

INFORMATION AND COMMUNICATION TECHNOLOGY ADOPTION MODEL FOR SECONDARY SCHOOL TEACHERS IN RURAL AREAS OF TANZANIA

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Abstract: *Application of ICT in African learning institutions is critical if the continent is to reduce the knowledge, technological and economic gaps. Learning institution and teachers are in pressure to adopt Information and Communication Technology in their teaching to impart knowledge, skills and attitudes to learners needed especially in rural areas. Numerous theoretical models have been useful in understanding and predicting of user acceptance and adoption of information and communication technology (ICT). The study was guided by Theory of Acceptance and Use of Technology (UTAUT). The quality of teaching is dismal especially in the rural areas of Tanzania. The role of ICT is seen as an enabler in successful teaching and learning in rural areas of Tanzania. Therefore, the purpose of the study was to develop ICT adoption model among secondary school teachers in rural areas of Tanzania. Positivist paradigm principles were employed in this study. The sample size involved 333 teachers from 150 secondary schools. Questionnaires and Interview guide were utilized for data collection. The study entailed logistic regression on the various factors that would lead to adoption of ICT in secondary schools in rural areas in Tanzania. The study found that constructs Performance Expectance would be associated with adoption of ICT among the teachers in secondary schools in Tanzania. The study recommended that despite the challenges in ICT adoption I secondary schools in rural areas, guidance of Theory of Acceptance and Use of Technology (UTAUT) model can be used effectively by learning institutions to improve the teaching.*

Keywords: *Adoption, Model, ICT, Secondary Schools, UTAUT*

INTRODUCTION

Background to the Study

The Technology adoption is perceived as the willingness of users to accept and make use of available systems, (Davis 1989 cited in Frans & Pather, 2021). Technology support and its development can hence be regarded as significant factors to contemplate on where adoption is concerned, and the lack thereof may impede the adoption of ICTs (Frans & Pather, 2021). Numerous interesting theoretical framework related to theories of acceptance of ICT in teaching have been developed, these include among others; Technology Acceptance Model, (TAM), Unified Theory of Acceptance and Use of Technology (UTATU), The Theory of reasoned action (TRA), The theory of Planned behavior (TPB), The motivational Model (MM), A model combining the technology acceptance model and the theory of planned behavior (C-TAM-TPB), The model of PC Utilization (MPCU), The innovation diffusion theory (ID) and Socio Cognitive Theory (SCT). UTAUT has been presented as being capable to explain about 70% of technology acceptance behaviour, unlike other previous models that could only explain 40% (Urumsah 2015 cited in Frans & Pather, 2021).

Statement of the Problem

Despite the need and efforts, there are still challenges and gaps in incorporating ICT in educational delivery in Tanzania secondary institutions. It is documented that numerous secondary schools do not have sufficient ICT facilities (URT, 2016). It has been reported that teachers still face difficulties in adopting the use of ICT in teaching as a consequent of several dynamics which comprises of lack of adequate computer skills, negative attitudes towards ICT and limited infrastructure, lacks adequate strategies to prepare teachers to integrate ICT in teaching and learning, systems and digital content, (Ndibalema 2014; Kayombo 2016; Kitta and Fussy, 2013). Though various studies have reported the importance of technology in enhancing teaching and learning mostly in urban areas, Hare, (2007; Sugiyama, 2005), there is scarcity of literature on the factors influencing the adoption of ICT among secondary schools' teachers especially in rural areas of Tanzania. Due to this the researcher developed interest on developing a Model of Information Communication Technology adoption among secondary school teachers and investigating more to deepen knowledge to discover why there is low adoption of ICT among secondary school teachers in rural areas of Tanzania.

General Objective of the study

The study aimed to establish an Information and Communication Technology Adoption Model for Secondary School Teachers in Rural Areas of Tanzania.

Specific Objective

To develop an effective Information and Communication Technology model for secondary school Teachers in Rural Areas of Tanzania.

Research Questions

Which ICT adoption Model is appropriate for secondary school teachers?

LITERATURE REVIEW

Numerous interesting theoretical frameworks related to theories of acceptance of ICT in teaching have been developed, UTAUT models have been praised to have more illustrative power than other technology

acceptance models (Açıkgül & Nihat Şad, 2021). The literature focusses on the different models of ICT adoption factors influencing ICT adoption in general.

1) Innovation Diffusion Theory

Innovation Diffusion Theory (IDT) by Rogers (2003) has been used in studying individuals' technology adoption. The main goal of IDT is to understand the adoption of innovation in terms of four elements of diffusion which include innovation, time, communication channels, and social systems. IDT also states that an individual's technology adoption behavior is determined by his or her perceptions regarding the relative advantage, compatibility, complexity, trialability, and observability of the innovation, as well as social norms according to (Rogers, 2003). There are a number of studies that used the IDT as its theoretical framework or combined the IDT with other theories and models to explain ICT adoption and use. IS scholars mentioned that in the context of end-user computing many of the classical diffusion assertions were valid as reported by (Ritu Agarwal & Prasad, 1997; Brancheau & Wetherbe, 1990). The five main constructs of IDT were used and shown to have significant relationships with other factors in ICT adoption and use research. Relative advantage was discovered to have a positive relationship with attitude according to (Ritu Agarwal & Prasad, 2000), and relative usage intention as by (Lin, Chan, & Wei, 2006). Compatibility was found to influence PU by (A Bhattacharjee & Hikmet, 2007), PEOU (Hernandez, Jimenez, & Martin, 2010), attitude (Ritu Agarwal & Prasad, 2000; Lee, Kozar, & Larsen, 2003), and intention (Saeed & Muthitacharoen, 2008; J.-H. Wu & Wang, 2005). Complexity was found to have a negative relationship with the technology adoption intention by (Beatty, Shim, & Jones, 2001; Son & Benbasat, 2007). This as illustrated in the figure 1 below.

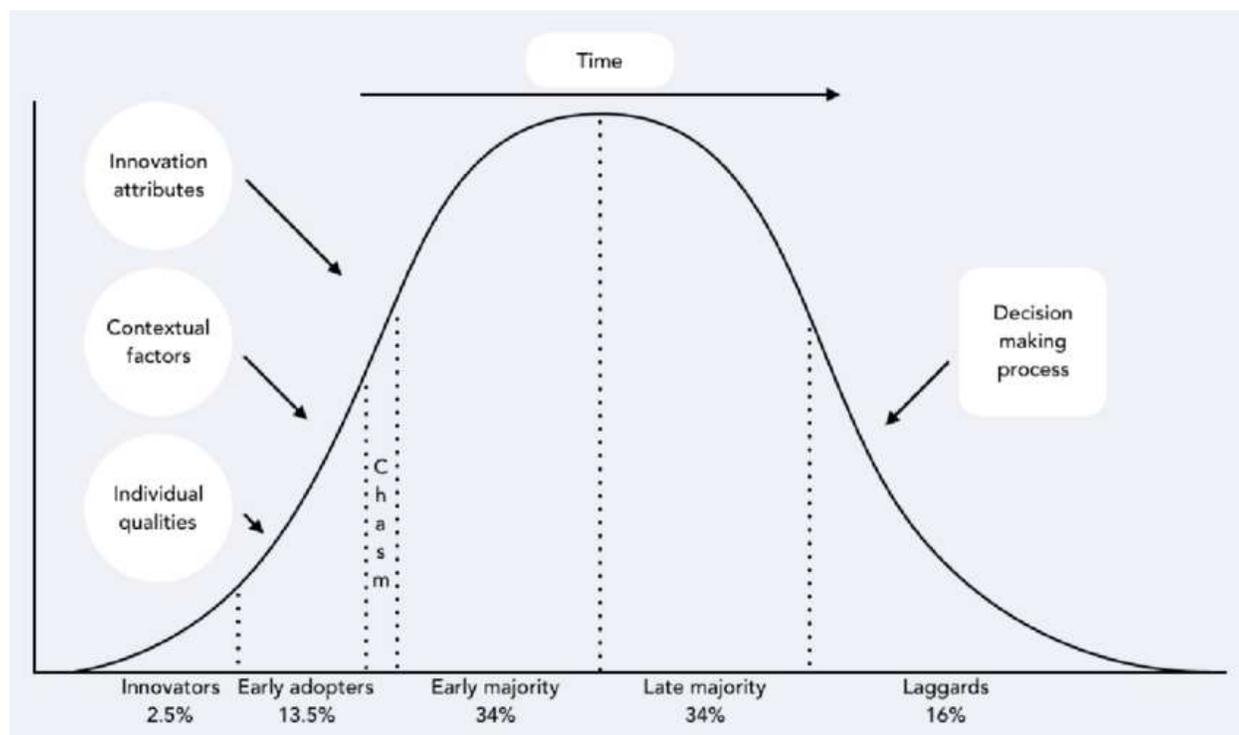


Figure 1 innovation Diffusion Theory

Source: Rogers (2003)

Social Cognitive Theory

Social Cognitive Theory (SCT) enlightens how people acquire and maintain certain behavioral patterns based on the learning from others as stated by (Bandura, 1977). SCT postulates that portions of an individual’s knowledge acquisition can be directly related to observing others within the context of social interactions, experiences, and outside media influences. SCT recommends that behavior is affected by both outcome expectations and self-efficacy, while outcome expectations and self-efficacy are in turn influenced by prior behavior. IS scholars have used SCT and instituted significant relationships with other constructs in ICT adoption and use research as mentioned by (Compeau & Higgins, 1995a). Outcome expectations were found to influence both affect and usage according to (Compeau & Higgins, 1995b). Self-Efficacy was identified to positively influence various adoption determinants including PEOU as stipulated by (Chan & Lu, 2004; Venkatesh & Davis, 1996), PU (Ritu Agarwal & Karahanna, 2000), and perceived enjoyment by (Roca & Gagné, 2008). In the post-adoption research self-efficacy also influences continued intention to use a technology according to (Chiu & Wang, 2008; Hsu & Chiu, 2004). This is illustrated in Figure 2.

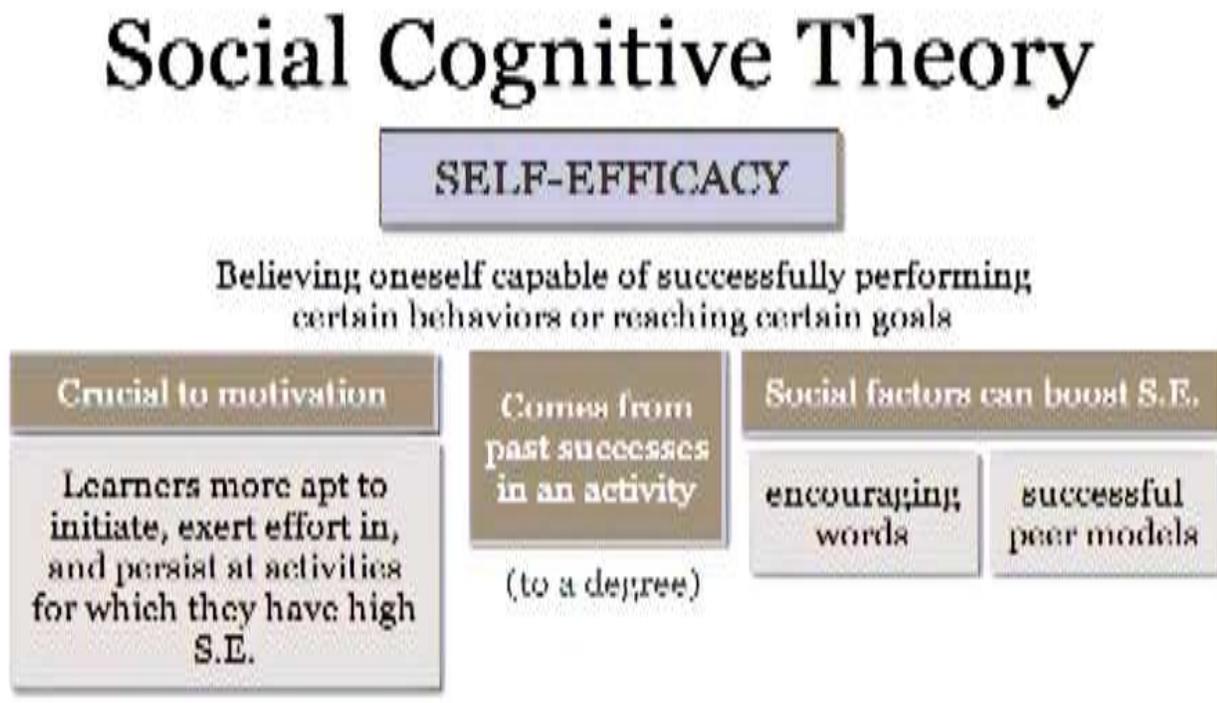


Figure 2 Social Cognitive Theory

Adopted from Bandura, 1977

Theory of Reasoned Action

Theory of Reasoned Action by Fishbein and Ajzen (1975) is a well-known social psychology theory which explains an individual’s behavior based on his or her behavioral intention, which is influenced by his/her attitude toward the behavior and perception of the subjective norms regarding the behavior. TRA has been used in ICT adoption and use research as a fundamental theoretical framework. The theory has been combined with other theories and models. Attitude and subjective norm were discovered to be important determinants of

peoples’ intentions to adopt and use ICTs according to (Brown, Massey, Montoya-Weiss, & Burkman, 2002; Karahanna, Straub, & Chervany, 1999). Attitude was identified to have a significant influence on the intention to adopt and continue to use ICT as indicated by (Anol Bhattacharjee and Premkumar, 2004; J. J. Po-An Hsieh, Rai, & Keil, 2008). Regarding the subjective norm, previous studies reported that subjective norm influences not only the behavioral intention according to (Hu, Lin, & Chen, 2005; Venkatesh & Davis, 2000), but also other constructs including satisfaction as stated by (Hsu & Chiu, 2004), image (Chan & Lu, 2004), and perceived usefulness (Venkatesh & Davis, 2000). This as illustrated in Figure 3.

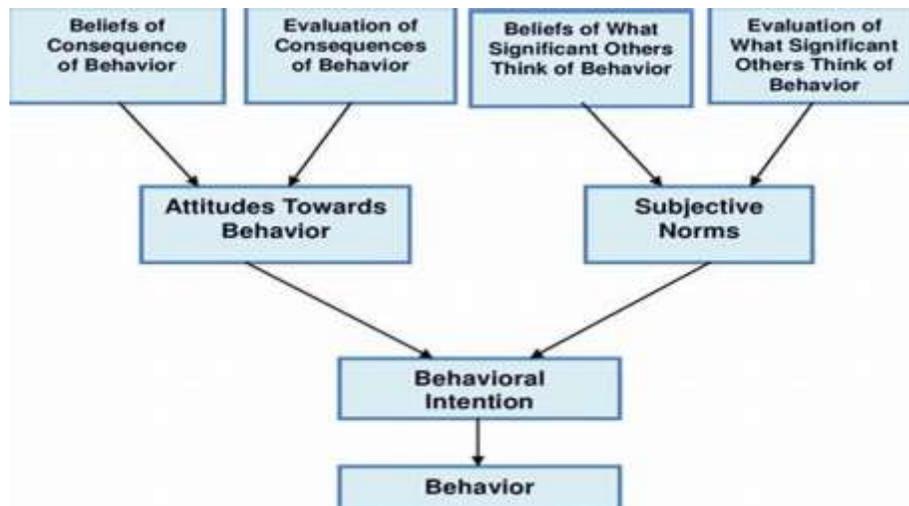


Figure 3 Theory of Reasoned Action

Source: Fishbein and Ajzen (1975)

Theory of Planned Behavior

Theory of Planned Behavior is also a well-established social psychology theory that also states that specific salient beliefs influence behavioral intentions and subsequent behavior (Ajzen, 1991). Compared to TRA, TPB added another construct, Perceived Behavioral Control (PBC), which can be defined as “one’s perceptions of his/her ability to act out a given behavior easily” (Ajzen, 1991). Several studies in ICT adoption and use research have used TPB as their theoretical framework (Hsu & Chiu, 2004; Liao, Chen, & Yen, 2007). Other studies using TRA, these studies also found significant relationships between attitude, subjective norm, perceived behavioral control and behavioral intention. PBC as an additional construct in TPB shed light on the importance of the perceived difficulty of the behavior and the person’s perceived ability to act out the behavior. A good number of studies found that PBC directly influences the technology adoption intention according to (Chau & Hu, 2001; Wu & Chen, 2005) and continuance usage intention (Hsu, Yen, Chiu, & Chang, 2006; Liao, et al., 2007). This is illustrated in Figure 4.

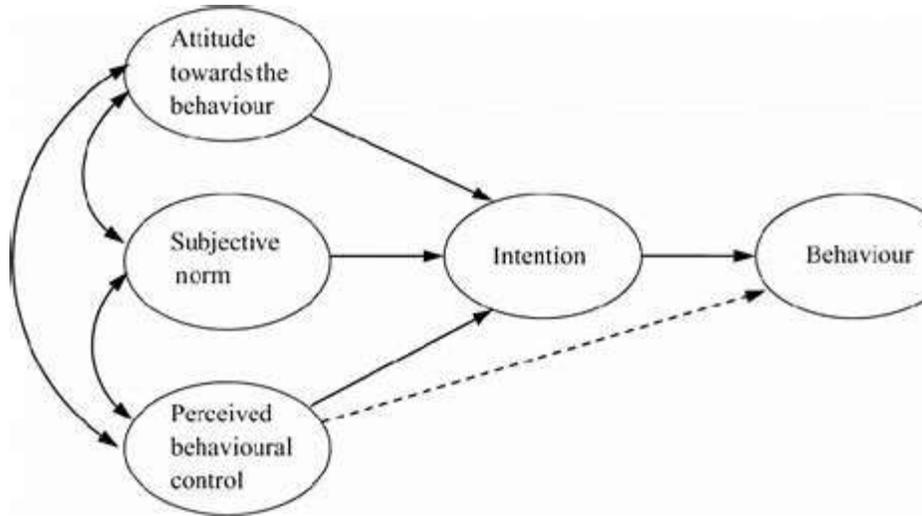


Figure 4 Theory of Planned Behaviour

Adopted from Ajzen, 1991.

Technology Acceptance Model

TRA and TPB have influenced the TAM and its extended models, which mainly focus on the adoption and use of ICT. Davis (1989) presented the TAM to explain the determinants of user acceptance of a wide range of end-user computing technologies. In TAM, Davis identified two theoretical constructs including Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) that affect the intention to use a system. A number of studies which have used TAM as their theoretical background for explaining ICT adoption and use. Researchers confirmed that PU has a positive relationship with both adoption intention (Davis, 1989) and continuance intention according to (Ritu Agarwal & Karahanna, 2000; Venkatesh, 2000). In post adoption studies, PU has been found to influence satisfaction as noted by (Anol Bhattacharjee, 2001a; Moez Limayem, Hirt, & Cheung, 2007) and attitude toward the technology as indicated by (Anol Bhattacharjee & Hikmet, 2008). PEOU has been found to influence both PU and adoption intention (Davis, 1989). In post-adoption studies, PEOU was found to influence satisfaction as shown by (Thong, Hong, & Tam, 2006), continuance intention (Venkatesh & Davis, 1996, 2000), and actual continuance usage (R. Agarwal, 2000; Lippert, 2007). Though TAM was found to be a valid theoretical framework in studying ICT adoption and use, it has been criticized for its several limitations including the original model's intended generality and parsimony as urged (Dishaw & Strong, 1999), not considering non-organizational setting (Venkatesh & Davis, 2000), and overlooking the moderating effects of ICT adoption and use in different situations according to (Sun & Zhang, 2006). This is illustrated in figure 5.

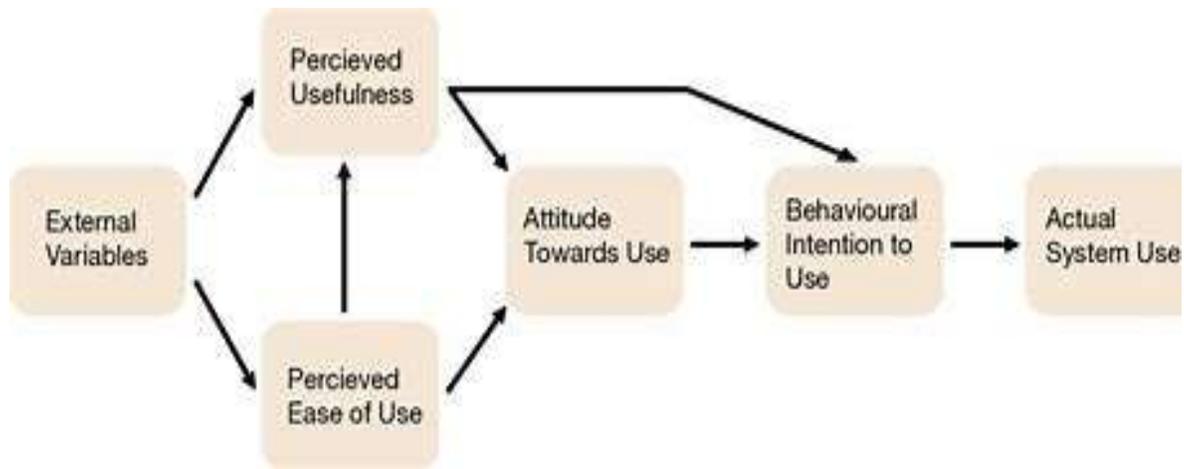


Figure 4 Technology Acceptance Model

Source: Davis (1989)

Enhanced Technology Acceptance Model

To be able to address the limitations of TAM, Venkatesh and Davis (2000) enhanced the TAM to Extended Technology Acceptance Model (TAM2), which provides a detailed explanation of the key forces underlying judgments of perceived usefulness as reported by (Venkatesh & Davis, 2000). Using TAM as the starting point, TAM2 incorporated additional theoretical constructs including social influence processes (subjective norm, voluntaries, image, and experience) and cognitive instrumental processes (job relevance, output quality, and result demonstrability), which original TAM lacked (Venkatesh & Davis, 2000). In TAM2, the social influences such as image and subjective norm were studied in order to overcome the limitations of the original TAM. TAM2 actually incorporated social influences into an individual's perceptions of usefulness (Venkatesh & Davis, 2000). Subjective norm is the same construct that has been studied in TRA and TPB. Compared to subjective norm, image can be defined as the way that people want to be seen. Image was found to have a significant influence on perceived usefulness as stated by (Chan & Lu, 2004; Venkatesh & Davis, 2000) and attitude (Karahanna, et al., 1999). TAM2 also included diverse variables in order to enhance the explanatory power, but many times TAM2 explained low percentages of a system's use (Lu, Yao, & Yu, 2005). As TAM2 was developed in order to improve the explanatory power of the original TAM, the Unified Theory of Acceptance and Use of Technology model (UTAUT) was developed to address the same limitation in TAM2 as stipulated by (Venkatesh, Morris, Davis, & Davis, 2003). This is as illustrated in Figure 6.

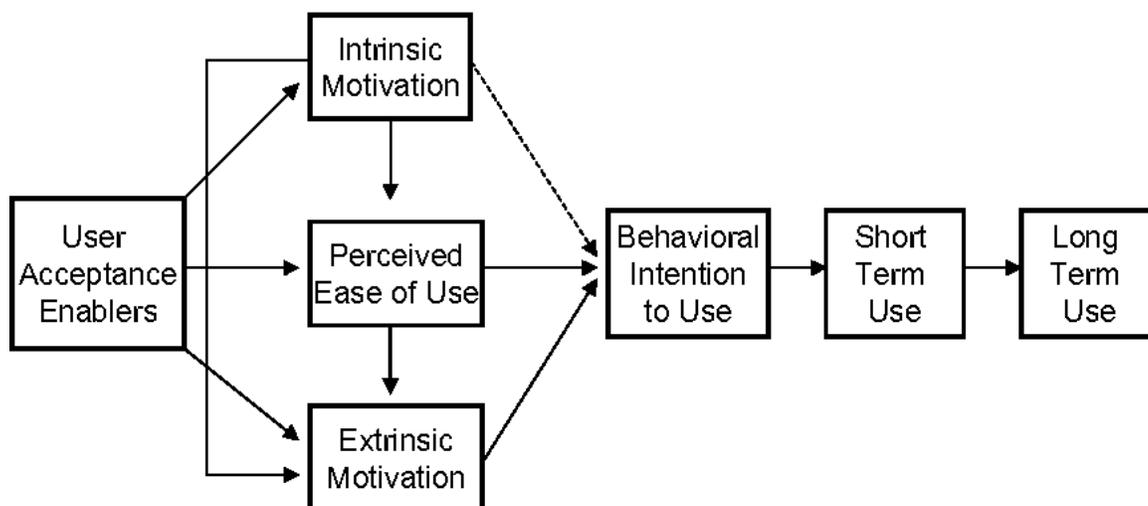


Figure 5 Enhanced Technology Acceptance Model

Source: Venkatesh and Davis (2000)

Unified Theory of Acceptance and Use of Technology

UTAUT provides a polished view of how the determinants of intention and behavior evolve over time. It assumes that there are three direct determinants of intention to use ICT which include performance expectancy, effort expectancy, and social influence and two direct determinants of usage behavior which include intention and facilitating conditions (Venkatesh, et al., 2003). These relationships are moderated by gender, age, experience, and voluntariness of use according to (Venkatesh, et al., 2003). Empirical testing of UTAUT shows that performance expectancy, effort expectancy, and social influence have significant relationships with the intention to use technologies (Venkatesh, et al., 2003). Advanced studies found that social influence affect perceived usefulness and perceived ease of use as noted by (S.-J. Hong & Tam, 2006; Lu, et al., 2005). Though, in post-adoption research, social influence on the continuance intention was inconsistent; some studies reported significant relationships according to (S.-J. Hong & Tam, 2006; S.-J. Hong, Thong, Moon, & Tam, 2008), but other studies testified non-significant relationships (Chiu & Wang, 2008). UTAUT is one theory that covers extensive individual difference constructs including gender, age, experience, and voluntariness of use as moderating variables.

Though there are some inconsistencies in previous studies on individual differences, researchers informed significant moderating effects by individual differences such as gender according to (M. G. Morris, Venkatesh, & Ackerman, 2005; Venkatesh & Morris, 2000; Venkatesh, et al., 2003), age (M. Morris & Venkatesh, 2000), prior experience (Venkatesh & Davis, 1996), and voluntariness of use (Venkatesh, et al., 2003). Biemans, Swaak, Hettinga and Schuurman (2005) used the UTAUT model to examine nurses’ behavioural intentions towards the use of Medical Teleconferencing Application, the study discovered that performance expectancy and effort expectation are high predictors of behavioural intention, but social influence prediction power is low. AlAwadhi and Morris (2008) examined the adoption of e-government services using UTAUT, the survey was carried out on 880 students revealed that performance expectancy, effort expectancy and peer influence determine students’ behavioural intention. Likewise facilitating conditions and behavioural intentions determine students’ use of e-government services. Some study of IT adoption, conducted by Oshlyansky, Cairns and Thimbleby (2007) discovered that performance expectancy, effort expectancy and

social influence predicts use intention. Šumak, Polančič and Heričko (2010) stated that social influence have a significant impact on students behavioural intention to use moodle and students' behavioural intentions is a powerful predictor of the use of the e-learning system. Cheng, Liu, Song and Qian (2008) study explored the validity of UTAUT using 313 intended users of Internet banking in China, the result advocated that performance expectancy and social influence are strong predictors of behavioural intention. In a parallel study by Cheng, Liu, and Qian (2008) reported that performance expectancy and social influence of the UTAUT constructs as predictors of user's behavioural intention towards internet banking. Venkatesh et al. also established that performance expectancy is the strongest predictor of behavioural intention to use several technologies in both voluntary and involuntary settings. Another study conducted in Africa with 96 respondents, performance expectancy was found to have strong influence for instructors to adopt and use OER in teaching according to (Percy & Belle, 2012).

An empirical study by Fang, Li, and Liu (2008) advocates that performance expectancy, effort expectancy and social influence significantly predicts managers intention to engage in knowledge sharing using web2.0. Maldonado, Khan, Moon and Rho (2009) surveyed the acceptance of an elearning technology in secondary school in Peru 240 Students took part in the survey. Result from their study suggests that social influence significantly predicts behavioural intention. In the same study, Maldonado et al. (2009) indicates behavioural intention to significantly predict use behaviour. Carlsson, Carlsson and Hyvönen (2006) inspected the acceptance of mobile telephone and found that performance expectancy, effort expectancy and social influence are predictors of behavioural intention. Too, Wu, Tao and Yang (2007) inspected the acceptance of 3G services in Taiwan and found performance expectancy and social influence as predictors of behavioural intention. Interestingly the authors also found performance expectancy, effort expectation, social influence and facilitating conditions as predictors of use behaviour. He and Lu (2007) further advocates that performance expectancy and social influence are predictors of behavioural intention towards consumer's acceptances of mobile advertising. The authors also stated that facilitating condition and behavioural intention predicts use behaviour. Cheng, Liu, Qian & Song (2008) studied the acceptance of internet banking, results advocated that performance expectancy and social influence predicts intention.

The review evidently shows that variables that need to be applied to determine users' acceptance or adoption of technology varies. Also, results from the reviewed papers do not portray any clear pattern of the predictions although majority of them (results) were consistent with the original postulations of the authors of UTAUT Venkatesh et al (2003). The effect of exogenous variables EE, PE, SI on endogenous variable BI is not consistent across countries, within country, and unit of studies. While in some studies the effect of effort expectancy on behavioural intension is significant and strong Im I et al. (2011) and the effects of the other variables are insignificant, in other studies performance expectancy or social influence Cheng et. al (2011) significantly influence BI. Other studies (AbuShanab E.and Pearson J. M (2007), Kijisanayotin B, Pannarunothai S and Speedie SM (2009), Martins C, Tiago O, and Ale P (2013), Chiao-Chen C (2013) had all the exogenous variables significantly predicting behavioural intension. Results from a comparative study in Nigeria conducted by Oye et. al (2012) to establish how students accepts and use ICT in two different universities, suggest PE is most influential predictor of students' intention at LASU while EE is the most influential predictor of students' of ADSU intentions to accept ICT. The study 'Using UTAUT to Explore the Behavior of 3G Mobile Communication User' done by Wu et al. (2007) found that among the four determining factors that influence the acceptance of 3G hand phones, only Effort Expectancy has no influence on the users' Behavioural Intention.

In another study, 'Assessing User Acceptance Toward Blog Technology Using the UTAUT Model', done by Bens Pardamean & Mario Susanto (2012), found that the media interactive function in e-learning has managed to attract students' interest and attention. They also agreed that e-learning media is suitable for collaboration and sharing of ideas among students. It clearly shows that social and environmental factors are the catalysts to influence students to use blogs in the e-trading lessons. To enhance the use of blogs in e-trading classes, peer influence and support is vital.

In addition, an empirical study by Fang, Li, and Liu (2008) suggests that performance expectancy, effort expectancy and social influence significantly predicts managers intention to engage in knowledge sharing using web2.0. Maldonado, Khan, Moon and Rho (2009) examined the acceptance of an elearning technology in secondary school in Peru 240 Students took part in the survey. Result from their study suggests that social influence significantly predicts behavioural intention. In the same study, Maldonado et al. (2009) found behavioural intention to significantly predict use behaviour. Carlsson, Carlsson and Hyvönen (2006) examined the acceptance of mobile telephone and found that performance expectancy, effort expectancy and social influence are predictors of behavioural intention. Too, Wu, Tao and Yang (2007) investigated the acceptance of 3G services in Taiwan and found performance expectancy and social influence as predictors of behavioural intention. Interestingly the authors also found performance expectancy, effort expectation, social influence and facilitating conditions as predictors of use behaviour. He and Lu (2007) further suggest that performance expectancy and social influence are predictors of behavioural intention towards consumer's acceptances of mobile advertising. The authors also found that facilitating condition and behavioural intention predicts use behaviour. Cheng, Liu, Qian & Song (2008) examined the acceptance of internet banking, results suggest that performance expectancy and social influence predicts intention.

As much as some studies have supported that the four predictive factors of UTAUT predicts intention and use behavior, results from some other studies suggest otherwise. Li & Kishore (2006) studied the Use of Online Community Weblog Systems, the results indicated that scales for the four constructs in UTAUT including performance expectancy, effort expectancy, social influence, and facilitating conditions have invariant true scores across most but not all subgroups. The authors expressed need for caution when interpreting UTAUT. In a structured PLS-Graph Conceptual Model, Tibenderana and Ogao (2008) found performance expectancy and social influence to be non-significant in predicting behavioural intention to use electronic Library services in Ugandan Universities. Performance expectancy, effort expectancy and social influence were found to be non-significant in predicting intention in a study investigating the acceptance of an interface robot and a screen agent by elderly users (Heerink, Kröse, Wielinga and Evers, 2009). Similarly, Šumak, Polančič and Heričko (2010) suggested that performance expectancy and effort expectancy are non-significant predictor of behavioural intention. In a related study, Cheng, Liu, Song and Qian (2008) discovered that effort expectancy does not significantly predict behavioural intention. Similar studies have also found effort expectancy to be non-significant in predicting behavioural intention (See Cheng, Liu and Qian 2008; He and Lu 2007; Wu, Tao and Yang 2007). In a study to investigate the role played by motivation in e-learning technology adoption, Maldonado, Khan, Moon and Rho (2009) found facilitating condition to be no- significant in predicting use behaviour n. Cheng, Liu, Qian, Song (2008) also examined the acceptance of internet banking and found that effort expectancy does not predict customers intention to use internet banking. In the context of eGovernment, Schaupp, Carter and Hobbs (2009) investigated the acceptance of E-Filing by the American taxpayers. Results from the study suggest that performance expectancy and social influence predicts behavioural intention. Interestingly, the study revealed that effort expectancy is not a predictor of behavioural intention. The

inconsistency in the outcomes of the studies on UTAUT leaves the output of the relationships in the model inconclusive. This is illustrated in figure 7.

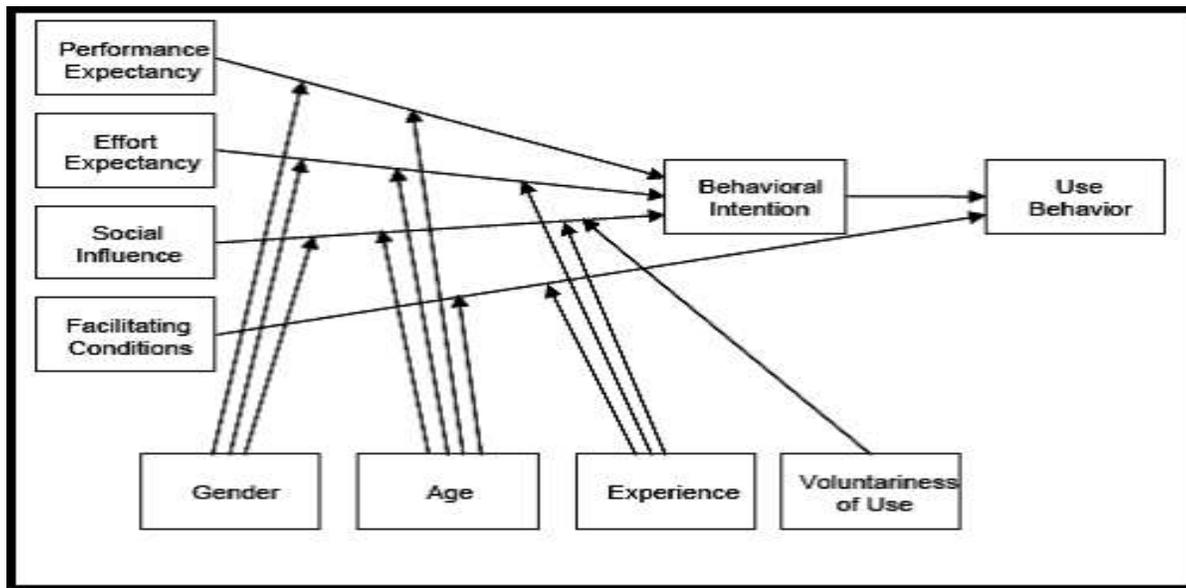


Figure 6 Unified Theory of Acceptance and Use of Technology (UTAUT)

(Source: Venkatesh et al., 2003)

2) Summary of reviewed Theories and Models

The underneath is a summary of theories and models deliberated above and resemblances originated between the constructs used to explain individual users’ technology adoption. The table 1 below shows how the constructs in TRA, TPB, TAM, TAM2, UTAUT, IDT, and SCT are related to each other.

Table 1 Summary of Reviewed Theories and Models in ICT Adoption

Factors for ICT adoption	IDT	SCT	TRA	TPB	TAM	ETAM	UTAUT
Performance Expectancy	Relative advantage	Outcome Expectations	Beliefs, Attitudes	Beliefs, Attitude	Perceived usefulness	Perceived Usefulness	Voluntary use
Effort Expectancy	Complexity	Self-efficacy	Not apply	Perceived Behavioural Control	Perceived easy of use	Perceived easy of use	Based on Experience
Social Influence	Not apply	Not apply	Subjective norm	Subjective norm	Not apply	Subjective Norm, Image	Age and gender influenced
Facilitating Conditions	Compatibility, Observability, Triability	Not apply	Not apply	Not apply	Not apply	Result oriented	Not apply

Source: Researcher, 2022

To begin with, “performance expectation” in UTAUT is similar to behavioral beliefs in TRA and TPB, perceived usefulness in TAM and TAM2, relative advantage in IDT, and outcome expectations in SCT. All of these constructs play a major part in explaining why people adopt and use a certain ICT. Many of these theories and models have the UTAUT effort expectancy construct for ICT usage that is similar to perceived ease of use in TAM, PBC in TPB, complexity in IDT, and self-efficacy in SCT. Even though all of these constructs are similar to each other, they have two distinct dimensions: Self-efficacy and controllability. Self-efficacy (internal PBC) is a construct proposed by Bandura (1986) defined as individual judgments of a person’s capabilities to perform a behavior. Controllability (external PBC) is defined as individual judgments about the availability of resources and opportunities to perform the behavior (Hsu & Chiu, 2004). Some of these theories and models also include social influence constructs, such as subjective norm and image. Subjective norm was studied in TRA, TPB, TAM2, and UTAUT, and image was researched in TAM2, UTAUT, and IDT. The facilitating condition construct in UTAUT appear as different types of constructs in other theories and models. For example, compatibility, observability, and trialability in IDT are related to facilitating conditions. Particularly, compatibility in IDT is associated with various beliefs including attitudinal belief (compatible with needs), normative belief (compatible with cultural and social norm), and control belief (compatible with past experience) (Rogers, 2003). Observability in IDT is also the similar to the result demonstrability, which measures the degree to which a person is able to explain to others what the device does. Trialability can be linked to experience using the device. These different constructs work as facilitating conditions in ICT adoption and use. A majority of studies that adopted UTAUT have extended the model by including new variables or reducing existing variables to suit a particular context of the study. Likewise, this study extended the model to suit the context of ICT adoption among secondary school teacher in rural areas of Tanzania.

Proposed ICT Adoption Model

The proposed ICT adoption model in figure 8 was developed by the researcher to investigate the factors influencing adoption of Information Communication Technology among secondary school teachers in rural areas, Iringa, Tanzania. The model has three variables, namely independent variable (IV), Moderating variable (Mo V) and dependent variable (DV). The independent variable is the factors influencing adoption of ICT among secondary school teachers in rural areas, Iringa, Tanzania focusing on constructs such as performance expectancy, effort expectancy, social influence and facilitating conditions. These core constructs are expected to influence either Intention to use ICT or the actual usage of ICT. Intention to use ICT is expected to influence Actual Usage of ICT or not. The moderating variable is composed of the constructs such gender, age, level of experience, according to Venkates *et al.*, (2003) but the researcher has decided to replace them with psychological factors, Demographic factors and Professional development factors which accommodate them all to meet the research interest. These moderators are expected to impact on the influence of core constructs toward behavior intention and actual usage. The effects of some constructs of independent variable on behavioral intention are moderated by constructs of moderating variable. The dependent variable is ICT adoption

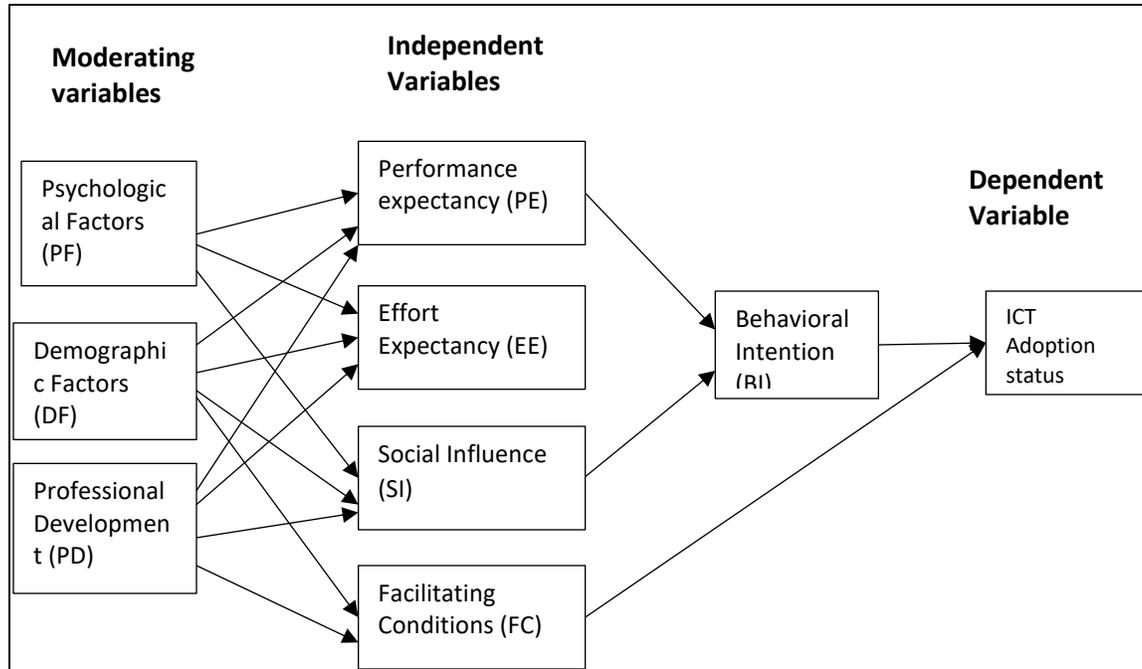


Figure 7 Proposed ICT adoption Model

Source: Adapted from UTAUT: Venkates *et al.*, (2003).

Theoretical Hypotheses

The UTAUT model integrates the eight theoretical models noted above and is composed of the core determinants of usage intention (Venkatesh *et al.*, 2003). Of the four core determinants, performance expectancy, effort expectancy, and social influence significantly predict intention. The UTAUT model is well suited to the context of this study. Based to these observations, the researcher developed the following hypotheses of this study.

1. **Hypothesis 1:** Performance expectancy has no statistically significant influence on users’ intentions to adopt ICT in teaching.
2. **Hypothesis 2:** Effort expectancy has no statistically significant influence on users’ intentions to adopt ICT in Teaching.
3. **Hypothesis 3:** Social influence has no statistically significant association with the users’ intentions to adopt ICT in Teaching.
4. **Hypothesis 4:** Facilitating conditions of ICT adoption has no statistically significant influence on users’ use behaviors of adoption of ICT in teaching.
5. **Hypothesis 5:** Users’ behavioral intentions to use ICT has no statistically significant influence on the users’ use behavior of adoption of ICT

6. **Hypothesis 6:** Psychological factors, Demographic factors and Professional development factors have no statistically significant influence on the core constructs i.e., Performance expectancy, Effect expectancy, social influence and facilitating conditions toward behavior intention and ICT adoption.

A model for ICT adoption among secondary school teachers in rural areas of Tanzania

The study entailed logistic regression on the various factors that would inform adoption of ICT in secondary schools in rural areas in Tanzania. The analysis was carried out systematically with the flow of the order of the conceptualized factors that would inform ICT adoption. The first analysis involving performance expectancy entailed 264(100%) included cases. The omnibus tests of model coefficients table 2 is presented as below.

Table 2. Omnibus Tests of Model Coefficients for Performance Expectancy

		Chi-square	df	Sig.
	Step	2.612	4	.625
Step 1	Block	2.612	4	.625
	Model	2.612	4	.625

Table 2 shows that the chi-square test of fit of the model had step, block and model equal across the chi-square values (2.612), df (4) and significance level of .625. This implied the good spread of the data to be used in the analysis.

Table 3 below shows the model summary of the logistic regression analysis.

Table 3 Model Summary for performance expectancy

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	329.154 ^a	.010	.014

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than .001.

Table 3 shows that the predictive power of the performance expectancy on ICT adoption was well fitted (Cox & Snell R Square =.01 and Nagelkerke R Square = .014). This implied that using the first method (Cox & Snell), 1% of the variations in ICT adoption were attributed to Performance expectancy. Similarly, the Nagelkerke methods shows that 1.4% of the variations in ICT adoption were attributed performance expectancy.

Regarding the responses on a dichotomous scale whether the teachers had adopted ICT or not, the analyzed data was presented using Table 4.

Table 4 Classification Table^a for Performance expectancy

Observed		Predicted			
		Overall, have you adopted IT		Percentage Correct	
		No	Yes		
Step 1	Overall, have you adopted IT	No	0	85	.0
		Yes	0	179	100.0
Overall Percentage					67.8

a. The cut value is .500

Table 4 shows that the predicted teachers who had not adopted ICT were 0 for no and 85 for yes while the ones predicted to have adopted ICT were 0 for no and 179 for yes. This led to a percentage correct for No against yes at .0% and 100% respectively with an overall percentage at 67.8%. At a cut value of .500, the statistics imply that the majority of the teachers had adopted ICT use in their teaching.

Under the same theme (performance expectancy), the logistic regression used four constructs under performance expectancy to analyze its influence on ICT adoption in secondary schools in Tanzania. The constructs included PE1 for “I find the ICTs offered at my institution useful in my job”, PE2 for “Using the ICTs available enable me to accomplish task more easily”, PE3 for “Using the ICTs available increases my productivity” and PE4 for “If I use the current ICTs, It will increase my chance of getting a rise results”. The analysis has presented the constructs as specific variables in the equation using Table 5.

Table 5 Variables in the Equation for performance expectancy

	B	S.E.	Wald	df	Sig.	Exp(B)	
PE1	-.048	.172	.079	1	.779	.953	
PE2	-.055	.175	.099	1	.754	.946	
Step 1 ^a	PE3	.036	.147	.060	1	.807	1.037
	PE4	-.110	.129	.728	1	.393	.896
	Constant	1.375	.434	10.037	1	.002	3.956

a. Variable(s) entered on step 1: PE1, PE2, PE3, PE4.

Table 5 shows that except for PE3 – “Using the ICTs available increases my productivity” which had a positive Beta, the rest of the variables had negative Beta. This implies that the increase in PE3 would increase the ICT adoption while increase in P1, P2 and P4 would reduce ICT adoption among teachers in secondary schools in Tanzania. However, all the changes in the first four constructs that is PE1, PE2, PE3 and PE4 would not be significant as their respective significance levels that is .779, .754, .807 and .393 respectively are greater than a critical p-value of .05. Moreover, Table 5 shows that the exponential Beta for the constructs PE1, PE2, and PE4 are less than 1 while that of PE is greater than 1. This implies that only PE3 would be associated with adoption of ICT among the teachers in secondary schools in Tanzania.

The study entailed data collected on the effort expectancy in the adoption of ICT in teaching in secondary schools in rural areas of Tanzania. The case processing used included cases of 264 which was 100%. The omnibus tests of model coefficients for the variable are presented using Table 6.

Table 6 Omnibus Tests of Model Coefficients for Effort Expectancy

		Chi-square	Df	Sig.
Step 1	Step	6.708	4	.152
	Block	6.708	4	.152
	Model	6.708	4	.152

Figure 6 shows the step block and model chi-square values of 6.708 and significance levels of .152. This implies that the data set was sufficient for model fit in the analysis.

The model summary of the analysis for effort expectancy is as presented in table 7.

Table 7 Model Summary for Effort Expectancy

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	325.058 ^a	.025	.035

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than .001.

Table 7 shows the R square values of .025 and .035 for Cox & Snell and Nagelkerke methods respectively. This implies that 2.5% and 3.5% of the variations in adoption of ICT were attributed to differences in effort expectancy among the secondary school teachers in rural areas of Tanzania.

Predictions for adopting ICT were also analyzed and pretend using table 8.

Table 8 Classification Table^a for Effort Expectancy

Observed		Predicted			
		Overall, have you adopted IT		Percentage Correct	
		No	Yes		
Step 1	Overall, have you adopted IT	No	0	85	.0
		Yes	1	178	99.4
Overall Percentage					67.4

a. The cut value is .500

Table 8 shows that the predicted overall on ICT adoption for no was 85 yes while the predicted yes with no was 1. That table also shows the overall percentage correct for ICT adoption at 67.4%. this implies that the Effort expectancy is plays an instrumental role in ICT adoption among the secondary school teachers in rural areas of Tanzania.

In general, the logistic regression generated the statistics for four variables, namely; EE1 - My interaction with the ICTs available is clear and understandable, EE2 - It is simple for me to use the existing ICT technology, EE3 - Whatever ICTs I come across; it will be simple to operate, and EE4 -The knowledge of using ICT is simple for me. The results are presented in Table 9.

Table 9 Variables in the Equation for Effort expectancy and ICT adoption

	B	S.E.	Wald	df	Sig.	Exp(B)	
EE1	-.030	.066	.212	1	.645	.970	
EE2	-.247	.148	2.770	1	.096	.781	
Step 1 ^a	EE3	.091	.142	.409	1	.522	1.095
	EE4	-.072	.146	.245	1	.621	.930
	Constant	1.641	.469	12.246	1	.000	5.158

a. Variable(s) entered on step 1: EE1, EE2, EE3, EE4.

Table 9 shows three beta values of four variables negative (EE1 B = -.030, EE2 B = -.247 and EE4 = -.072). This implies that increase in these variables would reduce the level of ICT adoption among the secondary school teachers in rural areas of Tanzania. However, the table shows that the significance levels of all the

changes in the variables would be as EE1 sig. =.645, EE2 sig. =.096, EE3 sig. =.522 and EE4 sig. .621 are greater than the p-value of 0.05.

Using the findings in this objective, various factors can be associated with adoption of ICT among secondary schools in Tanzania. The study thus employed SPSS to develop a model for ICT adoption among secondary schools' teachers in Tanzania. The model is as presented in figure 10.

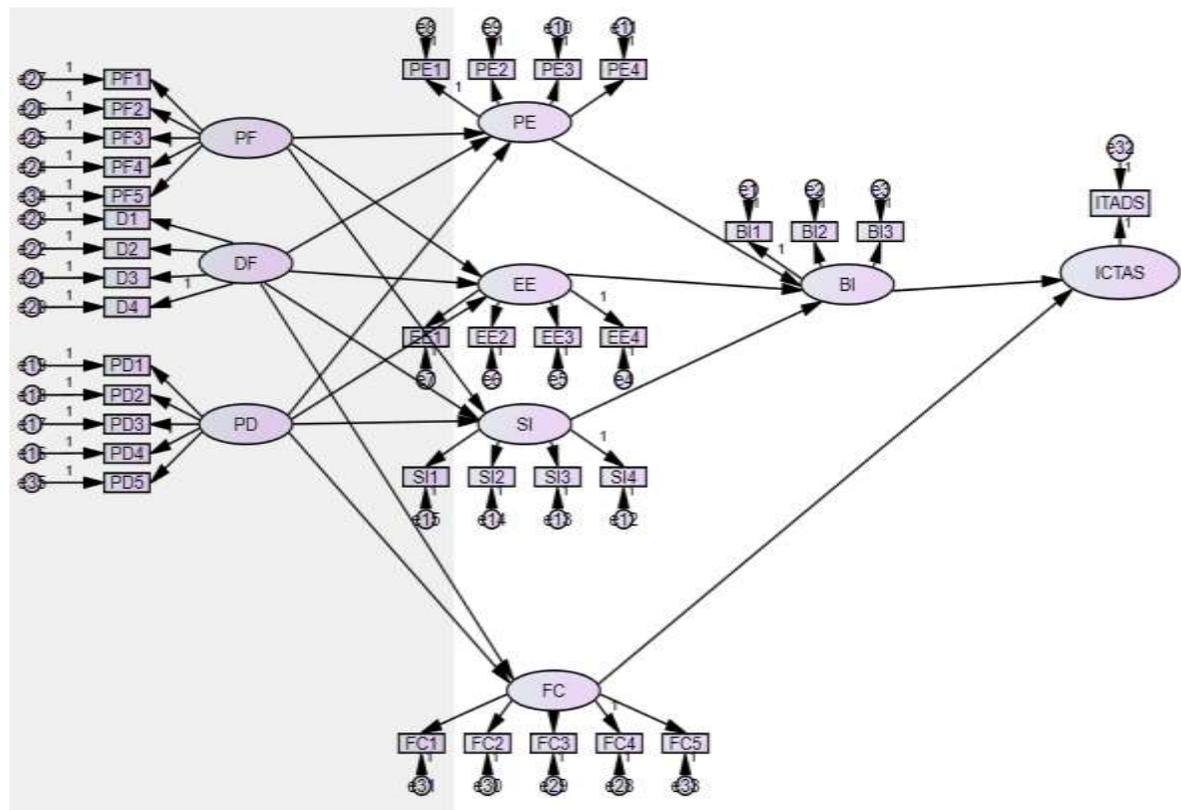


Figure 9 Developed Model for ICT adoption in secondary schools in rural Tanzania

Source researcher 2022

Figure 9 shows that the ICT adoption status is determined by behavioral indicators as well as facilitating conditions. The determinants of behavioral indicators included performance expectancy (PE), effort expectancy (EE), social influence (SI), and Facilitating Conditions (FC). On the other hand, PE is determined by physiological factors (PF), demographic factors (DF) as well as professional development (PD). Similarly, PF, DF and PD determine EE and SI. FC is determined by DF and PD only.

The figure also shows the number of constructs for each variable under study with the PF, PD and FC having the largest number of items = 5. The model was then validated through structural equation modelling to ascertain the level of estimates between items. This is as presented in the analysis of objective three below.

SUMMARY OF THE FINDINGS

The significant influence in the model were physiological factors on performance expectancy, demographic factors on effort expectancy and professional development on facilitating conditions.

The essence is to utilize the findings that revealed that while there are challenges in ICT adoption, guidance of Theory of Acceptance and Use of Technology (UTAUT) model can be used effectively. Moreover, the methodological applications including the mixed data approach described the effectiveness of ICT adoption in secondary schools in rural Tanzania. Through validation, the study showed that the model is feasible and thus the call on the ministry of education in Tanzania to adopt the model.

Conclusion

The study concludes that there exist different models in ICT adoption among secondary school teachers in Tanzania. However, The UTAUT model is more significant as it presents core factors applicable to ICT adoption in rural areas. The significant influence in the model were physiological factors on performance expectancy, demographic factors on effort expectancy and professional development on facilitating conditions.

Recommendation

The study recommends that the ministry of Education in Tanzania consider exploring more factors that influence the ICT adoption. The various studied factors that influence ICT adoption among secondary school teachers can be instrumental in dismal performance among the learners. The essence is to utilize the findings that revealed that while there are challenges in ICT adoption, guidance of Theory of Acceptance and Use of Technology (UTAUT) model can be used effectively. Moreover, the methodological applications including the mixed data approach described the effectiveness of ICT adoption in secondary schools in rural Tanzania. Through validation, the study showed that the model is feasible and thus the call on the ministry of education I Tanzania to adopt the model.

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