AN APPLICATION OF UTAUT2 MODEL IN EXPLORING THE IMPACT OF QUALITY OF TECHNOLOGY ON MOBILE INTERNET

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ABSTRACT

The purpose of this paper is to explore the adoption of mobile Internet in a developing country. This paper presents an application of the Extended Unified Theory of Acceptance and Use of Technology (UTAUT2) model. The model was adapted with a construct Quality of Technology (QT) represented by four variables. The aim of this study was to find out what impact QT has on the use of mobile Internet moderated by Gender, Age and Experience. The research was conducted in two phases: a pilot study and a quantitative survey. The pilot study aimed to test the validity and reliability of the questionnaire. The sample for the pilot study consisted of 80 respondents. The sample of 562 respondents was used for the quantitative survey. The Structural Equation Model (SEM) that includes confirmatory factor analysis, path analysis, partial least squares analysis and modelling latent variables was used for the analysis. The results confirmed that QT has a significant impact on the use of mobile Internet. The analysis showed that older users are more sensitive to the use of mobile Internet. Furthermore, the research confirmed that gender does not have a significant impact on the relation between QT and the use of mobile Internet. The impact of QT on the use of mobile Internet is higher for more experienced users. This paper confirmed that the adapted UTAUT2 model extended with QT can be used for exploring the adoption of mobile Internet in a country in transition. It recommends the application of this extended model in other developing countries with the purpose of testing its relevance. The research will fill a gap in the theory of user acceptance of technology due to the fact that UTAUT2 has not been applied in Bosnia and Herzegovina and that the models of user acceptance of technology have not so far treated QT.

Keywords: UTAUT2, mobile Internet, quality of technology

JEL classification: M30, M39, O33

1. INTRODUCTION

Mobile Internet is an enormously important technology which impacts various industries. Mobile Internet has experienced a significant development giving rise to business organizations, social communities, and individuals. According to the report by McKinsey & Company (McKinsey Global Institute 2013), mobile Internet is included in one of the 12 technologies that have shaken the world. The fast development of mobile Internet provokes researchers to explore conditions under which mobile Internet is adopted and used (Venkatesh & Davis 2000, p. 187). Mobile Internet was launched at the beginning of this century. Because of its incomparably smaller use in developing countries than in developed countries, it is a subject in many studies in the area of user acceptance of technology.

The number of mobile Internet users was supposed to exceed the number of fixed Internet users, regardless of the fact that fixed Internet is a far older technology used since the early 1970s. With respect to the data on the regional use of mobile Internet for 2014 (International Telecommunication Unit 2014), it is noted that mobile Internet penetration is greatest in Western Europe and America, amounting to around 78%, while Africa is the only region where the penetration is below 20%. The average mobile Internet penetration in developed countries is at the level of 87%,

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while in the developing countries it is at the level of 39%. The report also points to the possibility that the countries with poor mobile infrastructure have lower penetration level as it supposes that quality of technology has some impact on the use of mobile Internet. In Bosnia and Herzegovina (BiH), the telecommunication market and mobile Internet presence are not even close to the level of development in European or American countries. Undoubtedly, the potentials of such a potent market are not nearly as utilized as in the countries of the region, which is even less than in the developed world. According to the latest report by the national Regulatory Agency (Regulatorna agencija za komunikacije 2015), approximately 95% of the population in BiH constitutes the base of mobile telephony users. However, only 26% of the population uses mobile Internet, which is far below the European average or even the average for developing countries.

The basis for the research includes theories of technology adoption discovering factors that affect mobile service users' acceptance or non-acceptance of mobile Internet as a technological innovation. The Extended and Unified Theory of Acceptance and Use of Technology (UTAUT2) (Venkatesh, Thong & Xu 2012, p. 158) was used as the reference model modified by variables which describe users' perception of quality of mobile Internet. The key topics presented in the paper include technological innovation, mobile Internet as an information and communication innovation, theories and models describing the process of technology acceptance by users with the focus on the UTAUT2 model and its application in different contexts, and the significance of QT and its effect on mobile Internet acceptance.

The research aims to explore the impact of QT on the use of mobile Internet in BiH and proposes the applicability of the extended UTAUT2 model with the QT variable in a developing country.

2. LITERATURE OVERVIEW

Mobile Internet is a technology innovation which constitutes a new way of Internet access in the area where people do not have the privilege of accessing the Internet in the traditional way, i.e. by wire or fixed access (Chigona et al. 2008). It represents a huge opportunity for the countries where vast areas are still not covered with wired infrastructure to network citizens in a more efficient way.

Innovation is present in all business segments, although it is most often associated with technological changes. Joseph Schumpeter (Godin 2008; 2013) introduced the concept of innovation in economic research. He (1934) considered an innovation as the cause of specific economic changes, and technological innovation as a source for faster execution of business processes. According to Schumpeter, innovation can be a new product (Cooper 1979, p. 93; Klenischmidt & Cooper 1991, p. 241), a new production process, new markets, new production of raw materials or a new organizational structure, which provided some contributions to the value which is reflected in the profit to the seller or increased utility (Adams et al. 1992, p. 237) to the consumer. Schumpeter (1934) observed that significant advantages in economies caused by technological innovations often lead to the so-called creative destruction, which affects profits, industry restructuring and changing existing technologies.

The success of innovation as a new technology depends on the speed at which users accept and use technology. Acceptance of the technology is in the literature defined as the first use of technology by the user. Acceptance of the technology is often a crucial factor for researchers who explore users' behaviour during implementation of information systems in order to determine the success or failure of technological innovations (Davis 1986, p. 230; Davis 1993, p. 476; Davis & Venkatesh 2004, p. 32).

Studies dealing with consumers' intention to purchase and use services, goods or technology belong to the area of user behaviour research. In the age of extremely fast changes, the survival or growth of a company depends on the knowledge of user behaviour. Many users are not aware of external effects that spur them to make a decision on accepting, using or purchasing a product, service or technology. According to Kesić (1999, p. 170) there are two groups of factors which undergo user behaviour: cognitive (recognizing) and social (effective, active, which implies adopting a view, behavioural intention and a given behaviour). Those activities are directly involved in decision-making processes for purchasing a product/service.

Mobile Internet as a mobile technology can be viewed in the context of adoption of technology and could be explored using some of the known adoption theories. The basic concept of acceptance of information technologies by individuals is presented in Figure 2.1.

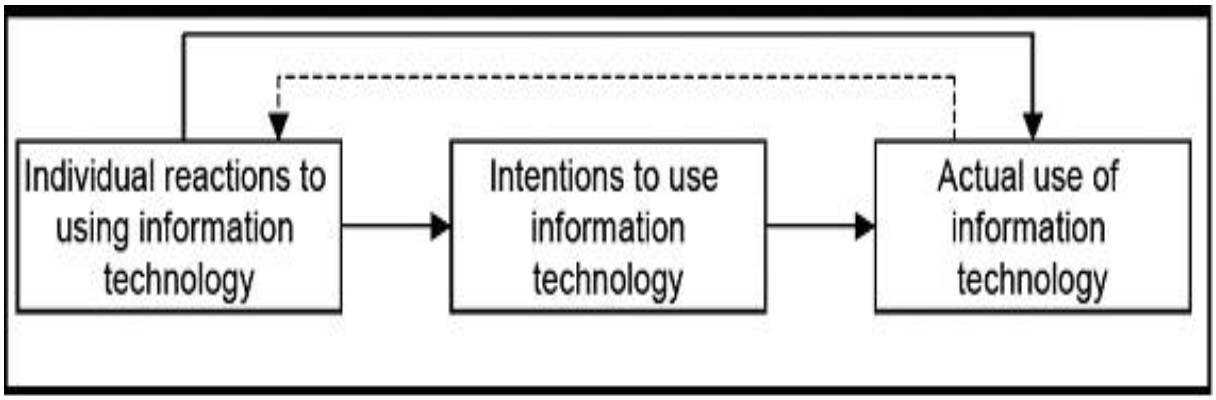

Figure 2.1: The basic concept underlying user acceptance model

Reaction of the individual to the use of information technology affects the formation of its behavioural intention to accept technology which encourages its active application later (Venkatesh et al. 2003, p. 426). The basic theories applied on explaining the acceptance and use of technologies include Diffusion of Innovations (Rogers 1995, p. 10), Theory of Reasoned Action (Ajzen & Fishbein 1980, p. 10), Technology Acceptance Model (Davis 1989, p. 321), Extended the Technology Acceptance Model (Venkatech & Davis 2000, p. 187), Unified Theory of Acceptance and Use of Technology (Venkatesh et al. 2003, p. 426), Extended Unified Theory of Acceptance and Use of Technology (Venkatesh et al. 2012, p. 158). The QT factor has not been examined in the mentioned models so far.

The modified UTAUT2 model was applied in this research. The modification consists of the introduction of the QT variable. The basic assumption was that QT has a significant impact on the use of mobile Internet. Besides QT, UTAUT2 deals with seven independent constructs: Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), Facilitating Conditions (FC), Hedonic Motivation (HM), Price Value (PV) and Habit (HT) and two dependent variables: Behavioural Intention to Use (BI) and Use of Technology (UB). The conceptual research model is a modified UTAUT2 model adapted due to the conditions of a developing country. The new construct QT essentially implies the users' perception of the technical quality of mobile Internet. The concept 'technical quality of mobile Internet' (Lu et al.2008, p.53) reflects infrastructure unreliability (Unyolo 2012, p. 2) which allows access to mobile Internet. The research used the variables according to Jeon (2008, p. 49), who showed that users create the perception of mobile Internet quality based on the following

factors: Speed of access, Connection stability, Reachability and Response time. According to Cullen's report (Cullen International 2014), which includes the analysis of the conditions on broadband development in 15 countries, acceptance of the Internet is closely related to infrastructure development. Particular goals set in national broadband plans in some countries include covering the areas that pertain to mobile Internet accessibility. These are the goals that pertain to the development or improvement of mobile infrastructure.

The available studies prove that there is a correlation between infrastructure development, acceptance and use of mobile Internet. Actually, huge capital resources (money, knowledge, time) are spent on the development and sustainability of any innovation, and if they fail in any way it inevitably affects a lower productivity and lower standard of living (James, Dan & Ray 1983, p. 281). The necessary prerequisites for using possibilities offered by mobile Internet include a high-quality mobile Internet and mobile device (Chae & Kim 2003, p. 241; Koh et al. 2011, p. 22).

The quality of mobile Internet is described by several variables such as speed of accessing content, signal coverage, connection stability and speed response which are correlated to the level of infrastructure development and quality of infrastructure (Feng et al. 2011, p. 374; Jeon 2008, p. 50; Ahmed & Qazi 2011, p. 4). If the mobile infrastructure is modestly developed, it is assumed that the lower quality of mobile Internet has a negative impact on the Behavioural intention to Use and the Use of mobile Internet.

The analysis of quality in the Internet context was also dealt with by Jayawardhena (2004, p. 186), who viewed the Internet as a service, rather than technology; he therefore adjusted the original SERVQUAL scale and developed 21 elements that can measure the quality of e-banking. After an exploratory and confirmatory factor analysis, the 21 elements were grouped into five quality dimensions: access, website, trust, attention and credibility. Although the mentioned research pertains to e-banking, where it is stated that access is especially important for quality of the Internet, it can be claimed that access should be a particularly important factor concerning mobile Internet, since Internet access is achieved wirelessly or in motion. The acceptance of mobile Internet in developing countries often encounters insurmountable barriers. Most often these include a lack of national infrastructure (Odedra et al. 1993, p. 26), capital resources or government policies that have not provided prerequisites for the so-called technology transfer, i.e. displacement of the old technology by the new one (Goodman & Green 1992, p. 22). With respect to technology acceptance, Mahler and Rogers (2000, p. 720) determined that there is a correlation between the innovation's attributes and characteristics of the network needed for using the innovation. They claimed that the existence of a difference in the process of technology acceptance can be explained by the very differences between network effects of the two technologies, which they demonstrated on the example of mobile and fixed telecommunication services.

3. METHODOLOGY

The proposed model includes ten constructs and three moderating variables, each of which was taken over from existing studies to ensure the content validity. The conceptual research model is a modified UTAUT2 model adapted due to the conditions of a country in transition with the variable QT. The conceptual model used in the paper derives from the analysis of the available literature. It is based on UTAUT2 (Venkatesh et al. 2012, p. 158). The independent variables include PE, EE, SI, FC, PV, HT taken from the basic UTAUT2 model, HM, and QT, while the dependent variables include BI and UB, also taken from the basic UTAUT2 model. BI is a degree to which an individual plans to implement (or not) future behaviour. The moderating variables discussed include all the three demographic variables of Venkatesh's model: Age, Experience and Gender. The items for PE, EE, SI, FC, HT, HM and PV were adopted from Venkatesh (Venkatesh et al.

2012, p. 159). The items for HM were modified because it was assumed that HM does not have a merely hedonistic character. Items for QT were constructed to fit four features which describe users' perception of quality of mobile Internet. The measurement scales for the constructs PE, EE, SI, FC, HM, PV, HT, BI and UB were drawn and adapted from Venkatesh et al. (2012, p. 161), while QT was constructed by the authors. All items were measured with five point Likert scales, ranging from "strongly disagree" to "strongly agree" opinion. After the questionnaire was constructed, a pilot test of 80 participants with mobile Internet usage experience of a minimum of three months was conducted to further test the validity and reliability of the instruments. Cronbach's alpha coefficient as well as the kurtosis and the curvature coefficient are located in the target range for all variables and it was concluded that the questionnaire was acceptable for further research.

The objective of the empirical research was to test applicability of the adapted UTAUT2 model by applying SEM using LISREL software solutions. The method of SEM has become the dominant method for testing existing theories of social sciences, particularly in research related to information systems and technologies (Freeze & Raschke 2007, p. 1482; Polites et al. 2012, p. 23) and marketing (Hair et al. 2011, p. 140; Hair et al. 2012, p. 415). SEM includes confirmatory factor analysis (CFA), path analysis, partial least squares analysis and modelling latent variables. CFA was conducted to examine construct reliability and validity. The loading factors, Cronbach's Alpha, Average Variance Extracted (AVE) and Composite Reliability (CR) were calculated. The QT variable was checked by applying moderator analyses. The moderating effects of the categorical variables Experience, Age and Gender were used for analysing the differences of the respective groups. Primary data were collected using a snowball method in order to get a convenience sample. Participants were mobile users with a minimum of three months of experience in using mobile Internet.

4. RESEARCH FINDINGS

The sample for the quantitative survey had a total of 562 respondents. The following table shows the demographic data of the respondents.

Table 3.1: Sample demographics

Items	Frequency (N=562)	Percent %
Gender		
M	359	63.9
F	203	36.1
Marital status		
Single	266	47.3
Married	296	52.7
Profession		
Employed in the public sector	85	15.1
Entrepreneur	22	3.9
Student	90	16.0
Unemployed	149	26.5
Employed in a private company	184	32.7
Pensioner	16	2.8
Other	16	2.8
Experience in using mobile Internet (months)		
< 6	225	40.0
6 – 12	149	26.5
12 – 18	125	22.2
18 – 24	47	8.4
24+	16	2.8
Age		
10-18		17.1
18-25	228	40.6
25-35	135	24.0
35-45	47	8.4
45-55	28	5.0
55-65	19	1.6
65+	19	3.4
Education		
Primary school	25	4.4
High school	160	28.5
Undergraduate degree (BA, BSc)	297	52.8
Masters Degree	68	12.1
Doctoral Degree (PhD, ...)	12	1.8

The final data were analysed using a two-step approach as analysis procedure of SEM which estimates the measurement model and the structural model separately (Anderson and Gerbing 1988, p. 411). To test the normality of a given data set, the values of skewness and kurtosis were calculated. All the counted values are within the acceptable range of the interval of ± 2.

The descriptive statistics data as well AVE, CR and Cronbach's Alpha values are presented in Table 3.2.

Table 3.2: Descriptive statistics data, AVE, CR and Cronbach's Alpha

Variables	Construct	Total Indicators	Mean	Standard Deviation	AVE	CR	Cronbach`s Alpha
IV1	PE	3	4,24	1,065	0,764733	0,905462	0,909
IV2	EE	4	4,56	0,884	0,689525	0,897074	0,913
IV3	SI	3	3,82	1,121	0,902567	0,965264	0,911
IV4	FC	4	4,39	1,068	0,69895	0,90151	0,9107
IV5	HM	4	3,95	1,005	0,69975	0,902805	0,909
IV6	PV	3	3,36	1,219	0,756967	0,903318	0,911
IV7	HT	3	3,65	1,000	0,7387	0,893907	0,910
IV8	QM	5	3,77	1,055	0,5484	0,858415	0,913
DV1	BI	3	3,77	0,937	0,5727	0,80078	0,9105
DV2	UB	2	3,78	0,955	0,54085	0,701773	0,911

**IV independent variable*
***DV dependent variable*

The estimation of the measurement model includes a reliability test and a validity test. According to the reliability test, all variables of the measurement model are acceptable because the values of Cronbach's alpha for the predictors and dependent variables of the sample are close to 1.00. The values of Cronbach's alpha for the QT indicators are between 0.905 and 0.913. The loading factors and CR values are greater than 0.7, thus it could be concluded that the reliability of the measurement model was achieved. To further assess the discriminant validity, it was compared the each construct's square root of the AVE and its correlation coefficients with other constructs. As shown in Table 3.3., the values on the diagonal, that represent square roots of the AVE, are larger than their corresponding correlation coefficients, suggesting the adequate discriminant validity (Fornell & Larcker 1981, p. 39).

The results in Table 3.3. indicate a greater number of statistically significant positive correlations. Greater positive correlations were obtained within relations between UB and PE, than between UB and HM, and between UB and HT. The variable BI has significant positive correlations with factors PE, HM and HT. In the correlation matrix it is evident that there are no negative correlations, beyond what was predicted in the conceptual model. No statistically significant correlation was measured between some variables, such as correlation between PE and PV, between PE and EE, and between PE and QT. It is also evident that UB has a low positive correlation with FC and PV. BI has lower positive correlations with SI and PV.

Table 3.3. Correlation matrix

	PE	EE	SI	FC	HM	PV	HT	QM	BI	UB
PE	**0,874**									
EE	0,451	**0,83**								
SI	0,441	0,305	**0,95**							
FC	0,417	0,319	0,479	**0,836**						
HM	0,568	0,522	0,442	0,279	**0,836**					
PV	0,277	0,18	0,346	0,512	0,416	**0,87**				
HT	0,562	0,218	0,248	0,374	0,583	0,453	**0,859**			
QM	0,243	0,299	0,214	0,319	0,388	0,622	0,274	**0,74**		
BI	0,736	0,524	0,454	0,419	0,834	0,364	0,678	0,544	**0,756**	
UB	0,711	0,584	0,527	0,399	0,761	0,408	0,751	0,517	0,539	**0,735**

To test the structural model, the fit of the internal structure of the proposed model was first verified. The value of indices calculated on the model with the collected primary data, as well as relations between variables of this conceptual model, for a ten-factor model amounts to ($\chi 2/df = 3.703$), and is smaller than the recommended value of $\chi 2/df \leq 5$, which indicates that the data are appropriate, i.e. that the model is set up in an appropriate manner. The standardized root mean square residual (RMSEA) equals 0.10, which indicates that the degree of model's fit is within limits of acceptability. The goodness-of-fit index (GFI = 0.877), as well as indices that pertain to the overall amount of explained variance range between values of 0 and 1 (CFI = 0.808, NFI = 0.879), and the fit is better if the values are closer to 1, which is the case in our research.

The objective of quantitative research was to check the significance of QT to use of mobile Internet and to check the impact of moderating variables on the behaviour of users of mobile Internet. In order to understand the proposed model, a regression analysis was conducted. The conceptual model has two constructs which were assumed to have some effect on the UB. Those two constructs are: QT and HM. Theirs effects to UB were tested moderating relations with Experience, Age and Gender. The results are showed in the tables 3.4., 3.5. and 3.6.

Table 3.4: Effects of QT to UB moderated by Experience

UB	**Predicted variable QT Experience as the moderator**	**< 6**	**6 – 12**
		$\Delta R^2 = 0.081$*	$\Delta R^2 = 0.096$*
		12 – 28	**18 – 24**
		$\Delta R^2 = 0.078$*	$\Delta R^2 = 0.091$*
		24+	
		$R^2 = 0.075$*	

**indicates that the value has been changed*

Table 3.5: Effects of QT to UB moderated by Age

UB	**Predicted variable QT Age as the moderator**	**10-18**	**18-25**
		$\Delta R^2 = 0.047$*	$\Delta R^2 = 0.051$*
		25-35	**35-45**
		$\Delta R^2 = 0.059$*	$\Delta R^2 = 0.075$*
		45-55	**55-65**
		$\Delta R^2 = 0.067$*	$\Delta R^2 = 0.055$*
		65 +	
		$\Delta R^2 = 0.052$*	

**indicates that the value has been changed*

The analysis showed that the respondents, who have more experience and who are older, have greater sensitivity to the use of mobile Internet. The level of explained variance using mobile Internet increases with greater experience and greater age.

Table 3.6: Effects of QT to UB moderated by Gender

		Male			Female		
		B	t – Value	P – Value	B	t – Value	P - Value
UB	Predicted variable QT Gender as the moderator	0.279	6.310	0.000	0.278	6.300	0.000

**indicates that the value has been changed*

In this study, it was also confirmed that Gender has no significant impact as a moderator variable in the relationship between the QT as predictor variables and the use of the mobile Internet as the dependent variable.

Through this research it was also verified that there were no empirical differences in the use of mobile Internet, depending on the intentions of using mobile Internet as predictor variables with moderation of experiences. The results are showed in Table 3.7.

Table 3.7: Effects of BI to UB moderated by Experience

UB	Predicted variable QT Experience as the moderator	< 6	6 – 12
		R^2 = 0.07*	R^2 = 0.021*
		12 – 18	18 – 24
		R^2 = 0.027*	R^2 =0.105*
		24+	
		R^2 =0.160	

**indicates that the value has been changed*

The results showed that the impact of QT to UB has been increased with Experience as the moderated variable. The analysis showed that those respondents who have more experience in using the Internet are more sensitive to QT by usage of mobile Internet. The level of explained variance of the use of mobile Internet increases with greater Experience.

5. DISCUSSION AND CONCLUSIONS

The research examined the factors that influence the adoption of mobile Internet by using a modified UTAUT2 model as a referent model which has been extended by QT represented through four indicators. The model also considered three moderated variables: Experience, Age and Gender. The demographic profile of respondents showed that the sample was apposite. The deficiency could be a disproportionate ratio of males compared to women respondents.

The empirical analysis using SEM confirmed the applicability of such a model adapted to the social and economic environment in a country in transition where penetration of mobile Internet is at a lower level than in developed countries in the world.

The CFA confirmed that the model was set up in the appropriate way. The measurement model could confirm that constructs have no issues in terms of reliability and construct validity. All the obtained values of goodness-of-fit index indicate that the ten-factor adjusted UTAUT2 model fits data to a satisfactory degree. The analysis showed that there are no negative correlations between the variables and that all the assumed variables affect BI and UB.

The result of the structural modelling revealed that almost all predictor variables are statistically significant and that they significantly affect UB and BI. There were no problems with multicollinearity between the predictor variables in the models. It was established that the moderator variables do affect relation between QT and UB.

To conclude, QT is particularly important for developing countries in which the level of the use of mobile Internet is lower than in developed countries. The significance of QT for the adoption of mobile Internet in developing countries was confirmed by the study and it complements the existing literature. However, the present study comes with limitations that point to opportunities for further research. Even though the size sample of this study was large enough and apposite for testing structural model, larger samples would be beneficial to additionally investigate the differences in adoption of mobile Internet in other countries. Also the model could be extended with additional moderating variables such education or income. Other researchers may find it challenging to reach compatible results in other countries and with

other technologies. Finally, operators have been provided with empirical evidence that they can use in the decision-making process in order to provide a faster penetration of mobile Internet by knowing what to concentrate their business efforts on. Considering that similar research of user behaviour in terms of the adoption of mobile Internet has not been conducted in this region so far, this study certainly fills the gap in the existing body of literature and provides a scientific contribution to the applicability of the UTAUT2 model.

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