: −3063.71), in which all estimates are set to zero [53], the difference results in 296.51. Multiplied with two, it results in a chi-square of 593.02. The degrees of freedom are obtained by subtracting the number of attributes from the number of attribute levels including the none-option [53]. Thus, the number of degrees of freedom is 8. Using the chi-square distribution table, a theoretical value of 20.09 is obtained for 8 degrees of freedom and a significance level of $p < 0.01$. The chi-square of 593.02 reached is many times larger than this value, so it can be concluded that the decisions of the participants are significantly influenced by the different attribute levels. *Table 4* depicts the results of logit estimation and displays the normalized part-worth utilities for each attribute level, their standard deviations and t-ratios. Since the part-worth utility reflects respondents' preferences concerning the attractiveness of a specific attribute level; the higher this value, the more it is desired. For each single attribute, part-worth utilities of all levels sum up to zero, and thus, negative values indicate levels that are not preferred. Studying the resulting part-worth utilities for each level attribute, we can deduce an “ideal” solution from a customer’s perspective. This solution is represented by the attribute levels written in bold in *Table 4*.

Table 4. Conjoint Results – Part-Worth Utilities

Attribute	*Level*	*Part-Worths*	*Standard Errors*	*t Ratio*
Reservation	via phone	-0.463	0.030	-15.399
	online (website) or via app	0.463	0.030	15.399
Vehicle location	**vehicles are located at fixed stations**	0.209	0.029	7.183
	vehicles are spatially dispersed - location via app	-0.209	0.029	-7.183
Vehicle access	key has to be picked up at a station and needs to be returned there	-0.149	0.029	-5.171
	access the vehicle with smartphone/membership card	0.149	0.029	5.171
Metering and accounting	fixed hourly and mileage rate according to paper and pencil-trip logbook	-0.178	0.029	-6.154
	automated usage-based accounting (time and mileage)	0.178	0.029	6.154
Online account	no online account available	-0.269	0.029	-9.236
	online account with information about trips and cost overview	0.269	0.029	9.236
Incentive scheme	no incentive scheme available	-0.100	0.029	-3.491
	cautious driving is rewarded with cash premiums	0.100	0.029	3.491
Interoperability	customer account exclusively for one carsharing provider in one city	-0.295	0.029	-10.086
	one customer account allows using various carsharing offers in various cities	0.295	0.029	10.086
None-option		0.484	0.049	9.935

In order to examine whether the determined part-worth utilities differ significantly from zero, a two-tailed t-test was conducted. The null hypothesis states that the estimated part-worth utilities do not differ significantly from zero and can be rejected at a significance level of 5% if the t-ratio exceeds the critical value of 1.96 absolutely [58]. Thus, as it can be observed in *Table 4*, the hypothesis that our attributes have no significant influence on the choice decisions is rejected with a significance level of <5% for all attributes and attribute levels. Since the calculated part-worth utilities for each level are in interval-scaled form, quantified inferences on the overall relevance of an attribute cannot be derived directly [58]. For this reason, the relative importance is calculated for each attribute in order to be able to draw conclusions about the influence the respective attribute has on participants’ choice decisions. The relative importance of an attribute is its span (the absolute difference between the highest and lowest part-worth utilities) divided by the sum of spans of all attributes. *Fig. 1* illustrates the relative importance for each attribute. As illustrated, the attribute reservation has the greatest influence on a respondent’s decision process (27.86%), followed by interoperability (17.74%), online account (16.17%), vehicle location (12.55%), and metering and accounting (10.7%). Vehicle access (8.94%) and incentive scheme (6.03%) were slightly less desired by respondents.

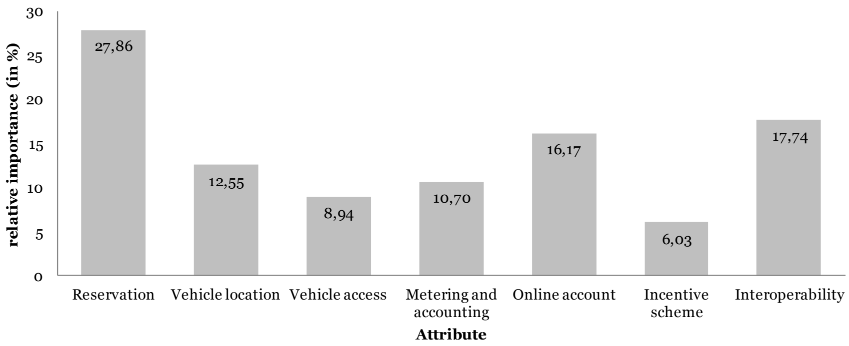

Fig. 1 Conjoint Results – Relative Importance

5 Discussion of Findings

More than 80% of the survey participants agreed that a carsharing offer that meets their expectations would lead them to not own a car themselves. Moreover, more than 35% of the respondents use their own vehicle at least once or twice a week. These numbers indicate the inherent potential of business model innovations in carsharing, which can be realized by advanced IS usage. The question of whether or not to use carsharing is thus not determined solely by the attitude concerning the concept but also by way the user experience is designed. Here, IS can play a key role. The results of our CA indicate that consumers prefer the advanced technology case for almost every attribute; the only exception is the vehicle location.

Former carsharing services were characterized by time-consuming reservations that involved calling a reservation center, inconvenient access to the vehicles and massive paperwork for both the consumer and the provider in order to perform the billing. Following Wagner and Shaheen [17], the attractiveness of carsharing can be greatly increased by reducing the customer's perceived transaction costs via a reduction of the perceived time and effort it takes to use the service. Our results indicate that advanced technologies have the potential to satisfy the customer's demand for flexibility, spontaneity, and reliable access; provide real-time information on availability; and allow advanced reservations and automated payment [17]. These findings can be explained by the aforementioned three roles of IS: Customers want to use mobility services conveniently, without being forced to perform time-consuming tasks such as calling a reservation help line, picking up a key to access the vehicle (and give it back afterwards), or filling in a trip logbook. Therefore, they prefer few-click reservations, easy and convenient vehicle access, and fully automated accounting functions. Here, the "automate"-role of IS becomes obvious by replacing manually conducted steps and thus decreasing the effort needed to use carsharing [44-46]. As can be seen in the vehicle-reservation or vehicle-access process steps, it is much easier and faster for customers to get the job done via, e.g., smartphone apps. Users can save time by avoiding getting a key or costs by not having to make phone calls to reservation hotlines.

Cost certainty is also a non-negligible factor; people perceive being able to review their actual costs at any time as essential. Here, the second role of IS, “informate”, becomes clear [44-46]. Users experience a higher level of informedness by using IS (“informate down”). They can access information about their driving costs in their user account, thus experiencing a higher level of transparency and lower uncertainty with the use of carsharing. Furthermore, strategic information of the provider is also enabled by IS (“informate up”), e.g., by remote vehicle-status checks. Additionally, the ability to track driving profiles through telematics offers the possibility of generating deeper insights into general mobility demand, a feature of particular interest for mobility providers and OEMs. This information supports various strategic decisions, such as those regarding the usefulness and location of further stations. The data collected further enables new business models, e.g., selling the insights to city planners who want to reduce traffic congestion.

Our results confirm the importance of interoperability of services. People prefer using mobility services independent of the responsible operator and of their location – a concept that seems unthinkable without IS. Being forced to carry out repetitive registrations whenever they visit another city is no viable solution; this process is time consuming and, in most cases, a registration fee is charged. Consequently, people will switch to other transportation modes such as public transport or taxis. Operators in touristic cities in particular thus miss a large number of potential customers. Moreover, participants prefer a driving-sensitive incentive scheme that offers users the possibility of further influencing their mobility costs. Here, IS with its third role, “transformate” [44], [46], enables functionalities that would not be possible without IS. Through IS in carsharing, it is easier for customers to use this kind of sustainable transportation. Moreover, through the mechanisms described above, IS increases the economic performance of carsharing by cutting administration costs or increasing economies of scale. By contributing to the economic performance of a green means of transportation, both environmental and economic sustainability are addressed simultaneously. Deploying more IS might make it possible to bridge the economic–environmental divide that is obvious in our data: More than 72% of the respondents declared a reduction in their personal mobility costs as important. Over 92% stated that they want to contribute to environmental sustainability. These two aspects of cheap and green can sometimes contradict; this debate is known, e.g., from the field of electro mobility, where new technology promises better environmental performance but is associated with higher initial costs [59]. Through an enhanced attractiveness of the carsharing business model, the mobility mix of society at large might be changed towards increased sharing usage and thus become more environmentally sustainable. Leaving the specific case of carsharing, our assumption that modern IS has the potential to massively enhance the attractiveness of service-oriented business models – which could also include bike, bus or train transport offerings, or peer-to-peer carsharing offerings is further supported by our findings.

6 Limitations and Future Research

Our study has several limitations that must be mentioned, as they could affect the generalizability of our findings. First, the participants chosen for our questionnaire are all carsharing customers, since we consider this characteristic to be important for obtaining qualified responses. Therefore, the participants do not have to be convinced of the value of carsharing as a sustainable mobility concept. However, it would be interesting to determine how an optimal carsharing design should look so that it attracts people who have no previous experience with carsharing. These thoughts may spark further research. Second, when determining our attributes and attribute levels, we aim to investigate the use of IT in carsharing operations. Determinants such as the pricing structure are omitted in our design, although the pricing can be closely related to the use of IT, e.g., different pricing while driving vs. parked or dynamic tariffs depending on the time of day or the operator's actual utilization. Nevertheless, this complexity is hard to capture in a CA and would probably result in overloading the participants cognitively. Thus, our approach simplifies real-world decisions by focusing on the object of investigation. This also applies to our single focus on the customer's perspective, which needs to be complemented by also investigating the carsharing provider's point of view on the role of IS in further research.

7 Conclusion

Alternative business models are necessary for achieving the goal of sustainable mobility, a key challenge for sustainable development as a whole. Result-oriented services that provide mobility on demand seem to be a promising means of meeting both societal trends and environmental sustainability targets. By conducting a conjoint analysis based on a survey of 221 carsharing customers, we were able to demonstrate that IS can play a substantial role in (re-)designing mobility services to be more convenient for the user. The results indicate that customers prefer high-technology operations. By guaranteeing safety and offering flexible and convenient access to the service, advanced IS reduces the customer's transaction costs, and enhances the customer's attitude towards the service [17]. IS responds to customer's changing requirements in mobility services. Thus, adapting operators' services to users' needs would increase subjective perceptions of the service and, therefore, would also be beneficial for providers [17].

With our research, we contribute to the IS community in the following ways. We add the perspective of business model innovation to the domain of green IS. As the results of our investigation reveal, customers appreciate IS use, as it is associated with enhanced convenience and connectedness, thus decreasing uncertainty. Insights were missing particularly in the mobility sector, which is a key aspect in achieving sustainability. Moreover, we contribute to the domain of product–service transition by theoretically and empirically describing the impact of IS on these developments. As more and more industries move towards service-oriented business models, it is important to examine how and to what degree IS contributes to this trend and to explore the underlying trade-offs.

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