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Comparing Technology Acceptance for Electric Vehicles – A Comparative Study in Turkey and Germany

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Abstract

Climate change, environmental concerns, scarcity of resources and dependence on energy cause the automotive industries to do sustainable developments. İn this regard, the adoption of new energy vehicles is key to environmental problems. The objective of this study is twofold, to understand consumer's intentions regarding electric vehicles (EV) adoption and secondly to compare these results for developing and industrialized/ developed "Western" countries, Turkey, and Germany. An empirical study was carried out with 557 potential consumers in Turkey and 513 in Germany and structural equation analysis was performed with AMOS. An integrated model based on Theory of Planned Behavior (TPB) and the Technology Acceptance Model (TAM) is applied as the research framework. The paper confirms the underlying assumptions of TAM in the context of EV. Perceived usefulness (PU) and perceived ease of use (PEOU) positively influence the behavioral intention to use EVs. TAM constructs were found to be statistically significant. The results showed that participants' technology acceptance attitudes differed by country. Behavioral usage intentions of participants living in Germany are higher than those in Turkey. Based on the empirical results, the formulation of marketing strategies to promote EV and suggestions for future research are discussed.

Key words: Electric Vehicles Adoption, Technology Acceptance Model; Structural Equation Modelling, Cross-market Comparison

JEL Code: M19, M31, O10

1. Introduction

Due to the ongoing climate change and the dependence on limited oil reserves, it is increasingly important to switch to alternative forms of propulsion (Zhang et al, 2018). Electromobility has been a key technology of the future

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nationally and internationally for years (Park et al., 2018, Sovacool, 2019). These vehicles are fully or partially electrically powered and help to reduce local emissions, consume less primary energy and thus have a climate-friendly effect (de Rubens, 2019).

Despite the numerous environmental benefits, such as clean air, quiet mobility, independence from fossil fuels and greenhouse gas, there is disillusionment in the demand for EV due to acceptance barriers from technical, policies, economic, charging infrastructure, and social aspects (Egbue and Long, 2012, Adhikari et al. 2020, Schwartz and Kolz, 2018, Kumar and Kolz, 2018, Melton et al., 2017, Chen et al., 2017, Ensslen et al., 2019, Sierzchula et al., 2014. The total number of electric vehicles sold is globally still small- except Norway with greater than 5% EV market share (IEA, 2018). In addition, these factors differ from country to country and between cultures (Spencer et al., 2015, Wang et al., 2017), but some are common globally (e.g. purchase cost of EV and long charging times) (Adhikari et al. 2020, Bockarjova and Steg, 2014, Caperello and Kurani, 2012).

Resource reduction coupled with environmental change ensures that EV are becoming the worldwide development trend of the future automotive industry. It is therefore imperative to understand user acceptance and research its effects in different countries and their markets.

The extant literature covered various barriers, factors, and problems related to the adoption of EVs and considered country-specific requirements and policy decisions (Kumar and Alok, 2020, Rezvani, 2015). Studies from North America, China, UK and on European countries such as France or Norway can very often be found (Kumar and Alok, 2020, Rezvani et al., 2015, Bobeth and Matthies, 2016, Canals Casals et al., 2016, Biresselioglu et al., 2018) since these countries are well suited for the research of EV due to the high use of renewable energies in their power generation. However, based on literature review, there are comparatively few comparative country studies (Sierzchula et al., 2014, Lieven, 2015), that are based on the dynamics of diffusion and point to regional differences. The current study attempted to overcome these gaps. However, this is particularly relevant as developers are forced to acquire knowledge of consumer behavior. A better understanding of customer buying behavior will, in turn, enable companies to improve consumer practices and provide opportunities to increase sales. For research, this study offers empirical support for the relationships between social influence and attitudes towards electric vehicles, as well as between attitudes and purchase intentions. Thus, this study also enriches the TAM by applying the social factors to EV acceptance contexts about their importance.

The primary objective of this study was to examine the factors affecting behavioral intention against EV on potential consumers. For this, research on the acceptance of a new product (that is EV) in different cultures within the framework of the TAM has been revealed.

This study focuses on private EV and consider EVs as electrified vehicles with rechargeable batteries and do not include plug-in hybrid electric vehicle (HEV), as they are mainly fuel-efficient and do not require a drastic change in behavior by consumers (She et al., 2017).

2. Theoretical background and hypothesis

2.1 Technology Acceptance Model

The Technology Acceptance Model (TAM) is the most widely used and accepted model that studies the adoption of innovation and explains many variances in customer behavior in the technological context by establishing key variables: perceived usefulness (PU), perceived ease of use (PEOU) and behavioral intention (BI) as a self-prediction of behavior (Hernández et al., 2010, Kim et al., 2016, Venkatesch, 2000, Davis, 1989). It is assumed that behavioral intention uses intentions significantly influence actual use (Davis, 1989). These classical elements of TKM constitute the core of the research model. In addition, in this study, TAM is extended by social norm and image in order to investigate the attitudinal effect on behavioral intention to use EV. Social norm and image was considered in TAM 2 (Venkatesch and Davis, 2000) and TAM 3 (Venkatesch et al., 2003) with social norm being the direct determinant of perceived usefulness and behavioral intent.

2.2 Model Construction and Research Hypothesis

2.2.1 Perceived Usefulness, Perceived Ease of Use and Behavioral Intention to Use towards EV

PU is the degree to which an individual is convinced that the use of an EV is beneficial and generate significant value (She et al., 2017). PEOU describes the physical or mental exertion that is thought to be necessary for the operation of EV; in simple terms, it is the degree to which a person believes technology is easy to use (Veríssimo, 2016). Both, PU and PEOU have a positive effect on behavioral intention to use (Chin and Todd, 1005). Several studies have confirmed these significant effects for variety of technologies (Smith et al., 2013). Therefore, following three hypotheses are proposed as follows:

Hypothesis 1 (H1). The Perceived Usefulness regarding EV has a positive influence on the Behavioral Intention to Use.

Hypothesis 2 (H2). The Perceived Ease of Use regarding EV has a positive influence on Perceived Usefulness.

Hypothesis 3 (H3). The Perceived Ease of Use regarding EV has a positive influence on the Behavioral Intention to Use.

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2.2.2 Subjective Norm

Social influences can play an important role in the adaptation of new technologies (Dudenhöffer, 2013). Since the TAM does not cover this influence, the TAM have extended by the construct subjective norm and combined with the TPB. Subjective norm (SN) describes positive or negative perceived evaluations/opinions from the external society or a reference group that a person receives when they adopt a certain behavior, and explains the perceived social pressure (Ajzen, 1991). Studies have found evidence that the factor also impacts the Behavioral Intention to Use EV significantly (Schepers and M. Wetzels, 2007, Peters et al., 2011). According to TAM 2 (Venkatesch, 2000), SN is a determinant of the PU. Consequently, if the social value of a product is appreciated, the PU of the product increases. Therefore, following hypotheses are proposed as follows:

Hypothesis 4 (H4). Social norm regarding EV has a positive influence on the Behavioral Intention to Use.

Hypothesis 5 (H5). Social norm has a positive influence on Perceived Usefulness of EV.

2.2.3 Image

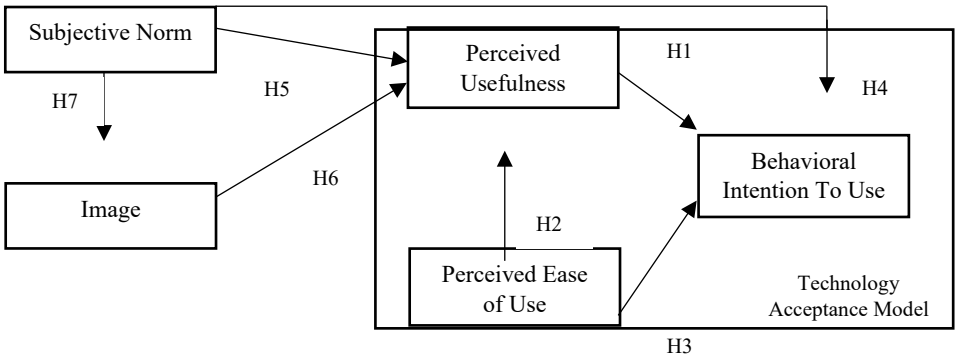
According to TAM 2 and TAM 3 Image refers to the extent to which potential users can improve their personal status by using an innovation within a social system (Grewal et al., 2004). Thus, the following hypothesis is suggested:

Hypothesis 6 (H6). Image has a positive influence on Perceived Usefulness of EV.

Hypothesis 7 (H7). Subjective Norm has a positive influence on Image of EV.

Figure 1 summarized model and hypothesis developed as follows:

Figure 1. Research model and hypotheses



3. Scale Development and Data Validation

3.1 Scale Development

The main purpose of the survey is to reveal research on the acceptance of innovative product / EV in different cultures within the framework of the TAM. Standard TAM items used in this study were obtained from previous studies and two screening questions have been developed by the authors. The testified scale consists of 22 questions is divided into four parts according to their different purposes: (i) level of knowledge of respondents about EV and their use, (ii) tendencies towards innovation and the effects of their social environment, (iii) thoughts and concerns about innovation, (iv) demographic and economic characteristics of respondents). In summary, apart from the two filter questions, the scales used in this study were taken from the existing literature, which ensured the validity and reliability of the measurement. All constructs were measured on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The survey was translated from English into Turkish and German by native or bilingual speakers. Before the survey, a pretest was conducted to ensure conceptual equivalence of terms. The measurement items and relevant articles are provided in Table 1.

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Table 1. Measurement items

Construct	Item Number		Item	Reference / Adapted from
Behavioral Intention To Use (BI)	**2**	BI_01	1. Assuming I needed a second car, I would use EV.	Davis 1989; Davis et al. 1989; **Venkatesh and Davis (2000)**
		BI_02	2. Assuming there are enough charging stations in Turkey/Germany, I would intend to use EV.	
Perceived Usefulness (PU)	**4**	PU_01	3. EV is useful because it makes you independent of oil (petrol / diesel).	Davis 1989; Davis et al. 1989; Chéron, Zins 1997; Ewing, Sarigōllū 1998; Gould, Golob 1998; **Venkatesh and Davis (2000)**; Heffner et al. 2007; Caulfield et al. 2010
		PU_02	4. EV is useful because it helps protect the environment.	
		PU_03	5. The advantages of using EV will outweigh the disadvantages.	
		PU_04	6. EV is useful because it supports technological progress.	
Perceived Ease if Use (PEOU)	**3**	PEOU_01	7. Using EV is easy.	Davis (1989); **Venkatesh and Davis (2000)**
		PEOU_02	8. Driving an EV is easy to learn.	
		PEOU_03	9. The process of charging EV is easy to learn.	
Subjective Norm (SN)	**2**	SN_01	10. My social environment (family, friends, neighbors, colleagues) thinks that I should use EV.	Fishbein and Ajzen 1980; Ajzen 1991; **Venkatesh and Davis (2000)**; Venkatesh et al. (2003)
		SN_02	11. My social circle would be happy if I would use EV.	
Image (IM)	**3**	IM_01	12. Using EV would have a positive impact on my reputation in my community.	**Tornatzky and Klein (1982);** Venkatesh and Davis (2000); Venkatesh and Bala (2008)
		IM_02	13. People who use EV enjoy a higher reputation.	
		IM_03	14. EV is to be seen as a status symbol.	

3.2 Sample and Data Collection

The target population of this study are consumers in Turkey and Germany who follow EV-related social media groups and forums. In research terms, Turkey was selected for this study because its customers are currently in the development and adoption stages of EV. Germany is viewed as a role model and the results are compared at the end of the study. The empirical data of the study were obtained via convenience sampling from June 2019 to December 2019 through an internet-based online survey. With the help of Google Forms, an access address was created for the survey and published in automotive-related forums, personal contacts, and social media accounts of the researcher. Out of 1193 questionnaires received (TR n = 650 and D n = 543), 1070 were included. To ensure the sample is appropriate for this study, we specifically targeted those who had knowledge about EV. The survey includes a filter question in the form of "Do you know about electric cars?". If this filter question was answered in the negative, the survey was ended immediately, and the respondents were eliminated from the sample. Only respondents who had knowledge about EV were qualified to participate in this study. After selection process 557 surveys were considered for Turkey and 513 surveys for Germany. Afterwards, reliability analysis was applied to the obtained data. To analyze the collected data in terms of consumer acceptance of EV, the software SPSS 23.0 and Amos 20.0 were used as statistical data analysis tools to create a structural equation model.

4. Results

4.1 Sample descriptive statistics

Demographic characteristics

The resulting sample of N = 1070 respondents contains 82 % men in Turkey and 90,6% in Germany. Most of the participants in Germany are within the age group of 41-50 years old (n=284, 55%), married (n=385, 75%), have acquired high academic degree (n=214, 41%), are working in full-time jobs and earn within the income group of <6000 per month (n=396, 77%). In 2021 the average monthly income per month is 2825 TL. The majority of the Turkish participants, like the Germans, are mostly male (n = 457, 82%), rather younger than the German participants between 21-30 years old (n = 254, 45%), married (n = 291 , 52%), have a high school qualification (n = 356, 63%) and work as civil servants within the income group of < 6 000 TL.

Consumers' knowledge about EV

While most of the participants in Turkey (60.3%, n = 392) stated that they had a bit knowledge about EV, 81.5% (n = 418) of the participants in Germany stated that they had detailed information about EV. The survey ended for those

participants who answered not when asked about their level of knowledge about EV. In this sense, the level of knowledge in Germany is higher. While in Turkey 14.3% n = 93 people state that they have no information, in Germany this figure is between 5.5% and only 30 people.

Table 2. Consumers' knowledge and usage of EV in Turkey and Germany

Item	Choice	Turkey		Germany	
		n	(%)	n	(%)
Do you know about EV?	Yes, I have detailed knowledge.	165	25,4	418	**77**
	Yes, I have a bit knowledge.	392	**60,3**	95	17,5
	No, I have no knowledge.	93	14,3	30	5,5
Sample		650	100	543	100
		n	(%)	n	(%)
Have you used EV?	Yes	79	14,2	361	**70,4**
	No	478	**85,8**	152	29,6
Sample		557	100	513	100

In terms of EV' usage status of the participants, most of the participants (85.8%) do not use EV in Turkey. In Germany, the majority (70.4%) used or has used EV. The results shown in Table 2.

4.2 Measurement Model / Reliability and validity analysis

The measurement model was evaluated by using the Cronbach's α coefficient to check the internal consistency among the items. The limit value of Cronbach's α in the reliability analysis is above 0.70 [39]. Cronbach Alpha values for the overall scale of the respective factors are between 0,759 and 0,856 which indicates a very strong consistency between the items.

The Kaiser-Meyer-Olkin (KMO) statistics, which can test the partial correlations between variables, and the spherical hypothesis test according to Bartlett are used for the validity analysis. The closer the KMO value is to 1, the more suitable it is for factor analysis. The Bartlett test is used to test whether each variable is independent. The results are shown in Table 3. The values of the KMO statistics are > 0.7 and thus the data are suitable for factor analysis. In addition, the F-value of the Bartlett ball test is 0.000, which means that the data have good construct validity and are suitable for the following factor analysis.

With factor analysis, the original variables are integrated into fewer factors and the analysis effort is significantly reduced. The factorial loads are determined using the principal component analysis. The Varimax rotation is used for the interaction process, whereby the criterion is that the eigenvalue should be > 1 and the factorial loads must have values above 0.5 (Hair et al., 2014). The results of the factor analysis are shown in Table 3.

Table 3. Results of reliability and validity analysis

Construct	Mean	Factor Loading	Explained Variance	Cronbach's Alpha	KMO	Item Total Correlation
Behavioral Intention To Use (BI)						
BI_01	4,16	,768	%12	0,759	0,500	0,609
BI_02	4,28	,818				0,554
Perceived Usefulness (PU)						
PU_01	4,33	,818	%20	0,856	0,816	0,629
PU_02	4,31	,823				0,619
PU_03	4,11	,666				0,641
PU_04	4,33	,732				0,654
Perceived Ease of Use (PEOU)						
PEOU_01	4,22	,752	%16	0,767	0,682	0,546
PEOU_02	4,47	,823				0,466
PEOU_03	4,41	,769				0,429
Subjective Norm (SN)						
SN_01	2,90	,843	%12	0,806	0,500	0,567
SN_02	3,47	,812				0,617
Image (IM)						
IM_01	3,33	,746	%16	0,847	0,659	0,616
IM_02	3,03	,864				0,614
IM_03	2,75	,873				0,497
Total Explained Variance			%76			

Correlation analysis was tested to know the correlations and the strength among variables in the construct of the model. The value of the correlation coefficient (r) is considered weak at 0.10 to 0.29, medium at 0.30 to 0.49 and strong at 0.5 to 1 (Hong et al, 2001).

Table 4. Convergent validity of latent variables/ AVE and correlations of the constructs.

Latent Variable	Mean	S.E.	CR	AVE	BI	PU	PEOU	SN	IM
BI	4,21	2,14	0,76	0,62	1				
PU	4,27	3,69	0,86	0,6	0,632**	1			
PEOU	4,36	2,39	0,77	0,53	0,446**	0,494**	1		
SN	3,18	2,31	0,81	0,68	0,415**	0,467**	0,350**	1	
IM	**4,3**	**3,45**	**0,86**	**0,68**	**0,311****	**0,387****	**0,278****	0,523**	1

** The coefficient significant at $p >$ 0.01 level (2-tailed). *Correlation is significant at the 0.05 level (2-tailed)

The correlation coefficient should be less than 0.8 to avoid multicollinearity. The result shows the highest correlation value as 0.632. Since this value is less than 0.80, there is no multicollinearity in this study. The dimensions in the model are therefore positively correlated with each other (Table 4). Convergent validity of scale items was estimated by reliability, composite reliability and average variance extracted (Fornell and Larcker, 1981). The composite reliabilities loadings for all scale items exceeded the minimum loading criterion of 0.70, and the average variance- extracted values were all above the threshold value of 0.50 (Hair et al., 2014). The conditions for convergent validity were met.

4.3 Structural model estimation and hypotheses testing

Based on the results of the factor analysis, a structural equation model (SEM) was created with the AMOS 21.0 software to test the fit between research model and collected data. The maximum likelihood estimation method was used for SEM estimation. The usage intention component is the dependent variable. The latent variables are the named 5 factors that were obtained from the factor analysis. The structural equations and the estimated structural parameters of the causal model are shown in Figure 2. The following values are used as criteria in this study: chi-square test, $\chi 2$ / df <5; the comparative fit index RMSEA <= 0.05; the comparative fit index CFI> = 0.95; GFI > = 0.90; and the standardized root mean square residual, SRMR <= 0.10 [43], [44] [40]. The indicators of the model adaptation are as follows: $\chi 2$ / df = 4,671; RMSEA = 0.059; CFI = 0.966; GFI= 0.958; SRMR = 0.0384, thus the proposed model has a good fit, all model fit values exceeded their acceptance levels and fits well with the collected sample data.

Figure 2 showed the results of path coefficients and variance explained (R2 values) for each depended on variable of the proposed model. All seven hypotheses were supported by the data, path coefficients are statistically significant and hence all hypotheses are accepted. Three endogenous variables were tested in the model. PU, PEOU and SN significantly impact BI, supporting H1, H3 and H4. These 3 constructs explained 58% of the variance in behavioral intention, with standardized coefficients of 0.6, 0.2 and 0.12. Among all of the key influencing factors, the expected benefit (PU) has the greatest weight, which is also proven by numerous research papers: [29], [45]–[48], [49], [50][51]. PU increases the perceived benefits of EVs, whereas PEOU reduces the perceived cost of EVs. EV are new to consumers; PEOU reduces the cognitive and effort resources required from individuals to learn and use an innovation which minimizes users' cost of using EVs. Consequently, users' perceived value of EVs increases. In other words, the difference decreases between perceived benefits and costs and motivates users' behavioral intention to use EVs. The finding also concurs with previous research that PU had a stronger impact on behavioral intention than PEOU [52], [53]. In addition, PEOU positively influences PU (β=0.48, $p < 0.001$). The results implied that if users consider EVs are easy to use, they will also discover EVs' usefulness. PU was found to be significantly determined by all two exogenous variables and PEOU: SN (β=0.35, $p < 0.001$), IM (β=0.19, $p < 0.001$) and PEOU (β=0.48, p <

0.001). Therefore, hypotheses H2, H5 and H6 were supported. The above variables explained 39% of variance in PU, respectively with standardized coefficients of 0.35, 0.48 and 0.19.

Figure 2. Structural equation model of EV acceptance / Path test of the research model

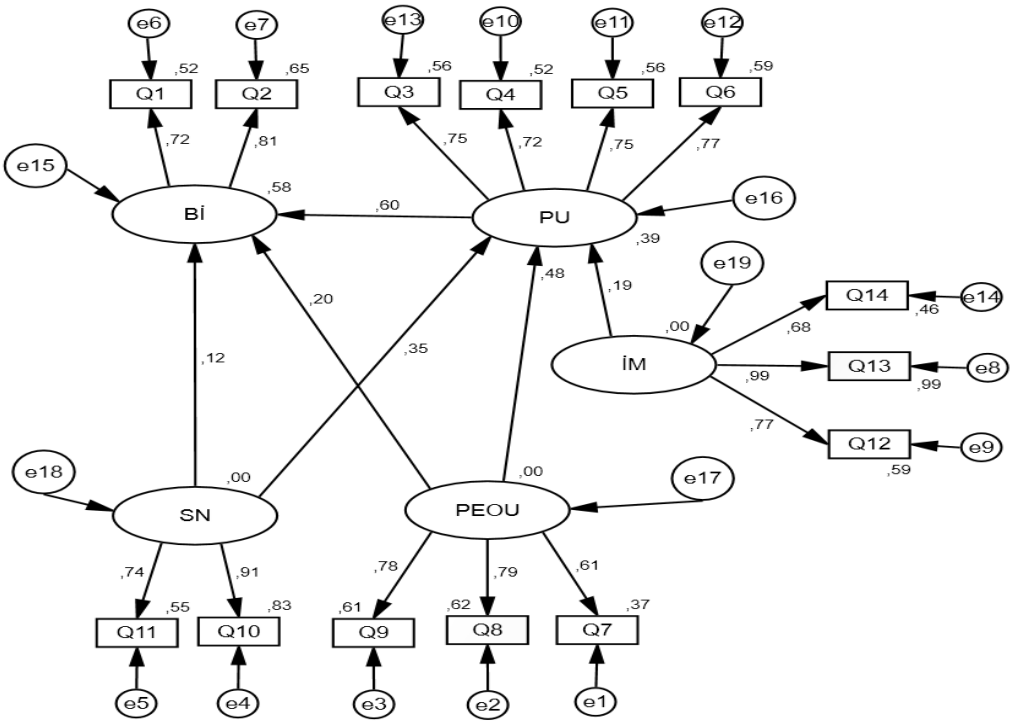

Image has positive effects on PU with standardized estimated effects of 0.19. Hence, H6 were supported. The results show that the correspondence between EVs and the current technical and social environment of the individual, the benefits of EVs and the simple explanation of their processes improve the PU. Especially social items as expected feedback from the reference groups for EV, influence of the environment on EV will influence the customer interest on EV. Indeed, the results shows that PU has direct positive effect on customers' behavioral intention to use EV, which is in line with current studies (Lee et al., 2011, Yuen et al., 2021, Suki and Suki, 2011, Davis, 1989). Hypotheses testing results and significant relationships between variables is shown in Table 5.

Table 5. Hypotheses testing results

Hypotheses	Path	Standard Estimates	Standard Error	Critical Ratio	p	Hypotheses Testing Result
H1	PU => BI	0,774	0,041	14,04	***	Supported
H2	PEOU=> PU	0,607	0,025	11,825	***	Supported
H3	PEOU=> BI	0,594	0,025	11,23	***	Supported
H4	SN=> BI	0,523	0,041	11,573	***	Supported
H5	SN=> PU	0,563	0,041	12,822	***	Supported
H6	IM=> PU	0,461	0,042	11,729	***	Supported
H7	SN=>IM	0,617	0,054	14,845	***	Supported

Note: *** p < 0,001, BI= Behavioral Intention to Use, PU=Perceived Usefulness, PEOU=Perceived Ease of Use, SN= Subjective Norm, IM= Image

4.4 The Acceptance of EV on Different Countries

The differences in the technology acceptance attitudes of the participants according to the country they live in were analyzed by independent t-test.

Table 6. Independent Sample T-Test Results for Determining the Variation of TAM by Country

	Country	N	$\bar{X}$	S.E.	t	sd	p
BI	TR	557	8,27	2,03	-2,44	1068	**0,015***
	GE	513	8,59	2,24			
PU	TR	557	17,36	3,46	2,55	1068	**0,011***
	GE	513	16,78	3,92			
PEOU	TR	557	12,72	2,59	-5,41	1068	**0,000***
	GE	513	13,50	2,07			
SN	TR	557	6,85	2,14	7,21	1068	**0,000***
	GE	513	5,85	2,39			
IM	TR	557	9,71	3,67	6,012	1068	**0,000***
	GE	513	8,46	3,07			

As shown in Table 6, behavioral intention to use EV differ according to the country of residence. It was found to be statistically significant at the 95% confidence level (t= -2.44; p=0.152; p<0.05). The behavioral intentions of potential consumer living in Germany ($\bar{X}$ = 8.59) are higher than those of Turkey ($\bar{X}$ = 8.27). The other constructs can be interpreted similarly.

5. Discussion

5.1 Research Findings

In this paper, the current acceptance of a new innovative product (that is, EV) in different cultures (Turkey and Germany) and their most important influencing factors were analyzed in order to offer automobile manufacturers decision-making aids and recommendations for the development of relevant policies and marketing strategies with relation to future consumers' choices and purchases. Based on in-depth literature research, the research model of the acceptance of EV was determined. The questionnaire was collected from 1070 potential consumers of EV in Turkey and Germany. The quality of the research model was validated and fully confirmed both on the measurement model and on the structural model level. The research results were obtained with the data analysis methods of factor analysis and the structural equation model. Afterwards the feasible proposals were made based on the research results.

According to the SEM analysis results, the paper confirms the underlying basic assumptions of the TAM by Davis [55] in the context of EV and emphasizes the significant influence of social norms and individual experiences on technology acceptance.

- First, PU, PEOU and SN positively influence the behavioral intention to use EVs. Indeed, PU and PEOU were found to be significant precursor of the behavioral intention to use EV. Specifically, PU is the most influential, followed by PEOU and subjective norm, which indicates that potential users' expected utility of EV has the greatest impact on behavioral intent.

- Second, Using the established TAM as a theoretical framework, it has been suggested that critical external variables consisting of two individual differences have a significant impact on the intention to use an EV via the perceived benefit. Hence, both individual differences as Subjective norm and image constructs are important determinants of PU of EV.

- Third, country-specific differences between Turkey and Germany regarding the technological acceptance of EV were examined using the independent Sample T-Test. Technology acceptance attitudes of the participants differ according to the country they live in. Behavioral usage intentions and PEOU for EV of participants living in Germany are higher than those in Turkey. PU and individual attitudes as SN and IM for EV of participants living in Turkey are higher than participants in Germany.

The general behavioral intention to use EV, which, in addition to the PU and the PEOU, represents the essential construct of the TAM, has a very high explanatory value with a degree of certainty of 0.58. This is well above that of comparable studies. The research model developed based on the TAM to investigate the acceptance of electromobility can thus be viewed as fully confirmed.

This is particularly interesting since the TAM on which the present work is based has so far primarily been applied in the field of information and communication technologies and the investigation of the technology of electromobility represents a considerable novelty in the field of TAM research. In addition to the modeling of the general behavioral intention to use an EV, the content and method of existing TAM investigations were expanded. The results of the present research work show that the TAM (after adapting the corresponding construct operationalizations) can also be used very well for the investigation of other technologies.

5.2. Managerial Implications

The results of this study have implications for the development trend for the automobile industry of EV in the future. Considering the millions of dollars that have been invested in e-mobility world- wide, it is of paramount importance to ensure that consumers will use them. To achieve this goal, attention must be placed in communicating relevant knowledge clear and simple including user-friendly terminology and remove uncertainties. At the same time, manufacturers of EV should keep in mind that, attractive measures must be taken to meet consumer needs to promote EV popularization in the future.

1. The evaluation of the research model provides numerous information about the characteristics of (potential) users. Both the social environment (construct of the subjective norm) as well as the external impact that (potential) users of EV hope (image) have a positive influence on the assessment of EV. The acceptance of electromobility (in the sense of the general behavioral intention to use an EV) therefore depends to a certain extent on external perception, which is shaped by media reports, expert opinions and the social environment such as colleagues and circle of acquaintances. The study found that these influences appear to be particularly important for the participants surveyed in Turkey, whereby the expected PEOU when using an EV plays a greater role for the participants in Germany. Furthermore, potential users recognize the possibility of signaling certain traits by using EV, such as the consideration of the environment, the use as a status symbol or simply the will to stand out from the crowd and to attract attention. This knowledge is of high practical relevance, as it implies the fact that the actors involved (e.g. automobile manufacturers) can do their part to position EV accordingly - especially with regard to the communication of the properties and the benefits of EV. For example, advertising campaigns or media reports can actively influence the public perception of this new technology, which in turn has a positive effect on acceptance behavior. In addition, in comparison to conventional vehicles, differentiating features can be displayed and the possible existing disadvantages (purchase price, uncertainties regarding charging infrastructure, etc.) can be compensated. In addition to communicating these properties, broad-based field tests and road shows are conceivable here, which give potential users the opportunity to experience electromobility and thus convince themselves directly of its positive properties.

2. According to the results of the study, the PU for Turkish participants has a positive effect on the acceptance of EV. This suggests that better education of the broad masses about technological details and the resulting increased technological knowledge about the special features of EV will lead to increased acceptance behavior. In contrast, the respondents in Germany consider the PEOU to be particularly important when it comes to the acceptance of EV. It describes the amount of physical or mental exertion a person needs to use a particular system. The easier electric vehicles are to operate, the more people are willing to use them and, consequently, the higher the acceptance of EV. This is an important aspect, especially in connection with the need to charge EV, as this is one of the main differences to conventional vehicles. Here, communicating relevant technological knowledge regarding the special features of electric vehicles (e.g. battery charging cycles, optimal temperature range for operating vehicle batteries) plays an important role as well. This knowledge can also be used by automobile manufacturers to develop suitable marketing strategies and thus remove psychological barriers for potential users.

In summary, automobile manufacturers and mobility providers can use the above-described findings in their marketing strategy as well as for products and services related to e-mobility across countries.

5.3. Limitations

The actual usage behavior has not been included in the proposed model. However, this is not a serious limitation, as the causal relationship between intention and behavior has been empirically proven (Venkatesh and Davis, 2000, Taylor and Todd, 1995, Venkatesh et al. 2000).

5.4. Future Research Directions

Against the background of the application of the TAM to a new technology outside the classic application area of information and communication technologies, it is desirable to confirm the model proposed here by further empirical validation. The aspect of experience with electromobility could also be integrated here.

Further cross-border data collection could help to deepen these country-specific differences in the acceptance of electric mobility. In practice, it is quite conceivable that country-specific differences in acceptance behavior can be identified, about differences in the forms of state subsidy programs to support electromobility (purchase incentive systems, programs to set up a charging infrastructure, etc.). In this context, an attempt could also be made to measure the success of the state support programs, some of which are very different in shape, through the different effects on acceptance behavior. Since electromobility is currently still in a very early phase of diffusion, a renewed validation of the research model at a later point in time could check to what extent the significance of the path connections from the current development stage of the technology of electromobility may change with increasing market penetration of EV.

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