

Measuring E-Learning System Adoption in Universities in Tanzania: An Integration of Trust, Environmental Factors, and University Readiness Into an IS Success Model

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ABSTRACT

The success of e-learning systems in Tanzania relies on various factors that influence its measurement. Examples of the key factors include trust, environmental factors, and the university readiness. However, influence of these factors towards e-learning systems is not clear. Understanding their impacts and significance helps decision makers and stakeholders in making informed decisions on how to handle them. This study modifies the information systems (IS) success model whereby it adopts 12 factors that had been suggested by this author in his previous study conducted in Open University of Tanzania (OUT) in 2017. A sample of 1,005 students from eight universities in Tanzania was collected. A structural equation modelling was used in data analysis. The results shows trust (T) has positive and significant impact on e-learning actual use (EAU) while environmental factors (EF) had positive and significant impacts on e-learning actual use and perceived benefits, and at the same time, university readiness had a positive and significant impact on perceived benefits (PB).

KEYWORDS

DeLone and McLean Model, E-Learning Systems, IS, Multi-Factors, OUT, SEM, Tanzania, Universities

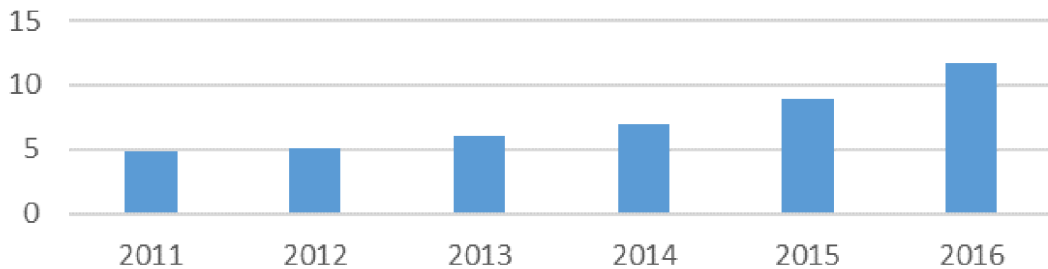
INTRODUCTION

Only 46% of 33 universities, both public and private owned, have managed to adopt electronic learning systems in Tanzania (Lashayo & Md Johar, 2017). Electronic learning system (e-learning system) is regarded as a type of web-based information system which is used specifically in teaching and learning in education institutions. In e-learning, internet is a main means of connecting computing devices for accessing contents (Ahmed, 2013; Ehlers, 2009; Lwoga & Komba, 2015). Adoption of e-learning in this context means accepting and using e-learning systems in university teaching and learning (Maina & Nzuki, 2015). A university is the higher education institution, devoted to professional and intellectual development of mankind, and society in general (URT, 1999). Success in adoption and use of e-learning in University context means achieving the objective that particular information system was meant for (DeLone & McLean, 2016).

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Since 2011, Tanzania has been systematically increasing her investment in e-learning systems (Adkins, 2013). For example, investment in e-learning in the country increased from \$4.9 million in 2011 to \$11.73 million in 2016, which is a massive investment considering economic power of Tanzania (Adkins, 2013). Figure 1, shows increase in investment in e-learning in Tanzania from 2011 through 2016.

Figure 1. Tanzania E-learning Investment from 2011 to 2016 showing duration in years against amount invested in million dollars (Adkins, 2013)



Despite massive investment in e-learning, study by Lashayo and Md Johar (2017) reported that only 46% of 33 universities, both public and private owned universities in Tanzania have managed successfully to have e-learning systems in their universities. Furthermore, statistics shows that 78% of e-learning systems in Higher Education Institutions (HEIs) (which include all education institutions registered by either National Council of Technical Education (NACTE) or Tanzania Commission of Universities (TCU)) are Moodle-based platforms while in universities (institutions registered by TCU only), 75% are Moodle-based platforms (Munguatosha, 2011). Global rate of adoption of e-learning systems is 65%, while in developing countries is 52% and in Africa is 49% (Aparicio, Bacao, & Oliveira, 2016; Isaacs, & Hollow, 2012; Unwin et al., 2010). Therefore, adoption of e-learning systems in Tanzania which is 46% is still low compared to global rate, developing countries and Africa region. Meanwhile both universities and non-universities institutions prefer Moodle-based platforms.

There is a problem of finding comprehensive model to measure e-learning systems in universities in the world and particularly in Tanzania (Hassanzadeh, Kanaani, & Elahi, 2012; Lwoga, 2014; Mohammadi, 2015; Tossy, 2017; Samarasinghe, & Tretiakov, 2012). As a result, there exist measurement models which are lacking important factors such as *Trust*, *Environmental factors*, *University readiness* and also *Intention to use* and *Actual use* been combined as one factor. In an effort to solve this problem of incomprehensiveness of existing models for measuring e-learning systems in Tanzania, this study validates and integrates missing factors into DeLone and McLean (2003) IS model through the following specific objectives:

- (1) to validate a proposed twelve factors of e-learning systems in Tanzania's universities (including *trust*, *environmental factors* and *university readiness*); and
- (2) to develop a measuring model which integrates simultaneously these validated factors.

The rationale of this study is to provide the enhanced e-learning systems model for increased education accessibility for universities in Tanzania.

The proceeding of this paper is as follows: section 2 is literature review, it details proposed factors, status of access of e-learning to universities education in Tanzania and studies which attempted to extend DeLone and McLean (2003) IS model. Section 3 points out the research methodology providing justifications for the tools and methods applied in proposing and testing a research model,

Section 4 focuses on analysis of proposed factors and testing list of hypotheses in this study. Section 5 discusses the results by relating them with existing knowledge. Section 6 provides conclusion and recommendations for further work.

LITERATURE REVIEW

In the course of coming out with an improved model, this study explored and surveyed key factors for e-learning success.

PROPOSED FACTORS

Lashayo and Md Johar (2018) proposed the following factors which were built on DeLone and McLean (2003) Information System (IS) model: *Course Quality*, *Instructor Quality*, *Technical System Quality*, *Educational System Quality*, *Service Quality*, *Intention to Use*, *E-learning Actual Use*, *Learner Satisfaction*, *Environmental Factors*, *University Readiness*, *Trust* and *Perceived Benefits*. These factors have been tested initially in Open University of Tanzania (OUT) in a preliminary study in 2017 (<http://www.mecs-press.org/ijmecs/ijmecs-v10-n3/IJMECS-V10-N3-4.pdf>).

Course quality measures quality of contents produced from e-learning systems, which includes how easy user navigate through content, how sufficient contents are and assessment quality (Delone, & McLean, 2003). On the other hand, *Instructor Quality* measures management of instructor over given e-learning systems which include how comfortable he/she is with e-learning systems, how he/she is responding towards the learner and how he/she manages interaction with other users of e-learning systems (Lwoga, 2014). *Technical System Quality* is a measure of technical aspect of e-learning systems which includes system usability, how easy to understand the system, how secured is the e-learning systems, as well as availability of e-learning systems and their reliability (Hassanzadeh et al., 2012). *Educational System Quality* measures educational features of e-learning systems which enable learning to take place including the following features: audio-structures, video structures, text structures and electronic forum (Hassanzadeh et al., 2012). *Service Quality* measures quality of technical support which are provided by a dedicated unit of information technology of a given university which has that e-learning systems (Delone, & McLean, 2003). *Intention to Use* means an attitude of using e-learning systems before it become routine in use (Delone, & McLean, 2003). *E-learning Actual Use* measures routine use (behaviour) of e-learning system materials which include learning notes, assessment and communication means (Delone & McLean, 2003; Mtebe & Raisamo, 2014). *Learner Satisfaction* means a rate of satisfaction of learner over an actual e-learning system in a place relative to his/her expectations, in other words it is a rate of anticipation of needs of the learner (Delone, & McLean, 2003). *Environmental Factors* measure impacts of externals (peer universities, prospective learners and government policy) over a learner in adopting e-learning systems in universities (Munguatosha et al., 2011). *University Readiness* measures preparation of internal mechanism of a given university over a given e-learning systems. This includes financial support, human resource support and top management support (Munguatosha et al., 2011; Ramayah et al., 2012). *Trust* measures rate of belief a user has on given e-learning systems that they will not let him/her down by compromising the expected standards of education (Ndume, Tillya, & Twaakiondo, 2008). *Perceived Benefits* measure benefits that e-learning systems is bringing to an organisation as a whole apart from immediate user benefits. These organisational benefits include time saving, cost saving, achievement in academic performance, increase pace of learning, knowledge gaining and sharing (Delone, & McLean, 2003).

UNIVERSITY EDUCATION IN TANZANIA

Currently, access rate (face to face and e-learning systems) for university education in Tanzania is 2.4% for about 2.9 million students who complete advance secondary school education and diploma level programmes (TCU, 2016). The national rolling plan for five years (2016-2021) is to increase access rate of university education from current 2.4% to 4.0% for the 2.9 million students by 2021 (TCU, 2016). Hence, the role of e-learning systems in providing an extended platform to access university education is needed.

Studies Extending Information Systems' Model

There have been several attempts to extend DeLone and McLean (2003) Information Success model of Lee-Post model (2009) was modified into three main constructs (*System design, System delivery and System outcome*) including five sub-constructs (System quality, Information quality, Service quality, Use, Net Benefits, User satisfaction) and was tested in Kentucky university in United States of America (USA). Ozkan and Koseler model (2009), famously known as (HELAM) was tested in Brunel university in United Kingdom (UK). This model has six constructs, namely, *System Quality, Service Quality, Content Quality, Learner perspectives, Instructor attitudes and Supportive issues*. Hassanzadeh et al (2012) came out with modified model known as (MELSS) which contained ten constructs (*Technical system quality, Contents and Information quality, Educational system quality, Service quality, User quality, User satisfaction, Intention to use, Use of system, Goal achievement, Benefits of system use and Loyalty to system*) and was tested in six universities in Iran. Mtebe and Raisamo model (2014) consisting of six constructs (*Course quality, System quality, Service quality, Use, User satisfaction, Perceived benefits*) was tested in the University of Dar es salaam (UDSM) in Tanzania. Lwoga model (2014) which has seven constructs (*Information quality, System quality, Service quality, Instructor quality, Perceived usefulness, User satisfaction and Continual usage intention*) tested in Muhimbili University of Health and Allied Science (MUHAS) in Tanzania. Mohammadi model (2015) which has nine constructs (*Quality factors, Perceived Ease of Use, Perceived, Perceived Usefulness, User intentions to use, Satisfaction*) was tested in four universities in Iran and Tossy model (2017) which has eight constructs (*Student engagement, Student cognitive, performance, Student control, Student satisfaction, Continue using, Student motivation and Student self-esteem*) was tested in four universities in Tanzania. In analysis of factors examined in these studies, little attention has been placed on impacts of *Trust, University readiness* (top management attention, human resources attention, financial support) and *External factors* (peer universities, university regulators like TCU, prospective students) on measuring the existing e-learning systems in universities in Tanzania. Hence this study investigates the integration of *Trust, University readiness* and *External factors* in DeLone and McLean (2003) IS model.

MATERIALS AND METHODS

Materials and methods are two important aspects of methodology employed in this research.

Data Collection Methods

In order to test and confirm a proposed research model, a survey design was chosen for data collection because sample size was big and the selected participant domains (universities) were geographically scattered. Therefore, the survey design was relevant approach to cover wide geographical area and large sample size (Stangor, 2011). A combination of systematic sampling method and random sampling method were used in each of eight universities because of limited class size (usually less than 45 students) of surveyed universities.

A total of 1,200 questionnaires were distributed in eight universities (both public and private owned universities) in Tanzania, from April to June, 2017. The researcher received 1,020 completed

questionnaires, equal to 85% of the distributed questionnaires, of which 1,005 were useable. Table 1 displays the actual number of participants against the target number of participants for sample size for the eight universities. The sample size from each university was obtained using size given by Sekaran and Bougie (2011, p.296). The total number of students who are using e-learnings from all Tanzanian

Table 1. Usable sample data against a target sample

S/N	University Name	Target Learners	Actual Learners
1	UDSM	353	207
2	SUA	286	59
3	OUT	364	77
4	MU	353	217
5	UDOM	286	138
6	MUST	286	111
7	MUM	110	96
8	SJUT	110	100
	Total	2148	1005

universities is less than 127,660 (“The Citizen”, 2018). According to Sekaran and Bougie (2011) the minimum sample to represent a population of between 75,000 to 1,000,000 is 384. Therefore, a sample of 1,005 was considered representative of learners who are using e-learning systems in Tanzania.

Research Model

Lashayo and Md Johar (2017) proposed a model with twelve factors as a result of preliminary study conducted in Open University of Tanzania (OUT) between February and March, 2017. That model was used as a base model in this research study.

Research model in Figure 2 contains twenty-five hypotheses as indicated by number 1 to 25 in the diagram and related information is given under H1 to H25 below.

Instructor quality was found to have a significant impact on Use of e-learnings in Tanzania (Lwoga, 2014). This means that skills and competencies of an instructor normally determine use of e-learning systems in university setting. Such important factors are also important and are considered in this study as proposed in hypotheses *H1, H2 and H3*.

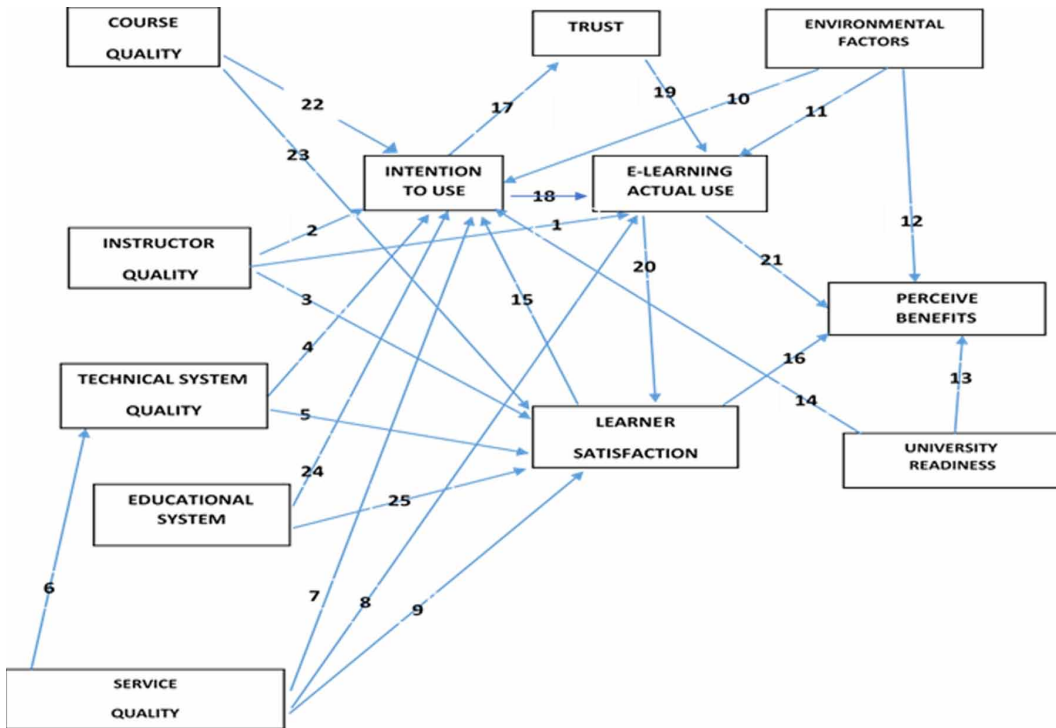
H1: Instructor Quality has positive and significant effect on E-learning Actual Use.

H2: Instructor Quality has positive and significant effect on Intention to Use.

H3: Instructor Quality has positive and significant effect on Learner Satisfaction.

Some previous studies on e-learning systems, such as Islam (2012) and Mohammadi (2015), show that Technical System Quality has a significant impact on user satisfaction. Such factor is relevant in this study as technical attributes of e-learning systems such as easy to use, reliability and accessibility are important in triggering intention of using e-learning systems. Also, Lwoga (2014) found that Technical System Quality has an impact on learner satisfaction in university. Therefore, hypotheses *H4 and H5* were also used in this study.

Figure 2. Research model



- H4:** Technical System Quality has positive and significant effect on Intention to Use e-learning system
- H5:** Technical System Quality has positive and significant effect on Learner Satisfaction.

Further, some research suggested that Service Quality given by IT unit of a particular organisation is likely to influence intention to use/actual use of information systems (DeLone & McLearn, 2003). In particular e-learning system setting, Service Quality attributes were affecting Intention to use e-learning (DeLone & McLean, 2003; Mtebe & Raisamo, 2014) and thus, the following hypotheses (H6, H7, H8 and H9) were proposed:

- H6:** Service Quality has positive and significant effect on Technical System Quality.
- H7:** Service Quality has positive and significant effect on Intention to use E-learning systems
- H8:** Service Quality has positive and significant effect on E-learning Actual Use.
- H9:** Service Quality has positive and significant effect on Learner Satisfaction.

Environmental factors which include peer universities, regulators and prospective students seem to highly influence evaluation of e-learning systems by universities in Ghana and Kenya. (Ansong et al., 2016; Namisiko et al., 2014). Therefore, this study proposed the following hypotheses as from the studies in the two countries:

- H10:** Environmental Factors have positive and significant effect on Intention to Use.
- H11:** Environmental Factors have positive and significant effect on e-learning Actual Use.
- H12:** Environmental Factors have positive and significant effect on Perceive Benefits.

University Readiness which include top-management readiness, human resource, and financial support plays a significant role in evaluation of e-learning systems in universities (Munguatosha et al, 2011). This study led to the following hypotheses:

H13: University Readiness has positive and significant effect on Perceive Benefits.

H14: University Readiness has positive and significant effect on Intention to Use.

Hassanzadeh et al. (2012) evidenced empirically that Learner Satisfaction has effect on Intention to use e-learning systems. DeLone and McLearn (2003) suggested that Learner Satisfaction positively affect Perceived Benefits in information systems. Specific to e-learning systems in Tanzania, it was also evident that Learner Satisfaction affect Perceived Benefits (Mtebe & Raisamo, 2014). This led to the following hypotheses:

H15: Learner Satisfaction has positive and significant effect on Intention to Use.

H16: Learner Satisfaction has positive and significant effect on Perceive Benefits.

Hassanzadeh et al. (2012) and Mohammed (2016) empirically showed that Intention to Use and Actual use were two separate factors which were combined by most of previous studies. For instance, DeLone and McLean (2003), Lwoga (2014), Mtebe and Raisamo (2014) which investigated them in universities setting combine these two factors. Masa'deh et al. (2016) and Twakiondo and Tillya (2008) suggested that Trust mediate the relationship between Intention to use and Actual Use. Based on these studies following hypotheses were proposed:

H17: Intention to Use has positive and significant effect on Trust.

H18: Intention to Use has positive and significant effect on E-learning Actual Use.

H19: Trust has positive and significant effect on E-learning Actual Use.

DeLone and McLean (2016; 2003; 1992) suggested that Actual use has significant impact on User Satisfaction and Perceived Benefits in information systems Similar relationship was found in Mtebe and Raisamo (2014). Based on these studies, the following hypotheses were proposed in this study:

H20: E-learning Actual Use has positive and significant effect on Learner Satisfaction.

H21: E-learning Actual Use has positive and significant effect on Perceive Benefits.

DeLone and McLean (2016; 2003; 1992) suggested that Information Quality has significant impact on Intention to Use and User Satisfaction in information systems. Based on the suggestion this study intended to test the following hypotheses:

H22: Course Quality has positive and significant effect on Intention to Use.

H23: Course Quality has positive and significant effect on Learner Satisfaction.

Hassanzadeh et al. (2012) and Mohammed (2016) evidenced empirically that education system quality as factor is different from technical system quality and they went further to show that this factor influenced significantly on Intention to use e-learning systems and also it affects learner satisfaction. Since individual separation of education system quality and technical system quality were rarely tested in education setting especially in universities in Tanzania, this study is intended to test the following hypotheses:

H24: Educational System Quality has positive and significant effect on Intention to Use.

H25: Educational System Quality has positive and significant effect on Learner Satisfaction

ANALYSIS

A normality test was conducted to check for normal distribution of sampled data prior to statistical analysis. Two techniques, namely, kurtosis and skewness, were used. (Al-Aulamie, Mansour, & Daly, 2013). Skewness is used to check for symmetric distribution of data (Tabachnick, & Fidell, 2007) which in this study was found to be normal. Kurtosis is the measure of a shape of distribution of data intended to show whether the data give a peak or flat-shaped graph and in this case was found flat (Hair et al., 2010). The Structural Equation Modelling (SEM) was used as a technique in analysing data and it was divided into two ordered stages, measurement modelling using Confirmatory Factor Analysis (CFA) and path/structure modelling (Awang, 2016).

Part One: Confirmatory Factor Analysis (CFA)

This part dealt mainly with analysis of items of given latent constructs (proposed factors) as shown in Table 2. The significant contribution of each item on a given latent construct was measured individually using three approaches which were unidimensionality, validity and reliability (Awang, 2016). The main idea of this part of analysis was to check for reliability and validity of proposed factors (constructs) of research model for e-learning systems in Tanzania.

Unidimensionality

This is achieved when each of the individual items of a given construct has a factor loading above 0.6 and altogether has one direction, usually positive direction (Awang, 2016). Table 2 indicates that all items which have remained, achieved unidimensional because their values were all positive.

Validity

Validity is extent of how strong a construct is in determining what is supposed to measure (Awang, 2016). According to Awang (2016) this validity of construct is measured through the following sub-procedures: (a) convergent validation, (b) construct validation (c) discriminant validation

Convergent Validation (CV) is realized at a point whereby all variable of items of given construct remain statistically significant and it is proved by calculating Average Variance Extracted (AVE) to find out if it is greater than 0.5 (Awang, 2016) and from Table 2, AVE for each of construct was greater than 0.5.

Construct validation is achieved when all indexes have reached a least edge (Awang, 2016). Table 3 indicates that fit indexes for construct validity were achieved.

Discriminant validity is a measure of items and constructs to find out whether they are free from redundancy (Awang, 2016). Constructs correlation should not be beyond 0.85 and it is normally shown by constructing discriminant validity index table (Awang, 2016). Discriminant validity index table is shown in Table 4.

Table 4 shows diagonal values are square root of AVE of latent construct whereas other values are correlations between latent constructs, hence the discriminant validity was achieved because values in diagonal are larger than the values in their respective row and column.

Reliability

Reliability is a measure of how consistent is a construct (factor) in a given model and this is attained when Composite Reliability (CR), Average Variance Extracted (AVE) and Cronbach alpha (α) have been attained (Hair et al., 2010).

Table 2. Cronbach alpha, composite reliability (CR) and average variance extracted (AVE)

Construct	Item Number	Item Name	Factor Loading	Cronbach Alpha ($\alpha > 0.7$)	CR > 0.7	AVE > 0.5
Instructor Quality (IQ)	1	IQ4	0.787	0.87	0.871	0.635
	2	IQ3	0.787			
	3	IQ2	0.819			
	4	IQ1	0.767			
Course Quality (CQ)	1	CQ4	0.724	*0.693	*0.693	0.533
	2	CQ3	0.733			
Technical System Quality (TSQ)	1	TSQ2	0.837	0.776	0.777	0.636
	2	TSQ1	0.758			
Education System Quality (ESQ)	1	ESQ4	0.769	*0.674	*0.682	0.518
	2	ESQ2	0.662			
Service Quality (SQ)	1	SQ3	0.693	0.784	0.786	0.551
	2	SQ2	0.769			
	3	SQ1	0.763			
Intention to Use (ITU)	1	ITU1	0.728	0.808	0.805	0.579
	2	ITU2	0.815			
	3	ITU3	0.738			
Trust (T)	1	T1	0.788	0.83	0.834	0.626
	2	T2	0.824			
	3	T3	0.761			
E-learning Actual Use (EAU)	1	EAU2	0.782	0.719	0.719	0.562
	2	EAU3	0.718			
Learner Satisfaction (LS)	1	LS2	0.835	0.747	0.752	0.603
	2	LS1	0.714			
Environmental Factors (EF)	1	EF1	0.713	0.819	0.804	0.507
	2	EF2	0.733			
	3	EF4	0.734			
University Readiness (UR)	1	UR1	0.831	0.832	0.838	0.635
	2	UR2	0.852			
	3	UR3	0.697			
Perceived Benefits (BP)	1	PB1	0.669	0.841	0.834	0.501
	2	PB2	0.672			
	3	PB3	0.776			
	4	PB4	0.683			
	5	PB5	0.735			

*Failing a required test

Table 3. Fit Indexes for both measurement modelling and structural modelling

Category Name	Index Title	Acceptance Point	Measurement Model	Structural Model
1.Absolute fit	RMSEA	RMSEA < 0.08	0.029	0.045
	GFI	GFI > 0.90	0.956	0.926
2.Incremental fit	AGFI	AGFI > 0.90	0.943	0.909
	CFI	CFI > 0.90	0.978	0.945
	TLI	TLI > 0.90	0.973	0.936
	NFI	NFI > 0.90	0.953	0.921
3.Parsimonious fit	Chisq/df (χ^2/df)	Chisq/df < 3.0	1.839	2.995

Table 4. The Discriminant validity index summary for the ten constructs

	UR	IQ	TSQ	SQ	ITU	EAU	T	LS	EF	PB
UR	0.797									
IQ	0.425	0.792								
TSQ	0.349	0.449	0.798							
SQ	0.441	0.579	0.456	0.742						
ITU	0.317	0.448	0.515	0.321	0.761					
EAU	0.363	0.540	0.412	0.566	0.343	0.750				
T	0.546	0.623	0.461	0.530	0.498	0.544	0.791			
LS	0.330	0.560	0.476	0.434	0.736	0.479	0.579	0.777		
EF	0.517	0.507	0.383	0.501	0.391	0.524	0.622	0.527	0.712	
PB	0.463	0.567	0.460	0.417	0.554	0.429	0.685	0.602	0.575	0.708

Therefore, to determine reliability of a construct, three measurements were performed which were AVE, CR and α and reliability would be confirmed by checking if AVE is greater than 0.5, CR was greater than 0.7, α was greater than 0.7 and CR was greater than AVE.

Table 2 indicates AVE, CR and α were achieved except for two constructs which were Course Quality (CQ) and Educational System Quality (ESQ). Course Quality (CQ) slip off the measure probably because the content delivered was not sufficient, not up-to-date and difficult for navigation, and for Education System Quality (ESQ), may be lacking forum, communication features and appropriate learning styles.

Part Two: Structure Analysis

In this part, the attention was shifted to model of cause-impact among validated latent constructs by pooling together all constructs (factors) and simultaneously running the research model (Hair et al., 2010). The main idea of this part two of analysis was to check the significance of the proposed hypotheses (H1-H21) and their relative strengths. Linear regression equation was used to perform structure modelling.

Given multiple regression equation:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \dots + \beta_n X_n + e_1$$

where $X_1, X_2, X_3, \dots, X_n$ =Independent (constructs) variables and

Y =Dependent (construct) variable, e_1 =residual

and $\beta_1, \beta_2, \beta_3, \dots, \beta_n$ are standardized regression coefficients.

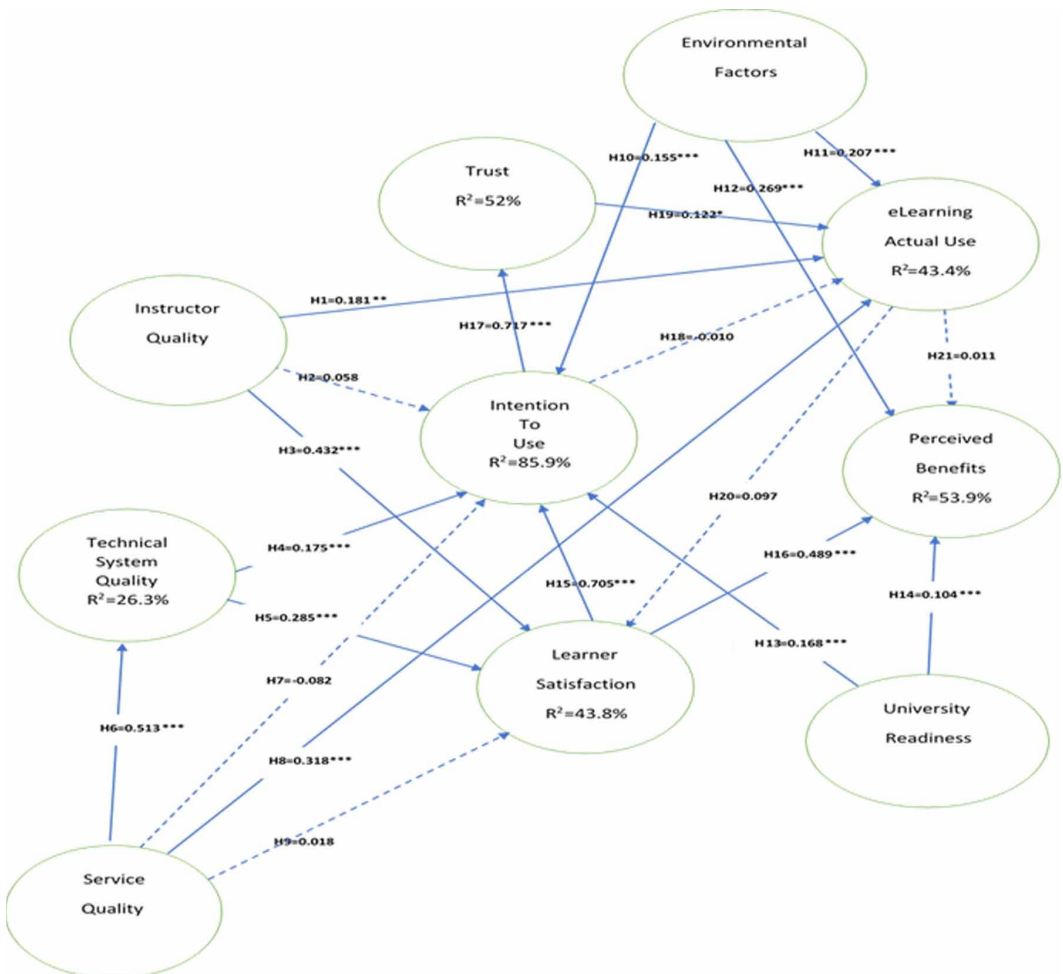
In this structural modelling three levels of statistical significance were considered on testing hypotheses proposed in conceptual model in Figure 2, these significant levels were:

(* means $p < 0.05$; ** means $p < 0.01$ and *** means $p < 0.001$) (Lwoga, & Komba, 2015).

Standardized Indirect and Direct Paths (Test of Full or Partial Mediation)

The model developed on Figure 3 has only one triangle of significant-linked constructs which need to be checked for full or partial mediation. The triangle consists of the following constructs: Technical System Quality (TSQ), Learner Satisfaction (LS) and Intention to Use (ITU), which can be described by the following paths: $TSQ \rightarrow LS \rightarrow ITU$ (indirect path) and $TSQ \rightarrow ITU$ (direct

Figure 3. Structural model of the study



path). Therefore, standardized direct path from TSQ→ITU and standardized indirect path (TSQ→LS→ITU). The significance of the hypotheses was checked using bootstrapping of learner path model as shown in Table 5.

Table 5 confirmed that the Learner Satisfaction (LS) in Figure 4 provides a full mediation on the following hypothesis TSQ→LS→ITU.

Table 5. Standardized direct and indirect paths

		Indirect Hypothesis (TSQ→LS→ITU)	Direct Hypothesis (TSQ→ITU)
Strength of path (β)		0.203	0.175
Significance ($p < 0.05$)		0.002	0.443
Remarks (significant or not significant)		Since $0.002 < 0.05$ then this hypothesis is significant	Since $0.443 > 0.05$ then this hypothesis is not significant

DISCUSSION OF RESULTS

Twenty-five hypotheses were proposed in Figure 2, of which 21 were qualified to be tested simultaneously. Two constructs (Course Quality and Educational System Quality) failed reliability test, therefore hypotheses which takes into consideration Course Quality and Educational System Quality were dropped. Results shown in Figure 3 indicate that out of 21 tested hypotheses, 15 hypotheses were supported. Three levels of statistical significance were considered, these were: p -value < 0.05 , p -value < 0.01 and p -value < 0.001 and their strengths of relationship were categorized in three types, which were: $\beta \leq 0.2$ stated as weak; $0.2 < \beta < 0.5$ stated as medium and last is $\beta \geq 0.5$ stated as strong (Lwoga & Komba, 2015). The results showed that ten valid factors were (Table 2 and Figure 3). The variance explained/coefficient of determination (R^2) which explain power of model to capture required factors was 53.9% (refer Figure 3).

Two newly developed hypotheses were found, these were Service Quality has positive and significant effect on Technical System Quality and Intention to Use has positive and significant effect on Trust.

H1: Instructor Quality has positive and significant effect on E-learning Actual Use.

This hypothesis was supported by $p < 0.01$ and strength of impact on E-learning Actual Use, $\beta=0.181$. It implies that instructor capability to manage e-learning systems has weak and significant impact on learner's behaviour on use of the e-learning system. This result was consistent with Lwoga (2014) in Tanzania which had minimum effect result ($\beta=0.336$).

H2: Instructor Quality has positive and significant effect on Intention to Use.

This hypothesis was not supported. A possible reason for this might be novice competency level of an instructor in managing e-learning system. Instructor is yet to create a significant impact to learner. This needs more research.

H3: Instructor Quality has positive and significant effect on Learner Satisfaction.

This hypothesis was supported with $p < 0.001$ and strength of relationship, $\beta=0.432$, it indicates a medium strength of impact on Learner Satisfaction. This result was consistent with previous study by Lwoga (2014) with medium impact ($\beta=0.215$). Similar result is found in Cheng (2012).

H4: Technical System Quality has positive and significant effect on Intention to Use.

This hypothesis was supported with $p < 0.001$ and strength of relationship, $\beta=0.175$, this implies that reliability, security, usability of e-learning system has weak and significant impact on learner attitude over a system. This was consistent with result in Islam (2012) and Mohammadi (2015).

H5: Technical System Quality has positive and significant effect on Learner Satisfaction.

This hypothesis is supported with $p < 0.001$ and strength of impact, $\beta=0.285$. It implies that usability, reliability and availability of e-learning system have created medium and significant impact on learner satisfaction on system. This was consistent with some findings in previous studies, such as those in Lwoga (2014) with medium impact ($\beta=0.486$) and DeLone and McLean (2003; 1992).

H6: Service Quality has positive and significant effect on Technical System Quality.

This hypothesis is supported with $p < 0.001$ and strength of impact which is strong ($\beta=0.513$). It implies that attributes of e-learning system such as timely response, knowledge and inclusion of stakeholder comments have critical impact on system properties (reliability, availability and usability). This was new finding.

H7: Service Quality has positive and significant effect on Intention to Use.

This hypothesis was not supported and it is the same result as the one found by Hassanzadeh et al. (2012).

H8: Service Quality has positive and significant effect on E-learning Actual Use.

This hypothesis was supported with $p < 0.001$ and minimum strength of impact, $\beta=0.318$. This implies that timely support, knowledge of system and incorporating learner opinions have medium and significant impact on behaviour of user to use the system. This was consistent with Mtebe and Raisamo (2014) who found strength of $\beta=0.192$.

H9: Service Quality has positive and significant effect on Learner Satisfaction.

This hypothesis was not supported. This need more research.

H10: Environmental Factors has positive and significant effect on Intention to Use.

This hypothesis was supported with $p < 0.001$ and weak but significant strength of impact, $\beta=0.155$. This implies that influence of other universities, national ICT policy and pressure of other collaborative partners have weak but significant impact on creating an attitude of using e-learning system by learners. This was consistent to finding in study by Namisiko et al. (2014).

H11: Environmental Factors has positive and significant effect on E-learning Actual Use.

This hypothesis was supported with $p < 0.001$ and medium strength of impact, $\beta=0.207$. It implies that pressure of surrounding universities, education partners and national ICT policy have medium impact on learners use behaviour over e-learning system. This was consistent with finding in Namisiko et al. (2014).

H12: Environmental Factors has positive and significant effect on Perceived Benefits.

This hypothesis was supported by $p < 0.001$ and medium strength of impact, $\beta=0.269$. This means having ICT policy and pressure of educational partners have significant impact on perceive benefits of using e-learning system. This was similar to finding in Ansong et al. (2016).

H13: University Readiness has positive and significant effect on Perceived Benefits.

This hypothesis was supported by $p < 0.001$ and weak strength of impact, $\beta=0.104$. It implies that benefits of using e-learning system are affected significantly by the top management, financial resources and support from other than technical staff. This result was consistent with finding in Munguatosha et al. (2011).

H14: University Readiness has positive and significant effect on Intention to Use.

This hypothesis was supported by $p < 0.001$ and weak strength of impact, $\beta=0.168$. This implies that top management support, human resource support and financial muscle have significant impact on learners' attitude toward use of e-learning systems. This was consistent with result in Munguatosha et al. (2011).

H15: Learner Satisfaction has positive and significant effect on Intention to Use.

This hypothesis is supported by $p < 0.001$ and strong strength of impact, $\beta=0.705$. This implies that the overall satisfaction of learners has strong positive impact on use-attitude of learners on a given system. The more learners are satisfied the more attitude of using e-learning systems. This was consistency with some fining in the study by Hassanzadeh et al. (2012) and coincidentally, the same range of strength of $\beta=0.760$.

H16: Learner Satisfaction has positive and significant effect on Perceived Benefits.

This hypothesis was supported by $p < 0.001$ and medium strength of impact, $\beta=0.489$. It implies that overall satisfaction of learners has medium impact on perceived benefits of using e-learning systems. This result corresponds to findings in by Mtebe and Raisamo (2014) a study done Tanzania, and found medium strength of $\beta=0.226$ with the same hypothesis

H17: Intention to Use has positive and significant effect on Trust.

This hypothesis was supported with $p < 0.001$ and strong strength of impact, $\beta=0.717$, it implies that use attitude of learners over a given system has a significant effect on learners' overall trust on it. This was new finding.

H18: Intention to Use has positive and significant effect on E-learning Actual Use.

This hypothesis was not supported. Possible reason may be the way content in the system is. If content is static then it becomes difficult for the users to be consistent users of a system. This result needs more research.

H19: Trust has positive and significant effect on E-learning Actual Use.

This hypothesis was accepted with $p < 0.05$ and weak strength of $\beta=0.122$. It implies that overall trust on e-learning systems is significant in accelerating use behaviour of e-learning system. This was consistent with result in Masa'deh et al. (2016).

H20: E-learning Actual Use has positive and significant effect on Learner Satisfaction.

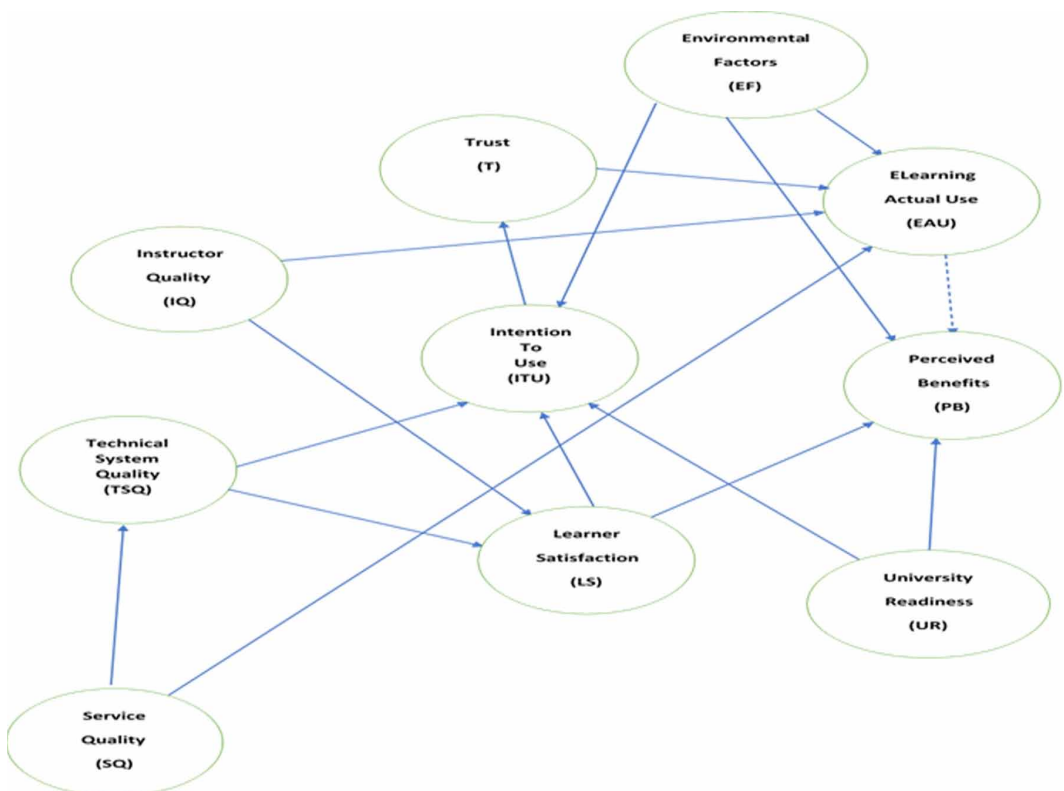
This hypothesis is not supported. This was consistent with qualitative study by Yengin et al. (2011).

H21: E-learning Actual Use has positive and significant on Perceived Benefits.

This hypothesis was not supported. It was consistent with study done in Tanzania by Lwoga (2014).

The result of Figure 3, after the discussion, were illustrated in Figure 4 showing the ten factors measuring e-learning systems in universities in Tanzania. The hypotheses which were not significant were left out and only significant hypotheses were considered to formulate a final model.

Figure 4. Final model



Factors which were confirmed in the model (Figure 4) were compared against other previous models extending DeLone and McLean (2003) IS model in universities in Tanzania as shown in Table 6.

Table 6 shows that there is a significant increase of number of factors examined in this study as compared to previous studies which extend DeLone and McLean (2003) IS model. Additional factors and sample size used make the developed model more robust and comprehensive.

Table 6. Comparison of number of factors examined in this study relative to previous studies in Tanzania which Adapt DeLone and McLean (2003) model

S/N	Author (s)	Year	Number of Learners	Number of Factors
1	Lwoga	2014	272	07
2	Mtebe and Raisamo	2014	200	06
3	Tossy	2017	306	08
4*	Lashayo	2020	1,005	10

*This research study.

CONCLUSION AND RECOMMENDATION FOR FUTURE STUDIES

This study set out to investigate impacts of trust, university readiness and environmental factors on DeLone and McLean (2003) information systems model, on measurement of e-learning systems which have been adopted in universities in Tanzania. In response to that, this research presents an empirical model as indicated in Figure 4 with ten unique constructs/factors (including trust, university readiness and environmental factors) which were tested and confirmed as measure of adoption of e-learning systems in Tanzania. This research further found that Service Quality has a strong positive impact on Technical System Quality and also Intention to Use has strong positive impact on Trust.

Integration of information system success factors which were Technical System Quality (TSQ), Service Quality (SQ), Intention to Use (ITU), E-learning Actual Use (EAU) and Learner Satisfaction (LS) with new factors which are Instructor Quality (IQ), University Readiness (UR), External Factors (EF), and Trust (T) has proved reliable and significant in context of Tanzania. This was a key success for this newly developed tool which is more comprehensive in measuring e-learning systems adoption in universities in Tanzania and developing world at large.

Coefficient of determination/variance explained (R^2) achieved for this developed model which was 53.9% showing a substantial success of this research (Falk, & Miller, 1992; Samarasinghe, & Tretiakov, 2012). This implies that the developed model has captured a substantial number of factors affecting adoption of e-learning systems in Tanzania.

The importance of the developed tool will be on e-learning system developers and practitioners in Tanzania and elsewhere as they have been provided with tool which will guide them in measuring e-learning systems adaptation and also to researchers and academics as they are provided with literature which adds to the existing body of knowledge

The final model in Figure 4 is an open model which provides room for researchers to add some construct(s) when required because of changes of technology and context. The model can also be validated in other environments or by other study methods and designs such as in typical information systems projects or by a mixed study (qualitative and quantitative).

Further research (learner perceptions) can be done around the following hypotheses: Impacts of Intention to Use on Actual Use, Actual Use on Perceived Benefits, Educational System Quality on (Intention to Use, E-learning Actual Use and Learner satisfaction), Service Quality over two factors Learner satisfaction and Intention to Use, Instructor Quality on Intention to Use and last Actual System Use on Learner Satisfaction.

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