DEVELOPING AN EXPANDED TECHNOLOGICAL ACCEPTANCE MODEL FOR EVALUATING E-LEARNING IN THE SUB-SAHARAN AFRICAN ENVIRONMENT

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ABSTRACT

The Technological Acceptance Model was originally developed in the United States of America, which is culturally different, from Sub-Saharan Africa. Applying the existing Technological Acceptance Model to evaluate technological applications intended for the Sub-Saharan African environment, is likely to give inaccurate results because of the cultural dissimilarities and the diverse socio-cultural composition of Sub-Saharan Africa. As a way to improve accuracy of results, this research reviewed relevant literature and applied a mixed methodology to gather data from 308 students from five public universities in five countries across the five Sub-Saharan African regions (North, South, East, West and Central) on the use of e-learning in universities. Upon analyses of the data through Cronbach's α measure, Kaiser-Meyer-Olkin's measure, Bartlett's test of Sphericity, confirmatory factor analysis and descriptive statistics, an extension of the original technology acceptance model was developed. The extended model has seven constructs: Perceived Ease of Use, Perceived Usefulness, Perceived Performance, Perceived Benefits, External Factors, Behavioural Intention, and Technological Acceptance. Four of these constructs (Perceived Ease of Use, Perceived Usefulness, Perceived Performance and Perceived Benefits) directly influence Behaviour Intention. In consonance with previous findings in literature findings, Perceived Usefulness rated higher than Perceived Ease of Use. Perceived Benefit rated the lowest among the four constructs. The research further confirms previous findings that Perceived Ease of Use influences Perceived Usefulness. Additionally, this study found that External Factors directly influence Perceived Usefulness, Perceived Ease of Use, Perceived Performance and Perceived Benefit. Amongst these, External Factors influence Perceived Benefit most, followed by Perceived Ease of Use, Perceived Performance, and lastly Perceived Usefulness. Last, but not least, the research further found that Behaviour Intention influences Technological Acceptance positively. Considering that this research collected data from only five countries in Sub-Saharan Africa to develop and test the model, caution needs to be taken when generalising the research findings beyond the said population and technology considered in the research. Future research on technological acceptance may refine the suggested expanded model to explain further, the variance in students' Behaviour Intention, Perceived Ease of Use, Perceived Benefit, Perceived Usefulness and Perceived Performance and also to examine the performance of the suggested expanded model to explain the different technology acceptance behaviours in the information technology field.

DECLARATION

This thesis is submitted for the award of Doctor of Philosophy in Information Technology. I hereby declare that this thesis is my original work under the guidance of Dr. Delene Heukelman and all resource materials used in the thesis have been acknowledged and referenced accordingly. I confirm that this thesis has not been submitted for a degree at any other university, and that its only prior publications that were undertaken in the form of conference papers and journal articles as listed below under Research Publications.

RESEARCH PUBLICATIONS

Book Chapter

1. Ujakpa, M., M. and Heukelman, D. (2020). Proposed Expanded TAM in the Sub-Saharan African Context: Theoretical Underpinnings towards the Acceptance of Technological tools for supporting Co-teaching, Co-researching and Co-learning. *Digital Literacy and Socio-Cultural Acceptance of ICT in Developing Countries.*

Conference Presentations & Proceedings Publications

2. Ujakpa, M., M. and Heukelman, D. (2020). Expanded Technological Acceptance Model for the Sub-Saharan African Environment. 18th JOHANNESBURG International Conference on Education, Economics, Humanities and Social Sciences, Johannesburg, South Africa, November, 2020.

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4. Ujakpa, M. M., Heukelman D., Rodriguez-Puente, R. and Mutasa, L. (2019). Use of Mobile Devices at Workplace. 2019 Global trends in Management, IT and Governance in an e-World Conference (e-MIG 2019), May, 2019, Mauritius. Retrieved from: https://e-mig.ukzn.ac.za/wp-content/uploads/2020/03/eMIG-2019-CP.pdf

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Joint Conference Presentations/Proceedings & Journal Publications

6. Ujakpa, M. M., Heukelman, D., Kleinveldt, L., Nyalugwe, S., & Kiana, L. (2019). Use and Acceptance of E-Books among Undergraduate Students. IST-Africa 2019 Conference, Nairobi, Kenya, May 2019. *IEEE, 2019*. Retrieved from: https://ieeexplore.ieee.org/document/8764835 http://www.ist-africa.org/home/outbox/ISTAfrica_Paper_ref_73_10910.pdf

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Dr. Delene Heukelman		4 September 2020
(Supervisor's Name)	Supervisor's Signature	Date

DEDICATION

I wholeheartedly dedicate this research to my wife (Mrs. Joana Eshun Ujakpa), my son (John Mabeifam Junior Ujakpa) and my extended family, most especially my father (Mr. Amos Tigma Ujakpa), mother (Mrs. Theresa Laadi Ujakpa), sister (Ms. Patience Nlibekugma Ujakpa, my brothers (Mr. David Ntekim Ujakpa and Mr. Mark Majah Ujakpa), my in-laws (the Eshun Family), the late Dr. John Corton and Brigid Rose.

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LIST OF EQUATIONS

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LIST OF ACRONYMS

Acronym	Full Meaning
BI	Behavioral Intention
CDT	Cognitive Dissonance Theory
Cul	Culture
EDT	Expectation Disconfirmation Theory
EITAM	Emerging Information Technology Acceptance Model
EoU	Ease of Use
Exp	Experience
FoU	Frequency of Use
GETAMEL	General Extended Technology Acceptance Model for E-Learning
HIS	Hospital Information System's
HRIS	Human Resource Information Systems
InfIP	Influence by Important Persons
InfoQual	Information Quality
InfoQual	Information Quality
InfPeers	Influence by Peers
IS	Information Systems
ISSM	Information System Success Model
ISSM	Information Systems Success Model
IT	Information Technology
PB	Perceived Benefit
PEOU	Perceived Ease of Use
PP	Perceived Performance
PU	Perceived Usefulness
SA	System Accessibility
Sat	Satisfaction
SE	Self-Efficacy
SEM	Structural Equation Modelling
ServQual	Service Quality

SERVQUAL	Service Quality Model
SI	Social Influence
S-UC	Student or user centeredness
SUDAFAST – Sudan	Sudan academy for Aviation Sciences and Technology
SystQual	System quality (SystQual)
TAM	Technology Acceptance Model
TAM2	Technology Acceptance Model 2
TAM3	Technology Acceptance Model 3
TOE	Technology Organisation and Environment
TRA	Theory Reasoned Action
Train	Training
U	Usefulness
UM	Use Mode

CHAPTER ONE
INTRODUCTION

1.1 Background to the Research

Information Technology (IT) permeates and transforms almost every aspect of our lives (DeCamargo et al., 2017; Mugica, 2015; Bhat and Khan, 2015). One such very important area is education. IT has permeated and transformed education through e-learning technologies. E-learning technologies are progressively used in Institutions of Higher Learning (IHL) in Africa, (Kennedy and Dunn, 2018; Hadullo, Oboko and Omwenga, 2017; Basak, Wotto and Bélanger, 2017; Saeed et al., 2017; Lodhia, 2006). Yanti et al. (2018) found that teachers perceived Edmodo (an e-learning or LMS system) as a valuable technology that offers satisfactory advantages. Also Fasasi and Heukelman (2017), found that Learning Management Systems (LMS's) permit extended term access to teaching and learning resources and ensure that new courses for teaching and learning can be developed to keep learners' skills up to date for the community of learners created in LMSs and this could improve learners' performance and productivity.

Although some progress has been made, some concerns on the quality of e-learning systems have been raised in literature. Among these are course design, administrative aid, content support, social aid, course evaluation, instructor characteristics, learner characteristics, and organisational factors (Hadullo, Oboko and Omwenga, 2018) who affirm that developing countries lag behind in the fast uprising e-learning technologies consumption in IHL. According to Miller (2015), teacher/learner interaction and online learning communities are two missing components of Massive Open Online Course (MOOC): components that could affect quality.

An area of concern is the assessment of the quality of e-learning. In the words of Grifoll et al. (2010), there is very little practice of evaluation of e-learning in Europe: also e-learning quality is not often included as a systematic or fundamental part of national quality evaluations; thus quality assurance of e-learning remains yet to be developed. Grifoll et al. (2010), recommended that e-learning assessment standards and benchmarking be developed to aid universities to make necessary internal transformations to evaluate and improve e-learning methodically. Though the recommendations by Grifoll et al. (2010) were in the European context, Sub-Saharan Africa also uses e-learning and hence there is the need to

examine perceived quality and adoption of e-learning. Harmonised with the recommendations by Grifoll et al. (2010), Hadullo, Oboko and Omwenga (2018) found that a complete model or framework to evaluate e-learning system quality in developing countries does not exist and hence called for a model that encompasses all stages in e-learning quality evaluation to be developed. Hadullo, Oboko and Omwenga's (2018) recommendation further stated that the proposed model to be developed, take into account the six quality dimensions (course design, learner sustenance, course assessment, institutional factors, user factors, and general performance) of an e-learning system.

The use of an Information System (IS) and sustaining its use, is mostly as a result of user acceptance of that information system (Ayele and Birhanie, 2018; Kamaludin and Kamaludin, 2017; Huang, 2015; Davis and Venkatesh, 2004). The intention to use, use and sustained use of an IS, may be as a result of the quality of that information system, (Yakubu and Dasuki, 2018; Adekiya, 2016; Hussein, 2016). hence the adoption of e-learning systems may be as a result of its quality. Quality and by-extension technological acceptance may be influenced by culture or other factors, as sustained use relies on acceptance of the IS.

To confirm the above assertions, this study developed an Expanded Technology Acceptance Model (TAM) by incorporating the existing TAMs (1, 2 and 3) constructs as propounded by Venkatesh and Bala (2008), Venkatesh and Davis (2000) and Davis, Bagozzi and Warshaw (1989), combined with the quality factors of the Information System Success model, that would be suitable and accurate in a Sub-Saharan African context. The study uses the suggested expanded TAM model to examine e-learning quality and its implications for e-learning acceptance in IHL in Sub-Saharan Africa.

To achieve the above, the following sections of the chapter outlines the scope of the study, problem, aim, objectives, questions, assumptions, methodology, and the structure of this thesis.

1.2 Problem Statement

Aparicio, Bacao and Oliveira (2016) define culture as the belief of a group of persons regarding human behaviour and their associations with realism: this includes the way people live and demonstrate truths and values. Sub-Saharan Africa consists of diverse populations, living in different regions, and all have their own unique culture. Africa, which Sub-Saharan

Africa is part of, has three thousand divergent ethnic groups, with two thousand languages, in 55 countries, and is home to the most genetically varied persons in the world (Africanholocaust, 2017; African Union, 2018).

Using the existing versions of TAM within the Sub-Saharan African context may not give accurate results (McCoy, Galletta, and King, 2007). Transference of TAM constructs to dissimilar cultural environments (apart from the United State of America: where data was collected to develop it), requires laborious analysis. In their work, McCoy, Galletta, and King (2007) confirm that caution needs to be taken when using TAM in some 20 identified nations and this could be as a result of cultural differences. Additionally, Woraporn and Seung (2002) and Lee, Kozar, and Larsen (2003) point out additional limitations of existing TAM versions. To Lee, Kozar and Larsen (2003), deeper understanding of factors contributing to the two TAM constructs (Perceived Usefulness and Perceived Ease of Use) is needed. Furthermore, the examination of different information systems and environments (cultural and social factors included) are neglected in the current TAM's.

According to Woraporn and Seung (2002), the existing versions of TAM presume that Technologies are used at individual levels; hence the Institutional perspective is missing. Additionally, TAM assumes that technology use is voluntary; hence use as a result of compulsion is missing. Use by voluntary act or compulsion may be influenced by culture (which varies from society to society). As a result of TAM's limitation, Jimoh, Pate, Lin and Schulman (2012) suggested that an expanded TAM is reflected as an obligatory part of a pre-implementation plan of Information Communication Technology among health workers in Sub-Saharan Africa. Furthermore, Abdullah and Ward (2016) proposed a General Extended Technology Acceptance Model for e-Learning (GETAMEL) based on the identified frequently used TAM external elements in e-learning adoption. Though Abdullah and Ward's (2016) study was carried out in Africa, they did not focus on the Sub-Saharan African context; rather they focused on the most frequently used external elements of TAM. Environmental factors, including cultural and social factors, were not considered in Abdullah and Ward's (2016) GETAMEL and similarly system quality, service quality, and information quality also were not considered. TAM has unceasingly been adapted and amended to be applied more widely, hence Technological Acceptance Model 3 is presently in existience (Venkatesh and Bala, 2008). Additionally, TAM has extensively been used to assess numerous technological novelties worldwide and has been efficacious in predicting

embracing behaviour in some international settings.

Since Abdullah and Ward's (2016) study did not centre on the Sub-Saharan African setting, and lacked environmental factors, GETAMEL may not give the best results as well. Hence there is the need to develop an expanded Technological Acceptance Model that takes into account the African setting (such as culture) for assessing use and adoption of e-learning. An expanded TAM incorporating the existing TAM, and an appropriate TAM for Sub-Saharan Africa, is necessary. In the context of this research, an expanded TAM is composed of identified existing TAMs' applicable concepts (supported other theories & framework: ISSM, TRA theory & TOE) and new technological acceptance concepts (established in this research) that are applicable to the Sub-Saharan African environment that is presented and tested.

1.3 Research Aim and Objectives

1.3.1 Aim

This research aimed at developing and evaluating an expanded TAM model that could improve the accuracy of evaluation of the quality, user satisfaction and acceptance of e-learning within the Sub-Saharan African environment. The developed expanded Technological Acceptance Model (TAM) model, is embedded with applicable existing concepts (constructs and variables) of the existing Technology Acceptance Models (one, two and three), Information System Success Model (ISSM), and Theory Reasoned Action theory (TRA) and Technology Organisation Environment (TOE) Framework.

1.3.2 Objectives

To achieve the research aim, three research objectives as below, were pursued:

- Analyse and evaluate existing TAM (1, 2 and 3), ISSM, TRA theory and TOE framework concepts (constructs and variables) from literature, to identify constructs relevant to the Sub-Saharan African environment;
- Develop an expanded TAM applicable to the Sub-Saharan African environment, based on the concepts (constructs and variables) of TAM, with quality factors of the ISSM, TRA theory and TOE framework concepts that can be used to measure e-learning quality, user satisfaction and acceptance in Sub-Saharan Africa;

- Compare the results obtained by using the expanded TAM to evaluate user satisfaction and acceptance of e-learning in Sub-Saharan Africa, to results of the existing TAM, documented in literature.

1.4 Research Questions

1.4.1 Main Research Question

In what form should an expanded TAM in the Sub-Saharan African context be developed so as to improve the accuracy of the evaluation of the quality, user satisfaction and acceptance of e-learning within the Sub-Saharan African environment?

1.4.2 Sub-Research Questions

- What are the components of an expanded Technology Acceptance Model, applicable specifically in the Sub-Saharan African context (including the Sub-Saharan African diverse cultural, social, and resource constrained settings)?
- Which constructs and variables from TAM, ISSM, TRA theory and TOE framework, applicable in the Sub-Saharan African context, influence and measure quality, user satisfaction, and acceptance of e-learning?
- What level of accuracy does the use of the expanded TAM give when applied to measure quality, user satisfaction and e-learning acceptance in public Institutions of Higher Learning in Sub-Saharan Africa?

1.5 Research Assumptions

It is assumed that environments of South Africa (from Southern Africa), Nigeria (from West Africa), Democratic Republic of Congo (from Central Africa), Sudan (from Northern Africa) and Kenya (from East Africa) are representative enough of the Sub-Saharan African Environment, since they are currently the highest e-learning markets in the various regions of Africa. It is also assumed that participants involved in this study would think through their observations and familiarities with e-learning truthfully, and share these frankly. Additionally, it is assumed that, having three thousand diverse ethnic groups with two thousand languages in fifty five countries, and home to the most genetically varied persons on the globe, the African culture, which Sub-Saharan Africais part of, is different from USA culture, from where TAM originated.

1.6 Research Methodology

The research method used for this research was a mixed method, comprising both qualitative and quantitative data gathering methods and analyses. The population for this study consisted of students from five public universities: one from each Sub-Saharan African region (Southern Africa, Northern Africa, West Africa, East Africa and Central Africa): South Africa, Sudan, Nigeria, Kenya and Democratic Republic of Congo, respectively representing each region. Since the implementation of e-learning in the five chosen universities had occurred over a period of time, users of e-learning systems in the five universities included cleaned up information on the pilot phase users, past and current student users, and users who had already exited the chosen institutions: it was challenging determining the total number of students who had used, and are using, e-learning systems in the five universities; as a result the population for this study was considered infinite.

Due to the infinite population for this study, Godden's (2004) sample size deterministic formula for infinite populations was used to calculate the sample size (308) for collecting quantitative data. Assumptions made in using this formula was that the population size is more than 50000, z-value (e.g. 1.96 for 95% confidence level), population proportion (expressed as decimal) assumed to be 0.5 (50%) since this provided the maximum sample size) and margin of error at 5% (0.05).

For qualitative research, there isn't a specific rule to use to arrive at an appropriate sample size: this has led to difference of opinion among researchers on the maximum/minimum number of research instruments to administer to reach data saturation point. Notwithstanding this, the rule-of-thumb it that as many subjects as possible are interviewed until interviewee responses reach saturation. As a result, Creswell (1998) and Morse (1994) stated that a sample size of 5 to 25 and 6 is recommended respectively. Other researchers who agree with using 15–20 participants for qualitative research include Saunders et al. (2003) and Tabachnick and Fidell, (2005).

Using semi-structured face-to-face interviews through research assistants (in South Africa, Nigeria, Kenya, Democratic Republic of Congo and Sudan), qualitative data were collected from 50 Students in five public universities (one in each region of Sub-Saharan Africa) that had an e-learning system. Using questionnaires, quantitative data were collected from 308 students in the said public universities. The students were selected at random. The qualitative

data were analysed using Daily Interpretive Analysis (DIA) to generate themes. To test the research instruments reliability and sampling adequacy of analysis and Bartlett's test of sphericity, Cronbach's α and Kaiser-Meyer-Olkin (KMO) measures were applied respectively. Furthermore, confirmatory factor analysis was conducted and descriptive statistics (average mean and standard deviation) of each construct was calculated. Thereafter an expanded TAM model was constructed from constructs and variables identified in literature, combined with the results of the analysed qualitative data. Further confirmatory factor analysis was conducted on the quantitative data and descriptive statistics (average mean and standard deviation) of each construct in the expanded TAM was calculated to confirm accuracy.

1.7 Structure of thesis

This research is structured into seven (7) chapters of which this chapter is the first. The content of this thesis as covered in the rest of the six (6) chapters is summarised below:

- Chapter Two discusses literature related to the research. Among literature discussed include definition of e-learning, impact of e-learning on student achievement, e-learning and quality of education, assessing e-learning, technological acceptance models and theories, Cognitive Dissonance Theory (CDT), Theory Reasoned Action (TRA), Expectation Disconfirmation Theory (EDT), Technology Acceptance Model (TAM), comparison between technological acceptance theories/models, and Information System Success Model (ISSM). Each of the said related literature was discussed in relation to the Technological Acceptance model in the Sub-Saharan African context.
- Chapter Three outlines the theoretical underpinnings from literature, to the research. Issues outlined in the chapter include studies that used the original Technology Acceptance Model (TAM) in explaining acceptance of technology, studies that applied a modified Technology Acceptance Model (TAM) in explaining acceptance of technology, studies that used the Information System Success Model (ISSM), studies of Technology–Organization-Environment framework in explaining technology acceptance, and finally, the chapter identified and evaluated potential variables for the proposed expanded TAM based on existing TAMs.
- Chapter Four explains the research methodology applied to undertake the research. Methods explained in the methodology include the research approach, qualitative research design, quantitative research design, research strategy, research questions

and objectives, population, sampling, data analyses and results, pilot study, reliability, and validity.

- Chapter Five presents the research results based on the different data analysis techniques applied in analysing the data. The results are presented in threefold: discussion of existing TAM in literature, presentation of results from the analysed qualitative data, how the analysed qualitative data results is used to structure an expanded technological acceptance model in the Sub-Saharan African settings and finally, the chapter presents results of the analysed quantitative data.
- Chapter Six presents interpretation of the analysed data results by deliberating the research model variables, constructs, hypotheses, and performance.
- Chapter Seven concludes the research by summarising it, outlining its outcomes, examining the practical and theoretical implications of the outcomes and highlights the limitations of the research, and improvements for future work.

1.8 Summary

The chapter discussed the background, field of study, problem statement, aim, objectives, questions and assumptions to the thesis. The chapter further briefly discussed the motivating related literature, an overview of the methodology applied and the thesis structure. A table of summary of the Thesis structure is illustrated in Table 1.1and Table 1.2:

Table 1.1: Summary of Thesis Structure

CHAPTER ONE: INTRODUCTION	CHAPTER TWO: LITERATURE REVIEW	CHAPTER THREE: THEORETICAL UNDERPINNING BASED ON LITERATURE
1.1 Background to the Research 1.2 Problem Statement 1.3 Research Aim and Objectives 1.3.1 Aims 1.3.2 Objectives 1.4 Research Questions 1.4.1 Main Research Question 1.4.2 Sub-Research Questions 1.5 Research Assumptions 1.6 Research Methodology 1.7 Structure of thesis 1.8 Summary	2.1 Introduction 2.2 Definition of e-learning 2.3 Impact of e-learning on Student Achievement 2.3.1 Blended learning 2.3.2 Improved motivation and academic results 2.3.3 Other benefits of e-learning 2.4 E-learning and quality of education 2.5 The need to Assessing e-learning 2.6 Technological Acceptance Models and Theories 2.6.1 Cognitive Dissonance Theory (CDT) 2.6.2 Theory Reasoned Action (TRA) 2.6.3 Expectation Disconfirmation Theory (EDT) 2.6.4 Technology Acceptance Model (TAM) 2.6.4.1 Newer Versions of TAM 2.6.4.2 Limitations of TAM 2.6.4.3 TAM and cultural dimensions 2.6.4.4 Relevance of TAM 2.6.5 Unified Theory of Acceptance and Use of Technology (UTAUT) 2.6.6 Comparison between TAM Models (CDT, EDT, TAM, TAM2 and TAM3) 2.6.7 Information System Success Model (ISSM) 2.7 Summary of the discussed models 2.8 Summary	3.1 Introduction 3.2 Research that applied original TAM 3.2.1 Existing TAM constructs to be included in the expanded TAM 3.2.2 Variables influencing the TAM constructs to be included 3.3 Research that applied TAM with modifications or extensions 3.4 Research that applied Information System Success Model 3.6 Variables for the proposed expanded TAM model
CHAPTER FOUR: RESEARCH METHODOLOGY		**CHAPTER FIVE: PRESENTATION OF RESULTS**
4.1 Introduction 4.2 Research Strategy 4.2.1 Research Aim, objectives and research questions 4.3 Research Philosophy: 4.4 Research Approach 4.4.1 Population 4.4.2 Qualitative Research Design 4.4.2.1 Qualitative Data collection instrument 4.4.2.2 Qualitative sampling method and size 4.4.3 Quantitative Research Design 4.4.3.1 Quantitative data gathering instruments 4.4.3.2 Quantitative Sampling 4.5 Data Analysis 4.5.1 Pilot study 4.6 Reliability and Validity 4.6.1 Reliability 4.6.2 Validity 4.7 Research Instruments 4.8 Limitation 4.9 Delimitation 4.10 Assumptions 4.11 Research Ethics 4.12 Summary		5.1: Introduction 5.2: Existing TAM Model 5.3 Analysis of the Qualitative Data 5.4 Discussion of analysed Qualitative Data 5.5 Research Hypothesis Formulation 5.6 Analysis of Quantitative Data 5.6.1 Demographic information 5.6.2 Missing Data 5.6.3 E-learning System Frequency of Use 5.6.4 Normality 5.6.5 Reliability Analysis 5.6.6 Factor Analysis 5.6.7 Correlation Analysis 5.6.8: The Fit of the Developed Expanded TAM Model 5.6.9 Regression Analysis 5.6.10: The Developed Expanded Model 5.7 Expert Review of the Model 5.8 Summary

Table 1.2: Summary of Thesis Structure Continuation

CHAPTER SIX: INTERPRETATION OF RESULTS	CHAPTER SEVEN: CONCLUSION AND FUTURE RESEARCH
6.1 Introduction 6.2 Influence of Cultural and Social Factors on PP and PB 6.3 Results Discussion 6.3.1 Constructs that influence BI 6.3.2 Constructs that influence PU 6.3.3 Constructs that influence PB 6.3.4 Constructs that influence PP 6.3.5 Constructs that influence External Factors 6.4 Expert Review of the Developed Expanded Model 6.5 The Performance of the Developed Expanded Model 6.6 Summary	7.1 Introduction 7.2 Research Aim and Objectives 7.3 Results' Implications 7.4 Summary of the Research Findings 7.5 The Research Contributions 7.6 Limitations and Future Research

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

This chapter reviews e-learning related literature. Issues discussed include definition of e-learning, impact of e-learning on student achievement, e-learning and quality of education, assessing e-learning, technological acceptance models and theories, Cognitive Dissonance Theory (CDT), Theory Reasoned Action (TRA), Expectation Disconfirmation Theory (EDT), Technology Acceptance Model (TAM), comparison between technological acceptance theories/models, and Information System Success Model (ISSM).

2.2 Definition of e-learning

There is no commonly established definition for e-learning. It is defined by different researchers and institutions differently; usually according to their specialisation (Arkorful and Abaidoo, 2014; Oblinger and Hawkins, 2005; Dublin, 2003). E-learning is defined by Pema et al. (2017) as the use of broadband internet and computers to aid teaching/learning. To Arkorful and Abaidoo (2014), e-learning is a practice that involves the use of digital tools for teaching and learning: with the said digital tools, learners are able to study anytime and anywhere. OECD (2005), Keller and Cernerud (2002) and LaRose et al. (1998) define e-learning as the use of ICT to gain access to educational resources. Widely, Abbad et al. (2009) and Wentling et al. (2000) defined it as electronically enabled teaching and learning.

From the above, it is deduced that, it's difficult arriving at a common definition for e-learning: a class of researchers define e-learning, asthe provision of full on-line courses, while another class of researchers say e-learning comprises web-augmented and/or web-reliant-on-services. This research, defines e-learning as a technology which enables teaching and learning to take place at any time, anyhow, and anywhere, using Information Communication Technology (ICT) tools.

2.3 Impact of e-learning on Student Achievement

Research on e-learning has highlighted the positive effects that e-learning could have for students at tertiary level.

2.3.1 Blended learning

Many studies confirm that e-learning impacts positively on students' academic accomplishments (Singh and Reed, 2001; Mothibi, 2015; Harandi, 2015; Moravec et al. 2015). In their white paper on blended learning, Singh and Reed (2001) explored the definition of blended learning: why blended learning, how to do blended learning, and where to start? To answer these questions, Singh and Reed (2001) compared self-paced enrichment programmes (through traditional means of teaching and learning) to live e-learning at Stanford University and found that the students' completion rate increased (slightly more than half to ninety four percent).

This is supported by a study by Al-Qahtani and Higgins (2013), that sampled 148 students from a Saudi Arabia university (Umm Al-Qura University). After collecting data from these students and analysing it, Al-Qahtani and Higgins (2013) concluded that the blended learning approach seems to have clear benefits with regard to students' achievement.

Studies by Garrison (2011), Arkorful and Abaidoo (2014), Callan et al. (2015) and Kattoua et al. (2016) also concluded that e-learning has advantages, not only in tertiary education. Using twenty-one semi-structured interviews, Callan et al. (2015) collected data from key stakeholders in four industries (bakery, building and construction, plumbing, and stonemasonry industries) on how Australian training institutes use blended e-learning to provide more flexible, novel, and responsive teaching. Like Garrison (2011), Callan et al. (2015) found that e-learning offers benefits to students, teachers, and institutions. Kattoua et al. (2016) summarises advantages for e-learning technologies as identified by Callan et al. (2015) and Garrison (2011) are: less costly to deliver, inexpensive, time saving, flexible, allows global access to resources, enables interaction between students and their instructors, self-paced, enables students to track their progress, and also has the possibility to improve quality of education as it complements the face-to-face educational approaches.

In their work to relate the impact of teaching & learning software and a training booklet on maternal self-effectiveness and baby care behaviour, Jamalivand et al. (2017) applied a randomized controlled trial, and, using questionnaires, gathered data from 126 Iranian pregnant women (grouped into control and non-control groups). The control group of pregnant women, made up of forty two women (first subgroup), received routine training on

maternal self-efficacy. The Non-Control group, made up of forty two women (second subgroup), received software and another forty two women (third subgroup), received booklets. Questionnaires consisting of regular motherly self-effectiveness and investigator-made baby care behaviour questions, were administered to pregnant women in the various subgroups as above (before intervention, and also in the fourth week end of the postpartum). Based on analysed data, Jamalivand et al. (2017) concluded that electronic software and training booklets positively impact and improve on maternal self-efficacy.

As a result of the many benefits of e-learning, some studies recommend that it should be used for teaching and training. Among these studies is the recommendation by Fasasi and Heukelman (2017) that learning management systems be used in training of Community Development Workers (CDWs). The recommendation was made after they undertook a study to determine the current employment status quo, level of productivity, and technical know-how on the use of ICTs among employees in KwaZulu-Natal. Using the survey methodology to collect data from one hundred and eighty nine CDWs, Fasasi and Heukelman (2017) found the need for CDWs to upgrade their basic ICT skills. The researchers therefore recommended that e-learning is the best option by which the CDWs could do continuous learning, using up-to-date and relevant workshop materials.

2.3.2 Improved motivation and academic results

In investigating the strength of the connection between e-learning and students' enthusiasm, Harandi (2015) used questionnaires to collect data from one hundred and forty students (calculated using GPower3.1) at Tehran Alzahra University. Using Cronbach's alpha and experts' view, the questionnaire was validated for reliability and validity respectively. Using Pearson's correlation coefficient, the obtained data were analysed. The outcome of the study established that e-learning is a tool that influences students' inspiration. As a result of using data from one country only for the study, Harandi (2015) recommended that care be taken when generalising his findings.

E-learning shapes students' approach to different points of view; thus easing communication, improving relationships, and increasing motivation (Wagner et al., 2008; Algahtani, 2011). Additional studies that confirm that e-learning motivates students include Trepka et al. (2008), Arkorful and Abaidoo (2014), Harandi (2015) and Pema et al. (2017).

In his study to assess e-learning's effectiveness in universities in Saudi Arabia, Algahtani (2011), reviewed literature and used questionnaires to collect data from 300 students and focus group interview to collect data from twenty one students. Analysing the data, Algahtani (2011) found that students are motivated by e-learning interactivity to pursue their courses with intensity and success. The researcher also found that, e-learning supported students' studies, facilitated communication and accommodated their learning needs and circumstances. Algahtani (2011) concludes that the probable benefits are countless likened to the face-to-face education mode: especially when e-learning is practised in a suitable way. This is confirmed by the findings of Somayeh et al. (2016).

Mothibi (2015) confirms in his research that e-learning improves students' academic accomplishments. In his research, Mothibi (2015) applied a meta-analysis methodology that enabled him to combine outcomes of several studies in order to determine new relationships that otherwise could not have been obtained. Using a systematic sample, data were collected from fifteen relevant research documents from 2010 to 2012. Effect-size, fixed, and random effects meta-analysis models were then applied to compute the mean effect and analyse the data. Using Cohen's model, the collected data were analysed, and results obtained. Results of the study show that, use of related ICTs for improving e-learning, enhances students' academic accomplishment. From the study, Mothibi (2015) suggested that, future studies examine the connection between the degree to which use of ICT tools (for e-learning) in teaching spaces, affect directly students' overall academic achievement rather than their individual courses.

Improved academic results were also described by Moravec et al. (2015). To determine the influence of e-learning tools' usage on students' test results in the Czech Republic, Moravec et al. (2015) juxtaposed the test results of questions where e-learning tools were provided in a pilot study with those where e-learning tools were not provided. Current results were then compared to test results from the previous year. From the analysed data, Moravec et al. (2015) concluded that the provision of e-learning tools for students affected their results positively.

Other studies that confirm that e-learning impacts on students' academic accomplishments include Dobbs, Waid, and Del Carmen (2009), Sarachandran and Rajendra (2012) and Al-Qahtani and Higgins (2013).

To analyse the differences in perception between students styudying by online and face-to-face mode; Dobbs, Waid and Del Carmen (2009) collected data from one hundred and eighty students studying through the face-to-face mode and 100 students studying by the online mode at university level. Upon analysing the data, they established that most of the online mode students learned about the same or more in the online mode than the students who studied by the face-to-face mode.

When implemented, e-learning increases students' knowledge and keeps them engaged in the learning process (Colace et al., 2014a; Salter, Karia, Sanfilippov and Clifford, 2014; Kaufman, 2015). In the researchers' paper to propose an e-learning and personalised learning path, Colace et al. (2014b), applied the Adaptive Educational Hypermedia System (AEHS) model in an experimentation of three different blended modules (Computer Science, Software Technology for Web, and Computer Networks). Using four hundred, eighty, and fifty students of the Computer Science, Computer Networks and Software Technology for Web courses respectively, the researchers applied course profiles (as described by teachers) and data sets (composed of one hundred descriptions as in the adaptive educational hypermedia system) of learning objects (as created or retrieved from the internet by teachers). After introducing the AEHS as a plugin into Moodle (the learning management systems in place) to create a form of a blended class (traditional class supported by Moodle), the researchers started the said courses above and at the end, submitted an assessment test. At the end of the course, students' average knowledge level was measured. Comparing these results obtained to results of the previous year, Colace et al. (2014a) concluded that the proposed approach increases students' knowledge level.

Often e-learning at universities is delivered using a Learning Management System (LMS). In order to study the effect of learning management systems on university students in Sultanate of Oman, Sarachandran and Rajendra (2012) collected data from five hundred and seventy nine students for a three year period (2009 to 2011). Upon analysis of the data, they found that e-learning improves students' learning skills and positively impacts positively on students' retention rate.

In his study to establish efficacy of e-learning classroom environment compared to the traditional classroom for children, Kaufman (2015) used questionnaires to gather data from thirty six participants. Analysing the data using scores obtained, ranking based on scores and performing factor analysis, Kaufman (2015) concluded that students' ability to progress academically was slightly higher in the e-learning environment: thus, having better chances of attaining academic success. Kaufman (2015) also concludes that students learn best in e-learning as it's tailored to their learning paths; their behaviour in e-learning is task-on, attentive, and engaged.

When implemented, e-learning improves on the learning process, (Kaufman, 2015; Ashraf, Khan and Rehman, 2016). According to Kaufman (2015), students rate their behaviour more positively within an e-learning environment than in the traditional classroom environment.

2.3.3 Other benefits of e-learning

More recently, studies by Somayeh et al. (2016), Kuimova, Kiyanitsyna and Truntyagin (2016), Pema et al. (2017) and Jamalivand et al. (2017) confirmed that e-learning has advantages. After reviewing thirty eight studies documented in literature to establish the effectiveness of e-learning environments, Somayeh et al. (2016) concludes that e-learning promotes education, individual gratification, learning at any place, anywhere and any how without the same preconditions, balances individual learning experiences, promotes personal learning that is blended with mutual learning (saving time and costs), enables the option of education to everyone, allows for joint education, promotes more learning as a result of using multimedia, maintains resources, and reduces environmental and audio pollution.

In their work on using e-learning to improve the quality of education in higher institutions of learning, Kuimova, Kiyanitsyna and Truntyagin (2016) surveyed sixty seven second year students at a National Research Tomsk Polytechnic University. Specific data gathered by them included the students' e-learning experience (for the various courses that they studied in the first and second semester of their current year of study). Based on the analysed data, they concluded that e-learning tools improve knowledge, sharing, and quality of education by enabling fast replacement of educational resources, expansion of range of university's educational services, and increased attractiveness of study material.

In their work, Pema et al. (2017), studied general features of e-learning tools, their advantages in teaching, as well as the pedagogical principles for their best integration in curriculums. Examining various case studies in five countries - Albania, integration of websites/emails; Romania, eMUSE platform; New Zealand, video/web conferencing; Kenya, web 2.0 tools; and Pakistan, use of ICT; - to support e-learning, it was found that incorporation of ICTs into the educational system increased flexibility for learners to access teaching, irrespective of venue or terrestrial barriers and time. It also influenced teaching and learning. Furthermore, it serves as a catalyst in promoting students' learner autonomy and synergistic collaboration with fellow students and other participants in the pedagogical process. From the case analysis, reasons that accounted for the benefits above include reliability, authoritativeness, authenticity of e-learning materials, and students' increased motivation to study.

Literature work that concludes that e-learning is beneficial include Garrison (2011), Arkorful and Abaidoo (2014), Callan et al. (2015) and Trepka et al. (2008). To investigate the advantages and disadvantages e-learning in higher educational institutions, Arkorful and Abaidoo (2014), reviewed various e-learning literature (including views of some people and institutions on e-learning technologies in education). Issues reviewed include e-learning definition, role, advantages, disadvantages, adoption, and implementation. Advantages of e-learning as unearthed by Arkorful and Abaidoo (2014) include: its flexibility in usage irrespective of time and place, it's enhancement of knowledge and qualifications efficacy as a result of easy access to large amount of information, its ability to offer opportunity for improved interaction among students and students with teachers, and its cost effectiveness as distant students don't have to travel to learn.

It also takes into account an individual learner's differences, scarcity of academic staff, and self-paced learning. The review concludes that e-learning enables learners to study anytime, anywhere, and additionally, motivates interaction amongst students (exchanging and respecting diverse opinions, thereby easing interaction and improving relations that contribute to improved learning). Arkorful and Abaidoo (2014) further stated that, online learning enables teaching to focus on individual learners' needs instead of on an instructor or an educational institution's needs.

In their study to establish the efficacy of collaborative multimedia, likened to pamphlets, to deliver training on food safety to exceptional auxiliary nutrition programmes for women, babies, and children (WIC), Trepka et al. (2008) applied a randomized controlled trial of WIC to compare personally-reported food safety practices between pre-intervention and post-intervention completed questionnaires. The population to which the questionnaires were administered, included pregnant WIC clients (usually mothers) who were 18 years of age or older, who could speak, read, and write English. Given some of the participants food safety pamphlets and other complete interactive multimedia food safety education programmes on a computer kiosk, data was collected andanalysed. Based on the analysis, Trepka et al. (2008) concluded that interactive multimedia was a more effective option for food safety education in WIC clinics than pamphlets.

Recent literature that confirms that e-learning is beneficial, include work by Somayeh et al. (2016) and Pema et al. (2017). According to Somayeh et al. (2016), e-learning affects teaching and learning significantly, and e-learning students usually take responsibility for their learning, and hence deep learning occurs. Thus, instead of knowledge acquisition, knowledge building takes place. They further point out that if government provides appropriate e-learning infrastructure, then the huge cost of inner-city travelling students, environmental and noise pollution, teaching and learning expenditures, harmful consequences of urban and world-wide migration, would go down.

Additional benefits of e-learning include authoritativeness of data, authenticity of materials, opportunities for the achievement of multidimensional objectives, and increased motivation (Pema et al., 2017),who further state that e-learning aids students to achieve a double goal: autonomic and synergistic collaboration with fellow students and other participants.

In their work on responsibility for e-learning success in IHL, Wagner et al. (2008) discussed e-learning, and educational stakeholder e-learning needs and concerns, and derived a stakeholder's responsibility matrix which when implemented would ease communication and improve relationships between the stakeholders.

Earlier studies indicate that with e-learning, anyone can take part in learning: even disabled persons (Brown, Cromby and Staden's, 2001) and full and part time students can participate (Hemsley, 2002) irrespective of place and time (Brown, Cromby and Staden, 2001; Hemsley,

2002). In his view and in support of Brown, Cromby and Staden's (2001) view, Hemsley (2002), writes that students (full and or part time) are also able to take part in learning, irrespective of location and time.

2.4 E-learning and quality of education

Many studies confirm that e-learning progresses the quality of education (Elango, Gudep and Selvam, 2008; Jachin and Usagawa, 2017; Moreira et al., n.d.). Analysing the quality of e-learning, Elango, Gudep and Selvam (2008) collected data from one hundred and twelve e-learning students from UAE and Oman. Analysing the data using scores, score ranking, and factor analysis, Elango, Gudep and Selvam (2008) found that: the majority of e-learners never resort to any kind of malpractice and always act in accordance with the course requirements and this eventually enhances quality in e-learning.

In order to establish whether blended learning improves the quality of education in teacher education, Jachin and Usagawa (2017) designed a pilot blended pedagogy course for the 2012-2013 and 2014-2015 school years. Using the Keller's ARCS model (Reynolds, Roberts and Hauck, 2017), data were collected and analysed and based on it, Jachin and Usagawa (2017) concluded that blended learning improves quality of education.

As part of their investigations about the possibility of on-line course tools enhancing students' learning, Moreira et al. (n.d.) used third year undergraduate students who had access to computers and various software (Internet Explorer, Microsoft Word, Microsoft Power Point, and Portable Document File viewer) and who had attend an immunology course in the faculties of medicine and dentistry medicine at the university of Porto. Undertaking a one group post-test without control group, WebCT classrooms were provided to both dentistry and medical faculties. Teaching was carried out using seminars to students via the WebCT. Also, additional reading materials were placed on the WebCT for students.

At the end of each seminar, students wrote a report and submitted it to their instructor. At the end of the academic year, using questionnaires, data were gathered from the students on their compliance to and satisfaction with the system. Using regression analysis, estimates on association between final grades (maximum 20 points) and number of sessions, and/or time using the platform, and/or number of URLs, and/or organiser, and/or content, pages visited

were recorded. Results of the analysed data indicated that e-learning offered students access to high quality learning contents and that there is a correlation between use of e-learning and final grades only in medical students.

In their work to study the advantages, weaknesses, and issues affecting the acceptance and use of Classera (an e-learning system), Alahmari and Kyei-Blankson (2016) applied the exploratory quantitative research approach to gather data from seventy in-service teachers who taught a variety of subjects in twelve public schools (in which the system had been implemented) from three districts. Analysing the data using descriptive statistics and ANOVA, it was found that, the Classera forum platform increased student contribution and advanced the quality of student responses.

2.5 The need to Assess e-learning

For every learning environment, students have expectations and perceptions. These expectations and perceptions serve as feedback for education administrators, instructors, and students. Hence identifying students' expectations and perceptions of e-learning quality can provide valuable feedback to education administrators, instructors, and students, so as to increase the perceptions of e-learning.

E-learning cannot be the panacea for solving all educational problems. In their systematic evaluation of literature on the quality of e-learning effectiveness, Salter, Karia, Sanfilippo and Clifford (2014) performed methodical reviews and meta-analysis of statements. Using a library staff with know-how on methodical literature reviews, a comprehensive search strategy was developed and used to search through databases dating from June 2013 to 2014, to identify research work on the efficacy of e-learning programmes at undergraduate and postgraduate levels. In view of the fact that the review failed to set a scope for language, research design, and publication year, four hundred and fifty nine records were retrieved. Of these, only four hundred and twenty four were used, as the rest were found to be duplicates. Another three hundred and sixty two records were excluded, because they neither assessed e-learning interventions nor assessed pharmacists or pharmacy students. Using the review criteria, the researchers narrowed the list of the literature material to be reviewed to seventeen. After reviewing these literature items, Salter et al. (2014) concluded that e-learning for pharmacy training increased knowledge efficiently. Hence, a more satisfactory

instructional setup for pharmacy education. Notwithstanding this, partial proof exists on e-learning success in improving expertise and/or expert skills/practice.

Advances in Technology could result in fast and easy access to information. However, the technological advancement does not necessarily ensure quality of information, (Alkhattabi, Neagu and Cullen, 2010). Considering the development of e-learning platforms (an area of technological advancement) for scholarship needs (Rjaibi and Latifa, 2014), the increasing use of e-learning in Africa (Lodhia, 2006), quality concerns raised on it (Song, 2010) and revelation by literature, confirm that there is no detailed e-learning assessment process that encompasses needed assessment dimensions (Rjaibi and Latifa, 2014), while there is the need to assess e-learning.

In their study to assess information quality of e-learning systems, Alkhattabi, Neagu and Cullen (2010) asserted that, improved technology means quicker and easier access to information, but not essentially ensuring high valued information and hence the need to develop reliable methods of quality measurement. Sampling twenty seven mathematics module final year bachelor degree students (who dealt with e-learning on a consistent basis) from Saudi Arabia's universities, data were collected in three phases and analysed. Upon analysis, Alkhattabi, Neagu and Cullen (2010) concluded that the suggested model for information standard in an e-learning environment could be applied as general Information quality gauge.

The proposed model by Alkhattabi, Neagu and Cullen (2010) has fourteen indicators for information quality. These include succinctness, verifiability, representational consistency/uniformity, comprehension, information amount, completeness/entirety, reputation, availability, relevancy, accessibility, response time, objectivity, accuracy, and believability. In their work at refining the quality of e-learning educational processes, (Rjaibi and Latifa, 2014) reviewed necessary literature and proposed a refined assessment model for e-learning.

In her studyon annotated bibliography of e-learning in African countries, Lodhia (2006) found that there is an accumulative number of IHL of learning in Africa that have introduced e-learning into their settings. Her work includes more than fifty eight publications on e-learning in Africa between the periods of 2000 and 2006. Since more and more Higher

Institutions are implementing e-learning, it has become increasingly important to examine expectations, perceptions, and adoption of e-learning.

In her paper to examine learners' adoption of online learning in the hospitality programmes, Song (2010) assessed the considerable concerns on the quality of e-learning, since online education is personally-directed and physical communications missing. Hence there is the need to assess interaction quality.

Theories, models, and frameworks that can be employed to assess perception and expectation of e-learning quality include the Cognitive Dissonance Theory (Festinger, 1957), TRA (Fishbein and Ajzen, 1977), Expectation Disconfirmation Theory (Oliver, 1980), TAM (Davis, 1986), TOE Framework (Tornatzky and Fleischer, 1990), Theory of Planned Behaviour (Ajzen, 1991), ISSM (DeLone and McLean, 1992), TAM 2 (Venkatesh and Davis, 2000), Updated ISSM (DeLone and McLean, 2003), and TAM 3 (Venkatesh and Bala, 2008). This study focussed on the TAM (1, 2 and 3), ISSM and TOE framework, to formulate an expanded TAM in the Sub-Saharan African context.

2.6 Technological Acceptance Models and Theories

2.6.1 Cognitive Dissonance Theory (CDT)

This theory was propounded in 1957 by Festinger (1957). CDT has three constructs: Belief, Actions, and Dissonance. It defines Dissonance between Belief and Action. Bhattacherjee and Premkumar (2004), state that CDT defines dissonance between thought of a thing and its realism. This is as a result of the variance between two kinds of reasoning; perception of something and the reality of that thing. The feeling of dissonance between what one thinks about something and what she or he realises or experiences from the actual performance causes discomfort in the person if there is a large gap between expectations and performance. The discomfort in the person motivates the person to change his or her idea about the cognition. CDT leads to people changing their ideas about specific cognitions. For this to occur, one of three alternatives, as propounded in the theory, must occur. Either an individual changes his/her mind about the Belief, or the Action, or the Action Perception. The theory is demonstrated in the Figure 2.1. The CDT constructs definition as Festinger (1957) is reemphasized in Staples and Wong (2002) study.

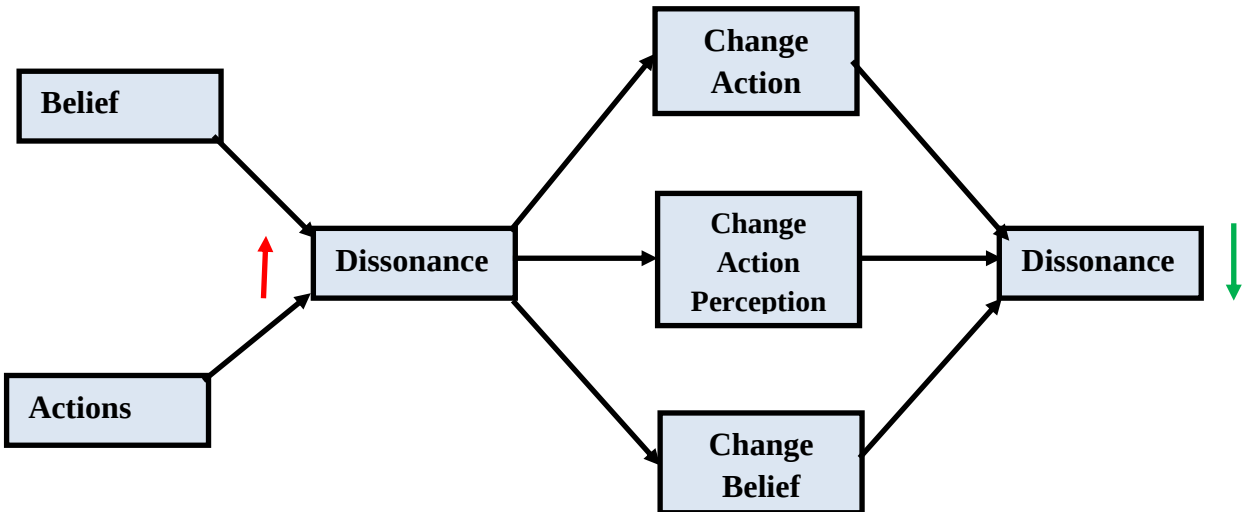


Figure 2.1: Cognisance Dissonance Theory (Festinger, 1957)

Though Festinger (1957) offered an extensive definition of dissonance, the definition remains unclear, especially when more than one individual is considered. Hence a disadvantage of implementing the theory practically. In fact, what may be dissonance to one individual may not be dissonance to another. According to Wall (1978), reality can only be known by what an individual perceives and experiences and hence Dissonance can only be defined in terms of that individual. In summary what one sees as inconsistent, another sees as consistent. Another back-draw of CDT is the amount of dissonance that an individual can reach to be motivated to try to reduce dissonance. This may differ from person to person. These backdraws can be summarised as dissonance inconsistency.

Recent studies that have used CDT to understand customer loyalty, cognisance dissonance, and dissonance induction, include Adekiya (2016), Munandar (2016) and Gosnell (2017) respectively. In his studies on customer loyalty, Adekiya (2016), used the *confirmation and disconfirmation theory* to give theoretical background to his work. Using self-administered and structured questionnaires, Adekiya (2016) collected data from three hundred and seventy six mobile phone users in eight local public offices in the Kano metropolitan area, by the use of a multi-stage sampling method. Using Pearson correlation and multiple regression analysis, he found that customer gratification has a constructive and substantial consequence on customer allegiance with Beta coefficient of 0.629 and significance of 0.01. He further found that the research participants showed an above average score in both customer gratification and allegiance. His findings confirm earlier findings by Mattila and O'Neill (2003).

In their working paper to survey the possibility of public information and dissonance persuasive message to influence ingenious attitude, Gosnell (2017) applied an experimental design to operate message framing to analyse behavioural motivators that businesses should consider when motivating clients. Using thirty eight thousand, six hundred and fifty four clienteles of renewable energy providers, Gosnell (2017) randomized information and messaging rooted in cognitive dissonance theories in email messages to promote an active switch to paperless billing. Results from the experiment revealed that public information and imagery were unsuccessful in persuading behaviour change. Remarkably, the dissonance persuading messaging progresses acceptance feebly among the central sample but fails among the sub-sample of research participants with enormous postgraduate education.

In their research on identifying cognisance dissonance in Muslim customers for competitiveness in sharia banking, the researcher applied the experimental design to collect data from forty Muslims who had interest bearing accounts with conversional banks: twenty of the participants formed the control group. Using t-test, one way ANOVA, regression analysis and descriptive statistics, Munandar (2016) analysed the collected data and found that Muslim customers that save in usurious banks and get information of prohibition of usury will experience cognitive dissonance.

2.6.2 Theory Reasoned Action (TRA)

This theory was propounded by Fishbein and Ajzen (1977). TRA models attitude-behaviour relationships. The theory postulates that a person's Intention in a Behaviour is determined by two constructs: Subjective Norm and Attitude. Each of these is also influenced by the external elements: Attitude is influenced by Behaviour Belief and Behaviour Evaluation: thus the belief about Behaviour and its Evaluation influence Attitude respectively, (Ajzen, 1991). Subjective Norm is influenced by Normative Norm and Motivation to comply with the Normative Norm. Subjective Norm is an individual's beliefs about others' expectations. Behaviour Intention in turn influences Behaviour. Figure 2.2 depicts the theory of reasoned action.

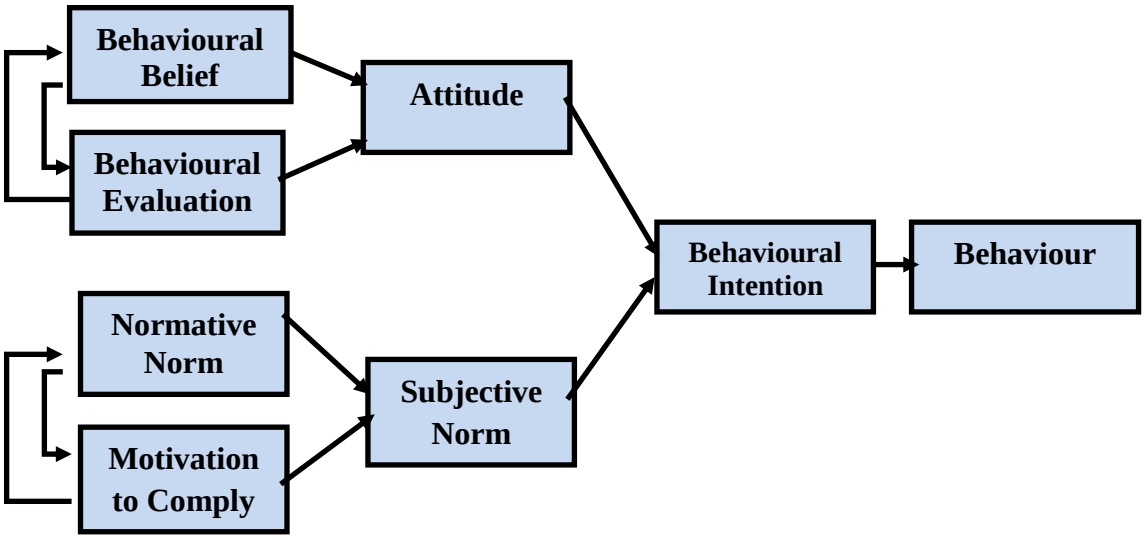


Figure 2.2: Theory Reasoned Action

This theory has eight constructs: Behavioural Belief, Behaviour Evaluation, Attitude, Normative Norm, and Motivation to Comply, Subjective Norm, Behaviour Intention, and Behaviour. Behaviour Belief is the perception that a user has about a product or service and this influences his/her attitude towards the product or service. Behaviour Evaluation is the assessment a user makes about his/her behaviour belief about a product or service. This also influences his/her attitude towards the service or product. Attitude is the behaviour that a user puts up towards a product or service. Normative Norm is what a user thinks other people think about him/her regarding the product/service. Motivation to Comply is about a user's decision either to comply or disregard what other people think about him/her with regards to the product or service. Subjective Norm is what other people think about a user regarding using a product or service. Behaviour intention involves a user forming an intention to use a product or service. Behaviour involves a user accepting a product or service or using it.

The disadvantage of this theory is that it lacks the factor that accounts for what users may perceive as limiting their behaviour. Ajzen (1991) refers to this factor as perceived control behaviour. Studies on TRA include technological innovation adoption by Otieno et al. (2016), effect of features of influencers on online purchasing intent (Nadezhda and Zeina, 2017) and influence of Perceived Usefulness of blogger recommendations on consumers' purchasing Attitudes and Intentions (Alsaleh, 2017).

In their work on the TRA as a foundation to techno novelty acceptance research, Otieno et al. (2016) used a qualitative research technique to collect secondary data. After analyses, Otieno et al. (2016) found that TRA is a very robust theory over several models that have been used in technological novelty adoption researches. Adoption being an attitude issue, makes TRA a robust theory, and that with just a slight adjustment, it becomes adequate to guide IS technological novelty adoption researches. In order to advance TRA, Otieno et al. (2016) recommend the extension of TRA so other variables like awareness of innovation, facilitating conditions, user readiness, and social pressure are made part of it. Similarly using TRA, after analysing the data, Nadezhda and Zeina (2017) found that perceived authenticity, together with credibility, trustworthiness, legitimacy, expertise honesty, and their influences are the main characteristics that have an effect on consumers and their online purchase intent.

In his research to establish the effect of Perceived Usefulness of blogger recommendations, readers' self-assurance in bloggers and the repute of bloggers on customers' buying characteristics and Intents, Alsaleh (2017) proposed a model founded on Action TRA. Examining dataset of four hundred and thirty nine bloggers in Kuwait, Alsaleh (2017) found that Perceived Usefulness of blogger references, assurance, and repute, had persuasive effects on blog users' buying features and intents. Self-assurance in bloggers significantly influenced Perceived Usefulness of blogger references. The status of bloggers had a substantial, constructive, and direct consequence on assurance in bloggers.

2.6.3 Expectation Disconfirmation Theory (EDT)

This theory was developed based on the cognitive dissonance theory. It was propounded by Oliver (1980) as part of his PhD Proposal. The theory postulates that Expectation (what an individual anticipates on a product's performance) and Perceived Performance (actual product performance) influence Disconfirmation Belief. Expectation influences Perceived Performance and Disconfirmation Belief influences Satisfaction. According to the theory, after a user compares anticipation to actual performance and there is a match: then there is a positive disconfirmation belief. However, if there is no match, there is a negative disconfirmation belief. When there is no difference between an individual's expectation and actual performance of a product or service, then Perceived Performance equals Expectation. At this stage, simple endorsement occurs, (Oliver, 1980; Santos and Boote, 2003). Simple confirmation has led to arguments among researchers whether Satisfaction is as a result of

simple confirmation (Hunt, 1991), or whether Satisfaction is a result of neither gratification nor dis-gratification (Erevelles and Leavitt, 1992).

Studies that used expectation disconfirmation theory include those on customers' perceptions of purchasing online pharmaceuticals (Hannula, 2015), service quality practices and customer satisfaction (Hussein, 2016) and consumers' electronic word-of-mouth engagement behaviour (Tang et al., 2017). After applying the purposive sampling technique, and the researcher's bid to assess clients' perceptions of purchasing online pharmaceuticals, Hannula (2015) gathered data from four respondents, using semi-structured interviews and observation.

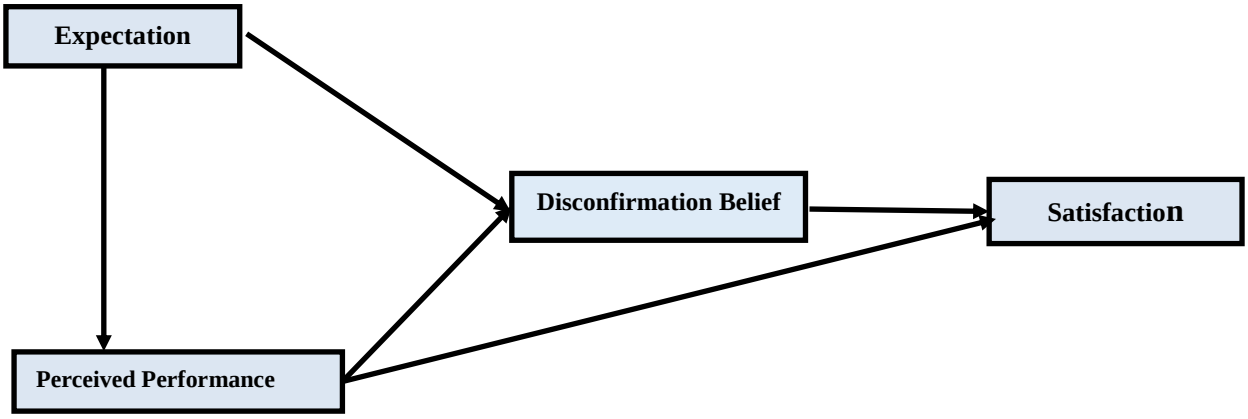


Figure 2.3: Expectation Disconfirmation Theory

Results from the analysed data indicate that Usability constructs and adoption elements are interconnected. Also, the outcomes show that Usability impacts Perceived Ease of Use and this impacts Perceived Usefulness and Behavioural Intention. Regulations restrict the design of online pharmacies and this affects Perceived Ease of Use and Perceived Usefulness, and hence Technology Acceptance.

As depicted in Figure 2.3, the theory has four constructs: Expectation, Satisfaction, Disconfirmation Belief, and Perceived Performance. In simple terms, Perception is defined as user's expectation of a product or service. It is defined as the actual performance of a product or service on the market. Disconfirmation belief involves matching a user's expectation of a product to its actual performance. Disconfirmation belief is positive if the expectation matches the actual performance of the product or service. However, it is said to be negative if the expectation and Perceived Performance do not match.

In his study on service quality practices in taxi firms in Kenya, Hussein (2016) also used the expectancy disconfirmation theory to provide a theoretical foundation for his study. Collecting data on *service quality* and customer satisfaction from forty managers and one hundred and twenty customers in the taxi industry of Kenya, Hussein (2016) applied descriptive and inferential statistics to examine the data. Results of the analysis indicate that most clients are satisfied with taxi firms and hence are allegiant to the taxi firms whose services they patronize. His findings may not necessarily be as a result of the taxi companies' quality services but could be as a result of customer satisfaction and hence further investigations are needed.

Another study that used EDT is that of Tang et al. (2017) which assessed the intricacies of Expectation Disconfirmation, Gratification, and consumer's electronic word-of-mouth engagement behaviour. Collecting data from two hundred and twenty one participants (buyers of online tourism products) and analysing using logistic regression, Tang et al. (2017) found that little and great gratification have contradictory impact on the purchasers' e-word-of-mouth interactions. Also, they found that gratification has an affirmative effect on photographic content input.

These studies confirm that EDT is a valid model to use when measuring technology interventions.

2.6.4 Technology Acceptance Model (TAM)

In his quest to find concepts that cause individuals to embrace or reject technology, Davis (1986) developed the technological acceptance model, using the theory of reasoned action as the basis. The theory has two constructs: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). Both constructs influence one's belief on the use of information technology. Additionally, the theory has three other constructs: Attitude towards Use (ATU), Intention to Use (IU) and Actual Usage (AU). PU and PEOU influence ATU and ATU influences IU and this in turn influences A U.

Between PU and PEOU, Davis (1989) found PU to have the strongest effect on IU. Davis et al., (1989) concluded that PU and PEOU are influenced by some external factors and hence modified the original TAM. Figure 2.4 depicts the original TAM, (Davis, Bogozzi and Warshaw, 1989).

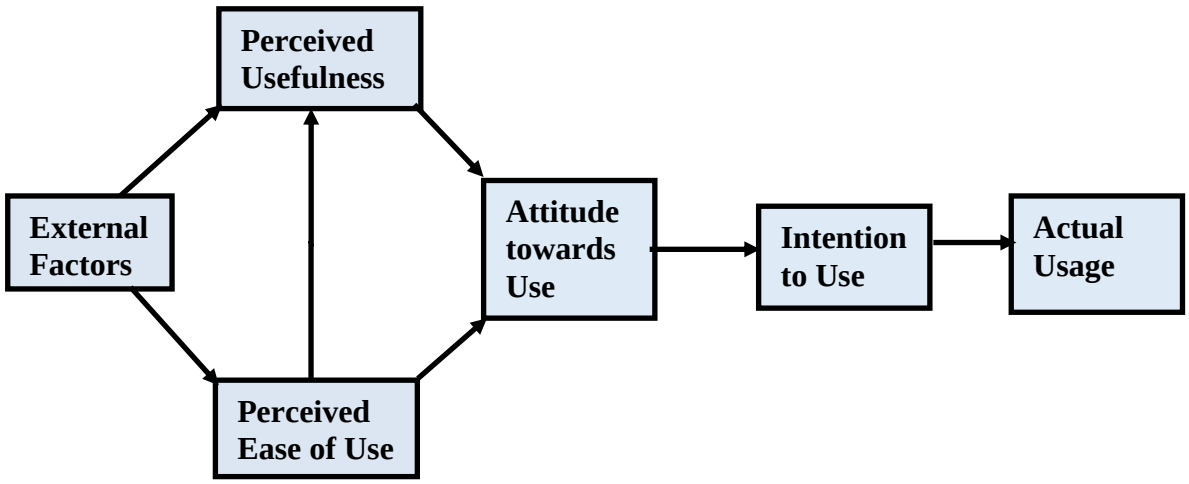


Figure 2.4: Technological Acceptance Model

Davis (1989) defined PU as the extent to which users believe that using a particular technology would enhance their job output. According to Davis (1989) as cited by Durodolu (2016), this construct is based on the consideration that capacity acquired will strengthen job output. Davis (1989) defines PEOU as the extent to which users believe that using a particular technology would be free from complexity and trouble (Durodolu, 2016). Attitude towards use is defined by Nel (2009) as users' positive or negative feelings about undertaking a target action. He also defines Intention to Use as a measure of the strength of one's intention to perform a specific action. Actual Usage is an individual's performance of a specific behaviour.

2.6.4.1 Newer Versions of TAM

As TAM was used, researchers proposed improvements to the original TAM. Venkatesh and Davis (2000) expanded TAM to create TAM2 as in Figure 2.5.

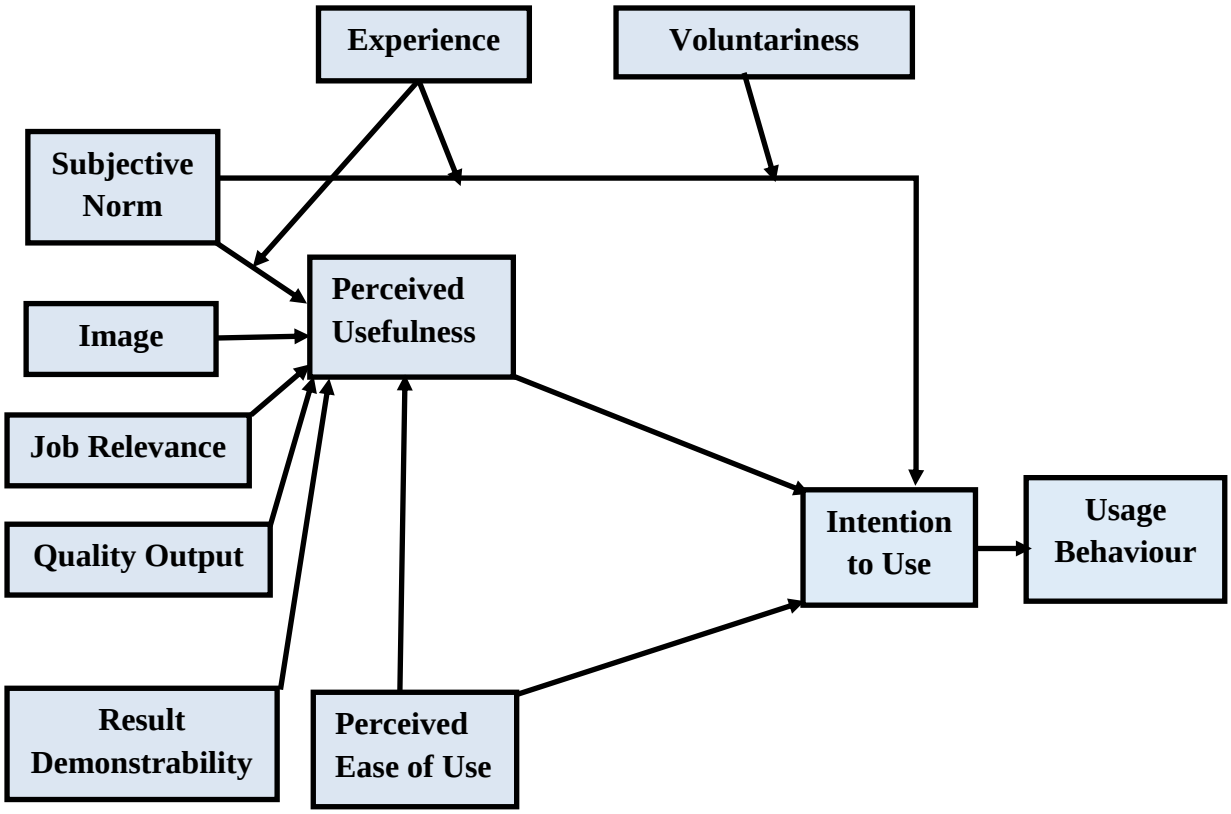


Figure 2.5: Technological Acceptance Model 2

The expansion was done by expanding the external factors that affect TAM. The external factors are categorised as: cognitive and social (Long, 2010). Cognitive factors include job relevance, result demonstrability, output quality, and PEOU. Social factors include Image and subjective norm. The expanded TAM with these cognitive and social factors is referred to as TAM 2.

Combining the determinants of PEOU (Venkatesh, 2000) and TAM 2 (Venkatesh and Davis, 2000), Venkatesh and Bala (2008) developed TAM3 as shown in Figure 2.6. According to Lai (2017), TAM 3 was developed using elements of Perceived Usefulness and Perceived Ease of Use. These elements include technology characteristics, individual differences, social effect, and assistive circumstances. This also includes expansion of the external elements that influence Perceived Ease of Use. These external elements are computer self-efficacy, computer playfulness, and perception of external control, perceived enjoyability, computer anxiety, and objective usability.

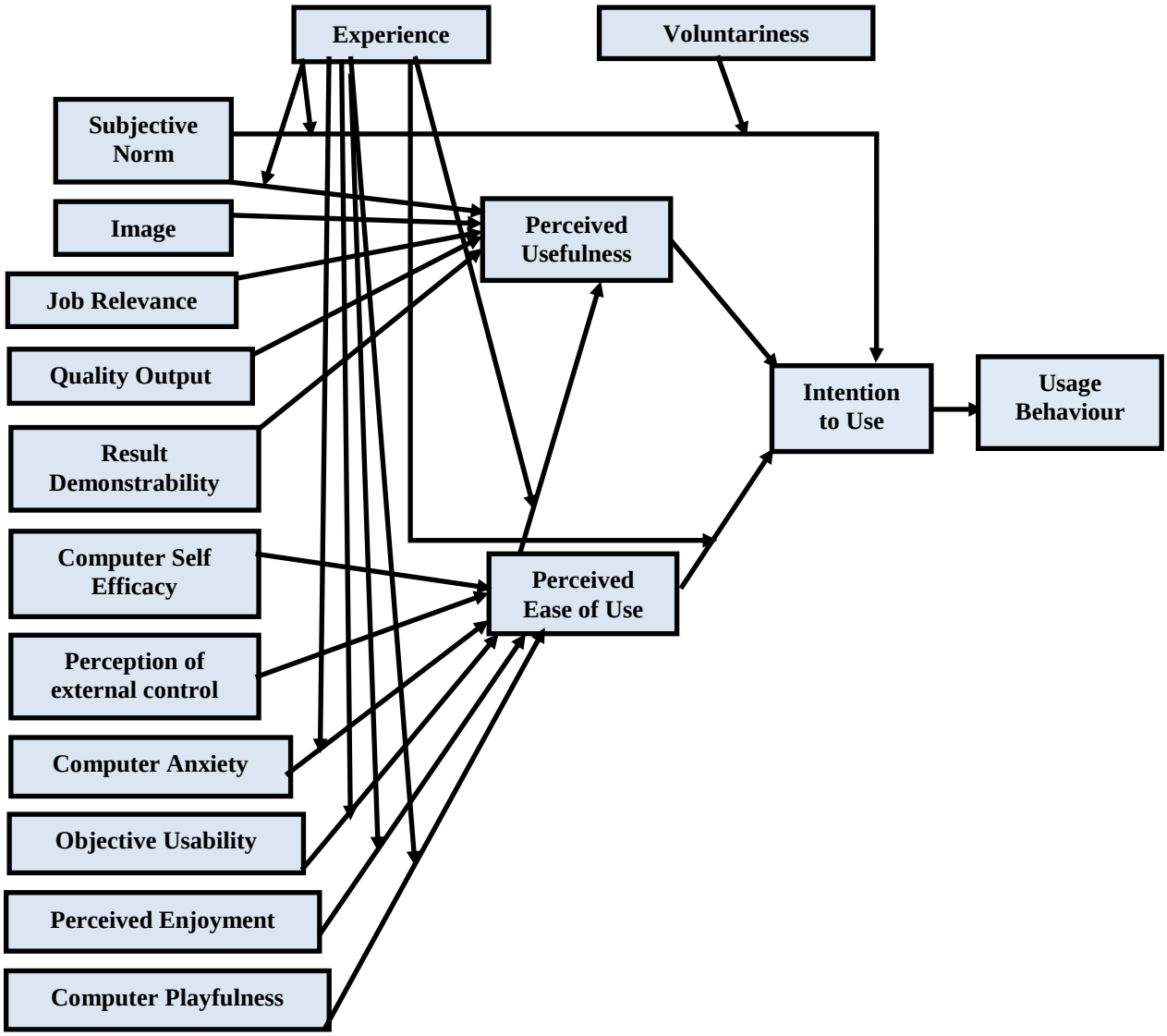


Figure 2.6: Technological Acceptance Model 3

These external factors are defined as follows:

- Computer Self-Efficacy

  It is the act of making the right choice of action to meet specific requirements for a situation that leads to maximum benefit from use of computer resources. To achieve this, two actions must necessarily be undertaken: acquiring expertise and using this expertise appropriately.

- Perception Of External Control

  It is the point at which a user trusts that using an organisational technology depends on the existence of resources (organisational and technical) to support it (Venkatesh and Bala, 2008).

- Computer Anxiety

  It is the fear or apprehension of the use of computer or computer resources. It increases negative attitude in users of computers or computer resources. Change in Information Systems, if not managed properly, can lead to resistance which will increase computer anxiety.

- Objective Usability

  It involves the judgement of technologies based on the actual level of energy needed to finish a task rather than the perceptions of energy needed to finish that task (Venkatesh and Bala, 2008).

- Perceived Enjoyability

  It is the extent to which the use of an information technology is considered to be pleasurable.

- Computer Playfulness

  This external factor is an explorative and a discovery factor. By definition, it is the use of computer and/ or its resources purely for fun.

- Image

  It is the degree to which one's perception of one's image is improved in society by the use of an information system.

- Voluntariness

  It is the extent to which the use of an Information System is considered as intended, or unrestricted by resolve.

- Job Relevance

  A system's capability to improve a person's job routine.

- Result Demonstrability

The extent to which the results of the use of an information technology can be observed and communicated to other people.

- Subjective Norm

  It is the perception of users that they use technologies because of what important people to them, think about them for using technologies to carry out a particular task (Venkatesh and Bala, 2008).

- Experience

  By definition, it is the prior usage of an information system or a similar information system.

2.6.4.2 Limitations of TAM

TAM has limitations. Two such limitations include the fact that TAM assumes only voluntary acts of users. Thus, TAM assumes users will voluntarily form an intention to act. For example, when a new technology is introduced, users will voluntarily form an intention to use it. TAM also addresses technology use only at the individual level (Woraporn and Seung, 2002). In their study on the history and status of TAM, Lee, Kozar, and Larsen (2003) concluded that TAM has some short comings. Among these short comings is the fact that a wider comprehension of elements causal to ease of use and usefulness is required. They go further to indicate that investigating different technologies and environments is ignored in TAM. McCoy, Galletta and King (2007) amplify this by indicating that the TAM model was developed in the United States, thereby implying that TAM is rooted in the context of US, which is a 1st world country, without many of the constraints found in developing countries.

In their work to identify frequently used external concepts of TAM for e-learning acceptance, Abdullah and Ward (2016) propounded the General Extended Technology Acceptance Model for E-Learning (GETAMEL). Though their study was carried out in Africa, their emphasis on extending TAM was not focused on the actual African context; rather their study focused on the most commonly used external constructs influencing the constructs. Environmental factors, including *cultural* and *social factors*, were neglected in GETAMEL by Abdullah and Ward (2016). Furthermore, *system quality, information quality* and *service quality* were not considered in developing GETAMEL. Though TAM has broadly been used on several

technology novelties worldwide and has been fruitful in predicting acceptance behaviours in some international settings, it might not hold true for all *cultures* (McCoy, Galletta, and King, 2007). Since Abdullah and Ward's (2016) work did not focus on elements of the African context, such as *culture*, GETAMEL may also not hold true for Africa. Additional disadvantages of TAM include inconsistencies that some researchers have found with it. Jackson et al. (1997) found that there is no connexion between Attitude and Perceived Usefulness. Lucas and Spitler (1999) also found that there was no evidence to support the connexion between Behaviour Intention and Perceived Usefulness.

2.6.4.3 TAM and cultural dimensions

There are two dimensions of culture: individualism and collectivism (Fiske, 2018; Hofstede, 1984). Aparicio, Bacao and Oliveira (2016) explained that whilst individualism is a notion that people take care of themselves before other people, collectivism is the notion that a collection of people place themselves principally before other people. Generally, in western culture, people incline to have an individual attitude and in non-western cultures, people incline to be communal (Fiske, 2018; Hofstede, 1984). A different study by Anandarajan, Igbaria and Anakwe (2000) revealed that in USA culture has a low uncertainty avoidance and high individualistic attitude, whereas in Nigeria and South Africa culture has a high uncertainty avoidance and low individualistic attitude.

A comparison by Wang and Liu (2005) show that TAM and ISSM have advantages and challenges: while TAM details comprehensive comprehension of technology use, ISSM assesses the connexion between actual technology usage, user gratification, and its effect on overall individual and Organisational impact. In view of this, Wang and Liu (2005) proposed the combination of the two models to build a more inclusive model. Considering the importance and relationship between culture, individualism, collectivism, and the fact that TAM and GETAMEL may not hold true for all cultures (which is an important factor in Information System (IS) adoption), Baptista and Oliveira (2015) and Wang and Liu (2005) proposed integration of TAM and ISSM. This study therefore developed an expanded TAM for the Sub-Saharan African setting for assessing quality, user gratification, and adoption of e-learning. This is supported by the fact that very few studies on effects of individualism and collectivism on IS adoption have been carried out (Leidner and Kayworth, 2006).

2.6.4.4 Relevance of TAM

TAM still remains relevant when examining and predicting technology acceptance. Studies that have used TAM include the study on elements affecting consumer adoption of Internet of Things (IOT) technology (Gao and Bai, 2014), TAM: understanding academics' behavioural for LMS (Alharbi and Drew, 2014), testing TAM 3 with the addition of alteration exhaustion (Jeffrey, 2015), e-learning adoption and integration (Al-Gahtani, 2016), adoption of human resource information systems (Kamaludin and Kamaludin, 2017) and Perceived Interactivity, PEOU and PU on online hotel booking Intention (Abdullah et al., 2017).

In their study on constructs influencing consumer acceptance of internet of things technology, Gao and Bai (2014) applied the Technology Acceptance Model to propose an Internet of things acceptance model. This model is composed of three main constructs: "technological constructs (Perceived Usefulness, Perceived Ease of Use, and Trust), the social context constructs (Social Influence) and two individual user variables (*perceived enjoyment* and *perceived behavioural control*)". Collecting data from three hundred and sixty eight users of internet of things in a northern China city and examining the data by structural equation modelling, Gao and Bai (2014) found that there was a strong sustenance for the effects of Perceived Ease of Use, Perceived Usefulness, Social Influence, *perceived behavioural control* and *perceived enjoyment*. Nevertheless, Trust was insignificant in forecasting intention. Additionally, Perceived Ease of Use and trust were found to affect Perceived Usefulness. Comparatively, the integrated Internet of things acceptance model offers additional clarification on user Behavioural Intention towards internet of things adoption than TAM.

With the increasing interest of most Saudi Arabia universities implementing learning management systems, Alharbi and Drew (2014) and Chao (2019) modified the TAM and UTAUT model respectively in an attempt to aid universities to predict the behavioural intention to use e-learning systems. In addition to the core constructs of TAM (Perceived Usefulness, Perceived Ease of Use and Attitude towards Usage), the proposed theoretical framework included the External Factors: "*learning management systems (LMS) unavailability, job relevance,* and *prior experience (LMS usage experience)*. The proposed theoretical framework propounds that all the constructs and variables mentioned above influence general behavioural intention to use an LMS directly or indirectly.

In his study to examine the variables that predict usage of e-learning systems in the perspective of faculty members, Jeffrey (2015) used questionnaires (based on TAM3 with *change fatigue* as an additional variable) to collect data from two hundred faculty members selected randomly. Employing correlations, regressions, and path analysis, the collected data were analysed and significant differences from associations in the TAM 3 model were found. The construct Subjective Norm and the variables, *computer anxiety, computer self-efficacy, experience, computer playfulness, objective usability, perceived enjoyment, and image,* do not considerably influence the current model. The consistent dynamic on these variables is that, with more effortlessness, additional use of computers, and the increase in digital wisdom, each of these variables diminishes in significance. Overload does not affect the model. However, *change fatigue* was a substantial forecaster of lower e-learning system use. Based on the findings, Jeffrey (2015) constructed a further sparing reviewed model of constructs and variables that reflected the variations.

Using the third Technological Acceptance Model (TAM) as basis for his study to investigate e-learning uptake, Al-Gahtani (2016) applied a quantitative technique to collect data from 286 students. Analysing the collected data using structural equation modelling, Al-Gahtani (2016) found that TAM3 works well in the Arab culture.

In their research to comprehend the underlying concepts that affect user adoption of the Human Resource Information Systems (HRIS) in hospitals, Kamaludin and Kamaludin (2017) used Ipoh Specialist Hospital (where an HRIS was almost failing), for case study and the technological acceptance model (TAM) as theoretical basis. Collecting data from two hundred and sixty seven consumers of the HRIS at this hospital, and analysing it using Cronbach's alpha, descriptive statistics, convergent validity, and discriminant validity, they found that Usage is influenced by Perceived Ease of Use, *information quality, and social influence*. Also, Perceived Usefulness was found to be inversely related to Usage, and System Usage influences user *satisfaction*.

In an attempt to solve the challenge of using too many interactive features on a website (that make it look complex and less useful to some users), Abdullah et al. (2017) reviewed past literature and proposed a framework that has nine suggestions for comprehension of the role of Perceived Usefulness, Perceived Interactivity, and Perceived Ease of Use towards intent of online booking among hotel websites users. The proposed conceptual framework was based

on the Technology Acceptance Model (TAM) theory. In the proposed framework, it is concluded that Perceived website Interactivity dimensions (*two-way communication, user control, and responsiveness*) influence Perceived Ease of Use and Perceived Usefulness and hence websites with more Perceived Ease of Use and Usefulness are more likely to influence hotel online booking Intention.

2.6.5 Unified Theory of Acceptance and Use of Technology (UTAUT)

As in the prceeding sections, multiple studies (Dwivedi et al., 2019; Fretzen, 2018; Ahmad, et al., 2018) were used and some cases were even extended to the existing TAMs, by adapting and adding (sometimes) onto the models concepts (variables and constructs), in order to optimize their validity and generalization (Fretzen, 2018; Ahmad et al., 2014; Venkatesh et al., 2003). One such study is that of Venkatesh et al. (2003) in which the researchers postulated the Unified Theory of Acceptance and Use of Technology (UTAUT) as depicted in Figure 2.7.

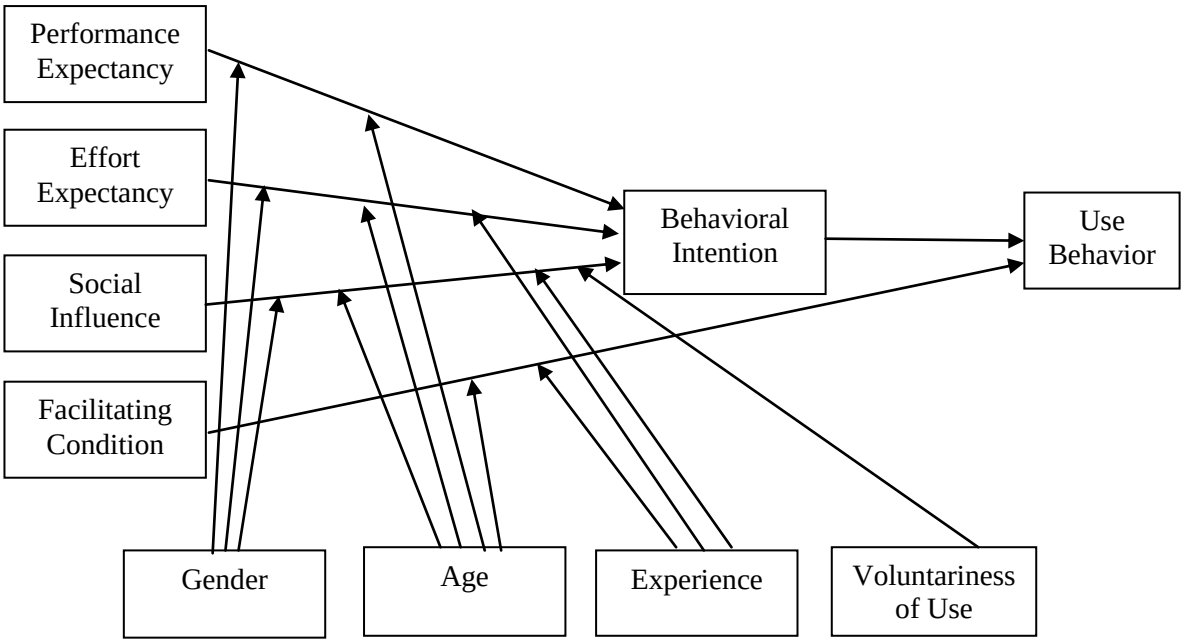


Figure 2.7 UTAUT (Source: Venkatesh et al., 2003)

According to Ahmad et al. (2014), the UTAUT model was formulated from the eight models: the Social Cognitive Theory (SCT), TAM, TRA, Motivational Model (MM), Theory of Planned Behaviour (TPB), combined TAM and TPB, and the Innovation Diffusion Theory (IDT).

According to Dwivedi et al. (2019) and Ahmad et al. (2014), the UTAUT model has four constructs (performance expectancy, effort expectancy, social influence, and facilitating conditions) that determine usage behaviour and behavioural intentions. It also has four moderators (gender, age, experience, and voluntariness) that enhanced its predictive power.

The UTAUT constructs and moderators are defined as follows:

- Performance Expectancy (PE): the degree of an individual's belief on the gain made in a job's result(s) based on a system use
- Effort Expectations (EE): the degree of mental efforts required to use a system with less efforts
- Social Influence (SI): the level of importance given by an individual to use a system
- Facilitating Conditions (FC): the degree to which an individual believes that an organisational and technical infrastructure exists to support the use of a system

According to Venkatesh et al. (2003) and Venkatesh et al. (2012), comparison between the UTAUT model and the eight models, from which it originates, resulted in the UTAUT model outperforming all the eight models: specifically, using the same data, an explained 70% of variance in behavioural intention (Venkatesh et al., 2003) and 50% in technology use (Venkatesh et al., 2012) were arrived at. Almaiah et al. (2019) reiterate this in their study by stating that UTAUT has a higher explanatory power compared to other relevant TAM models and theories in the IS/IT acceptance context. Based on the higher explanatory power of UTAUT, a number of researchers (Almaiah et al., 2019; Ahmad et al., 2014; Fretzen, 2018) applied it in their research.

In their study to assess how different factors affect students' adoption of mobile learning applications, Almaiah et al. (2019) applied the UTAUT model. Using questionnaires to gather data from 697 university students and analysing the data using the SEM method, Almaiah et al. (2019) found that perceived information quality, perceived compatibility, perceived trust, perceived awareness, and availability of resources, self-efficacy, and perceived security were the main motivators of students' acceptance of mobile learning system.

Applying the UTAUT model in order to predict the use of e-zakat online payment system in Malaysia, Ahmad et al. (2014) employed survey questionnaires to collect data from academics in Klang Valley and upon analysis of the data, concluded on the necessity to improve on the awareness and utilisation of the system.

The attempt to identify external elements that influence the acceptance and use of Internet of Things in an organisation (IoT), resulted in Fretzen (2018) applying UTAUT in his exploratory studies and collecting data through interviews. Analyses of the data revealed that elements that influence the acceptance of IoT include costs, skills gap, technological infrastructure, stakeholder convergence, process optimisation, value chain expansion, higher profitability, and organisations quest to create digitized economies. The study further found that organisations' quest to create digitized economies, was the main driving element motivating organisations to adopt and use technology. This could be as a result of the notion that directly or indirectly organisations' stakeholders are gaining more digital access than before and hence the possibility of culture (including individuals' attitudes) shift towards digital transactions taking place more ever than before.

Notwithstanding it's higher explanation power and use in some studies as illustrated above, some researchers have pointed to some limitations in it and that it could have been the reason it's original propounds suggested that it's moderators be reconsidered. A study that made an attempt to improve on the UTAUT model is the study of Dwivedi et al. (2019), who argue that the UTAUT moderators may not be applicable in all contexts. They further argue that a path from Facilitating Conditions to Behaviour Intent is missing in the model and also that the model failed to theorise the individual characteristics (such as attitude).

Reviewing the existing UTAUT model and formalising an alternative theoretical model, Dwivedi et al. (2019) empirically examined their proposed alternative theoretical model using meta-analysis and SEM methods. Through the meta-analysis, the researchers made one thousand and six hundred observations on twenty one relationships that they coded from one hundred and sixty two prior studies on Information Systems / Information Technology (IS/IT) acceptance and use. Results of the data analysis indicated that, attitude:

- Was central to BI and use behaviours
- Partially mediated the effects of exogenous constructs on BI

- Had a direct influence on use behaviours.

Based on the findings, Dwivedi et al. (2019) proposed an alternative UTAUT model by reframing the original UTAUT model to include Attitude. Figure 2.8 illustrates the alternate UTAUT proposed by Dwivedi et al. (2019).

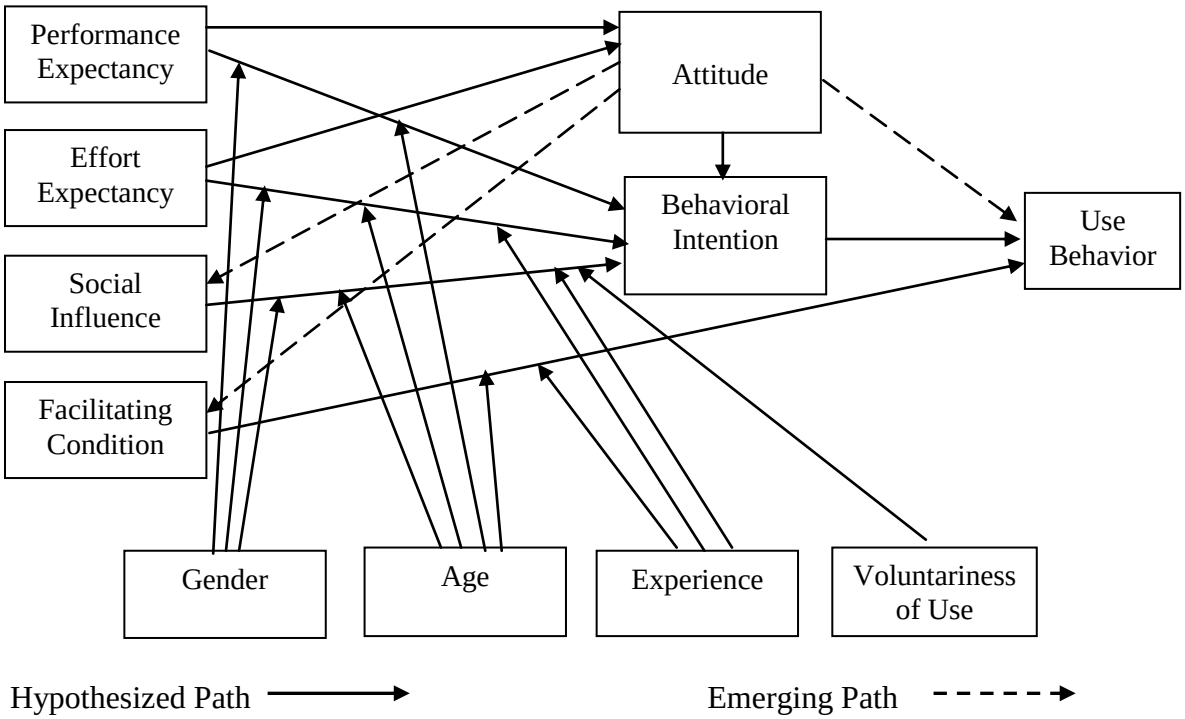


Figure 2.8: Modified UTAUT (Source: Venkatesh et al., 2003)

The said UTAUT model weakness (not being applicable in all contexts) above, could include the Sub-Saharan African context and hence the need to develop an expanded TAM in the Sub-Saharan African context as proposed in this thesis. Also the UTAUT weakness of missing individual characteristics, which forms part of culture (as indicated by Fiske, 2018; Aparicio, Bacao and Oliveira, 2016; Hofstede, 1984), confirms further why applying of UTAUT to the Sub-Saharan African context may not yield the best results and hence the need to develop an expanded TAM in the Sub-Saharan African context. Notwithstanding the above and considering the concepts (constructs and moderators) of UTAUT are Technology Acceptance concepts, they are then applicable to the proposed expanded TAM in the Sub-Saharan African context.

2.6.6 Comparison between TAM Models (CDT, EDT, TAM, TAM2 and TAM3)

According to Samaradiwakara and Gunawardena (2014), CDT and EDT theories have shown to be related to technology adoption as indicated also by a few studies such as Bhattacherjee (2001) and Bhattacherjee and Premkumar (2004). However, CDT and EDT do not address technology adoption adequately and hence have not received the same consideration as TRA, TAM, TAM2 and TAM3, which are more common technology acceptance theories/models and used internationally in information system literature (Samaradiwakara and Gunawardena 2014), though TRA has been used in several fields, such as academic and business circles (Magee, 2002). TRA has limitations and among these is the trend of often rephrasing Norms as Attitudes and vice versa.

A further drawback of TRA is the fact that freedom to act is not limited. In reality, freedom to act is limited by factors such as environment, time and level of ability. Compared to TRA and EDT, TAM is favoured. According to King and He (2006), "TAM is a valid and robust model". But not withstanding this, many researchers have proposed (and some gone ahead with) expansion of TAM. Previous studies comparing technology acceptance models include studies by Venkatesh et al. (2003) and Kriponant (2007) correlated eight and nine models respectively e. According to Samaradiwakara and Gunawardena (2014), the correlation by Venkatesh et al. (2003) is considered the most pragmatic.

2.6.7 Information System Success Model (ISSM)

After reviewing Information System related research publications from the period of 1981 to 1987, DeLone and McLean (1992) created a classification of Information System (IS) success and also identified six variables that make an IS successful. The constructs are: "*system quality, information quality, use, user satisfaction, individual impact, and organizational impact*". Using these variables, DeLone and McLean (1992), created the Information System Success Model (ISSM). Figure 2.7 depicts the ISSM Model.

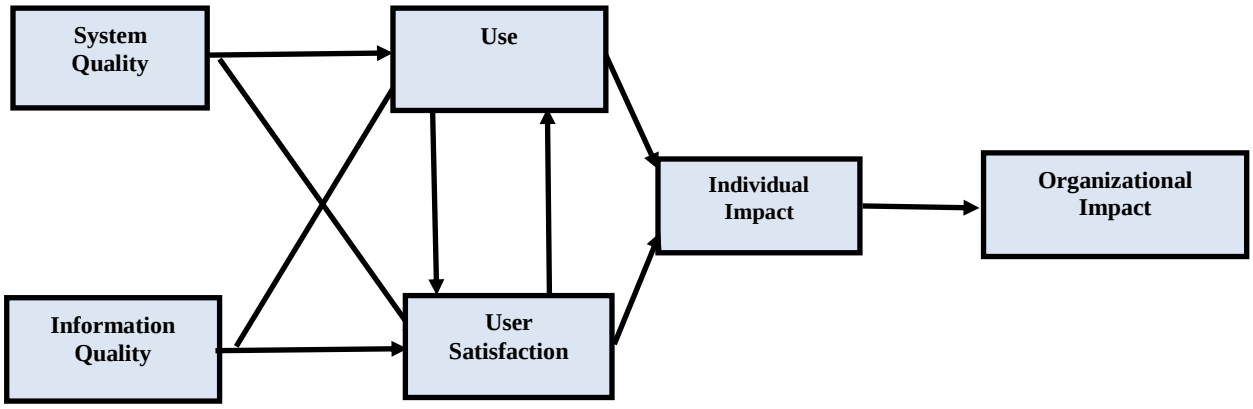


Figure 2.9: Information System Success Model (ISSM)

In response to the recommendation by the authors, DeLone and McLean (1992), for advance development and authentication, a number of researchers evaluated ISSM and made suggestions. One such researcher is Polit et al. (2001); after looking into the marketing literature of SERVQUAL from an IS perspective, Polit et al. (2001) suggested that "*service quality* be added to the ISSM model as an additional independent variable". By this, *service quality* of information technology departments can be measured (thus comparing consumer expectations and perceptions of the IT/IS division).

Other researchers who evaluated ISSM are Seddon and Kiew (1996). They specifically evaluated *system quality, information quality, use*, and *user satisfaction* variables of the ISSM. From the evaluation, they argued that "the variable '*use*' is not appropriate for mandatory systems". Though DeLone and McLean (2003) agreed with him slightly, they differed as they responded that, "there is considerable variability of *use* and hence the variable *use* should be retained".

As indicated by Petter, DeLone and McLean (2008), "other researchers suggested additional modifications to the ISSM". Reviewing the suggestions made by researchers, DeLone and McLean (2003), modified the '*use*' variable into two: "*intention to use* and *use*". They also added *service quality* to the ISSM. The modified ISSM is referred to as "updated information system success model". The model is depicted in Figure 2.8 below.

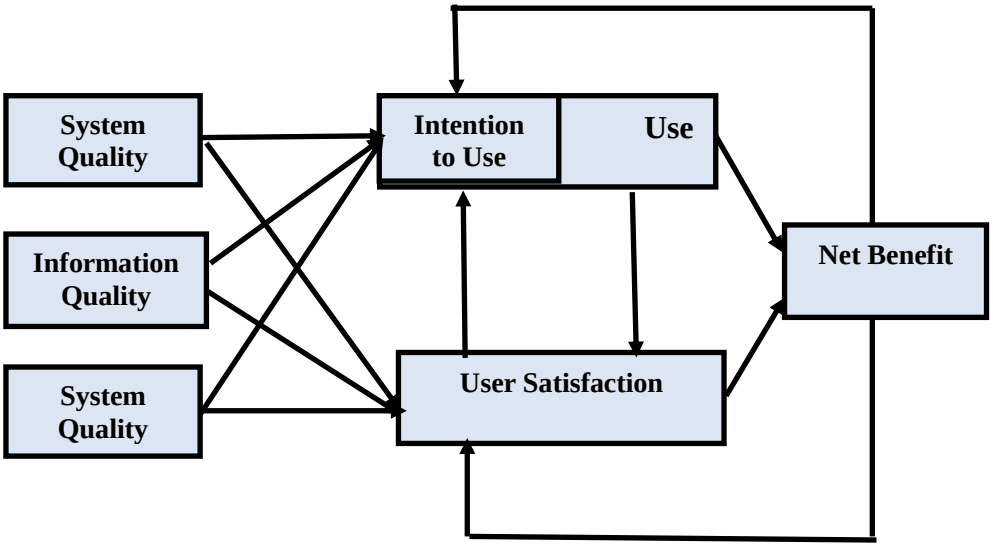


Figure 2.10: Updated Information System Success Model

Studies that have made use of this model include that of Petter, DeLone and McLean (2008) to "measure Information Systems Success" and Manchanda and Mukherjee (2014) to investigate "Information systems success models".

In their study to "measure Information Systems Success", Petter, DeLone and McLean (2008) undertook a qualitative literature review. From the "one hundred and eighty papers found in the academic literature for the period 1992 to 2007", ninety had the six variables ("*system quality, information quality, service quality, use, user satisfaction*, and *net benefits*") of the ISSM; hence ninety experiential scholarly work were scrutinised and the outcomes summarised. The research revealed that "researchers and practitioners tend to focus on single variables of IS success and therefore do not get a clear picture of their impact on systems and methods". It also found that "progress in measuring individual success dimensions has been slow, and valid and reliable measures have yet to be developed and consistently applied for *system quality, information quality, use*, and *net benefits*".

In their study to gauge information systems success models, Manchanda and Mukherjee (2014) compared, among other things, the "information system success model" (ISSM), updated ISSM, TAM and the Gable et al. (2008) model. From the comparison, it's noticed that ISSM is the "first attempt to measure information system success". According to Manchanda and Mukherjee (2014), "ISSM is the most popular among all the models given in the past" and TAM remains the most popular model in studying users' willingness towards accepting Information Technology (Ahmad et al., 2014; Lai, 2017). Manchanda and

Mukherjee (2014) conclude that "it's very difficult identifying the model that is the best". They therefore further stated that, "the choice of using any one model for a particular study, depends on the requirement of that particular study".

2.7 Summary of the discussed models

Table 2.1 presents the summary of the nine models that were discussed above in relation to the proposed expanded TAM in the Sub-Saharan African context. it also presents related concepts on the said models in other articles as discussed above.

Table 2.1: Summary of the discussed models and their components

Sr. No.	Theory. Theories and Models	Components		Other authors. Related articles	Journal
1	Technological Acceptance Model (TAM1)	Perceived Usefulness		Mugo et al. (2017)	British Journal of Mathematics & Computer Science. 20(4), pp. 1-8
		Perceived Ease of Use		Alsamydai (2019)	International Review of Management and Business Research, 3(4), pp 2016 - 2028
		Attitude Toward Using		Alharbi (2011)	International Journal of Advanced Computer Science and Applications, 5(1), pp 143 - 155
		Actual System Used		Stalfors and Nykvist (2011)	Retrieved from https://gupea.ub.gu.se/bitstream/2077/25614/3/gupea_2077_25614_3.pdf
2	Technological Acceptance Model (TAM2)	Perceived Usefulness		Gao and Bai (2014)	Asia Pacific Journal of Marketing and Logistics, Vol. 26, No. 2, pp. 211-231.
		Perceived Ease of Use		Hameed, Counsell and Swift (2012).	Journal of Engineering and Technology Management
		Behaviour intention		TAM 2 - built on TAM 1	
		Subjective norm			
		Actual System Used			
3	Technological Acceptance Model (TAM3)	Perceived usefullness		TAM 3 - built on TAM 2	
		Perceived ease of use			
		Behaviour intention			
		Subjective norm			
		Use Behaviour			
		Experience			
		Voluntariness			
		Perceptions of external control			

4	Theory of Planned Behavior (TPB)	Attitude Towards An Act		TAM 1 Built on TPB	
		Subjective Norm			
		Perceived Behaviour Control			
		Behaviour Intention			
5	Theory of Reasoned Action (TRA)	Beliefs		TPB built on TRA	
		Evaluation			
		Normative Behaviour			
		Motivation to comply			
6	Information Systems Success Model	System Quality		Zaied (2012)	Journal of Emerging Trends in Computing and Information Sciences, 3(6), pp. 814 – 825
		Information Quality		Ojo (2017)	Healthcare Informatics Research, 23(1), pp. 60-66.
		Use		Adjin (2014)	Aalborg: Department of Electronic Systems, Aalborg University.
		User Satisfaction		Masoumi & Lindström (2012)	Journal of Assisted Learning. 28. 27-41.
		Individual Impact			
		Organizational Impact			
7	Updated Information Systems Success Model	System Quality		Updated Information Systems Success Model Developed 10 years later after the original one	
		Information Quality			
		Service Quality			
		Intention to Use			
		Use			
		User Satisfaction			

2.8 Summary

This chapter reviewed e-learning related literature, theories, and models of TAM. Issues reviewed include definition of e-learning, impact of e-learning on student achievement, e-learning and quality of education, assessing e-learning, technological acceptance models and theories, cognitive dissonance theory (CDT), theory reasoned action (TRA), expectation disconfirmation theory (EDT), technology acceptance model (TAM), comparison between technological acceptance theories/models, and information system success model (ISSM).

The review of the e-learning definition, impact of e-learning on student achievement and on the quality of education, showed an increased trend on e-learning research, which showed consistently a positive impact of e-learning on students' academic accomplishments,

especially if teaching and learning through e-learning is practised in a suitable way. Among the positive impacts of e-learning are: increased students' knowledge level and achievement; improved students' academic results, completion rate and gratification; and e-learning's capability to enable learning to take place anywhere and anytime, without the same preconditions, hence balancing individual and personal learning experiences. Additionally, the increased trend on e-learning research also revealed the ability of e-learning to promote a sustainable environment, as learning through it occurs through various multimedia/online platforms.

Notwithstanding the above, the review also found that increased technological advancement does not necessarily ensure quality of information, and, as result, quality concerns are raised on e-learning technology. These include the lack of a detailed e-learning assessment process to encompass needed assessment dimensions, inability of e-learning technology to enable facilitators/lecturers to take note of physical cues/feedback from students to adjust their delivery during teaching and learning, and challenges of technological infrastructure.

Based on the quality concerns raised, the review went further to identify and examine tools used in assessing e-leaning towards those concerns. tools identified and examined include theories, models, and frameworks. Specific theories Models identified include the Cognitive Dissonance Theory (Festinger, 1957), TRA (Fishbein and Ajzen, 1977), Expectation Disconfirmation Theory (Oliver, 1980), TAM (Davis, 1986), TOE Framework (Tornatzky and Fleischer, 1990), Theory of Planned Behavior (Ajzen, 1991), ISSM (DeLone and McLean, 1992), TAM 2 (Venkatesh and Davis, 2000), Updated ISSM (DeLone and McLean, 2003), TAM 3 (Venkatesh and Bala, 2008). This study focused on the TAM (1, 2 and 3), ISSM and the TOE framework.

Discussing the strengths and weaknesses of the theories, models and frameworks, the review found TAM and UTAUT as the most widely used models. Reviewing further on the applicability of TAM, UTAUT and the other said models, theories and framework above, to the Sub-Saharan African environment, may not produce the best results. As a result, this chapter concluded by proposing development of an expanded TAM model in the Sub-Saharan African context.

To investigate further the need for the development of an expanded TAM model in the Sub-Saharan African context, the next chapter discussed the theoretical underpinnings to this research.

CHAPTER THREE
THEORETICAL UNDERPINNING BASED ON LITERATURE

3.1 Introduction

Chapter Three outlines the theoretical underpinnings from literature for this research. The first section of the chapter discussed studies that used the original Technology Acceptance Model (TAM) (Ibrahim, 2018; Matikiti, Mpinganjira and Roberts-Lombard, 2018; Ayele and Birhanie, 2018; Brandon-Jones and Kauppi, 2018) in explaining acceptance of technology .. The second section focusses on studies that applied a modified Technology Acceptance Model (TAM) (Byun, Chiu and Bae, 2018; Yang, Wang and Sun, 2018; Helia et al., 2018 and Nagy, 2018), in explaining acceptance of technology, while the third and fourth sections respectively discuss studies that used the Information System Success Model (ISSM) (Nugroho and Prasetyo, 2018; Stylianides et al., 2018; Laakkonen, 2018; Guzmán, Fóster, Ramírez-Correa, Grandón, and Alfaro-Perez, 2018 and Thielsch et al., 2018) and Technology–Organization-Environment framework (Kilström, 2016; Ismail and Azwadi, 2016; Ma and Lee, 2018; Hussein, Baharudin, Jayaraman and Kiumarsi, 2019; Feibert and Jacobsen, 2019) in explaining technology acceptance. Finally, the fifth section identified and evaluated potential variables for the expanded TAM based on these previous models.

Different researchers use different terms for constructs, factors, and variables. In the context of this research, factors that influence or contribute towards Perceived Usefulness (PU), Attitude towards Use (ATU), Perceived Ease of Use (PEOU), Intention to Use (ITU) and Actual Usage (AU) are called variables, since their presence and impact may vary. Constructs are denoted by starting with a capital letter and the use of acronyms while factors or variables are denoted by lower case letters.

3.2 Research that applied original TAM

The original TAM, as in Figure 3.1, was found in very recent studies to still be an acceptable tool for predicting technological acceptance (Ibrahim, 2018; Matikiti, Mpinganjira and Roberts-Lombard, 2018; Ayele and Birhanie, 2018; Brandon-Jones and Kauppi, 2018). While Ibrahim (2018), Matikiti, Mpinganjira and Roberts-Lombard (2018), and Ayele and Birhanie (2018) conducted research in Africa, the study conducted by Brandon-Jones and Kauppi (2018) was conducted in the Netherlands.

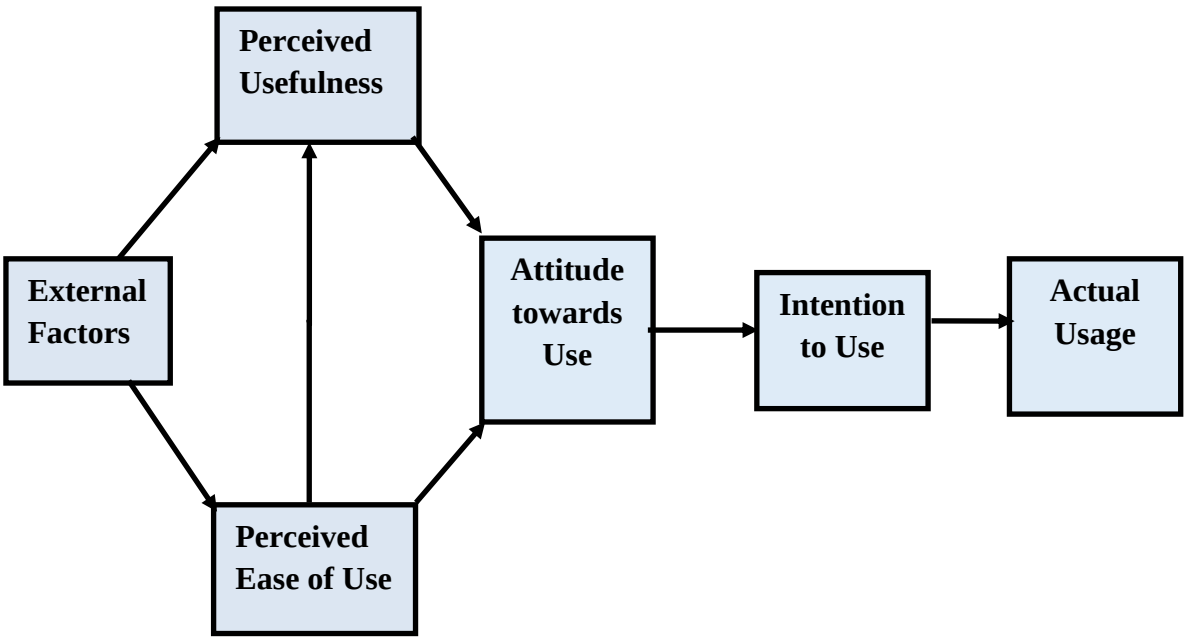


Figure 3.1: Technological Acceptance Model (Davis, Bogozzi and Warshaw, 1989)

3.2.1 Existing TAM constructs to be included in the expanded TAM

In his studies, Ibrahim (2018) examined the technology acceptance level among university academics, using a sample of 355 academics from Nigerian universities and conducting regression analysis of the data and Structural Equation Modelling (SEM), he concluded that the Technological Acceptance Model is a worthy theoretical instrument to understand user adoption of technology. In the same study, he further found that Social Influence (SI), Self-Efficacy (SE), System Accessibility (SA), Perceived Ease of Use (PEOU) and Perceived Usefulness (PU) contribute to changes in Behavioural Intention (BI) to use technology. Ibrahim, (2018)also found substantial relationships between SE, BI and SA, and PU. Furthermore, the Ibrahim (2018) found insignificant relationships between BI, PEOU and SI. As a result of his findings, Ibrahim (2018) recommendeded that leadership of universities organise trainings, seminars, and workshops, on the use of the technologies (Ibrahim, 2018). The researcher's finding that PEOU was insignificantly related to BI, contradicted the TAM model and hence the need for a further study on Ibrahim's (2018) findings, especially within the Sub-Saharan African context. TAM constructs that were included in the expanded TAM for this research were PEOU, PU and BI. SE, SI and SA were measured by the use of variables.

King and He (2006)'s meta-analysis of the technology acceptance model using 88 published studies provided sufficient data to be credible and makes a stronger case on why PU and BI

should be incorporated into the proposed model. Their meta-analysis concluded that the PU and BI were exceedingly reliable and could be applied in a variety of settings. Hence this study included PU and BI into the new expanded TAM.

Using TAM as theoretical background and collecting data from 400 university teachers in Ethiopian public universities to examine e-learning adoption and use, Ayele and Birhanie (2018) established that, PEOU and PU were significant causes of BI to using e-learning technologies (Ayele and Birhanie, 2018). They also found that BI, user training, and leadership support were factors that determined actual usage of e-learning systems and that the effect of motivations for the actual usage of e-learning systems was minor (Ayele and Birhanie, 2018). This supports the notion that *knowledge/training* and *support* are important factors to include.

In the researchers study to assess the adoption of MOOCs in developing countries, Ma and Lee (2018) collected data from 827 participants and performed hierarchical regression analysis to develop the model. Outcomes of the study showed that, among the technological characteristics, perceived Usefulness significantly influenced Behaviour Intention, followed by *lack of availability and performance to price*. Ma and Lee (2018)'s study results further revealed that, among user variables, *self-regulation* was the most significant predictor of MOOC adoption, and female learners showed higher willingness to adopt MOOCs. Finally, among *social environmental* variables, *tradition and social norms* and *lack of information* about MOOCs were associated negatively with adoption of MOOCs (Ma and Lee, 2018); confirming Kilström (2016)'s finding of lack of understanding of a technology as having a negative impact on adoption. These results indicate the need to include PU and Perceive Performance (*accessibility and performance*) as constructs in the expanded model.

3.2.2 Variables influencing the TAM constructs to be included

Adopting TAM for their studies, Matikiti, Mpinganjira and Roberts-Lombard (2018) established elements that impacted South African travel agencies, and tour operators Attitude towards use of social media marketing (Matikiti et al., 2018). Applying a quantitative approach using questionnaires, data gathered from one hundred and fifty travel agencies and tour operators were analysed using multiple regression analysis and one-way analysis of variance (ANOVA) (Matikiti et al., 2018). Outcomes of the research showed that *managerial*

support and *managers' level of education* were the two factors that determined the Attitude towards of use of social media marketing (Matikiti et al., 2018). It was also established that *competitors pressure*, PB and PEOU were the most prominent external factors that influenced the use of social media marketing (Matikiti et al., 2018). The study further revealed that "*technical knowledge* moderates the relationship between Attitude towards use and Usage of social media marketing" (Matikiti et al., 2018). The variables of *knowledge/training, support,* and the constructs PU and PEOU are therefore important to include in the proposed model. Seemingly, the study by Venkatesh (2000) on determinants of PEOU, recommended this as well.

While all the previous studies discussed were conducted in Africa, the study by Brandon-Jones and Kauppi (2018) was conducted in the Netherlands. The authors examined key antecedents of employees' acceptance of e-procurement systems by applying an "extended TAM (Brandon-Jones and Kauppi, 2018). Focusing on the possible role of user-perceived e-procurement *quality* dimensions of PU and PEOU, the researchers collected data from one hundred and thirty nine e-procurement consumers at a university in Netherlands. Conclusions drawn from the analyzed data show that *usability, processing and professionalism* affected the levels of employee e-procurement adoption (Brandon-Jones and Kauppi, 2018). Since *processing, usability* and *professionalism* influence *system quality* towards PEOU, *ease of use* towards i*nformation quality* and *culture* towards Perceived Performance respectively, *system quality*, *information quality* and *culture* variables need to be included in the expanded Technology Acceptance Model for the Sub-Saharan African Context.

All these studies found TAM to be suitable for use in determining variables and constructs that influence technology acceptance and therefore all the constructs of TAM are used for the expanded TAM for the Sub-Saharan African context.

3.3 Research that applied TAM with modifications or extensions

Apart from the use of the original TAM in previous studies (Ibrahim, 2018; Matikiti, Mpinganjira and Roberts-Lombard, 2018; Ayele and Birhanie, 2018; Brandon-Jones and Kauppi, 2018), modified or extended TAMs were also used by other previous studies. Previous studies that used modified or extended TAMs include the studies of Byun, Chiu and Bae (2018), Yang, Wang and Sun (2018), Helia et al. (2018) and Nagy (2018).

Applying a modified Technology Acceptance Model (TAM) as in Figure 3.2, Byun, Chiu and Bae (2018), examined variables and constructs that influenced consumers' intention and actual behaviour to use sports brand applications. Using convenience sampling, data were collected from 261 Korean sports brand application consumers and analyzed (Byun, Chiu and Bae, 2018). The study results indicated that *level of enjoyment* had a substantial positive impact on PEOU and that PEOU also positively impacted PU (Byun, Chiu and Bae, 2018).

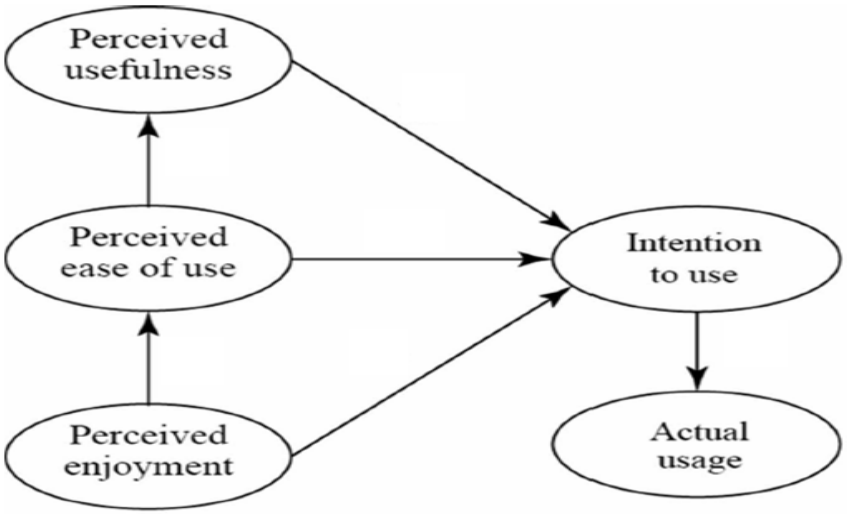


Figure 3.2: Modified TAM (Byun, Chin and Bae, 2018)

On constructs that influenced BI to use sports brand applications, Perceived Enjoyment was found to be the most influential. It was followed by PU, and thereafter PEOU. The study further found that BI positively affected Actual Behaviour and also that variances were found between the three age groups: 20s, 30s, and 40+ (Byun, Chiu and Bae, 2018). The construct of enjoyment may be directly due to the applications being sports brand related and was therefore not included in the expanded TAM created by this research.

In their bid to comprehend why emerging information technology is adopted and implemented, Yang, Wang and Sun (2018) proposed the EITAM (Emerging Information Technology Acceptance Model) (Yang, Wang and Sun, 2018). Using structural equation modeling (SEM) based on data from an open-ended questionnaire survey, hypotheses were tested and the research identified elements that affect evolving information technologies adoption among engineering, construction, technology, and innovation professionals. Creating a modified "Technology Acceptance Model" (TAM) with "Structural Equation Modeling" (SEM) and testing it using the statistical package SPSS Amos 20, Helia et al. (2018), identified the variables that influence "Hospital Information System's (HIS)

applications" most. Using questionnaires to collect data from numerous hospitals in Sleman, Daerah Istimewa Yogyakarta Province, Indonesia, Helia et al. (2018), found that seven constructs influenced users in using a HIS. Among these constructs are Subjective Norm, PU, PEOU, User Satisfaction (US), BI, Attitude towards Using, and Actual System Usage. Since the study by Helia et al. (2018) was conducted in a developing country, the seven identified constructs were considered for the new expanded model. As in the literature and discussed earlier in 2.6.2, Subjective Norm will be measured by two variables (*influence by peers* and *influence by important persons*) in this research.

In the Nagy (2018) study to examine elements that define students' video usage and satisfaction, the researcher made educational course materials and videos accessible to students through Moodle. Using a theoretical background from an expanded Technology Acceptance Model (TAM), the researcher used questionnaires to gather data from eighty nine students. Examining the constructs learner-learner interaction, learning performance, and learner-teacher interaction, the researcher found that PU, Internet Self-Efficacy,and Attitude, had a direct consequence on the video use (Nagy, 2018). Learner-Learner Interaction, PEOU, and Learning Performance directly influenced Learning Satisfaction, (Nagy, 2018). Also video usage had a substantial consequence on learning performance and learning gratification, Nagy (2018). Considering that attitude and learner-learner interaction more likely stems from culture which may influence frequency of use, experience, and internet self-efficacy, this study included *culture*, *frequency of use* and *experience* as variables in the expanded model.

In their meta-analysis on the influence of trust on technology adoption, focusing on controlling impact of subject and context categories, Wua et al. (2011) analysed one hundred and twenty six studies on PEOU and PU of TAM and found that PEOU and PU influence Attitude which in turn influences BI. Findings of Wua et al. (2011) confirmed the findings of King and He (2006) and hence adds further reason PEOU and PU should be included as constructs in the expanded model. In addition to PEOU and PU, the study by Siregar, Puspokusumo and Rahayu (2017) on the factors that affect technology adoption for knowledge management applications, found that *user willingness* to use and *knowledge management* influenced technology acceptance. As *user willingness* to use and *knowledge management* match f*requency of use* and *experience* respectively, the findings Siregar,

Puspokusumo and Rahayu (2017) give further reasons *frequency of use* and *experience* should be incorporated as variables in the expanded model as proposed in this research.

The constructs identified in studies, using the existing and modified TAMs, which were suitable for the expanded TAM for the Sub-Saharan African context were therefore PEOU, PU, PP, BI, and TA. The variables influencing the constructs are *culture, frequency of use* and *experience, influence by peers* and *influence by important persons, accessibility, and performance.*

3.4 Research that applied Information System Success Model

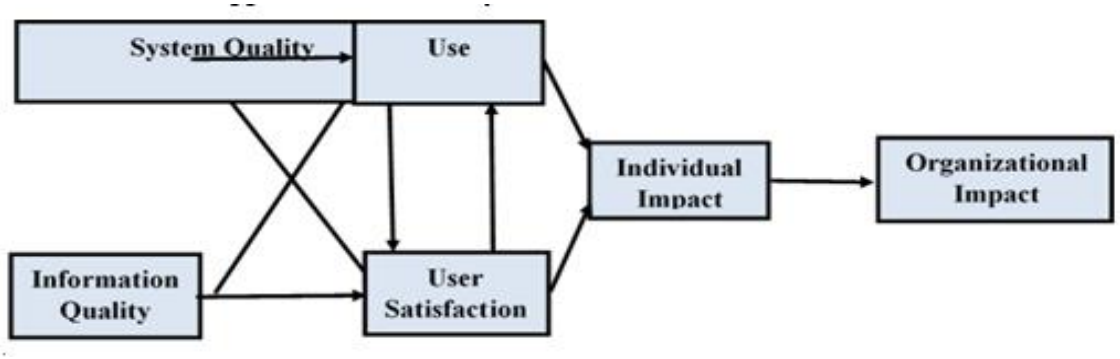


Figure 3.3: Information System Success Model (DeLone and McLean, 1992)

The original and updated ISSM models as in Figure 3.3 and Figure 3.4 were found in very recent studies still to be an acceptable tool for predicting technological acceptance (Nugroho and Prasetyo, 2018; Stylianides et al., 2018; Laakkonen, 2018; Guzmán, Fóster, Ramírez-Correa, Grandón, and Alfaro-Perez, 2018 and Thielsch et al., 2018).

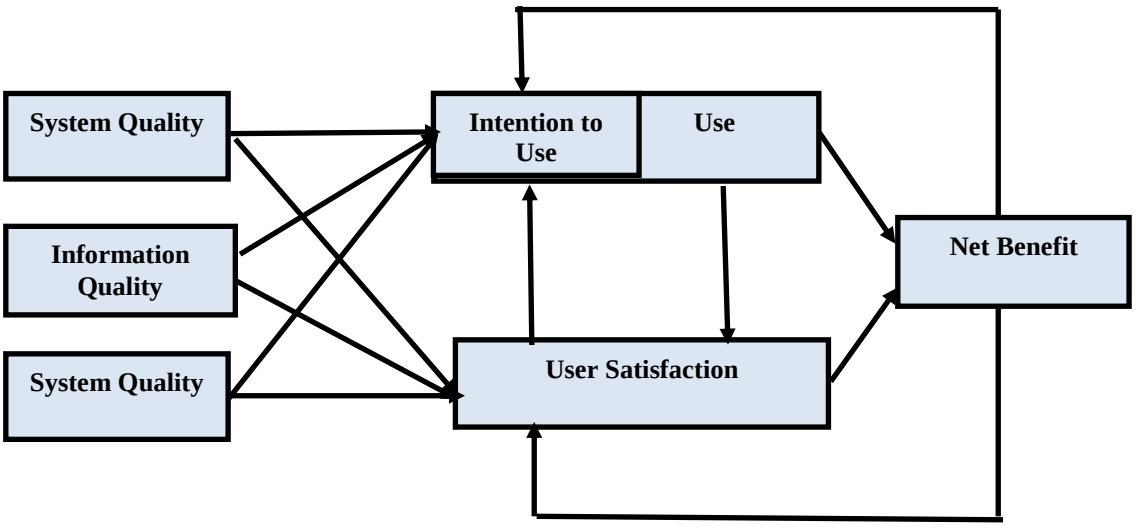


Figure 3.4: Updated Information System Success Model (DeLone and McLean, 2003)

To understand a user perspective organization's information systems, Nugroho and Prasetyo (2018), re-itemizsed and authenticated the ISSM model by DeLone and McLean (2003) by recommending a social exchange theory for changes in *perceived quality,* and added perceived value variables as suggested by Wang and Hui (2003). Gathering data from one hundred and two respondents who used Accounting Information Systems (IS) in their corporations and twenty seven businesses by email, Nugroho and Prasetyo (2018) developed a model for testing IS Success. From the model, Nugroho and Prasetyo (2018) concluded that a stout connection existed between *perceived quality, user satisfaction, perceived value, and net benefits.* Further, Nugroho and Prasetyo (2018) found that *information* quality and *system quality* affect *service quality*. They further found that *system quality, information quality, and service quality* caused the formation of *perceived value* and *perceived value* causes the formation of *user satisfaction* and *net benefits*. Based on these findings, this research included *information quality, system quality, service quality,* and *satisfaction* in the expanded model.

Leveraging on the ISSM model (DeLone and McLean, 2003) and using questionnaires to collect data, Stylianides et al. (2018) developed an assessment framework for health IS. Considerations made in developing the framework included *collaboration, satisfaction, safety, procedures* and *system quality* (Stylianides et al., 2018). *Satisfaction* and *system quality* being part of considerations for Stylianides et al. (2018) in developing a framework for evaluating health information systems, reinforced the inclusion of *system quality* and *satisfaction* as possible variables for the expanded model. Another study that made use of *satisfaction* variable is that of Fayada and Paperb (2015), which developed an extended TAM with Process Satisfaction and Outcome Satisfaction as constructs.

Though not a construct in ISSM, 'use' as a construct in ISSM influences satisfaction and benefit directly and influences intention to use indirectly (DeLone and McLean, 2003). To understand the way that organic search engine visibility on Google affects e-commerce system use, Laakkonen (2018) reviewed relevant literature, including ISSM and thereafter undertook user tests and consultations with 12 participants. Results from the study revealed that high organic search engine visibility is not the reason for ecommerce system use, but rather use is a result of high visibility, Laakkonen (2018). This result reinforces the inclusion of *frequency of use* and *satisfaction* as variables in the expanded model, asthey influence

Technology Acceptance (TA). The study also found that, user use a number of factors for evaluation when choosing an e-commerce system, (Laakkonen, 2018). This finding informs the expanded model to have the factors *frequency of use* and *satisfaction* as variables.

To determine whether the success of IS affects job gratification and obligation among employees, Guzmán et al. (2018) gathered data from fifty people in the higher institutions of learning. Results of the analysed data show that there are dimensions associated with IS that influence the success of the IS and this success in turn influences job gratification and obligation, and through the latter, institutional performance (Guzmán et al., 2018). Dimensions associated with information systems that influence its success (Guzmán et al., 2018) may include system quality, information quality, service quality and culture. By including *system quality*, *information quality*, *service quality* ,and *culture* as variables in the expanded model, it becomes possible to verify whether these dimensions of information systems influence its success in the the Sub-Saharan African context.

In some organisations, information systems may not exist or exist but are not used as employees lack trust in them. To investigate users' (employees) trust in IS and preconditions for trust, Thielsch et al. (2018) collected data from 30 professionals on occupational incidents towards highly trusted or distrusted an IS. Performing content analysis of the one hundred and eleven critical incidents uncovered, the researchers found twelve predictors of trust and distrust in IS, which partly correspond to the structure of the established DeLone and McLean (2003) model. Analysis of data further gathered from one hundred and seventy nine professionals to validate the initial findings, show that reliability (system quality) and credibility (information quality) of IS are the most important predictors for trust and distrust in IS at work. with reference to job gratification and commitment, the study found that welfare and performance were rated greatest in trust events and that experienced strain was rated greatest in distrust events. The study concluded by developing a comprehensive model of trust in IS at work.

3.5 Research that applied Technology Organisation and Environment (TOE) Framework

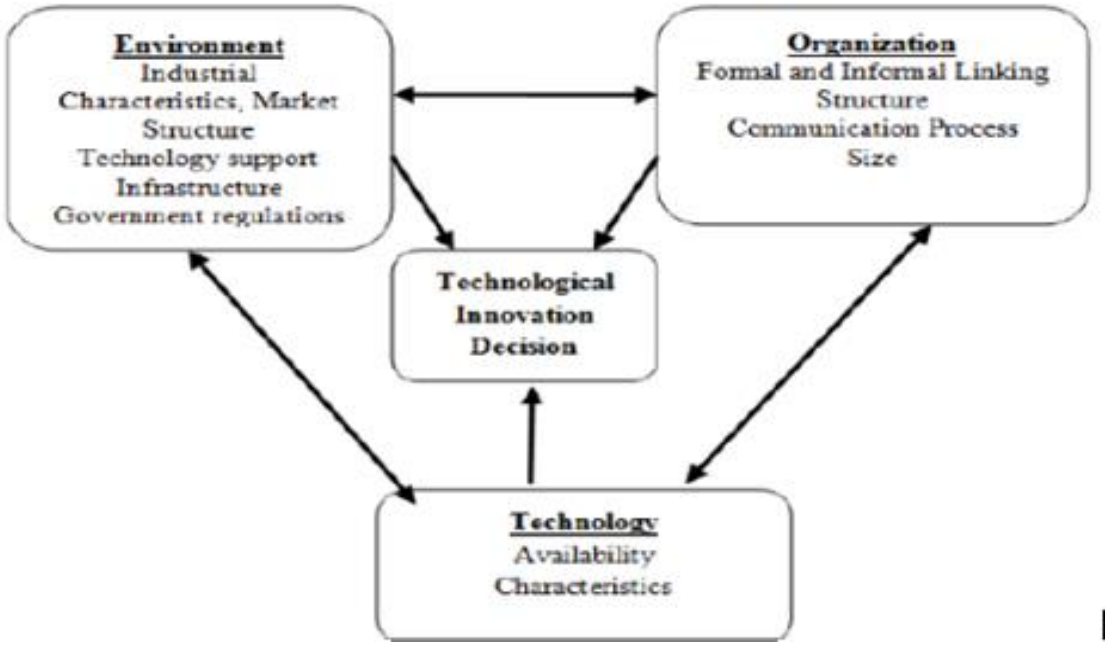


Figure 3.5: TOE framework (Tornatzky and Fleisher, 1990)

The original TEO model as in Figure 3.5 was found in very recent studies still to be an acceptable tool for predicting technological acceptance (Kilström, 2016; Ismail and Azwadi, 2016; Ma and Lee, 2018; Hussein, Baharudin, Jayaraman and Kiumarsi, 2019; Feibert and Jacobsen, 2019).

Kilström (2016)'s study to examine the shortcomings of transitioning from premise system to a cloud computing service, reviewed the TOE framework and thereafter conducted interviews to collect data from participants. Analyses of the data found *security*, *perceived loss of control* and *lack of cloud computing understanding* as shortcomings and hence the researcher recommended that further research on cloud computing comprehension be undertaken, (Kilström, 2016). As *security*, *perceived loss of control* and *lack of cloud computing understanding* were as a result of the cloud computing (system) quality and the researcher (Kilström, 2016) recommended further study on it *System quality* needed to be included as a variable in the expanded model.

In Ismail and Azwadi (2016)'s study to develop a conceptual model for examining influential elements of computerised accounting as IS adoption, they applied the TOE framework to

examine current experiential research work in information technology and information systems acceptance at the organizational level to collect and analyse data. Based on results, Ismail and Azwadi (2016) developed a model. The use of the TOE by Ismail and Azwadi (2016) in developing a technological adoption model indicates the possibility of using some of TOE's constructs and variables in the expanded model and hence supporting the use of *system quality*, *information quality*, *service quality* (TOE technological dimensions) and *culture* (a TOE environment dimension) as above.

In their study to assess the elements that impact the intent for continual use of e-commerce among Jordan manufacturing SMEs, Hussein, Baharudin, Jayaraman and Kiumarsi (2019) employed a questionnaire to gather quantitative data from one hundred and sixty eight research participants in Jordan and thereafter analysed the data. The Results indicated that *top management support*, *relative advantage* and *information intensity* have substantial indirect consequence on Behaviour Intention to use ecommerce continuously, through Perceived Usefulness (PU), (Hussein, Baharudin, Jayaraman and Kiumarsi, 2019). PU mediates the relationship of *relative advantage* and *information intensity* with the Behaviour Intention to continue using B2B e-commerce, (Hussein, Baharudin, Jayaraman and Kiumarsi, 2019). Since *information intensity* and *top management* are linked to *information quality* and *service quality*, the results of Hussein, Baharudin, Jayaraman and Kiumarsi (2019)'s study shows the need for *information quality* indirectly and *service quality* to be included as variables and PU to be included as a construct in the expanded TAM for the Sub-Saharan African environment.

In Feibert and Jacobsen's (2019) study to improve and expand technology acceptance for medical logistics scenery by merging the technology-organisation-environment (TOE) framework with a business process management (BPM) perspective, the researchers undertook multiple case studies at five Danish hospitals on the bed logistics process. Results of the study indicate that seventeen sets of factors affect adoption of technologies in the healthcare logistics system, and, most importantly, they relate to *employee work conditions*, *quality*, and *employee engagement*. Feibert and Jacobsen (2019) pointing to *quality* as an important factor reinforces the inclusion of *information quality*, *system quality*, and *service quality* as variables in the expanded TAM in the Sub-Saharan African context.

The examples of recent studies as discussed above, therefore confirm that even modified or extended TAMs, ISSM and TOE are still being used in examining and identifying factors that influence technology acceptance and are, therefore, a suitable theoretical basis for this study.

3.6 Variables for the proposed expanded TAM model

Based on various Technological Acceptance Models (TAM), theories, and their applications in previous studies as discussed, two main issues were considered in this study to identify variables for the proposed extended Technology Acceptance Model. The first consideration has to do with variables that will address technological acceptance within the Sub-Saharan African context. The second consideration has to do with variables that have the possibility to forecast and clarify adoption and use of e-learning within the Sub-Saharan African context. The study carried out a critical analysis of existing Technology Acceptance Research. External variables were then selected based on their ability (as described in the literature) to forecast and clarify adoption of technology.

Based on the critical analysis of TAM models and theories, four principal constructs (consisting of thirteen variables) were identified from the literature. These constructs are: PEOU, PU, PP and PB. Within these constructs, 13 variables were identified. The identified 13 variables in literature include: *ease of use, usefulness, frequency of use, system quality, culture, satisfaction, experience, student or user centeredness, training, information quality, use mode, influence by peers, and influence by important persons.*

Previous studies on TAM focused on eight of the said variables and were handled either partly or neglected the other five variables. The eight variables that were handled in previous studies include *ease of use, usefulness, system quality, satisfaction, experience, information quality, influence by peers,* and *influence by important persons*. The five variables that were handled partially or neglected in previous studies include: *use mode, culture, student or user centeredness, frequency of use,* and *training*. The said constructs and variables above were applied in the methodology section to construct appropriate research instruments.

3.7 Summary of Chapter

This chapter discussed the literature and theoretical underpinnings for the research in five sections. Section One discussed scholarly work that used the original Technology Acceptance

Model (TAM) in explaining acceptance of technology. Section Two discussed studies that applied a modified Technology Acceptance Model (TAM) in explaining acceptance of technology. The third and fourth sections respectively discussed studies that applied the Information System Success Model (ISSM) and Technology–Organisation-Environment framework in explaining technology acceptance. Finally, the fifth section identified potential variables for the expanded TAM, based on these previous models. The next chapter discusses the methodology applied in the research.

CHAPTER FOUR
RESEARCH METHODOLOGY

4.1 Introduction

This chapter discusses the methodology applied in this research. Issues discussed in the chapter include research approach, qualitative research design, quantitative research design, research strategy, research questions and objectives, population, sampling, data analyses and results, pilot study, reliability, and validity.

4.2 Research Strategy

The research strategy can be summarized by Figure 4.1:

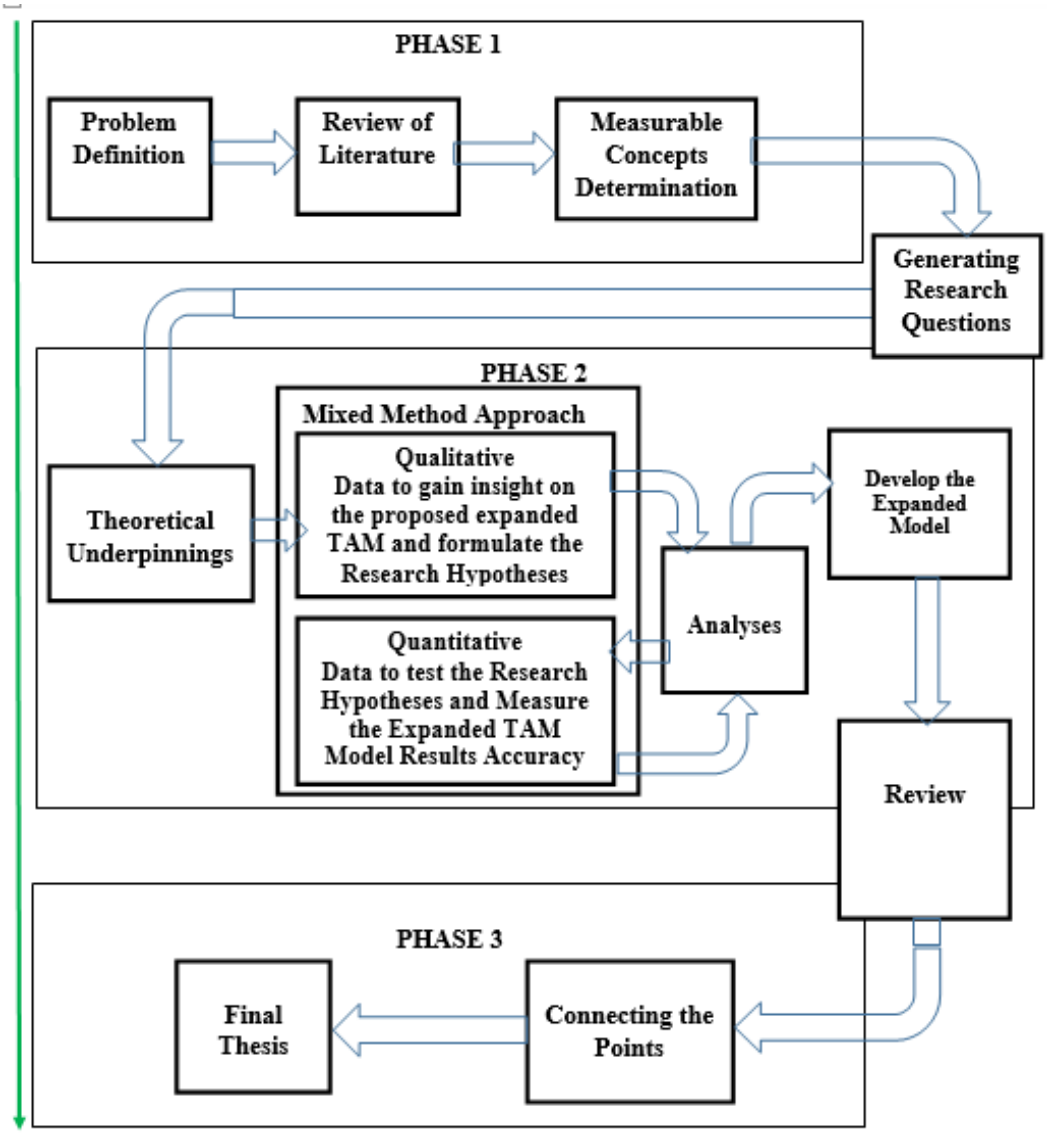


Figure 4.1: Research Strategy

The problem that has been identified is that existing models to predict technology acceptance lack Sub-Saharan African specific constructs and variables, which could negatively impact the accuracy of the prediction models.

4.2.1 Linking Research Aim, Objectives and Rresearch Qquestions to methodology

The aim of this research was to improve existing Technology Acceptance Models to predict technology acceptance within the Sub-Saharan African context more accurately, by investigating which constructs and variables are more relevant within the Sub-Saharan African context, specifically for an e-learning environment.

As a reminder and way of establishing the position of the research methodology in this research, the research objectives and questions are re-presented below and linked to the relevant methodology used to achieve these objectives.

4.2.1.1 Research Objectives

- To analyse and evaluate existing TAM (1, 2 and 3), ISSM, TRA theory and TOE framework concepts (constructs and variables) from literature, to identify constructs relevant to the Sub-Saharan African environment -
  considering that this objective was set to aid the researcher to assess, critique, and synthesisze literature on Technological Acceptance concepts in order to expand on the existing TAM for Sub-Sahara Africa (as stated in objective 2 below), the researcher applied the integrative literature review approach to review various literature materials. As evidenced in the previous chapters (two and three), a comprehensive literature study was conducted to identify the current technology acceptance models and the Information Systems assessment constructs and variables.

- To develop an expanded TAM applicable to the Sub-Saharan African environment, based on the concepts (constructs and variables) of TAM, with quality factors of the ISSM, TRA theory and TOE framework concepts that can be used to measure e-learning quality, user satisfaction and acceptance in Sub-Saharan Africa -
  This objective was implemented by applying a mixed methodology to collect qualitative and quantitative data. As in the succeeding chapter (five), the analysed

qualitative data enabled the researcher to gain more insight into Technological Acceptance concepts, formulate the research hypotheses and propose the expanded TAM for the Sub-Saharan African context. The quantitative methodology enabled the researcher to collect further data to test the research hypotheses and revise the proposed expanded TAM for the Sub-Saharan African environment.

- To compare the results obtained by using the expanded TAM to evaluate user satisfaction and acceptance of e-learning in Sub-Saharan Africa, to results of the existing TAM, documented in the literature.

  In implementing this, the research applied the quantitative methodology to compare the performance of the developed expanded TAM and the existing TAMs. As carried out in chapter six, the performance of the developed expanded TAM and the existing TAMs were measured by the explained variance (R^2) in the independent constructs (PU, PEOU, PP, PB and Ext Fact) and the dependent construct BI of the developed expanded TAM and existing TAM and were compared using a Table (as in Table 6.1 in chapter six)

4.2.1.2 Research questions

Main Research Question

In what form should an expanded TAM in the Sub-Saharan African context be developed so as to improve the accuracy of the evaluation of the quality, user satisfaction, and acceptance of e-learning within the Sub-Saharan African environment?

Sub-Research Questions

- What are the components of an expanded Technology Acceptance Model, applicable specifically in the Sub-Saharan African context (including the Sub-Saharan African diverse cultural, social and resource constrained settings)?

  Applying a mixed methodology to gather and analyse both qualitative and quantitative data, components to develop an expanded Technology Acceptance Model were generated. The research applied the qualitative method that enabled it to gather qualitative data on Technological Adoption concepts (as identified during the integrative literature review) and based on analyses of the data, formulated the research hypotheses and proposed an expanded TAM model in the Sub-Saharan

African context. This is evidenced in the next chapter (five). Applying the quantitative method, quantitative data was gathered and analysed to test the research hypotheses and revise the proposed expanded TAM in the African context. This is also evidenced in the next chapter (five).

- Which constructs and variables from TAM, ISSM, TRA theory and TOE framework, applicable in the Sub-Saharan African context, influence and measure quality, user satisfaction, and acceptance of e-learning?

  Considering that existing Technological Acceptance models, theories, and frameworks have been used in several studies (evidenced in chapters two and three) and also used on several technological applications to understand their adoption internationally, it's possible that some concepts (constructs and variables) of the existing TAMs including TAM (1, 2 and 3), ISSM, TRA and TOE may be applicable to the proposed expanded TAM for the African environment. To ascertain this, the researcher applied the integrative literature review approach to review various literature materials comprehensively (as evidenced in the preceeding chapters (two and three)). From the said literature review in chapter two, Technological Acceptance concepts (constructs and variables) of TAM, ISSM, TRA and TOE, applicable to the proposed expanded TAM for the African environment, were identified (chapters two and three) and applied to construct the proposed expanded TAM in the African context (see discussions in chapters five, six and seven for evidence).

- What level of accuracy does the use of the expanded TAM give when applied to measure quality, user satisfaction, and e-learning acceptance, in public Institutions of Higher Learning in Sub-Saharan Africa?

  Available literature as reviewed in chapters two and three, indicate that some of the existing Technological Acceptance models and theories perform better than others in assessing Technological Acceptance. As a way of ascertaining that the developed expanded TAM in the African context performs better than existing TAMs when used in the African context, its performance was measured against the performance of the existing TAMs (see discussion in chapters six and seven for evidence). To find the answer to this research question, the researcher computed the explained variance (R2) in the independent constructs (PU, PEOU, PP, PB and Ext Fact) and the dependent

construct BI of the developed expanded TAM and compared it to existing TAMs explained variance (R2) - as in Table 6.1 in Cchapter Ssix.

The research strategy for this research was divided into three phases. As in Fig 4.1, phase one of the strategy defined the research problem, reviewed relevant literature, and determined measurable concepts towards the generation of the research questions. Phase two of the strategy discussed the research's theoretical underpinnings, the research methodology which encompassed the research approaches (qualitative and quantitative methodologies) applied in the research. Initial data was gathered and analysed using the qualitative methodology so as to understand Technological Acceptance (TA) concepts that are at play in the Sub-Saharan African context. Based on the TA concepts generated from the qualitative analysed data, the research hypotheses were formulated and the initial expanded TAM model in the Sub-Sahara Africa context was generated. Applying the quantitative methodology, further data was collected to test the research hypothesis and the initial generated expanded TAM in the Sub-Sahara Africa context. Outcomes of the quantitative data analyses were then applied to develop the expanded TAM model in the Sub-Saharan African context. Results of the proposed model were reviewed, their performance generated through explained variance (R^2) and compared with the explained variance of existing TAMs. Results from Phase 2 were looped into phase three, where the various points from different sections of the thesis were connected together thus completing the thesis.

4.3 Research Philosophy

This research adopted the pragmatic research philosophy as it allowed the implementation of both qualitative and quantitative methods as enumerated below in the research strategy. Existing literature also indicate the use of the pragmatic research philosophy as the most appropriate for research applying mixed methods approach.

Considering the weaknesses of different research methodologies which led to the evolution of the mixed research method and also the conflicting philosophical differences between the positivist and interpretivist philosophies that led to the evolution of the pragmatic philosophy' this research applied the pragmatic philosophy as a way to address some of the weaknesses of the positivist and interpretivist philosophies. The weaknesses envisaged include the challenges of a single research method such as data accuracy, inherent biases, etc. By

applying the pragmatic research philosophy, different research methodologies (qualitative and quantitative) could be applied to collect data from multiple sources and analyse them using multiple methodology analytic techniques for the results to complement each other.

In implementing the pragmatic philosophical approach as discussed in the preceding sections, a sequential confirmatory design was followed through as the qualitative part was undertaken first and the quantitative part followed subsequently. The qualitative part enabled the collection of initial qualitative data based on the proposed expanded TAM, as formulated from the reviewed literature concepts (constructs and variables) and subsequent analyses of the data that resulted in the research hypotheses. The quantitative part enabled the collection of quantitative data, enabling the testing of research hypotheses and subsequent development of the expanded TAM in the African context, and assessing its performance. Detailed explanations of the use and implementation of the qualitative and quantitative methods for this research follow.

4.4 Research Approach

To achieve the research aim and objectives, a mixed method approach was applied. This approach enabled the implementation of triangulation of data. Related data from different sources were analysed in various but appropriate ways that aided in the research, achieving its aim and objectives. In implementing the mixed method approach, literature on the existing TAMs were reviewed, and, based on the review, an expanded TAM for the Sub-Saharan African context was proposed. Secondly, the qualitative method to collect and analyse initial primary data was applied to gain insights on the proposed expanded TAM in the Sub-Saharan African context. Based on these insights, the research hypotheses were formulated. Thirdly, applying the quantitative method approach, quantitative data were collected and analysed towards testing the research hypotheses and developing an expanded TAM in the Sub-Saharan African context. The quantitative method also enabled the validation of the proposed expanded model. The term mixed method, as used in this context, was preferred over the term mixed approach, as most recent studies (Fetters and Molina-Azorin, 2020; Sileyew, 2019; Met-Hodos, 2019; Pardede, 2018; Wrczbrgr, 2016) often used mixed method than mixed approach.

4.4.1 Population

A population is defined as the sum of all individuals or entities that can aid a researcher to collect relevant information regarding ongoing research. The population for this study consisted of students from five universities: one from each Sub-Saharan African Region: Southern Africa, Western Africa, Central Africa, Eastern Africa, and Northern Africa. The countries selected from the various Sub-Saharan African region included South Africa (Southern Africa), Sudan (Northern Africa), Nigeria (Western Africa), Kenya (Eastern Africa) and Democratic Republic of Congo (Central Africa). These countries were chosen as a result of their high e-learning market share in Africa (IT News Africa, 2016; Zealousys, 2017).

Additionally, these countries are a fair representation of the mix (small to large) of Sub-Saharan countries' socio-economic and infrastructure conditions. This is evidenced in the mixed range (low to high) of per capita and telecommunication infrastructure of Sub-Saharan countries. The per capita for South Africa, Sudan, Nigeria, Kenya and Democratic Republic of Congo as at 2018 was 13090, 4481, 2100, 1507 and 870 respectively (Miniwatts Marketing Group, 2020). Smart phone ownership rate for South Africa, Sudan, Nigeria, Kenya and Democratic Republic of Congo as at 2018 was 60%, 20%, 39%, 41% and 31% respectively. Further, the internet penetration rate for South Africa, Sudan, Nigeria, Kenya and Democratic Republic of Congo as at 2018 was 54%, 29%, 55%, 83% and 6% respectively, (Silver and Johnson, 2018; Clement, 2019; Miniwatts Marketing Group, 2020).

Comparatively, the trend in per capita per country did not translate into proportionate smart phone ownership and internet penetration rate for the said countries above. For instance: 1. though Sudan had the second highest per capita, it had the least smart phone owners; 2. though Kenya had the fourth highest per capita, it stood out as the country with the highest internet penetration rate. Though a class of thought may argue that socio-economic conditions in the selected countries could affect mobile and internet rates and eventually the adoption of technology (e-learning in this case), the above discussion indicates that it wasn't the case in selected countries. Considering the different statistics per capita per country, mobile and internet penetration rates and e-learning market share, selecting equal subjects to represent each of the selected countries, could create a bias. Hence, considering that the study focused on technology (e-learning in this study) adoption, it is justified to determine the

proportion of the research subjects representing each country on the existing e-learning market share in Sub-Saharan Africa for the data to be representative and a true reflection of e-learning consumption in the various regions of Sub-Saharan Africa.

The public universities from which data were collected in the said countries included Durban University of Technology – DUT (South Africa), Federal University of Agriculture (Nigeria), University of Kenyatta (Kenya), Universite Evangelique en Afrique (Democratic Republic of Congo) and Sudan Academy for Aviation Sciences and Technology (SUDAFAST - Sudan). These universities were chosen as a result of them having an established e-learning system. Qualitative data and quantitative data were gathered from selected students. The qualitative data were gathered from students by face-to-face interviews and the guide to semi-structured interviews. Quantitative data were gathered by self-administrated questionnaires (developed from the proposed model as theorised from the interview results) through research assistants. The students selected for the survey are those who have used or are using an e-learning system in the said universities above. Though possible to obtain the number of users and user logs per each e-learning system‘ it was difficult to determine the total number of students who had used or are using the e-learning system. Hence the population for this study was considered infinite.

4.4.2 Qualitative Research Design

This research approach enabled the researcher to “explore and understand the meaning of individual groups ascribed to a social problem” (Creswell, 2018). Compared to the quantitative approach, it’s believed that this approach can, in specific cases, be more accurate (Miller, 2010). A qualitative research approach enables the research to follow flexibly unexpected ideas and processes, become sensitive to contextual issues, study social meaning (Ospina, 2004) and suggest appropriate theories regarding a phenomenon (Crowther and Lancaster, 2012). Examples of research conducted, using the qualitative approach, include a qualitative study of the “applicability of technology acceptance models to senior mobile phone users” (Van and Renaud, 2008), a “qualitative approach to examine technology acceptance” (Vogelsang, Steinhüser and Hoppe, 2013) and “Technology Acceptance Model as a predictor of using information systems to acquire information literacy skills” (Durodolu, 2016).

The initial phase of this research examined the various technological acceptance theories and models documented in the literature. Thereafter the "Technology Acceptance Model", "Information System Success Model" and the "Theory of Reasoned Action" were investigated in detail, to determine whether any of their constructs apply to the proposed expanded Technology Acceptance Model in the Sub-Saharan African context.

4.4.2.1 Qualitative Data collection instrument

Different research instruments, such as interviews or questionnaires with open ended questions may be employed to collect primary data for qualitative research. For this study, an interview guide was employed and face-to-face interviews were conducted with the assistance of research assistants in each of the five Sub-Saharan African countries. The semi-structured interview instrument was designed such that in-depth information was acquired from each interviewee. As stated, the interviews were conducted with students (users of e-learning systems) from five public universities in five African countries. After obtaining the data, the research objectives were re-delineated and hypotheses formulated. Findings from the interviews were compared to the research literature to unearth more data that informed the quantitative data collection and analysis. The interview questions for this study are in Appendix A.

4.4.2.2 Qualitative sampling method and size

With an infinite study population and sampling for collecting qualitative data in phenomenological studies, Creswell (1998) states that "a sample size of 5 to 25 is recommended for a phenomenological study". To Morse (1994), "at least 6 interviews are recommended", which is confirmed by Hagaman and Wutich (2017) through their research conclusion that "16 or fewer interviews were enough to identify common themes from sites with relatively homogeneous groups". They, however, stated further that a larger sample size: ranging from 20 to 40 interviews is needed when using interview as a research instrument. Though larger sample sizes tend to be used for collecting quantitative information, there should always be a trade-off between the representativeness, diversity of a sample, efficiency, and timeliness with which data can be collected (ACAPS, 2011). During the qualitative data collection in the various countries in the various Sub-Saharan Africa regions, the point of saturation was reached on the 15^{th}, 12^{th}, 10^{th}, 7^{th} and 6^{th} Interviewee in South Africa (Southern

Africa), Nigeria (West Africa), Sudan (Northern Africa), Kenya (East Africa) and Democratic Republic of Congo (Central Africa) respectively. At this point, the researcher stopped collecting qualitative data. In all (15 + 12 + 10 + 7 + 6), the researcher collected qualitative data from 50 participants as illustrated in Table 4.1.

Table 4.1: Strata for qualitative data collection

No	Region	Country	Sample
1	Southern Africa	South Africa	15
2	West Africa	Nigeria	12
3	Northern Africa	Sudan	10
4	East Africa	Kenya	7
5	Central Africa	Democratic Republic of Congo	6
Total			**50**

4.4.3 Quantitative Research Design

Quantitative research design is the design approach by which a researcher "tests objective theories by examining the relationship between variables". To achieve this, the study designed and used a Questionnaire. Figure 4.2 indicates the empirical research approach.

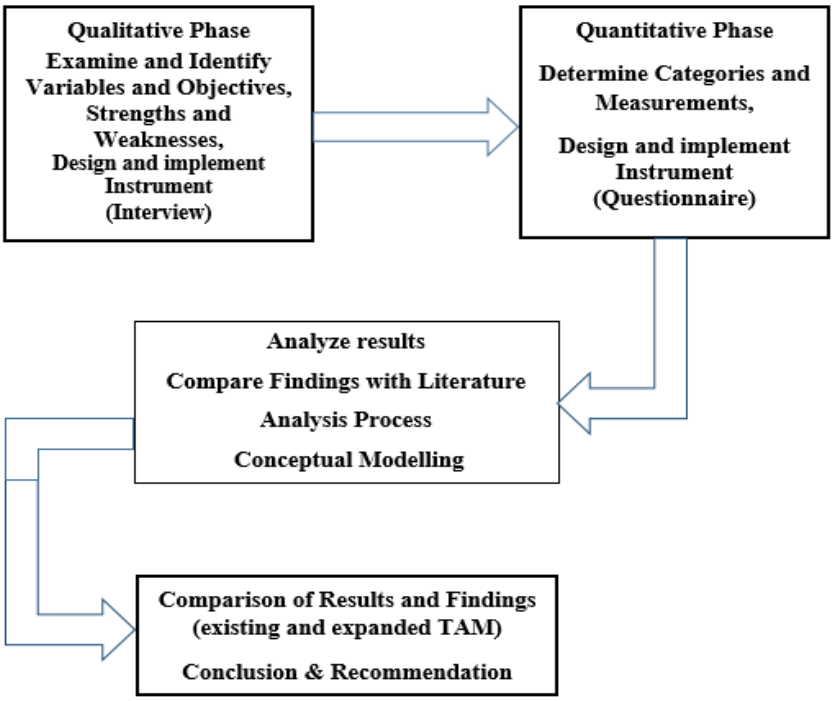


Figure 4.2: Empirical Research Approach

4.4.3.1 Quantitative data gathering instruments

In the literature on TAM, most questionnaires used five to nine Likert scales (Saunders et al., 2009; Al-Aulamie, 2013).As a result, this study applied a five Likert scale comprising of strongly agree (1), agree (2), neutral (3), disagree (4), and strongly disagree (5). The questionnaire items were phrased such that they are in an agreement statement where users choose whether they strongly agree through to strongly disagree (in context of the five scale points). The questionnaire for this study can be found in Appendix B.

4.4.3.2 Quantitative sampling method and size

Since the population for the study is considered infinite; Godden's (2004) sample size deterministic formula for infinite population, as shown below, was used to arrive at the sample size by which quantitative data was collected.

$$SS = \frac{Z^2 \text{ x } p\ (1\text{-}p)}{M^2}$$

(Source: Godden, 2004)

Where:

SS = Sample size for infinite population (more than 50,000)
Z = Z value (e.g. 1.96 for 95% confidence level)
p = Population proportion (expressed as decimal) (assumed to 0.5 (50%) since this would provide the maximum sample size)
M = Margin of error at 5% (.05)
For instance, if the proportion is 60%

$$SS = \frac{1.962^2 \times 0.6(1 - 0.6)}{0.05^2}$$

$$SS = \frac{3.842 \times 0.6(0.4)}{0.05^2}$$

$$SS = \frac{0.923}{0.003}$$

$$SS = 307.666 \approx 308$$

From the above calculations, the sample size from which data were collected was 308. Using stratified random sampling, the 308 participants (students) were selected at

random from the population based on the e-learning market share of the countries representing the various regions in Sub-Saharan Africa. According to IT News Africa (2016) and Zealousys (2017), South Africa is Africa's largest e-learning market. With reference to the market consumption of e-learning in Africa, the strata for collecting the quantitative data were allocated as in Table 4.2:

Table 4.2: Strata for quantitative data collection

No	Region	Country	e-learning Market Share	Sample
1	Southern Africa	South Africa	30%	92
2	West Africa	Nigeria	25%	77
3	Northern Africa	Sudan	20%	62
4	East Africa	Kenya	13%	40
5	Central Africa	Democratic Republic of Congo	12%	37
Total			**100%**	**308**

4.5 Data Analysis

4.5.1 Pilot study

To minimise ambiguity and misunderstanding in the research instruments (interview tool and questionnaire), a pilot study was undertaken. Through the pilot study, it could be determined whether the questions in both instruments were appropriate. Instructions on the research instruments were also assessed for clarity, and, most importantly, tested for reliability and validity. Specific items that were checked in the pilot study included time required for participants to respond to the interview or to answer the questionnaire and level of understand-ability of questions in the questionnaire.

In preparation for the pilot study, the interview and questionnaire instruments were drafted in English and compared to the research objectives to ensure correspondence. Subsequently English-French-Arabic (and vice versa) translators translated the questionnaire and interview

guide. For credibility, the translators were chosen from a university language department (where English or French and or Arabic are thelanguages taught).

4.5.2 Data Gathering and Analysis Process

Once the quality, reliability, and validity of the interview guide were confirmed, interviews were conducted with 50 participants to collect qualitative data. The interviews were conducted over a period of 6 months and were conducted by research assistants, using the interview guide. Through faculty officers, the students of identified classes in identified faculties were selected during the first few minutes of their classes and the interview was conducted facetoface by the research assistants. While interviewing the participants, the research assistants listened and took notes from the research participants. They also recorded the conversions.

The data were analysed, using interpretative analysis to identify various themes and cumulatively added on during the interview period, on a daily basis, The data collected were evaluated by assessing the semi-structured interview guide items. To satisfy this research's criteria that developed an initial model, generated a questionnaire that was used to collect data and in line with the research's philosophy of pragmatism, triangulation (as recommended by Hafeez-Baig; Gururajan and Subrata, 2016; Golafshani, 2003; Patton, 2001; Barbour, 1998; Healy and Crotty, 2000; Hipps, 1993), was applied by the researcher on the qualitative research instrument and data to measure reliability through Cronbach's α measure (item by item through model component).

The sampling adequacy of analysis was checked using the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test of sphericity. Thereafter a confirmatory factor analysis was conducted and descriptive statistics (average mean and standard deviation) of each construct calculated. The expanded TAM model was subsequently developed and the questionnaire, designed to collect quantitative data to test the model, was implemented.

Quantitative data collected from the questionnaire were also analysed using descriptive statistics such as frequency tables and means to understand demographic information. Reliability of the questionnaire instrument was measured through Cronbach's α (item by item through model component). The sampling adequacy of analysis was assessed using the

Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test of sphericity. Thereafter a confirmatory factor analysis was conducted and descriptive statistics (average mean and standard deviation) of each construct calculated. Further analysis was conducted by screening collected data for missing data, normality, linearity, outliers,and multi-collinearty.

Confirmatory factor analysis of the expanded model variables was then undertaken to examine the model for unidimensionality, through which , the researcher ensured that the measured variables were loading into one underlying variable. Additionally, model goodness-of-fit was measured using observed responses, expected responses and residuals from frequencies, significance (probability value) of chi-square (x^2) and P values from Test Statistics. Furthermore, multiple regression analysis was undertaken to examine the expanded model and research hypothesis.

Finally a panel of six experts (with expert knowledge in information systems, human computer interaction, and technology acceptance) examined the developed expanded model qualitatively. At the onset of examination, the developed expanded model was initially opened up to undergo a number of phases of examination. However, after three rounds of individual expert examinations and clarifications by the researcher (as questioned by the individual experts), a conclusion was reached on the acceptability of the model. These six experts (with highest qualifications of PhDs and a number of publications in information systems/computing) were drawn from three different universities. They were involved in teaching and managerial activities in the universities and hence had good understanding of how e-learning systems operated in universities.

4.6 Reliability and Validity

According to Cramer and Howitt (2004), "Construct validity is the extent to which a measure assesses the construct that it is intended to measure". According to Kripanont (2007) and Hair et al. (2010), it "can be assessed by using convergent validity (extent to which a measure is related to other measures, which have been designed to assess the same construct by the use of average variance extracted - AVE) and discriminate validity (extent to which a variable is very distinctive from other variables)".

According to Kripanont (2007), “reliability is a measure that indicates the extent to which a measure is without bias (error free) and hence offers consistent measurement across time and across the various items in measurement instrument”. In order words, “it is the extent to which research findings would be the same if the research were to be repeated at a later date, or with a different sample of subjects” (Ticehurst and Veal, 2000). Sekaran (2003) believes “it assesses goodness of measure and indicates accuracy in measurement”.

4.6.1 Reliability

The reliability of the qualitative and the quantitative data gathering instruments were ensured. In this research, notes were taken during interviews to ensure that the information being conveyed by the interviewee was captured, as much as possible, in its completeness. To support this and to capture information that could have been omitted, an audio recording was also undertaken. The daily interpretative analysis was applied to analyse data collected. Using this method minor matters that might slip from memory was handled while interview information was still very recent and easy to remember.

To ensure that respondents were unbiased in their answers to the questionnaire, additional questions testing the same theme were asked. Questions were repeated in different formats in different parts of the instrument to guarantee that the research participants understood the questions. To ensure that survey responses were complete, the responses were crosschecked (right after receiving the questionnaire responses) with respondents to ensure completeness of responses. Survey responses which were found to be incomplete or to be answered inappropriately were deemed biased and hence eliminated before analysis of data. In the data analysis, Cronbach’s alpha and factor analysis were performed to remove inconsistencies.

4.6.2 Validity

Every effort was made to ensure the validity of both the qualitative and the quantitative data gathering. An extensive literature review had been undertaken to define and clarify the questions and scales used in this research. The items and scales designed for this research were adopted from previous studies (Peker, 2010; Al-Aulamie, 2013; Fathema, 2013). By the adoption, it’s believed that content validity was achieved. As part of the validation process, the pilot study was designed to test the validity of the interview guide and questionnaire (data collection tools); thereafter these tools were refined before usage.

4.7 Research Instruments

Research instrument is a generic term used by researchers for measurement of tools. For this research, the measurement tools used in collecting data were semi-structured interviews and questionnaires. The interview guide and questionnaires for this survey were developed, based on the constructs and variables identified from the technology acceptance theories and models discussed in the previous chapter. The four constructs and the thirteen variables identified in Chapter 3 were further classified into forty three) items, which translated into forty four questions in the questionnaire and fourteen questions on the interview guide. The questions were grouped topically. Copies of the interview guide and questionnaire are in appendices A and B respectively. The questionnaire has both open and closed ended questions. The 43 specific items that were formulated from the 4 constructs and 13 variables included the following in Table 4.3:

Table 4.3: Identified 43 items from Literature

Item Code	Item
IQ1	Output completeness
IQ2	Output conciseness
IQ3	Output currency
IQ4	Output usability
IQ5	Output accuracy
IQ6	Output relevance
IQ7	Output timeliness
IQ8	Output understandability
SQ1	System Reliability
SQ2	System flexibility
SQ3	Ease of use
SQ4	Learnability
SQ5	Response Time
SQ6	System Complexity
SvQ1	Responsiveness
SvQ1	Staff Empathy
SvQ1	Accuracy
SvQ1	Reliability
SvQ1	Technical Competency
PU1	Performance
PU2	Productivity

PU3	Usefulness
PEOU1	Required Mental Effort
PEOU1	Ability to do what I want
S1	Satisfaction with functions and content
S2	Use system often
S3	Use system in the future
EA1	Overall system use
EA2	System used in last one month
EA3	System used in last one week
V1	Voluntary use
V2	Mandatory Use by Lecturers
V3	Mandatory Use by University
Ep1	Used e-learning before
Ep1	Trained on e-learning use
Ev1	Acceptance from Course Mates
Ev2	Compliance to Acceptance
Ev3	Students / User Centred
LF1	Lecturers as Facilitators
SN1	what People think
SN2	Influence by Important people
SN3	Influence by Peers
SN4	Influence by Lecturers

4.8 Limitation

The study put measures in place to ensure that the data provided by the study participants are valid. Among the measures in place was asking the same question (in different sections of the research instruments) in order to compare the consistency of respondents' answers. Furthermore the study data were analyzed and p values evaluated to see if less than 0.0001 (for validity). Notwithstanding this, it is possible that some respondents might give false information. This study therefore assumes that the study participants gave accurate information that reflect their perceptions and experiences with e-learning and shared those feelings sincerely.

In order to satisfy the exploratory nature of this study, since there is no known TAM model in Sub-Saharan African context and also considering that the subject characteristics regarding e-learning is unknown; the study employed interviews to collect initial data to develop the expanded TAM model for the Sub-Saharan African context. Using the rule of thumb for

saturation, data were collected from 50 study subjects. Cronbach's alpha analysis was carried out to find variables that correlated to measure specific constructs. Despite the fact that it is recommended that Cronbach's alpha analysis be done on data from a minimum of 100 to 200 participants, this study performed the analysis on responses from 50 study participants. This was a limitation, because conducting more than 50 interviews in five African countries in five regions was not feasible and hence the use of 50 study subjects.

4.9 Delimitation

Data were collected from five regions of Sub-Saharan Africa: Southern, Northern, Western, Eastern, and Central. For each region, data were collected from only one country. The country from which data were collected was based on their having a large e-learning market share in Africa and in the said region. For each chosen country, data were gathered from students in only one public university. This study preferred a mixed method (consisting of both qualitative and quantitative approaches) to a purely qualitative or purely quantitative approach, so as to have rich data at each stage of the study: qualitative data at the beginning to base the development of an expanded TAM on and later quantitative data to test the accuracy of the model. The study used semi-structured interviews to obtain rich and deep qualitative data. The study subsequently used questionnaires to obtain quantitative data to test the expanded model.

4.10 Assumptions

The study assumed that cultures and environments from South Africa (from Southern African), Nigeria (from West Africa), Democratic Republic of Congo (from Central Africa), Sudan (from Northern Africa) and Kenya (from East Africa) are sufficiently representative of the Sub-Saharan Africa, since they are the highest e-learning markets in the various regions of Sub-Saharan Africa. The per capita per country in Sub-Saharan Africa did not necessarily translate proportionately into the number of mobile ownership and internet penetration rates per country and hence the choice of e-learning market share as an indicative index of consumption of technology across the said Sub-Saharan African countries above to determine the numbers from each region. Considering that Africa has three thousand diverse ethnic groups with two thousand languages in fifty five countries and is home to the most genetically varied people in the world, it is assumed that the African culture is different from USA culture (where TAM originated).

4.11 Research Ethics

Research ethics items considered in this research related to literature materials, ethical clearance, participants' willingness to participate in the research and language of the research instrument.

All literature materials that were used in the research are referenced to give credit to the original owners of the literature material. In instances where the researcher used the direct words in literature materials, they were put within quotation marks as such. To ensure that ethical considerations were considered in formulating the research proposal and research instruments, these were subjected to peer review and were also subjected to the researcher's own university ethics committee for consideration and approval. Upon approval, a letter was issued to confirm approval. Further permission was obtained from respondents' institutions to collect data and upon approval, the researcher confirmed receipt of respondents' consent (a letter of information and a letter of consent) before collecting data from the respondents. To ensure that the respondents understood the letters of information and consent, they were written in English and translated into French and Arabic. For the pilot study, the interview and questionnaires were administered to 5 and 10 participants respectively using the official spoken language in each of the countries used for the study. These participants did not form part of the main study. All the respondents who took part in the research did so of their own will, without coercion from the researcher, research assistants, or respondents' peers. They were all free to express themselves and give their opinions without fear. They were also aware of their right to withdraw from the research at any time of the data collection (in case they were no longer willing to continue participating) without any consequences.

To ensure the anonymity of the respondents, no identification of the respondents was required. For the qualitative data collection, respondents were notified of the presence of a mobile phone audio recording and were assured of the security of the recording within the period for which it was being used for research and stored after the research.

4.12 Summary

This chapter discussed the methodology applied in this research. Issues discussed in this chapter include research philosophy, research approach, qualitative research design,

quantitative research design, research strategy, research questions and objectives, population, sampling, data analysis and results, pilot study, reliability, validity and research instruments. The chapter also discussed the study limitations, delimitation, assumptions, and research ethics. The researcher formulated the research hypotheses and model in the next chapter.

CHAPTER FIVE
PRESENTATION OF RESULTS

5.1 Introduction

This chapter presents the research resultswhich are presented in threefold. Firstly, the existing TAM from the literature is discussed in section 5.2. Secondly, results from the qualitative data analysis are presented in sections 5.3, 5.4 and 5.5. The outcome of this was used to structure an expanded technological acceptance model more appropriate to the Sub-Saharan African setting. Finally, the quantitative data, that was subsequently gathered to evaluate the expanded model, were analysed, and are presented in section 5.6.

5.2 Existing TAM Model

The TAM model is summarized in Figure 5.1:

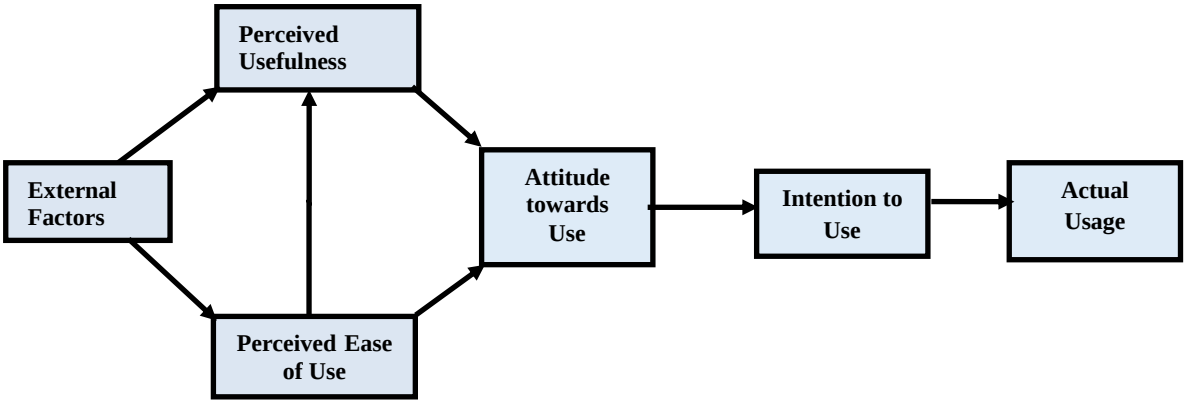


Figure 5.1: Technological Acceptance Model (Davis, 1986)

As developed by Davis (1986) in his PhD thesis, TAM has two main constructs (Perceived Usefulness (PU) and Perceived Ease of Use (PEOU)) that affect an individual's belief on using Information Technology (Davis, 1986). Apart from these two constructs, the model has three other constructs: "Attitude towards Use (ATU), Intention to Use (IU) and Actual Usage (AU)". PU and PEOU affect ATU and ATU affects IU and this in turn affects AU. Comparing the influence of PU and PEOU on IU, PU had a stronger influence on IU than PEOU had (Davis, 1989). Further, external factors influenced PU and PEOU (Davis, et al., 1989). Although there have been many studies conducted to identify factors that influence specific constructs such as PU, these are grouped under External Factors. The constructs and variables identified in the literature which could be relevant are listed in Table 5.1. These constructs and variables formed the basis for collecting data during the face-to- face interviews.

5.3 Analysis of the Qualitative Data

Table 5.1 presents a summary of the statistics for the qualitative data, gathered by this study during face-to-face interviews, in seven columns. The first and second columns show the proposed constructs and corresponding variables used to measure each of the constructs, respectively. The number (N) of learners from whom data were gathered and the Cronbach's α value of the constructs are represented in the third and fourth columns respectively. The fifth, six and seventh columns show the Eigen value and explained variance (EV), KMO and Bartlett's test, factor loadings and mean and standard deviations values respectively.

Table 5.1: Constructs, Cronbach A, KMO, Factor Loading, Mean and Average Values

Construct	Variable	N	Chron Alpha	Eigen Value, Explained Variance	KMO, Bartletts test	Factor Loading	Average Mean, SD
Perceived Usefulness PU **(Existing TAM Construct)**	Ease of Use	50	0.77	4.3, 30 2.9 20	0.717 P < 0.0001	0.8	1.87 0.78
	Usefulness					0.45	
	Frequency of Use					0.75	
	Information Quality					0.82	
	Culture					0.54	
	Satisfaction					0.49	
Perceived Ease of Use PEOU **(Existing TAM Construct)**	Experience	50	0.82	2.8, 18, 2.7 19	0.72 P < 0.0001	0.9	2.58 1.26
	Student or user centeredness					0.73	
	Training					0.88	
	System Quality					0.67	
Perceived Benefit PB **(Proposed Construct for expanded TAM)**	Voluntary Use	50	0.75	1.3 10 2.4 17	0.73 P < 0.0001	0.7	1.94 0.79
	Influence (Peers)					0.83	
	Influence (Important Persons)					0.67	
	Satisfaction					0.6	
Perceived Performance PP **(Proposed Construct for expanded TAM)**	Service Quality	50	0.7	1.2 8 1.4 10	0.7 P < 0.0001	0.8	2.04 0.88
	Influence (Important Persons)					0.7	
	Culture					0.6	

(Source: Field Data, 2018)

Data in Table 5.1 enabled verification of the correlations between the constructs in the existing and proposed extended model. The data were generated from the Cronbach's α measure of variables that formed the interview guide. The results presented in Table 5.1 were used as input to generate Figure 5.2 and are discussed further below.

In Figure 5.2 the associations between the constructs and their associated variables are shown. Figure 5.2 was generated by employing the partial least squares structural equation modeling (PLS-SEM) approach, using Smart-PLS 3.0. PLS-SEM that enabled the research to test all the relationships between the independent and dependent variables completely and simultaneously (Hair et al., 2012; Ullman, 2006). As a second generation multivariate data analysis, the PLS-SEM is used to advance the theoretical foundations in exploratory research (Hair et al., 2012). In addition to performing multivariate measurements, PLS-SEM also assess a model that uses single-item constructs (Peña-Vinces, and Urbano, 2014; Temme, Diamantopoulos, & Pfegfeidel, 2014), such as the one in this research, which has four independent variables, namely, PU, PEOU, PP and PB.

To establish the theoretical underpinning, the PLS-SEM analysis in this research was undertaken by evaluating the reliability and validity of the measurement model through computation of the Cronbach's α values of the constructs, the Eigen values and explained variance, KMO, and Bartlett's test and factor loadings. Thereafter, the mean and standard deviation values were computed, and the summary of the direct, indirect,and total effects for the association between variables and constructs made. Figure 5.2 demonstrates the relationships between the constructs and associated variables, depicted by arrows.
Out of the 13 variables in the interview guide, six connected proximately with a Cronbach's alpha (α) value of 0.77, to measure the PU construct (a construct in the existing) as in Table 5.1 and Figure 5.2. In relation to this construct, some of the respondents responded that, "my university e-learning system is reliable, flexible, easy to use, learnable, responds in time and not complex to navigate". Some of the respondents went further to state that, "I am satisfied with my university – e-learning system".

Of the 13 variables, four variables connected proximately with a Cronbach's alpha (α) value of 0.82 to measure the PEOU construct (Table 5.1 and Figure 5.2). The six variables correlated to measure the PU construct (a construct of the existing TAM) and four variables correlated to measure the PEOU construct (a construct of the existing TAM), indicating that

PU and PEOU influence IU and hence support the existing TAM. In relation to the PEOU construct, one of the respondents indicated that, "I use my university e-learning system with minimal mental effort".

This further confirmed the applicability of the two principal constructs (PU and PEOU) in the existing TAM to the proposed extended TAM: thus PU and PEOU influence (Behavior Intention) BI. Figure 5.2 demonstrates how the said variables above measures PU and PEOU. The two way arrows PB and *satisfaction* and vice versa indicate that PB and satisfaction influence each that as analysed from the qualitative data.

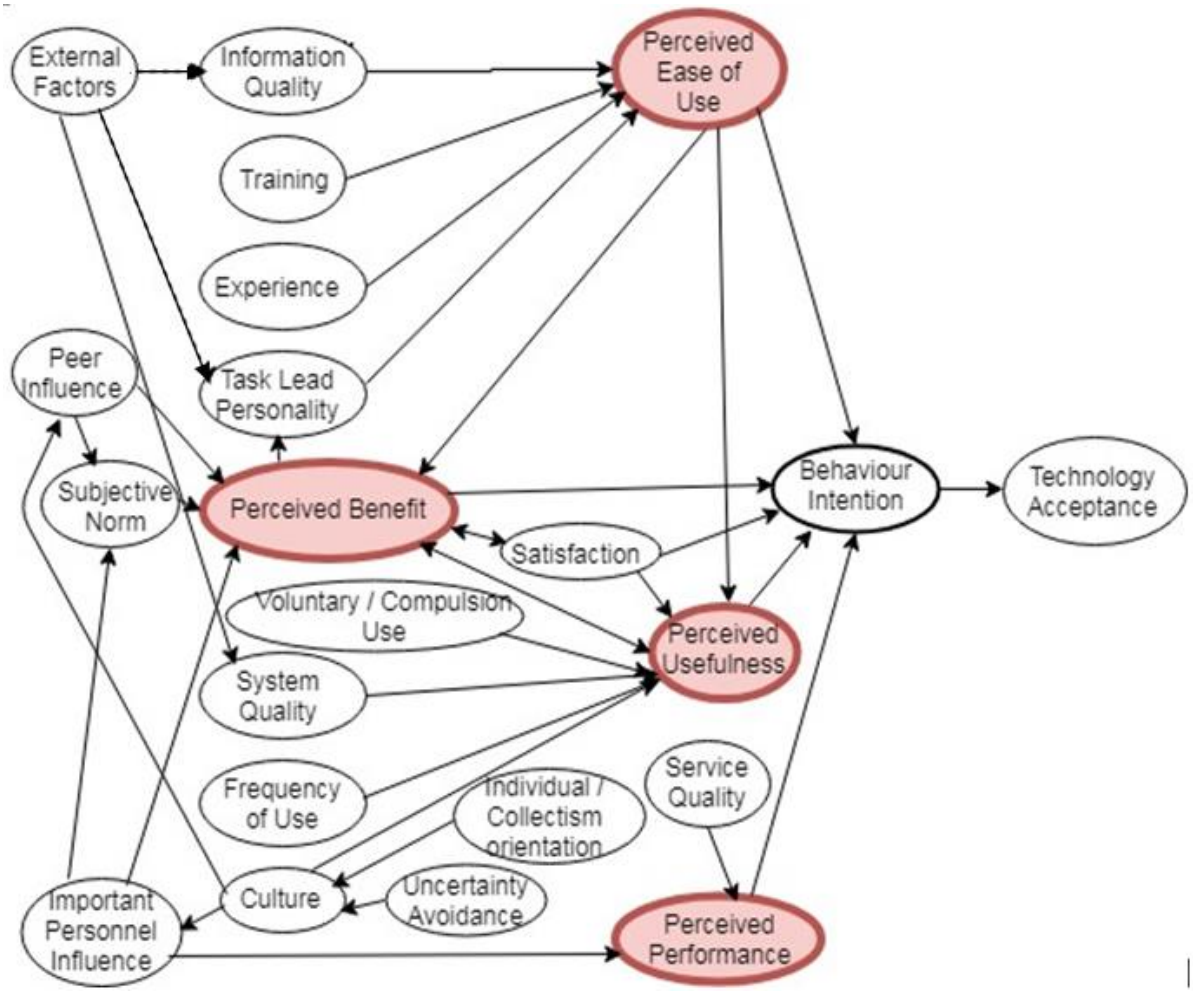


Figure 5.2: Relationships between constructs and their associated variables

With a Cronbach's alpha (α) value of 0.75 as in Table 5.1 and Figure 5.2, four variables further correlated to measure the PB construct (a new proposed construct). Furthermore, three variables correlated with a Cronbach's alpha (α) value of 0.70 to measure the PP construct (a new proposed construct). Comparatively, the existing TAM model does not have the

constructs, Perceived Benefit (PB) and Perceived Performance (PP). PB has two variables strongly influenced by the Sub-Saharan African culture, *influence (peers)* and *influence (important persons)*, while PP has the variable *culture*, which would directly measure the Sub-Saharan African influence, hence the existing model should be extended by the constructs PB and PP for the Sub-Saharan African environment. Although this may not be unique to the Sub-Saharan African environment and may also apply in other environments, the lack of these constructs in the Sub-Saharan African environment could impact negatively on the results when measuring technology acceptance. PB has two variables strongly influenced by the Sub-Saharan African culture, *influence (peers)* and *influence (important persons)*, while PP has the variable *culture*, which would measure directly the Sub-Saharan African influence; hence the existing model should be extended by the constructs PB and PP for the Sub-Saharan African context. The above is supported by responses from of the respondents who indicated that, "the *culture of use* of technology (e-learning in this case) in my school, *peer influence* and *important persons influence*, influence me to use existing e-learning system in my school".

The above resonates with the response of some of the respondents to the interview question on whether they are influenced to use their university e-learning systems. They responded, "My lecturers and colleagues mentioned to me about notes and video tutorials that clarifies further on topics that I was finding it difficult to understand and hence I went to look for them on my university e-learning system". In reaction to the interview question of acceptability for using their university e-learning system, some of the research participants shared that, "I use my university e-learning system because, in peer discussions after or before lessons, my peers relate discussions to items on e-learning system and they reject my views as they indicate that my views aren't from the items on my e-learning system. Until I started relating the peer discussions to the e-learning system items, my colleagues in the past would not want me to sit amongst them to discuss lessons after or before class"

With the maximum average mean of 2.58 and a standard deviation score of 1.26 as shown in Table 5.1, PEOU was rated as the construct with the most influence. Since the variables associated with PEOU in an e-learning system were *experience on use prior to using it*, *training on use*, *system quality*, and *students/user centeredness*, this result indicates that these four variables in an e-learning system enhance intention to accept and use an e-learning system.

The interview questions for the PB construct were reverse-phrased, and therefore the result must be interpreted with this in mind. With an average mean of 1.94 and standard deviation of 0.79, the construct PB rated lower than the PP construct. Since the variables associated with PP were *influenced by peers and important persons* (referred to as subjective norm in literature), *voluntary use* and *satisfaction*, this result indicates that these variables account for students' intention to accept and use e-learning in Sub-Saharan Africa.

PU was rated the lowest with an average mean of 1.87 and a standard deviation score of 0.78. Since the variables associated with PU included *frequency of use*, *information quality*, and *culture*, these results support the use of these variables to measure technology acceptance in Sub-Saharan Africa.

The construct PP was rated as the construct with the second highest influence, with an average mean score of 2.04 and a standard deviation score of 0.88. This indicates that within the Sub-Saharan African settings, *culture, system quality,* and *influence by important persons* enhances intention to accept and use technology.

Ease of use, frequency of use, and *usefulness* are variables that enhanced acceptance and use of e-learning systems. The construct PU from which they emanate, was rated with an average mean of 1.87 and standard deviation of 0.78, as in Table 5.1. The extended TAM model in the Sub-Saharan African context, developed based on the qualitative results, is shown in Fig 5.3.

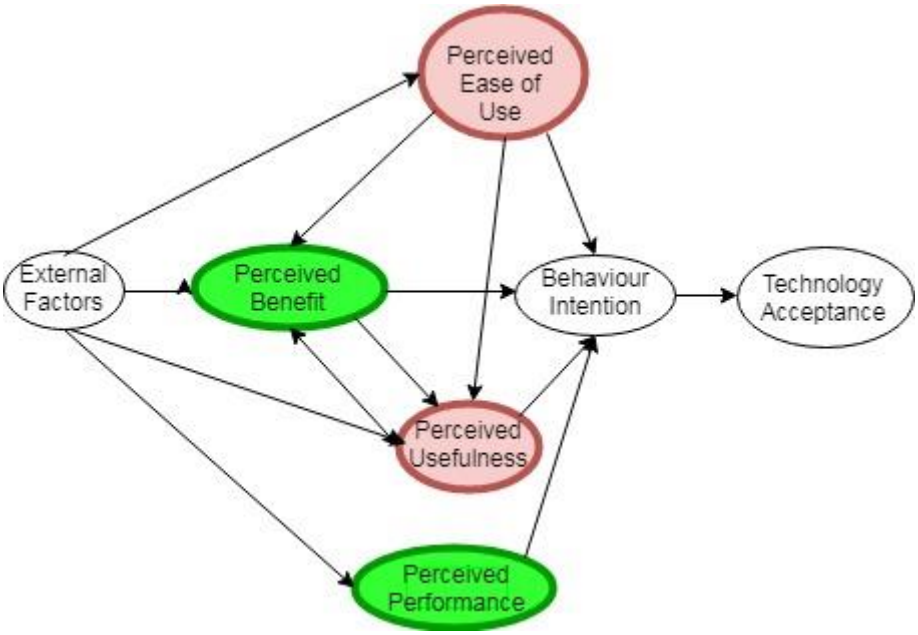


Figure 5.3: Extended Technological Acceptance Model in the Sub-Saharan African context

5.4 Discussion of analysed Qualitative Data

The 13 variables identified in literature to model the extended technology acceptance model, were confirmed to correlate with each other in four different groups to form four constructs and hence the 13 variables in Table 5.1 were used to produce Figure 5.2. A critical observation of the four groups of the 13 variables confirmed four constructs: Perceived Performance (PP), Perceived Ease of Use (PEOU), Perceived Benefits (PB) and Perceived Usefulness (PU) as influencing BI: thus confirming the two main constructs (PU and PEOU) in the existing TAM and to the relevance of the two new constructs (PB and PP). The results further confirmed that the four constructs (PU, PEOU, PB, and PP) influence BI directly: thus confirming that when considering TAM in the Sub-Saharan African context, the existing TAM should be extended by two additional factors (PB and PP).

Though results of the analyzed qualitative data confirmed Davis's findings that PEOU influenced PU, it also contradicted Davis's, 1985 (as cited in Davis and Venkatesh, 2004) finding that PU influences IU more than PEOU does. Further analysis was therefore necessary to confirm the consistency and contradiction between the existing model (Davis and Venkatesh, 2004) and the expanded TAM. In furtherance of this and the fact that the qualitative data aimed at unravelling constructs that influenced BI towards Technology Acceptance (TA), hypotheses were generated to be tested (section 5.5). Further data

(quantitative) was collected, and analysed, and the hypotheses tested to verify the influence of the generated constructs on BI (section 5.6).

5.5 Research Hypothesis Formulation

Using the qualitative data analyses outcomes, 13 hypotheses were postulated. These are:

1. H1a: External Factors (EF) influence Perceived Ease of Use of Technology (PEOU)
2. H1b: External Factors influence Perceived Benefit of using Technology (PB)
3. H1c: External Factors (EF) influence Perceived Usefulness of Technology (PU)
4. H1d: External Factors (EF) influence Perceived Performance of Technology (PP)
5. H2a: Perceived Ease of Use (PEOU) of Technology influences Perceived Benefit (PB) of using technology
6. H2b: Perceived Ease of Use (PEOU) of Technology influences Perceived Usefulness (PU) to use Technology
7. H2c: Perceived Ease of Use (PEOU) of Technology influences Behavioural Intention (BI) to use technology
8. H3a: Perceived Benefit (PB) of using Technology influences Behavioural Intention (BI) to use Technology
9. H3b: Perceived Benefit (PB) of using Technology influences Perceived Usefulness (PU) of Technology
10. H4a: Perceived Usefulness (PU) of using Technology influences Perceived Benefit (PB) of using Technology
11. H4b: Perceived Usefulness (PU) of Technology influences Behavioural Intention (BI) to use Technology
12. H5: Perceived Performance (PP) of Technology influences Behavioural Intention (BI) to use Technology
13. H6: Behaviour Intention (BI) to use Technology influence Technology Acceptance (TA)

Reference to the hypotheses above, the developed expanded model associations were organized as in Fig 5.4.

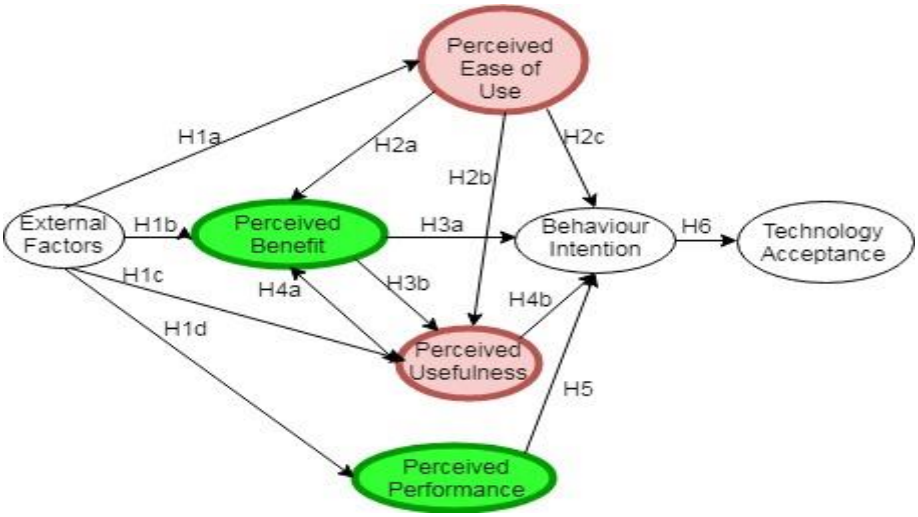


Figure 5.4: Relationship in the developed expanded TAM model

5.6 Analysis of Quantitative Data

In this section, demographic information, missing data, e-learning system frequency of use, reliability analysis, factor analysis, correlation analysis, and regression analysis are discussed respectively.

5.6.1 Demographic information

Outcomes of the demographic information analysis from the quantitative data are presented in Table 5.2.

Table 5.2: Demographic Information

DEMOGRAPHIC INFORMATION											
Age		**Gender**			**Year of Study**		**University**		**Country**		**African Region**	
Age	%	Male	Female	Not answered	Year of Study	%	University	%	Country	%	Region	%
16 - 17	3.2	55.5	44.2	0.3	Year1	25	Durban University of Technology	30	South Africa	30	Southern Africa	30
18 - 25	71.4				Year2	20.1	Federal University of Agriculture	25	Nigeria	25	West Africa	25
26 - 35	21.1				Year3	20.8	University of Kenyatta	20	Kenya	20	East Africa	20
36 - 59	3.2				Year4	24	University of Evangelica Africa	13	DR Congo	13	Central Africa	13
60 and Above	0.3				Postgraduate	8.4	SUDAFAST	10	Sudan	10	Northern Africa	10
Not Answered	0.6				Unanswered	1.6	Unanswered	2	N/A	2	N/A	2
Total	100				Total	100	Total	100	Total	100	Total	100

(Source: Field Data, 2018)

Table 5.2 indicates respondents' profiles, age, gender, year of study, region, country, and university of study. As in Table 5.2, research participants aged 18 to 25, formed the core group in this research, as 71.4% of them responded to the research questionnaires. Ages 26 to 35 comprised 21.1% while 3.2% of respondents were from ages 36 to 59 and 16 to 17 each, 0.6% of the respondents did not respond to these questions.

Respondents between ages 18 to 35 (born from 1980 to 2000) in this research, are referred as generation Y (Millennials), which consists of people who prefer to be focussed on Information and Communication Technology (ICT) 24 hours a day and would rather communicate via emails and text than give face-to-face inerviews (Dewanti and Indrajit, 2018). 71.4% of the respondents in this age category, 18-25 years, formed the core group in this research. Based on the characteristics of generation Z (born from 2001 to 2018) as described by Dewanti and Indrajit (2018), it would have been the best category of persons to use for this study, but considering that they are minors (below 18 years) and therefore very few are at tertiary level of education, they formed a very small part of this study.

In terms of gender, outcomes presented in Table 5.2 point out that the research sample is slightly skewed as 55.5% of the research participants were male, 44.2% were female and 0.3% unknown, as the participants did not indicate their gender. The skewed result towards male participants may be because the sampled universities and programmes are more male dominated. The male dominated sample for this research may influence results as previous studies have indicated that males adopt technology more readily than females do (Goswami and Dutta, 2016).

From Table 5.2, 89.9% (25%, 20.1%, 20.8%, and 24% from first, second, third and fourth year respectively) are undergraduate students, 8.4% are postgraduate students and 1.6% respondents failed to indicate the level of their studies. The respondents' level of study is skewed towards undergraduate studies, because the population of most universities is skewed towards undergraduate students. Most of generation Y and a few generation Z participants in this research fell in this category and since they are those who use and interact with computers and internet actively and more often than they will usually do face-to-face, their dominance in the research respondents validates the research results.

In terms of the Sub-Saharan African regions (southern, western, eastern, central and northern), countries (South Africa, Nigeria, Kenya, Democratic Republic of Congo and Sudan) and universities (Durban University of Technology, Federal University of Agriculture, University of Kenyatta, Universite Evangelique en Afrique, and Sudan academy for Aviation Sciences and Technology), 30%, 25%, 20%, 13% and 10% of respondents were from the said regions, countries, and universities respectively. The numbers were determined using the rate of e-learning consumption in the said regions, countries, and universities.

5.6.2 Missing Data

During data gathering, a few respondents neglected some questions. A number of reasons could have accounted for this. These include sensitivity, lack of information, tiredness, or stress. The neglect of a question is termed as missing data. Missing data can lead to inaccurate outcomes, and as a result, there are ways of handling it to avoid inaccurate results. Among these, as discussed by Pampaka, Hutcheson, and Williams (2016), is the list wise method (discarding any record missing from the variable under consideration), pairwise deletion for bivariate correlations (statistics calculated based on existing pairwise data), mean substitution (mean value is substituted for the missing variable).

For this research 1950 items (39 by 50) from the 20020 (64 questions by 308 participants) items were missing. The missing data formed 9.7% of the items in the research questionnaire. According to Sekaran (2003), the recommended percentage of any missing data should be between 5% and 10%. Since the missing data (9.7%) for this research fell within the accepted range of missing data, no corrective measure was taken, as the effect of the missing data on the analysed result was considered to be insignificant. A comprehensive depiction of the data sample and descriptive information is illustrated in Table 5.3. The frequency column summarises the total number of cases.

Table 5.3: Missing Data

Item	N	Mean	Std. Deviation
Frequency in e-learning Usage	302	2.74	1.285
e-learning System Reliability	308	2.37	1.169
e-learning System Flexibility	308	2.48	1.054
e-learning System Easy to Use	308	2.28	1.138
e-learning System Easy to Learn	308	2.28	1.115
e-learning System is Fast	308	2.52	1.182
e-learning System Easy to Navigate Through	308	2.48	1.105
e-learning Information Completeness	307	2.42	1.203
e-learning Information Conciseness	307	2.39	1.131

e-learning Information Currentness or Recency	305	2.35	1.177
e-learning Information Usage Comfortability	306	2.25	1.199
e-learning Error Messages Clear and Suggest Fix	306	2.93	1.207
e-learning Usage - Easy recovering from Mistakes	307	2.61	1.217
e-learning System Interface Pleasant	307	2.50	1.139
e-learning Language items Easy to Understand	307	2.15	1.142
e-learning Systems Possess Expected Functionalities	307	2.53	1.106
e-learning Information Accurateness	307	2.38	1.118
e-learning Information Relevance	306	2.26	1.103
e-learning Information Timeliness	307	2.45	1.138
e-learning Information Generally Understandable	307	2.26	1.105
e-learning Support Staff responds on Time to Queries	307	2.55	1.286
e-learning Support Staff have empathy	306	2.50	1.146
e-learning Support Staff are reliable	306	2.36	1.096
e-learning Support Staff provide Accurate Solution	307	2.35	1.148
e-learning Support Staff are Technically Competent	306	2.31	1.168
e-learning Usage Guidelines Available	306	2.42	1.191
e-learning Support Personnel, Staf,f or Team always available to attend to Difficulties	306	2.47	1.174
e-learning System Usage Improves Performance	307	2.33	1.151
e-learning System Usage Improves Productivity	306	2.32	1.169
e-learning System Useful to my Studies	303	2.28	1.164
e-learning Usage require very little effort	306	2.41	1.157
e-learning Usage is easy	307	2.29	1.174
Satisfaction with e-learning Functionalities	307	2.42	1.173
Intention to use e-learning Functionalities often	307	2.20	1.145
Intention to use e-learning Functionalities in the Future	306	2.16	1.182
Satisfaction with e-learning Content	307	2.33	1.193
Intention to use e-learning Content often	307	2.21	1.130
Intention to use e-learning Content in the Future	307	2.12	1.131
e-learning System use is Voluntarily	307	2.39	1.259
Lecturers Require Students to Use E-learning System	306	2.30	1.197
e-learning System use is Not Compulsory	307	2.48	1.317
Used an e-learning System Earlier	307	3.21	1.528
Received Training on e-learning Usage	301	2.75	1.425
Using e-learning System promotes Course/Module Peer Acceptance	307	2.41	1.232
Peer Acceptance as a Course/Module member more Important than Individual Independence	305	2.36	1.319
Students or User Centeredness on e-learning System	306	2.58	1.286
Lecturers only facilitate Teaching and Process on e-learning System	305	2.50	1.233
People who Influence me think I should use e-learning	307	2.58	1.214
People who are Important to me think that I should use e-learning	306	2.41	1.128
Colleagues encourage me to use e-learning	308	2.50	1.188
Lecturers influence me to use e-learning	307	2.28	1.120
Use e-learning to a very high extent	308	2.63	1.188

Used e-learning to a very high extent in the Last One Month	308	2.74	1.309
Used e-learning to a very high extent in the Last One Week	308	2.75	1.303
Use e-learning because others use it	276	1.66	1.294
Uncertainty Avoidance Level High	308	2.04	1.209
Service Quality of e-learning	307	3.83	1.183
Interaction Requires Minimal efforts	308	2.13	1.030
Easy Navigating	302	2.15	.861
Easy Accessing	307	2.14	1.026
Influence B and BI	308	2.17	.869
Improves Performance	308	2.17	.869
Improves Productivity	308	2.17	1.058
Is Useful to my studies	308	2.17	.869
Improved Performance	308	1.96	.925
Improved Productivity	308	2.20	1.198
Was Useful to my studies	308	2.29	1.154
Reliable	308	3.69	1.180
Flexible	307	2.17	1.060
Flexible Fast	307	2.17	.870
Behavioural Intention influence by Perceived Performance	308	1.96	.925
Behavioural Intention influence by PEOU	308	2.19	1.200
Behavioral Intention influence PU	308	2.28	1.158
Behavioural Intention influence Technological Acceptance	308	2.19	1.200
External Factors influence Behaviour Intention	308	2.29	1.154
External Factors influence Perceived Performance	308	2.19	1.200
External Factors influence PEOU	308	2.29	1.154
External Factors influence PU	308	2.29	1.154
Valid N (list wise)	244		

(Source: Field Data, 2018)

$$Mean = \frac{\sum M}{N}$$

M = the variables
N = the number of variables

5.6.3 E-learning System Frequency of Use

Frequency of usage of e-learning systems from the outcomes of the analysed quantitative data is represented in Figure 5.5:

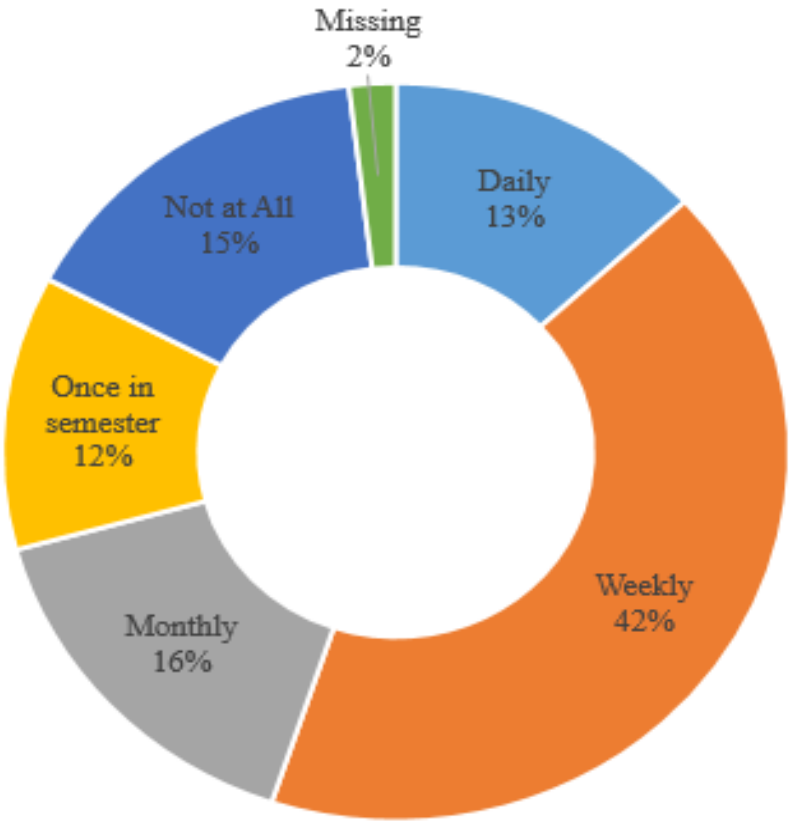


Figure 5.5: e-learning System Frequency of Use
(Source: Field Data, 2018)

From Figure 5.5, 42% of the research participants indicated that they use an e-learning system on a weekly basis, 16% said they use e-learning on a monthly basis, 13% said they use it daily, 12% said they use it once in a semester, 15% said not at all and 2% did not respond to this question. It is noticeable that 15% of the respondents don't use e-learning (despite its availability), 12% use it once in a semester and 16% use it once in a month: this could be as a result of late adoption of e-learning or the voluntary/compulsion factor of e-learning use. Notwithstanding this, it is encouraging to note from the results that majority of the students (42%) use e-learning on a weekly basis, especially when combined with the 13% using it on a daily basis, this brings regular use to 55%, which is more than half the participants.

5.6.4 Normality

Normality is defined as the extent to which a "distribution of a sample data corresponds to a normal distribution" (Hair et al., 2010). Normality of data is evaluated through Skewness and Kurtosis. While Tabachnick and Fidell (2007) define Skewness as the measure of symmetry of data distribution, Hair et al. (2010) define Kurtosis as the shape of the data distribution (i.e.

peaked or flattened, compared to the normal distribution). Hair et al. (2010) went further to indicate that, a large sample size (i.e. from 200) reduces the detrimental effect of non-normality.

Skewness is calculated by: $$\frac{n}{(n-1)(n-2)}\sum_{i=1}^{n}\left(\frac{x_i - \bar{x}}{s}\right)^3$$

x = observation number in the sample
$\bar{X}$ = average numbers in the sample
n = sample size
s = the sample standard deviation

Kurtosis is calculated by $$\frac{n-1}{(n-2)(n-3)}[(n+1)g_2 + 6]$$

n = sample size
$g_2 = \frac{m_4}{m_2^2}$
m_r = Sample moments

For this study, Skewness and kurtosis was computed using SPSS and the outcomes are shown in Table 5.4. All assessed variables were within the tolerable range of values (Skewness < 3) and (Kurtosis < 10) as Kline (2011) recommended.

Table 5.4: Skewness and Kurtosis Measure

Items	N	Skewness		Kurtosis	
	Statistic	Statistic	Std. Error	Statistic	Std. Error
Frequency in e-learning Usage	302	.562	.140	-.864	.280
e-learning System Reliability	308	.841	.139	-.115	.277
e-learning System Flexibility	308	.707	.139	.015	.277
e-learning System Easy to Use	308	.844	.139	-.084	.277
e-learning System Easy to Learn	308	.958	.139	.244	.277
e-learning System is Fast	308	.473	.139	-.669	.277
e-learning System Easy to Navigate Through	308	.713	.139	-.155	.277
e-learning Information Completeness	307	.578	.139	-.610	.277
e-learning Information Conciseness	307	.649	.139	-.144	.277
e-learning Information Currentness or Recency	305	.788	.140	-.233	.278
e-learning Information Usage Comfortability	306	1.022	.139	.234	.278
e-learning Error Messages Clear and Suggest Fix	306	.296	.139	-.917	.278

e-learning Usage - Easy recovering from Mistakes	307	.474	.139	-.714	.277
e-learning System Interface Pleasant	307	.592	.139	-.308	.277
e-learning Language items Easy to Understand	307	.962	.139	.134	.277
e-learning Systems Possess Expected Functionalities	307	.549	.139	-.374	.277
e-learning Information Accurateness	307	.675	.139	-.191	.277
e-learning Information Relevance	306	1.076	.139	.731	.278
e-learning Information Timeliness	307	.720	.139	-.191	.277
e-learning Information Generally Understandable	307	.926	.139	.254	.277
e-learning Support Staff responds on Time to Queries	307	.363	.139	-.998	.277
e-learning Support Staff have empathy	306	.526	.139	-.398	.278
e-learning Support Staff are reliable	306	.657	.139	-.190	.278
e-learning Support Staff provide Accurate Solution	307	.716	.139	-.238	.277
e-learning Support Staff are Technically Competent	306	.798	.139	-.112	.278
e-learning Usage Guidelines Available	306	.607	.139	-.504	.278
e-learning Support Personnel, Staff or Team always available to help with Difficulties	306	.593	.139	-.573	.278
e-learning System Usage Improves Performance	307	.710	.139	-.137	.277
e-learning System Usage Improves Productivity	306	.623	.139	-.373	.278
e-learning System Useful to my Studies	303	.731	.140	-.171	.279
e-learning Usage requires very little effort	306	.717	.139	-.255	.278
e-learning Usage is easy	307	.756	.139	-.191	.277
Satisfaction with e-learning Functionalities	307	.787	.139	-.225	.277
Intention to use e-learning Functionalities often	307	.832	.139	.006	.277
Intention to use e-learning Functionalities in the Future	306	1.060	.139	.359	.278
Satisfaction with e-learning Content	307	.802	.139	-.152	.277
Intention to use e-learning Content often	307	.978	.139	.340	.277
Intention to use e-learning Content in the Future	307	.997	.139	.368	.277
e-learning System use is Voluntarily	307	.682	.139	-.515	.277
Lecturers Require Students to Use e-learning System	306	.817	.139	-.126	.278
e-learning System use is Not Compulsory	307	.559	.139	-.859	.277
Used an e-learning System Earlier	307	-.156	.139	-1.487	.277
Received Training on e-learning Usage	301	.306	.140	-1.266	.280
Using e-learning System promotes Course/Module Peer Acceptance	307	.530	.139	-.633	.277

Peer Acceptance as a Course/Module member Important than Individual Independence	305	.718	.140	-.624	.278
Students or User Centeredness on e-learning System	306	.416	.139	-.822	.278
Lecturers only facilitate Teaching and Process on e-learning System	305	.415	.140	-.733	.278
People who Influence me think I should use e-learning	307	.478	.139	-.684	.277
People who are Important to me think that I should use e-learning	306	.766	.139	-.024	.278
Colleagues encourage me to use e-learning	308	.630	.139	-.422	.277
Lecturers influence me to use e-learning	307	.891	.139	.102	.277
Use e-learning to a very high extent	308	.413	.139	-.635	.277
Used e-learning to a very high extent in the Last One Month	308	.260	.139	-1.074	.277
Used e-learning to a very high extent in the Last One Week	308	.288	.139	-1.135	.277
Use e-learning because others use it	276	1.829	.147	1.784	.292
Uncertainty Avoidance Level High	308	1.289	.139	.674	.277
Service Quality of e-learning	307	-.437	.139	.810	.277
Interaction Requires Minimal efforts	308	1.118	.139	.840	.277
Easy Navigating	302	.991	.140	.821	.280
Easy Accessing	307	1.129	.139	.879	.277
Influence B and BI	308	.918	.139	.470	.277
Improves Performance	308	.918	.139	.470	.277
Improves Productivity	308	1.062	.139	.569	.277
Is Useful to my studies	308	.918	.139	.470	.277
Improved Performance	308	1.563	.139	2.758	.277
Improved Productivity	308	1.327	.139	.972	.277
Was Useful to my studies	308	1.345	.139	.999	.277
Reliable	308	-.934	.139	-.205	.277
Flexible	307	1.059	.139	.556	.277
Flexible Fast	307	.914	.139	.457	.277
Behavioural Intention influence by PP	308	1.563	.139	2.758	.277
Behaviorual Intention influence by PEOU	308	1.326	.139	.964	.277
Behavioraul Intention influence PU	308	1.337	.139	.979	.277
Behavioural Intention influence TA	308	1.326	.139	.964	.277
External Factors influence BI	308	1.345	.139	.999	.277
External Factors influence PP	308	1.326	.139	.964	.277
External Factors influence PEOU	308	1.345	.139	.999	.277
External Factors influence PU	308	1.345	.139	.999	.277
Valid N (list wise)	244				

5.6.5 Reliability Analysis

The research questionnaire was examined to ensure that all components of the study model as developed (in section 5.4: Figure 5.4), have been assessed for reliability, and for convergent and discriminate validity. To achieve this, Cronbach's Alpha was computed for internal consistency for each component: by this, it was ensured that items in the components were adequately interassociated. The need to apply Cronbach's Alpha here was necessitated as a result of the fact that several researchers (Jaber, 2016; Pallant, 2005; Sekaran, 2003; Davis et al., 1989; and Nunnally and Bird, 1975) previously used it for computing the steadiness and uniformity of a research instrument. Pallant (2005) and Nunnally and Bird (1975) go further to state that reliability approximations of 0.50 to 0.60 can be accepted as adequate for fundamental research. However Pallant (2005) and Davis et al. (1989), argue that an excellent reliability should yield a minimum coefficient value of 0.60, for it to be at a satisfactory level for a freshly developed scale or an application across fields of study. In this research, the Cronbach's Alpha (as a reliability analysis of all variables in the research instrument) was 0.679 as indicated in Table 5.5. This value indicates that the internal consistency between components was high and more than the recommended minimum value as above.

Table 5.5: Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.679	0.696	13

5.6.6 Factor Analysis

Three steps were followed to perform the factor analysis. Step 1 involved identifying the factors as shown in Table 5.1. To achieve this step, the 13 variables and four constructs established in the qualitative data analysis were adopted. Step 2 involved interpreting the factors - Since the 13 variables and four constructs were adopted from the results of the qualitative data analysis, the constructs were interpreted as in the qualitative data analysis. Step 3 involved selecting the final factor solution, as shown in Figures 5.2 and 5.3.

The suitability of the quantitative data for factor analysis was assessed using the Kaiser-Meyer-Oklin (KMO) value. The resulting KMO value (in Table 5.6) is 0.70, which, according to Norusis (1994), is reasonable as it is greater than 0.6. The Bartlett Test of

Sphericity for the analysed quantitative data is significant as the p is <0.001 and hence supports the factorability of the correlation matrix as shown in Table 5.6.

Table 5.6: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.70
Bartlett's Test of Sphericity	Approx. Chi-Square	872.310
	Df	15
	Sig.	.000

Table 5.7: Variables and Constructs Factor Loading

Construct	Variable	N	Chron Alpha	Eigen Value, Explained Variance	KMO, Bartletts test	Factor Loading	Average Mean, SD
Perceived Usefulness	Ease of Use	308	0.78	4.3, 2.9 30 20	0.718 P < 0.0001	0.8	1.88 0.79
	Usefulness					0.45	
	Frequency of Use					0.75	
	Information Quality					0.82	
	Culture					0.54	
	Satisfaction					0.49	
Perceived Ease of Use	Experience	308	0.84	2.8, 2.7 18, 19	0.74 P < 0.0001	0.9	2.59 1.27
	Student or user centeredness					0.73	
	Training					0.88	
	System Quality					0.67	
Perceived Benefit	Voluntary Use	308	0.77	1.3 2.4 10 17	0.72 P < 0.0001	0.7	1.95 0.78
	Influence (Peers)					0.83	
	Influence (Important Persons)					0.67	
	Satisfaction					0.6	
Perceived Performance	System Quality	308	0.72	1.2 1.4 8 10	0.71 P < 0.0001	0.8	2.06 0.89
	Influence (Important Persons)					0.7	
	Culture					0.6	

5.6.7 Correlation Analysis

Using correlation coefficient, a researcher can demonstrate the variables association: thus the trend and strength of the variables correlations. To achieve this, Pearson correlation and bivariate correlative relationships between External Factors (Ext. Fact), PEOU, PU, Perceived Benefit (PB), Perceived Performance (PP), and Behavioural Intention (BI) were undertaken. Table 5.8 shows the correlation analysis.

Table 5.8: Correlation Analysis

		External Factor	Perceived Ease of Use	Perceived Usefulness	Perceived Benefit	Perceived Performance	Behavioural Intention
External Factor	Pearson Correlation	1	.146*	.113*	.235**	.124*	.216**
	Sig. (2-tailed)		.010	.047	.000	.030	.000
	N	308	308	308	307	307	308
Perceived Ease of Use	Pearson Correlation	.146*	1	.932**	.190**	.100	.677**
	Sig. (2-tailed)	.010		.000	.001	.080	.000
	N	308	308	308	307	307	308
Perceived Usefulness	Pearson Correlation	.113*	.932**	1	.203**	.085	.692**
	Sig. (2-tailed)	.047	.000		.000	.137	.000
	N	308	308	308	307	307	308
Perceived Benefit	Pearson Correlation	.235**	.190**	.203**	1	.065	.256**
	Sig. (2-tailed)	.000	.001	.000		.254	.000
	N	307	307	307	307	307	307
Perceived Performance	Pearson Correlation	.124*	.100	.085	.065	1	.112*
	Sig. (2-tailed)	.030	.080	.137	.254		.049
	N	307	307	307	307	307	307
Behavioural Intention	Pearson Correlation	.216**	.677**	.692**	.256**	.112*	1
	Sig. (2-tailed)	.000	.000	.000	.000	.049	
	N	308	308	308	307	307	308
*. Correlation is significant at the 0.05 level (2-tailed).							
**. Correlation is significant at the 0.01 level (2-tailed).							

Table 5.8 outcomes show that BI correlates highly with all variables. Except for BI and Ext Fact, PP correlates negatively with the other variables. The outcomes in Table 5.8 confirm that BI to accept technology has a high (>0.05) correlation to Ext Fact(0.216), PEOU (0.677), PB (0.256) and PP (0.112). This is similar to the findings for western countries

(Fiske, 2018; Jaber, 2016; Akour et al., 2006; Hofstede, 1980) for three factors (Ext Fact, PEOU, and PU). Comparing the Table 5.8 correlation results with the findings of Fiske (2018), Hofstede (1984), Jaber (2016), Akour et al. (2006) and Hofstede (1980) indicate that the two new additional constructs, PB and PP, indeed influence BI to accept technology in the Sub-Saharan African context.

5.6.8 The Fit of the Developed Expanded TAM Model

The developed expanded model goodness of fit was measured using observed responses, expected responses, residuals from frequencies, significance (probability value) of chi-square (x^2), and P values from Test Statistics. Observed responses, expected responses, and residual values in frequencies, are presented in Table 5.9, and values for significance (probability value) of chi-square (x^2) and P values in the Test Statistics are represented in Table 5.10.

Table 5.9: Frequencies of Observed Response, Expected Response, and Residuals

External Factors influence Behaviour Intention			
	Observed N	**Expected N**	**Residual**
Strongly Agree	58	61.6	-3.6
Agree	184	154.0	30.0
Neutral	21	30.8	-9.8
Disagree	10	30.8	-20.8
Strongly Disagree	35	30.8	4.2
Total	308		
External Factors influence Perceived Performance			
	Observed N	**Expected N**	**Residual**
Strongly Agree	84	61.6	22.4
Agree	156	154.0	2.0
Neutral	29	30.8	-1.8
Disagree	2	30.8	-28.8
Strongly Disagree	37	30.8	6.2
Total	308		
External Factors influence Perceived Ease Of Use			
	Observed N	**Expected N**	**Residual**
Strongly Agree	58	61.6	-3.6
Agree	184	154.0	30.0
Neutral	21	30.8	-9.8
Disagree	10	30.8	-20.8
Strongly Disagree	35	30.8	4.2
Total	308		
External Factors influence Perceive Usefulness			
	Observed N	Expected N	Residual
Strongly Agree	58	61.6	-3.6
Agree	184	154.0	30.0
Neutral	21	30.8	-9.8
Disagree	10	30.8	-20.8
Strongly Disagree	35	30.8	4.2
Total	308		
Benefit Influence Behaviour Intention			
	Observed N	Expected N	Residual
Strongly Agree	58	61.6	-3.6

Agree	184	154.0	30.0
Neutral	21	30.8	-9.8
Disagree	10	30.8	-20.8
Strongly Disagree	35	30.8	4.2
Total	308		
Perceived Performance Influence Behavioural Intention			
	Observed N	Expected N	Residual
Strongly Agree	87	61.6	25.4
Agree	185	154.0	31.0
Neutral	6	30.8	-24.8
Disagree	20	30.8	-10.8
Strongly Disagree	10	30.8	-20.8
Total	308		
Perceive Ease of Use Influence Behavioural Intention			
	Observed N	Expected N	Residual
Strongly Agree	84	61.6	22.4
Agree	156	154.0	2.0
Neutral	29	30.8	-1.8
Disagree	2	30.8	-28.8
Strongly Disagree	37	30.8	6.2
Total	308		
Perceive Usefulness Behavioural Intention			
	Observed N	Expected N	Residual
Strongly Agree	60	61.6	-1.6
Agree	182	154.0	28.0
Neutral	21	30.8	-9.8
Disagree	10	30.8	-20.8
Strongly Disagree	35	30.8	4.2
Total	308		
Behavioural Intention influence Technological Acceptance			
	Observed N	Expected N	Residual
Strongly Agree	84	61.6	22.4
Agree	156	154.0	2.0
Neutral	29	30.8	-1.8
Disagree	2	30.8	-28.8
Strongly Disagree	37	30.8	6.2
Total	308		

Results of Table 5.10 indicate that there is an association between variables in each of the postulated hypothesis. The p-values (less than 0.01) in Table 5.10 indicate that the variables for each hypothesis are not independent of each other and that there is a statistically significant relationship between the variables for each hypothesis. As a result, the null hypothesis is rejected and the alternate hypothesis for each postulated hypothesis is accepted.

Table 5.10: Test Statistics (significance of chi-square and P values)

	External Factors influence Behaviour Intention	External Factors influence Perceived Performance	External Factors influence Perceive Ease Of Use	External Factors influence Perceive Usefulness	Benefit Influence Behavior Intention	Perceived Performance Influence Behavioral Intention	Perceive Ease of Use Influence Behavioral Intention	Perceive Usefulness Behavioral Intention	Behavioral Intention influence Technological Acceptance
Chi-Square	23.792[a]	36.455[a]	23.792[a]	23.792[a]	23.792[a]	54.516[a]	36.455[a]	22.870[a]	36.455[a]
Df	4	4	4	4	4	4	4	4	4
Asymp. Sig.	.000	.000	.000	.000	.000	.000	.000	.000	.000
a. 0 cells (.0%) have expected frequencies of less than 5. The minimum expected cell frequency is 30.8.									

5.6.9 Regression Analysis

Multiple regression analysis enables a researcher to investigate the relationships between single dependent variables and multiple independent variables. For the analysis of the quantitative data, three different types of regression analysis (normality of data, linearity of the phenomenon measured and homoscedasticity) was conducted. In the process of regression analysis, it is assumed that all research valuables are distributed normally (Jaber, 2016). Data value that does not follow the parameters of a normal distribution could mean that there is a significant distortion in both relationships and tests of significance.

To correct this, visual inspection is usually undertaken. Inspection is usually done through frequency distribution, kurtosis, skew, data, P-P ((probability–probability) and Scatter plots. Notwithstanding this, the effect on the outcome of regression analysis on normal distribution trends is limited when the sample size is sufficiently large (De-Vaus, 2002). StatSoftInc (2003) emphasises this by stating that if the sample size exceeds one hundred, then regression analysis results are likely to be an accurate reflection of behaviours and trends.

Conducting data and P-P plots (Figures 5.6 and 5.7), the data normality is illustrated (Figure 5.6). This demonstrates a level of close to near normality. The plot in Figure 5.7 is a normal probability plot, where the observed residuals are roughly y distributed normally. Although there are some divergences, these are not significantly divergent from the norm and therefore the overall tendency for the residuals is that they adhere closely enough to normal distribution

for a firm conclusion to be drawn. Figure 5.7 indicates that standardised residual values are in the range $0 \leq 1$, whereas, in a typical distribution sample, one would expect only a one percent exclusion (Pallant, 2005).

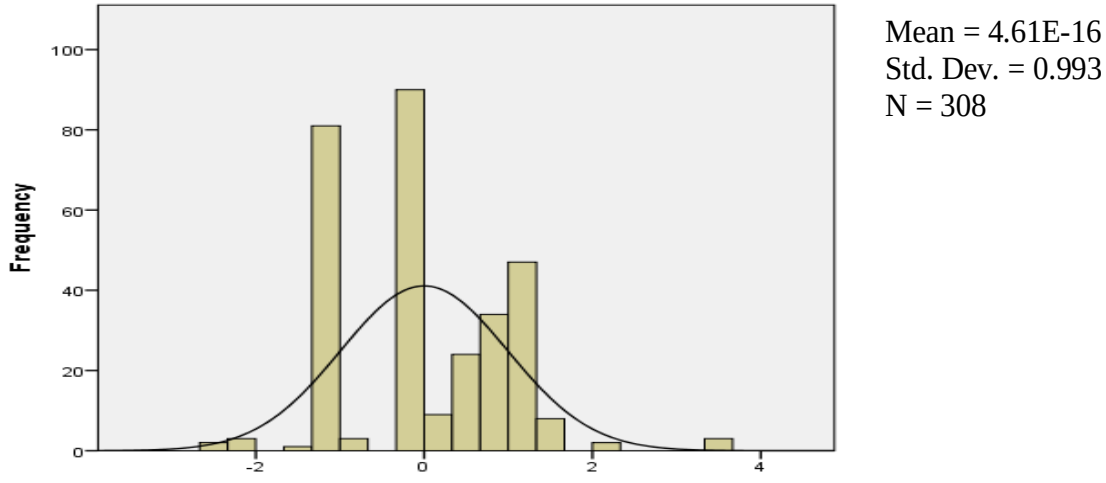


Figure 5.6: Histogram: Distribution of the Data

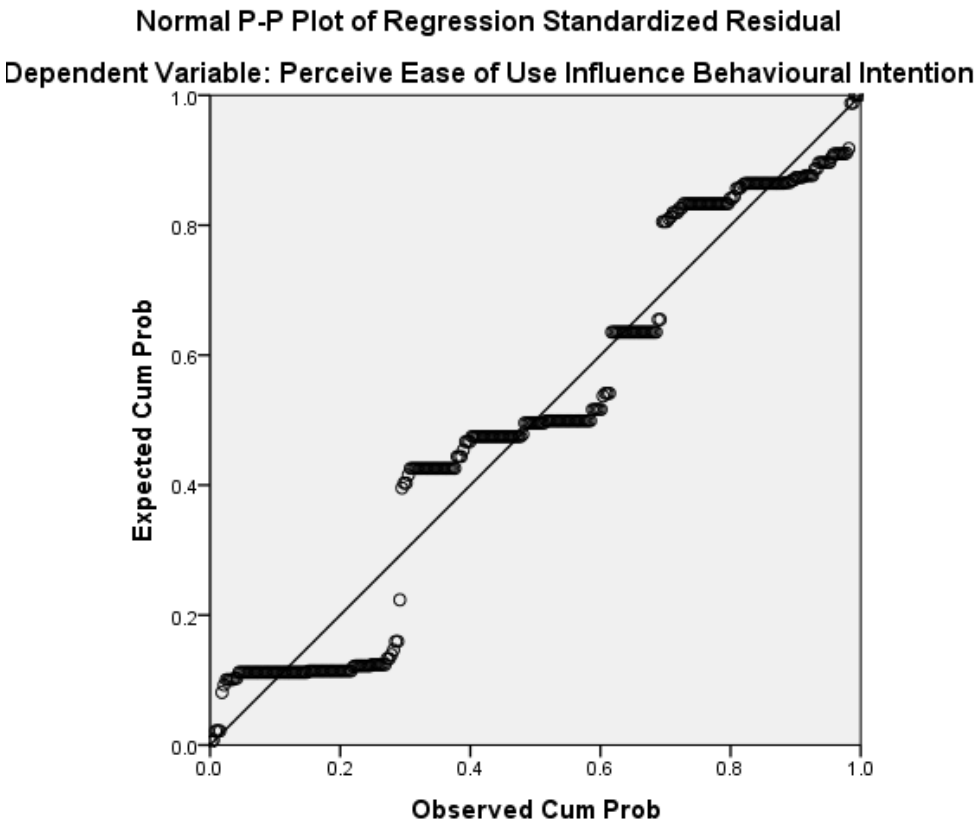


Figure 5.7: Normal probability plot

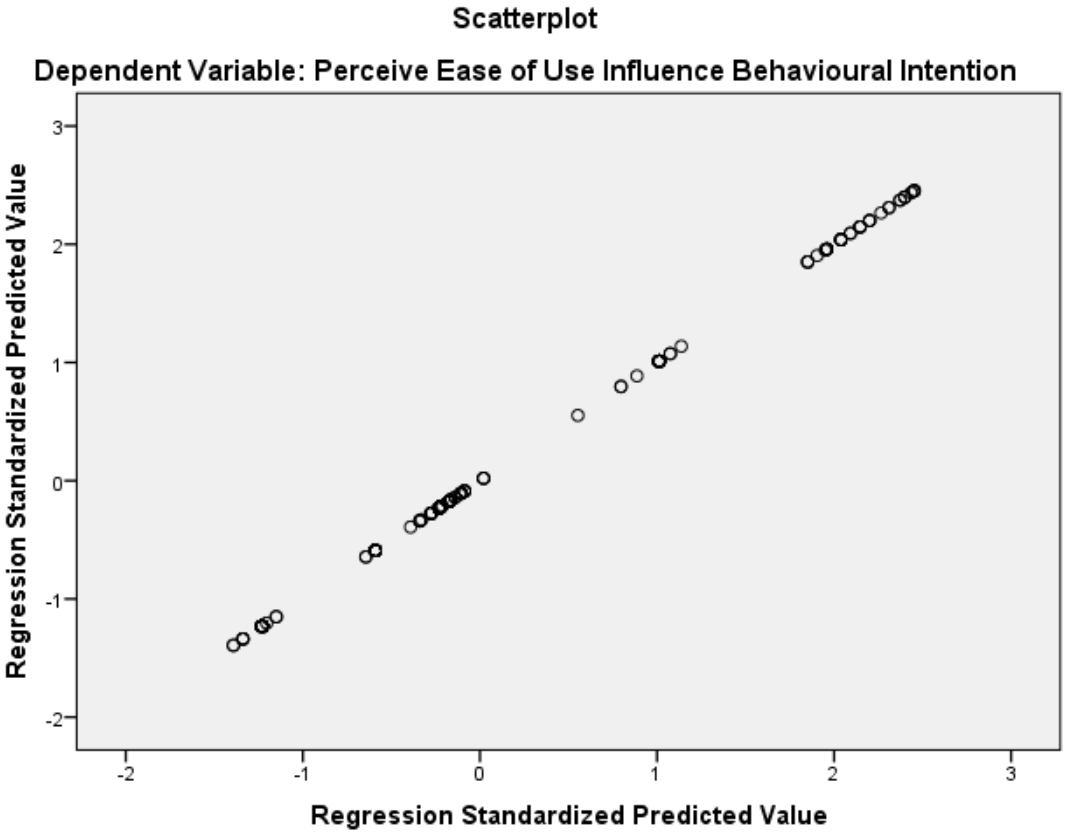


Figure 5.8: Scatter plot

Table 5.11: Residual statistics

Residuals Statistics[a]					
	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	1.03	4.25	2.20	.839	308
Residual	-2.248	2.991	.000	.861	308
Std. Predicted Value	-1.392	2.453	.000	1.000	308
Std. Residual	-2.594	3.451	.000	.993	308

a. Dependent Variable: Behavioural Intention

With reference to linearity, it is assumed that if the relationship between an independent and dependent variable(s) is linear, results of the regression analysis will be precise: linearity is achieved if residuals are spread according to chance, and at the same time evenly, through the plot of a scatter graph. Results shown in Figure 5.7 suggest that the dependent variables do not violate any presuppositions of linearity. With reference to Homoscedasticity, it is assumed that if the variance in error formation is equal at all levels of the independent variable, it can be claimed that there is evidence of homoscedasticity, (Jaber, 2016). The presence of homoscedasticity will be an indication of a possible serious distortion in the

analysis and its results. The scatter graph in Figure 5.8 above shows that there is no presence of homoscedasticity in this case.

5.6.10 The Developed Expanded Model

The research hypotheses were tested by determining probability values (P-value) and standardized coefficients (β) through multiple regression analysis. Vogt and Johnson (2011) define P - value as "the probability that a statistic would occur by sampling error - if a null hypothesis is true" and β as "a statistic that provides a way to compare the relative importance of different variables in a multiple regression analysis". According to Hair et al., (2010), "usually research hypotheses with P-value ≤ 0.05 is acceptable but are rejected if the P-value > 0.05. On the other hand, a standardised coefficient enables researchers to figure out a prediction value for the independent variable towards the dependent variable". The P-values and β values for this research are indicated in Table 5.12.

Table 5.12: P-values and β values

No	Hypothesis	Path			Standard Coefficient (β)	Probability Value P (P ≤ 0.05)	Hypothesis Results Based on P-Value
1.	H1a	EF	→	PEOU	0.146	0.010	Accepted
2.	H1b	EF	→	PB	0.235	0.001	Accepted
3.	H1c	EF	→	PU	0.113	0.047	Accepted
4.	H1d	EF	→	PP	0.131	0.021	Accepted
5.	H2a	PEOU	→	PB	0.190	0.001	Accepted
6.	H2b	PEOU	→	PU	0.932	0.001	Accepted
7.	H2c	PEOU	→	BI	0.190	0.001	Accepted
8.	H3a	PB	- - →	BI	0.015	0.790	Rejected
9.	H3b	PB	→	PU	0.411	0.001	Accepted
10.	H4a	PU	→	PB	0.202	0.001	Accepted
11.	H4b	PU	→	BI	0.202	0.001	Accepted
12.	H5	PP	→	BI	0.131	0.021	Accepted
13.	H6	BI	→	TA	0.113	0.047	Accepted

Table 5.12 indicates that there were 13 research hypotheses. Of the 13 hypotheses, 12, represented by straight arrowed lines were accepted, and 1, represented by a dotted arrow line, was rejected. Figure 5.9 indicates the straight arrowed lines and dotted arrowed line with the standardized coefficient values. Based on Table 5.12, the developed expanded model was generated as in Figures 5.9 and 5.10 below.

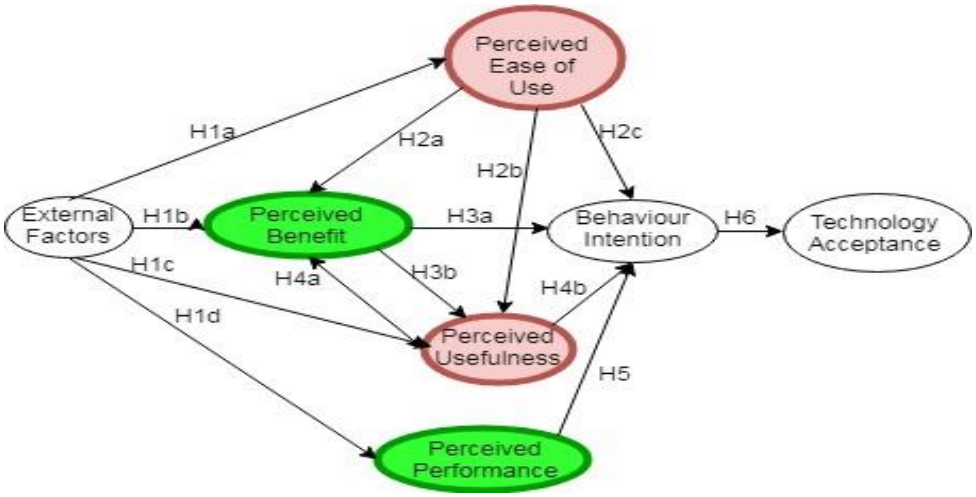
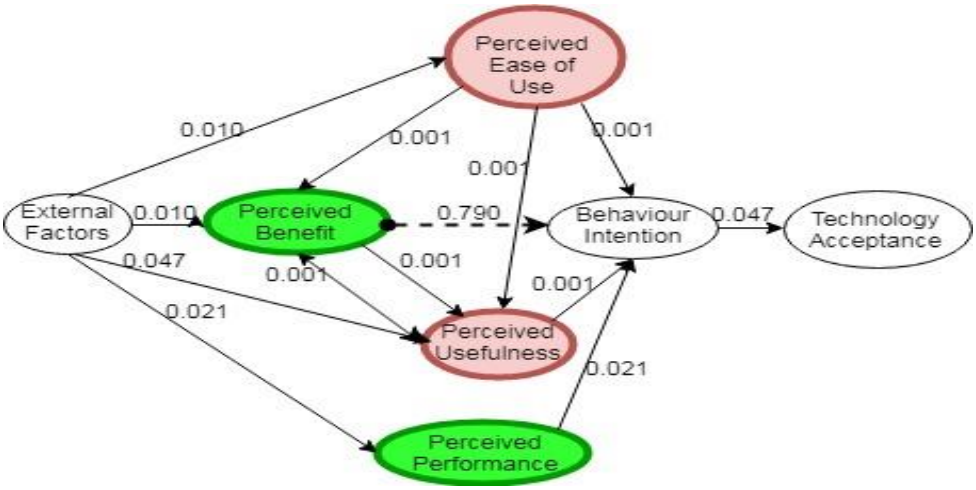


Figure 5.9: Developed Expanded Model (before hypotheses testing)



The numbers represent the standardized coefficient

Figure 5.10: Developed Expanded Model (after hypotheses testing)

Figure 5.9 shows the developed model before the multiple regression analysis and Figure 5.10 shows the developed model after the multiple regression analysis. The probability value

and standardized coefficient for each hypothesis is presented in Table 5.12 and figures 5.9 and 5.10. Results of figure 5.10 are explained below:.

Figure 5.10 and Table 5.12 indicate that three factors (PU, PEOU and PP) positively influence BI. Among these three factors, PU (H4b) was the strongest determinant of Behaviour Intention (β =0.202, P-value $\leq$ 0.001). Perceived Ease of Use (H2c) was the second strongest determinant of Behavior Intention (β =0.190, P-value $\leq$ 0.001). Perceived Performance (H5) was the third strongest determinant of Behavior Intention (β =0.131, P-value $\leq$ 0.021). This result confirms that TAM's constructs, PU and PEOU, were functional and significant in predicting Behavioral Intention towards Technological Acceptance.

In the developed model, Perceived Ease of Use, Perceived Benefit, and External factors were hypothesised to influence Perceived Usefulness positively. The three hypotheses were accepted with Perceived Ease of Use (H2b) being a strongest determinant of Perceived Usefulness (β =0.932, P-value $\leq$ 0.001). Second strongest determinant of Perceived Usefulness (H3b) was Perceived Benefit (β =0.411, P-value $\leq$ 0.001) and the third determinant of Perceived Usefulness (H1c) was External factors (β =0.113, P-value $\leq$ 0.047). External Factors, Perceived Usefulness, and Perceived Ease of Use were hypothesized as influencing Perceived Benefit positively. The three hypotheses were accepted with External Factors (H1b) being the strongest determinant of Perceived Benefit (β =0.235, P-value $\leq$ 0.001). he second strongest determinant of Perceived Benefit (H4a) was Perceived Usefulness (β =0.202, P-value $\leq$ 0.001) and thethird determinant of Perceived Benefit (H2a) was Perceived Ease of Use (β =0.190, P-value $\leq$ 0.001). Perceived Benefit influencing Perceived Usefulness (Figure 5.10), indicates that Perceived Benefit indirectly influenced Behaviour Intention.

It was also hypothesized that External Factors influence Perceived Performance, Perceived Ease of Use, Perceived Usefulness, and Perceived Benefit positively. Among the three, External factors influenced Perceived Benefit (H1b) the most positively (β =0.235, P-value $\leq$ 0.001), followed by Perceived Ease of Use (H1a) (β =0.146, P-value $\leq$ 0.010), Perceived Performance (H1d) (β =0.131, P-value $\leq$ 0.021),and, lastly, Perceived Usefulness (β =0.113, P-value $\leq$ 0.047). Figure 5.10 also illustrates that Behavioral Intention (H6) influences Technological Acceptance positively (β =0.113, P-value $\leq$ 0.047). Finally, the hypothesis that

Perceived Benefit (H3a) influences Behavioral Intention was rejected (β =0.015, P-value ≤ 0.790).

5.7 Expert Review of the Developed Expanded Model

To ascertain experts' opinion on the developed expanded TAM in the Sub-Saharan African context, the developed expanded model (as in Figure 5.9 in sub-section 5.6.10 above), its associated probability values (P - values), and standardised coefficients (β values as in Table 5.12 in sub-section 5.6.10 above), were circulated (through emails) to six experts with expertise in information systems and human computer interaction for review. After a week of study of the developed expanded model, the researcher followed up with each of the experts with three telephonic calls at separate times, to collect data on their opinion of the developed expanded model in the Sub-Saharan African context.

The method of using emails to circulate the model and its associated data to the experts and later interviewing them telephonically was preferred over a focused group discussion as the researcher wanted to avoid the situation of some experts influencing others in their opinion of the developed expanded model. The number of telephonic interviews (three as above) was not predetermined before the consultation (via emails and interviews) with the experts. Rather, it was the round of interview in which none of the experts probed further for clarity on the model and its concepts (constructs and variables). Experts' opinion gathered during the telephonic interviews are summarily presented in Table 5.13.

Table 5.13: Experts' Review of the Developed Expanded TAM in the Sub-Saharan African Context

No	Path in the Expanded TAM Model			Expert Confirmation of Acceptability of the Path (Relationship)						Mode of Model Distribution Model and Probability Values	Telephonic Interview		
				1	2	3	4	5	6		1	2	3
1	EF	→	PEOU	Yes	Yes	Yes	Yes	Yes	Yes	Email	Ok	Ok	Ok
2	EF	→	PB	Yes	Yes	Yes	Yes	Yes	Yes	Email	Ok	Ok	Ok
3	EF	→	PU	Yes	Yes	Yes	Yes	Yes	Yes	Email	Ok	Ok	Ok
4	EF	→	PP	Yes	Yes	Yes	Yes	Yes	Yes	Email	Ok	Ok	Ok
5	PEOU	→	PB	Yes	Yes	Yes	Yes	Yes	Yes	Email	Ok	Ok	Ok
6	PEOU	→	PU	Yes	Yes	Yes	Yes	Yes	Yes	Email	Ok	Ok	Ok
7	PEOU	→	BI	Yes	Yes	Yes	Yes	Yes	Yes	Email	Ok	Ok	Ok

8	PB	→	PU	Yes	Yes	Yes	Yes	Yes	Yes	Email	Ok	Ok	Ok
9	PU	→	PB	Yes	Yes	Yes	Yes	Yes	Yes	Email	Ok	Ok	Ok
10	PU	→	BI	Yes	Yes	Yes	Yes	Yes	Yes	Email	Ok	Ok	Ok
11	PP	→	BI	Yes	Yes	Yes	Yes	*Yes	*Yes	Email	*Further Clarity Requested by Experts 5 and 6	Ok	Ok
12	PB	- - →	BI	Yes	Yes	Yes	Yes	*Yes	**Yes	Email	*Further Clarity Requested by Experts 5 and 6	*Further Clarity Requested by Experts 6	OK
13	BI	→	TA	Yes	Yes	Yes	Yes	Yes	Yes	Email	Ok	Ok	Ok

Key to the Table 5.13:

→ Accepted path in the model (relationship exists)

- - → Rejected path in the model (no relationship exists)

* Yes: Clarity Sorted on the construct by the expert in one of the first Interviews as expertthinks the path may not be correct as it is

**Yes: Clarity Sorted on the construct by the expert in one of the first Interviews as expert thinks the path may not be correct as it is

Ok: Expert agreed that the path is correct as postulated in the TAM expanded model in the African context

As presented in Table 5.13, in the first telephonic interview, all six experts agreed that: 1. External factors influence the four main constructs of the developed expanded TAM model in the Sub-Saharan African context (see rows 1 to 4 in the table); 2. PEOU influence PB, PU and BI (see rows 5 to 7 in the table); 3. PB influence PU (see row 8 in the table); 4. PU influence PB and BI (see rows 9 and 10 in the table); 5. BI influence Technological Acceptance (see row 13 in the table). On the paths/association from PB and PP to BI, only four experts agreed (see rows 11 and 12 in the table; denoted by yes), that it is correct as postulated in the developed expanded model; expert 5 and 6 requested for further clarity on the variables that influence PB and PP for more comprehension to enable them to make informed inputs on the said paths/relationships.

As discussed, the researcher sent a write up on the variables and their description to experts 5 and 6, a day after the telephone call. After a week of studying the variables, another telephone interview (2^{nd}) took place between the researcher and experts 5 and 6 separately. In this interview, both experts 5 and 6 agreed that PP influence BI (see row 11 in Table 5.13: denoted by *Yes). Though expert 5 agreed that PB does not influence BI directly: but only does indirectly through PU (see row 12 ; denoted by *Yes and Row 8), expert 6 further requested the researcher to send him additional description of the variables that influence PB. Based on this request, a third telephone interview was scheduled between the researcher and expert 6. Whilst waiting for the third telephone interview to take place, the researcher conducted a second telephone interview with experts 1, 2, 3 and 4. In the interview, the researcher clarified to the experts about variables that influence PB and PP, and later asked the experts if they were still standing by their original opinion on the paths/association between PB, PP, and BI and all other paths/association as they indicated in the first interview. To this, all four experts affirmed that their opinion (denoted by *Yes in rows 1 to 13) remained the same. In the third telephone interview with the 6^{th} expert, he agreed that, as in the model, PB does not influence BI directly: but does, indirectly.

Results of the expert opinion and the review above show that the model is acceptable to evaluate technology acceptance in the Sub-Saharan African environment.

5.8 Summary

This chapter presented the qualitative and quantitative data analysis. Results from the qualitative data analyses unearthed 13 variables and 4 constructs, further resulting in an initial model and hypotheses that were discussed. The hypotheses were tested by collecting and analysing quantitative data. The quantitative data analysed include system use frequency, reliability, factor analysis, correlation, multiple regression analysis, testing of the hypotheses generated from the developed model, and expert review of the developed expanded TAM in the African context.

In Chapter six data analyses, outcomes and findings are discussed in detail. Additionally, Chapter six will also assess the developed model performance by likening its outcomes to existing TAM model outcomes.

CHAPTER SIX
INTERPRETATION OF RESULTS

6.1 Introduction

Using the research model variables, constructs, hypotheses, and performance, this chapter interprets the data analyses results. Section 6.2 deliberates on Perceived Performance (PP) and Perceived Benefit (PB) in the Sub-Saharan African context by discussing the cultural and social elements which affect PP and PB. Significance of each construct is explained individually (Section 6.3). Using the explained variance, the performance of the research model is measured in the independent concepts (PU, PEOU, PP and PB). The research model's performance is subsequently compared to similar models (including the existing TAM) within the technological acceptance context in section 6.4.

6.2 Influence of Cultural and Social Factors on PP and PB

Cultural and social factors influence acceptance of technology. Cultural factors include individualism/collectivism, power distance, uncertainty avoidance, language, long-term/short-term orientation and masculinity/femininity (Eseonu and Egbue, 2014; Herbig and Dunphy, 1998; Hofstede, 1997)

According to Srite & Karahanna (2006), individualism emphasises individual roles and rights and hence an individual is expected to stand up for himself/herself. In contrast, collectivism emphasizes an individual behaving as a member of an organization or group and hence the individual pays unquestioning loyalty to the group.

Contrary to the existing TAM, which did not consider *culture* as a variable during its development, this research identified *culture* as a factor, which contributed directly to the variables, *important personnel influence and peer influence*, and indirectly into the constructs, Perceived Benefit, and Perceived Performance (two of the resulting constructs for TAM in the Sub-Saharan African context). This therefore shows that *culture* influences BI to accept technology. This is due to the cultural traits in the USA being very different from that of Sub-Saharan Africa: while the culture in USA and the Western world is characterised by high *individualism*, low *uncertainty avoidance*, a common language, and low power distance; the culture of Sub-Saharan Africa is characterised by high *collectivism*, high *uncertainty avoidance*, many discreet languages and high power distance (Fiske, 2018; Africanholocaust,

2017; Al-Jumeily and Hussain, 2014; Srite & Karahanna, 2006; Akour et al., 2006 and Hofstede,1984).

High uncertainty avoidance as a cultural characteristic that enables culture to influence BI to adopt technology is supported by findings from Eseonu and Egbue (2014) that high uncertainty avoidance opposes change and innovation. Eseonu and Egbue (2014) attribute this to the risk and uncertainty that people in risk averse cultures perceive and hence their unwillingness to invest in the resources needed to implement and adopt new technology. This affects long term orientation negatively (Eseonu and Egbue, 2014; Hofstede, 1997) which is likely to keep the people in risk averse cultures in their unwilling state to adopt new technologies.

A study by Lee (2009) concluded seemingly that the intent to use technology, specifically for e-banking, is undesirably drawn back by risk and is affected directly by Perceived Benefit. The adversity to risk as demonstrated by these studies, confirms that very few people will dare to take risks in a high *uncertainty avoidance* and short term orientation culture and the larger community or institutions (reference to *subjective norm* and *importance personality*) are unlikely to support them. The above confirms that the cultural dimensions, *uncertainty avoidance, long term orientation, subject norm,* and *important personnel* influence Perceived Benefit and Perceived Performance, which influence Behaviour Intention (two of the resulting constructs for TAM in the Sub-Saharan African context).

As cultural dimensions, Hofstede (1997) defines masculinity/femininity as the degree to which culture is controlled by male values as opposed to "female values and long-term/short-term orientation as the extent to which members of a society" are future concerned. He further argues that societies with a high masculinity index have an inclination to reward performance as well as individual training and improvement. Based on Hofstede's (1997) argument, Eseonu and Egbue (2014) point out that the inclination to reward performance as well as individual training and improvement, are essential features for innovation and hence a high masculine culture is more likely to adopt innovative technology. By implication, the likelihood of a highly masculine society approving members whose values are more male oriented, is high, and hence the *subjective norm* of such a society is masculine biased. The same may be said in the case of important personnel: the likelihood of perceiving a personality as important (*important personnel*) in high masculine society, is high, if the person exhibits masculine characteristics. Based on these research findings, *subjective norm* and *importance personality* are variables that influence the constructs Perceived

Benefit and Perceived Performance, and that culture influences *subjective norm* indirectly and *importance personality* directly.This confirms that *culture* influences BI to accept technology.

Seemingly, like cultural factors, social factors also influence BI. According to Al-Jumeily and Hussain (2014), available technical support (known as *service quality* in this research) is a social factor that influences Perceived Performance. The above discussion on the Western and the Sub-Saharan African context confirms that culture and social factors influence PP and PB and as a result, PP and PB could influence BI to accept technology in the Sub-Saharan African context.

According to Srite & Karahanna (2006), only a limited number of research work incorporated culture in the technology adoption framework. Among these studies are the ones conducted in Europe (Göğüş, Nistor & Lerche, 2012) and the Middle East (Tarhini, Hone & Liu, 2017) on e-learning applications. Though these research works commonly come to an understanding that social settings offer a tool to link subjective norm to "Behaviour Intention with some agreement that collectivist cultures prefer to maintain normative stability", the said research works did not include the Sub-Saharan African culture, nor did they apply hypothetically derived values at individual levels to understand learner perceptions, but instead relied on "espoused national culture arbitrarily demarcated at geographical borders" (Mehta et al., 2019; McSweeney, 2002; Schaffer & Riordan, 2003).

This confirms the need for a technological acceptance model with culture integrated into it and a focus on the Sub-Saharan African context, as it was neglected in existing studies and models. Without an expanded TAM in Sub-Saharan African context with culture integrated, individuals and organisations in Sub-Saharan Africa that wish to apply the existing TAM in the Sub-Saharan African context could only do so being mindful (Mehta et al., 2019) that it may not give the very best of results.

Amongst the constructs in the developed model, PB appears to look similar to PU; however the two are not the same. By comparison, while PU is the extent to which an individual considers that using a specific technology boosts his or her work performance (Guriting and Ndubisi, 2006; Eriksson et al., 2005; Laforet and Li, 2005; Liao and Cheung, 2002; Polatoglu and Ekin, 2001; Mathwick et al., 2001; Davis, 1993; Davis, 1989; Davis et al., 1989), PB is the belief that, in the presence of threats/risks, a specific behaviour will result in a specific

positive outcome/gain (Forsythe et al., 2006; Champion, n.d.). PU focuses on system use to enhance job/task performance and PB focuses on specific behaviour that results in a positive outcome/gain. Unlike PU, PB assumes that there are risks or threats and that in the midst of the threat/risk, the gain or positive outcome to be derived from a specific behaviour outweighs the threat/risk. This explains why, within the African environment, which, as discussed before, tends to be a risk averse culture, PB is an important construct.

6.3 Results Discussion

The research aimed to develop and evaluate an expanded TAM that can be utilized to evaluate the quality, user satisfaction, and acceptance of e-learning within the Sub-Saharan African Environment. As part of this research, the existing TAM and ISSM concepts (constructs) relevant to the Sub-Saharan African environment were identified and analysed; an expanded TAM was developed, and its result was compared to the existing TAM. The newly developed expanded TAM consisted of four main constructs that influenced BI which in turn influenced TA. The four main constructs of the developed, expanded TAM included Perceived Ease of Use PEOU), Perceived Usefulness (PU), Perceived Benefit (PB), and Perceived Performance (PP). The relationship between these constructs and BI as confirmed by previous studies in discussions below, were also confirmed by experts of information systems experts and human computer interactions, who reviewed the model and confirmed it as such.

6.3.1 Constructs that influence BI

From the quantitative data analysis, the construct PU emerged as the strongest determining factor of BI. This was because of the e-learning system information output at the respondents' institutions being *complete, concise, current, timely* and *comprehensible*; thus, the result was good *information quality*. The e-learning systems also have *working functionalities,* which make it *useful* for students and thereby affect their productivity and performance positively. This resulted in students' *satisfaction* with the system, hence encouraging them to *use it frequently* and *voluntarily* in the absence of a force-use policy.

Results from the quantitative data analyses of this research indicate that the second strongest determining factor of BI is PEOU. This was as a result of the e-learning systems from respondents' institutions being *reliable, flexible, simple, fast, pleasant, comfortable to use, and easily navigable,* had all *expected functionalities*, *gave clear error messages and*

guidance on how to fix the errors, allowed users to recover easily from mistakes and overall *required little mental efforts* from the user: thus good *system quality is the result*. This is also because respondents either had an *experience* of using e-learning prior to joining their current institution or they received *training* in the system usage in their current institutions. The results confirm that the system was *easy to access*, *easy to learn* and *easy to use*, thereby *requiring less mental efforts to use*. It even became much easier as students encouraged each other to use the system. Lecturers who used the system also encouraged students to access their lecture materials and activities on the system. These results also confirm earlier outcomes on TAM (Venkatesh and Bala, 2008; Davis, 1985). The direct connection between PEOU and BI, has been documented by several studies (Nikou and Economides, 2019; Jaiyeoba and Iloanya, 2019; Chen, Tao and Zhou, 2019; Chuchu and Ndoro, 2019; Portz et al., 2019; To, Lee and Lam, 2018; Tanduklangi, 2017; Abdullah and Ward, 2016; Hamida et al., 2016).

The outcomes from the examined data showed that PP was the third strongest determinant of BI. This could also be linked to the high quality of the e-learning systems from respondents' institutions. The high *system quality* is as a result of the respondents' *Institution Information Technology staff being available, responding to queries on time, having empathy for e-learning users, being reliable and technically competent, and providing accurate solutions and documented guidance (in the form of manuals: manual / digital) on system use*: thus high system *services quality* as well as a third construct, PP, in addition to the two proposed by Davis (1985) and Venkatesh and Bala (2008), were therefore established in this study. PP is thus a new construct, and although it may not be limited to the Sub-Saharan African environment, it may have more influence within the Sub-Saharan African context where resources may be more limited, than in other environments less adverse to risk and with more resources.

6.3.2 Constructs that influence PU

Due to the level of PU being high, a good number of students use their university e-learning systems and spread the message of its usage. Based on the collective *cultural* nature of the Sub-Saharan Africa, as evidenced in the results (*encouragement from friends, lecturers, family, and community*), the e-learning system usage easily spread, thereby increasing acceptance and usage. This confirms earlier conclusions on TAM (Davis, 1985; Venkatesh

and Bala, 2008) in which PU influences BI. The direct relationship between PU and BI is confirmed by several other studies (Suhud et al., 2019; Jaiyeoba and Iloanya, 2019; Chen, Tao. and Zhou, 2019; Chuchu and Ndoro, 2019; Portz et al., 2019; Talukder, Mubasshira and Hasnat, 2018; To, Lee and Lam, 2018; Tanduklangi, 2017; Ramirez-Anormaliza, Sabaté and Llinàs-Audet, 2016; Abdullah and Ward, 2016; Hamida et al., 2016 and Tobbin, 2010).

In the developed model, PEOU, PB, and EF influence PU positively. Studies that confirm the influence of PEOU and Ext Fact influencing PU include studies by Talukder, Mubasshira and Hasnat (2018), Mahmodi (2017), Tanduklangi (2017), Abdullah and Ward (2016). Among PEOU, PB and EF, PEOU was the strongest determinant of PU. External factors that influenced PU include *system quality*, PB, *voluntary/compulsion use, culture, frequency of use and satisfaction*. Except for PB, which is the new construct, previous studies (Portz et al., 2019; Aristovnik, et al., 2016; Talukder, Mubasshira and Hasnat, 2018; Vululleh, 2018; Abdullah and Ward, 2016) confirmed that the said external factors (*system quality, voluntary/compulsion use, culture, frequency of use and satisfaction*) influence PU. PB influencing PU indicates that PB indirectly influences BI.

6.3.3 Constructs that influence PB

The results of the data analyses from this research showed that EF, PU and PEOU positively influenced PB. The analysis further confirmed that BI influenced TA positively. This is supported by a number of studies (Oliveira, Thomas, Baptista and Campo, 2016; Akturan and Tezcan, 2012; Lee, 2009; Lin and Lin, 2008; Amoako-Gyampah and Salam, 2004).

6.3.4 Constructs that influence PP

Results of the data analyses show that *culture* directly influenced *important personnel* which in turn influenced Perceived Performance. The result further confirmed that the cultural dimensions, *uncertainty avoidance* and long term orientation, *subjective norm* and *important personnel*, and available technical support (known as *service quality* in this research) influenced Perceived Performance, which in turn, influenced BI.

The analysed results from this study therefore clearly support the inclusion of the two new constructs, Perceived Benefit (PB) and Perceived Performance (PP), in a Technology Acceptance Model to use within the Sub-Saharan African e-learning environment.

6.3.5 Constructs Influenced by External Factors

Results from the quantitative data analyses, as in figure 5.10, indicate that External Factors positively influenced Perceived Performance, Perceived Ease of Use and Perceived Benefit. Amongst these three, External Factors influenced Perceived Benefit the most, followed by Perceived Ease of Use, and lastly Perceived Performance. As in figure 5.10 and Table 5.12, the results further showed that PU, PEOU, and PP influenced BI positively and directly and that PB influence BI indirectly.

6.4 The Performance of the Developed Expanded Model

A number of studies have investigated the acceptance of technology, specifically students' acceptance of e-learning. Though a number of these studies have worked at extending or/and expanding the Technological Acceptance Model, only very few of them (Abdullah and Ward, 2016; Hussein, 2016; Andrew, 2015; Arkorful and Abaidoo, 2014) have done it within the African context. These few only considered data from isolated African countries and not from a group of countries. This study therefore took into consideration PP, PB, PEOU, PU and Ext Fact as constructs to investigate TA in Sub-Saharan Africa and developed a Technological for the Sub-Saharan African context.

The relationships between the constructs discussed previously in the newly developed TAM were directed by the research hypotheses. The research model's performance can be measured by the explained variance in the independent constructs (PU, PEOU, PP, PB, and Ext Fact) and the dependent construct BI. The explained variance (R^2) is calculated as part of the multiple regression analysis. R^2 represents the proportion of the variance for a dependent construct that's explained by the independent construct(s) (Hayes, 2019; Vogt and Johnson, 2011). As indicated in the last row of Table 6.2, the variance in PU and PEOU towards BI in the developed model is 89.0% and 89.2% respectively. Statistically, variance values are greater than 0 and less than 100%. This is formularised as $0\ \% < R^2 < 100\%$. The variance values in PU and PEOU towards BI (89.0% and 89.2%) in the developed model are very high (close to 100%), indicating that 89% and 89.2% of the variation in Behaviour Intention can be explained by PU and PEOU respectively and hence a strong relationship between PU, PEOU and BI.

As a result of the fact that External Factors do not influence BI directly and also that all previous studies on variance computation from 2011 to 2019 (Al-Harbi, 2011; Tselios et al., 2011; Al-Aulamie, 2013; Liu, 2014; Sasoia and Gao, 2018; Musa et al., 2018; Marbán and Mulenga, 2019; Sánchez-Prieto et al., 2019; and Arias-Oliva, Pelegrín-Borondo and Matías-Clavero, 2019) ignored it, this study left it out of the variance computation towards BI.

The research model was able to explain more variance in the two independent constructs PUand PEOU and the dependent construct, BI. Additionally, the research was also able to explain the moderate variance in another two independent constructs: PP and PB.

The explained variance results for PU, PEOU, PP, PB and BI are 0.890, 0.892, 0.213, 0.282 and 0.510 respectively.
The first 10 rows of Table 6.2 demonstrates previous studies' variance computation result in PU, PEOU towards BI: based on the existing TAM. The previous studies include the study of Alenezi et al. (2010) in Saudi Arabia, Al-Harbi (2011) in Saudi Arabia, Tselios et al. (2011) in Greece, Al-Aulamie (2013) in Saudi Arabia, Liu (2014) in China, Sasoia and Gao (2018) in Sweden, Musa et al. (2018) in Malaysia, Marbán and Mulenga (2019) in Spain, Sánchez-Prieto et al. (2019) in Spain and Arias-Oliva, Pelegrín-Borondo and Matías-Clavero (2019) in Spain. The variance value for PU, PEOU towards BI in the previous studies ranged from 21.3% to 62%.

To compare the performance of the existing model with the developed model, the variance in PU and PEOU towards BI in the developed TAM was computed and compared with the variance values of the existing TAM as reported in the previous studies for the period of 2010 to 2019 (Al-Harbi, 2011; Tselios, et al., 2011; Al-Aulamie, 2013; Liu, 2014; Musa, et al., 2018; Marbán and Mulenga, 2019; Sánchez-Prieto, et al., 2019; and Arias-Oliva, Pelegrín-Borondo and Matías-Clavero, 2019). The variance values in PU, PEOU towards BI (in the new model), ranged from 89.0% to 89.2%. Comparing the variance values in the previous studies (21.3% to 62%) to the current studies (89.0% to 89.2%), it is concluded that the developed model outperformed the existing model, as it accounts for more variance in PU and PEOU towards BI than the existing model. Based on the fact that the larger the R^2 (variance) value, the better the regression model fits the observations (Hamilton, Ghert and Simpson, 2015; Frost, 2018), then the results show a strong relationship between PU, PEOU and BI.

The explained variance for the two new independent constructs, PP and PB, were moderate (0.213 and 0.282 respectively). This indicates that 21.3% and 28.2% of the variation in BI can be explained by PP and PB respectively. Though this is not a high explained variance, it is still an improvement, as the previous studies had no explained variance at all for these two independent constructs. These results also suggest a moderate relationship between PP, PB, and BI. Overall, this confirms a relationship between PU, PEOU, PP, PB, and BI as predictors of technology acceptance in the context of Sub-Saharan Africa, confirming the expanded Technology Acceptance Model's applicability to predict and explain Technological Acceptance, in Sub-Saharan Africa.

Table 6.1: Comparison of the explained variance among PU, PEOU, PP, PB and BI

Study	Country	Sample	Key Factors		Variance Explained R^2					
			Factor(s)	Effect Direction Towards	PU	PEOU	PP	PB	ATU	BI
(Alenezi et al., 2010)	Saudi Arabia	480	Enjoyment, Computer Anxiety, Computer Self-Efficacy and Internet experience	BI	None	None	None	None	None	61%
(Al-Harbi, 2011)	Saudi Arabia	531	Accessibility, Computer Self-Efficacy, University Support, Interactivity, Flexibility, Internet Experience	BI PU PU PU and PEOU	56%	23%	None	None	None	43%
(Tselios et al., 2011)	Greece	102	None	None	37%	None	None	None	None	39%
Al-Aulamie (2013)	Saudi Arabia	766	Enjoyment, Computer Playfulness, Learning Goal, Orientation, Information Quality, Accessibility, Functionality, Interface Design	BI Insignificant BI PU PU PU, PEOU and BI PU	59%	48%	None	None	None	56%
Liu (2014)	China	211	PU and PEOU	ATU PU, BI	None 53.9%	None None	None None	None None	78.3% None	None 78.9

			PU, PEOU, PU and ATU							%
Sasoia and Gao (2018)	Sweden	130	PMC and AR UMS ATU	PU PEOU	56% None None	None 23% None	None None None	None None None	None None None	None None 56%
Musa et al., (2018)	Malaysia	44	PU and PEOU PU and PEOU PU, PEOU and ATU	BI ATU BI	None None None	None None None	None None None	None None None	None 94% None	55.6 % None 57.8 %
Marbá and Mulenga (2019)	Spain	163	IF IF, G IF, G, A, IF, GA, E	ATU	None None None None	None None None None	None None None None	None None None None	9.3% 13.9% 17.1% 2%	None None None None
Sánchez-Prieto, et al., (2019)	Spain	160	PU, PEOU and BI	BI	62%	21.3%	None	None	None	70.85 %
Arias-Oliva, Pelegrín-Borondo and Matías (2019)	Spain	402	PP, EE, EF	TPCK-W	None	None	None	None	None	84.8 %
This Research	Africa (South Africa, Nigeria, Kenya, Sudan and Democratic Republic of Congo)	308	PU, PEOU, PP, B	BI	89%	89.2%	21.3 %	28.2 %	None	51%

6.5 Summary

This chapter interpreted the data analysis results and provided some insights. Firstly, the significance of the research model constructs was examined based on the hypothesis results. In relation to similar models, the research model's performance was assessed in terms of the explained variance in Perceived Usefulness, Perceived Ease of Use, Perceived Performance, Perceived Benefit, and Behavioural Intention. The assessment results showed that the research model outperformed the existing TAM and extension / expansion models.

CHAPTER SEVEN
CONCLUSION AND FUTURE RESEARCH

7.1 Introduction

This research aimed at developing and evaluating an extended TAM model that can improve the accuracy of the evaluation of quality, user satisfaction, and acceptance of e-learning in the Sub-Saharan African environment. Pursuing three objectives, reviewing relevant literature, and applying a mixed methodology, the research developed and validated an extended TAM Model. As the concluding chapter to the research, this chapter recaps the research aim and objectives and how they were achieved, summarises the research findings, presents the research implications of the findings, highlights the contributions, states the limitations of the study, and recommends avenues for further research.

7.2 Research Aim and Objectives

The research aimed at developing and evaluating an extended TAM Model that can be utilised to evaluate the quality, user satisfaction, and acceptance of e-learning in the Sub-Saharan African Environment. To achieve this, the research proposed and worked from three objectives. The following sub-sections discuss how each of the three objectives was achieved.

7.2.1 Objective 1: Identify and analyse existing TAM (1, 2 and 3), ISSM, TRA theory and TOE framework concepts (constructs and variables) from literature, relevant to the Sub-Saharan African environment.

To achieve this objective, various TAM models, theories, and their application were discussed in Chapter Two. Theoretical underpinnings to TAM were also discussed in Chapter Three. The discussions focussed on unearthing variables and constructs that could potential be used to predict and explain the acceptance and technology use in the Sub-Saharan African context. Based on a critical analysis of TAM models and theories, fourmain constructs were identified from the literature. The identified constructs are Perceived Ease of Use (Davis et al., 1989), Perceived Usefulness (Davis et al., 1989), Behaviour Intention (Southey, 2011), and Actual Usage (Davis and Venkatesh, 2004).

Within these constructs, 14 related variables were identified as follows: *ease of use, system quality, usefulness, frequency of use, information quality, culture, satisfaction, experience, student or user centeredness, training, use mode, influence by peers, service quality, and influence by important persons.*

Previous studies on TAM focused on nine of these variables and handled the remaining five either partly or neglected them. The nine variables that were handled in previous studies include *ease of use, system quality, usefulness, information quality, satisfaction, experience, service quality, influence by peers, and influence by important persons.* The five variables that were handled partially or neglected in previous studies include: *use mode, culture, student or user centeredness, frequency of use, and training.* The said constructs and variables were used in the methodology section to construct the research instruments, interviews and questionnaire that were used to collect data from the field.

7.2.2 Objective 2: Develop an extended TAM applicable to the Sub-Saharan African environment.To achieve this objective, constructs of TAM and quality factors of ISSM that were applicable to the Sub-Saharan African context were identified and applied appropriately. The research developed an extended TAM with four constructs: Perceived Usefulness, Perceived Ease of Use, Perceived Performance and Perceived Benefit. The two new constructs, Perceived Performance and Perceived Benefit allowed for the incorporation of variables which were either neglected or only partly used in previous models. Proposed relationships between these constructs were outlined and based on itand research hypotheses were propounded. The proposed hypotheses were justified for each construct, based on the literature review and each construct's analysis. The developed model is illustrated in Figure 7.1.

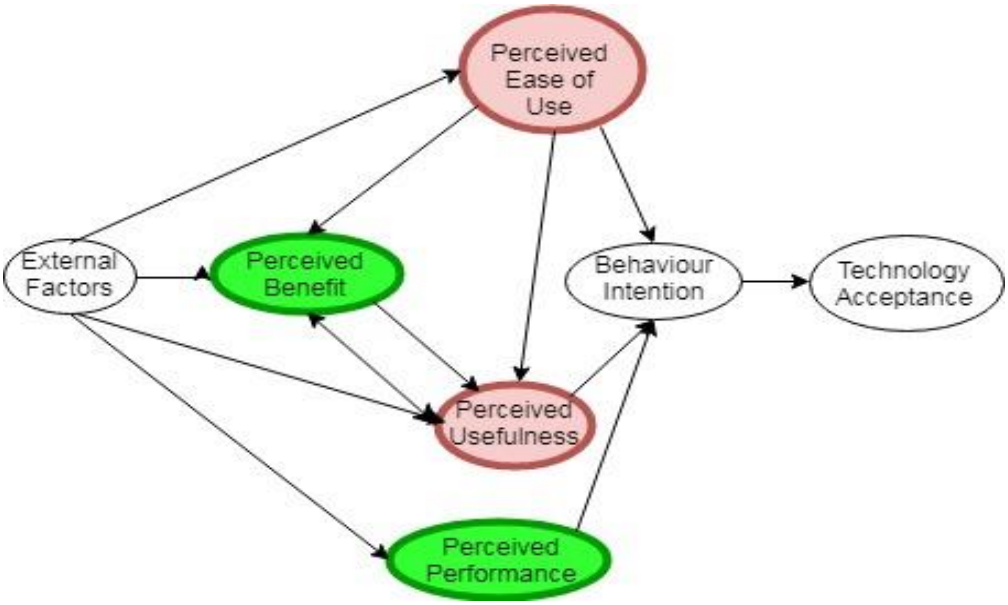


Figure 7.1: The Developed Model

7.2.3 Objective 3: Compare new expanded TAM to existing TAM

Results obtained from the expanded TAM on e-learning user satisfaction and acceptance in Sub-Saharan Africa were compared to those obtained by the existing TAM. To achieve this objective, the responses from the questionnaires were used to calculate the explained variance of the four independent constructs (PU, PEOU, PP, and PB) and the dependent construct BI, as part of the multiple regression analysis. The results indicated that the research model was able to explain the high variance in two of the independent constructs (PU and PEOU) and a moderate variance in the two new independent constructs (PP and PB). Further, the comparison, as listed in Table 6.1 indicates that the newly developed model's explained variance outperformed that of the existing model, as found in literature, suggesting that PU, PEOU, PP, PB. and BI are predictors of technological acceptance in the context of Sub-Saharan Africa. This therefore confirms the developed model's applicability to explain Technological Acceptance in Sub-Saharan Africa.

7.3 Results' Implications

The study results indicate that *system quality* is an important variable to the Perceived Ease of Use construct. This implies that stakeholders in the design, development, or implementation of a technology, should ensure that it is *reliable, flexible, simple, fast, pleasant, comfortable to use,* and *navigate*. They should also ensure that the technology has *expected functionalities, gives error messages with clear messages on how to fix the errors, allows users to recover easily from mistakes,* and *overall, requires little mental efforts from user to use*. Additionally, *training, user manuals availability, experience* of a technology and *user*

centeredness influence Perceived Ease of Use directly. This denotes that acceptance of a technology is highly dependent on whether users have received *training* on the technology and whether user manuals are available and easily accessible. It also infers that user *experience* and *user centeredness* of the technology determine the technology acceptance. Hence designers should design technologies such that it is user centred, comes with user manuals accessible in all possible formats and that technology implementers ensure that users receive training on it. The study results also indicate that *peer and important personnel* influence *subjective norm* directly and the three together influence Perceived Benefit directly. This signifies that when colleagues of a category of persons or important personnel to a category of persons use and encourage the use of a technology, its acceptance is high. A group of influential individuals from different levels within the organisation could play a vital role in the successful implementation of new technology. For instance, in the case of this study, students tend to use e-learning, based on colleagues and lecturers' influence.

Furthermore, the study results indicate that *information quality* is a significant variable influencing the Perceived Usefulness construct. This signifies that stakeholders in designing, developing, or implementing a technology, should ensure that the information output of the technology is *complete, concise, current, timely*, and *comprehensible*. Additionally, the *frequency of use, voluntariness in use, the culture of independence or group acceptance, or general use or compulsion of use* and *uncertainty avoidance* influence Perceived Usefulness directly. This implies that a technology becomes more acceptable in the context of Sub-Saharan Africa as one tends *to use it voluntarily* and *or more*. Equally the Technology tends to be acceptable when found in a *culture* where group acceptance is high and also when some group members use the technology and tend to approve of other group members that also use the technology. Based on the above, *cultures* like work environments should encourage the voluntary use of technology as its group members' actions and ??? benefit from the system and thus will encourage others to use it.

The study also found that Perceived Ease of Use and Perceived Benefit influence directly Perceived Usefulness which in turn influence Perceived Benefit. This denotes that technology be designed such that it's easy to use as this will influence users' Behaviour Intention towards use. *Service quality* is a significant variable influencing the Perceived Performance construct. This implies that stakeholders in the implementation of a technology should ensure that information technology services support staff are *available, reliable, competent, have*

empathy, and *provide accurate solutions* to staff, as these influence users' perception of Perceived Performance and Acceptance of Technology. Perceived Ease of Use, Perceived Usefulness, and Perceived Performance affect Behaviour Intention directly, which affects Technology Acceptance directly in turn. This denotes that, for a technology to be accepted in the Sub-Saharan African environment, it should be perceived to be easy to use, useful, beneficial, and to have a high performance. Perceived Benfit was found to indirectly influence BI.

7.4 Summary of the Research Findings

As can be seen in Figure 7.1, a summary of the research findings are as follows:

a. Perceived Usefulness, Perceived Ease of Use, Perceived Performance, and Perceived Benefit influence Behaviour Intention to accept technology.
b. Among the four constructs, Perceived Usefulness is the strongest determinant of Behaviour Intention. Perceived Ease of Use is the second strongest determinant of behavior intention, followed by Perceived Performance and Perceived Benefit. This result confirms that the existing TAM's constructs (PU and PEOU) were functional and significant in predicting Behavioural Intention towards Technological Acceptance in general. Additionally, this also indicates that the constructs PP and PB (in the extended TAM) account for Technology Acceptance in the Sub-Saharan African environment.
c. The Perceived Ease of Use, Perceived Benefit, and External Factors' constructs influence the construct Perceived Usefulness. Perceived Ease of Use is the strongest determinant of Perceived Usefulness followed by Perceived Benefit and External Factors.
d. External Factors, Perceived Usefulness, and Perceived Ease of Use, influence Perceived Benefit. The construct External Factors is the strongest determinant of Perceived Benefit, followed by Perceived Usefulness, and Perceived Ease of Use.
e. External Factors influence Perceived Performance, Perceived Ease of Use, and Perceived Benefit. Within these, External Factors influences Perceived Benefit more, followed by Perceived Ease of Use, and lastly but not least, Perceived Performance.
f. Behavioural Intention influences Technological Acceptance.
g. Finally, Perceived Benefit influences Behavioral Intention indirectly.

7.5 The Research Contributions

This research makes a number of important contributions to existing literature on technology acceptance in Sub-Saharan Africa. Firstly, the research presents an extended technological acceptance model to explain technological acceptance in the context of Sub-Saharan Africa. The developed model added two new constructs (PP and PB) to improve the accuracy of predicting technology acceptance in Sub-Saharan Africa. Identifying variables specific to the Sub-Saharan African context, which influence External Factors impacting on Perceived Ease of Use, Perceived Usefulness, Perceived Performance, and Perceived Benefit, it also explains the high percentage of variance in two of the independent constructs (Perceived Usefulness and Perceived Ease of Use) towards Behaviour Intention to accept technology. Additionally, it explains the moderate variance in the other two independent constructs: Perceived Performance and Perceived Benefit, towards technology acceptance.

Secondly, the developed model was empirically validated through confirmatory factor analysis in section 5.6.6 and multiple regression analysis in section 5.6.9, to assess the model adequately. The results of the validation as indicated by the statistical analysis sections 5.6.3, 5.6.4 and 5.6.5, uni-dimensionality goodness of fit measures and constructs validity in section 5.6.8, confirmed the developed model's validity. Furthermore, through the multiple regression analysis, the developed model was examined for the explained variance and research hypotheses in relation to the probability value and standardised coefficient. The results pointed out the collective effect of the independent constructs (Perceived Usefulness, Perceived Benefit, Perceived Ease of Use, and Perceived Performance) to explain the variance in Behaviour Intention. The probability value and standardised coefficient pointed out the significance level and prediction value of each hypothesis.

Thirdly, the research contributed to the development of a questionnaire and an interview guide to measure the said constructs (at the individual level) in the developed model. Both questionnaire and interview guide were developed and validated for each construct in the said model. The questions on both questionnaire and interview guide were adapted from the literature and reviewed to fit the context of this research. These instruments passed through a thorough examination to ensure their validity and reliability. As a result, the instruments may be modified and applied in similar studies in the future. The study applied the developed

model to explain Technological Acceptance in the context of Sub-Saharan Africa and it was successful in explaining Technology Acceptance in the five regions of Sub-Saharan Africa.

The biggest contribution this study made was the development of a model for technology acceptance to be utilized within the Sub-Saharan African environment, with improved accuracy. The model recognized the significant role that culture plays in technology acceptance and provides a basis for developing the expanded TAM for other environments with significant cultural differences from technologically highly developed countries. Third world environments may benefit the most from the developed model by applying the developed expanded TAM.

7.6 Limitations and Future Research

Though this research was able to reach some stimulating findings to explain the acceptance of technology in the Sub-Saharan African environment, it has some limitations. First among the limitations is the research population and the technology (e-learning) used as representation for technologies. As a result, caution needs to be taken when generalising the research findings beyond the said population and technology considered in the research. Secondly, the research population was limited to students in public universities. However, users of technology go beyond students to include lecturers, administrative staff, and also the general public, beyond universities. Lecturers and administrative staff were excluded from the population because this research focused on students' perspectives. Future research on Technological Acceptance may refine the extended model to further explain the variance in students' Behavioural Intentions' based Perceived Usefulness, Perceived Ease of Use, Perceived Performance, and Perceived Benefit, and also examine the performance of the extended model to explain the different Technology Acceptance behaviours in the Information Technology field.

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APPENDICES

Appendix A: Interview Guide

Sr. No.	Interview Questions
1	May I know: Your age: Your gender: Your year of Study: Your programme of Study: Name of your Department: Full name of your university: Country where University is located: Region of Africa where country is located: [North][South][Central][East][West]
2	What's the name of your University e-learning System (Learning Management System):
3	Is your University e-learning System (Learning Management System) useful (your performance, productivity) to you. [Yes] [No] If yes: How [ ]: If no: How [ ]:

4	Do you find it easy (Minimal mental effort) to use your University e-learning System (Learning Management System). [Yes] [No] If yes: why [ ]: If no: why [ ]:
5	Could you tell me about information quality of your university e-learning system: In your opinion what do you think accounts for the information quality of your university e-learning system:

6	Could you tell me about the System quality (system reliability, system flexibility, ease of use, learnability, response time, system complexity) of your university e-learning system
7	Could you tell me about service quality (responsiveness, staff Empathy, accuracy, reliability, technical competency) of your university e-learning system
8	To what extent are you satisfied with your university e-learning system

9	How often do you use your university e-learning system?
10	Could you tell me whether you use your university e-learning system voluntarily
11	Could you tell me whether you use your university e-learning system because you want to be accepted by your fellow students

12	Who leads the teaching and learning process in your university e-learning process: student or teacher and how
13	If you use your university e-learning system because influence, then explain? (If Applicable)
14	If you use your university e-learning system because of what other people think about you: then explain? (If Applicable)

Appendix B: Questionnaire

Your age: 16 – 17 [ ] 18 – 25 [ ] 26 – 35 [ ] 36 – 59 [ ] Above 60 years [ ]

Your gender: Male [ ] Female [ ]

Your year of Study: 1st Year [ ] 2nd Year [ ] 3rd Year [ ] 4th Year [ ] Postgraduate[ ]

Your programme of Study:……..

Name of your Department:……..

Full name of your university:……..

Country where University is located:……..

Region of Africa where country is located: [North] [South] [Central] [East] [West]

Frequency of Usage:							
Sr. No	**Code**	**Question**	**Daily**	**Weekly**	**Monthly**	**Once in a Semester**	**Not at all**
1	FU1	How often do you use your university e-learning system					
Frequency of Usage 2:							
Sr. No	**Code**	**Question**	**Today**	**Last Week**	**Last Month**	**Last Semester**	**Not at all**
2	FU1	When last did you use your university e-learning system					
Frequency of Usage :							
Sr. No	**Code**	**Question**	**Today**	**Next Week**	**Next Month**	**Next Semester**	**Not at all**
3	FU1	When do you plan to use e-learning system in the future					

Sr. No	**Code**	**Question**	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly disagree**

System Quality							
4	SQ1	The e-learning system (learning management system) in my university is reliable					
5	SQ2	The e-learning system (learning management system) in my university is flexible					
6	SQ3	Whenever I make a mistake using my university e-learning system (learning management system), I recover easily					
7	SQ4	The interface of my university e-learning system (learning management system) is pleasant					
8	SQ4	My university e-learning system (learning management system) has all the functions I expect it to have					
9		I feel comfortable using my university e-learning system (learning management system)					
10		My university e-learning system (learning management system) gives error messages that clearly tells me how to fix problems					
11	SQ5	The e-learning system (learning management system) in my university is fast (during upload, downloads and general system use)					
Information Quality							
12	1Q1	The Information on my university e-learning system (learning management system) is complete					

13	1Q2	The Information on my university e-learning system (learning management system) is concise					
14	1Q3	The Information on my university e-learning system (learning management system) is current					
15	1Q9	The language of items on my university e-learning (learning management system) is easy to understand					
17	1Q11	The Information on my university e-learning system (learning management system) is accurate					
18	1Q12	The Information on my university e-learning system (learning management system) is relevant					
19	1Q13	The Information on my university e-learning system (learning management system) is timely					
20	1Q14	The Information on my university e-learning system (learning management system) is understandable (general)					
Service Quality							
21	SvQ1	My university e-learning system (learning management system) support staff responds on time when called upon to solve e-learning issues					
22	SvQ2	My university e-learning system (learning management system) support staff have empathy for e-learning users					

23	SvQ3	My university e-learning system (learning management system) support staff are reliable					
24	SvQ4	My university e-learning system (learning management system) support staff provide accurate solutions to challenges when notified					
25	SvQ5	My university e-learning system (learning management system) support staff are technical competent					
26	SvQ6	When I need help to use my university e-learning system (learning management system), guidance is available to me					
27	SvQ7	A specific person / group is available for assistance with any difficulties related with use of my university e-learning system					
Perceived Usefulness							
28	PU1	Using my university e-learning system (learning management system) improves my performance					
29	PU2	Using my university e-learning system (learning management system) improves my productivity					
30	PU3	I find my university e-learning system (learning management system) useful to my studies					
Perceived Ease of Use							
31	PEOU 1	Interacting with my university e-learning system (learning management system) does requires very little mental effort					

32	PEOU 2	I find it easy to get my university e-learning system (learning management system) to do what I want it to do					
33	PEOU 3	The e-learning system (learning management system) in my university is easy to use					
34	PEOU 4	The e-learning system (learning management system) in my university is easy to learn					
35	PEOU 5	The navigation of the e-learning system (learning management system) in my university is easy					
Satisfaction							
36	S1	I am satisfied with the functions of my university e-learning system (learning management system) to assist my academic activities					
37	S2	I intend to use the functions of my university e-learning system (learning management system) as often as possible					
38	S3	I intend to use the functions of my university e-learning system (learning management system) in the future					
39	S4	I am satisfied with the content of my university e-learning system (learning management system) to assist my academic activities					
40	S5	I intend to use the content of my university e-learning system (learning management system) as often as possible					

41	S6	I intend to use the content of my university e-learning system (learning management system) in the future					
Voluntariness							
42	V1	I use my university e-learning system (learning management system) voluntarily					
43	V2	My lecturers do require me to use the system					
44	V3	Although it might be helpful, using my university e-learning system (learning management system) is not compulsory					
Experience							
45	Ep1	I used an e-learning system elsewhere before meeting my university e-learning system					
46	Ep2	I received training on e-learning use					
47	Ep3	I have access to E-learning Training Materials (prints, videos, audio, etc)					
Culture							
48	Ev1	Using my university e-learning system (learning management system) promotes course group acceptance					
49	Ev2	Being accepted as a member of my course group is more important than having independence					
50	Ev3	When not sure of how a technology work: I avoid it					
51	Ev3	Attitudes in my Environment influence my attitude to Technological Uptake					

User Centeredness							
52	UCd1	Student are allowed to lead the learning process					
53	UCd2	Lecturers only facilitate the learning process					
54	UCd3	Administrators design system such that student lead the teaching and learning process					
55	UCd4	The E-learning System Designed such that students lead the process of teaching and learning					
Subjective Norm							
56	SN1	People who influence my behaviour think that I should use my university e-learning system (learning management system)					
57	SN2	People who are important to me think that I should use my university e-learning system (learning management system)					
58	SN3	My colleagues encourage me to use my university e-learning system (learning management system)					
59	SN4	My lecturers influence me to use my university e-learning system (learning management system)					
E-learning Acceptance							
60	EA1	I use my university e-learning system (learning management system) to a very high extent					
60	EA2	In the last month, I used my university e-learning system (learning management system) to					

		a very high extent					
61	EA3	In the last week, I used my university e-learning system (learning management system) to a very high extent					
62	EA4	Use e-learning to a very high extent on daily basis					
External Factors							
63	EFac 1	External Factors Influence perceive usefulness					
64	EFac 2	External Factors Influence perceive ease of use					
65	EFac 3	External Factors Influence perceive performance					
66	EFac 4	External Factors Influence Benefit					
General Comments							
67	GC1	Generally, what is your impression on the quality of your university e-learning system (learning management system)					
68	GC2	Generally, what is your impression on the information quality of your university e-learning system (learning management system)					
69	GC3	Generally, what is your impression on the usefulness of your university e-learning system (learning management system)					
70	GC4	Generally, what is your impression on the ease of use of your university e-learning system (learning management system)					

71	GC5	Generally, how satisfied are you regarding your university e-learning system (learning management system)	
72	GC6	Generally, how frequent do you use your university e-learning system (learning management system)	
73	GC7	Generally, why do you use your university e-learning system (learning management system)	
74	GC8	Generally, what is your impression on the voluntary use of your university e-learning system (learning management system)	
75	GC9	What type of training did you received on e-learning prior to using your university e-learning system (learning management system)?	
76	GC10	Generally, how does your environment influence your use of your university e-learning system (learning management system)	
77	GC11	Generally, how is the service quality of your university e-learning system (learning management system)	

Appendix C: Ethical Clearance Letter

Faculty Research Office
Durban University of Technology
20 March 2018

Mr Martin Mabeifam Ujakpa
Student Number: 21752115
Degree: PhD: IT
Email: ujakpamabeifam@gmail.com

Dear Mr Ujakpa

Permission to Conduct Research

Your email correspondence in respect of the above refers.

I am pleased to inform you that the Faculty Research Committee (FRC) at its meeting on 10 October 2017 has granted permission for you to conduct your research "Developing a Technology Acceptance Model for evaluating E-Learning in an African environment".

Since your proposal is deemed to be at ethics clearance level 2 the Faculty has given ethical clearance for you to conduct your research.

You are required to obtain permission from the institutions where you will be gathering data.

Kindest regards.
Yours sincerely

Dr Delene Heukelman
Faculty Research Coordinator (Acting)

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