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MODELLING THE ADOPTION OF MOBILE PAYMENT SYSTEM FOR PRIMARY AND SECONDARY SCHOOL STUDENT EXAMINATION FEES IN DEVELOPING COUNTRIES: TANZANIAN EXPERIENCE

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Abstract

This paper examines the Use of Mobile Phones for Examination Fees Payment among Primary and Secondary School Students. The paper analyses whether there are factors affecting the use of mobile payment systems for examination fee payment. The rationale of this study is based on the fact that most scholars claim that while number of mobile phones ownership, access and usage in primary and secondary school students increases, there is decrease of who opt mobile examination fee payment method. From the perspective of primary and secondary school exam candidates in Tanzania, this paper used Structural Equation modelling technique to examine whether the mobile payment systems technology acceptance level is affected by factors affecting the mobile phone uses. The study identified three significant factors: performance expectancy, social influences and trust.

Keywords: Mobile Payment System, Technology Acceptance Model, Structural Equation Modelling, Information Systems, Tanzania major cities.

INTRODCUTION

Mobile payments, also known as m-payments, may be defined as any payment where a mobile device is used to initiate, authorize and confirm an exchange of currency in return for goods and services (Tobbin and Kuwornu 2011, Shin 2010). Mobile devices include mobile phones, PDAs, wireless tablets and other devices that can connect to mobile telecommunication networks. Mobile payments can be an alternative to cash, checks, credit cards and debit cards, and can make possible new opportunities for commerce convenience (Shin 2010).

As Penicaud (2013) states that there are more mobile money accounts than bank accounts, mobile payment systems are receiving increasing attention in Tanzanian major cities. It has become an important alternative payment method as compared to traditional cash based transaction. Among the services available to the users of mobile money include money transfers between individuals, mobile payments (for airtime, bill payments and salary transfer), and mobile banking. Mobile banking includes services like bank account balance inquiry, deposit money from mobile account to bank account and withdraw from bank account to mobile account. It is reported that, the top three used services are mobile airtime top-up, money transfer between individuals and electricity bill payments (Ericsson ConsumerLab 2012, InterMedia 2013).

Tanzania has a potential to expand the adoption of mobile money services given the rate of access to mobile phones. More than 61% of Tanzanians own or have access to mobile phones (TCRA 2013, InterMedia 2013). The trend of mobile phone subscribers show that, in the year 2005 there were 2,963,737 which later raised to 27,450,789 in the year 2012 (TCRA 2013). At least 35% of households in Tanzania have at least one mobile money user (InterMedia 2013). The rate of mobile money usage in urban areas and banked households is highest (InterMedia, 2013). This increase is improved due to

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a wider range of services and goods that can be paid by mobile money are offered (Alexandre et al. 2012).

However, according to National Examination Council of Tanzania (NECTA) database, in year 2012, there were 2,976 candidates who opted mobile payment method, out of 92,007 registered candidates (NECTA 2012). The number of mobile payment users increased to 3,298 in 2013 out of 82,747 registered candidates (NECTA 2013). There was an increase of mobile payment users from 2,976 to 3,298 candidates only. This indicates that, the rate of adoption of mobile payment system is not adequate. The NECTA database further reveals that, mobile payment adopters for applicants in major cities have decreased from 1,353 in 2012 to 371 in 2013 despite the overall increase of users (NECTA 2012, 2013). Major cities residents are known for their high rate of adopting new technologies as compared to their counterpart rural and small townships. However, this has not been the case in adoption of mobile payment system in Tanzania major cities.

Seems there is little or no previous research on the adoption of mobile payment and in particular examination fee payment in Tanzania. The well-known models and theories for technology acceptance have yielded inconsistent results as to their core determinants of technology adoption (Omwasa 2012 p. 4). Therefore, in order to promote adoption and usage of mobile payment, it is important and necessary to model the behavioural intention to use mobile payment in Tanzanian culture.

This study aims to identify, understand and model factors that affect the behavioural intention to use mobile payment system in Tanzanian major cities. With focus on assessing the adoption of mobile payment system for paying examination fees, the paper intents to answer the following questions:

- What are the key factors affecting the behavioural intention to use Mobile Payment Systems for paying national examination fees in Tanzania Major cities
- How factors affecting adoption of mobile payment for paying examination fee in Tanzania major cities modelled

LITERATURE REVIEW

MOBILE PAYMENTS AND MOBILE COMMERCE ADOPTION

E-commerce, mobile banking and mobile payments systems have similar characteristics. They all involve cashless transaction between two parties. While e-commerce applications can also be accessed from mobile devices, mobile banking and mobile payments systems are more close together as they are always accessed through mobile devices. To understand issues related to mobile payments adoption, it is important to consider the similar technologies as well.

Several studies have been conducted on adoption of e-commerce and internet banking using different theoretical models. Examples include the application of TAM in mobile banking (Lule et al. 2012), integration of trust and TAM in online shopping (Gefen et al. 2003) and application of TAM in banking information system acceptance (Reid and Levy 2008). These studies demonstrated how various factors have contributed to the adoption of respective technology.

Some of the studies that specifically investigated the adoption of mobile payments adoptions are those done by Padashetty & Kishore (2013), and Shin (2010). Studies that were carried in Africa include Tobbin & Kuwornu (2011) and Vincent & Cull (2011).

Both TAM and UTAUT were used as models for investigating factors affecting the adoption of mobile payment services. The justification for use of the two was based on its suitability and relevance to the adoption of technology such as mobile payment services.

CONSTRUCTS

Since mobile payment systems involve money transfer between two parties, trust and perceived risk becomes important factors to consider. However, the original TAM and UTAUT did not include these two

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factors. These two important factors are reviewed in the subsequent sections.

TRUST CONSTRUCT

According to Bunduchi cited in Omwasa (2012 p. 56) "trust is a psychological expectation that a trusted party will not behave opportunistically". The nature of mobile payment interactions requires trust for successful transaction completion. A fundamental requirement must be that users ought to have absolute trust in the mobile payment system in which they participate.

Results from study carried out by Lee and Song (2013) shows trust to be direct antecedents of behavioural intention to use technology in the UTAUT model. Moreover, trust confirmed as an indirect antecedent through perceived risk, performance expectancy, and effort expectancy in the model. Shin (2010) confirms that there is a positive correlation between trust and intention to use technology in a TAM modified model that include some constructs from UTAUT. Other researchers who found significance importance of trust in adoption of mobile payment include McLeod et al.(2009), Summons (2009), Gefen et al. (2003), Omwasa (2012) and Tobbin & Kuwornu (2011).

It is therefore evident that, any adoption of mobile payment must consider trust as an important determinant of behavioural intention to use. Trust is fragile, its takes time to build but can be lost immediately.

PERCEIVED RISK CONSTRUCT

Perceived risk is another important construct that was left out in all original previous models reviewed earlier. In this context, perceived risk can be defined as perceived uncertainty of the outcome of using mobile payment system.

Different researchers have applied perceived risk differently in various models. Im et al (2008) confirm that, there was a significant difference in perceived risk across two technologies for both pre-use and post-use. It was further found that, perceived risk to be determined by trust. In his study, perceived risk was used as a moderating construct. In another study, it was confirmed that, perceived risk reduces significantly the individual intention to use information system using UTAUT model (Lee and Song 2013). Lee and Song (2013) study found also that there is a significant negative correlation between trust and perceived risk. Individual users tend to use a technology when they perceived risk is low.

THEORETICAL FRAMEWORK

In this section, first, evaluation of different competing theoretical models is discussed. Secondly a selection of one model that fit this study is selected. Thirdly, factors that are not included in selected models are discussed and finally a conceptual model is formulated.

Gumussoy and Calisir (2009) compared between TRA, TAM and an integrated model of TAM and TPB. While TAM is useful theoretical model for explaining user behaviour of information technology, it did not include social factors. On the other hand, TPB has social factors alone. An integrated mode was created to include both factors. The results of the comparison showed that, TAM could explain the behavioural intention to use information technology than TAM and the integrated behaviour.

A study comparing TAM and TRA confirmed that, TAM is parsimonious and easy to apply across different research settings (Davis, Bagozzi and Warshaw cited in Omwasa 2012). However, TAM does not include social influence which is an important determinant which is theorized in TRA and TPB (Omwasa 2012).

TAM and TPB were compared to find that, both explained very well intention to use technology (Mathieson cited in Omwasa 2012 p. 42). This study reveals that, the information derived by TPB was more useful during system development than information provided by TAM. However, TAM was easier to use and provided quicker and cheaper method of collecting information, which is consistent with what Davis, Bagozzi and Warshaw cited in Omwasa (2012 p.43) findings.

Plouffe et al cited in Venkatesh (2003) compared TAM against IDT as a cross-sectional study. The results were that, variance in intention explained by

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TAM was 33% and IDT was 45%. In this case, IDT was found to be superior to TAM.

Venkatesh et al (2003) compared eight competing models and finally formed the UTAUT. The models involved in the settings were TPB, TAM, TRA, ITD, MM, combination of TPB and TAM (C-TAM-TPB), MPCU and SCT. When the formed UTAUT was validated against the eight models, it was found that UTAUT outperformed the eight models. UTAUT is a combination of eight competing information technology acceptance models.

A meta-analysis of empirical review findings of various technology acceptance concluded that, there is an inconsistence in an inadequate use and inconsistency in the use of a theory (Taiwo and Downe 2013). However, the various studies where conducted in different technologies and in varying environments to give inconsistent results.

Assessing the various model comparison, it is noted that, the study carried out by Venkatesh et al (2003) is the only one which compared all the competing models at the same time. The formed UTAUT was validated against the other models and found to be superior. Moreover, the formation of UTAUT was based on the similar constructs that were used in the other models with similar roles. It is evident that, UTAUT is a preferred model for technology acceptance of the rest.

CONCEPTUAL FRAMEWORK

The fact that UTAUT constructs are adapted from several other competing models might be the reason for its superiority. Therefore, this study investigates factors affecting the intention to use mobile payment system in Tanzanian cities using a model based on UTAUT.

However the original UTAUT models do not include the perceived risk and trust constructs. Trust and perceived risk are two important constructs for any technology involving money transfer. This study is based on a proposed extension of UTAUT by combining the two new constructs perceived risk and trust to form a conceptual model shown in Figure 1.

HYPOTHESIS

This study proposes the adaptation of the UTAUT with some modification. Perceived risk and trust constructs are added while the actual use of the system construct is omitted. The following hypotheses are proposed for testing:

H1: Facilitating conditions has a positive effect on behavioural intention to use mobile payment system for examination fee payment

H2: Performance expectancy has a positive effect on behavioural intention to use mobile payment system for examination fee payment

H3: Effort expectancy has a positive effect on behavioural intention to use mobile payment system for examination fee payment

H4: Social influence has a positive effect on behavioural intention to use mobile payment system for examination fee payment.

H5: Trust has a positive effect on behavioural intention to use mobile payment for examination fee payment.

H6: Trust has a negative effect on perceived risk.

H7: Perceived risk has a negative effect on behavioural intention to use mobile payment system for examination fee payment.

International Journal of Information Technology and Business Management
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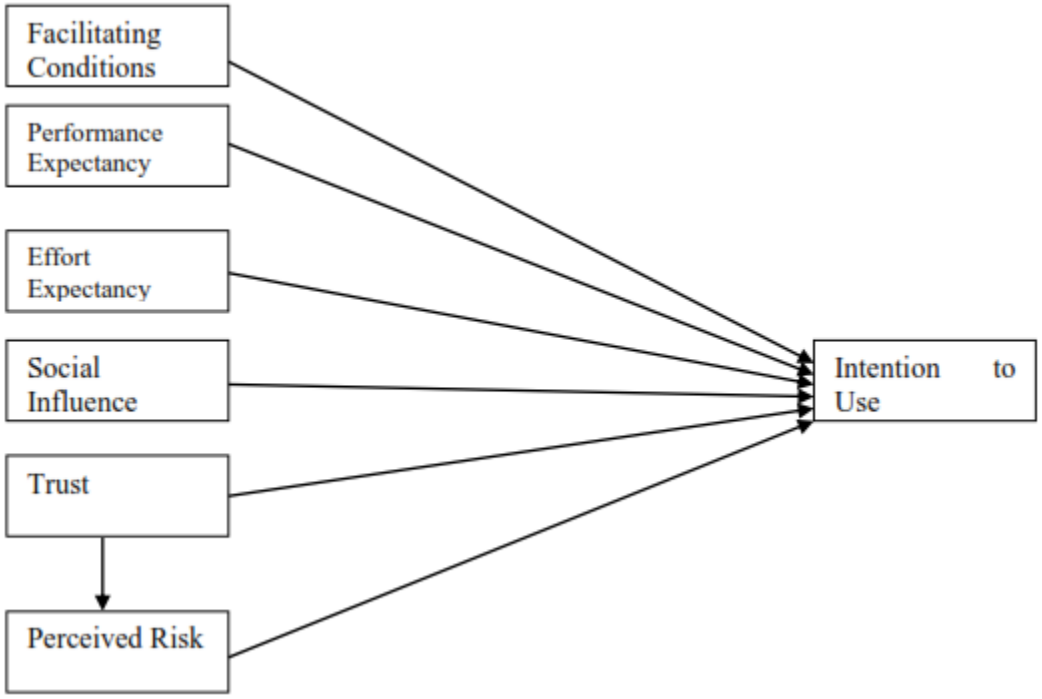

Figure 1: Conceptual Framework

RESEARCH METHODOLOGY

DATA COLLECTION STRATEGY

A survey method was adopted in this study, where by, a population sample was selected from major cities involving candidates intending to sit for primary and secondary school examinations. Data collection instrument involved Likert type items. Likert scale was used for two reasons; First it is a proven scale for measuring traits and secondly, Likert type items can be combined to Likert scale for quantitative analysis (Boone and Boone 2012).

Multi-stage cluster sampling technique was selected for this study. This calls for breaking down sampling frame into clusters in which random sampling is made to each cluster (Lunenburg 2008, Greener 2008). In this case, schools were sampled randomly within Dar es Salaam city and then in each school selected, candidates were randomly selected. The reason for using this sampling technique is to reduce cost and time for data collection.

A questionnaire for data collection was constructed such that, it had several items for each latent variable. The questionnaire was adapted from previous studies from Davis (Davis 1989) Venkatesh et al. (Venkatesh et al. 2003) and Omwasa (2012) with some wording modifications to fit the context of this study.

DATA ANALYSIS STRATEGY

Structural equation modeling was used to validate the model of MPS adoption. SEM was selected since it is superior to other methods such as multiple regressions. SEM has a collection of statistical techniques that allows a set of relationships between multiple dependent variables and multiple independent variables to be investigated simultaneously (Gefen et al. 2011, Omwasa 2012).

International Journal of Information Technology and Business Management
29th July 2014. Vol.27 No.1

ISSN 2304-0777 www.jitbm.com

Structural equation model (SEM) was used to analyze relationship between measured and latent variables as well as estimating and testing a theoretical relationship between variables affecting the behavioral intention to use MPS.

PLS-SEM was a SEM technique selected to investigate the MPS adoption model. PLS-SEM and CBSEM are two competing SEM techniques. Selection of any one of them depends on several situations. Gefen et al. (2011) suggests that, PLS-SEM should be selected when either there is a lack of strong theory base or formative scales are used in the research model. On the other hand, CBSEM technique is selected when bias in estimations are to be avoided or when the study in question is addressing confirmatory research objectives.

The MPS adoption model investigated in this study include formative model and hence PLS-SEM was a suitable SEM technique for this study. Software package for analysis selected was SmartPLS 2.0 M3. The reasons for this choice over other packages are:

i. SmartPLS is free as compared to other SEM packages such as Amos and LISREL.
ii. Although R is an open source SEM package, the learning curve for R is steeper than that of SmartPLS
iii. SmartPLS includes PLS-SEM technique required by this study.

The following procedure was followed in evaluating the model:

i. Collinearity among exogenous variables was evaluated. Each set of predictor constructs where examined separately for each subpart of the structural model for significant collinearity. Therefore, collinearity between FC, PE, EE, SI and TR was assessed.
ii. Next, significance and relevance of the structural model relationships was assessed. Assessment of coefficients sizes must be examined together with their significance.
iii. Level of R^2 is then assessed. The larger the value of R^2 the better the model explain the variance of a give construct.
iv. Effect size f^2 was then assessed. Effect size is the measure of the impact of a predictor construct on an endogenous construct. It measures the change of R^2 value when a given endogenous construct is removed from a model.
v. Predictive relevance Q^2 was finally assessed. The Q^2 is used to measure the predictive validity of a model.

FINDINGS

This research intended to study some of the key factors affecting the individual intention to use MPS in paying examination fee in major cities of Tanzania. These are facilitating conditions, performance expectancy, effort expectancy, social influence, trust and perceived risk.

To analyze the data, internal reliability of the data was first tested using SPSS 16.0. The Cronbach's alpha for the factors is as shown in table 4 below. Cronbach's alpha for all seven variables are greater than 0.7 (see Table 1) and therefore, the reliability of data is acceptable. However, item two for EE and three for PR were dropped to improve the reliability.

Factor	Facilitating Condition FC	Effort Expectancy EE	Performance Expectancy PE	Behavioural Intention BI	Social Influence SI	Trust TR	Perceived Risk PR
Cronbach's alpha	0.708	0.762	0.791	0.867	0.788	0.814	0.711

Table 1: Data Reliability

International Journal of Information Technology and Business Management
29th July 2014. Vol.27 No.1

ISSN 2304-0777 www.jitbm.com

DESCRIPTIVE STATISTICS

There were a total of 182 respondents composed of 96 males (52.7%) and 83 females (45.6%) as shown in Table 2.

Among the respondents, 11% were below age of 19, 74.2% were aged between 19 to 29 years. There were 12.1% who were older than 29 years. The Table 3 below summarizes the age distribution of the respondents.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		3	1.6	1.6	1.6
	Male	96	52.7	52.7	54.4
	Female	83	45.6	45.6	100.0
	Total	182	100.0	100.0	

Table 2: Gender Distribution of Respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	> 19	20	11.0	11.3	11.3
	19 - 29	135	74.2	76.3	87.6
	< 29	22	12.1	12.4	100.0
	Total	177	97.3	100.0	
Missing	System	5	2.7		
Total		182	100.0		

Table 3: Age Categories

STRUCTURAL EQUATION MODELLING

Structural equation modelling was run using SmartPLS 2.0 M3 to give results shown in Figure 2.

Assessment for collinearity, significance of constructs relationships, level of R^2, effect size of f^2 and predictive relevance Q^2 was carried out one at a time.

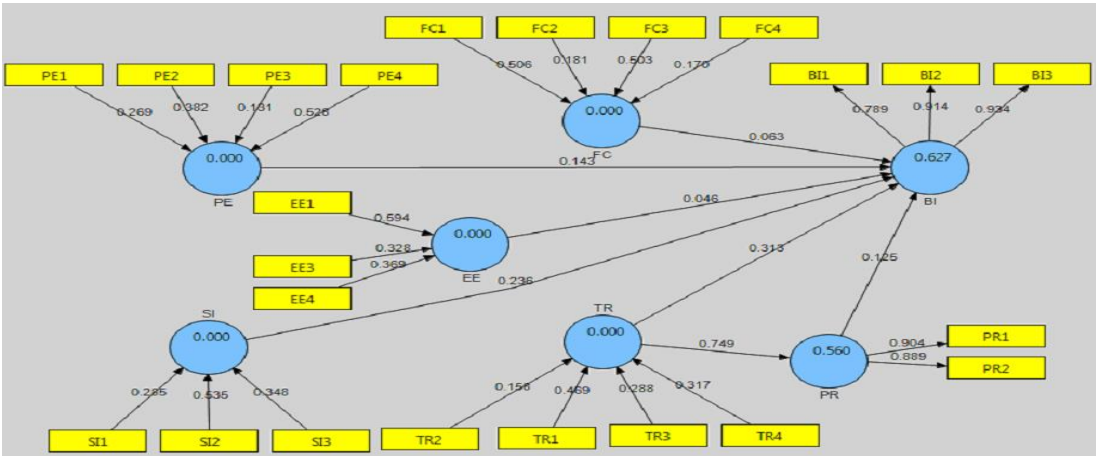

Figure 2: Model Estimation

International Journal of Information Technology and Business Management
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Step 1: Evaluating collinearity among exogenous constructs

The independent variables were assessed for collinearity. Collinearity measures correlations among independent variables. SmartPLS was used to run the model and produced latent variable scores. The scores were imported in SPSS and linear regression was performed to obtain variance inflation factors (VIF). All VIF were found clearly below the threshold 5 and therefore there is no collinearity between the variables as seen in Table 4 below. Therefore, there was no collinearity among the variables.

Step 2: Assess Significance and Relevance of the Structural Model Relationships

Using SmartPLS to run the hypothesized model, path coefficients and their significance were obtained as seen in the Table 5 below.

From the Table 5, Trust has the largest effect on behavioral intention (0.3131) followed by social influence (0.2361). Perceived risk and perceived effectiveness has little effect of 0.1253 and 0.1425 respectively. Facilitating condition has coefficient of 0.0629 on BI. Effort expectance effect on behavioral intention is least (0.0439).

Model		Unstandardized Coefficients		Standardized Coefficients		t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta				Tolerance	VIF
1	(Constant)	-2.196E-5	.046			.000	1.000		
	EE	.056	.078	.056		.727	.468	.359	2.788
	FC	.068	.068	.068		.988	.324	.461	2.170
	PE	.134	.076	.134		1.758	.080	.374	2.675
	SI	.263	.072	.263		3.683	.000	.422	2.371
	TR	.383	.079	.383		4.821	.000	.343	2.920

Table 4: Path Coefficients

Trust has a positive effect of 0.7485 on PR which is statistically significant since t statistic 15.3254 is clearly greater than 0.98. This result is contrary to expectations.

Examining the significance, the results show that, SI, PR and PE coefficients are statistically significant (T statistic > 0.98) using a one-tailed test at 95% confidence level. Path coefficients for EE and FC are not statistically significant as the t statistic value is less than 0.98 at 95% confidence level.

Path	Path coefficients	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics
EE -> BI	0.0459	0.0892	0.0892	0.5146
FC -> BI	0.0629	0.0726	0.0726	0.8664
PE -> BI	0.1425	0.0827	0.0827	1.7242
PR -> BI	0.1253	0.0878	0.0878	1.4272

International Journal of Information Technology and Business Management
29th July 2014. Vol.27 No.1

ISSN 2304-0777 www.jitbm.com

SI -> BI	0.2361	0.0718	0.0718	3.2858
TR -> BI	0.3131	0.0944	0.0944	3.3155
TR -> PR	0.7485	0.0488	0.0488	15.3254

Table 5: Significance and Relevance of Path Coefficients

Step 3: Assess the Level of R^2

R^2 values for both BI (0.6241) and PR (0.5799) are considered moderate as seen from results in table 7.

Step 4: Assessing Effect Size – f^2

The calculated f^2 value is 0.00266 which is smaller than 0.02 and hence the PR has no substantive impact on the R^2 value of BI.

The formula for calculating f^2 is given as:

$$f^2 = \frac{R^2_{included} - R^2_{excluded}}{1 - R^2_{included}}$$

Step 5: Assessment of Predictive Relevance Q^2

By running blindfolding for each endogenous factor, one at a time, it was found that Q^2 for BI and PR were 0.4484 and 0.3488 respectively. Both Q^2 values indicate large predictive relevance since they are larger than zero.

	AVE	Composite Reliability	R^2	Cronbach's Alpha	Communality	Redundancy
BI	0.7771	0.9123	0.6241	0.8538	0.7771	0.0455
EE					0.4443	
FC					0.4767	
PE					0.542	
PR	0.6561	0.8501	0.5799	0.7367	0.6561	0.3779
SI					0.7166	
TR					0.6274	

Table 6: Level of R^2

DISCUSSION

Data were analyzed to answer the two research questions addressed in this study. In answering those questions, the null hypotheses related to the research questions were statistically tested. In this section, the results of the analyses performed in relation to the research questions are discussed.

RESEARCH QUESTION ONE

The first research question was **"What are some of the key factors affecting the behavioral intention to use MPS for paying national examination fees in Tanzanian cities?"** After estimating model using SmartPLS, factors that had significant impact on intention to use MPS were trust, social influence, perceived risk and perceived effectiveness.

From Table 6, path coefficients for TR, SI, PR and PE coefficients are statistically significant (T statistic

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> 0.98) using a one-tailed test at 95% confidence level. Path coefficients for EE and FC are not statistically significant as the t statistic value is less than 0.98 at 95% confidence level.

Interestingly, it was found that, trust positively correlated to perceived risk contrary to expectations. Likewise, perceived risk positively correlated to intention to use MPS again contrary to expectations. The reasons for this could be the items used to measure risk were not clear enough to the respondents.

Effort expectancy was not significant probably the respondents had previous skills for using mobile payment system for payments of other services like electricity bills, television channels and similar services. Hypotheses H1, H3, H5, H6 and H7 were rejected while hypothesis H2 and H4, are accepted.

RESEARCH QUESTION TWO

The second research question was **"How factors affecting adoption of mobile payment for paying examination fee in Tanzanian cities modeled?"** Based on the test results of hypotheses H1 through H7, The model under study was able to explain the intention to use MPS by 62.7%. Although it is below 70% that was explained by Venkatesh et al. (2003) but higher than 59% explained by (McLeod et al. 2009). Therefore, this model has power to explain the intention to use MPS for fee payment in Tanzanian major cities.

From theoretical point of view, the MPS model provides a foundation for understanding the relationships of constructs determining the behavioural intention to use MPS in Tanzanian cities. The constructs were first appreciated in the deep literature review in a logical manner and then validated using PLS-SEM. This study therefore, contributes to the body of knowledge on technology acceptance by validating factors as well as extending UTAUT framework in the context of mobile payment system in Cities of developing countries.

From practical point of view, the study helped to answer question about what are some of the key factors affecting the individual intention to use mobile payment system and specifically for paying examination fee. Not only that the factors are now clear, but their relative significance has been established.

It is vital for management of network operators who deploy mobile money to align their business process while realizing the contribution of the factors that influence users' intention to use mobile payment system. Organizations that are planning to accept payments through mobile systems should also consider these factors before and after deployment for faster adoption of the system.

CONCLUSION

This research has established factors affecting the behavioural intention to use mobile payment system. It further developed the relationship among the factors using a modified UTAUT framework. Among the six factors (facilitating conditions, performance expectancy, effort expectancy, social influence, trust and perceived risk), two factors (facilitating conditions and effort expectancy) were found not significantly affecting the individual intention to use MPS. Moreover, the effects of trust and perceived risk on the intention to use MPS were contrary to expectations may be because the perceived risk items were not clear to the respondents.

This study was cross section. It is well understood that, the model of MPS adoption can well change over time. It is therefore recommended a longitudinal study to be carried out for an improved understanding of the factors affecting the individual intention to use MPS.

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