Gender and age differences in rural farmers' intention to use m-government services

Herman Eliawaha Mandari*

Faculty of Computing, Information Systems and Mathematics,
Computer Science Department,
The Institute of Finance Management,
Dar-es-Salaam, Tanzania
Email: mandari@ifm.ac.tz
*Corresponding author

Yee-Lee Chong

Faculty of Business and Finance,
Marketing Department,
Universiti Tunku Abdul Rahman,
Kampar, Perak, 31900, Malaysia
Email: chongyl@utar.edu.my

Abstract: The purpose of this study is to determine: (1) the direct effect of the innovation diffusion theory (IDT) constructs and government support on rural farmers' behavioural intention to use m-government service; and (2) how different categories of age and gender in Tanzania rural areas could moderate the effect generated by IDT constructs and government support on respondents' behavioural intention. Structural equation modelling (SEM) was employed to analyse 407 completed questionnaires. Relative advantage, ease-of-use, compatibility; and government support were found to be significant determinants of rural farmers' behavioural intention. Age and gender were found to moderate the effects of relative advantage and ease-of-use on behavioural intention while gender could moderate the effect of compatibility on behavioural intention partially. Tactical suggestions to policy makers are given. In general, different strategies and policies could be used to increase different cohorts' behavioural intention to use m-government service.

Keywords: m-government; innovation; moderation; government-support; Tanzania.

Reference to this paper should be made as follows: Mandari, H.E. and Chong, Y-L. (2018) 'Gender and age differences in rural farmers' intention to use m-government services', *Electronic Government, An International Journal*, Vol. 14, No. 3, pp.217–239.

Biographical notes: Herman Eliawaha Mandari is a PhD Scholar at the University Tunku Abdul Rahman in Malaysia. He obtained his Master's degree in Web Technology from Southampton University, UK (2008) and his Bachelor's degree in Science with Computer Science from the University of Dar-es-Salaam, Tanzania (2006). He has research interest in technology acceptance focus more on mobile government, mobile banking; web technology issues focusing more on accessibilities and web programming

technologies. He is currently working as an Assistant Lecturer in the Department of Computer Science, Faculty of Computing, Information Systems and Mathematics at the Institute of Finance Management, Tanzania.

Yee-Lee Chong graduated with a PhD in Tourism. She is the Deputy Director of Institute of Postgraduate Studies and Research from 1st January 2015 to 31st December 2017. She held various managerial positions for 13 years in non-academic industry before joining the University as a lecturer. Apart of publishing journal articles, she has been conducting workshop and taught research skills to new academic staff and postgraduate students in local and international universities. Her research interest fields include social science studies in tourism, ageing, and ICT context.

1 Introduction

The agriculture sector in developing countries is focusing more on subsistence farming rather than agribusiness which could provide more benefits (Waceke and Kimenju, 2004; Morton, 2007). The sector is highly dominated by peasants who lack usefully agricultural information which may guide them on various best agricultural practices (Siyao, 2012; Misaki et al., 2016)

As the sector is contributing a significant fraction of GDP in most of developing countries (Gollin, 2010), policy makers have been trying to disseminate more agricultural information related to best farming methods, metrological information, storage of agricultural products and agricultural markets and prices (Misaki et al., 2016) by using various distribution channels such as telecentres, radio, television, internet and mobile technologies (Mtega and Ronald, 2013). Such agricultural information is useful to help farmers to improve their farming practices which could increase their earnings. Despite such efforts, much of the agricultural information could not reach farmers located in rural areas (Misaki et al., 2016; Siyao, 2012).

Compared to other technology channels, mobile technology is relatively more effective and less expensive in rural areas (Mtega and Ronald, 2013). This is due to wider mobile network coverage and high rate of mobile devices ownership in rural areas (Jotischky and Nye, 2011). As a result, rural residents are using mobile devices for communication as the technology enables them to disseminate their message faster and at a cheaper cost. To capitalise on the development of mobile usage, Tanzania government has introduced mobile government services (termed as m-government) to provide agricultural information to rural farmers. With m-government rural farmers could access government farming information easily and in a cheap way (Ogunleye and Van Belle, 2014).

Despite the wide coverage of mobile network and increasing number of mobile users, Tanzania is facing a number of challenges in encouraging rural farmers to adopt m-government services. Several studies have been conducted and clearly pointed out that lack of inadequate government support and technological factors related to complexity, incompatibility, and less usefulness limit utilisation of technology including m-government services among the adopters (Yonazi, 2013; Dewa and Zlotnikova, 2014;

Kyem, 2016). Furthermore, several studies have found that most of the available channels used to disseminate information in Tanzania rural areas are more dominated by young male users (Mtega and Ronald, 2013; Siyao, 2012). In spite of the available literatures, empirical studies on the usage of m-government services in Tanzania context is very limited. Therefore, this study examines factors which could motivate rural farmers to use m-government services by using innovation diffusion theory (IDT). The study examines further the effects of social demographics on the determinants of m-government services so as to provide clear information to policy makers on the need of different strategies based on different groups of rural farmers.

2 Literature review

2.1 Mobile government services in Tanzania

Provision of standard and timely public services is the target of any government in serving citizens. In making sure that, they achieve this objective, various technologies have been used to disseminate public information and services. In developing countries like Tanzania, mobile government technology is a cost-effective tool to disseminate public information and services to rural residents (URT, 2015). This is because m-government does not require initial heavy fixed internet infrastructures to be operated (Abdelghaffar and Magdy, 2012). M-government uses mobile and wireless internet technologies to deliver public service and information. Therefore challenges associated with uses of e-government technology may easily be addressed through m-government technology (Abdelghaffar and Magdy, 2012).

Many studies have been carried out to address e-government issues in general that are currently facing Tanzania (Dewa and Zlotnikova, 2014; Kyem, 2016; Munyoka and Manzira, 2014; Oreku and Mtenzi, 2012; Yonazi, 2013). Most of these studies have concentrated on identifying problems and challenges which affects its adoption and acceptance. However, this is just one side of the coin, the other side which is on the willingness of adopters to adopt m-government has been less considered in the literature. This suggests that adoption could be difficult if policy makers and practitioners are not aware of different factors which could influence rural farmers' behavioural intention to adopt the said technology.

2.2 Innovation diffusion theory

The theory was developed by Rogers (1983) to address the adoption of agricultural technology in rural areas. Furthermore, IDT has been widely used by the past researchers to address the diffusion of innovation technology in various aspects such as internet banking, e-government and mobile banking (Gohary et al., 2010). Rogers (1995) defines diffusion as the process in which an innovation is communicated through certain channels over time among society members and rate of technology innovation adoption could be influenced by five main characteristics: relative advantage, complexity, compatibility, observability and trialability. Nevertheless, Rogers' IDT constructs were criticised as it is not easy for researchers to measure the IDT constructs (Moore and Benbasat, 1991). Therefore, Moore and Benbasat (1991) modified the original five IDT's constructs into seven constructs: relative advantage, ease-of-use, compatibility, image, result

demonstrability, visibility and trialability were re-developed and theorised to have direct and positive effects on information technology adoption (Moore and Benbasat, 1991).

Several studies have shown that there are similarities between some of IDT constructs and TAM constructs used to examine technology adoption (Gohary et al., 2010; Yi-Hsuan et al., 2011). The definitions of constructs of relative advantage and ease of use in IDT are quite similar to perceived usefulness and perceived ease of use in TAM respectively (Gohary et al., 2010; Yi-Hsuan et al., 2011). This means IDT accommodates TAM's constructs used to determine technology adoption behaviour. This suggests that using IDT could provide more insight on adoption of technology because IDT accommodates more constructs that measure different concepts in technology adoption compared to TAM. Furthermore, given the fact that m-government is considered as an innovative way of addressing challenges encountered when using e-government in Tanzania and still m-government is in its early stage of being implemented, adopting IDT could provide more advantages to the government to understand the whole process of diffusion as well as to know how rural farmers make an informed decision based on the evaluation of the perceived characteristics of innovation (Gohary et al., 2010; Rogers, 1995).

2.3 Extending the IDT

Although IDT could solve part of the problems faced by Tanzania government, the theory needs to be extended by including an additional variable which is government support. By including government support, the developed model could be able to take into consideration the issues that are related to inadequate support provided by the government in the adoption of m-government services (Yonazi, 2013; Dewa and Zlotnikova, 2014). On top of that, literature also shows that certain demographic characteristics could moderate the effects of determinants on behavioural intention. For example, studies carried out by Venkatesh et al. (2003) shown that older respondents tend to be influenced by technology which is easy to use compared to younger which are more influenced by results-oriented. Similarly, Venkatesh et al. (2003) assert that females are more likely to use the system if they find the system to be easy to use and there adequate supportive environment. In IS literature, investigation on the moderating effect generated by social-demographic factors such as age and gender on the relationship between the predictor variables and intention to use m-government services is limited (Peek et al., 2014; Wang et al., 2009). Furthermore, Tarhini et al. (2014) and Venkatesh et al. (2003, 2012) suggest that demographic variables could moderate respondents to perform certain behaviours. To fill the literature gap, current authors extend the IDT theory by including the moderating factors.

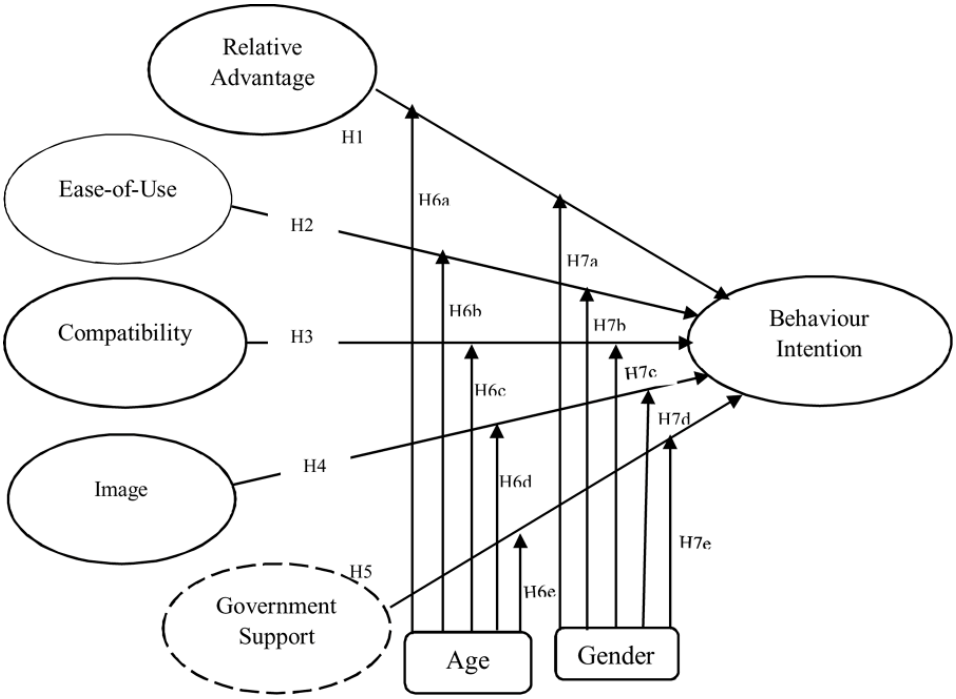
3 Theoretical framework and hypotheses development

Different studies that have examined the effects of IDT constructs show that the constructs tend to produce different results in different research context. Most of the scholars claim that the following IDT constructs: relative advantage, ease-of-use (complexity), compatibility and image are most important elements in influencing respondents' intention to use certain technology positively (Gohary et al., 2010; Al-Qirim, 2006, 2007; Tornatzky and Klein, 1982; Carter and Bélanger, 2005).

As current research is investigating rural farmers' behavioural intention to adopt m-government service, the four IDT constructs were hypothesised to be positively related to rural farmers' behavioural intention. In addition, government support is projected to have a positive relationship with respondents' intention to use m-government service. Past studies have supported the hypothesis and showed that respondents' tendency to perform certain behaviour may increase if government played an important role to support the implementation of certain technology (Al-Shafi, 2009; Al Salmi and Hasnan, 2016). In other words, the IDT constructs: relative advantage, ease-of-use (complexity), compatibility and image; and the variable of government support are expected to produce a direct effect on the change of rural farmers' intention to use m-government service.

To fill the literature gap as suggested by Wang et al. (2009), this study further examines the moderating effect generated by certain demographic variables: age and gender (see Figure 1). Venkatesh et al. (2003) propose the test of four demographic variables (age, gender, experience and voluntariness) but in this study, only the age and gender variables were tested. This is because m-government technology is still in its infancy stage of adoption in Tanzania's rural areas, and thereby many of the rural farmer respondents would not able to provide opinion on their experience (Kripanont, 2007). Furthermore, voluntariness was not included as moderator because m-government services are not yet integrated as a mandatory channel for accessing agricultural information provided by the government (Venkatesh et al., 2012). The discussions of the development of current research hypotheses are presented in the following sub-topics.

Figure 1 Proposed conceptual model



3.1 Relationship between relative advantage and behavioural intention

Moore and Benbasat (1991) define relative advantage as how much a person believes that the technology innovation would be useful to his or her work life or social life or in other aspects as compared to available alternative technologies. The past studies suggest that relative advantage tends to influence behavioural intention positively (Shareef et al., 2012; Baabdullah et al., 2016; Mohammadi, 2015; Rokhman, 2011). Therefore, this study predicts that rural farmers would tend to use m-government service if the m-government services could enable them to access certain agricultural information quickly at any time and anywhere (see hypothesis 1).

Hypothesis 1: Relative advantage has a positive and direct effect on rural farmers' behaviour intention to adopt m-government services.

3.2 Relationship between ease-of-use and behavioural intention

According to Moore and Benbasat (1991), ease-of-use shows the degree to which adopters perceive that a certain innovation technology requires less physical and mental effort to operate. Several past studies have supported IDT's proposition: ease-of-use tends to produce a positive direct effect on respondents' behavioural intention to use certain technology (Baabdullah et al., 2016; Shareef et al., 2012; Althunibat et al., 2014). Thereby, current authors hypothesise that rural farmers would be eager to use m-government service if they perceive that not much physical and mental effort is required to navigate, search and access agricultural information through m-government systems (see hypothesis 2).

Hypothesis 2: Ease-of-use has a positive and direct effect on rural farmers' behaviour intention to adopt m-government services.

3.3 Relationship between compatibility and behavioural intention

Compatibility refers to the extent which an innovation is perceived by an individual to be compatible with existing values, experience and needs of the adopters (Moore and Benbasat, 1991). Several studies have found that compatibility could have a positive and direct influence on respondents' behaviour intention to adopt m-government services (Abdelghaffar and Magdy, 2012; Rambocas and Arjoon, 2012; Mat, 2011; Eri et al., 2011). Therefore, the studied respondents: rural farmers are expected to use m-government service if the agricultural information is compatible to their needs and their experience allows using the design m-government services (see hypothesis 3)

Hypothesis 3: Compatibility has a positive and direct effect on rural farmers' behaviour intention to adopt m-government services.

3.4 Relationship between image and behavioural intention

The image shows how much a person believes that his or her social status within certain society could improve after using a certain technology innovation (Moore and Benbasat, 1991). The existence of direct and positive causal relationship between image and respondents' behaviour intention in the adoption of technology innovation is supported in

a number of studies (Liu et al., 2014; Lean et al., 2009; Ong et al., 2008). Thereby, this study predicts that rural farmers' tendency to use m-government services would increase if they perceive that their social status within rural farmers society could be enhanced when using m-government services (see hypothesis 4).

Hypothesis 4: Image has a positive and direct effect on rural farmers' behaviour intention to adopt m-government services.

3.5 Relationship between government support and behavioural intention

Government support is considered as facilitating condition in which the provision of related training, availability of regulations, policies, and strategies could help target users to use certain technology innovation (Goh, 1995; Kushchu and Kuscu, 2003). Previous studies have suggested that government support could produce a positive and direct effect on respondents' intention to use e-government services and internet banking (Rambocas and Arjoon, 2012; Tan and Teo, 2000; Al-Shafi, 2009; Al Salmi and Hasnan, 2016). Based on the past studies results, current study's respondents are expected to use m-government service if the government could provide appropriate support, such as improving the back-end information systems used to process mobile transactions, promote m-government usages and reduce delay time taken to provide (see hypothesis 5).

Hypothesis 5: Government support has a positive and direct effect on rural farmers' behaviour intention to adopt m-government services.

4 Hypothesising the moderating effects

4.1 Age

Past studies have shown that younger and older respondents have different perceptions in regards to different factors that can motivate their intention to perform a certain behaviour. For example, older people tend to avoid technology that is perceived to be complex compared to younger ones (Venkatesh et al., 2003, 2012). Furthermore, younger people's tendency to use certain technology innovation is higher than older people as they may have the necessary experience or tendency to explore the use of certain technology (Morris and Venkatesh, 2000; Venkatesh et al., 2003; Tarhini et al., 2014). Previous studies have shown that age tends to moderate the relationship between performance expectancy (similar to relative advantages) (Sun and Zhang, 2006; Tarhini et al., 2014; Wang et al., 2009); effort expectancy (similar to ease-of-use) (Sun and Zhang, 2006; Yu, 2012; Tarhini et al., 2014); facilitating conditions (similar to compatibility) (Venkatesh et al., 2003, 2012); social influence (similarly to image) (Wang et al., 2009; Alotaibi, 2016) on behavioural intention. On top of that, Venkatesh et al. (2012) assert that availability of external support is important to older adopters due to the decline of cognitive and memory capability. This implies that, it is possible that age will moderate the effect generated by government support on rural farmers' behavioural intention to use m-government service (Yu, 2012; Morris and Venkatesh, 2000). To summarise, this study hypothesise that:

Hypothesis 6a: Age will moderate the effect of relative advantage on behaviour intention, such that the effect will be strong for younger rural farmers.

Hypothesis 6b: Age will moderate the effect of ease-of-use on behaviour intention, such that the effect will be strong for older rural farmers.

Hypothesis 6c: Age will moderate the effect of compatibility on behaviour intention, such that the effect will be strong for older rural farmers.

Hypothesis 6d: Age will moderate the effect of the image on behaviour intention, such that the effect will be strong for younger rural farmers.

Hypothesis 6e: Age will moderate the effect of government support on behaviour intention, such that the effect will be strong for older rural farmers.

4.2 Gender

The level of effect generated by each factor on respondents' behavioural intention could be different if the respondent is a male or a female (Tarhini et al., 2014; Venkatesh et al., 2003). In studies related to technology innovation, males tend to dominate usage of technology as compared to females (Sun and Zhang, 2006; Laforet and Li, 2005). Sun and Zhang (2006) state that males are more pragmatic and motivated by achievement needs while females are anxiety and tend to be more affected by the immediate environment while making a decision. Furthermore, Venkatesh et al. (2012) explain that females rely more heavily on the availability of external support to achieve their goals compared to males. This can be due to the cognition of gender roles in the society where males are considered to be task-oriented (Lynott and McCandless, 2000).

Past studies have shown that gender, in fact, could moderate the relationship between following constructs – performance expectancy (Venkatesh et al., 2003; Yu, 2012); effort expectancy (Sun and Zhang, 2006; Tarhini et al., 2014); facilitating conditions (Venkatesh et al., 2003, 2012); social images (Venkatesh et al., 2003, 2012; Alotaibi, 2016) – and behavioural intention. On top of that, gender could moderate the relationship between government support and respondents' intention to perform certain behaviour too (Venkatesh et al., 2012; Malik et al., 2016). Based on the previous results, the following hypotheses are formulated:

Hypothesis 7a: Gender will moderate the effect of relative advantage on behaviour intention, such that the effect will be strong for male rural farmers.

Hypothesis 7b: Gender will moderate the effect of ease-of-use on behaviour intention, such that the effect will be strong for female rural farmers.

Hypothesis 7c: Gender will moderate the effect of compatibility on behaviour intention, such that the effect will be strong for male rural farmers.

Hypothesis 7d: Gender will moderate the effect of image on behaviour intention, such that the effect will be strong for male rural farmers.

Hypothesis 7e: Gender will moderate the effect of government support on behaviour intention, such that the effect will be strong for female rural farmers.

5 Research methodology

5.1 Measures and instrument development

To ensure that the content is valid in the questionnaire used in the current study, all items used to measure the variables of interest were adopted from previous IS studies related to technology acceptance. The statements to measure each measurement item were carefully reworded so that current respondents could comprehend the measurements better and thereby more truthful response can be given. Transitional validity was conducted to check the relevancy of measurement items in terms of wording, clarity and completeness of the questionnaire (Lynn, 1986). Six experts from e-governments and academicians from different institutions in Tanzania were involved, two items were found to be irrelevant and were dropped. After affecting the amendments suggested by the experts, a complete questionnaire with three sections (introduction, demographic variables and measurement items) was developed. All items were measured by using five points Likert-scale, ranging from strongly disagree (1) to strongly agree (5). On top of that, the English version questionnaire was translated to Swahili language because most of the rural farmers are not fluent in English. The translation exercise was done by two translators from different academic institutions in Tanzania. A pilot study was then conducted to establish the validity of the items in measuring the underlying constructs by using the sample of 182 rural farmers which is more than the recommended sample size for pilot study: 100 (Comprey and Lee, 2013; Hair et al., 2009). Two items were dropped because of low factor loading and thereby, 41 items were found to be relevant and used for the main survey.

5.2 Sampling design and respondents selection

As the coverage of rural areas in Tanzania is wide and due to unavailability of an extensive list of rural farmers, this study used stratified and multistage sampling process. By using this sampling technique, each population unit have equal chances to be selected as the study's respondent, and thereby the results can be generalised (Sekaran, 2006; Teddlie and Yu, 2007). Five strata namely coastal, central, north, southern highland and south which are based on national geographical were adopted and used in this study. Subsequently, in each region, one district was randomly selected. After that, only one rural ward was selected in each district and one village was finally selected from the selected ward.

The list of the household was obtained from the village main office. Simple random sampling was used to select households. The age-order procedure was applied to select one respondent within the household because the method is cost-effective and guarantee random selection (Kumar, 2013). Furthermore, drop off/pick up method was used to distribute the questionnaires because the method can reduce nonresponse problem (Trentelman et al., 2016).

Out of 500 distributed questionnaires, 427 (or 85.4%) questionnaires were collected. Among the collected questionnaire, 20 questionnaires were voided due to a large number of missing data. About 51% of the respondents were male and the majority of them aged below 36 years (50.6%). Most respondents were educated up to primary and secondary levels. Detailed descriptive statistics about respondent's characteristics are shown in Table 1.

Table 1 Demographic characteristics of the sample

Characteristics	*Number*	*Percentage*
Gender		
Male	208	51.1
Female	199	48.9
Age		
15–35	206	50.6
36–59	180	44.2
60–64	21	5.5
Income (Tshs)		
Below 200,000	107	26.3
200,000–300,000	146	35.8
300,001–400,000	67	16.5
Above 400,000	87	21.4
Education		
No formal education	19	4.7
Primary	235	57.7
Secondary	144	35.4
Diploma	7	1.7
Bachelor	2	0.5

5.3 Data analysis techniques

To test and confirm the study's hypotheses, structural equation modelling (SEM) was used because of the following reasons:

- it takes care of measurement error in each measurement item which can produce more biased results (Alavifar et al., 2012)
- SEM allows simultaneous estimation of multiple equations specified in the research model which may result in a meaningful information (Singh and Sharma, 2016).

SEM is considered as the two steps analysis in which measurement and structural model are analysed (Awang, 2015). In measurement model, confirmatory factor analysis (CFA) is employed to examine validity and reliability of the observed and unobserved variables while in the structural model, the pre-defined hypotheses are examined and confirmed (Awang, 2015). Two software packages were employed in data analysis, SPSS version 21 for preliminary data analysis and AMOS version 22 for examining the model validity, reliability and testing for direct and moderating effects. To assess model fit, the most recommended fit indices which are the root mean square error approximation (RMSEA), comparative fit index (CFI), Tucker Lewis Index (TLI), standardised root mean residual (SRMR), and a ration of chi-square (χ^2) to a degree of freedom (*d.f*) where used

(Boomsma, 2000; Hooper et al., 2008; Hu and Bentler, 1999). These model fit indices are considered to be suitable for evaluating model fit because they are insensitive to sample size (Hooper et al., 2008).

6 Results

Data cleaning was conducted by checking missing values and data normality. A total of twenty-eight missing values were identified from twenty cases. These missing values could be due to unintentional skipping of the items during responding to the questionnaire. The effects of all missing values were analysed by using Little's MCAR test (Kang, 2013), the result shows that they have an insignificant effects (χ^2 (224) = 254.778, ρ = 0.0773), therefore all missing values were replaced by using Expectation Maximisation method (Karanja et al., 2013). Square Mahalanobis distance (D^2) was employed to examine the presence of outliers, five cases produced *p values* which are less than 0.001 and therefore were considered as outliers (Kline, 2005; Tabachnick and Fidell, 2007). The investigation was further conducted to examine its effect on predictors by using Cook's distance (Cook, 1977). The result shows that they have non-significant effect on the predictors because cook's distance and leverage values produced are below the acceptable thresholds of 1.0 and 0.5 respectively (Stevens, 1992). Data normality test was carried out by checking skewness and kurtosis value. The result shows that skewness and kurtosis values range from –1.209 to 0.122 and –1.179 to 1.287, respectively, which are within the recommended absolute value of 2 and 3 for skewness and kurtosis respectively (Kline, 2005), Thereby, concluding that the data are normal distributed. CFA test was conducted to validate the measurement model. The initial measurement model did not attain the required unidimensionality due to low factor loading values (below 0.5) produced from three items: IMG4, RA4 and RA5. Based on Awang (2015) and Hair et al. (2010) recommendations, modifications were conducted by deleting items with low factor loading values in different iterations to produce the final measurement model that is composed of items with sufficient loading values (see Figure 2). Table 2 shows that the adjusted measurement model achieved the model fit.

Table 2 Models indices goodness of fit

Model/Goodness of fit measures	*ρ-Value*	*RMSEA*	*SRMR*	*CFI*	*TLI*	χ^2/df
Benchmark[a]	$\rho > 0.05$	<0.05	<0.08	>0.95	>0.95	<3
Initial measurement model	*	0.039	0.045	0.95	0.94	1.629
Adjusted measurement model	*	0.031	0.037	0.97	0.97	1.384

*$p < 0.001$.

Sources: [a]Hair et al. (2010), Byrne (2010) and Hu and Bentler (1999)

Convergent validity was attained in this study as the average variance extracted (AVE) values range between 0.508 and 0.599, which are above the recommended threshold of 0.5 (see Table 3) (Fornell and Larcker, 1981). Also, Table 3 shows that the square root of AVE (the diagonal bolded values) are greater compared to all values in their respective column and row (Fornell and Larcker, 1981). This denotes that constructs discriminant

validity was achieved. Finally, in testing the reliability and consistency of each construct's item, composite reliability (CR) was examined and the results show that all CR values are above the required threshold of 0.7 (Hair et al., 2010).

Figure 2 Adjusted measurement model (see online version for colours)

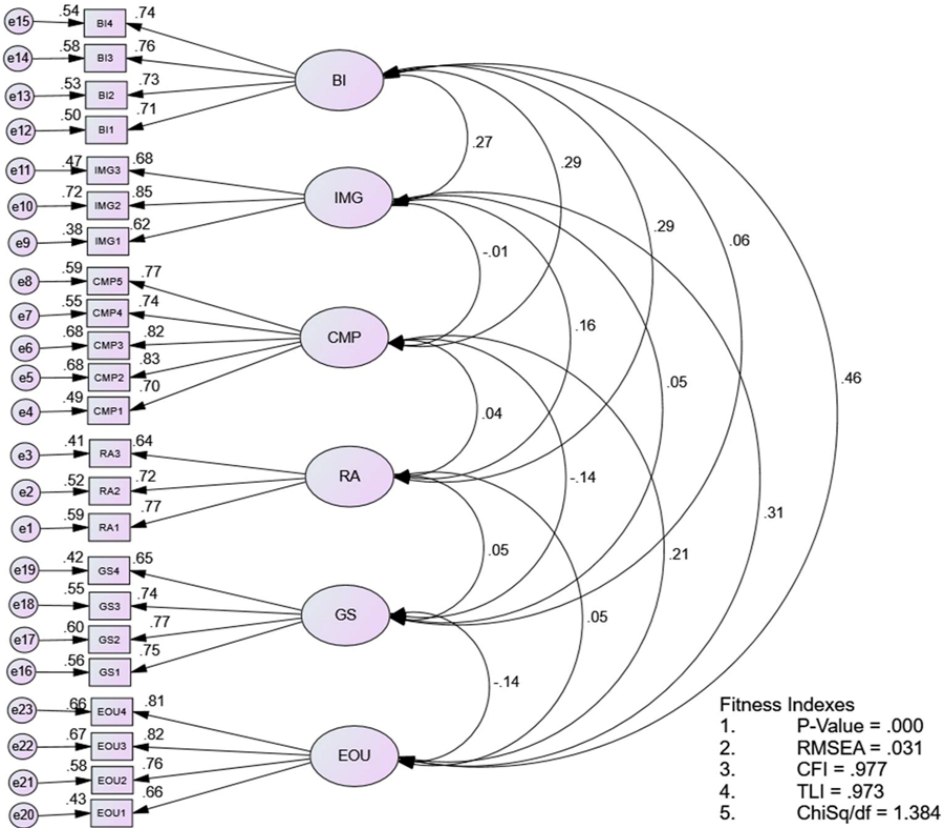


Table 3 Measurement model reliability and validity

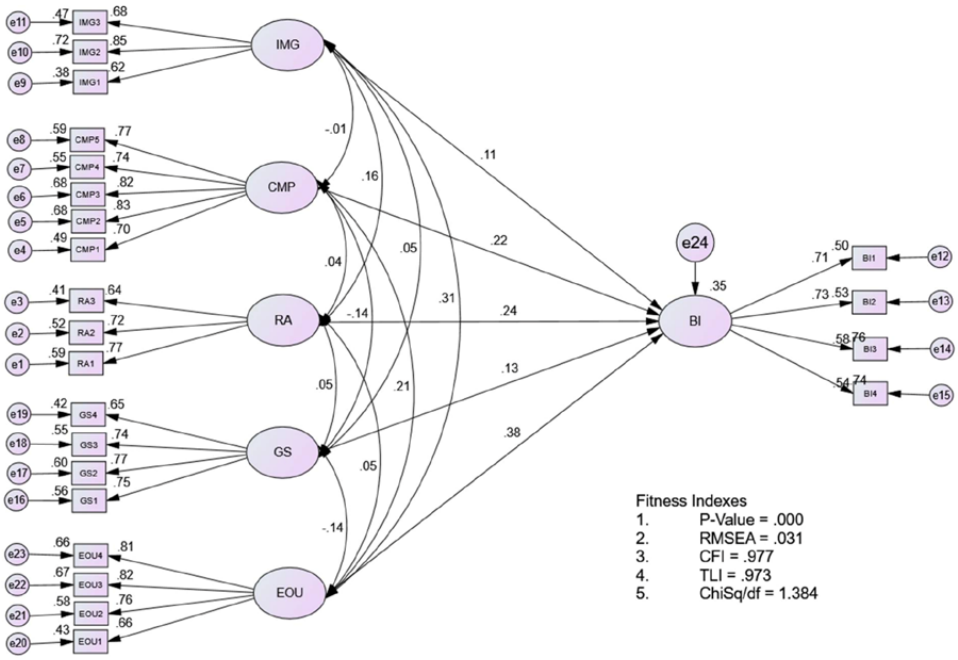
	CR	*AVE*	*MSV*	*BI*	*EOU*	*IMG*	*RA*	*GS*	*CMP*
BI	0.824	0.539	0.209	**0.734**					
EOU	0.848	0.584	0.209	0.457	**0.764**				
IMG	0.763	0.523	0.095	0.268	0.308	**0.723**			
RA	0.755	0.508	0.082	0.287	0.046	0.158	**0.713**		
GS	0.819	0.531	0.019	0.061	–0.135	0.054	0.049	**0.729**	
CMP	0.882	0.599	0.087	0.295	0.212	–0.011	0.039	–0.138	**0.774**

BI: Behaviour intention; EOU: ease-of-use; IMG: image; RA: relative advantage; GS: government support; CMP: compatibility; CR: composite reliability; AVE: average variance extract.

Figure 3 shows that the structural model produced has achieved adequate unidimensionality as the factor loadings for all items have scored above 0.5 (Awang,

2015). In addition, the model fit indices are also shown to be adequate. Therefore, current authors proceed to examine the hypotheses. Table 4 shows that relative advantage (RA), ease of use (EOU), compatibility (CMP), and government support (GS) are direct determinants of rural farmers' behavioural intention, hence hypotheses H1, H2, H3, and H5 were supported. Nevertheless, the construct of image (IMG) was non-significant on effecting the change of behavioural intention. All significant predictors produced 35% ($R^2 = 0.35$) ability to explained rural farmers' intention to use m-government services.

Figure 3 Structural model (see online version for colours)



BI: Behaviour intention; EOU: ease-of-use; IMG: image; RA: relative advantage; GS: government support; CMP: compatibility

Table 4 The direct effects of predictors on behaviour intention

Hypotheses	*IV*	*DV*	*Estimate*	*S.E.*	*C.R.*	*ρ-Value*	*Remarks*
H1	RA	BI	0.142	0.035	4.066	*	Supported
H2	EOU	BI	0.282	0.048	5.893	*	Supported
H3	CMP	BI	0.167	0.041	4.039	*	Supported
H4	IMG	BI	0.101	0.055	1.835	0.067	Not supported
H5	GS	BI	0.073	0.032	2.308	0.021	Supported

*$p < 0.001$; BI: Behaviour intention; EOU: ease-of-use; IMG: image; RA: relative advantage; GS: government support; CMP: compatibility.

To analyse the strength of the path coefficients for different groups which are based on age and gender characteristics, the multi-group analysis was conducted (Moon et al., 2017). In multi-group analysis, two models namely unconstrained and constrained were

used. In the constrained model, paths coefficient are constrained to be equal across the two groups of interest. Based on chi-square difference test, the results of the constrained model fit were compared to the unconstrained model (Wang et al., 2009; Wong et al., 2012). A significant difference in chi-square shows that the path coefficients between the groups are different (Wong et al., 2012).

To examine the multi-group effects of age, two groups which are younger and older were established. According to Tanzania population distribution by age and sex, any person below 35 is considered as a youth (URT, 2013), this definition was used to categorise respondents into two groups younger and older. Based on the pre-defined conditions, the analyses of paths coefficient differences between younger and older respondents are shown in Table 5.

Table 5 Moderating effects of age on predictors of behaviour intention

Paths	*Unconstrained model* (*a*) -χ^2 (*df = 430*)	*Constrained model* (*b*) – χ^2	*ρ-Values*	$\Delta\chi^2$	*Remarks*
RA → BI	548.397	554.059	0.017	5.662*	Different
EOU → BI	548.397	552.420	0.044	4.023*	Different
CMP → BI	548.397	550.825	0.119	2.429^{ns}	No Difference
IMG → BI	548.397	548.427	0.187	0.031^{ns}	No Difference
GS → BI	548.397	553.972	0.018	5.575**	Different

ns: not significant; RE: relative advantage; EOU: ease-of-use; CMP: compatibility; IMG; image; GS; government support; BI: behaviour intention; χ^2: Chis-square; df: degree of freedom.

(a): Paths coefficient for age groups were allowed be free estimated.

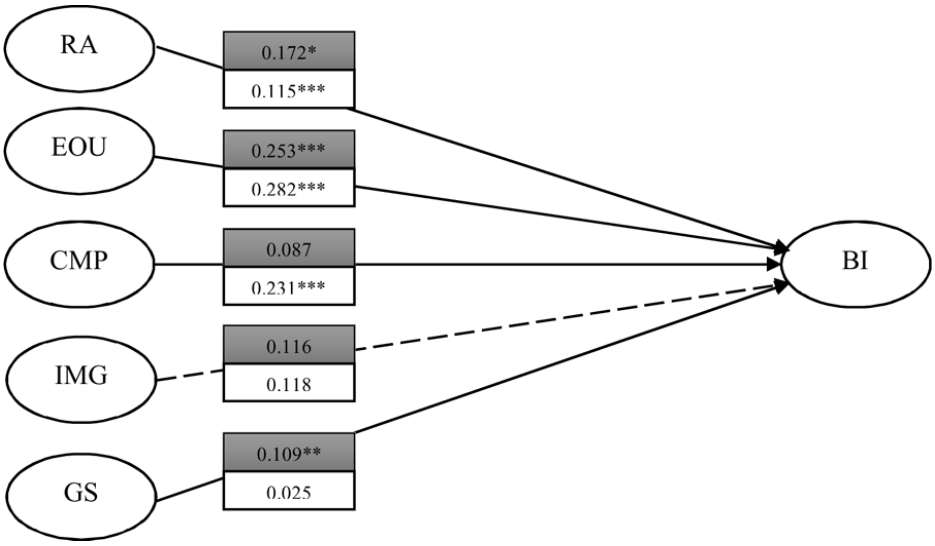
(b): The path specified was constrained to be equal across the two groups.

The difference between the chi-square was found to be significant on paths related to RA, EOU and GS, which means that effect generated by RA, EOU, and GS on behavioural intention to use m-government service is different between younger and older. Furthermore, Figure 4 shows that the effect of age on relative advantage and ease-of-use supported hypotheses H6a and H6b. The moderating effect of gender on government support was found to be more on younger ($\beta = 0.109$, $p < 0.01$), However, older respondents tend to be influenced by support more than their counterpart, and thereby hence hypothesis H6e was not supported (see Table 6). On the other hand, the analysis shows that the effect of age on CMP and IMG is not significant, this denotes that there is no difference in path coefficients between younger and older, hence hypotheses H6c and H6d were not supported.

Table 7 shows that the paths coefficient between male and female were different on RA, EOU and CMP. The effect of RA, EOU and CMP on behavioural intention is different between male and female. Furthermore, Figure 5 shows that the effect of gender on the relative advantage and ease-of-use are more on male and female, respectively, hence hypotheses H7a and H7b were supported. The effects of gender on compatibility was found to be strong on male ($\beta = 0.193$, $p < 0.001$), however, the relationship was

found to be insignificant for female, hence hypothesis H7c is partially supported (see Table 6). On the other hand the two paths coefficient related to the effects of IMG and GS on BI were found to be similar between male and female, hence hypotheses H7d and H7e were not supported.

Figure 4 Standardised path coefficients for younger and older

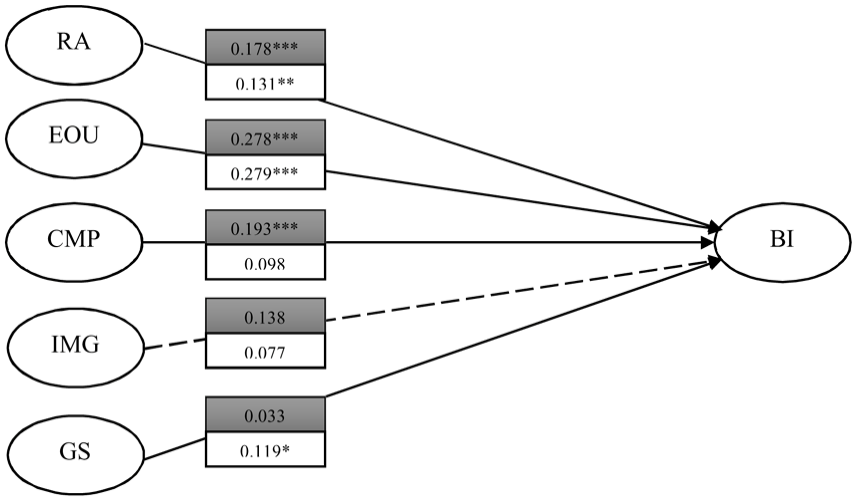


Coefficients for Younger are in the shaded boxes. $^{**}p < 0.05$; $^{***}p < 0.01$; $^{****}p < 0.001$.

Table 6 Summary of moderating effects testing

Moderating variable	*Hypotheses*	*Paths*	*Moderation results*	*Hypothesised effects*	*Results of effects*
Age	H6a	RA → BI	Significant	Younger > Older	Supported
	H6b	EOU → BI	Significant	Older > Younger	Supported
	H6c	CMP → BI	Not significant	Older > Younger	Not supported (No Difference)
	H6d	IMG → BI	Not significant	Younger > Older	Not supported (No Difference)
	H6e	GS → BI	Significant	Older > Younger	Not supported (Younger > Older)
Gender	H7a	RA → BI	Significant	Male > Female	Supported
	H7b	EOU → BI	Significant	Female > Male	Supported
	H7c	CMP → BI	Significant	Male > Female	Partially supported
	H7d	IMG → BI	Not significant	Male > Female	Not Supported (No Difference)
	H7e	GS → BI	Not significant	Female > Male	Not Supported (No Difference)

Figure 5 Standardised path coefficients for males and females



Coefficients for males are in the shaded boxes. $^{**}p < 0.05$; $^{***}p < 0.01$; $^{****}p < 0.001$.

Table 7 Moderating effects of gender on predictors of behaviour intention

Paths	*Unconstrained model (a) -χ^2 (df = 440)*	*Constrained Model (b) – χ^2*	*ρ -Values*	*$\Delta\chi^2$*	*Remarks*
RA → BI	529.488	533.674	0.040	4.186*	Different
EOU → BI	529.488	534.807	0.021	5.319*	Different
CMP → BI	529.488	535.428	0.014	5.940*	Different
IMG → BI	529.488	529.742	0.614	0.254^{ns}	No Difference
GS → BI	529.488	530.948	0.227	1.460^{ns}	No Difference

ns: not significant; RE: relative advantage; EOU: ease-of-use; CMP: compatibility; IMG; image; GS; government support; BI: behaviour intention; χ^2: Chis-square; df: degree of freedom.

(a): Paths coefficient for age groups were allowed be free estimated.

(b): The path specified was constrained to be equal across the two groups.

7 Discussion and Implications

The study findings show that relative advantage, ease-of-use, compatibility and government support are significant determinants of rural farmers' behavioural intention to adopt m-government services. Ease-of-use was found to be the strongest determinant of behaviour intention that implies that rural farmers could be more attracted to use m-government services if they found m-government system is easy to use. This may be attributed to the facts that most of the rural farmers are less technology savvy (Misaki et al., 2016). This result is consistent with the studies carried out by Agarwal and Prasad (1999) and Dass and Pal (2011). The m-government system designers should thereby provide ease to use navigation systems, clear and usable interfaces, and help/user guide option to help rural farmers who are novice user.

The relative advantage was also found to be a significant predictor of behaviour intention to adopt m-government services and supports IS studies carried out by Baabdullah et al. (2016) and Shareef et al. (2012). To attract more rural farmers to use m-government services, policy makers should provide an up-to-date agricultural information through m-government systems and educate the farmers on how to make use of the information to improve their market and price knowledge. Furthermore, agricultural information should be customised to serve the needs of specific rural farmers, for example, information should be provided by type of crops, seasons and geographical locations. It is also advisable that the back-end information systems be available 24/7 days to enable accessibility of agricultural information anytime, anywhere.

As compatibility is one of the determinants of behavioural intention, providing information that is compatible with the users should be considered. For example, certain agricultural information should be disseminated to or customised for relevant rural farmers. Policy makers should consider the experience of rural farmers in using mobile phones as well. The interface should be designed to map mobile gadgets that have different technology. In this way, more rural farmers could access the information. The result supports the findings of the prior IS researches (Abdelghaffar and Magdy, 2012; Rambocas and Arjoon, 2012).

Government support was also found to be the key determinant of rural farmers' intention to use m-government services as supported by Al-Shafi (2009) and Al Salmi and Hasnan's (2016) studies. Therefore, policy makers should consider formulating policies and guidelines, promote the uses of m-government services as well as building m-government infrastructures (Chong et al., 2010).

This study further examines the moderating effects of age on determinants of rural farmers' behavioural intention. Younger farmers perceived the effect of a relative advantage as more important than older farmers and this support studies carried out by Tarhini et al. (2014) and Venkatesh et al. (2003). As a result, policy makers should pay more attention to the performance-related advantages of m-government systems which could influence younger cohort. Meanwhile, the effects of ease-of-use were found to be stronger to older farmers rather than younger farmers and the result supports Tarhini et al. (2014) and Venkatesh et al's (2003) studies. Thereby, the m-government system designers not only need to design a system which is easy for farmers to use, but also priority should be given to older rural farmers.

Furthermore, the effect that can be generated by the government support on behavioural intention was found to be significant for younger farmers and insignificant for older farmers. This finding is contradictory with previous studies which found that facilitating conditions is more stronger to older farmers than younger farmers (Venkatesh et al., 2003). This implies that younger farmers are more receptive to support provided by government. This could be attributed to the fact that younger people are more eager to understand, learn and use new technology innovation.

The result shows that age differences do not moderate the relationship between compatibility and behavioural intention. This means that in the context of m-government, younger and older farmers behave indifferently, or both need agricultural information that is compatible with their own needs.

This study further examined whether male and female respondents behave differently on the evaluation of effect generated by each predictor. The finding shows that gender did not moderate the relationship between government support and behavioural intention. This implies that both male and female respondents valued government support

indifferently and this finding is similar to Hu et al. (2010) study. Therefore, universal strategies related to government support could be implemented, not necessarily appealing to a certain gender.

Nevertheless, gender could moderate the effect of compatibility on behavioural intention, and this result supports Venkatesh et al.'s (2003) study. However, this finding is partially supported because the effect was found to be significant for male and insignificant for female. This could be attributed by the fact that most of rural farmers society in developing countries are considered as a masculine culture so the values and needs of IS are more determined by males (Twati, 2014; Ebrahimi et al., 2010). Also, gender was found to moderate the relationship between relative advantage and behavioural intention, the moderating effect was found to be stronger among male respondents. This finding supports previous studies which found that the effects of relative advantage, in fact, are more important to male (Venkatesh et al., 2003, 2012). From the result, policymakers thereby should focus on promoting relative advantage that could encourage male farmers to use m-government service. Contrarily, the effect of ease-of-use on behavioural intention was found to be more stronger to female as compared to male and consistent to the studies carried out by Tarhini et al. (2014) and Venkatesh et al. (2003). This further suggests that the m-government system should be designed to map female farmers' self-efficacy or their cognitive and physical abilities.

8 Conclusion, limitation and future studies

Compared to past studies, this study had extended the IDT by including the testing of direct and moderating effects generated by government support and demographic variables: age and gender respectively which are limited in previous studies related with technology adoption. Therefore, the current study's results could expand the theoretical knowledge and provide more comprehensive recommendations to policy makers for useful strategies.

The result shows that relative advantage, ease-of-use, compatibility, and government support could create a direct effect on rural farmers' intention to use m-government services. In addition, age and gender could moderate the effect of relative advantage and ease-of-use on behavioural intention. Similarly, males were found to be more affected by compatibility in their decision of m-government service's usage tendency. In other words, demographic variables could moderate the fundamental relationships between IDT's constructs. Therefore, it would be useful for researchers to examine the moderating effects when IDT is applied in other contexts.

The study's results could provide useful implications which will enable policy makers to distinguish their strategies in encouraging target users to use m-government services in rural areas instead of implementing universal strategies that are related to significant determinants. To elaborate, policies on promoting and alerting rural farmers of m-government services' relative advantage, ease-of-use and compatibility should be customised to suite different cohorts.

Despite the study's theoretical and practical contributions, this study is facing some limitations. Firstly, the study employed self-assessment technique in data collection, such kind of instrument may be prone to common method biased. Therefore, future studies should consider using both objective and subjective techniques in data collection. Secondly, the study employs cross-sectional design technique which means that the data

have been collected at one point in time. However, due to time changes, respondents might become more experienced and knowledgeable in technology innovation which could change their perceptions on m-government determinants. Therefore, further studies which employ longitudinal design need to be carried out when certain environment such as improvement on education and communication technology in rural areas have changed. The current study examines respondents' behavioural intention instead of actual usage behaviour because m-government technology is still in its infancy stage in Tanzania's rural areas. However, if m-government technology has been established for quite sometimes and yet the usage is minimal, it would be wise to expand the IDT by including the testing of actual usage behavioural.

References

Abdelghaffar, H. and Magdy, Y. (2012) 'The adoption of mobile government services in developing countries: the case of Egypt', *International Journal of Information and Communication Technology Research*, Vol. 2, No. 4, pp.333–341.

Agarwal, R. and Prasad, J. (1999) 'Are individual differences germane to the acceptance of new information technologies', *Decision Sciences*, Vol. 30, No. 2, pp.361–391.

Al Salmi, M. and Hasnan, N. (2016) 'E-government analysis: sultanate of Oman case', *Open Journal of Social Sciences*, Vol. 4, pp.35–40.

Alavifar, A., Karimimalayer, M. and Anuar, M.K. (2012) 'Structural equation modeling vs multiple regression', *Engineering Science and Technology: An International Journal*, Vol. 2, No. 2, pp.326–329.

Alotaibi, M.B. (2016) 'Antecedents of software-as-a-service (SaaS) 'adoption: a structural equation model', *International Journal of Advanced Computer Research*, Vol. 6, No. 25, p.114.

Al-Qirim, N. (2006) 'Personas of e-commerce adoption in small business in New Zealand', *Journal of Electronic Commerce in Organizations*, Vol. 4, pp.18–45.

Al-Qirim, N. (2007) 'E-commerce adoption in small business eases from New Zealand', *Journal of Information Technology Case and Application Research*, Vol. 9, No. 28).

Al-Shafi, S. (2009) *Factors Affecting E-Government Implementation and Adoption in the State of Qatar*, Published Doctoral Thesis, Brunel University, England.

Althunibat, A., Alrawashdeh, T. and Muhairat, M. (2014) 'The acceptance of using M-government services in Jordan', *Journal of Theoretical and Applied Information Technology*, Vol. 63, No. 3, pp.733–740.

Awang, Z. (2015) *SEM Made Simple: A Gentle Approach to Learning Structural Equation Modeling*, 1st ed., MPWS, Selangor.

Baabdullah, A., Nasseef, O. and Alalwan, A. (2016) 'Consumer adoption of mobile government in the kingdom of Saudi Arabia: the role of usefulness, ease of use, perceived risk and innovativeness', in Dwivedi, Y.K., Mantymaki, M., Ravishankar, M.N., Janssen, M., Clement, M., Slade, E., Al-Sharhan, S., Rana, N., Al-Sharhan, S. and Simintiras, A. (Eds.): *Conference on e-business, e-Services and e-Society*, Springer Publishing, Swansea, pp.267–279.

Boomsma, A. (2000) 'Reporting analyses of covariance structures', *Structural Equation Modeling*, Vol. 7, No. 3, pp.461–483.

Byrne, B.M. (2010) *Structural Equation Modeling with AMOS: Basic Concepts, Applications and Programming*, 2nd ed., Routledge, New York.

Carter, L. and Bélanger, F. (2005) 'The utilization of e-government services: citizen trust, innovation and acceptance factors', *Info Systems*, Vol. 15, No. 1, pp.5–25.

Chong, Y., Ooi, K.B., Lin, B. and Tan, B.I. (2010) 'Online banking adoption: an empirical analysis', *International Journal of Marketing Studies*, Vol. 28, No. 4, pp.267–287.

Comprey, A. and Lee, H. (2013) *A First Course in Factor Analysis*, Psychology Press, New York.

Cook, R.D. (1977) 'Detection of influence observations in linear regression', *Technometrics*, Vol. 19, No. 1, pp.459–470.

Dass, R. and Pal, S. (2011) 'Exploring the factors affecting the adoption of mobile financial services among the rural under-banked', *European Conference on Information Systems 2011 Proceedings*, AIS e-Library, India, pp.1–12.

Dewa, M. and Zlotnikova, I. (2014) 'Citizens' Readiness for e-government services in tanzania', *Advances in Computer Science: An International Journal*, Vol. 3, No. 4, pp.37–45.

Ebrahimi, N., Singh, S.K.G. and Tabrizi, R.S. (2010) 'Cultural effect on using new technologies', *World Academy of Science, Engineering and Technology*, Vol. 10, No. 70, pp.1030–1034.

Eri, Y., Islam, M.A. and Daud, K.A. (2011) 'Factors that influence customers' buying intention on shopping online', *International Journal of Marketing Studies*, Vol. 3, No. 1, pp.128–139.

Fornell, C. and Larcker, D.F. (1981) 'Evaluating structural equation models with unobservable variables and measurement error', *Journal of Marketing Research*, Vol. 18, No. 1, pp.39–50.

Goh, H.P. (1995) *The Diffusion of Internet in Singapore, Academic Exercise, Faculty of Business Administration*, National University of Singapore.

Gohary, H., Truemsn, M. and Fukukawa, K. (2010) 'Understanding the factors affecting the adoption of E-Marketing by small business enterprises', in Thomas, B. and Simmons, G. (Eds.): *E-Commerce Adoption and Small Business in the Global Marketplace*, Business Science Reference, Hershey.

Gollin, D. (2010) 'Agricultural productivity and economic growth', *Handbook of Agricultural Economics*, Vol. 4, pp.3825–3866.

Hair, J.F., Black, W.C., Babin, B.J. and Anderson, R.E. (2009) *Multivariate Data Analysis*, 7th ed., Prentice-Hall, New Jersey.

Hair, J.F., Black, W.C., Babin, B.J. and Anderson, R.E. (2010) *Multivariate Data Analysis*, 7th ed., Prentice Hall, New York.

Hooper, D., Coughlan, J. and Mullen, M. (2008) 'Structural equation modelling: guidelines for determining model fit', *The Electronic Journal of Business Research Methods*, Vol. 6, No. 1, pp.53–60.

Hu, H., Al-Gahtani, S. and Hu, P.J. (2010) 'Examining gender effects in technology acceptance by Arabian workers', *A Survey Study. In PACIS*, p.76.

Hu, L. and Bentler, P.M. (1999) 'Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria vs. new alternatives', *Structural Equation Modeling: A Multidisciplinary Journal*, Vol. 6, No. 1, pp.1–55.

Jotischky, N. and Nye, S. (2011) '*Mobilizing Public Services in Africa: The m-Government Challenge*, Informa Telecoms and Media, London.

Kang, H. (2013) 'The prevention and handling of the missing data', *Korean Journal of Anesthesiology*, Vol. 64, No. 5, pp.402–406.

Karanja, E., Zaveri, J. and Ahmed, A. (2013) 'How do MIS researchers handle missing data in survey-based research: a content analysis approach', *International Journal of Information Management*, Vol. 33, No. 5, pp.734–751.

Kline, R.B. (2005) *Principles and Practice of Structural Equation Modeling* 2nd ed., Guilford Press, New York.

Kripanont, N. (2007) *Examining a Technology Acceptance Model of Internet Usage by Academics within Thai Business Schools*, Published Doctoral Thesis, Victoria University, Australia.

Kumar, R.V. (2013) 'Respondent selection methods in household surveys', *Jharkhand Journal of Development and Management Studies*, Vol. 12, No. 1, pp.1–9.

Kushchu, I. and Kuscu, M. (2003) 'From E-government to M-government: facing the inevitable', *The 3rd European Conference on e-Government (ECEG 2003*), MCIL Trinity, Dublin.

Kyem, P.A.K. (2016) 'Mobile phone expansion and opportunities for e-governance in Africa', *The Electronic Journal of Information Systems in Developing Countries*, Vol. 75, No. 6, pp.1–15.

Laforet, S. and Li, X. (2005) 'Consumers' attitudes towards online and mobile banking in China', *International Journal of Bank Marketing*, Vol. 23, No. 5, pp.362–380.

Lean, O.K., Zailani, S., Ramayah, T. and Fernando, Y. (2009) 'Factors influencing intention to use e-government services among citizens in Malaysia', *International Journal of Information Management*, Vol. 29, No. 1, pp.458–475.

Liu, Y., Li, H., Kostakos, V., Goncalves, J., Hosio, S. and Hu, F. (2014) 'An empirical investigation of mobile government adoption in rural China: a case study in Zhejiang province', *Government Information Quarterly*, Vol. 31, No. 3, pp.432–442.

Lynn, M.R. (1986) 'Determination and quantification of content validity', *Nursing Research*, Vol. 35, No. 6, pp.382–386.

Lynott, P.P. and McCandless, N.J. (2000) 'The impact of age vs. life experience on the gender role attitudes of women in different cohorts', *Journal of Women and Aging*, Vol. 12, Nos. 1–2, pp.5–21.

Malik, B., Shuqin, C., Talukder, M. and Mattiullah, B. (2016) 'Investigating factors influencing adoption of land record management information system (LRMIS): a case of Pakistan', *European Scientific Journal*, Vol. 12, No. 2.

Mat, N.K.N. (2011) 'Modeling the antecedents of internet banking service adoption (IBSA) in Jordan: a structural equation modeling (SEM) 'approach', *Journal of Internet Banking and Commerce*, Vol. 16, No. 1, pp.1–14.

Misaki, E., Apiola, M. and Gaiani, S. (2016) 'Technology for small scale farmers in tanzania: a design science research approach', *The Electronic Journal of Information Systems in Developing Countries*, Vol. 74, No. 4, pp.1–15.

Mohammadi, H. (2015) 'A study of mobile banking loyalty in Iran', *Computers in Human Behavior*, Vol. 44, No. 1, pp.35–47.

Moon, S-G., Jeong, S.Y. and Choi, Y. (2017) 'Moderating effects of trust on environmentally significant behavior in Korea', *Sustainability*, Vol. 9, No. 3, p.415.

Moore, G. and Benbasat, I. (1991) 'Development of an instrument to measure the perceptions of adopting an information technology innovation', *Information Systems Research*, Vol. 2, No. 3, pp.192–222.

Morris, M.G. and Venkatesh, V. (2000) 'Age differences in technology adoption decisions: implications for a changing work force', *Personnel Psychology*, Vol. 53, No. 2, pp.375–403.

Morton, J.F. (2007) 'The impact of climate change on smallholder and subsistence agriculture', *Proceedings of the National Academy of Sciences*, Vol. 104, No. 50, pp.19680–19685.

Mtega, W. and Ronald, B. (2013) 'The state of rural information and communication services in Tanzania: a meta-analysis', *International Journal of Information and Communication Technology Research*, Vol. 3, No. 2, pp.64–73.

Munyoka, W. and Manzira, M.F. (2014) 'From e-government to m-government-challenges faced by Sub-Saharan Africa', *The International Conference on Computing Technology and Information Management*, Society of Digital Information and Wireless Communication, Dubai, pp.86–99.

Ogunleye, O.S. and Van Belle, J-P. (2014) 'Scalability and sustainability of M-government projects implementation in developing countries', in Mahmood, Z. (Ed.): *Emerging Mobile and Web 2.0 Technologies for Connected E-Government*, IGI Global, Hershey, pp.180–197.

Ong, J.W., Poong, Y.S. and Ng, T.H. (2008) '3G services adoption among university students: diffusion of innovation theory', *Communications of the IBMA*, Vol. 3, No. 16, pp.114–121.

Oreku, G.S. and Mtenzi, F.J. (2012) 'A review of e-Government Initiatives in Tanzania: challenges and opportunities', in Bwaya, K. and Zulu, S. (Eds.): *Handbook of Research on E-Government in Emerging Economies: Adoption, E-Participation and Legal Frameworks: Adoption, E-Participation and Legal Frameworks*, Hershey: IGI Global, pp.37–68.

Peek, S., Wouters, E., van H., Luijkx, K., Boeije, H. and Vrijhoef, H. (2014) 'Factors influencing acceptance of technology for aging in place: a systematic review', *International Journal of Medical Informatics*, Vol. 83, No. 4, pp.235–248.

Rambocas, M.M. and Arjoon, S. (2012) 'Using diffusion of innovation theory to model customer loyalty for internet banking: a TT millennium perspective', *International Journal of Business and Commerce*, Vol. 1, No. 8, pp.1–14.

Rogers, M. (1983) *Diffusion of Innovation*, 3rd ed., The Free Press, New York.

Rogers, M. (1995) *Diffusion of Innovations*, 4th ed., The Free Press, New York.

Rokhman, A. (2011) 'E-government adoption in developing countries; the case of Indonesia', *Journal of Emerging Trend in Computing and Information Sciences*, Vol. 2, No. 5, pp.228–236.

Sekaran, U. (2006) '*Research Methods for Business: A Skill Building Approach*, John Wiley & Sons, New York.

Shareef, M.A., Norm, S. and Dwivedi, Y.K. (2012) 'Examining adoption behavior of mobile government', *Journal of Computer Information Systems*, Vol. 53, No. 2, pp.39–49.

Singh, V. and Sharma, S.K. (2016) 'Analyzing the moderating effects of respondent type and experience on the fuel efficiency improvement in air transport using structural equation modeling', *European Transport Research Review*, Vol. 8, No. 2, pp.1–20.

Siyao, P.O. (2012) 'Barriers in accessing agricultural information in Tanzania with a gender perspective: the case study of small-scale sugarcane growers in Kilombero district', *The Electronic Journal of Information Systems in Developing Countries*, Vol. 51, No. 6, pp.1–19.

Stevens, J.P. (1992) *Applied Multivariate Statistics for the Social Sciences*, Routledge, New York.

Sun, H. and Zhang, P. (2006) 'The role of moderating factors in user technology acceptance', *International Journal of Human-Computer Studies*, Vol. 64, No. 2, pp.53–78.

Tabachnick, B.G. and Fidell, L.S. (2007) '*Using Multivariate Statistics* 5th ed., Allyn and Bacon, New York.

Tan, M. and Teo, T. (2000) 'Factors influencing the adoption of internet banking', *Journal of the Association for Information Systems*, Vol. 1, No. 5, pp.1–42.

Tarhini, A., Hone, K. and Liu, X. (2014) 'Measuring the moderating effect of gender and age on e-learning acceptance in England: a structural equation modeling approach for an extended technology acceptance model', *Journal of Educational Computing Research*, Vol. 51, No. 2, pp.163–184.

Teddlie, C. and Yu, F. (2007) 'Mixed methods sampling: a typology with examples', *Journal of Mixed Methods Research*, Vol. 1, No. 1, pp.77–100.

Tornatzky, L. and Klein, K. (1982) 'Innovation characteristics and innovation adoption-implementation: a meta-analysis of findings', *IEEE Transactions on Engineering Management*, Vol. 29, No. 1, pp.28–43.

Trentelman, C., Irwin, J., Petersen, K., Ruiz, N. and Szalay, C. (2016) 'The case for personal interaction: drop-off/Pick-Up methodology for survey research', *Journal of Rural Social Sciences*, Vol. 31, No. 3, pp.68–104.

Twati, J.M. (2014) 'The influence of societal culture on the adoption of information systems: the case of Libya', *Communications of the IIMA*, Vol. 8, No. 1, p.1.

URT (2013) '*Population Distribution by Age and Sex*, National Bureau of Statistics, Dar es Salaam.

URT (2015) *Government Mobile Platform*, E-Government Agency, Dar es Salaam.

Venkatesh, V., Morris, M., Davis, G. and Davis, F. (2003) 'User acceptance of information technology: toward a unified view', *MIS Quarterly*, Vol. 27, pp.427–478.

Venkatesh, V., Thong, J. and Xu, X. (2012) 'Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology', *MIS Quarterly*, Vol. 36, No. 1, pp.157–178.

Waceke, J.W. and Kimenju, J.W. (2004) 'Intensive subsistence agriculture: impacts, challenges and possible interventions', *Dynamic Soil, Dynamic Plant*, Vol. 1, No. 1, pp.43–53.

Wang, Y., Wu, M. and Wang, H. (2009) 'Investigating the determinants and age and gender differences in the acceptance of mobile learning', *British Journal of Educational Technology*, Vol. 40, No. 1, pp.92–118.

Wong, K-T., Teo, T. and Russo, S. (2012) 'Influence of gender and computer teaching efficacy on computer acceptance among Malaysian student teachers: an extended technology acceptance model', *Australasian Journal of Educational Technology*, Vol. 28, No. 7, pp.1190–1207.

Yi-Hsuan, L., Yi-Chuan, H. and Chia-Ning, H. (2011) 'Adding innovation diffusion theory to the technology acceptance model: supporting employees â€™ intentions to use E-Learning systems E-learning and TAM the technology acceptance model (TAM)', *Educational Technology and Society*, Vol. 14, No. 4, pp.124–137.

Yonazi, J. (2013) *Adoption of Transactional Level e-Government Initiatives in Tanzania*, Clknet Research, Dar es Salaam.

Yu, C-S. (2012) 'Factors affecting individuals to adopt mobile banking: empirical evidence from the UTAUT model', *Journal of Electronic Commerce Research*, Vol. 13, No. 2, pp.104–121.