FUNCTIONAL SUITABILITY MODEL FOR ENTERPRISE RESOURCE PLANNING SYSTEMS IN KENYAN UNIVERSITIES

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DECLARATION

This thesis is my original work prepared with no other than the indicated sources, support, and has not been presented elsewhere for any other award.

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CERTIFICATION

The undersigned certify that they have read and hereby recommend for acceptance of Masinde Muliro University of Science and Technology a thesis entitled ***Functional Suitability Model for Enterprise Resource Planning Systems in Kenyan universities***.

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DEDICATION

I dedicate this work to my late parents Mary Nandaa and Daniel Osore Waliaro, loving and supporting family; dear wife Arnet and daughter Nandaa. My brother John, sisters Selpha and Phanice. To my uncles Apollo, Maurice, Silas, Ayub and Charles.

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ABSTRACT

Management of institutions needs correct information to enhance their competitiveness. Universities, just like any other institution requires proper information for decision-making. In universities, there are complex processes, and related activities that require proper decisions. Automation brings in a myriad of benefits to the users of the systems or software being implemented. Universities today have embraced Enterprise Resource Planning Systems in their processes. However, the challenge is on how useful their functionalities are to the institutions because of the unique nature of their processes. Given Enterprise Resource Planning Systems mostly are standard applications; there is need for a well thought out approach to determine the functionality of these systems in order to reap from their benefits. The main objective of the study was to develop a model to measure functionality of enterprise resource planning systems in Kenyan Universities. To achieve this, the study was guided by the following specific objectives: Determine the status of Enterprise Resource Planning System implementation in Kenyan universities, and identify the factors that affect the functionalities of the Enterprise Resource Planning systems in universities. The study adopted exploratory design, the study focused on the features incorporated in the Enterprise Resource Planning System and mapped out these features with the users' expectations of the system. Sample population was selected using both purposive sampling and simple random sampling techniques. The population of interest in this study were the users of Enterprise Resource Planning system; staff members, technical Information Communication Technology staff and the top management staff. The main data collection instruments were content analysis, interviews and questionnaires. The study employed mixed approach where both quantitative and qualitative data was used. Quantitative data was analyzed using inferential statistics and presented using tables. On the other hand, thematic analysis was used for qualitative data and presented using themes. The study presents a Model to measure functionality of Enterprise Resource Planning System for universities. Apart from developing a better user interaction and operation, the findings presented can be used by educational policy makers, Enterprise Resource Planning system developers, systems administrators and other stakeholders in the academic environment in implementation and smooth running of these systems in the academic environment.

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ABBREVIATIONS AND ACRONYMS

Abbreviation	Description
AJAX	Asynchronous JavaScript and XML
ASP	Active Server Page
BPR	Business Process Reengineering
ERP	Enterprise Resource Planning
FURPS	Functionality, Usability, Reliability, Performance & Supportability
HE	Higher Education
HEIs	Higher Education Institutions
ICT	Information Communication Technology
IEC	International Electro Technical Committee
IEEE	Institute of Electrical and Electronic Engineers
ISO	International Standards Organization
ISSP	Information Systems Security Policy
JSP	Java Server Page
MRP	Material Requirement Planning
MRP- II	Manufacturing Resources Planning
MMUST	Masinde Muliro University of Science and Technology
MVC	Model View controller
PHP	Hypertext Server Page
ROI	Return On Investment
SASS	School of Arts and Social Sciences

SAVET	School of Agriculture, Vetinery Science and Technology
SCI	School of Computing and Informatics
SEBE	School of Engineering and Built Environment
SEDU	School of Education
SHDMA	School of Disaster Management
SOBE	School of Business and Economics
SOM	School of Medicine
SONAS	School of Natural Sciences
SONMAPS	School of Nursing, Midwifery and Public Health
SPSS	Statistical Package for Social Studies
TTF	Task-Technology Fit Theory
UCD	User - Centered Design
UTAUT	Unified Theory of Acceptance and Use of Technology

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

The unknown growth of information technology is being driven by microelectronics. The computer hardware and software have an effect on all faces of applications in computing across all organizations [1]. It is important to realize that the commercial surroundings are becoming more complex with different functional units. For decision- making, the units require more data that are more flow that is inter-functional. Other units that require more data include efficiency in product part procurement, accounting, and management of inventory, distribution of goods and services and human resources [1]. Further, on, Rashid [1] opines that competitiveness; better logistics and cost reduction can be improved. These can be done through having the right information by the top management. Additionally, Rashid goes on to state that in the world of competitiveness sophisticated business activities, the ability of providing the right information at the right time comes with large benefits to the organization [1].

Few years back, enterprise resource planning systems emerged in the market as new software systems. They were majorly targeting huge complex business setups [2]. However, the ERP were costly, complex, powerful customized systems off the shelf solutions. They required experts to fine tune them and implement them basing on the organization's needs. In most scenarios, the companies were forced to reengineer their commercial activities to accommodate the sense of the software units for smooth data flow within it.[3]. The software solutions, not like the old-fashioned designed systems, are put together in modular designs [2]. The designs can be expanded when need arises [2].

According to Gore[3], the major function of ERP is to extract data from various functional areas across the enterprise system. Due to its ability to process different business processes across different functional areas, it can therefore also be called a cross-functional system.

This facilitates decision making in organizations. Furthermore, it betters the visibility of information across the organizations. Ignatius's and Nandhakum [3], adds that ERP should be implemented across their set up. This is to allow a better way to access information in an environment that is borderless [2].

Jorges in their report for UN[3], indicates that, more UN institutions are replacing the legacy systems. This is in order to reduce the costs and improve operational efficiency, performance and controls. Further, they are of the view that, there are other many systems in the industry but not as beneficial as the ERP system [3]. The ERP systems have the ability to bring together different business activities. The data can be shared and used in real-time in these organizations [3].

Universities and colleges has been an area that has its kind of institutional models and procedures as well as aims compared to other business entities. The systems support learning activities in higher education such as planning, management, performance guides and the examination procedures [4].

Higher education sectors like the universities have started using the ERP just like other big organizations around the globe. They are replacing financial, management and administrative computer systems. ERP has played an important function in the ICT management of universities, which is not to some reason the main business of the universities. The complexity of the ERP allows it to play different functions in the universities. Among others, they include functions like timetable reporting, staff leave processing, the HR systems, financial systems, Student administrative information systems and academic reports [4].

According to Pollock and Cornford, some characteristics are similar between universities and manufacturing industries. However, universities have exact and unique administrative functions [3]. Customary ERP systems took care of normal commercial administrative needs. Such needs included marketing applications, finance, sales, operations and logistics among others. However, the higher education contains unique systems for modules such as timetabling module, student administration module, Unit administration module and other education applications, which are not part of the customary ERP system[2]. H.A Awad notes

sectors that systems in universities and in academic and administrative sections should cover. Some of the sectors in use include; library management, student registration management, human resource module, procurement management module, financial management module, warehousing and student registration management. However, the ERP is a software system and its functionality must be considered [4].

Functionality of the software is one of the major aspect of any software. Functionality can be stated as the degree to which the software commodity give functions that satisfy mentioned requirements. This should occur when the software is under usage in certain environment. Software functionality can also be " the ability of the software to provide activities that meet the said and aimed necessities of its users under certain environment of its use"[5]. There are sub- characteristics of functionalities. They include; Functional Compliance, Accuracy, Suitability, Security and Interoperability [6].

Functionality of the software service quality tries to figure out how well the software conforms to a given structure. This is usually based on functional needs. Its description can be the fitness for sole reason of software. It can also be pegged on its comparison to competitors in the market place as a substantive product[7]. Still there is inadequate literature on software functionality service, research and practice. This is so despite the fact that it is one of the most important attributes on software quality [8], [9], [10].

Functionality has in the process led to the starting of large and more sophisticated projects in institutions [11]. A greater demand has been put on software that is being made for learning purpose ensuring that they meet the necessary needs. This can be attributed to its rampant use. However, many software that depend on systems in universities have failed to meet the needs of their users. This has been so even after being keenly examined by the

respective authorities to provide all the functional needs. All the modules and the sub-modules of the system met their respective needs and non-by that time they failed[12]. The big difference is in the uses, user needs and functionality indicating a big gap between the laid down requirements against which the system section and sub-sections are verified. For this software to carry out their intended needs, their quality has to be put into consideration.

Quality can considered to be all the characteristics and important features of a product, which satisfy given needs [13]. All attributes and traits of a software product that have an influence on the capability to satisfy given wants can be included as quality. The standard glossary of IEEE software Terminology [14], [15], defines software product as the degree to which, process or component meets specified requirements. It further states that it can be the frequency to which the process meets the demands or expectations of the users[16].

Quality models can be used as tools for focusing software development efforts [17]. They are used to plug out program units that are likely to have imperfections [18]. They also help in effective use of resources. Quality management software products allows the use of models as an acceptable means. ISO/IEC IS 9126-1 defines quality model as "the set of characteristics, and the relationships between them that provides the basis for specifying quality requirement and evaluation". Quality of software has been constructed that define basic factors. This has been done through models within each of the sub-factors have been assigned. To each sub factor metrics have been assigned for the real evaluation[19][20]. Researchers target only those modules, which are defective, and hence resource utilization is very cost effective. The trained model is applied to modules to estimate their quality [13]. There is a major effort that has been geared towards assuring and maintaining quality software products through the initiation of standardization bodies. There are bodies such as

ISO/SEC 25000 family of standards (ISO/IEC 2014). This body targets at putting up a quality framework that is working for examining software products. The major section of the ISO/IEC 25000 family include; ISO/IEC 25010 (ISO/IEC 2011a) and ISO/IEC 25010 (ISO/IEC 2011b). The ISO/IEC 25010 (ISO/IEC 2011a)elaborates the quality model for software product while ISO/IEC 25010 (ISO/IEC 2011b) defines the process software quality product evaluation [5] [21] [22] [5] Other current standards of the quality model including the ISO/IEC 25010 are majorly made up of eight characteristics of standards. They include transferability, reliability, efficiency, performance, operability, functional suitability and security [23].

The way institutions, individuals, companies and manufacturing firms perform and coordinate; their jobs have been shifted by the existence of software This has affected globally the economy, society and environment in the sense of increase in innovations. Abundant increase in improved social knowledge and productivity is an open idea [24] [25] [26] [27] [28]. Additionally, electronic equipment, the computer hardware and the machine depends on software for them to be functional. Neither can be used on its own realistically requiring each other. An important aspect to determine the success of commercial system performance or technical aspect of a software is its quality [8] , [7].

Current practices focus on functional requirements [12]. High-performance organizations engineer systems relatively well in providing the nominal functions that their customers expect, that is in identifying and satisfying functional requirements, defined as follows, in: [29] Functional requirement: [29] “A statement that identifies what a product or process must accomplish to produce required behavior and/or results”. [30]A need which outlines a function that a system or system part should operate.

Other considerations include safety; security; verifiability; comprehensibility are relegated to the category of "non-functional requirements," defined as follows, in [29] Nonfunctional requirement: [29] "A software requirement that describes not what the software will do but how the software will do it". Synonym: Design constraints, nonfunctional requirement. Nonfunctional requirements usually provide challenges in their process of testing. This leads to them being examined subjectively. Rodriguez and Plattini carried out a systematic review on functional suitability. They established that it is among the most appropriate trait of a software [30]. They also established that it generates the most interest in functional suitability. Evaluations that are present shows the levels of fulfilment of a products characteristics aid to ensure that software products is the best for works it's supposed to perform[31].

1.2 Statement of the Problem

Other studies have picked similarities between ERP system implementation in universities and other institutions. Many universities have invested and still investing in ERPs. The challenge is whether they are getting value on the investments. There is no approach to determine functionality of ERPs acquired by these institutions, to maximize of ROI; there is need for a well thought out structure mechanism by these intuitions. In universities, there are complex processes, and related activities that require proper decisions. Automation brings in a myriad of benefits. Universities today have embraced Enterprise resource planning systems in their processes. However, the challenge is on how useful their functionality is to the intuitions because of their unique nature of their processes. Given ERPS mostly are standard applications; there is need for a well thought out approach to determine the functionality of these systems in order to reap from their benefits.

1.3 Objectives

1.3.1 General Objective

The main objective of the study was to determine the status of ERP implementation in Kenyan universities, identify the factors that affect the functionalities of the ERP systems in universities in Kenya and to develop a model to measure functionalities of enterprise resource planning systems in Kenyan universities.

1.3.2 Specific Objectives

The specific objectives of the study are:

i. To determine the status of ERP implementation in Kenyan universities
ii. To identify factors that affect the functionality of the ERP systems in universities in Kenya
iii. To develop a model to assess functional suitability of ERP systems for usage in Kenyan universities.

1.4 Research Questions

i. What is the status of ERP system implementation in universities in Kenya?
ii. What are the factors that affect functionality of ERP systems in universities in Kenya?
iii. Are there models that can measure functional suitability of ERP systems developed to improve functionality of education software systems in universities in Kenya?

1.5 Significance of the Study

The importance of the study, after considering the above considerations, was to come up with a full format output for examining the functional suitability of ERP systems in Kenyan

universities. The study was also to help show the application by means of a case study, which is practical. It has provided an insight and possible solutions to functionality issues affecting ERP systems. The model that has been developed will help in the implementation of education software systems in a manner that can improve its functionality and hence improve user satisfaction.

1.6 Justification

This study is going to save most institutions time and money used to purchase and install systems that are not suitable for their functionality. If embraced systems will undergo critical analysis through the laid down test to ensure that it performs its function to the maximum.

1.7 Scope of the Study

Through purposive sampling specifically extreme sampling, Masinde Muliro University of Science and Technology, seventh public university in Kenya, was chosen as the case study. It is a case of interest since it is one of the universities in Kenya. Like other universities, it started and implemented the ERP in one of its stages of development in the process of imparting knowledge. The study focused on the Functionalities of the ERP systems and did not dwell into the user-related characteristics.

1.8 Definition of terms

Functionality – "The capability of the software product to provide functions, which meet stated and implied needs when the software is used under specified conditions (what the software does to fulfil needs)".

Functional suitability – "The degree to which a product or system provides functions that meet the stated or implicit requirements when used under specific conditions. It is understood as the degree to which a product or a system conforms to the functional requirements (hereinafter referred as requirements) described in the product requirements specification, because it is impossible to know the implicit requirements of the different use context".

ERP – "Enterprise Resource Planning term comes from the industry for integrated, multi-modules application software packages that are aimed to serve and enhance multiple business functions. ERP system can include software for manufacturing, order entry, general ledger, accounts receivable and payable, purchasing, warehousing, transportation and human resources".

Software – "Software, in its most general sense, is a set of instructions or programs instructing a computer to do specific tasks. Software is a generic term used to describe computer programs.

Scripts, applications, programs and a set of instructions are all terms often used to describe software".

Quality – "Quality is defined as a set of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs. Different perspectives of quality can be considered".

Theories – "Academics point to a theory as. 1 being made up of four components, 1 definitions of terms or variables, 2 a domain where the theory applies, 3 a set of relationships of variables, and 4 specific predictions factual claims Hunt".

Models – "These are structures used to describe the overall framework used to look at the reality, based on a philosophical stance. They identify basic concepts and describe what reality is like and the conditions by which we can study it".

Framework - "It is the blueprint or guide for a research. It is a framework based on existing theory in a field of inquiry that is related and/or reflects the hypothesis of a study. It is a blueprint that is often borrowed by the researcher to build his/her own research inquiry".

UCD – "UCD is a design that is based on actual requirements of users, and comprises of task analysis, prototype development with users, evaluation, and iterative design. UCD is a design that is based on actual requirements of users".

CHAPTER TWO

LITERATURE REVIEW

2.1 Overview

Software based systems have become common in the education sector, more so in higher education institutions. The most common of the systems being implemented is the ERP system. Several researchers have studied various aspects of these system but most of them focus on non-functional aspects. However, a functional suitability assessment of these systems is needed to be determining whether the users get exactly what they expect from the system. Functionality is important since the user cannot maximize the use of the system without understanding fully its functionality aspects.

2.2 ERP Concepts

Bahar [32] states that ERP is a multi-module software application in the industry. It's a packaged software designed to support and serve many and different business functions [32]. It can include software for different functionalities. For example, transportation and human resources, accounts receivable and payable, order entry, purchasing, manufacturing and warehousing among others. Since ERP came from the manufacturing sector, it insinuates that it uses a packaged software instead of proprietary software made for or written by one customer. The ERP should be able to interchange and mix with any institution's software, with different degree of effort. This however, will depend on the software. Furthermore, the ERP modules may be able to be altered via the vendor's proprietary, tools and ordinary programming languages [33].

2.2.1 History of Enterprise Resource Planning

The limelight of manufacturing systems in the 1960's was on the control of inventory. It was based on the old inventory concepts. Majorly the software package were built to handle stock. The focus changed to MRP (Material Requirement Planning) in the 1970. These systems were used to translate master schedule made for end items into time phased net necessities. This was meant for procurement, material planning, and sub-assemblies [37].

I980's saw the evolution of MRP-II. This was an advancement of MRP to be able to accommodate the distribution management functions. MRP-II was further advanced in the 1990's to cover other areas. The areas include, finance, management, projects, engineering and human resource. This was to complete the many functionalities within any commercial enterprise. The term ERP system insinuates a comprehensive and sophisticated software package manufactured to integrate commercial processes and activities [34]. The last decade has witnesses a tremendous increase in the use of ERP in the world, more so in other fields such as the education sector. This is so even though there are many challenges and risks in the implementation of such systems [35].

2.2.2 ERP in Higher Education

Big organizations around the globe are using the ERP systems. They are phasing away the old administration, management and financial computer systems in the universities [36]. The system has played an important role in the ICT management of the universities. However, it was not the main business of universities. The ERP system in the universities is very diverse in its functionalities. It has different modules for different functionalities. They range from the Learners information systems, finance systems and the HR systems among others [34].

Institutions in the corporate world that operate in a free and competitive financial environment rip more benefits than the non-profit organizations like the universities. This is so despite the fact that they face many challenges and risks in the implementation.

Universities as an entity has always had unique demands and institutional models and core functionalities as well as aims and objectives compared to other commercial activities. The systems in the universities support normal educational activities. Some of them include; examination activities, learning activities, scheduling activities, performance activities among others. According to other studies, there are plenty of similarities between implementation of the ERP systems in other institutions and educational institution.

Other studies have identified some familiarities between ERP implementation. That includes other commercial organizations and education institutions [36]. Hence, it is crucial to study the outcome of using ERP systems in universities, gather the required information to avoid the challenges posed by the same system. This is important in order to outline the role of ERP in the rapidly evolving educational centers and state of its use in similar organizational culture.

2.2.3 Higher Education ERP software Misfit

Universities ERP software has some weaknesses due to poor procurement processes. ERP can be found to be unfitting with the requirement they have i.e. business requirements. For example, if ERP does not comply with the legal requirements the vending companies will not be able to provide its customers with the correct legal guide. This is so because the university is not a profit making organization. Other than that, other ERP software misfit are discussed below. [34], [37].

2.2.3.1 Great change of the system team staff

There seems to be a great change of staff in non-profit oriented organizations. This includes the staff that is employed to implement the ERP in universities. One of the reason may include high workload and burn out. These may lead to burn out and resignation to some members. Other may get other opportunities to implement the system somewhere else. The challenge to this is inadequate knowledge and skills needed in the implementation of the system. These hinders their ability to fully implement ERP in the daily use of the system[38].

2.2.3.2 Too much customization

Due to software differences in their environment, too much customization is needed in the areas of software customization and report customization. This could cause delays in implementation and use due to many consultative reasons. The budget could be stretched and the system may end up being unreliable due to too much customization. The customization may make the vendor to compromise good practice in order to satisfy the customers' needs. Other reasons may be due to unresolved system and insufficient testing. [38].

2.2.3.3 Insufficient consultant efficiency

Other consultants can be said to be having inadequate skills with the ERP systems more so in the academic sector. These leads to them providing unprofessional advice to the management on ERP implementation. Such consultants suggest workarounds without factoring in the professional skills to bridge the gap between ERP systems used in the commercial industries and the ones that are used for education purposes.

2.2.3.4 Inferior IT facilities

In some cases, the top management has inadequate financial resources that is set aside for the implementation procedures. Such cases leads to cutting costs hence the budget for the entire project of implementation is reduced. The inferior IT infrastructure will definitely have a negative impact on the long term running of the infrastructure [38].

2.2.3.5 Scanty skill dissemination

This is through the inexperienced consultants engaged. They are not conversant with the commercial industry environment. Such trainers will not deliver professional knowledge to the ERP users. The training materials also is not always written well. This may lead the information to be short and not very helpful[38] .

2.2.3.6 Ineffective Project Management

The ERP project will have many challenges and said to be demanding if there is little or no knowledge on its implementations. This is so because it involves the management of systems and the people, as well as re-engineering of the commercial process. It is also of great importance that the project head efficiently manage the consultants. That is in terms of their training, performance, communication, and even testing the system. [34].

2.2.3.7 Inferior standards of Business Process Reengineering (BPR)

Another factor to consider is the knowledge of the people involved in the entire process of the project implementation and their vision towards the same. These may have resulted from the misinformation given by the consultants pegged to their requirements and specifications. This will lead to poor BPR, which will lead to incorrect ERP configuration challenges. If the activities and procedures are not successfully, implementation of the entire system will not

be a success. With that in mind, the consultant may not map the software functionalities with the university requirements. As a result, this may create a great gap between the software functionalities and the activities it's intended to do [34] .

2.2.3.8 Weak standards of testing

The schedules of ERP implementations are always tight. This leads to a rush and low quality during the process of testing. The standards are the pointers for revealing the preparedness of the system to be used in the real field. Testing includes the staffing capacity, the infrastructure capacity, system configuration, the people and the users of the ERP system. It should show the data used in testing. All this fails due to the schedules that are tight and do not permit the above procedures to take place. [34].

2.2.3.9 Inadequate Support from Top Management

The management is supposed to provide the necessary support in the process of the continuation of the project. This include financial support, human resource, the good will, and political resolutions if any. Some of the challenges that goes with inadequate top management include rushed implementation, project team members will be overloaded among others. Poor top management support may lead to political problems such as licensing which may cause poor BPR. Uncooperative staff and low user satisfaction among the users of the system[34].

2.2.3.10 Unrealistic Project Schedule

In some cases, the system project reduces the costs of the ERP system implementation in collaboration with the management. These forces the implementation team to rush over the implementation of the entire process. In such scenario the team, the users will end up

overloading the system. The concept, nature and the use of the system will not be clear from the users' perspective. Inadequate training and implementation will be hindered due to the schedule, which will not factor in the users. This has a serious outcome since most of the users will resist change hence become hindrance to the use and implementation[34].

1.2.3.11 High Expectations from Management on ERP

The management of most universities put many expectations on the ERP. They assume that the system will provide solutions to most of the challenges in the institution. They never consider the sophistication nature of the system, the challenges and risks associated with the implementation. Too much pressure is given on the people who implement the system. The situation leads to underestimation of the project costs, resources leading to the failure of the ERP implementation hence failure of the whole project [34].

1.2.3.12 Components of ERP used in education

The functional suitability wants describes what universities ERP should have and perform, while non-functional wants places setbacks on how the universities ERP systems will do based on the same. Hence, it is important to differentiate between universities ERP functional and non-functional requirements.[34]. The following are some of the components of the ERP systems used in education;

Table 2. 1: Components of ERP used in Education

NO.	COMPONENT
1.	Organization outline
2.	Employee outline
3.	Learner outline
4.	Response module
5.	Courses
6.	Accomplishment analysis
7.	Register
8.	Index
9.	Odel examination
10.	Odel assignment
11.	Registration
12.	Payment
13.	Timetable Module
14.	Occurrence Management
15.	Notice board
16.	Hostel management

Source: ERP Systems Functionalities in H.E [39]

2.4 Related Studies

"Mohamed et al (2015): ERP System as an Innovative Technology in Higher Education Context kin Egypt". The authors focused on the adoption of ERP systems globally in universities. The focus of the study was in the Egyptian higher education. As the demand for ERP systems grows, the makers of ERP targets higher education more so universities. However, very little has been published on the topic concerning ERP. The study as a report is published as a sub-topic to help in the understanding of the concept of the ERP adoption in higher education in Egypt as a country. The authors state that educational systems of commercial activities in universities undergo alternative modules. They argue that ERP in universities should respond to the main functionalities of an academic system. The

modification and or the adoption the other legacy systems, which originated from the experience in commercial activities which are not always useful. The authors state that the ERP serves the education sector successfully. An invention will make the education system better in its operations. They encourage for its adoption in the universities in Egypt. Apart from its educational values, they state that the ERP helps in the better management of the resources available in any organization. It allows for automation of the departmental activities. Information is available to users whenever it is needed. This facilitates accurate decision making by the management. The ERP system has brought more benefits that are important to the organizations as well as the users. [40].

"Leo et al (2005): Implementing ERP Systems in Higher Education Institutions". The computerization of the higher education sector has opened up a new market opportunity for the ERP vendors. The modification and or the adoption the other legacy systems, which originated from the experience in commercial activities which are not always useful. Different environments were analyzed for both domestic higher education and the vendors' side. The major environments analyzed included the present needs and the future expectations of the higher education in a global view perspective.

The study presented research results in the field of ERP in abroad countries like Slovenia. It focused mainly on their use in universities i.e. faculties and higher education institutions. Through the study of the supply in the market, mainly focusing on the case study cases, the author looked at differences and similarities between the world trend and Slovenian higher education systems.

[41].

"Mohamed et al (2019): Modelling Intention to Use ERP Systems among Higher Education Institutions in Egypt: UTAUT Perspective". The authors state that organizations strive to achieve sustainable competitive environment. This is done in changing and diverse market places. For firms to cope with such circumstances, they have to align information technology with business strategy. This is so in order to exploit their capabilities and change commercial practices. In regards to that, the ERP systems have become important to organizations for different reasons including, enhancing decision making, improve operational performance, building strong capabilities and competing in a global business context. The organizational resources are integrated by the ERP and it involves business processes and institutional changes. Implementation of ERP systems has grown strongly with the universal growth of Information System investment. ERP systems are being adopted in higher education systems. However, from the past research ERP systems have been known to have a great rate of failure in implementation. This is one of the reasons why many users resist using the system. Conversely, ERP user acceptance is the key to its implementation. The study strives to find out the key factors that influence users' intentions to use ERP during the implementation phase in the lifecycle in the universities [42].

"Singh et al (2018): ERP Challenges in Higher Education". The authors state that ERP in universities and colleges should respond to the exact requirements of education systems. Additions or other modifications, which are carried from other past systems, do not always match the needs of the current environments. The authors state that it is prudent to outline those ERP systems in universities as being wide in their scope. The scope ranges from administrative duties, the human resource activities, financial systems, information systems among others. It is therefore necessary to learn the implication of using the ERP in

universities and information obtained in order to avoid challenges created by inherited systems. This is important because it addresses the functions performed by the ERP in the ever-changing universities and its effects in the use in the same institutional environment. The authors outline the contents of the ERP that provide the education system successfully and present the requirements and future expectations of higher learning institution [43].

"Christian et al (2017): Implementing ERP Systems in Higher Education Institutes: Critical Success Factors Revisited". Investigation of the ERP project critical success factors with the focus in universities was the major focus of this study. The authors carried out a step-by-step review of the literature to bring out specific CFC affecting higher education projects outcome. There is little literature that deals with higher education. Furthermore, almost all factors in the literature were also mentioned. In the general studies, there are general factors that are important CSFs in general studies. They include; top management support, ERP systems tests, project management, configuration among others. Research for specific types of organizations is still important in spite of the maturity of the field [41].

"Matilda (2006): Change management success factors in ERP implementation". Just like any endeavor, ERP project implementation is challenging. To ensure a successful completion of the project goals, the stakeholders' commitment and competence need to be brought to the right level. This is in addition to the related business processes and the ever-changing core information systems.

The most frequently cited critical success factor in ERP implementation is the change management factor. Change management in the theoretical coverage is very limited. This study sets to provide answers to this research question that is; "how should organizational change be managed in an ERP implementation project?" Prescriptive framework is the

answer. It is based on Hannus' [44] strategic change process model Salmien's [44]change management success factors.

The global ERP implementation of Wartsila [44] is the empirical case. The full-scope SAP R/3 implementation was successful despite it being challenging. The project ended in 2007 and started in 2002. The six informant held the key roles. The realistic and insightful case study dwelled on the pilot implementation project. It covered mainly the go-live, implementation and support phases. Also included in the global project is the reflection and analysis in its entirety. Empirical cases revealed three key things in the analysis of change management practices. They improved change management success. They include, 1. Systematic standardization and improvement of the selected approaches brings in efficiency and consistency 2. Stakeholder management lays the foundation for building change readiness effectively. 3. The change management activities should be integrated with other project activities. This is so that individual change management competence can be turned into institutional change management ability.

In the form of two new success factors, the three key findings were appended to the framework. Relevant in the context of a global ERP implementation are the success factors. The concept of change management and stakeholder management need further development [44].

2.4.1 Software Engineering Design Concept

Software engineering involves a number of processes. It includes examining user requirements and architectural designs, building, and testing applications among others. The whole process is directed towards meeting the requirements of user needs using programming languages. Software engineering is used for bigger and more sophisticated

software systems in contrast to simple programming. It is an application of engineering principle to software development. The systems developed by this principle are used as critical systems for business and institutions.

2.4.2 User Centered Design

UCD is a prudent idea in usability engineering. An area outlines the various categories of design interactive application [45] . The design is based on actual requirements of users. They include iterative design, task analysis, evaluation and prototype development. The five objectives of UCD as mentioned by Thimbleby [46] include; 1. To iterate design to continuously improve 2. To eliminate areas that have challenges from the design including the requirements 3. To identify and prioritize usability values with users. 4.to test against usability criteria and 5. To match task requirements to design. In UCD [47] as stated by Buurman[47], it involves all the users in the whole process of design. This sis done so as to link the product to the users' needs and requirements. Users are involved in the entire process. This is in order to match the product to the users requirements. It increases user acceptance of new technology. That is according to Kotogiannis and Embrey [48]. It allows users to join in the design process . This design procedure reduces the development time and expenses. This is achieved by reducing the amount of change needed in the future design stages [49]. In the whole process, the users should be able to comprehend the design procedures and the designers should be able to understand the users who are to use the design [50];[51].

The process of design causes great interaction between clients and designers [52]. Other stakeholders also facilitate communication around the design. Interaction design is classified as contextual by nature by Saffer [51]. It acknowledges that it must provide solutions to

certain challanges under specific environment using the available materials. ISO 9241 includes necessities and proposals to the original ISO 13407:1999 [53]. This is in order to conduct and organize the practical application of knowledge in ergonomics and usability.

The changes include; it emphasizes that the methods of UCD can be used throughout the system life cycle, clarifies the whole iterative process and not just the evaluation, clarifies UCD principles, and also explains the activities of design. A number of principles that should be considered in the development of the interactive system are listed by ISO 9241-210[53]. The principles should be considered when the goal is to design an interactive system centered on users and their needs. The system should also be useful and easy to use. They include;

a) "The project should be based on the explicit knowledge of users, their tasks and surroundings. The design should take into consideration aspects involved in the project, indirectly or directly. The importance of this is the establishment of system requirements. An interface to be used in the social activity, for example, should be very different from the one to be used in traffic lights[53]" .
b) Users should be involved throughout the development process project; user engagement is a valuable source of knowledge about the context of use and should be used to explore solutions. The nature and frequency of engagement will depend on the type of project in question [53].
c) "All users should be involved throughout the process of project development. Engagement of users is an important source of information about the context of use. This should be used to explore solutions. The frequency and nature of engagement will depend on the type of project being undertaken[53]".

d) The design process should be repetitive. In ISO 9241-210[53], the iteration is the refinement and review of design specification from the acquisition of new information. This seeks to reduce the danger of developing a system that does not reach the requirements and user expectations.

e) The users architectural integrity encounters should be looked at; "The user experience is a result of the presentation, functionality, system performance, the interaction behavior and assistive capabilities of an interactive system, both in terms of hardware and software. The user experience is also consequent of previous user experience as well as their attitudes, skills, habits and personality the capabilities, limitations, preferences and expectations must be taken into account in the specification that features are the user's competence and what system of competence" [53].

f) Multidisciplinary skills and perspectives should be included in the project team. Team members should come from different areas. This is to gather enough skills, experiences and views so that they can be shared and benefit projects with this diversity.

2.5 ERP Architecture

2.5.1 MVC Architecture

MVC is a common architecture that is used to implement the ERP. M stands for MODEL classes, C stands for Controller and V stands for View Pages. The pattern of the MVC is made up of the following three major sections; [54]

The pattern of the Model View Controller MVC is composed of three major sections;

Model – This model is found at the low most section of the mound. It is in charge of data maintenance.

View – This section is in charge of presenting a large chuck or the whole chuck of data to the users.

Controller – This program code manages the interactions between the model section and the view section.

The MVC is liked as it separates the application logic from the user interface. It also supports separation of concerns [54] [55]. The controller accepts all the requests for the application. It then works with the model to provide the data required by the view mound. The view then uses the data made by the controller to prepare a final presentable response. The MVC abstraction can be presented as follows graphically.

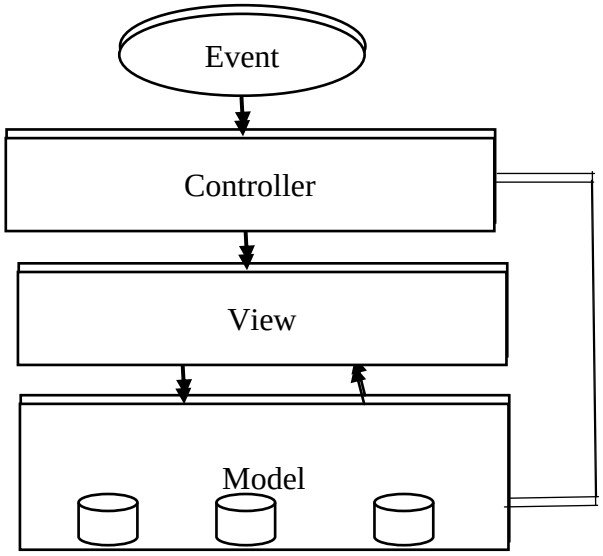

Figure 2. 1: MVC System Architecture [54]

The model is in charge of organizing the data of the application layer. It answers to the request from the view and responds to instructions from the controller to make itself up to date.

View: it presents data in a particular format, influenced by a controller's decision to present the data. They are script based templates. For example, PHP,ASP, JSP. They are very easy to integrate with AJAX technology.

Controller: this section is responsible for answering to user input and perform interactions on the data model objects. It receives the input, authenticates it and then performs the operations required which modifies the state of the data model [54] [55] [1].

2.6 Theories, models and framework

This section will look at same of the theories, models and frameworks that contribute to the functionality of the ERP in higher education. They contribute to the final conceptual framework that guide the work.

2.6.1 Task Technology Fit Theory

TTF provides a relevant and comprehensive theoretical framework for addressing the issues related to the current Enterprise Resource Planning design studied. First, task characteristics apply to the underlying characteristics that differ among the different users of the ERP in different sections of the higher learning institution. Second, technology characteristics pertain to the attributes associated with consumer interface design; specifically interfaces of the different modules of the ERP [29].Third, individual characteristics encompass the inherent differences that exist across a heterogeneous set of consumers, in this particular case – personality. Finally, the congruence of these three preceding factors is used to predict and understand any performance related issues, such as functional suitability, user satisfaction among others [29].

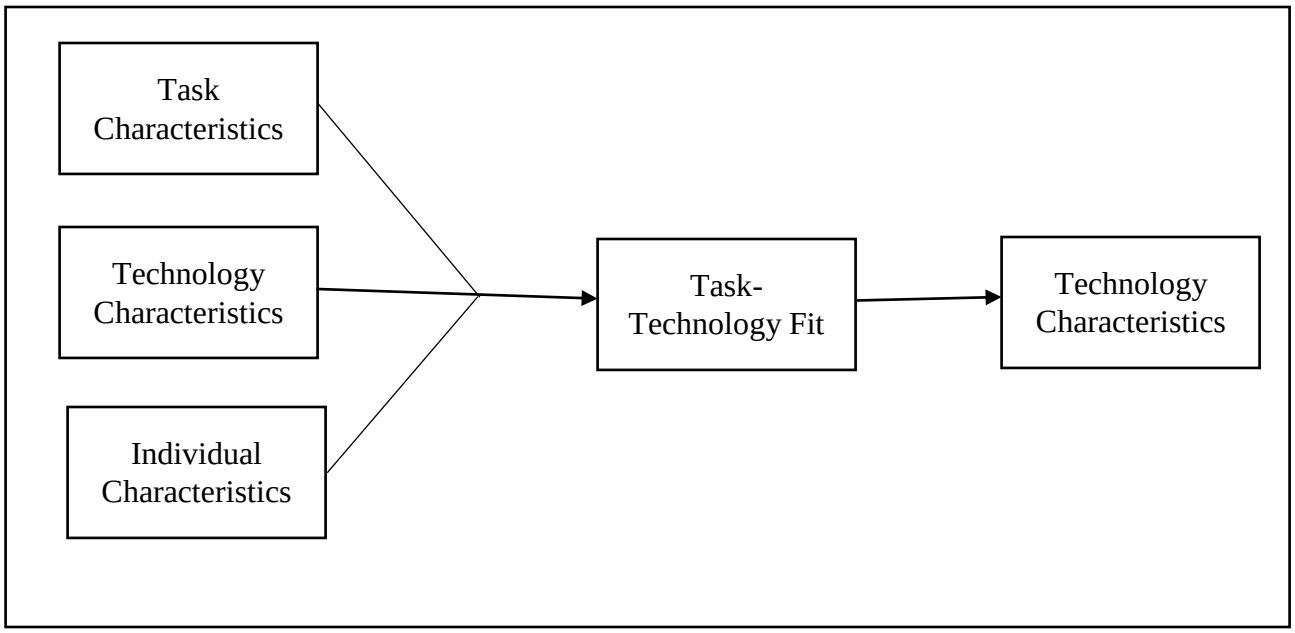

Figure 2. 2: Task Technology Fit Theory [29]

2.6.2 Software Quality Models

The last few years have witnessed an increase in studies conducted concerning the evaluation of software functional suitability. A number of factors, whose mandate is to carry out the examination of these characteristics, has come into being as a direct result of that work [56]. Models of software are important to get information so that action can be taken to ensure that their performance is improved. Such performance can be in terms customer satisfaction improvement, measured standards and decrease in prices of standards [57]. Quality models and software metrics play a vital role in gauging the role in measurement of software standards. Different scholars have proposed different models of software quality to help gauge the standards of software outcomes[57]. Below are some of the models from the quality management gurus;

2.6.3 **McCall's Quality model (1977)**

This model is one of the most common quality model in the literature of software engineering. The McCall model is targeted towards the system development process and system developers[58]. It reduces the gap between developers and users. This is done by focusing on a number of software quality characteristics that show the views of both developers and users. This model has three main aspects; product revision, product transition and product operations [59].

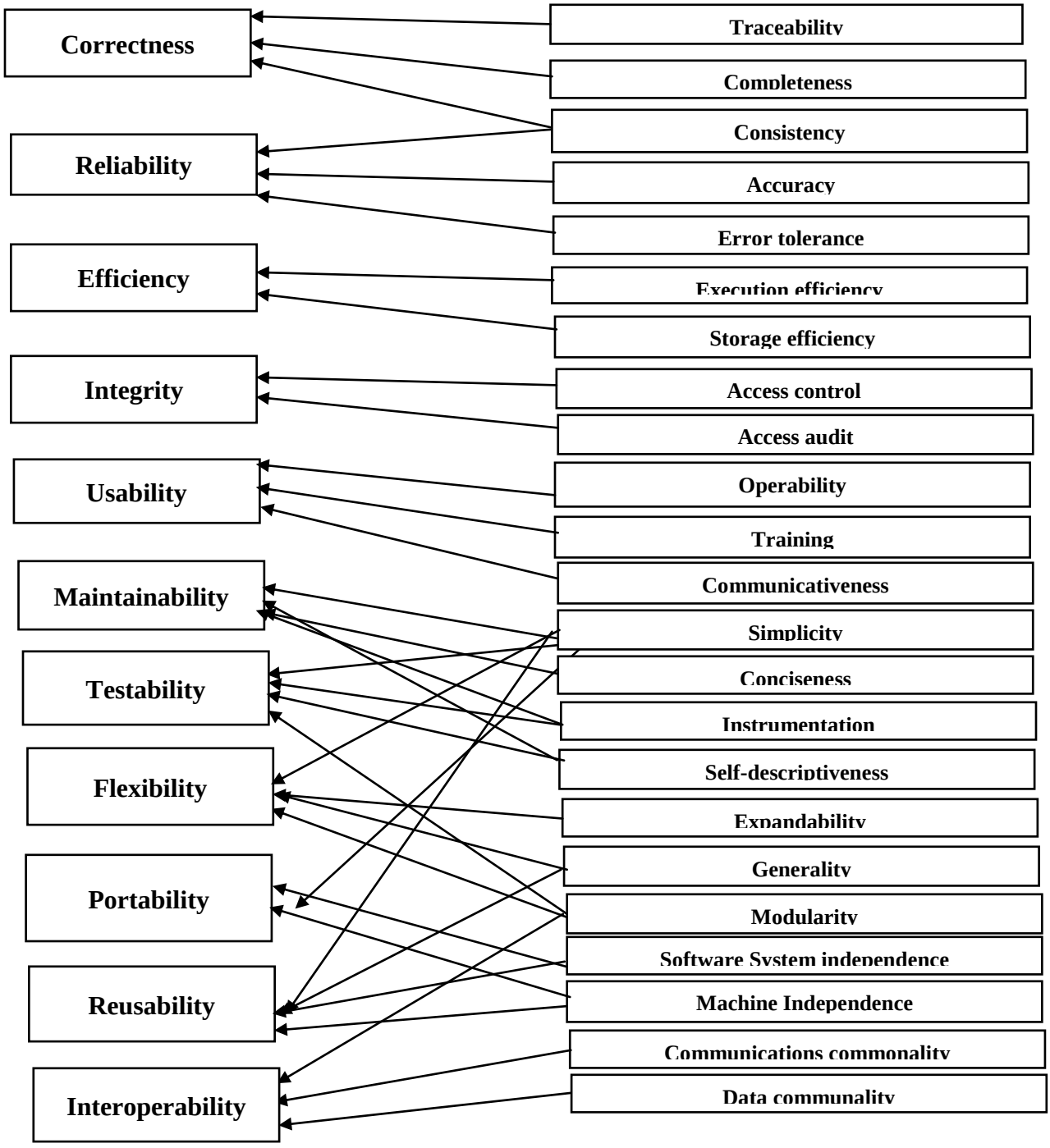

Figure 2. 3: McCall Quality Model [59]

This model is made up of eleven quality characteristics to give a description of the external view of the software i.e. users' view. It also has twenty three quality factors to give a

description of the internal view of the software i.e developer's view. A set of metrics are used for quality evaluation. The product revision category consists of the following attributes, efficiency, usability, correctness, reliability and integrity [58], [60]. This model's fundamental idea is to asses the relationship among product quality criteria and external quality factors. The relationship between metrics and quality characteristics is the main contribution of this model [60].

2.6.3.1 Criticism of the McCall's Quality model (1977)

There are some criticism towards the McCall model. For instance, not all the metrics are objective [61]. Furthermore, functionality of the software product in this model is not considered [62]. Furthermore, the model completely leaves out the functional suitability in organizations including the education institutions [6]. The design coherence is not considered in the model. Furthermore, not all the factors or standard processes in the model is related to the design integrity about the knowledge and integrity to the design decisions. The model is perfect fit for general application systems, and thus some features are not in the domain specific. Another disadvantage is the accuracy in quality measurement of the model. It is based on responses of Yes or No. the users' vision is also diminished since the model does not consider the functionality.

2.6.4 Boehm Model (1978)

Boehm introduced this model for assessing both the quantitative and the quality of software [61]. Its hierarchical structure is similar to McCall structure. It consists of the high level, intermediate level, and the low level characteristics. The average standard of the software is contributed by each of these factors. The model takes into consideration some account of software product with regard to the utilization of the program. The extended factors by

Boehm to the McCall model by putting emphasis on the maintainability factor of a software product. This is one of the positives of this model[59]. The standard metrics can be used to give the foundation for definition of quality metrics. This use is one of the most significant objectives established by Boehm when he created his quality model. One or more metrics are supposed to weigh a given primitive factor. Boehm defined the 'metric' as "a measure of extent or degree to which a product possesses and exhibits a certain (quality) characteristic."

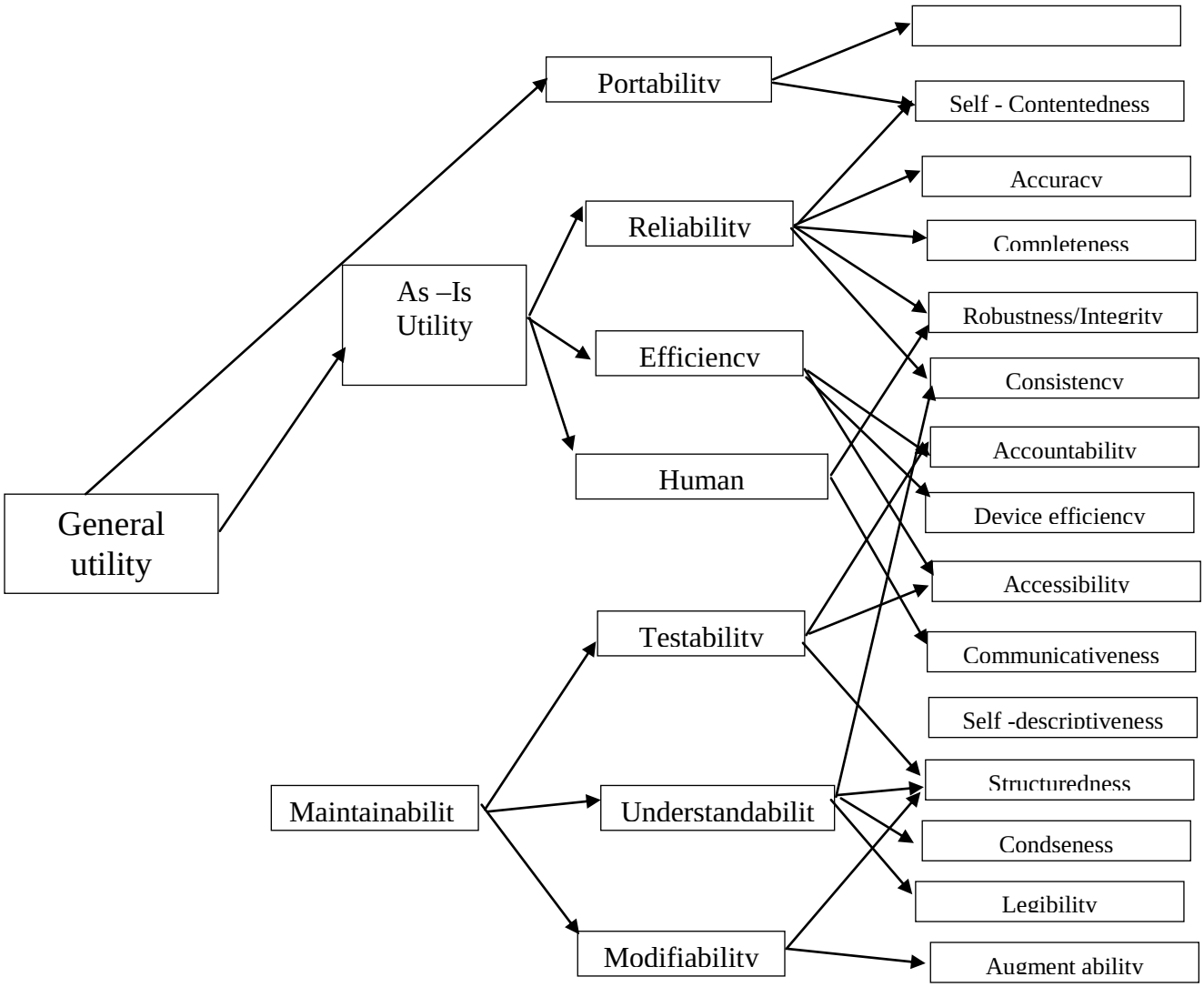

Figure 2. 4: Boehm's Model [61]

2.6.4.1 Criticism of the Boehm Model (1978)

Just like McCall, Boehm model ignores the functionality aspects of the software which is not mentioned anywhere within the model [6]. All the software evolvability sub characteristics in the Boehm's quality model is not explicitly taken care of. Additionally, analyzability is partly addressed in the character understandability. Understandability is supposed to give a description that the reasons of the code is clear to the inspection. Furthermore, none of the circumstances or measurable characteristics are able to describe the ability to assess the impact at the software integrity level due to change initiators. [63]. In this model, also architectural integrity is not covered in the model.

2.6.5 FURPS Model

FURPS model as put by Robert Grady and Hewlett Packard subdivides factors into two categories of requirement. They include the functional requirements and the non-functional requirements [64]. The functional requirements consists of only input and the output. The nonfunctional requirements consists of performance, usability, supportability and reliability. The term FURPS is an acronym that entails five characteristics. That is functionality, usability, reliability, performance, and supportability [64].

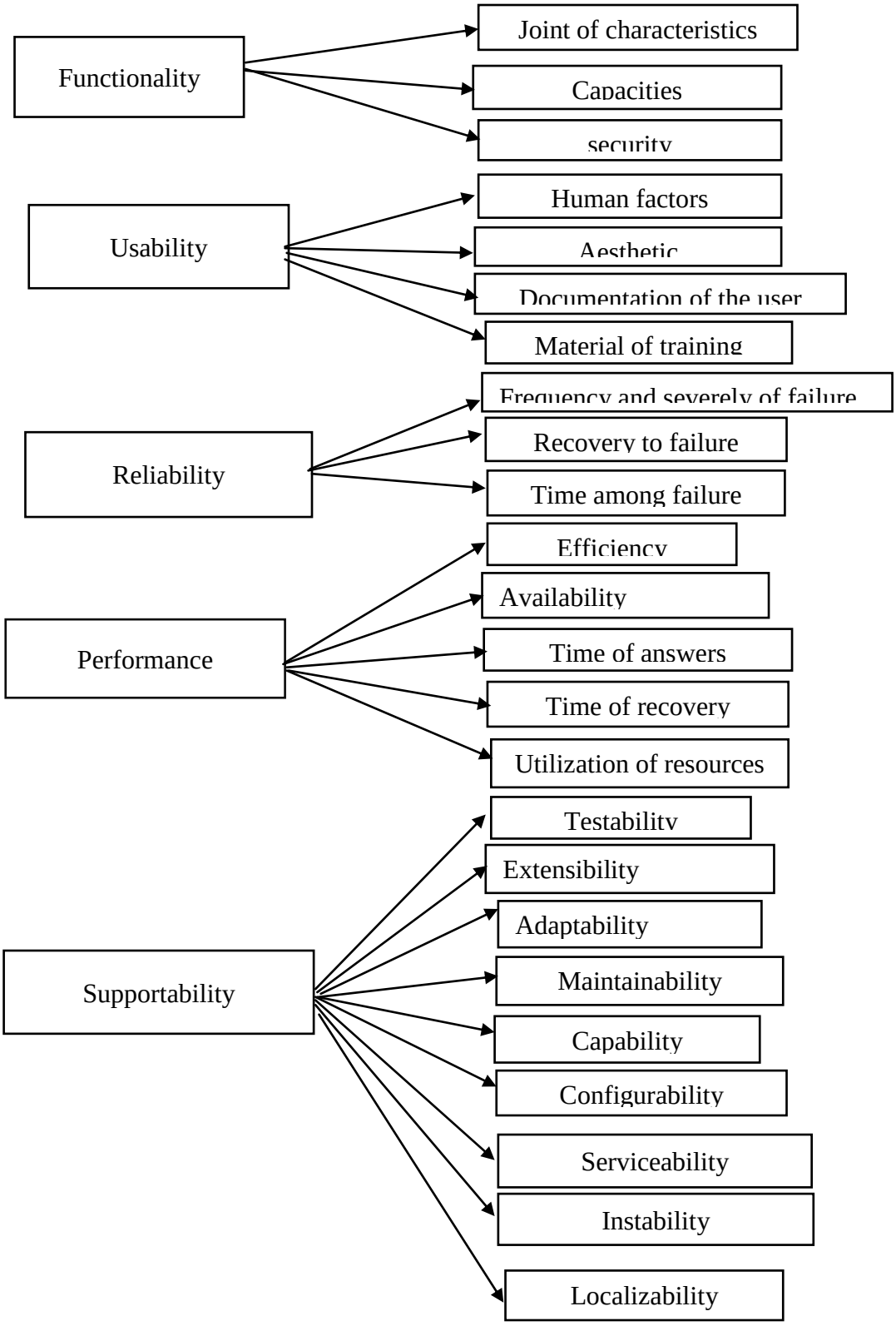

Figure 2.5: FURPS Model [7]

2.6.5.1 Criticism of the FURPS Model

It is important to note that domain specific attributes and software product portability were not addressed in this model [38]. The model does not consider the subsets of functionality such as suitability, accurateness, interoperability, security and compliance [6]. The traits or sub-traits in the model are not related to the architectural integrity. This is in respect to the comprehending and coherence of the decisions of the architecture. [64] One major disadvantage of the FURPS model is that it does not take into account the software portability. Furthermore, other attributes like domain specific are not addressed [63].

2.6.6 Research gaps in Reviewed model

After analyzing the above models, the study was able to identify the following research gaps. They were summarized as follows;

Table 2. 2: Summary of Limitations of Software Quality Models

MODEL	LIMITATIONS
McCall Quality Model	✓ Metrics are not objective. ✓ Software functionality is not considered. ✓ Functional suitability in organizations (including HE institutions) not covered. ✓ No quality architectural integrity ✓ Proposed for general applications only ✓ No accuracy in measurement of quality
Boehm Quality Model	✓ Software functionality is not covered. ✓ No quality architectural integrity. ✓ No software evolvability ✓ No architectural integrity
FURPS Quality Model	✓ Software portability not addressed. ✓ Software functionality not considered. ✓ Subsets of functionality are ignored ✓ No architectural integrity

2.7 Conceptual Framework

A conceptual framework is an argument that the concepts chosen for examination or reading and other anticipated relationship among them. The concepts will be important and useful under the research gap under study. It contributes to a research report in at least two ways; first, it identifies research variables; secondly, it clarifies relationship among the variables [34].

System features and tools determine the system's functionality attributes. According to ISO/IEC IS 9126-1 system attributes that affect that affect functional suitability of a software functionality and user satisfaction include; suitability, accurateness, interoperability, compliance to standards and security [34].

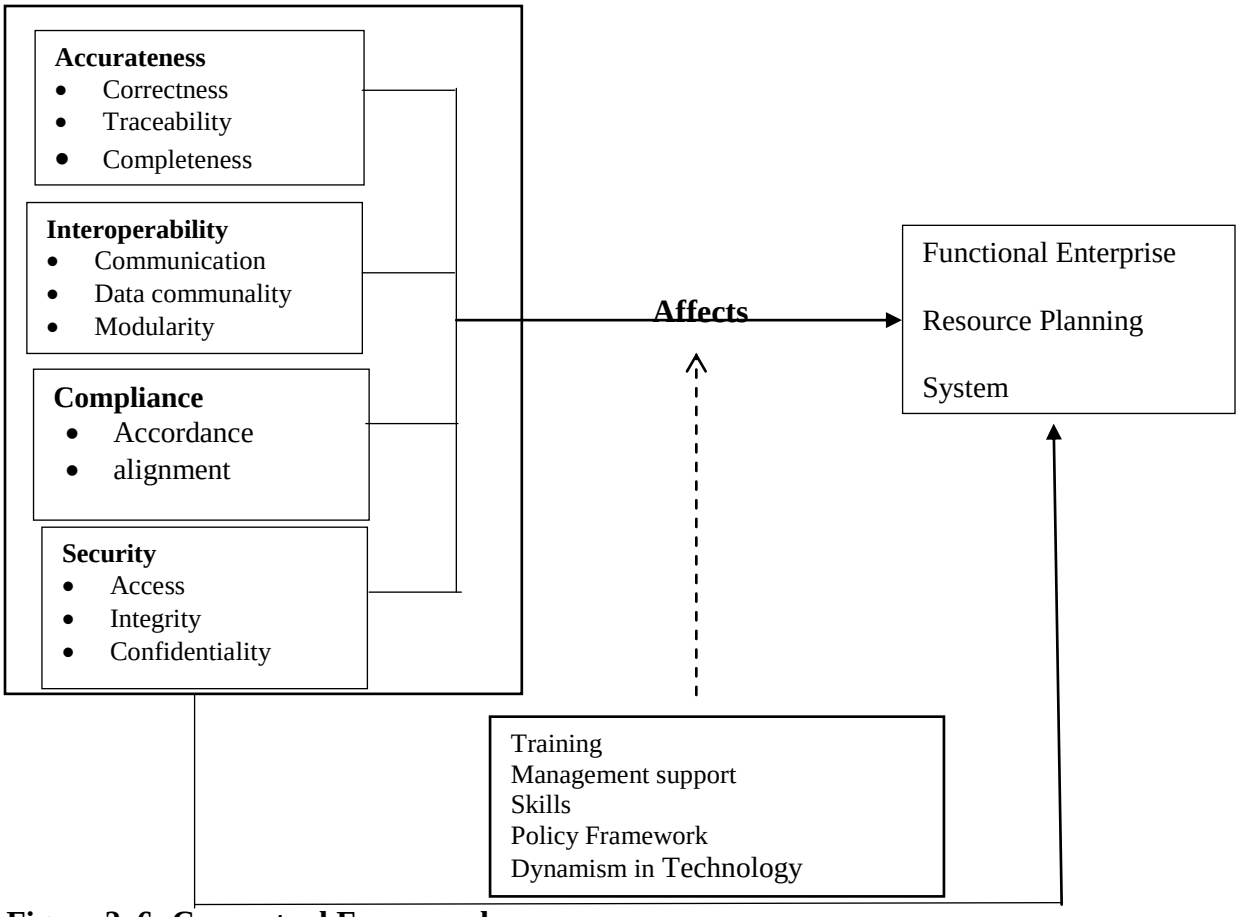

Figure 2. 6: Conceptual Framework

2.7.1 Accurateness

It is the degree of precision of the functionality of the system software. The system should be able to meet the specific tasks of the users without any challenges. Accurateness is an important characteristic since it will determine the users' willingness to use the system.

2.7.2 Interoperability

A certain software part or parts of the software do not typically work in isolation. The sub-set functionalities concerns the capability of a software part to it interact with other parts of the system. The structure of data exchange if defined by the interoperability structure. It makes sure that the exchange between data technology systems can be explained at the data field level.

2.7.3 Compliance

According to ISO/IEC 25010, compliance is defined as the rate at which functionalities enhance the success of the activities and objectives that have been set. Every organization, industry and even the government has rules that need to be followed to the latter. The sub unit deals with the compliant capability of the software.

2.7.4 Security

The ability to prevent to allow only authorized access to data, information or a system is considered security. This at architectural and design level means to have a way of performing exclusively that task. This may be a part or a functionality that is integrated into another part. It can be shaped into a characteristic whose value is a no or yes. This depends on the availability of the device or mechanism

2.7.5 Training

Training is an activity that is planned systematically. It is supposed to improve level of skills, information and efficiency that are required to perform work effectively [65]. It is evident that human resource is a crucial resource. It's essential to maximize the output of the employees to the organization. The goal is to to meet the goals and sustain effective performance. This therefore calls for organizations to ensure that there is enough human resource that is viable both technically and socially [66]. This will not only propel their career but also help to provide specialists in departments. The firm's only intellectual property are the employees. They are the only source of resource that will help the firm to gain competitive advantage. For any organization to be successful, they have to fully invest in the training of its staff [65].

2.7.6 Management support

Information system management support refers to the degree, to which an individual believes that institutions are committed to the successful implementation and use of the interactive technology, including information systems [67]. In this study, management support refers to the degree to which a HE institute supports the adoption and the use of the ERP as a new technological tool in teaching, learning and management of the HE. Mutohar [68] puts forth the idea that an important measure is the provision of support for staff in the integration of technology [68]. Ideally, institutions should provide technological support for example: teach the staff to troubleshoot and to overcome instructional issues if any, instead of relying on vendors and sellers that may cause many technological and economical break down when they arise.

2.7.7 Skills

A skill is a capacity and ability that one gets through systematic, deliberate and sustained effort. It enables one to carry out sophisticated functions or job activities that involve ideas, technical skills or other people [69]. Skills lead to competence. Competence is a group of commitments, skills, knowledge and related abilities. Competence point to abundance of information and skills that enables anyone to act in different situations. Knowledge involves practical skills, involved in efficient use of ICT and the electronic information resource. Skills go beyond the technical skills. It influences also the cultural and even the philosophical context and impact [69].

2.7.8 Policy framework

For organizations to stay put in today's turbulent commercial environments, they must heavily invest in the information systems available [70]. Ways of providing protection of data and information held in these systems is proving to be key to management in different organizations. Institutions often use security methods such as the firewall to provide protection to important information systems assets [71]. Other sophisticated mechanisms put into practice include content monitoring technologies, log file management and data leak prevention. As much as organization use these tools to protect their data, they are never a sufficient way to protect the information systems resources [71]. Socio organizational imperatives are important in enhancing the output for institutions in such issues [72]. Among the methods used to streamline the behavior of their employees in regard to how information systems are used. The common methods used include the use of guidelines, rules and requirements put out in their use of information systems security policies [72].

There are policies, rules and regulations to safeguard the information systems at work place. That include against misuse, destruction of assets, abuse, employees always do not comply with such rules [73]. A lot of research is needed to improve people's understanding to encourage information system policy compliance in institutions [73].

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Overview

This chapter provides the methods that were used to carry out this research. It covers areas such as the design, tools for analysis, testing, development technology and the proposed architecture.

3.2 Research design

Research design elaborates the way the study was planned and conducted[74]. The design is to help control the variation due to independent variables and do away with or reduce influence of extraneous variables. It also helps reduce error variance and at the same time ensure that the findings can be tested for significance.

The study used a case study. The case study is an empirical inquiry that looks at contemporary phenomenon, especially when the boundaries between the phenomenon and context are not evident. Quantitative and qualitative research was applied. In qualitative analysis, regression methods were applied. Tables were used to explain the data obtained about the current state of functionality of the ERP under study.

Table 3. 1 : Summary of Methodology

Objectives	Research Questions	Data Collection Procedure	Data Analysis
To determine the status of ERP implementation in Kenyan universities	What is the status of ERP system implementation in universities in Kenya?	Literature review Questionnaire	Content Analysis Descriptive Statistics
To identify factors that affect the functionality of the Enterprise Resource Planning systems in universities in Kenya	What are the factors that affect functionality of ERP systems in universities in Kenya?	Questionnaire Interviews	Descriptive
To develop a model to assess functional suitability of education software systems in universities in Kenya.	How can a model to measure functional suitability of education software system be developed to improve functionality of education software systems in universities in Kenya?	Questionnaire Interviews	Multiple Regression Inferential Statistics

3.3 Target Population and Sample

A population is the total collection of element about which we wish to make some inferences. The major target population was universities in Kenya. The universities in Kenya include both private and public universities. A sample of public universities and private universities were sampled for the same. The ERP functionality of these universities were considered before narrowing down to the University of the case study, which is MMUST. The population of interest in this study were the users of ERP system; staff members, technical ICT staff and the top ICT management staff in MMUST. Technical because they

are the ones who majorly interact, use and execute the functions of the ERP in the institution.

The researcher adopted purposive sampling technique where subjects with desired characteristics are to be identified using purposive sampling technique. Ideally, the typical case sampling technique was employed. According to Patton, this is a technique used when you are interested in the normality/typicality of the units (e.g., people, cases, events, settings/contexts, places/sites) you are interested, because they are normal/typical**.** This method was chosen because the target population was large and unknown. In this case, the researcher was interested with users who use ERP in their daily operations. The method is justified because that population is the one that uses these systems or have an idea what ERP is.

Table 3. 2: Table of Target Population

SAMPLE	**PERCENTAGES**	**STRATA VALUE (n) SAMPLE SIZE**
STAFF	80	120
TECHNICAL STAFF	7	10
TOP MANAGEMENT	13	20
TOTAL	100	150

3.4 Sample Size and Sampling techniques

A sampling frame is the list of a group or a cluster, which forms the basis of the sampling processes. This is where a representative sample is drawn for the purpose of research. Ten percent of the target population of both the target university ICT technical, staff and management respondents, was the representative sampling frame for the research.

This study used stratified random sampling technique. A stratification is the process of dividing members of the population into homogeneous subgroups before sampling. The study used stratified sampling to select departments in MMUST. Stratified sampling allowed

the researcher to target the most representative sample elements that are equipped with the knowledge about the intended phenomena.

The following formula by Robert for determining sample size of the population was used [75];

$$S = \frac{\square^2 NP\,(1-P)}{d^2\,(N-1) + \square^2 P\,(1-P)}$$

Where

Where;

S = "Required sample size".

$\square^2$ = "The table value of chi-square for 1 degree of freedom at the desired confidence level (3.841)".

N = "The population size".

P = "The population proportion (assumed to be .50 since this would provide the maximum sample size)".

d = "The degree of accuracy expressed as a proportion (0.05)".

The above formula and data can be combined to calculate the sample size as follows;

For the general population:

$S = \{3.841 * 150 * 1.70(1-0.5)\} \div \{0.150^2\,(150-1)\} + 3.841 * 0.150(1-0.150)\}$

$S = 80$

Table 3. 3: Table of Strata Value (Sample Size)

SAMPLE	PERCENTAGES	STRATA VALUE (n) SAMPLE SIZE
STAFF	80	64
TECHNICAL STAFF	7	6
TOP MANAGEMENT	13	10
TOTAL	100	80

Source (Author)

3.5 Data collection instruments

This research study used primary data. The primary data was gathered using the interview and questionnaire methods. A pre-test was done before the main data collection. Questionnaires were given to the respondents. Those that seemed not very clear were revised and corrections made to make them as clear as possible. Both open-ended questions and close-ended questions were used in the research study. It is simple to administer questionnaires and they are highly reliable. The questions were developed based on the research objectives. The questionnaire e contained three sections; Section A addressed background information, Section B will sought information on factors that affect use of ERP applications while Section C and others will address technology preferences on ERP applications by users.

3.5.1 Questionnaire

A questionnaire is a tool to gather data. It contains questions that are written down and given to other people referred to as respondents. The respondents also give their answers in written form. The questionnaire can be given to the respondents using different ways. They can be sent through the mail delivery, hand delivered or even online [76].

The research questionnaire was administered with the help of the research assistants. They administered the questionnaire in different departments to different categories of people in the field. The questionnaire had six different sections namely;

Section A - (Demographic Section) – Section got the demographic information of the users of the ERP. For example, their gender, age and level of education among others.

Section B - (ERP awareness Section) - this section gathered information on whether the users are aware of the existence and use of ERP in the university. It gathered information about their general knowledge on ERP existence.

Section C - (User Involvement) – this section gathered information about user involvement in ERP functional suitability analysis. It sought to establish whether users helped developers capture user needs and expectations.

Section D - (Functional Success of ERP) – this section got information on whether the use of ERP was successful or not. It explored on whether the users got exactly what they expected from the ERP system.

Section E - (Causes of ERP Failure/Underutilization) – this section gathered information on user needs and expectations. It also explored the various causes of ERP failure/underutilization from the users' perspectives.

Section F - (Functional Process) – this section captured information from the users on what they think affects the functionality process.

3.5.2 Interview

Another common data collection method is the interview. The respondents are orally asked question as a person or as a group. The person asking the question can note down the

answers one by one or can use other means like tape recording. The person asking the question can also use both methods to get the answers [76].

Interviews can be conducted with varying degrees of flexibility. The two extremes, high and low degree of flexibility, are described as High degree of flexibility Low degree of flexibility [76]. The researcher sought to get critical information from the key stakeholders of the ERP system. These are the people are largely involved in the running, implementation and functioning of the ERP system in the university. The key areas the interview gathered information from included;

The nature of users – the researcher wanted to know the specific group of people that heavily uses the ERP system in their daily operations. The university is big and has many groups of people ranging from students to the staff.

The user needs – From the varying users of the ERP, the researcher gathered the different needs of the users from an expert's point of view.

Functionality – the researcher sought to get the functionality of the ERP in its environment. The knowledge.

ERP challenges – the researcher wanted the key stakeholders to mention some of the challenges they encounter with the use of ERP system.

The key informants the researcher interacted in the interview included;

Director ICT, System Administrator and the network administrator

3.6 Validity and Reliability

3.6.1 Reliability

Research tools should be able to give the same results repeatedly after different trials. This is referred to as reliability in research. This type of reliability is called test retest. In this

scenario, the results of test number one should be the same results of test number two even if they are done after some period of time (Yin, 2003).

Alpha coefficient was used to test reliability of the instrument whereby a coefficient of 0.70 Or more is acceptable. A high Cronbach alpha coefficient (0.7 and above) implies that the items correlate highly among themselves, that is, there is consistency among the items in measuring the concept of interest.

3.6.2 Validity

Validity refers to the relationship between measure used and some external/alternative measure "criterion" of the same concept. A predictive validity deals with how well does the measure used predict performance on another indicator (which is assumed valid)? A theoretical, empirical approach to validation deals with the sample for pre-test which was also used to test data validity [77],[78]. The validation of the instrument aimed at ensuring the instrument was measuring what they were intended to measure.

The researcher utilized experts in the IT, (who included the supervisors) field in order to ensure face and content validity of the instrument. The experts ranking them in a scale of out of ten examined the questionnaires and interview schedule. They were examined to determine if they extensively covered the topic under study. The questionnaire was ranked as follows by the three experts consulted; the first one gave seven, the second one seven while the third one gave eight to the scale out of ten. This averaged to seven out of ten, which showed the questionnaire was aligned to the research values. The interview schedule was also examined and given the following score out of ten. The first expert assigned eight out of ten, the second seven and the third eight out of ten. This averaged to eight out of ten.

3.7 Data Processing and Analysis

Descriptive statistics was used for the analysis of primary data. This was in order to give an over view of the respondents perception of the different aspects of the research objectives. Graphs were used where necessary for clarity of the research findings and understandability. Clean up for mistakes was done on all the secondary data that was gathered. The data was then coded to allow response put into groups. After the coding, the data was then grouped according to similar characteristics. The common traits were tabulated in an intact form using rows and columns. This was to facilitate detailed analysis, comparisons and explanations. Furthermore, quantitative analysis was used to interpret and elaborate the outcome of the study. In order to remove the possibility of getting wrong relationships, the study ensured that all the variables incorporated into the predicted model are clearly established in the literature

3.8 Ethical Consideration

The research considered all the requirements to maintain its ethical considerations. First of all, the respondents were assured of confidentiality of their responses. Besides, the researcher sought for a letter of approval from the directorate of postgraduate studies (Appendix IV). A research permit was also granted from the National Commission for Science technology and Innovation (NACOSTI) (Appendix V). This was to facilitate the process to be carried out under laid down procedures.

CHAPTER FOUR

DATA ANALYSIS AND PRESENTATION

4.1 Introduction

This chapter presents the research analysis, findings and data presentation of the study. Descriptive statistical analysis included; frequencies, means, standard deviations, and percentages. The chapter also presents correlations and regression analysis, and inferences drawn from the analysis.

4.2 Reliability and validity tests

Reliability of an instrument is the consistency of an instrument in measuring what it is intended to measure. This was established by first ensuring internal constancy approach followed by carrying out a pilot study. A questionnaire is considered reliable if the Cronbach's Alpha coefficient is greater than 0.70. The variables were subjected to reliability test using SPSS and the results obtained are shown in Table 4.1

Table 4. 1: Reliability test

Variable	Cronbach alpha
Functional Enterprise Resource Planning System	0.791
Functional Accurateness	0.771
Functional Interoperability	0.736
Functional Compliance	0.903
Functional Security	0.902

The results indicated that all the variables obtained had Cronbach's Alpha greater than 0.7 thereby achieving the recommended 0.7 for internal consistence of data (Mugenda & Mugenda, 2008).

Data validity is the degree to which a test measures that which it is supposed to measure (Porter, 2010). Mugenda and Mugenda (2008) define validity as the degree to which the research results obtained from the analysis of the data represent the phenomenon under study.

According to Table 4.2 Kaiser –Meyer -Olkin measure of sampling adequately indicated KMO value of greater than 0.5 meaning thereby that the sample size was good enough to treat the sampling data as normally distributed. Bartlett's test sphericity which tested the null hypothesis "item to item correlation matrix based on the responses received from respondents for all the effective variables was an identity matrix". The Bartlett's test was evaluated through chi-square test as shown in Table 4.2 for the entire variables and were all significant at 5% level of significance, indicating that null hypothesis is rejected.

Table 4. 2: Test for validity

Factors	**KMO test**	**Barlett's test of sphericity**		
		Chi-Square	df	Sig.
Functional Enterprise Resource Planning System	.906	221.26	4	0.000
Functional Accurateness	.907	340.74	4	0.003
Functional Interoperability	.310	220.28	4	0.000
Functional Compliance	.868	310.05	4	0.000
Functional Security	.772	243.50	4	0.004

Extraction Method: Principal Component Analysis.

4.3 Response Rate

In this study, out of 80 questionnaires that were distributed to the sampled respondents, 77 of them were filled and returned. Therefore, 77 were correctly filled and were used for the analysis, which made up a response rate of 96.25%.

Table 4. 3: Questionnaire Return Rate

		Frequency	Percent
Valid	Returned	77	96.25
	Not Returned	3	3.75
	Total	**80**	**100.0**

Source: (Researcher, 2019)

In this study, the researcher employed various strategic techniques that attributed to the high response rate. The researcher recruited two research assistants who distributed and collected the questionnaires while the researcher carried out the interview schedules with the key informants in the study.

4.4 Demographic Characteristics of the Respondents

This section contains the analysis of the respondent's information on the gender of the respondent, education level, designation of work, age of the respondent, level of experience, school where they belong and location of the place of work. The main purpose of this was to find out on any trend from the respondent's profile that was directly linked to the variables of the study.

4.4.1 Distribution of the respondent by Gender

The study sought to establish the gender status of the respondents in the Study. Table 4.4 shows the distribution of the respondents according to their gender status.

Table 4. 4: Gender status of Respondent

Gender	Frequency	Percent	Mean	Std. Deviation
Male	50	64.9	1.35	.480
Female	27	35.1		

Results in Table 4.4 illustrates that the majority of the respondents were male at 64.9% while the female respondents were 35.1% with a mean of 1.35 and a standard deviation of 0.480. The study attributed to show the existence of a gap in the employment in the Kenyan public sector which is predominantly dominated by male gender.

4.4.2 Distribution of the respondent by Level of education

The study sought to establish the education level of the respondents in the study. Table 4.5 shows the distribution of the respondent according to their education levels.

Table 4. 5: Education level of ERP users

	Frequency	Percent	Mean	Std. Deviation
Diploma	12	15.5	3.29	0.825
Degree	37	48.1		
Masters	22	28.6		
PhD	6	7.8		

The findings in Table 4.5 indicate that majority of the respondents were degree holders representing a 48.1%, 28.1% were masters' holders, 7.8% were Doctorate degrees' holders (PhD) and 15.6% of the respondent were Diploma holders. This meant that the sample used in the study was well distributed in terms of the education level, as many non-teaching staffs are diploma, degree and masters' holders. This also shows most of the respondents had

necessary skills and competencies required to perform their duties effectively. In addition, majority of the respondents had enough experience with the ERP system. Therefore, they can perform their duties effectively.

4.4.3 Designation of the respondent.

The study sought to establish the designation of the respondents in the study. Table 4.6 shows the designation distribution of the respondents.

Table 4. 6: Designation of ERP users

	Frequency	Percent	Mean	Std, Deviation
Secretary	25	32.5	2.99	0.881
Administrator	30	39.0		
Academic Staff	18	23.4		
Others staffs	4	5.1		

The study findings in Table 4.6 indicate that majority of the respondents were Administrators serving at various capacities in the university representing a 39.0%; 32.5% of the respondent were designated as secretaries serving in various schools and department. Academic staffs were representing a 23.5% and other supporting staff were representing a 5.2%. Thus, the highest number of ERP users in the university are the Administrators and Secretaries followed by members of the academic staffs.

The administrators and secretaries are the key users of the ERP system as they access it daily either on reporting of student, checking of student details and requesting of office accessories online. On the other hand, most of the academic staffs rarely uses the ERP except when loading and approval of marks in the ERP system.

4.4.4 Distribution of the respondent by Age

The study sought to establish the age groups of the respondents in the study. Table 4.7 shows the distribution of the respondents according to their age groups

Table 4. 7: Age of users of ERP in the University

Age	Frequency	Percent	Mean	Std. Deviation
Below 25	2	2.6	2.64	0.810
26-35	38	49.4		
36-45	23	29.9		
46-55	12	15.6		
Above 55	2	2.5		

Table 4.7 illustrates that majority of the respondent (ERP users) in the university were between the age bracket of 26 – 35 years representing a 49.4%. 29.9% of the respondents were between 36 – 45 years of age. While 2.6% of the respondents were aged below 25 years; 15.6% were aged between 46 – 55 years of age and 2.6% of the respondent were above 55 years of age with a mean of 2.64 and a standard deviation 0.810. This meant that the sample used by the study was well distributed in terms of the age and therefore it gives a reliable information about the use ERP.

The study establishes that the majority of the respondent were mainly young adults (26 – 35 years of age). Majority of the office administrators and secretaries in the university are young people who are innovative and creative in problem solving. They are the majority that are in use of the ERP users in various operations of the university. The working forces in the public universities are becoming increasingly diverse in age demographics, creating professionalism environs that are rich with experience and maturity. Institutions that employ

workers in wide ranges of ages have the advantage of creating a dynamic, multi-generational workforce, with a diverse range of skills sets that is beneficial to the institution.

4.4.5 Distribution of the respondent by their working Experience.

This study also sought to establish the working experience of the respondents. This was done to link the study with the previous studies that indicated a strong relationship between the experience and employee working performance. Table 4.8 shows the distribution of the working experience of the respondents.

Table 4. 8: Length of Experience of ERP users.

Experience in years	Frequency	Percent	Mean	Std. Deviation
Below 2	14	18.2	2.7	1.405
3-5	30	39.0		
6-8	16	20.8		
9-11	11	14.3		
Above 12	6	7.7		

The findings in Table 4.8 indicates that majority of the respondents at 39.0% had worked in the university for between 3 – 5 years. Those who had worked in a university for less than 2 years were representing an 18.2% with a mean of 2.7 and standard deviation of 1.405. Ideally, all combined, more than 80% had worked in the university for more than 2 years. From the findings, the researcher concluded that majority of the respondent had enough experience in the use of ERP system and therefore would provide a valid and credible information concerning the ERP system usage and challenges met when using the system. Therefore, it was established that experience in ERP usage meant most of the respondents were aware of the challenges and failures of it.

4.4.6 Distribution of the respondent by their working Experience.

This study also sought to establish the school where the respondents belongs. The findings were illustrated in Table 4.9

Table 4. 9: Distribution of the Respondents by School

School	Frequency	Percentage (%)
SCI	21	27.2
SEDU	6	7.7
SASS	12	15.5
SONAS	5	6.4
SOBE	7	9.0
SEBE	9	11.6
SONMAPS	5	6.4
SOM	4	5.1
SAVET	5	6.4
SHDMA	4	5.1
	77	**100**

The study findings of Table 4.9 shows that majority of the respondents were from the School of Informatics and Computing representing 23.7%. While School of Arts and Social Sciences represented 15.6%. Additionally, 10.4% of the respondents were from the School of Engineering and Built Environment (SEBE). Other respondents were distributed as the summarized in Table 4.9 This meant that the sample used by the study was well distributed according to all the school in the universities and eventually cutting across all the

departments in the university. Therefore, provide reliable information about the ERP usage across the university.

4.4.7 Place of Work of the respondent.

The study sought to establish the location of the respondent in the study. The summary of the findings is presented in Table 4.10

Table 4. 10: Location of the ERP users.

Location	Frequency	Percent	Mean	Std. Deviation
Main Campus	60	77.9	1.22	0.417
Satellite Campus	17	22.1		

The study findings in Table 4.10 shows that majority of the respondents were from the main campus representing a 77.9%. While 22.1% of the respondents were from different satellite campuses of the university. This meant that majority of the ERP users were from the main campus where there is centralization of all operations done from the satellite campuses. Most of the satellite campuses have limited access to internet therefore affecting the functionality and usability of the ERP system.

4.5. Usability of the ERP system

In this section, the study sought to examine the usability of the ERP system in the university by the respondents. The summary of the findings was presented as below:

4.5.1 Usage of ERP of day-to-day activity of the university.

The study sought to establish the usability of the ERP system in the day-to-day activities of the university. Table 4.11 shows the findings on the usability of the ERP system

Table 4. 11: Daily use of ERP in university activities.

	Frequency	Percent	Mean	Std. Deviation
Strongly Agree	29	37.7	1.62	0.488
Agree	48	62.3		
Not Sure	0	0.0		
Disagree	0	0.0		
Strongly Disagree	0	0.0		

The study findings presented in Table 4.11 shows that majority of the respondent agreed at 62.3% that the ERP system was used on day-to-day activity of the university with a mean of 1.62 and standard deviation of 0.488. While 37.7% of the respondent strongly agree that every university activity run by the university were based on the ERP.

4.5.2 Usage of ERP.

The study sought to the usability of the ERP system by the respondent. Table 4.12 shows the findings on the individual use of the ERP system by the respondent.

Table 4. 12: Use of ERP

	Frequency	Percent	Mean	Std. Deviation
Yes	71	92.2	1.08	0.270
No	6	7.8		

The findings in Table 4.12 shows that majority of the respondents were aware of the usability of the ERP system representing a 92.2% with a mean of 1.08 and standard deviation of 0.270. However, 7.8% of the respondent had not used the ERP in any of the

activities of the university. This meant that the sample used in the study was well distributed as majority of the respondent have interacted with the ERP in one way or another. Therefore, a reliable and valid information on the ERP system use was provided.

4.5.3 How often does the Respondent use the ERP?

The study sought to establish how often the respondent uses the ERP system. The findings were summarized in Table 4.13

Table 4. 13: Frequent use of ERP

	Frequency	Percent	Mean	Std. Deviation
Daily	49	63.9	1.73	1.210
Weekly	14	18.2		
Once a semester	6	7.8		
Rarely	2	2.6		
Never	6	7.8		

From the study findings in Table 4.13, most of the respondents were daily users of the ERP representing a 63.9%. 18.2% of the respondent reported to be weekly users of the ERP system. While a total of 7.8% of the respondents uses the ERP system once per semester. 2.6 % of the respondent reported that they rarely uses the ERP system and 7.8% of the respondents have never interacted with the ERP system.

4.5.4: Training of the Respondent on the use the ERP.

The study sought to evaluate whether the respondents were trained on the use of the ERP system by the university. The findings were summarized in Table 4.14.

Table 4. 14: Trained on use of ERP

	Frequency	**Percent**	**Mean**	**Std. Deviation**
Yes	53	68.8	1.47	0.754
No	24	31.2		

The study finding, most of the respondents were trained on the use of ERP system by the university representing a 68.8% with a mean of 1.47 and a deviation of 0.754. Additionally, 31.2% of the respondents reported that they never had any training on the use of the ERP system. However, this proportion of the untrained ERP users reported that the system is self-explanatory and no much is needed on how to use the system. This meant that the sample used would give a credible information on the ERP usability.

4.5.5 Functional Analysis Process involvement.

The study sought to establish the functional analysis process involvement of the respondents before the university acquire the ERP system or any other educational software. The findings were as presented in Table 4.15 below.

Table 4. 15: Functional Analysis Process involvement

	Frequency	Percent	Mean	Std. Deviation
Yes	33	42.9	1.57	0.498
No	44	57.1		

The study findings in Table 4.15 shows that 57.1% of the respondents were not involved in the functional analysis process before the university acquire any education software. However, 42.9% of the respondents reported that they were involved in the process of functional analysis prior to acquire of any of the educational software by the university. This meant that majority of the ERP users are not involved by the university on the functional analysis prior to acquire of the educational software.

4.5.6 Importance of Functional Analysis Process involvement.

The study sought to evaluate the importance of the involvement of the respondent in the functional analysis process to prior to acquire of the educational system by the university. The summary of the findings is as shown in Table 4.16

Table 4. 16: Importance of User Involvement in Functional Analysis

	Frequency	Percent	Mean	Std. Deviation
Yes	69	89.6	1.10	0.307
No	8	10.4		

The study finding in Table 4.16 shows that 89.6% with a mean of 1.10 and deviation of 0.307 of the respondents supported that opinion that there is importance of the ERP users to be involved in the process of functional analysis of the educational software before acquiring it. Additionally, 10.4% of the respondent rejected the opinion that there is need for their involvement on the functional analysis process before the university acquire the educational system. This meant that the majority of the respondent support their importance in the involvement in the functional analysis process prior to acquiring of the software.

4.5.7 Acquisition of the ERP system.

This sought to establish how the university acquired the educational software that they use. This summary of the finding was as shown in Table 4.17.

Table 4. 17: University ERP Acquisition

	Frequency	Percent	Mean	Std. Deviation
Developed	8	10.4	1.90	0.307
Bought	69	89.6		

The findings in Table 4.17 shows that 89.6% of the respondent reported that the educational system in use by the university was bought from vendors with a mean of 1.90 and deviation of 0.307. However, 10.4% of the respondents reported that the software was developed by the university itself. The ERP system link the university website, the portal, and other software developed by the university, this support the 10.4% of the respondent who are in use of the software developed by the university.

4.6 Correlation Analysis

This sought to establish the correction analysis relationship between the variable of the study ie. Interoperability of the system, Accurateness of the system, Compliance of the system and Security of the system. The results of the correlation analysis are as shown in Table 4.18

Table 4. 18: Correlation analysis of the study variables.

		Correlation				
		nteroperability	**Accurateness**	**Functional Enterprise Resource Planning Suitability**	**Compliance**	**Security**
Interoperability	Pearson Correlation	1				
	Sig. (1-tailed)					
	N					
Accurateness	Pearson Correlation	.324*	1			
	Sig. (1-tailed)	.002				
	N					
Functional Enterprise Resource Planning	Pearson Correlation	.095	.821*	1		
	Sig. (1-tailed)	.206	.000			
Compliance	Pearson Correlation	.225*	.648*	.785*	1	
	Sig. (1-tailed)	.025	.000	.000		
Security	Pearson Correlation	.094	.631*	.566*	.575*	1
	Sig. (1-tailed)	.209	.000	.000	.000	
	N	**77**	**77**	**77**	**77**	**77**

*. Correlation is significant at the 0.05 level (1-tailed).

The findings in Table 4.18 indicated that there was a strong positive and significant association between Interoperability and Accurateness of the ERP. This is depicted by a Pearson correlation coefficient, r = 0.324, p-value = 0.002 < 0.05 which was significant at

0.05 level of significance. This implies that an improvement on the completeness of the ERP would result to more comfort and at ease use of the system.

The study also indicates that there was a strong positive and significant association between the Accurateness of the system and the security with a Pearson correlation coefficient, r =0.631, p-value= .000 <0.05 which was significant at 0.05 significance level. This meant that an increase in functionality of the system results to more user satisfactions.

The results indicates that there was a weak positive and non-significant association between the correctness and suitability of the ERP system with a Pearson correlation coefficient, r = 0.095, p-value =0.206 > 0.05 which is not significant at 0.05 level of significance. There was also a strong positive and significant relationship between the compliance and the Accurateness of the ERP system. This is depicted by a Pearson correlation coefficient, r = 0.648, p-value = 0.000 <0.05 which was significant at 0.05 level of significance. This implies that the functionality of the ERP system directly relates to the appropriateness encountered in its use.

4.7 Effect of the user involvement in Functional Suitability Analysis.

The study used the parameters where: 1 = Strongly Agree (SA), 2 = Agree (A), 3 = Not Sure (NS), 4 = Disagree (D) and 5 = Strongly Disagree (SD). The summary of the findings are as shown in Table 4.19

Table 4. 19: Responses on the user involvement in Functional Suitability Analysis.

Statement	N	SA (%)	A (%)	NS (%)	D (%)	SD (%)
Institution asked staff for their needs and expectations	77	20(26.0)	14(18.2)	21(27.3)	12(15.6)	10(13.0)
User not involved in any step of ERP functionality.	77	18(23.4)	32(41.6)	8(10.4)	11(14.3)	8(10.4)
Process of functionality capture is systematic and well captured	77	8(10.4)	37(48.1)	18(23.4)	10(13.0)	4(5.2)
Users are later conducted for verification and validation	77	6(7.8)	24(31.2)	2(2.6)	31(40.3)	14(18.2)
Technique used to capture functionality was appropriate	77	0(0.0)	33(42.9)	20(26.0)	18(23.4)	6(7.8)
Time and place of functionality capture was suitable for user	77	12(15.6)	23(29.9)	18(23.4)	18(23.4)	6(7.8)
User not informed about the functional requirement	77	14(18.2)	34(44.2)	8(10.4)	11(14.3)	10(13.0)

The study sought to investigate the ERP user's involvement in its functionality suitability. The study findings in Table 4.19 shows that 26.0% of the respondents strongly agreed that the institution asks their staff for their needs and expectations before acquiring the ERP system. It is observed that majority at 27.3% of the respondents are not sure of the institution involvement for their need and expectation of ERP before its acquisition.

Majority of the respondent agreed that they were not involved in any step of the ERP functionality capture representing 41.6%. Additionally, 48.1% of the respondent agreed that the process of functionality capture is systematic and well organized. 40.3% of the respondents disagree that they were conducted again for verification and validation of their expectations after giving their opinion. The respondents representing 42.9% agreed that the techniques used to capture the functionality of the system was appropriate to them. Likewise, 29.9% of the respondents agreed that time and place for functionality capture was suitable for them, with 23.4% not sure of how suitable time and place of functionality

capture was. Lastly, 44.2% of the respondents agreed that they were aware about the functionality requirement process.

4.8 Functional Suitability success of the ERP

An educational software system is successful if its users get exactly what they expected from the system. The study sought to establish the functional suitability success of the ERP system. The summary of the findings was presented in Table 4.20.

Table 4. 20: Responses on the functional suitability success of the ERP.

Statement	N	SA (%)	A (%)	NS (%)	D (%)	SD (%)
Success of ERP starts from its functional suitability	**77**	46(59.7)	22(28.6)	0(0.0)	5(6.5)	4(5.2)
ERP in institution meets the needs and the expectations of its users	**77**	18(23.4)	41(53.2)	8(10.4)	8(10.4)	2(2.6)
Not all functions were captured for the ERP at my institution	**77**	12(15.6)	31(40.3)	16(20.8)	10(13.0)	8(10.4)
ERP is rarely used because it doesn't meet the needs and expectations of users	**77**	6(7.8)	16(20.8)	22(28.6)	21(27.3)	12(15.6)
ERP in my institution is generally successful	**77**	12(15.6)	37(48.1)	18(23.4)	4(5.2)	6(7.8)
ERP is rarely used because its users don't know how to use it	**77**	8(10.4)	26(33.8)	8(10.4)	17(22.1)	18(23.4)

According to the study findings in Table 4.20, 59.7% of the respondents strongly agreed that the success of ERP system starts from its functional suitability. Likewise, 53.2% of the respondent agreed that the ERP system in their institution meets their needs and expectations. Majority of the respondents representing 40.3% agreed that not all functions of the institution were captured in the ERP system. However, 28.6% of the respondents were not sure if or not the ERP system meets their needs and expectations. Additionally, 48.1% of the respondents agreed that the ERP is generally successful in their institution. Lastly,

33.8% of the respondents agreed that they rarely use the ERP system because they don't know how to use it.

4.9 Cause of ERP failure /Under Utilization

An educational system fails if it does not meet the need and expectation of the user, which leads to system under-utilization or not used correctly. The study sought to establish the causes of the failure of the system. The summary of the findings were as shown in Table 4.21 below.

Table 4. 21: Responses on the Causes of ERP Failure/Under Utilization.

Statement	N	SA (%)	A (%)	NS (%)	D (%)	SD (%)
Lack of user involvement in functional suitability capture process	**77**	20(26.0)	41(53.2)	10(13.0)	0(0.0)	6(7.8)
Failure to capture functionality from all users	**77**	4(5.2)	46(59.7)	21(27.3)	2(2.6)	4(5.2)
Wrong requirements captured from users	**77**	12(15.6)	35(45.5)	18(23.4)	8(10.4)	4(5.2)
Poor identification of real users of ERP	**77**	12(15.6)	32(41.6)	16(20.8)	13(16.8)	4(5.2)
Wrong interpretation of functionality analysis	**77**	6(7.8)	34(44.2)	20(26.0)	11(14.3)	6(7.8)
Lack of skilled expert	**77**	2(2.6)	50(64.9)	8(10.4)	17(22.1)	0(0.0)
Lack of user understanding by ERP developers	**77**	18(23.4)	34(44.2)	12(15.6)	10(13.0)	3(3.9)
Lack of resources to help in the entire process of development	**77**	6(7.8)	36(46.8)	28(36.4)	3(3.9)	4(5.2)
Lack of management support for the entire process	**77**	6(7.8)	28(34.6)	20(26.0)	13(16.9)	10(13.0)
Inappropriate tools used in functional suitability capture process	**77**	8(10.4)	34(44.2)	16(20.8)	15(19.5)	4(5.2)

According to the study findings in Table 4.21, 53.2% of the respondent agreed that the failure of the system was attributed by lack of user's involvement in functional suitability capture process of the system. The respondents also agreed (59.7%) that the failure to

capture functionality from all ERP users causes failure to ERP system. Likewise, 45.5% of the respondents agreed that failure of the ERP system might be due to wrong requirement captured from the users. However, 23.6% of the respondents were not sure if the system failure was attributed by the wrong requirement captured during functional process. They also agreed (41.6%) that the system failure would be due to poor identification of the real users of ERP in the institution. Additionally, 44.2% of the respondents agreed that wrong interpretation of functionality analysis would be a possible cause of failure to the ERP system. The majority of the respondents agreed (64.9%) that a possible cause of system failure was attributed by lack of skilled experts to use the ERP system. The respondents also agreed (44.2%) that lack of user understanding by the ERP developer might be the cause of failure in the system.

Lack of resources to help in the entire process of development might be the cause of system failure; this was supported by 46.8% of the respondents. However, 36.4% of the respondent were not sure if lack of resources to help in the entire process of development would lead to system failure. Majority of the respondents agreed (34.4%) that lack of management support for the entire process would cause the failure of the educational software functionality in the institution. Lastly, 44.2% of the respondent agreed that the system failure caused by use of inappropriate tools in the functional suitability capture process. Overall, from the findings in Table 4.9, majority of the respondents agreed all the indicators used to measure the causes of failure of the system on. This calls for the institution, especially the top management to look into the causes of the failure of the system and possibly have refresher trainings, support and employ expert's users of the ERP system.

4.10 Factors Affecting Functionality Suitability Process

The suitability of the system is an important and extensive process of capturing the needs and expectations of the users. The study sought to establish the issues affecting the functional suitability process ranging from human, organizational to environmental.

Table 4. 22: Responses on the Factors Affecting Functional Suitability Process

Statement	N	SA (%)	A (%)	NS (%)	D (%)	SD (%)
Gender and age of ERP users	77	0(0.0)	31(40.3)	6(7.8)	32(41.6)	8(10.4)
Level of education of ERP users	77	5(6.5)	31(40.3)	25(32.5)	10(13.0)	6(7.8)
Computer literacy level of ERP users	77	21(27.3)	36(46.8)	6(7.8)	10(13.0)	4(5.2)
Experience of ERP users	77	14(18.2)	47(61.0)	8(10.4)	4(5.2)	5(5.2)
Availability of the ERP users	77	47(61.0)	22(28.6)	4(5.2)	4(5.2)	0(0.0)
Diverse cultural background of the ERP users	77	6(7.8)	14(18.2)	41(53.2)	12(15.6)	4(5.2)
Geographical distribution of the users of ERP	77	14(18.2)	21(27.3)	24(31.2)	10(13.0)	8(10.4)
Communication breakdown between ERP users and analysis	77	6(7.8)	46(59.7)	7(9.1)	6(7.8)	4(5.2)
Varied preferences of the ERP users	77	6(7.8)	41(53.2)	22(28.6)	8(10.4)	0(0.0)
Awareness and training on the functionality capture process	77	22(28.6)	39(50.6)	6(7.8)	6(7.8)	4(5.2)
Time of the functionality capture process	77	14(18.2)	30(39.0)	23(29.9)	5(6.5)	5(6.5)
Techniques/Methods used to capture functionality from users	77	12(15.6)	53(68.8)	6(7.8)	6(7.8)	0(0.0)
Management support and decision making	77	10(13.0)	47(61.0)	14(18.2)	2(2.6)	4(5.2)
Institutional policies And bureaucracy	77	16(20.8)	36(46.8)	12(15.6)	9(11.7)	4(5.2)
Institutional functional suitability policy	77	12(15.6)	38(49.4)	20(26.0)	7(9.1)	0(0.0)
Participants lack of cooperation and motivation	77	12(15.6)	43(55.8)	16(20.8)	2(2.6)	4(5.2)
Experts experience when capturing functionality	77	6(7.8)	46(59.7)	19(24.7)	2(2.6)	4(5.2)
Lack of resources e.g. finance	77	12(15.6)	36(46.8)	16(20.8)	3(3.9)	10(13.0)

According to the study findings in Table 4.22, majority (41.6) of the respondent disagree that the functional suitability process of the ERP system would depend on the gender and the age of the ERP user. However, 40.3% of the respondents agreed that age and gender are key

factors affecting the functional suitability process of the ERP system. They also agreed (40.3%) that the level of education of the ERP user affects the functional suitability process. Majority of the respondents agreed (46.8%) that computer literacy level of ERP user affects functional suitability process of the ERP system.

The experience of the ERP user also was a key factor affecting the functional suitability process of the ERP system; this was agreed by 61.0% of the respondents. The respondents strongly agreed (61.0%) that the functional suitability process of the ERP system depends on the availability of its user. This also was supported by 28.6% of the respondents who agreed that availability of ERP user is a key factor. A proportion representing a 53.6% of the respondent were not sure of the involvement of diverse cultural background of the ERP user as a factor affecting its functional suitability process. However, 18.2% agreed that diverse cultural background of the ERP user affects the functional suitability process. Likewise, 31.2% of the respondents were not sure of the ones geographical distribution affects the functional suitability process of the ERP system. 59.7% of the respondent agreed that communication breakdown between the ERP users and analysts affects its functional suitability process.

The respondents agreed (53.2%) that varied preferences of the ERP users affects the system functional suitability. Additionally, 50.6% of the respondents agreed that functional suitability process of the ERP system was affected by the awareness and training of its users. Majority of the respondents agreed (39.0%) that time of the functional capture process affects the suitability process of the ERP. 68.8% of the respondents agreed that the method/technique used to capture functionality from the users affects its suitability.

Likewise, 61.0% of the respondents agreed that management support and decision-making affects the functional suitability.

The respondents agreed (46.8%) that the institutional policies and bureaucracy affects the suitability process of the ERP. 49.4% of the respondents agreed that institutional functional policy affects the ERP system suitability process. Additionally, 55.8% of the respondents agreed that participant's lack of cooperation and motivation affects the functional suitability process of the ERP system. 59.7% of the respondents agreed that experts experience when capturing functionality of the ERP affects the functional suitability process. Lastly, 46.8% of the respondents agreed that lack of resources e.g., finance affects the functional suitability process of the ERP users.

4.11 Thematic Review of Functional Suitability Model for Enterprise Resource Planning Systems In Kenyan Universities.

Table 4. 23: Approach to Thematic Analysis

<table>
<tr>
<td>Evidence of each theme prior and after functional ERP implementation from interview schedule
Characteristics of a good functional ERP through different stakeholders

Sub Themes

1. Work experience
2. ERP acquisition approach
3. User functional suitability
4. Satisfaction of user needs
5. Existence of functional suitability model
6. Functional suitability policy
7. User awareness
8. Re-invention functionality in-house
9. User classification
10. Special user groups</td>
<td>Examining of concepts before and after functional ERP implementation from stakeholders' perception
EXTERNAL FACTORS
Sub Themes
– Economic (e.g. crisis)
– Social-cultural (e.g. demographic trends, social economic inequality etc)
– Political/legal (e.g. political situation, regulations, laws etc)
– Institutional (e.g. industry's specific regulations/requirements)
– Technological (e.g new banking systems, e-banking)
– Globolisation (e.g workplace diversity & variation, expansion to new markets, temporary work etc)
– Industry Restructuring (e.g. business amalgamations)

INTERNAL FACTORS
Organizational culture/Business Climate/ corporate structure & Strategies/Stakeholders' Expectations</td>
</tr>
</table>

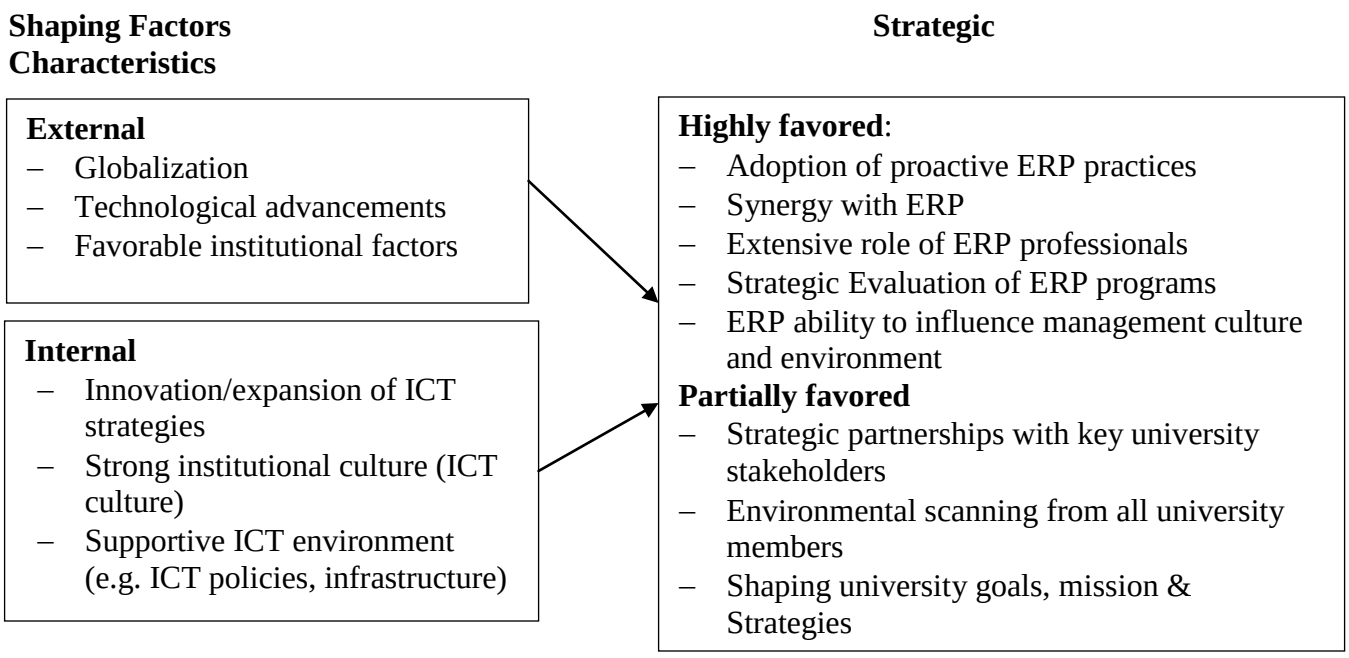

Figure 4. 1: Pre- Implementation Period of ERP System

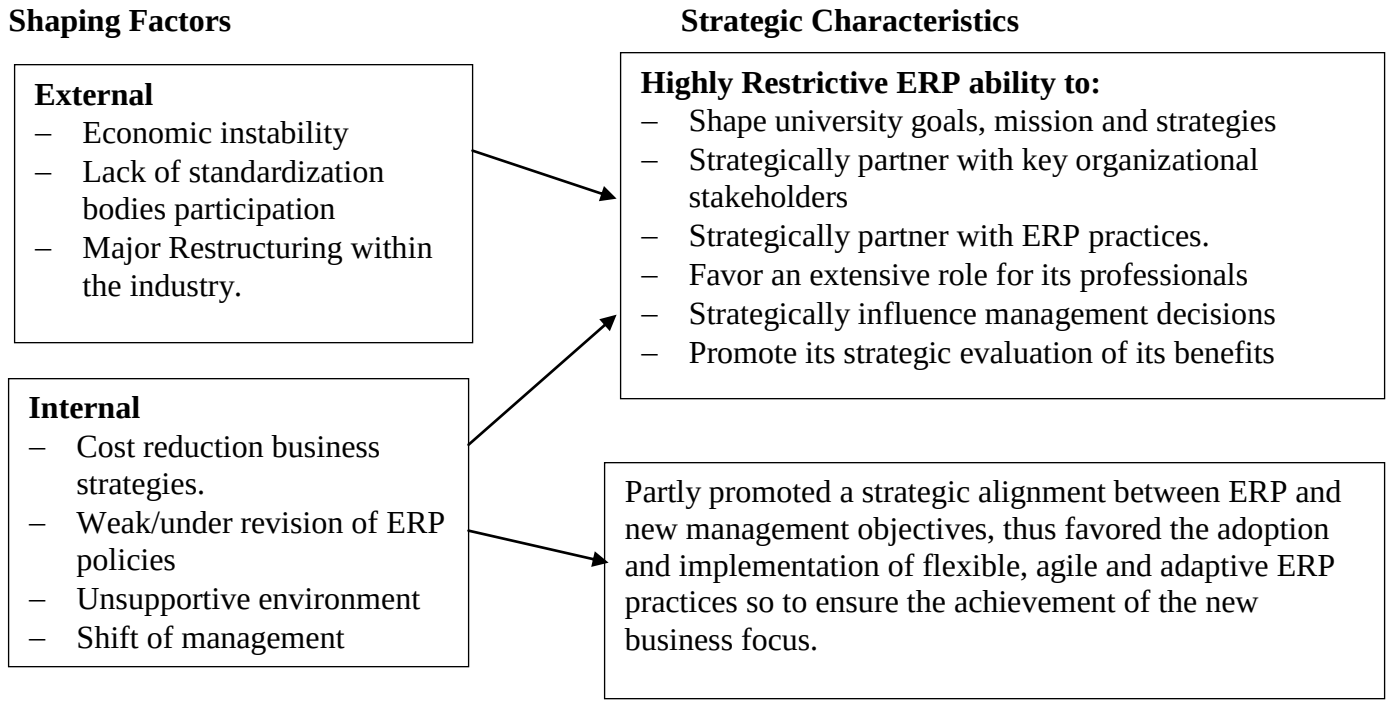

Figure 4. 2: Post Implementation Period of ERP System

4.12 Regression Analysis

The ANOVA test id used to determine where the model is important in predicting the functionality of the educational software (EPR) in Kenyan universities.

4.12.1 Proposed Functionality Suitability Model

The summary of the model was presented in Table 4.24 below.

Table 4. 24: Model Summary

Model Summary						
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**	**Sig. F Change**	**Durbin-Watson**
1	.534[a]	.285	.245	1.83015	.000	1.922

Predictors: (Constant), Security, Interoperability, Compliance, Accurateness
Dependent Variable: Functional Enterprise Resource Planning System

From the findings in Table 4.24, the value of R-Square is 0.285. This indicate that, 28.5% of the variation of the functionality suitability process of the ERP.

Table 4. 25: ANOVA Table.

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	96.008	4	24.002	7.166	.000[b]
	Residual	241.160	72	3.349		
	Total	337.169	76			

a. Dependent Variable: Functional Enterprise Resource Planning System
b. Predictors: (Constant), Security, Interoperability, Compliance, Accurateness

At 0.05 level of significance, the ANOVA test indicated that the independent variables namely; Accurateness, Security, Interoperability of ERP and Compliance variables were

good estimators of the functional suitability of the ERP system as indicated by p-value = 0.000 which is less than 0.05 level of significance.

From the finding in Table 4.25 below, at 0.05 level of significance, the association of the dependent and the independent variable is summarized as follows

$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon$ ………………………………………………………… i

Here, Y represent the functional suitability of the ERP, X_1 represent the functionality of the ERP system, X_2 represents the usability of the ERP system, X_3 represents the user challenges of the ERP system and X_4 represents the satisfaction of the ERP user. E represents the error term in the model

Therefore, using the regression coefficient in Table 4.12.2, we have;

$Y = 9.684 + 0.334 * X_1 - 0.383 * X_2 + 0.137 * X_3 - 0.049 * X_4 + \varepsilon$ ……………………… ii

The equation above indicates that an increase by one unit in functionality of the ERP, its functional suitability will increase by 0.334.

Table 4. 26: The Regression Coefficient

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	T	Sig.	Tolerance	VIF
1	(Constant)	9.684	.977		9.910	.000		
	Accurateness	.334	.072	.875	4.670	.000	.283	3.536
	Interoperability	-.383	.097	-.853	-3.961	.000	.214	4.670
	Compliance	.137	.049	.469	2.807	.006	.355	2.815
	User s	-.049	.027	-.246	-1.832	.071	.551	1.815

a. Dependent Variable: Functional Enterprise Resource Planning

b. Predictors: (Constant), Security, Interoperability, Compliance, Accurateness [b]

4.13. Empirical Validation of Proposed Functional Suitability Model

In order for adoption of the above model, it was subjected to validation process. It involves judgement of the proper design and integration of the underlying technology supporting the model. Validation does not just lie on mathematical exercise performed by quantitative specialists. It looks at all aspects of coming up with the model. It ranges from the data used, accurateness, the literature to the output. Following the best practice procedure, the model was subjected to validation from some experts in the area of software engineering drawn from university. They include the director of ICT, the system administrator, the network administrator and the other ICT personnel. Ten experts were consulted to give out their opinion on the same. They first went through the whole document using given scorecards to outline their findings. They then went to the model variable to check on their effects on

functional suitability of ERP in the university. Their validation was compiled and summarized as follows in table 4.27 and table 4.28;

Table 4. 27: Feedback of Expert Validation

SCORECARD	EXPERT VALIDATION	ASSESMENT
Methods/ theory/approaches	From the study, various models and theories were used. They focused on the topic understudy by bringing out the similarities, differences and even the shortcomings in the used theories and models. The study was built systematically its problem and model basing on the existing theories and models.	Good
Assumptions/variables/sensitivity	The study employed the use of certain variables to be tested. The variables have an impact to the final output of the model. They were carefully chosen from the relevant literature. Any changes to the data and the effects to the final output were considered.	Good
Data	The data was evenly collected for the research. The relevant samples were collected from the field. It was evenly distributed since it covered a large field of the study.	Good
Mathematical calculation/Algorithms	There was limited use of mathematical formula. However, this did not affect the study since it was not pegged on the same. The mathematical calculations were majorly used in methodology to get the sample sizes and target groups under study.	Average
Code generation	The study did not employ coding. It was not built around the same.	N/A
Scenarios	There were different scenarios in data analysis. The study was able to outline and test different variables using different formula.	Average
Output	The output of the study was a model. The study was able to produce one which is able to be tested.	Average
Benchmarking	Through the literature, there was comparison of the study to other studies. This was able to bring out what has been done concerning the topic under study and the research gaps that are to be filled.	Good
Documentation	Study was documented from the beginning to the end. All the procedures, processes and functions to the last output which is a model is well documented. Any person can follow the process to the final product without any difficulties.	Good

4.13.2 Validation of the Model

The study used the parameters where: 1 = Strongly Agree (SA), 2 = Agree (A), 3 = Not Sure (NS), 4 = Disagree (D) and 5 = Strongly Disagree (SD) to get the experts view on the model variables after the analysis. The summary of the findings are as shown in Table 4.13.2

Table 4. 28: Validation of the Model

	N	SA (%)	A (%)	NS (%)	D (%)	SD (%)
Accurateness	10	3(30.0)	3(20.0)	2(20.)	2(20.0)	0(00.0)
Interoperability	10	4(40.0)	4(40.0)	1(10.0)	1(00.0)	0(00.0)
Compliance	10	4(40.0)	3(30.0)	2(20.0)	1(10.0)	0(0.0)
Security	10	1(10.0)	1(10.2)	6(60.0)	1(10.0)	1(10.0)

According to the study findings in Table 4.28, 60.0% of the respondents strongly agreed that the success of ERP system starts from its functional accurateness. Likewise, 80.0% of the respondent agreed that the ERP system in their institution needs to be more interoperable. Majority of the respondents representing 70.0% agreed that compliance is key to functionality. However, 60.0% of the respondents were not sure if security issues contribute functionality suitability of the system.

CHAPTER FIVE

SUMMARY, CONCLUSIONS & RECOMMENDATIONS

5.1. Chapter Overview

This chapter contains a summary of the findings obtained from the research, conclusions and recommendations on the topic of study. The researcher evaluated the findings and made recommendations deemed necessary. The researcher answered the research questions based on the findings of the study. In conclusion, the study contains the findings, recommendations and suggestions on how the ERP can be used in universities to facilitate better learning and management in universities in Kenya.

5.2. Summary

As much as higher learning institutions including universities heavily rely on the use of the ERP as an education software system; they have to consider its usefulness it their daily operations. This is because as stated earlier the ERP system was originally build for business enterprises for business purposes. This was so before it evolved and started to be used in the education sector in many countries including Kenyan institutions. Most of the ERP by then focused on non-functional aspects. However, functionality aspects are important in the education sector. This is so because functionality of this software goes hand in hand with their quality. The quality of this software comprises of different characteristics, which include software functional suitability, software reliability, software performance, software efficiency, software operability, software security, software compatibility and software transferability as stated by the ISO/IEC, 2011b. Functionality is emphasized since it addresses the specific needs of the users of the software. User satisfaction is a priority since it's a prerequisite in the smooth use of the software.

5.3 Conclusion

This study was designed to respond to the following general objective: The main objective of the study is to determine the status of ERP implementation in Kenyan universities, identify the factors that affect the functionalities of the ERP systems in universities in Kenya and to develop a model to measure functionalities of enterprise resource planning systems in Kenyan universities, Kenya. In KMO analysis, we studied the four independent factors in isolation but realized that they all contribute to the overall research objective of coming up with the model.

Specific objective number one was to determine the status of ERP implementation in Kenyan universities. Based on the study findings and the literature review constraints were identified based on the ERP system in universities. The research identified lack of users' involvement in functional suitability capture process of the system, failure to capture functionality from all ERP users and wrong requirements captured from the users to be the major constraints in the use of ERP in universities in Kenya.

The specific objective number two was to determine the functionality of Enterprise Resource Planning systems in universities in Kenya. The research revealed that the success of the ERP would start from its functional suitability. It further revealed that the ERP meets the user needs and expectations. However, not all functions of the institution were captured in the ERP system. The research also looked at the factors affecting the functional suitability process. It revealed that functional suitability of the ERP system would depend on the gender and age bracket of the ERP users. Furthermore, the age bracket affected the use of the ERP to a large extend. Other factors such as the level of education of the users,

experience, availability of its users, varied preferences also affected the functional suitability of ERP in universities in Kenya.

Literature was reviewed on the existing software quality models and technology adoption models. Among the software quality models studied include the McCall Quality Model, Boehm's Quality Model and FURPS Quality Model. The characteristics of these models were put into consideration and their weaknesses analyzed in relation to software functional suitability. There characters were considered. Among other characteristics that were found to be their major weaknesses in the three models include; software functionality was not considered, functional suitability in all organization (including HE institution) is not covered. In addition, no architectural integrity was covered in the three models.

Specific objective three was to develop a model to measure functional suitability of ERP systems in universities in Kenya. This was achieved through analyzing the domains initially identified and coming up with a model which acted as the output of the study.

Further, the results demonstrate that, there are moderating factors that need to be put into consideration for successful use of the ERP in universities in Kenya. Top management support, commitment of government bodies and ICT literacy levels can more effectively encourage the use of ERP. This is because ERP relies on top management to provide financial resources this goes hand in hand with commitment of government bodies. There is also need for adequate well-trained technical and support staff who can successfully implement ERP in universities.

5.4 Recommendations

For all government institutions including higher learning institutions to deploy fully the education software systems like the ERP, the developers must spend much time understanding the needs of these institutions. The developers must understand and satisfy the needs and requirements of higher education, more so functionality. The ultimate goal must and should always be user satisfaction. These does not come in vain but always depends on functionality. Satisfaction always depends on different functionalities available on the ERP application. The aperture that exists between institutional practice and the ERP system works has to be reduced to a considerable amount. The specific issues that needs to be addressed in this process includes but not limited to:-

i. The need to address ERP functionality through higher learning institutions and its users being involved in the process of functional suitability analysis in planning, before and in the process of ERP acquisition.

ii. There is need to address the causes and challenges that lead to ERP failure or under-utilization in the learning institutions.

iii. There is an apparent need to look into stakeholders' involvement (top management) bureaucracy, ownership and business process re-engineering in a coherent manner. This is necessary to investigate and understand how they affect software functionality in higher education.

iv. Management support is very important in the proper functioning of the ERP. Creation of awareness in staff, training, and all other forms of support go a long way in making the ERP succeed or fail in learning institution.

5.5. Future Work

5.5.1. A Model for evaluating the quality Education Software Systems in Universities

Future study to explore on the possibility of coming up with a Model for evaluating the quality of ERP system and other education systems in the higher education institutions, focusing on their characteristics and sub-characteristics

5.5.2. Develop tools for Education Software Systems Quality evaluation

There is need also for further research and development of tools for quality evaluation, focusing on empirical assessment of users' satisfaction on the use of education software systems.

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APPENDIX 1: LETTER OF INTRODUCTION

Dear respondent,

RE: MASTER OF SCIENCE IN INFORMATION TECHNOLOGY RESEARCH QUESTIONNAIRE

I am a postgraduate student pursuing a Master of Science degree course in Information Technology at Masinde Muliro University of Science and Technology. My research topic is "***A Model to Measure Functional Suitability of Enterprise Resource Planning Systems in Kenyan universities***".

The aim of this letter is to humbly request you to fill the attached questionnaire to the best of your knowledge to help me complete this academic endeavor. The information you will provide will be treated with utmost confidentiality and shall be used for academic purposes only. I will collect the completed questionnaire from your departmental office, or can be sent online to osoredickson@gmail.com.

Your assistance is highly appreciated.

Yours sincerely,

……..

OSORE D.WALIARO – SIT/G/14-58185/2016

SCHOOLOF COMPUTING AND INFORMATICS

APPENDIX 2: QUESTIONNAIRE

SECTION A DEMOGRAPHIC INFORMATION

A1 Gender Male [ ] Female [ ]

A2 Level of Study Certificate [ ] Diploma [ ] Degree [ ] Masters [ ] PhD [ ]

A3 Designation Secretary [ ] Administrator [ ] Academic Staff [ ]

Others …….……(Specify)

A4 Age in years Below 25 [ ] 25-30 [ ] 31-35 [ ] 36-40 [ ]

41-45 [ ] 46-50 [ ] Above 50 [ ]

A5 Level of experience in years worked in the university Below 2 [ ] 2-4 [ ] 4-6 [ ] 6-8 [ ] 8-10 [ ] Above 10 [ ]

A6 School you belong SCI [ ] EDU [ ] BIOLOGY [ ] JOURNALISM [ ] ENGINEERING [ ] OTHERS …….(SPECIFY)

A7 location Main Campus [ ] Satellite Campus [ ]

A8 Can you use a computer on your own Yes [ ] No [ ]

SECTION B – EDUCATION SOFTWARE SYSTEM (ERP) USE IN UNIVERSITY

B1 The University uses ERP to carry out its day to day activities

Strongly Agree [ ] Agree [ ] Not Sure [ ]

Disagree [ ] Strongly Disagree [ ]

B2 Have you ever used the ERP Yes [ ] No [ ]

B3 How frequent do you use ERP Daily [ ] Weekly [ ] Once a semester [ ] Rarely [ ] Never [ ]

B4 Have you been trained on how to use the ERP Yes [ ] No [ ]

B5 Have you ever been involved in the process of functional analysis before acquiring of any education software in the university Yes [ ] No [ ]

B6 In your opinion, is it important for staff and other users to be involved in the process of functional analysis before acquiring any education software system Yes [ ]

No [ ]

B7 How do universities acquire education software system they use

Developed by university [ ]

Bought from software vendors [ ]

SECTION C: USER INVOLVEMENT IN FUNCTIONAL SUITABILITY ANALYSIS

User involvement in ERP functional suitability analysis is important because it helps developers capture user needs and expectations. Using the following scale, rate the extent to which you agree to the statement above.

Key **SA**- Strongly Agree, **A** – Agree, **NS** – Not Sure, **D**- Disagree, **SD**- Strongly Disagree.

STATEMENT		RESPONSE				
		SA	A	NS	D	SD
C1	The institution asks staff for their needs and expectations of ERP before acquiring them.					
C2	I was not involved in any step of ERP functionality capture					
C3	The process of functionality capture is systematic and well organized					
C4	After I gave out my opinion, I was conducted again for verification and validation of my expectations.					

C5	The technique used to capture functionality was appropriate for me					
C6	The time and place of functionality capture was suitable for me.					
C7	I was not informed about the functional requirement process					

SECTION D: FUNCTIONAL SUITABILITY SUCCESS OF THE ERP

An education software system is considered successful if its users get exactly what they expected from the system software i.e. when it meets the needs and expectation of users. Using the following scale, rate the extent to which you agree to the statement above.

Key **SA**- Strongly Agree, **A** – Agree, **NS** – Not Sure, **D**- Disagree, **SD**- Strongly Disagree.

STATEMENT		RESPONSE				
		SA	A	NS	D	SD
D1	The success of any education software system starts from its functional suitability.					
D1	The ERP at my institution meets the needs and expectations of its users.					
D1	Not all functions were captured for the ERP at my institution.					
D1	I rarely use the ERP because it doesn't address all my needs and expectations.					
D1	The ERP at my institution fails to meet the					

	needs and expectations of users.					
D1	The ERP in my institution is generally successful.					
D1	I rarely us the ERP because I don't know how to use it					

SECTION E: CAUSES OF ERP FAILURE/UNDER UTILIZATION

ERP fails when it doesn't meet the needs and expectations of users. This leads to system underutilization/ not being used well. Using the following scale, rate the extent to which you agree to the statement above.

Key **SA**- Strongly Agree, **A** – Agree, **NS** – Not Sure, **D**- Disagree, **SD**- Strongly Disagree.

STATEMENT		RESPONSE				
		SA	A	NS	D	SD
E1	Lack of user involvement in functional suitability capture process.					
E2	From Failure to capture functionality from all users					
E3	Wrong requirements captured from users					
E4	Poor identification of real users of ERP					
E5	Wrong interpretation of functionality analysis.					
E6	Lack of skilled expert					
E7	Lack of user understanding by ERP developers					
E8	Lack of resources to help in the entire process					

	of development.					
E9	Lack of management support for the entire process					
E10	Inappropriate tools used in functional suitability capture process.					

F: FACTORS AFFECTING FUNCTIONAL SUITABILITY PROCESS

Education software system suitability is an important and extensive process of capturing the needs and expectations of the users. However, this process is affected by a number of issues ranging from human, organizational to environmental. Using the following scale, rate the extent to which you agree to the statement above.

Key **SA**- Strongly Agree, **A** – Agree, **NS** – Not Sure, **D**- Disagree, **SD**- Strongly Disagree.

STATEMENT		RESPONSE				
		SA	A	NS	D	SD
F1	Gender and age of ERP users.					
F2	Level of education of ERP users					
F3	Computer literacy level of ERP users					
F4	Experience of ERP users					
F5	Availability of the ERP users					
F6	Diverse cultural background of the ERP users					
F7	Geographical distribution of the users of ERP					
F8	Communication breakdown between ERP users and analysts					

F9	Varied preferences of the ERP users.					
F10	Awareness and training on the functionality capture process					
F11	Time of the functionality capture process					
F12	Technique/Method used to capture functionality from users					
F13	Management support and decision making					
F13	Institutional policies and bureaucracy					
F14	Institutional functional suitability policy.					
F15	Participants lack of cooperation and motivation					
F16	Experts experience when capturing functionality					
F17	Lack of resources e.g. finance					

APPENDIX 3: EDUCATION SOFTWARE SYSTEM INTERVIEW SCHEDULE

1. Gender [ ]

2. Designation …….

3. What is your work experience in years?

4. How can you describe the software users in the university?

5. What approach does the university take in acquisition of software?

6. In any of the approaches taken, user functional suitability is carried out. How Important ie functional suitability to Education software system success?

7. In your opinion do you think you are able to capture the needs and functionality of all users of the university software?

8. Are there any existing functional suitability models used in the university?

9. If yes, describe briefly……..

10. Is there any existing formal functional suitability policy in the institution?

11. Are there any factors that affect the functional suitability of education software systems in your institution?

12. If yes, describe briefly……

13. Do you conduct user awareness before functional suitability elicitation?

14. Do you sometimes re-invent functionality in-house?

15. Do you classify users into groups before extracting functionality from them?

16. Do you tailor a particular technique for a particular user group?

17. Is there a need to have a model tailored for heterogeneous education software system users?

Thank you for taking your time to attend to this interview

APPENDIX 4: APPROVAL LETTER FROM UNIVERSITY

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

Tel: 056-30870
Fax: 056-30153
E-mail: directordps@mmust.ac.ke
Website: www.mmust.ac.ke

P.O Box 190
Kakamega – 50100
Kenya

Directorate of Postgraduate Studies

Ref: MMU/COR: 509099 **Date:** 11th December, 2018

Osore Dickson Waliaro,
SIT/G/14-58185/2016
P.O. Box 190-50100,
KAKAMEGA.

Dear Mr. Osore,

RE: APPROVAL OF PROPOSAL

I am pleased to inform you that the Directorate of Postgraduate Studies has considered and approved your Masters proposal entitled: ***'A Model to Measure Functional Suitability of Educational Software Systems: A case of ERP Systems"*** and appointed the following as supervisors:

1. Dr. Kelvin Omieno - School of Computing and Informatics, MMUST
2. Dr. Jasper M. Ondulo - School of Computing and Informatics, MMUST

You are required to submit through your supervisor(s) progress reports every three months to the Director Postgraduate Studies. Such reports should be copied to the following: Chairman, School of Computing and Informatics Graduate Studies Committee and Chairman, Computer Science Department. Kindly adhere to research ethics consideration in conducting research.

It is the policy and regulations of the University that you observe a deadline of two years from the date of registration to complete your Master's thesis. Do not hesitate to consult this office in case of any problem encountered in the course of your work.

We wish you the best in your research and hope the study will make original contribution to knowledge.

Yours Sincerely,

DEAN
SCHOOL OF GRADUATE STUDIES
MASINDE MULIRO UNIVERSITY
OF SCIENCE & TECHNOLOGY
Date:..... Sign:.....

Prof. John Obiri
DIRECTOR, DIRECTORATE OF POSTGRADUATE STUDIES

APPENDIX 5: RESEACH PERMIT FROM NACOSTI

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone:+254-20-2213471,
2241349,3310571,2219420
Fax:+254-20-318245,318249
Email: dg@nacosti.go.ke
Website : www.nacosti.go.ke
When replying please quote

NACOSTI, Upper Kabete
Off Waiyaki Way
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No. **NACOSTI/P/19/47131/28312**

Date: **26th February, 2019**

Osore Dickson Waliaro
Masinde Muliro University of Science and Technology
P. O Box 190-50100
KAKAMEGA

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"A model to measure functional suitability of educational software systems: A case of ERP Systems"*** I am pleased to inform you that you have been authorized to undertake research in **Kakamega County** for the period ending **26th February, 2020.**

You are advised to report to **the County Commissioner and the County Director of Education, Kakamega County** before embarking on the research project.

Kindly note that, as an applicant who has been licensed under the Science, Technology and Innovation Act, 2013 to conduct research in Kenya, you shall deposit **a copy** of the final research report to the Commission within **one year** of completion. The soft copy of the same should be submitted through the Online Research Information System.

GODFREY P. KALERWA MSc., MBA, MKIM
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Kakamega County.

The County Director of Education
Kakamega County.