The Actual Demand Behind Demand-Responsive Transport:

Assessing Behavioural Intention to Use DRT Systems in two Rural Areas in Germany

Despite the potential capability of demand-responsive transport systems (DRT) to improve service quality of public transport in rural areas, existing DRT systems in Germany are often under-utilized. Thus, there is a need to examine usage barriers and facilitating factors that affect the adoption of DRT systems. A household survey in two rural areas of Germany with DRT systems (N = 205) based on the *Unified Theory of Acceptance and Use of Technology* (UTAUT) was conducted and analysed using the Structural Equation Model (SEM) approach. The results indicate that the constructs of *Performance Expectancy* and *Facilitating Conditions* were useful predictors of *Behavioural Intentions* to use DRT systems, with *Performance Expectancy* having the strongest impact on the model. The resulting model explained 47% of variance of *Behavioural Intention* to use a DRT. The results contribute to a greater understanding of the actual users' demand behind demand-responsive transport and provide recommendations for policy and practitioners to design and operate user-centred DRT systems and thus to enhance their adoption.

Keywords: demand-responsive transport, flexible transport, user perspective, case study, rural area

1. Introduction

1.1 A psychological perspective on demand-responsive transport systems

Rural depopulation and emigration to the cities cause a growing disparity between cities and the countryside. Faced with a perceived lack of opportunity, many young people migrate from rural to urban areas (Taylor & Martin, 2001). Thinned out supply and care facilities in remote rural structures lead to continuously growing challenges for the provision of public mobility. A decreasing service quality of public transport and increasing car ownership cause vicious cycles of demand in rural areas as described by Brake & Nelson (2007). Furthermore, public transport providers scarcely ever have sufficient resources to collect and analyse data to assess the effectiveness of their service (Brown et al., 2018). The described circumstances impede conventional public transport in meeting the residents' mobility demands in rural areas (Kirchhoff, 1995; Wang et al., 2015).

Flexible and demand-responsive transport systems are a promising way to improve rural public transport (Brake & Nelson, 2007; Kirchhoff, 1995; Velaga et al., 2012). Demand-responsive transport (DRT) can be defined as "an intermediate form of public transport, somewhere between a regular service route that uses small low floor buses and variably routed, highly personalised transport services offered by taxis" (Brake et al., 2004; p. 324). Thus, as a main characteristic DRT systems respond to changes in demand by adapting their route and/or timetable (Wang et al., 2015).

Laws (2009) predicts a wider dissemination of DRT systems. For urban areas, DRT systems have the potential to complement public mobility as a feeder system for first and last-mile transport (Chandra, Bari, Devarasetty & Vadali, 2013), and thus to replace motorized individual transport (Gunay, Akgol, Andréasson & Terzi, 2016). In the last years, several DRT systems started to operate in urban areas as well, like Kutsuplus in Helsinki (Rissanen, 2016) or Allygator Shuttle in Berlin (Frese, 2016). Before starting to operate new DRT systems, it is necessary to study the factors that facilitate their adoption as well as usage barriers that prevent people from using DRT systems. This study pursues the objective of examining the psychological factors that affect the adoption of DRT systems. To develop a DRT system that achieves broad acceptance, the analysis of existing systems may help to understand the driving forces behind travellers' decisions to use or not to use the system offered. In this context, the utilization of 15 German DRT services was evaluated by König & Grippenkoven (2017). They observed that, on average, the service was used by only around a quarter of inhabitants once a year in 2015 (König & Grippenkoven, 2017). The authors concluded that it is essential to study the factors that contribute to this low utilization rate.

Earlier research on DRT services mainly focused on different operational schemes of DRT systems (Davison et al., 2014, Laws et al., 2009), economic aspects (Laws, Enoch, Ison & Potter, 2009), the market potential (TCRP, 1995; Ryley et al., 2014) as well as operational and institutional barriers to DRT systems (Enoch et al., 2004; Laws, 2009). Even though DRT systems have operated for several decades in rural areas (Kirchhoff, 1995) and the number of new services is rapidly increasing (Shaheen & Cohen, 2018a), the user-centered perspective has been usually disregarded in studies concerning DRT systems. Hence, little is known about the needs and requirements concerning demand-responsive transport, especially for the elderly that form a main target group for flexible transport services (Bond, Brown & Wood, 2017). There is a considerable line of research focusing on the psychological determinants of the intention to use fixed-scheduled bus transport (Eboli & Mazzulla, 2007; Fujii & Van, 2009) but very few studies considered the requirements of travellers in the field of DRT systems (e.g. Finn et al., 2004; Ryley et al. 2014; Wang et al., 2015; Yim & Ceder, 2006). Gössling et al. (2018) state that the understanding of transport systems in that it ignores the psychology and social embeddedness of mobility consumption is too simplistic. Adding onto this, literature concerning pro-environmental behaviour emphasizes the relevance of internal factors, such as awareness, locus of control, attitudes and values besides external factors (e.g. institutional and economic, Kollmuss & Agyeman, 2002). Consequently, for approaching the user perspective on DRT system, the study of psychological motivators and barriers is considered to be of high relevance. Wang and colleagues (2015) outlined the relevance of factors for the use of DRT services at an individual-specific level. Ryley et al. (2014) determined the propensity to use DRT in two rural areas in Great Britain with the help of a choice experiment and found that very few respondents within the survey area had heard of the DRT service before. Finn et al., (2004) underlined the relevance of a detailed user needs analysis to design a DRT system that meets the users' demand and described a six-step approach for determining user needs. Yim & Ceder (2006) addressed the question what kind of service features would likely attract travellers to switch from private vehicle to a smart shuttle that serves as a flexible feeder system to a rail station. They found cost, travel time and reliability of the service to be the most important attributes for travellers' willingness to use the smart shuttle system (Yim & Ceder, 2006). Laws (2009) conducted a survey with residents of rural areas for identifying the market potential of different DRT systems and pointed out: „Interestingly, the issue of user demand is one that was neglected in a recent DRT good practice guide (aimed at the UK market)" (Laws, 2009, p. 28).

This study imparts a user-centered view on DRT systems. In order to develop a better understanding of DRT services from the users' and the non-users' perspective, factors that hinder or facilitate the adoption of such systems need to be identified and assessed. The introduction of a new DRT system can be understood as the introduction of a new transport technology, as Chen & Chao (2011) proposed for mass rapid transit systems and Wolf & Seebauer (2013) with regard to e-bikes. From this perspective, technology acceptance models like the Unified Theory of Acceptance and Use of Technology (UTAUT, Venkatesh et al., 2003) appear to be a promising starting point to examine DRT adoption.

1.2 The Unified Theory of Acceptance and Use of Technology (UTAUT)

Venkatesh et al., (2003) tried to unify theoretical models that explain usage intention and usage behaviour of information technology by developing the Unified Theory of Acceptance and Use of Technology (UTAUT) based on eight acceptance models, for instance the Theory of Planned Behaviour (TPB, Ajzen, 1991). The theory was empirically supported by several studies mainly in the field of information and communication technology (Venkatesh et al., 2016) but was also applied to the field of mobility and transport, for example regarding electric mobility (Wolf & Seebauer, 2014), carsharing (Fleury et al., 2017), driver assistance systems (Adell, 2010) and automated road transport systems (Madigan et al., 2016). The model states that the four key constructs *Performance Expectancy*, *Effort Expectancy*, *Social Influence* and *Facilitating Conditions* affect *Behavioural Intention*, which in turn predicts *Use Behaviour*. These constructs will be described in the following section.

Performance Expectancy is defined as the degree to which an individual believes that using the systems will contribute to achieve his or her goals (Venkatesh et al., 2003). Performance Expectancy finds its roots in Davis' (1989) concept of Perceived Usefulness within the Technology Acceptance Model. Performance Expectancy and Perceived Usefulness have proven to significantly predict Behavioural Intention in studies concerning transport mode choice (Chen & Chao, 2011; Fleury et al., 2017; Madigan et al., 2016, Wolf & Seebauer, 2014). In line with the findings of Venkatesh et al. (2003), it is assumed that Performance Expectancy has a conducive impact on Behavioural Intention to use DRT.
Hypothesis 1Performance Expectancy positively affects the Behavioural Intention to use DRT.
Effort Expectancy is defined as the degree of ease associated with the use of the system and describes how much effort is needed to use a system (Venkatesh et al., 2003). Fleury et al., (2017) showed that Effort Expectancy is the best predictor for Behavioural Intentions to participate in carsharing. The construct of Effort Expectancy is expected to be an important determinant of intention to use DRT.
Hypothesis 2: Effort expectancy positively affects the Behavioural Intention to use DRT.

Social Influence refers to the individual's perception that important others believe he or she should use the new system (Venkatesh et al., 2003). Findings regarding Social Influence have been controversial within the literature. A number of studies based on the UTAUT failed to find a significant impact of Social Influence on Behavioural Intention (Fleury et al., 2017, Emmert & Wiener, 2017). Yet in line with studies regarding mobility behaviour (Chen & Chao, 2011; Haustein & Hunecke, 2007), Social Influence can be expected to be a determinant of intention to use DRT.
Hypothesis 3: Social Influence positively affects the Behavioural Intention to use DRT.

The construct of *Facilitating Conditions* is defined as "the degree to which an individual believes that an organizational and technical infrastructure exists to support the use of the system." (Venkatesh et al., 2003, S. 453). The construct is strongly linked to the construct of Perceived Behavioural Control of the TPB (Ajzen, 1991) which has proven to predict transport mode choice (Haustein & Hunecke, 2007). Thus, Facilitating Conditions are expected to predict intention to use DRT.
Hypothesis 4: Facilitating Conditions positively affect the Behavioural Intention to use DRT.

The UTAUT theorizes that the construct of *Attitude* is not a direct determinant of *Behavioural Intention* (Venkatesh et al., 2003). *Attitude*, which is defined as an "individual's overall affective reaction to using a system" (Venkatesh et al., 2003, S. 455), is said to operate through constructs like Performance Expectancy or Effort Expectancy and, therefore, is not significant in the presence of those constructs (Venkatesh et al., 2003). Yet, the construct of attitude was found influential in the context of travel mode choice in several studies (e.g. Bamberg et al., 2007; Ozeanne & Mollenkopf, 1999; Wolf & Seebauer, 2014) and, thus, was reintroduced to the UTAUT in several studies (Emmert & Wiener, 2017; Šumak et al., 2010). Thus, modifying the UTAUT by adding the constructs *Attitude towards public transport* and *Attitude towards private cars* seems a promising way to examine the

underlying factors of DRT use. It is expected that a positive attitude towards public transport has a positive influence on usage intention of DRT systems, whereas a positive attitude towards private cars has a negative influence on usage intention of DRT systems.
Hypothesis 5: Attitude Towards Public Transport positively affects the Behavioural Intention to use DRT.
Hypothesis 6: Attitude Towards Private Cars negatively affects the Behavioural Intention to use DRT.

The aim of this study is to develop a better understanding of DRT services from the users' and the non-users' perspective by identifying the factors that hinder or facilitate the adoption of such systems. The main objective of the present study is to analyse whether an expanded UTAUT model can be appropriately applied to describe the underlying factors that affect the intention to use DRT systems.

2. Method

2.1 Surveyed Area

A survey study was conducted in the operation area of two German DRT systems, the DRT *Anruf-Auto Rodenberg* and the DRT *RufBus Nuthe-Urstromtal*. The Anruf-Auto Rodenberg has operated as a door-to-door service in Rodenberg, a township in Lower-Saxony, 27 km in linear distance to Hanover since its launch in 2007. The RufBus Nuthe-Urstromtal is a DRT service that has operated since 2010 exclusively at bus stops in the township of Nuthe-Urstromtal. The villages of Nuthe-Urstromtal are situated in Brandenburg, approximately 70 km in linear distance to Berlin. Table 1 compares operating times, ticket prices and number of passengers per year of the two DRT systems.

Table 1

Comparison of the Anruf-Auto Rodenberg and the RufBus Nuthe-Urstromtal concerning the operational concepts and spatial characteristics of the operational areas

	Anruf-Auto Rodenberg	RufBus Nuthe-Urstromtal
Residents within operation area	15.496	23.926
Size of operation area	86 km²	214 km²
Population density	230.7 inhabitants/km²	76.7 inhabitants/km²
Launch of operation	2007	2010
Number of passengers (2015)	6.000	1.960
Operating times	Mon-Sat: 7:30-19:00	Mon-Fri: 5-24; Sat, Sun: 8:00-24:00
Ticket price	Depending on distance, starting from 4 € within a town	Local tariff (2.90 €)+ 1 € additional fee
Point of access	Front door	Bus stop
Method of booking	Via phone	Via phone (since 2020 via app)
Pre-booking time	If possible the previous day	60 min
Accessibility	Access for wheelchair if announced early	Access for wheelchair if announced early

Operation	Subcontracted taxi service	Subcontracted service by Johanniter

Note. Sources: Destatis (2016), Rodenberg.de (2018), Verkehrsgesellschaft Teltow-Fläming mbH (2016)

2.2 Research model and measures

For the present study the UTAUT model was extended by two dimensions that are assumed to be influential in the context of travel mode choice: *Attitude Towards Public Transport* and *Attitude Towards Private Cars* as argued in section 1.2. The two constructs were measured by four items each that were adapted from Chen & Chao (2011). The items referred to the respondents feelings of comfort, flexibility, speed and availability of private car and public bus transport. For adapting the UTAUT model to the field of DRT systems the items from the model of Venkatesh et al. (2003) and its applied versions were modified in order to apply them to the context of DRT. All of the items were measured using a five-point Likert scale, ranging from “strongly disagree” (1) to “strongly agree” (5).
As survey methods are limited in their power to collect data about actual use of DRT systems, the dependent variable of Use Behaviour was excluded from the research model. This was done before in studies using the UTAUT (Adell, 2010; Fleury et al., 2017; Madigan et al., 2016). The dependent variable in this model was *Behavioural Intention*. The research model is shown in figure 1.

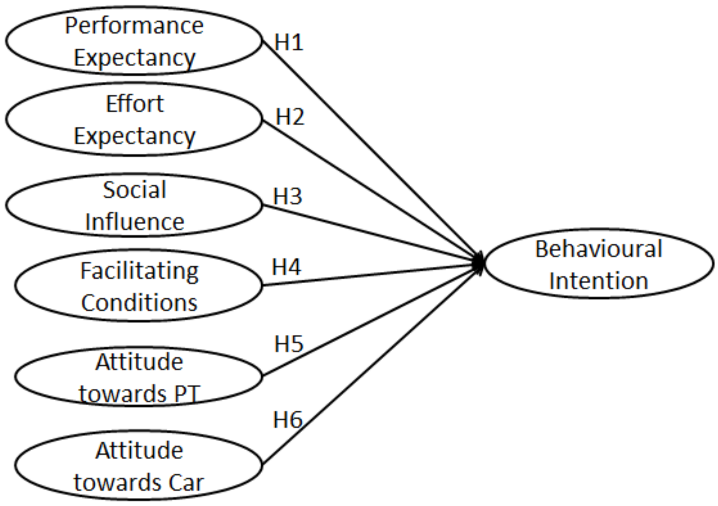

Figure 1: Proposed research model and hypotheses (PT = Public Transport)

2.3 Data collection and analysis

A survey study was conducted in the operation area of both DRT systems. At the township of Rodenberg 2000 questionnaires were distributed in November 2016. In February 2017 another 1000 questionnaires were distributed in Nuthe-Urstromtal. Additionally an online survey was provided to increase the number of respondents. The surveys were distributed by dropping them into letter boxes of every second household in the determined area. The respondents were asked to return the surveys at predetermined locations like bakeries or shops.
The questionnaire contained questions concerning the UTAUT constructs as well as sociodemographic characteristics of respondents, respondents' travel behaviour, modal split and respondents' attitudes towards different transport modes.

In Rodenberg 158 out of 2000 questionnaires that were distributed were returned, resulting in a response rate of 7.9%. In addition, a total number of 67 residents of Rodenberg participated in the online survey. In Nuthe-Urstromtal 71 out of 1000 questionnaires were returned (7.1%). The online survey was filled in by additional 28 persons in Nuthe-Urstromtal. Over the two DRT areas this left a total number of 323 returned surveys. 118 responses had to be excluded because respondents either had not heard before about the DRT service, or refused to answer the questions connected to the DRT service. After exclusion, the dataset consisted of 205 respondents.

Data was analysed using Structural Equation Modelling (SEM) as done before in work related to UTAUT (Emmert & Wiener, 2017; Šumak et al., 2010; Wu et al., 2007). SEM is a well-established analytical method that was used in numerous recent studies for travel behaviour research (see Golob, 2003). SEM provides a methodology for analysing and modelling the relationship between observed and unobserved variables based on a series of separate multiple regression equations estimated simultaneously (Hair et al., 2014). The statistical software AMOS version 21 was used for conducting SEM analysis (IBM Analytics, 2017). Hot Deck imputation was applied to replace missing values (Myers, 2011).

2.4 Respondents

In the final sample (N = 205), 135 respondents came from the survey area of Rodenberg, whereas 70 respondents were residents of Nuthe-Urstromtal. Within the sample, 27.8% of the respondents (n = 57) stated to have used the local DRT at least once and 72.2% respondents had not used the service before (n = 148). The share of respondents that have used the DRT at least once was nearly the same in both samples ($N_{\text{Nuthe-Urstromtal}}$ =31.4%, $N_{\text{Rodenberg}}$ = 25.9%). With the exception of four individuals (two from each sample) all respondents possessed a driving license (98.0%). Important sociodemographic characteristics and modal split data of the two samples are compared in table 2. No data concerning the income level of the two regions was available.

Table 2

Sociodemographic characteristics of study sample according to study area

	RufBus Nuthe-Urstromtal	Anruf-Auto Rodenberg
Gender	Male = 39.1%	Male = 59.1%
Age	*Mean* = 51.1 years, *SD* = 16.1 years	*Mean* = 54.8 years, *SD* = 15.1 years
Share of retired respondents	20.3%	31.1%
Share of respondents with university degree	41.4%	25.4%
Share of mobility-impaired	10.3%	12.7%
Share of daily car usage	72.9%	79.3%
Share of daily bus usage	7.1%	3.7%

3. Results

SEM models consist of two components: (1) the *measurement model*, which specifies how a construct is represented by variables and (2) the *structural model*, which specifies how the constructs are interrelated (Hair et al., 2014). First, the measurement model is evaluated to examine reliability and validity and the model fit. Second, the structural model is assessed to test the research hypotheses.

3.1 Model specification

A descriptive analysis was performed as a first step to compare the respondents' appraisal and use of the DRT systems drawn from the two samples. No differences in the previous use revealed between the two samples revealed ("Have you used the local DRT at least once before?", 1 = yes, 2 = no; $M_{\text{Rodenberg}}$ = 1.74, $SD_{\text{Rodenberg}}$ = 0.440, $M_{\text{Nuthe-Urstromtal}}$ = 1.69 $SD_{\text{Nuthe-Urstromtal}}$ = 0.468; $F(1, 203) = 0.691$; p = .407). No differences between the samples were shown in the assessment of the DRT according to the items listed in Table 3, except the item EE1 ("I think that there are a lot of things to consider when ordering the *Anrufbus*", $M_{\text{Rodenberg}}$ = 2.73, $SD_{\text{Rodenberg}}$ = 1.03, $M_{\text{Nuthe-Urstromtal}}$ = 3.37, $SD_{\text{Nuthe-Urstromtal}}$ = 0.97 $F(1, 203) = 18.430$; $p < .000$). This item was later excluded from the model due to low factor loadings. Furthermore, the comparison of the sociodemographic characteristics of the two samples revealed no notable differences in the age of the respondents ($M_{\text{Rodenberg}}$ = 54.8, $SD_{\text{Rodenberg}}$ = 15.1, $M_{\text{Nuthe-Urstromtal}}$ = 51.1, $SD_{\text{Nuthe-Urstromtal}}$ = 16.1; $F(1, 203) = 2.771$; p = .098) and other characteristics (Table 2). Thus, the two samples were joined in the model.

Cronbach's Alpha was used to test the reliability by specifying internal consistency of the UTAUT`s constructs (Hair et al., 2006). Neither the Effort Expectancy scale, nor the Social Influence scale reached the recommended Cronbach's Alpha value of > 0.6 (Byrne, 2010, table 2), which is common in UTAUT literature (AlAwadhi & Morris, 2008; Madigan et al., 2016; Wong et al., 2013). Statistical significance of parameter estimates was reported by the critical ratio (C.R.), which represents the parameter estimate divided by its standard error (Byrne, 2010). As shown in table 3, except the first item of Effort Expectancy (EE1) all items reached the critical value of C.R. > ±1.96 (Byrne, 2010). To test convergent validity, the average variance extracted (AVE) was assessed, that is calculated by the total of all squared standardized factor loadings divided by the number of items according to Backhaus et al., (2005). An AVE of more than .5 is an indicator for an adequate convergent validity. As shown in table 2, only Performance Expectancy, Attitude towards Car and Attitude towards Public Transport reached a recommended AVE of .5.

The overall model fit was examined by the use of five measures. As shown in table 4, the ratio of the chi-square value to degrees of freedom (χ^2/df) was 2.01, indicating a good model fit. The comparative fit index (CFI), the goodness-of-fit index (GFI), the root mean square error of approximation (RMSEA) and the adjusted goodness-of-fit index (AGFI) slightly failed to reach the required values. To conclude, the model fit indices revealed that the supposed model does not fit perfectly to the data. Thus, a model respecification was performed.

Table 3

Results of the extended UTAUT measurement model

Construct	Items	Description	Standard loading	C.R.	AVE	Cronbach's Alpha
Performance Expectancy	PE1	I believe the *Anrufbus* (DRT) is useful for me personally.	.89	15.073	.810	.896
	PE2	I believe the *Anrufbus* (DRT) improves my personal mobility.	.91	15.439		
Effort Expectancy	EE1	I think that there are a lot of things to consider when ordering the *Anrufbus*.	.15	1.541	.216	.429
	EE2	I believe the way the *Anrufbus* (DRT) works is easy to understand.	.42	4.191		
	EE3	I believe that I can define myself	.67	4.383		

		when and where the *Anrufbus* (DRT) picks me up.				
Social Influence	SI1	Most of my friends and family members use public transport regularly.	.49	5.393		
	SI2	I believe that the *Anrufbus* is used by many people.	.43	4.812	.270	.518
	SI3	People that are close to me say that I should use the private car less but use public transport more often.	.62	6.436		
Facilitating Conditions	FC1	I am familiar with the timetables and the internet pages that provide information about public transport service.	.25	3.191		
	FC2	I know the schedule and timetable of local public transport.	.64	9.106	.418	.619
	FC3	I know the tickets and pricing system of the local public transport.	.79	11.621		
	FC4	I know which bus lines operate in the vicinity of my home.	.76	11.064		
Attitude towards Public Transport	AB1	I believe bus transport to be comfortable.	.54	7.983		
	AB2	I believe bus transport to be flexible.	.92	15.452	.551	.816
	AB3	I believe bus transport to be available.	.86	14.066		
	AB4	I believe bus transport to be fast.	.57	8.459		
Attitude towards Car	AC1	I believe private cars to be comfortable.	.59	8.679		
	AC2	I believe private cars to be flexible.	.92	15.149	.519	.767
	AC3	I believe private cars to be available.	.76	11.933		
	AC4	I believe private cars to be fast.	.55	8.025		

Note. C.R. = critical ratio, AVE = average variance extracted

Model respecifications are commonly conducted in SEM to improve model fit (Byrne, 2010). Due to their low factor loadings the items FC1, SI2 and EE1 were excluded from the model. As single-item constructs face the problem of difficulties in validation and using multiple items is recommended, no further items of the *Effort Expectancy* construct and the *Social Influence* construct were excluded (Hair et al., 2014). The content of the items was considered as valuable and therefore maintained for the analysis. According to the modification indices that provided recommendations for improving model fit three covariances between error variables within a construct were included to the model. After the model respecification, the proposed research model showed a good fit: ($\chi2$ = 142.88, *df* = 113, χ^2/df = 1.26, GFI = .929, RMSEA = .036, AGFI = .893, CFI = .976, table 3). Attachment 1 provides an overview over the items used in the model.

Table 4

Goodness of fit measures of proposed model before and after respecification

Fit indices	Before model respecification	After model respecification	Recommended value according to Backhaus, Richson, Plinke and Weiber (2005)
χ^2/df	2.01	1.26	< 2.5
GFI	.867	.929	> 0.9

RMSEA	.071	.036	< 0.05
AGFI	.821	.893	> 0.9
CFI	.870	.976	> 0.9

3.2 Evaluation of the measurement model

Figure 2 shows the standardized path estimates and the squared multiple correlations of the manifest variables for the revised model. The variance extracted is defined as the squared path estimate of the indicator variable, e.g. .80 for PE1. As shown in figure 2, the variable AC2 reaches the highest variance extracted. The construct of *Attitude towards Car* explains .92 of variance of the variable AC2, indicating that only 8% of variance remains unexplained. The model includes variables with very small variance extracted as SI2 (18%) and EE2 (24%). Concerning the endogenous latent variable of *Behavioural Intention*, 59% of the variance of BI1 could not been explained. Taken together, the latent variables account for 47% of the variance of the construct *Behavioural Intention*.
The model was tested for differences between the two survey areas. The comparison revealed no significant effect of operation area on the model (χ^2 (23, N = 205) = 24.287, *p* = .388).

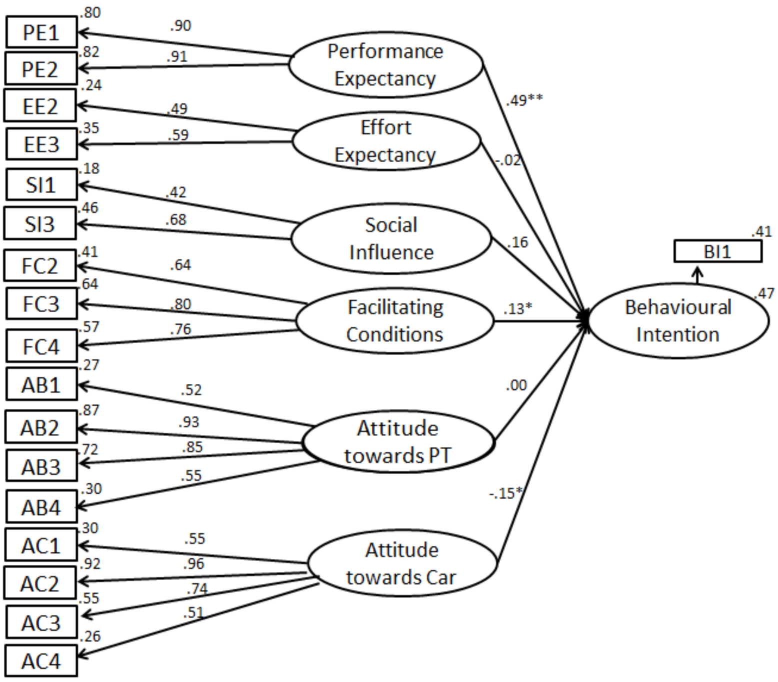

Figure 2: Standardized path estimates and squared multiple correlations for the revised model (PT = Public Transport, *= p < 0.05, **= p < 0.01)

3.3 Evaluation of the structural model

Having a sufficiently valid and reliable measurement model, the structural model is tested to examine the relationships between the constructs and Behavioural Intention and to test the hypotheses. As presented in table 5, the exogenous latent variable having the highest positive effect on Behavioural intention to use DRT systems is Performance Expectancy, with a unstandardized path coefficient of $\beta_{PE\text{-}BI}$ = .668, *p* < .001. This finding supports the hypothesis H1. As supposed, the construct of Facilitating Conditions significantly predicts BI ($\beta_{FC,BI}$ = .180, *p* = .039), which supports hypothesis H4. As predicted by hypothesis H6, having a positive attitude towards private cars is linked with a decreased Behavioural intention to use DRT services ($\beta_{AC,BI}$ -.202, *p* =. 011). In more detail, the four

attributes of the attitude towards private cars flexibility (r = -.321, p < .001), comfort (r = -.174, p =.013), availability (r = -.212, p = .002) and speed (r = -.193, p = .006) significantly negative correlated with the intention to use DRT in the next three months. The effect of the perceived flexibility of the private car was higher than for the other three items.
Contradictory to the assumptions, neither *Effort Expectancy* ($P_{EE,BI}$ = -.026, p = .814) nor *Attitude towards Public Transport* ($ß_{AP,BI}$ = .000, p = .996) show a significant effect on *Behavioural Intention*, indicating that hypothesis 2 and 5 are nor supported by the data. Social Influence revealed a marginally significant effect on Behavioural Intention ($ß_{SI,BI}$ = .218, p = .073).

Table 5

Unstandardized parameter estimates of the structural model and hypothesis testing

Hypothesis	Estimate	S.E.	C.R.	p-Value	Hypothesis testing
H1: Performance Expectancy -> BI	.668	.107	6.265	< .001**	supported
H2: Effort Expectancy -> BI	-.026	.111	-.235	.814	not supported
H3: Social Influence -> BI	.218	.122	1.792	.073	not supported
H4: Facilitating Conditions -> BI	.180	.087	2.063	.039*	supported
H5: Attitude towards PT -> BI	.000	.075	-.005	.996	not supported
H6: Attitude towards Car -> BI	-.202	.080	-2.535	.011*	supported

Note. PT = Public Transport, BI = Behavioural Intention, S.E. = Standard error, C.R. = Critical ratio, *= p < 0.05, **= p < 0.01

4. Discussion

4.1 Summary and discussion of findings

Although demand-responsive transport systems are promising solutions for rural and urban mobility planning, few empirical studies have covered the topic of demand-responsive transport systems yet and even fewer have sought to identify the psychological factors determining intentions to use this type of transport. The aim of the present study was therefore to fill this gap by analysing the influence of psychological determinants on the intention to use a DRT system.
The model explained 47% of variance of Behavioural Intention to use a DRT which is notably higher than the explained variance that was reached in previous studies that applied the UTAUT to the transportation context (Adell, 2009; Madigan et al., 2016). The results revealed that the UTAUT framework can be applied to increase understanding of residents' intentions to use DRT systems. More specifically, the results show that respondents' intention to use the DRT system was found to be significantly affected by *Performance Expectancy*, *Facilitating Conditions* and *Attitude towards Car* whereas *Effort Expectancy*, *Social Influence* and *Attitude towards Public Transport* did not play a statistically significant role.
In line with the findings of Venkatesh et al. (2003), *Performance Expectancy* was found to be the strongest predictor of *Behavioural Intention* to use DRT services, indicating that if people think it is useful to use DRT, they express a strong intention to do so. The results of the presented study show that the strong relationship between *Performance Expectancy* and *Behavioural Intention* can be confirmed for the field of DRT services. Thus, the statement of Davis (1989) is today as relevant as it was in 1989: "The prominence of usefulness over ease has important implications for designers, particularly in the human factors tradition, who have tended to overemphasize ease of use and overlook usefulness" (Davis, 1989, p. 334). Overall, the results show that it is of paramount importance to enhance the perceived usefulness or performance expectancy of the transport system.

First of all, practitioners should aim to reach a high usefulness of the transport system by designing and operating an efficient DRT system that meets the specific needs of users. Furthermore, to integrate the DRT into the tariff and operation system of local public transport would facilitate intermodal mobility chains. A next step would be to enhance the peoples` perception of the DRT`s usefulness through appropriate methods. Such methods might be a comprehensive information provision and a careful introduction of the new transport system. Thus, it seems necessary to provide clear and comprehensible information about the DRT and improve transparency to support the construction of a mental model of the bus concept. Yet, it is not describes precisely which factors contribute to the usefulness of a DRT system and how to enhance them. Thus, further research addressing those factors is needed.

The construct of *Effort Expectancy* has unexpectedly emerged in this research as an insignificant predictor of respondents' intention to use DRT services. Though, several studies also failed to find a significant effect of *Effort Expectancy* on *Behavioural Intention* in research domains like mobile telecommunication (Wu, Tao & Yang, 2007) and Internet websites (Emmert & Wiener, 2017). A possible explanation for the insignificance of the link between Effort Expectancy and Behavioural Intention may be that the DRT systems were perceived as easy to use. This was indicated by the high means of the three construct`s variables EE1 (M = 3.68, SD = 1.06), EE2 (M = 3.04, SD = 1.05), EE3 (M = 3.44, SD = 1.15). Thus, giving a satisfactory level of ease of use, the construct becomes less important for the decision to use the transport system. The results indicate the need to examine the constructs of *Effort Expectancy* in more detail since previous studies also failed to find a significant link between Effort Expectancy and Behavioural Intention (Emmert & Wiener, 2017; Wu et al., 2007).

Regarding the construct of *Social Influence* slightly failed to have a significant impact on *Behavioural Intention* to use DRT as the significance level is 92.7%, so fairly close to the 95% significance level. However, this result is in line with previous findings in the field of transport systems. Fleury et al., (2017) failed to find a significant effect of *Social Influence* on the intention to use carsharing. Accordingly, Ozanne and Mollenkopf (1999) showed that the construct of *Subjective Norm* of the Theory of Planned Behaviour is not related to carpooling intentions. A possible explanation might be provided by Venkatesh et al. (2003) who found the role of *Social Influence* to be more important in mandatory contexts. As the use of DRT systems is mainly voluntary, except for so called captive users, this might explain the missing link between *Social Influence* and *Behavioural Intention*. To conclude, further research is needed to examine under which circumstances the construct of *Social Influence* affects Behavioural Intention.

The findings of the study at hand confirm the relevance of *Facilitating Conditions* that have been proven in the field of e-bike adoption (Wolf & Seebauer, 2014). Premised on the significant effect of *Facilitating Conditions* on *Behavioural Intention* the study implies that people should be supported in using the DRT system by providing extensive and comprehensible information about the DRT concept. In this context, it is of particular importance to make information on the booking process available as well as times and area of operation. A further recommendation to facilitate the use of DRT systems would be to provide online booking and real time information about departure, route and detours of the DRT.

Contradictory to the hypothesis, the added construct *Attitude towards Public Transport* made no important contribution to the model, indicating that a positive appraisal of the public transportation system is no sufficient predictor of the behavioural intention to use a DRT. A possible explanation might be that respondents appraised public transport rather poor in terms of flexibility and mean variation was small (M_{AB2} = 1.72, SD_{AB2} = 0.938), availability (M_{AB3} = 1.78, SD_{AB3} = 0.954) and speed (M_{AB4} = 2.24, SD_{AB1} = 1.038). However, the added construct of *Attitude towards Car* revealed a negative influence on the behavioural intention to use DRT, as had been predicted. Especially the perceived flexibility of the private car was related to a low willingness to use the local DRT. Thus, it can be concluded, that the service of DRT should be more flexible and demand-responsive than today to compete with the flexibility of the private car. The results indicate that people who attribute positive characteristics like comfort, speed and flexibility to private cars are less likely to be willing to use DRT systems. Based on these findings, further research is needed to examine how people that have a high appraisal of private cars could be impelled to use DRT systems.

4.2 Limitations

For interpretation of the findings, several shortcomings of the study design and methodology should be considered. First, it is a common truth that the validity of results depends on the applied methods. Thus, it should be reflected whether the chosen measures were appropriate for answering the research questions. To name one example, the selection of the attributes for measuring attitude towards public transport and private cars should be critically reflected. It is reasonable to expect that the consideration of further attributes such as costs or ecological friendliness would have resulted in a different picture. Thus, the selection of the attributes can be an explanation for the missing link between the attitude towards public transport and the behavioural intention to use DRT.

It should be further reflected as a limitation that, the results of the two surveys from the operation areas was combined in the analysis. A separate analysis may have revealed differences between the two cases. Yet, besides the differences in the service concept of the two DRT systems and in sociodemographic structure of the two areas, a descriptive analysis of each survey construct had found no meaningful differences between the two cases. Thus, the two cases were analyzed in a combined model. The authors would like to encourage further comparisons of cases and more important a comparison of users and non-users.

As another shortcoming of the study, the response rate was low, but yet comparable to other surveys using a similar method (Oostendorp & Gebhardt, 2018). The response rate of surveys in European countries is decreasing due to several reasons (Beullens, Loosveldt, Vandenplas & Stoop, 2018). A higher response rate might be attained by a mixed approach based on participant recruiting via mail, telephone and online (Dillman et al., 2009).

The method of hot deck imputation was used to replace missing data by imputing real values (Myers, 2011). The method is widely used by practitioners to handle non-response but there is still little theoretical research concerning the imputation method (Andridge & Little, 2010). To name one important challenge, the method requires good matches of donors, which is challenging in small samples (Andridge & Little, 2010).

For interpretation of the results it should be considered that two separate study samples drawn from two DRT operation areas were joined up in the model. Besides the fact, that the descriptive analysis revealed no significant differences between the two samples it is possible that the combined modelling approach caused a loss of information.

4.3 Suggestions for further research

Since the construct of Performance Expectancy manifested as the best predictor of the intention to use DRT, approaches to operate user-centered DRT systems should focus on methods to increase the users' perceived usefulness of DRTs. Accordingly, the statement of Davis (1989) is today as relevant as it was in 1989: “The prominence of usefulness over ease has important implications for designers, particularly in the human factors tradition, who have tended to overemphasize ease of use and overlook usefulness” (Davis, 1989, p. 334). Yet, further research should address the question, which service aspects contribute to the perceived usefulness of DRT systems. Adding onto this, it seems of interest to study ways to raise awareness about the usefulness of DRT systems and impart knowledge to the prospective users (König & Grippenkoven, 2019).

Giving regard to the flexibility and complexity of the service concept of DRT systems, the question arises how individuals make assumptions about the service. Do they compare the new systems to the more familiar concept of fixed-line public transport or taxis? Further research could address this topic by studying individuals’ conceptual understanding of DRT systems.

Furthermore, the study contributes to the literature of UTAUT by expanding the theory to new contexts, which has been demanded by Venkatesh et al. (2012). Since a literature review of Williams et al., (2015) implies that “[…] UTAUT research is still in its relatively early stages of development, with no clear areas of maturity, but appears to be developing quickly.” (p. 469), there is a need for further validations of the theory in various fields of application and distinct study designs. The study presented here contributes to the state of science by applying the theory to the investigation of a heterogeneous study sample as demanded by Williams et al., (2015). Furthermore the presented approach of studying users as well as non-users provides new insights into the applicability of the UTAUT for studying non-users which was addressed by a still inconsiderable part of UTAUT literature (Emmert & Wiener, 2017). Further research could address the question, how previous experiences with DRT systems affect the appraisal of the service by comparing the perspective of users and non-users.

Furthermore, the results provide another indication for the need to examine the constructs of Effort Expectancy and Social Influence in more detail. Consistent with a line of previous studies (Emmert & Wiener, 2017; Fleury et al., 2017; Taiwo et al., 2012; Wu et al., 2007), the presented study failed to find significant effects of these two constructs on Behavioural Intention, indicating that further research is needed to examine under which circumstances the constructs affect Behavioural Intention.

Subsequent research should consider further individual-specific factors like income and their effect on the willingness to use DRT systems. Adding onto this, the authors would like to encourage research concerning the comparison of DRT systems in rural and urban areas since the number of new, so called mobility-on-demand-systems or ridepooling is increasing in cities around the world (Gilibert et al., 2019; Liyanage et al., 2019; Shaheen & Cohen, 2018b). How can service characteristics of DRT systems react to the prevalent spatial structure, i.e. by offering a door-to-door service or reducing the maximum detour?

5. Conclusions

The presented study attempted to contribute to a richer understanding of adoption of demand-responsive transport. To the best of our knowledge, we presented the first empirical study to examine the users’ and non-users’ perspective on DRT in ongoing operation. By describing the facilitating factors (high *Performance Expectancy* and high *Facilitating Conditions*) and usage barriers (a positive attitude of using private cars) the study contributes to the establishment of user acceptance for the new product as required by Finn et al., (2004). To sum up, the study contributes to the literature of UTAUT by expanding the theory into new contexts, which has been demanded by Venkatesh et al. (2003). The results revealed that the UTAUT framework can be applied to increase understanding of residents' behavioural intentions to use DRT systems as the model explained 47% of variance of *Behavioural Intention*. More specifically, the study revealed facilitating factors (high *Performance Expectancy* and high *Facilitating Conditions*) and usage barriers (a positive attitude of using private cars) to DRT adoption. In line with previous studies in distinct domains, *Performance Expectancy* revealed the strongest impact on the intention to use DRT. The results point out that in order to improve individuals' intention to use DRT systems lawmakers and transport authorities should enhance the perceived usefulness of the systems by appropriate measures.

Overall, the results show that it is paramount to enhance the perceived usefulness or performance expectancy of the transport system. First of all, practitioners should aim to reach a high usefulness of the transport system by designing and operating an efficient DRT system that meets the specific needs of users. This could include enabling users to reach all local places of interest to provide better access to shopping and other facilities. To achieve this, the provision of sufficient resources for service quality analysis is an essential prerequisite (Brown et al., 2018). Furthermore, integrating the DRT into the tariff and operation system of local public transport would facilitate the change between DRT and fixed-schedule buses. Yet, it is not describes precisely which factors contribute to the usefulness of a DRT system and how to enhance them. Thus, further research addressing those factors is needed.

For now, a first step would be to enhance individuals' perception of the usefulness of the DRT. Measures might pertain to comprehensive information provision and a careful introduction of the new transport system (Brandies et al., 2017). Thus, it seems necessary to provide clear and comprehensible information about the DRT and improve transparency to support the construction of a mental model of the bus concept.

Based on the conducted research, other recommendations for lawmakers and practitioners in the field of DRT can be drawn. Premised on the significant effect of *Facilitating Conditions* on *Behavioural Intention,* the study implies that people should be supported in using the bus system by providing extensive and comprehensible information about the bus concept. In this context, it is of particular importance to make information on the booking process available as well as times and range of operation. A further recommendation to facilitate the use of DRT systems would be to provide online booking and real time information about departure, route and detours of the DRT. In this way, the users' perception of controllability could be strengthened (König & Grippenkoven, 2017).

Acknowledgements

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

References

Adell, E. (2010). Acceptance of driver support systems. *Proceedings of the European conference on human centred design for intelligent transport systems*, 475-486.

Ajzen, I. (1991). The theory of planned behavior. *Organizational and Human Decision Processes*, 50, 179-211. http://dx.doi.org/10.1016/0749-5978(91)90020-T

Andridge, R. R., & Little, R. J. (2010). A review of hot deck imputation for survey non-response. *International statistical review*, *78*(1), 40-64.

Arbuckle, J. L. (2012). *IBM SPSS Amos 21 User's Guide.* Chicago, IL: SmallWaters Corporation.

Backhaus, K.; Erichson, B.; Plinke, W. & Weiber, R. (2005). *Multivariate Analysemethoden. Eine anwendungsorientierte Einführung*. Springer, Heidelberg

Bamberg, S.; Hunecke, M. & Blöbaum, A. (2007). Social context, personal norms and the use of public transportation: Two field studies. *Journal of Environmental Psychology* 27, 190–203

Beullens, K., Loosveldt G., Vandenplas C. & Stoop I. (2018). Response Rates in the European Social Survey: Increasing, Decreasing, or a Matter of Fieldwork Efforts? *Survey Methods: Insights from the Field.* DOI:10.13094/SMIF-2018-00003BMVI - Bundesministerium für Verkehr und Digitale Infrastruktur (2016). *Integrierte Mobilitätskonzepte zur Einbindung unterschiedlicher Mobilitätsformen in ländlichen Räumen.* BMVI-Online-Publikation Nr. 04/2016. Retrieved from: http://www.bbsr.bund.de/BBSR/DE/Veroeffentlichungen/BMVI/BMVIOnline/2016/bmvi-online-04-16.html [17.07.2018]

Bond, M., Brown, J. R., & Wood, J. (2017). Adapting to challenge: Examining older adult transportation in rural communities. *Case studies on transport policy*, *5*(4), 707-715.

Brake, J., Nelson, J. D., & Wright, S. (2004). Demand responsive transport: Towards the emergence of a new market segment. *Journal of Transport Geography*, 12, 323–337. https://doi.org/10.1016/j.jtrangeo.2004.08.011

Brake, J. & Nelson, J.D. (2007). A case study of flexible solutions to transport demand in a deregulated environment. *Journal of Transport Geography*, 15, 262-273, https://doi.org/10.1016/j.jtrangeo.2006.08.006

Brown, J. R., Duncan, M., Horner, M. W., Bond, M., & Wood, J. (2018). Provider perspectives on six strategies to overcome the barriers to older adult use of alternative transportation services: Evidence from seven communities. *Case studies on transport policy*, *6*(2).

Byrne, B.M. (2010). *Structural Equation Modeling with AMOS. Basic Concepts, Applications, and Programming*. Second Edition. Taylor & Francis, New York, ISBN 978-0-8058-6372-7

Chandra, S., Bari, M. E., Devarasetty, P. C., & Vadali, S. (2013). Accessibility evaluations of feeder transit services. *Transportation Research Part A: Policy and Practice*, 52, 47-63. https://doi.org/10.1016/j.tra.2013.05.001

Chen, C. F., & Chao, W. H. (2011). Habitual or reasoned? Using the theory of planned behavior, technology acceptance model, and habit to examine switching intentions toward public transit. *Transportation Research Part F: Traffic Psychology and Behaviour*, *14*(2), 128-137. https://doi.org/10.1016/j.trf.2010.11.006

Davis, F.D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly*, 13 (3), 319-339

Davison, L.; Enoch, M.; Ryley, T.; Quddus, M. & Wang,C. (2014). A survey of Demand Responsive Transport in Great Britain. *Transport Policy*. 31, pp. 47-54. https://doi.org/10.1016/j.tranpol.2013.11.004

Destatis - Statistisches Bundesamt (2016): Gemeinden in Deutschland nach Fläche, Bevölkerung und Postleitzahl am 30.09.2016 (3. Quartal). Retrieved from: https://www.destatis.de/DE/ZahlenFakten/LaenderRegionen/Regionales/Gemeindeverzeichnis/Administrativ/Archiv/GVAuszugQ/AuszugGV3QAktuell.html;jsessionid=77CB380895FDB8CFA3FF1C99038F7C2A.cae4 [07.03.2017].

Dillman, D. A., Phelps, G., Tortora, R., Swift, K., Kohrell, J., Berck, J., & Messer, B. L. (2009). Response rate and measurement differences in mixed-mode surveys using mail, telephone, interactive voice response (IVR) and the Internet. *Social science research*, *38*(1), 1-18.

Eboli, L., and G. Mazzulla. (2007). Service quality attributes affecting customer satisfaction for bus transit. *Journal of Public Transportation* 10(3), 21‑34. DOI: 10.5038/2375-0901.10.3.2

Emmert, M., & Wiener, M. (2017). What factors determine the intention to use hospital report cards? The perspectives of users and non-users. *Patient Education and Counseling*, *100*(7), 1394-1401.

Finn, B., Ferrari, A. and Sassoli, P. (2004) Goals, requirements and needs of users. In: Ambrosino, G., Nelson, J.D. and Romanazzo, M. (Ed.) *Demand Responsive Transport Services. Towards the Flexible Mobility Agency.* Enea*,* 33 - 54. ISBN 88-8286-043-4

Fleury, S.; Tom, A.; Jamet, E. and Colas-Maheux, E. (2017).What Drives Corporate Carsharing Acceptance? A French case study . *Transportation Research Part F: Traffic Psychology and Behaviour*, 45, pp. 218-227. DOI: http://dx.doi.org/10.1016/j.trf.2016.12.004

Fujii, Satoshi & Van, Hong T. (2009). Psychological Determinants of the Intention to Use the Bus in Ho Chi Minh City. *Journal of Public Transportation*, 12 (1), 97-110. DOI: http://doi.org/10.5038/2375-0901.12.1.6

Gilibert, M., Ribas, I., Maslekar, N., Rosen, C., & Siebeneich, A. (2019). Mapping of service deployment use cases and user requirements for an on-demand shared ride-hailing service: MOIA test service case study. *Case Studies on Transport Policy*, *7*(3), 598-606. https://doi.org/10.1016/j.cstp.2019.07.004

Golob, T.F. (2003). Structural equation modeling for travel behavior research. *Transportation Research Part B: Methodological*, 37 (1), 1–25. https://doi.org/10.1016/S0191-2615(01)00046-7

Gössling, S., Cohen, S., Higham, J., Peeters, P. and Eijgelaar, E. (2018). Desirable Transport Futures. Transportation Research Part D, DOI: 10.1016/j.trd.2018.01.008

Gunay, B.; Akgol, K., Andréasson, I. & Terzi, S. (2016). The Estimation of Modal Shift Potential For a New Form of Dial-A-Ride Service. *Journal of Public Transportation*, 19 (2): 75-88. DOI: http://doi.org/10.5038/2375-0901.19.2.5

Hair, J.; Black, W.C; Babin, B. & Anderson, R.E. (2014). *Mutivariate Data Analysis*. Pearson, New International Edition. Harlow, England.

Haustein, S., Hunecke, M. (2007). Reduced use of environmentally friendly modes of transportation caused by perceived mobility necessities. An extension of the theory of planned behavior. *Journal of Applied Social Psychology* 37 (8), 1856–1883.

IBM Analytics (2017). SPSS Amos [Software]. Retrievable online: https://www.ibm.com/de-de/marketplace/structural-equation-modeling-sem

Kirchhoff, P. (1995). Public transit research and development in Germany. *Transportation Research Part A: Policy and Practice*, *29*(1), 1-7. https://doi.org/10.1016/0965-8564(94)E0009-X

Kollmuss, A., & Agyeman, J. (2002). Mind the gap: why do people act environmentally and what are the barriers to pro-environmental behavior?. *Environmental education research*, *8*(3), 239-260.

König, A. & Grippenkoven, J. (2017). From public mobility on demand to autonomous public mobility on demand – Learning from dial-a-ride services in Germany._ In: E. Sucky, R. Kolke, N. Biethahn, J. Werner, G. Koch (Eds.). *Logistik und Supply Chain Management*, 16. University of Bamberg Press, 295-305. ISBN 978-3-86309-489-8

König, A., Kowala, N., Wegener, J. & Grippenkoven, J. (2019). Introducing a Mobility on Demand System to Prospective Users With the Help of a Serious Game. *Transportation Research Interdisciplinary Perspectives, 3, 100079*. https://doi.org/10.1016/j.trip.2019.100079Laws R. (2009). Evaluating publicly funded DRT schemes in England and Wales, PhD Thesis, Loughborough University, Loughborough.

Liyanage, S., Dia, H., Abduljabbar, R., & Bagloee, S. A. (2019). Flexible Mobility On-Demand: An Environmental Scan. *Sustainability*, *11*(5), 1262. doi:10.3390/su11051262

Madigan, R., Louw, T., Dziennus, M., Graindorge, T., Ortega, E., Graindorge, M., & Merat, N. (2016). Acceptance of automated road transport systems (ARTS): an adaptation of the UTAUT model. *Transportation Research Procedia*, *14*, 2217-2226. https://doi.org/10.1016/j.trpro.2016.05.237

Mageean, J. & Nelson, J.D. (2003). The evaluation of demand responsive transport services in Europe. *Journal of Transport Geography*, 11, 255-270, https://doi.org/10.1016/S0966-6923(03)00026-7

Myers, T.A. (2011). Goodbye, Listwise Deletion: Presenting Hot Deck Imputation as an Easy and Effective Tool for Handling Missing Data. *Communication Methods and Measures* 5(4), 297-310. DOI: 10.1080/19312458.2011.624490

Oostendorp, R. & Gebhardt, L. (2018). Combining means of transport as a users' strategy to optimize traveling in an urban context: empirical results on intermodal travel behavior from a survey in Berlin. *Journal of Transport Geography*, 71, Seiten 72-83. Elsevier. DOI: 10.1016/j.jtrangeo.2018.07.006

Ozanne, L. & Mollenkopf, D. (1999). Understanding consumer intentions to carpool: a test of alternative models. *Proceedings of the 1999 annual meeting of the Australian & New Zealand Marketing Academy.*

Rissanen, K. (2016). Kutsuplus: Final Report, HSL, Helsinki. Retrieved from: https://www.hsl.fi/sites/default/files/uploads/8_2016_kutsuplus_finalreport_english.pdf [16.07.2018]

Rodenberg.de (2018). Anrufauto der Samtgemeinde Rodenberg. Online available: http://www.rodenberg.de/downloads/FlyerAnrufauto.pdf

Ryley, T.J.; Stanley, P.A.; Enoch, M.E.; Zanni, A.M. and Quddus, M.A. (2014). Investigating the contribution of Demand Responsive Transport to a sustainable local public transport system. *Research in Transportation Economics*. 48, 364-372. https://doi.org/10.1016/j.retrec.2014.09.064

Shaheen, S. & Cohen, A. (2018a). Is It Time for a Public Transit Renaissance?: Navigating Travel Behavior, Technology, and Business Model Shifts in a Brave New World. *Journal of Public Transportation*, 21 (1): 67-81. DOI: https://doi.org/10.5038/2375-0901.21.1.8

Shaheen, S. & Cohen, A. (2018b). Shared Mobility Policy Briefs: Definitions, Impacts, and Recommendations. Report Number UC-ITS-RR-2017-11. University of California, Berkeley, https://doi.org/10.7922/G27S7KX6

Šumak, B., Polancic, G., & Hericko, M. (2010). An empirical study of virtual learning environment adoption using UTAUT. In *Mobile, Hybrid, and On-Line Learning, 2010. ELML'10. Second International Conference on Mobile, Hybrid, and Online Learning.* IEEE, 17-22

Taylor, J. E., & Martin, P. L. (2001). Human capital: Migration and rural population change. *Handbook of agricultural economics*, *1*, 457-511. ISBN: 978-0-444-50728-0

Velaga, N.R.; Beecroft, M.; Nelson, J.D.; Corsar, D. & Edwards, P. (2012). Transport poverty meets the digital divide: accessibility and connectivity in rural communities. *Journal of Transport Geography* 21, 102-112, https://doi.org/10.1016/j.jtrangeo.2011.12.005

Venkatesh, V.; Morris, M.G.; Davis, G.B. & Davis, F.D. (2003). User Acceptance of Information Technology: Towards a unified view. *MIS Quarterly*, 27 (3), 425-478

Venkatesh, V.; Thong, J. and Xu, X. (2016). Unified theory of acceptance and use of technology: A synthesis and the road ahead. *Journal of the Association for Information Systems* 17(5), pp.328–376. DOI: 10.17705/1jais.00428

Verkehrsgesellschaft Teltow-Fläming mbH (2016). *RufBus R 755*. Retrieved from: http://www.vtf-online.de/vbb_rufbus755.pdf [08.03.2017]

Wang, C., Quddus, M., Enoch, M., Ryley, T., & Davison, L. (2015). Exploring the propensity to travel by demand responsive transport in the rural area of Lincolnshire in England. *Case Studies on Transport Policy*, *3*(2), 129-136.

Wolf, A., & Seebauer, S. (2014). Technology adoption of electric bicycles: A survey among early adopters. *Transportation Research Part A: Policy and Practice*, 69, 196–211. https://doi.org/10.1016/j.tra.2014.08.007

Wong, K. T., Teo, T., & Russo, S. (2013). Interactive whiteboard acceptance: Applicability of the UTAUT model to student teachers. *The Asia-Pacific Education Researcher*, 22(1), 1-10. https://doi.org/10.1007/s40299-012-0001-9

Wu, Y. L., Tao, Y. H., & Yang, P. C. (2007). Using UTAUT to explore the behavior of 3G mobile communication users. In *Industrial Engineering and Engineering Management, 2007 IEEE International Conference on Industrial Engineering and Engineering Management, 2nd – 5th December 2007*, Singapore, 199-203

Yim, Y. B & Ceder, A. (2006). Smart Feeder/Shuttle Bus Service: Consumer Research and Design. *Journal of Public Transportation*, 9 (1), 97-121. DOI: http://doi.org/10.5038/2375-0901.9.1.5