UNIVERSITY OF NAIROBI

A FRAMEWORK FOR IMPLEMETATION OF CLOUD-BASED ERP SYSTEMS IN PUBLIC UNIVERSITIES IN KENYA.

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This research project is submitted to the School of Computing and Informatics – The University of Nairobi in partial fulfillment of the requirements for the award of the degree of Master of Science in Information Technology Management (MSc. ITM)

DECLARATION

I, the undersigned, declare that this project is my original work and that it has not been presented in any other university or institution for academic credit.

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Signed……..... Date: 22nd August 2023

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This proposal has been submitted for examination with my approval as university supervisor.

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Signed…… Date…August 22, 2023

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Above all, I express my gratitude to God for bestowing upon me wisdom, knowledge, good health and the gift of life, which have empowered me to successfully conclude this study. I would also like to express my appreciation to Dr. Samuel Ruhiu, my supervisor, for his unwavering guidance and diligent oversight throughout the duration of this project.

DEDICATION

I dedicate this thesis project to my family, acknowledging their unwavering perseverance, incredible support and encouragement throughout the process towards achieving this Master's degree.

ABSTRACT

This study sought to provide a framework for successfully deploying cloud-based ERP systems in public universities in Kenya. Previous studies indicated that locally hosted or on-premises ERP systems have had challenges from limited customization or enhancement capacities, integration complexity, minimal functional relevance, to disruptive software updates and backups leading to largely failed implementations. Cloud Enterprise Resource Platforms provide a solution to the rigidity and costliness of existing ERP software by facilitating the automation of business processes and operations efficiently, with minimal information technology (IT) resources requirements.

The specific aim of this research endeavor was to ascertain and analyze the impact of technological, organizational, and environmental factors on the implementation of cloud-based ERPs within public universities in Kenya. The theoretical framework used to guide the study are Information System Success Model (ISSM), Technology Organization Environment (TOE) theory and the Diffusion of Innovation theory. The study used descriptive and correlational research designs targeting a population of the thirty-one (31) Public Chartered Universities (PCU) in Kenya. Quantitative data was collected using a questionnaire with the respondents comprising key personnel within the universities. The data underwent analysis through descriptive and inferential statistical methods using SPSS, and the outcomes were visually represented through tables, charts, and graphs. The results demonstrated that technological factors, particularly aspects like technology infrastructure sufficiency, compatibility, data security, and the cost-effectiveness of the solution, were statistically significant in the implementation decisions of cloud-based ERP systems. Further, the organizational and environmental factors, specifically, top management support, adequate training, policy regulations and vendor support, were statistically significant in influencing the implementation of cloud-based ERPs in public universities in Kenya.

The study is recommended to relevant policy makers to guide in developing strategies for adoption and effective implementation of cloud-ERPs in public universities. Further study is recommended to be done to investigate the user satisfaction and experience of cloud-based ERP in public universities.

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LIST OF ABBREVIATIONS

CCT – Cloud Computing Technology

CUE – Commission for University Education

CSF - Critical Success Factors

ERP – Enterprise Resource Planning

ICT – Information Communication Technology

KENET – Kenya Education Network Trust

NIST - National Institute of Standards and Technology

PCUs – Public Chartered Universities

R&D – Research and Development

SOA - Services Oriented Architecture

CHAPTER ONE: INTRODUCTION

1.0 Introduction

This chapter will provide the contextual background, elucidate the problem statement, outline the objectives, present the research questions, and highlight the significance of the research.

1.1 Background

ERP systems are integrated software packages and functional solutions designed to automate essential organizational functions which include finance operations, procurement, human capital/resources, manufacturing, order and distribution. ERP Systems, as illustrated by (Nazemi et al., 2012) "involve integration of organizational business processes. ERP systems enhance order management, accuracy in inventory information, streamlined workflows, effective supply chain management, and the establishment of best operational standards and practices".

ERP system are therefore aggregators of business processes in a centralized model allowing multiple functionality that are otherwise siloed to collaborate in real-time. Moreover, through the standardization and integration features of an ERP system, an organization can harness the capability to gather, store, manage, and interpret data from various departmental units.

An Enterprise Resources Platform facilitates the different departments of an institutions to work seamlessly by exchanging data and information hence reducing costs and improving accountability of business processes and human resource output (Goel et.al., 2011).

1.2 Evolution of ERPs

Kline and Rosenberg (1986) argue that it is incorrect to view a novel innovation as a single, definite entity that can be easily identified and tracked. Innovation is a process, not an event. Hence, the significance of taking into account the evolution of ERP systems from their early days to the present, with a focus on cloud-based ERPs.

ERP systems history can be dated back to 1960s, when manufacturing was scaling up in the United States, where the need to better manage the increased production and customer demand was on the rise hence the Material Requirement Planning (MRP) was made. The MRP system enabled the manufactures to manage procurement, check on production runs, track delivery of products, and purchase orders. The MRP system was however costly, required a team of experts to maintain, and large physical space which was out of the reach of smaller manufactures at the time (Oracle

Netsuite, 2022).

The enhancement into MRP 2.0 in the 1980s was a major milestone in the progression of the technology, with the key differentiator being the capacity for scheduling processes. The system allowed various previously siloed departments in the manufacturing process to coordinate through enhanced scheduling capabilities. However, the system required large resource investment in regards to funding as well as expertise unattainable to mid-level to small manufacturers, in addition MRP 2.0 had in built assumption developed for primary use by manufacturers locking out potential stakeholder for instance from the services industries like education (Albany, 2005)

During the early 1990s, the USA-based Gartner Group introduced the term ERP (Enterprise Resource Platform) to describe the succeeding generation of MRP (Manufacturing Resource Planning) software (Mugahed Ahmed Abdulla, 2017). The primary goal of ERP is to integrate different functions and units of the business enterprise under one integrated suite of software applications – purchased, controlled, operated and maintained by the business.

The ERP system offers multiple advantages, that include the ability for enhanced data analysis, elevated levels institutional performance, and increased efficiency through optimized practices aimed at delivering improved customer service (Noorliza Karia, 2015).

In the 2000's ERPs evolved to include internet web functionalities which enabled interaction of ERP with other applications. This marked the introduction of fresh technological opportunities in the realm of ERP, such as functionalities enabling information access through web browsers and mobile devices via concepts like Service-Oriented Architecture (SOA).

In recent years, the scope of ERP systems' functionalities has been broadened significantly, encompassing a wider array of applications including supply chain management, marketing automation, electronic commerce, grants management, and student management systems.

Notwithstanding the challenges and risks associated with ERP system implementation, the latter part of the 2010s witnessed a continued evolution of ERP, incorporating novel functionalities that enabled the delivery of business applications through a Software-as-a-Service (SaaS) model. The ERPs and applications are hosted in the cloud, with access facilitated through integration technologies like application programming interfaces (REST APIs). Emerging programming languages like Android, iOS, and browser-based applications were developed to provide ERP

software within the framework of the SaaS model. This phenomenon has paved the way for cloud-based ERPs, establishing themselves as the forefront of the ERP landscape.

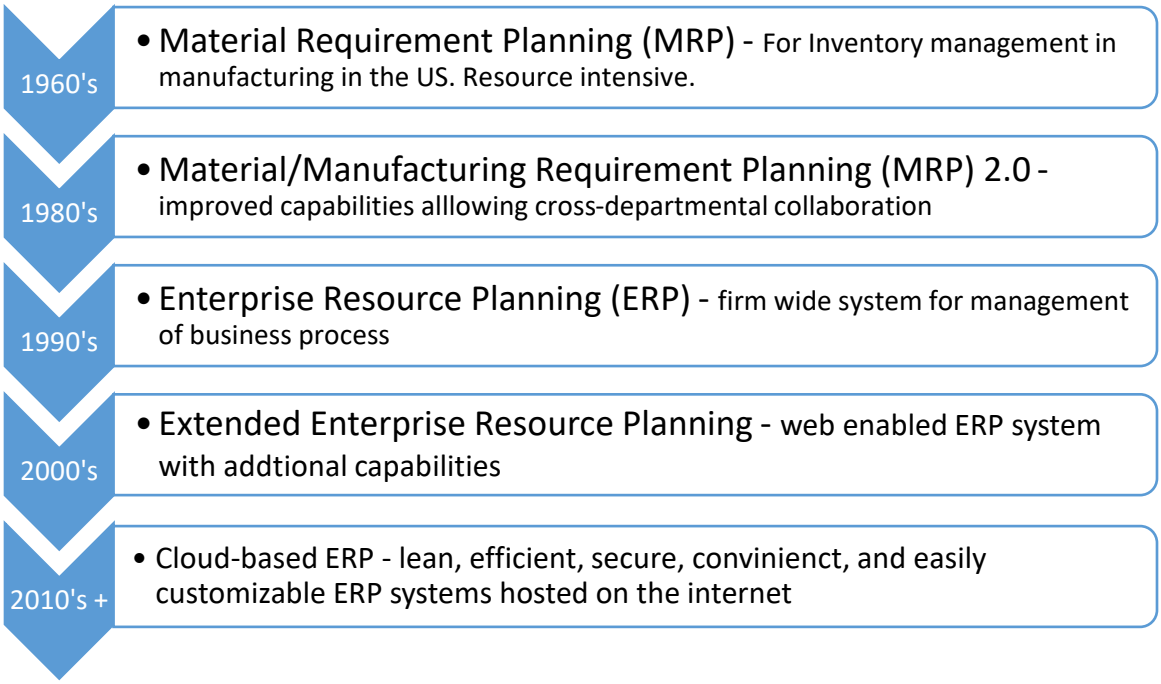

Figure 1: Evolution of Enterprise Resource Platforms

Source: International Journal for Technology Management, Q1, 2014

1.3 Problem statement

Statistics from university authority CUE indicate that the increase in the number of public universities in Kenya has been accompanied by a corresponding growth in student enrolment, programs offered and faculty members. This growth places the need for these institutions to develop strategies to efficiently manage voluminous students' data and increasingly complex operations.

Locally hosted or on-premises ERP systems are faced with various implementation challenges such as limited customization to suit specific needs, conflicts with business strategy, resistance to change, complex solution integration, unique industry functionality, large upgrade costs, and frequent technology upgrades (KENET, 2021). These issues make the implementation of on-premise ERP systems complex, time-consuming, and funding intensive, on evaluation illustrating the need for a massive change in the ERP implementation framework to improve the success rates. The considerable high costs linked to deploying ERP solutions are notably impeding the widespread acceptance of such solutions within educational institutions.

The utilization of ERP systems international is widespread in large and medium sized institutions of higher learning. A study of 74 successful ERP system implementations within the education sector of Sri Lanka by (Wickramasinghe and Gurawardena, 2010) found that training, users' expectation, inter-departmental collaboration, and good communication were the key factors for effective implementation of ERPs.

Moreover, in the research conducted by Hasibuan and Dantes (2012) concerning the pivotal factors for success in implementing ERP systems across seven enterprises spanning different sectors in Indonesia, their conclusion highlighted the presence of organizational elements, technological or data processes, and infrastructural or environmental aspects within the implementation process. ERP implementations in the Kenyan PCUs have not yielded the much-needed success in terms of improved business operation and need for reduced costs. A few of the implementations are in various stages with varying degrees of success, however most of the implementation projects have stalled or have been abandoned. The majority have suffered massive delays pushing costs above intended budget. Despite these institutions continue to invest millions of Kenyan Shillings in an attempt to implement a suitable ERP system. According to A. Al-Johani & E. Youssef, (2013), on-premises ERPs offer expensive models that are difficult to implement in higher education institutions due to budget limitations. Additionally, it has been noted that since a significant number of PCUs have attempted to re-engineer ERPs from their existing business models without a well-defined roadmap, this often results in unsuccessful ERP implementations (Kumar et al., 2021).

Cloud-based ERP systems have brought about a fundamental change in the realm of Information Systems. They bring advantages such as cost-effectiveness, scalability, flexibility, availability, adaptability and configurable data management tools that are well-suited for a wide range of organizations. And with innovation, traditional models such on-premises ERPs are being re-engineered or and substituted with enhanced or new models to optimize value for both enterprises and customers. However, the transition from the traditional model such as from the locally hosted ERP to cloud-based ERPs demands clear implementation roadmaps indicating the planning process, challenges and return on investment, regarding the primary innovations being promoted to drive sustainable growth for educational institutions.

A review of past studies identifies a gap on cloud-based ERP studies. A study conducted by

(Mpanga et al., 2019) primarily centered on a research model for implementing cloud-based ERP systems within local governments in developing countries, drawing from experiences of local government in Uganda. The researchers posit that the shortcomings in ERP system implementations aren't solely attributed to software design; instead, these failures might stem from misalignments between solutions and organizational structures, which are distinctively contextual to specific organizations. This study, however, focused mainly on local governments which have different organizational structures and operations as educational institutions. Other studies (Nguyen et al., 2014,) attempt to show how beneficial is cloud-based ERPs and they proposed models that can help to promote the successful implementation of cloud ERPs which can be applied in the Kenyan education sector context. (Orwa & Wang, 2019) study centered on the experiences related to ERP implementation within public universities in Kenya, yet it did not encompass the establishment of a framework for the implementation of cloud-based ERPs. Another study done by Sasmal et al., 2019 focused on the difficulties encountered during the implementation of an ERP system within an educational institution found that as a result of inadequate ERP selection and assessment procedures, ERP software might be identified as incompatible or misfit for an institution. In most cases, the ERP system for educational institutions should be customized to address the unique academic functionalities.

Most significantly, few other studies (Makathimo, 2016) outline adoption of cloud ERP as an emerging domain but focuses more on private sector business and SMEs and no study has been done in the Kenya higher education space to outline ways how cloud-based ERPs can be best implemented to ensure realization of business value and as a cure to the implementation challenges of existing traditional ERP.

This study, thus, seeks to evaluate and propose a model for assisting public universities institutions in implementation decisions of cloud-based ERPs.

1.4 General Objective of the Study

The objective of the study is to examine a framework for implementing cloud-based ERP systems in public universities in Kenya.

1.5 Specific Objectives

a) To examine the technological factors affecting the implementation of cloud ERPs in public universities in Kenya.

b) To identify the organizational factors affecting the implementation of cloud ERPs in public universities in Kenya.
c) To investigate the environmental factors affecting the implementation of cloud ERPs in public universities in Kenya.
d) To propose a framework for implementing cloud ERPs in public universities in Kenya.

1.6 Research Questions

The study answers the following questions:

a) To what extent do technology factors affect the implementation of cloud ERPs in public universities in Kenya?

b) How has organization factors affected implementation of cloud ERPs in public universities in Kenya?

c) To what extent has environmental factors affected implementation of cloud ERPs in public universities in Kenya?

1.7 Significance of the research study

A few arguments can be fronted to justify this study. To begin with, even though ERP systems remain widely favored, a growing body of evidence is suggesting that reaping benefits from such systems is not as direct and immediate as proponents and marketers of these systems often portray. Secondly, numerous advantages and obstacles related to the execution and acceptance of cloud ERP have been recognized across various universities in developed countries. However, there exists a scarcity of empirical investigations in the context of academia realm in Kenya. Third institutions having implemented traditional ERP systems that are in various stages of implementation with varying degrees of success rates, the research will provide concrete data on these challenges and propose an alternative model in ERP implementations enriching the choices of those institutions that are considering cloud-based systems. Fourthly, the emergence and adoption of cloud computing solutions are inevitable. The advantages of cloud-based systems in contrast to on-premises systems are worth contemplating for institutions seeking contemporary, cost-effective solutions for automating their administrative processes and academic functions.

This research will be significant to the following parties: -

The findings and suggestions from the study can serve as valuable resources for the Commission

of University Education (CUE) in addressing the obstacles to ERP implementation and in promoting the uptake of cost-efficient cloud-based ERPs in educational establishments. Consequently, CUE could devise policies to boost technology adoption and stimulate the integration of cloud ERP computing within these institutions. Of equal importance, this study could serve as a reference for upcoming researchers and students seeking to bridge the knowledge gap in cloud ERP implementations. Thus, the insights garnered will play a crucial role in academic pursuits and will serve as an empirical foundation for subsequent research in the realm of ICT and education.

Public Chartered Universities (PCU) the ERP as a solution to automate institutional administrative and academic processes brings more benefits if well implemented and as institutions face budget constraints, they need low-cost solutions like cloud-based ERPs that leverage on current technological trends where students and faculty need to access services from wherever location as long as they've internet access. The knowledge from this study will be significant to the leadership of educational institutions as they develop strategies to implement cost-effective solutions for managing the institutions as they aim to be relevant and competitive.

The Ministry of Education responsible for education policy planning and execution in Kenya will benefit from the study in understanding the best practices in integrating ERPs for managing institutional operations and academic affairs by leveraging on emerging technologies like cloud computing.

The Faculty and Staff who are presented with volumes of data and workload that needs to be processed efficiently and on a timely manner. This study will help them appreciate how the cloud-based ERPs can assist them work effectively without restrictions of locations. Students will be empowered by ERP systems through access to precise and prompt data within universities and academic community and, importantly, in a world where work and learning settings are increasingly remote, from any geographical location.

CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction

Chapter three (3) delves into the subjects pertinent to the study, encompassing the theoretical and conceptual framework, cloud computing technology (CCT), the landscape of cloud-based ERP, literature review, empirical exploration of cloud-based ERP implementation, and the pivotal factors for the successful execution of such implementations.

2.1 ERP Systems

As noted by (Monk & Wagner, 2013), ERP systems serve as fundamental software applications employed by businesses to harmonize and synchronize information across all sectors of the organization. This integration aids in the centralized management of company-wide processes, facilitated through shared management reporting tools. A search on the information sharing online portal, Wikipedia, provides a generalized definition of ERP as a classification of business management software, commonly a bundle of integrated applications, that an organization can employ to gather, store, administer, and interpret data from various business operations (Wikipedia, 2022). This implies that ERPs constitute a comprehensive set of tools, amalgamating financial, accounting, human capital, and procurement information into a unified database. (Nguyen et al., 2014).

Although ERP initially emerged from manufacturing and production systems, the range of ERP functionalities broadened during the mid-1990s to encompass tasks like financial management ,order management, asset management, and human resources management among others (Swartz & Orgill, 2011).

Presently, several ERP systems vendors exist in the market each providing ERP systems with various modules for organizations in diverse sectors with different sizes from small, medium an large enterprises.

The top listed commercial ERP brands in the market include Oracle, SAP, PeopleSoft, Microsoft, Workday and Salesforce (Weinberg, 2022). While other vendors have focused on sector specific solutions to meet industry-specific needs for instance for the education sector ERP systems such as Jenzebar, ERPNext, Kuali, Unit4z, Campus Nexus among others are in use (Jepma, 2021).

2.2 Landscape of ERPs in Public Universities in Kenya

According to a baseline survey done by KENET (2021), about 98% of universities in Kenya are already using an ERP System with Microsoft Dynamics and Abno Unisol systems as the dominant ERPs in their institutions. Others are using ERPNext (RAF international University), Baraza ERP (University of East Africa, Baraton), CampusNexus (Kenyatta University) while others are using separate siloed systems.

However, only 51% reported having completed the ERP implementation. Tertiary colleges reported a far lower ERP implementation completion rate of 25% of the 70% that have ERPs (KENET, 2021). Moreover, certain higher education institutions continue to adhere to the conventional method of managing information systems through individualized IT systems and storing data within distinct departmental systems, often attributed to a deficiency in infrastructure. Various modules such as admission, fee collection, attendance, examination, grading, billing, inventory, human resource management, etc. are implemented ad hoc in a single system or network-based system without any objective general value of a comprehensive ERP. The software utilized in these systems lacks integration of processes and the ability to communicate with one another (KENET, 2021).

The primary advantages of ERP systems for the education institutions lie in their ability to enhance administrative and academic services for students, faculty members, and the administrative staff. This is achieved by fostering greater integration across departments, leading to improved efficiency, increased revenues, and reduced costs. In Figure 2 below, Abdellatif, (2014) illustrates the business operations within higher education institutions and the ERP application systems tailored for this sector.

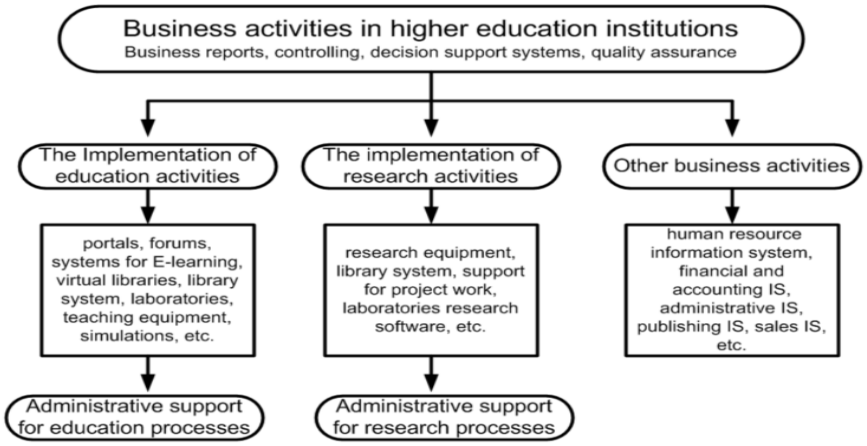

Figure 2 : *ERP in higher education context*

Source: (Abdellatif, 2014)

Quality and innovation in ERP solutions are anticipated to stand as significant factors distinguishing value delivery within PCUs. *Cost* and *quality* of service will continue to be the key drivers for evaluation of service delivery. Currently, the global educational system is experiencing the effects of the COVID-19 pandemic, leading to substantial difficulties for both educational institutions and students (Global Industry Analysts, 2022).

The Covid-19 pandemic crisis resulted in universities adopting remote learning platforms for continued learning out of class, as well as online management systems for seamless and efficient management capabilities. Online learning solutions enabled educators to readily connect with students and adjust to the remote work environment. The response to the pandemic has created an ideal scenario for the embracing of new technologies that support remote learning and working like cloud-based ERP solutions in the education sector.

The circumstance led numerous institutions in Kenya to embrace online or remote teaching and learning to ensure continuous education. The crisis expedited the transition to digital education. Furthermore, a number of institutions have invested in automated systems such as educational ERPs, learning management systems, and student information systems. Additionally, in a report published in the International Journal of Technology Management June, 2021 opines that acceleration and consumerization of technology is reshaping expectations by university administrators, faculty, students, and prospects alike. Instant, uninterrupted, secure, and mobile access to an institution's system is largely expected as the norm. Yet each audience brings with it numerous internet-enabled devices, straining campus networks already congested by simultaneous demands for speed, storage space, and massive downloads. To meet these challenges, universities and colleges must embark on a journey of technological transformation.

2.3 Cloud Computing Technology

Cloud computing represents a technological progression that has revolutionized how business is done in global industry. According to (Makathimo, 2016), cloud computing could be termed as delivery of computing resources to consumers over a network, such as an internet platform. Cloud computing enables organizations to offer services on demand and help their customers access computing resources at their convenience.

In their research (Fakeeh et. al., 2015) posit that cloud computing facilitates application software to be operated employing internet-enabled devices. According to a description by NIST, "Cloud

computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources for instance networks, servers, storage, applications, and services that can be rapidly provisioned and released with minimal management effort or service provider interaction (Mell & Grance, 2011).”

According to (Fakeeh et al., 2015), there's a contention that, in a broader context, cloud computing technologies (CCT) encompass services that present technological infrastructure resources via internet-based means and store data on remote or third-party servers in an intangible manner. The access models for CCT technology include pay-per-use, self-service provisioning through software, easily scalable services, and virtualized physical resources. These five cloud characteristics are distinctly outlined by NIST as “on-demand self-service, wide network accessibility, resource pooling, rapid scalability, and metered service”.

In addition, the primary classifications of cloud computing consist of Platform as a Service (PaaS), Infrastructure as a Service (IaaS), and Software as a Service (SaaS) (Mell & Grance, 2011). Within the SaaS model, customers access applications via the Internet using a lightweight client (web browser) and are billed according to usage. Cloud ERP systems fall under the SaaS category. Platform as a Service (PaaS) provides developers with middleware containing tools, services, and platforms that enable the creation of SaaS applications. Infrastructure as a Service (IaaS) involves delivering computing resources like hardware, storage, and software and is aimed at administrators (Abd Elmonem et al., 2016). Mell & Grance, 2011 further also described deployment models in cloud computing, which include private cloud, public cloud, community cloud, and hybrid cloud as shown in Figure 4 below.

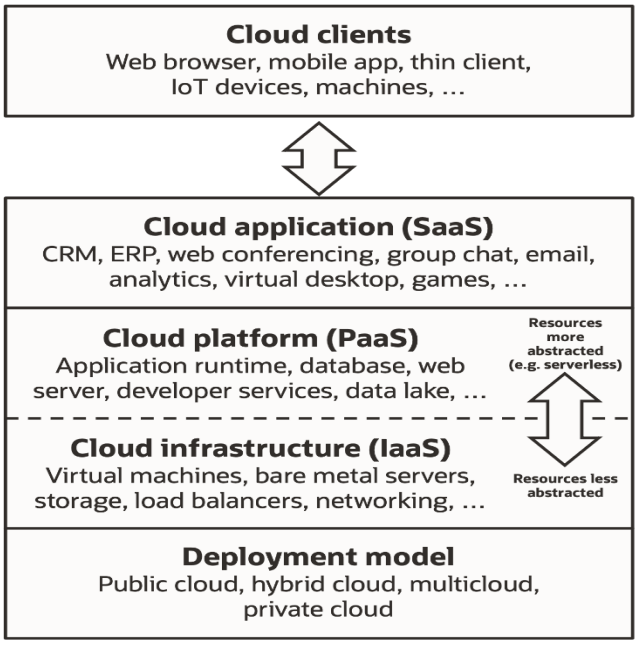

Figure 3: Cloud computing service models

Source: Researchgate.net

2.4 Cloud-based ERP Systems

Cloud Computing Technologies have allowed ERP systems to have capabilities of being offered as SaaS. To this end, most ERP vendors currently include cloud-based ERPs solutions in their product offering in order to leverage on the benefits of CCT.

Cloud-based ERPs are cost-effective and convenient in implementation to an organization (Duan et al., 2013). Additionally, according to research by Abd Elmonem et al., 2016, characteristically, cloud-based ERP systems are accessible through users' internet browsers, eliminating the need for installation or configuration on the user's end. These systems underpin fundamental business processes and should align with the organizational structure, ensuring they are tailored to suit the industry's specific requirements. (Nguyen et al., 2014).

Cloud-based ERP feature minimal application and support costs, near plug-and-play installation and improved agility, so that companies can deal with dynamic market situations (AlBar & Hoque, 2019). Furthermore, cloud-based ERP systems can be promptly configured as per specific requirements, easily maintained, and swiftly replicated. This efficiency in utilizing computing infrastructure subsequently results in decreased operational expenses (Duan et al., 2013).

As the fiercely competitive SaaS landscape continues to expand within the enterprise software

market, cloud-based ERP service providers are consistently enhancing their value proposition (Nguyen et al., 2014). Cloud deployment is rapidly emerging as the prevailing option for implementing ERP systems. A study by Panorama Consulting Group, an R&D firm, in 2022 shows that leading ERP vendors like Oracle, Microsoft, SAP, Infor Sys all provide cloud-based ERPs in their product portfolio. This is in addition to hundreds of other customized and industry specific cloud ERPs that are used by the different segments of the market. Oracle Netsuite, Microsoft Dynamics 365, Acumatica Cloud ERP, Workday are some of the leading cloud ERP systems for small to midsized organizations. (Jepma, 2021) noted that the leading top five educational cloud ERPs in the market are Jenzebar, ERPNext, Kuali, Unit4 and Campus Nexus.

In regard to overall improvement over on-premises ERP systems, according to study by AlBar & Hoque, (2019), calculations suggest that the expense associated with employing cloud-based ERP is approximately 15 percent less than that of locally-hosted ERP systems. Furthermore, the implementation period has been curtailed by approximately 50 to 70 percent. This is supported by (Al-Johani & E. Youssef, 2013) whose study avers that cloud-based ERP can reduce 50 per cent development team cost, 40 per cent on technical support team cost, 10 per cent on testing, 25 per cent requirement modification, 15 per cent on backups, and up to 40 per cent cost on the overall project expenditure.

Duan et al., (2013) concluded that the primary advantages of cloud-based ERP encompass reduced initial expenses, decreased ongoing operational costs, swift implementation, scalability, increased emphasis on primary strengths, availability of cutting-edge technologies, swift updates and enhancements, improved accessibility, mobility, and user-friendliness, seamless integration with other cloud services, and enhanced disaster recovery capabilities.

The main concern in regard to cloud-based ERP is data insecurity and apprehension of data security by users (Nguyen, et, al., 2014). It's observed that organizational top management often holds concerns about data stored in the cloud, given their limited control over security, relying on cloud service providers. As a result, cloud computing service providers need to furnish state-of-the-art technologies, coupled with unwavering commitment and assurances regarding data integrity and security.

2.5 Implementation of Cloud-Based ERP systems in Kenyan Public Universities

The challenges associated with ERP systems underscore the insufficiency of quality research study that takes into account the distinctive functional requirements of higher education (Epizitone & Olugbara, 2020). The primary goal of introducing ERP systems in higher education is to consolidate diverse administrative functions into a more organized and economically efficient approach, aiming for strategic and competitive advantages (Makokha et al., 2013).

In the past, the consolidation of administrative tasks, such as financial systems, human capital management, and academic functions (like registration, admissions and recruitment), has been managed through distinct legacy systems. However, creating a model for the economical implementation of ERP systems that can smoothly interlink these modules remains a notable hurdle for the administrations of Kenyan public universities. This challenge persists due to the intricate nature of ERP solutions. (Machal et al., 2013).

According to (Seo, 2013), the significant challenges surrounding ERP implementation encompass not only technological concerns but also organizational and environmental factors. These include issues of resistance to change, organizational culture, incongruous business practices, mismanagement of projects, and insufficient commitment from top management, among others. The study further points out that the adoption of ERP systems prompts universities to adopt a more business-oriented perspective on education, which in turn brings about significant cultural shifts in the administration and management of both academic and administrative affairs. Resistance to ERP implementation can arise in public universities since it not only introduces a new information system but also necessitates changes in organizational workflow and consequently, the overall culture.

Therefore, on-premises ERPs have faced many challenges, hence the lower implementation success rates in most institutions, many of which have taken longer delivery duration and incurring substantial expenses for deployment, ranging from investments in IT infrastructure to the costs associated with software licenses. In contrast, cloud ERP implementation takes less time than on-premises ERP implementation. Consequently, cloud ERP customers save significant time and resources reserved for troubleshooting and ERP implementation (Machal et al., 2013). Further, to attain improved cost efficiency, choosing to implement a cloud ERP is regarded as the optimal

choice, given its affordability in both adoption and maintenance when compared to on-premises ERP systems. (Kumar et al., 2021).

2.5.1 Implementation Models of Cloud ERPs

According to (Agrawal, 2016), Cloud ERP implementations are categorized into three types: “cloud infrastructure (IaaS), cloud platform (PaaS), and complete cloud application (SaaS)”. In Cloud Infrastructure-based ERP, users are furnished with a virtualized infrastructure (servers and compute resources) accessible over the internet, while the operating system and the ERP application remain physically hosted on the customer's premises but running say on virtual machines. Cloud Platform ERP offers customers both cloud infrastructure and platform, with the ERP application situated on the users’ side. The complete Cloud ERP is a comprehensive solution where all the ERP application, the platform, and infrastructure reside in the cloud, whether it's a private or public cloud, and is accessed via the users' secure web browser channel.

2.5.2 Critical Success Factors of Cloud ERPs Systems in Higher Education

Understanding and defining the key success factors used to indicate and assess the success of cloud ERP system implementations is pivotal. Kumar et al., 2021 in their research identified 17 CSFs categorized in to 6 groups namely; skills and knowledge, system assurance, organizational culture, system usability, external support and Strategic considerations are some of the key critical success factors to be considered. Furthermore, scholars have emphasized the necessity of critical success factors (CSFs) that would help optimize the potential outcomes of implementing an ERP application system. In his study regarding the implementation of cloud-based ERPs in SMEs, Hamdar (2020) concluded that organizational leaders should strive to formulate and execute a strategy for cloud-based ERP implementation, considering factors like strategic alignement, top management endorsement, software selection, vendor selection, project management, change management, and user engagement. Top management should also harmonize institutional policies, procedures and practices and the strategic plan with the strategy for ERP implementation. Moreover, they should anticipate and adequately equip themselves to address challenges linked to the adoption of the new ERP system (Hamdar, 2020). Moreover, a research study by (Al-Hadi & Al-Shaibany, 2017) on the critical success factors (CSF) applicable in higher education of Yemeni universities concluded on the below CSFs: “1. Vision and objectives. 2. Top management support and commitment. 3. Clear business process, information flow and organizational structure. 4.

Budget size and cost. 5. Full functions integration. 6. Project management, training and skill empowerment. 7. Change management. 8. Effective communication"

2.6 Theoretical Framework

This research is underpinned by the Information Systems Success Model (ISSM), the Technology-Organization-Environment (TOE) framework, and the Diffusion of Innovation (DOI) theory, which serve as suitable theoretical foundations.

2.6.1 Information Systems Success Model

It is resource intensive endeavor for organizations to implement ERP systems (Davenport, 1998). Institutions globally have put in, the effort, time and financial resources into adoption of ERP systems, with the objective of leaner business processes, better customer satisfaction and retention, as well as improved strategic business management (Umble, Haft and Umble, 2003). Despite this many enterprises and ERP users continue to register dissatisfaction, with the Information Systems describing a failure to deliver on critical success factors.

After an empirical and comprehensive study of literature into instruments used to assess IS success on diverse categories, (DeLone and McLean, 2003) suggested an overall Information Systems Success Model (ISSM). The IS success model they proposed distinguishes six distinct evaluations dimensions and provides a framework of temporal and causal factors for evaluation of IS success (Seddon, 1997). Given that cloud-based ERP systems are information systems, they are well-suited for the application of the ISSM in assessing their implementation.

The six dimensions posited by (DeLeon and McLean, 2003) applicable to evaluating the success of implementation IS are; "system quality, information quality, service quality, use, user satisfaction and net benefit". During the evaluation of IS success in the design phase, the model examines three dimensions: "system quality, information quality, and service quality". On the other hand, when assessing success in the utilization phase, the model puts forward a single success factor: "Use". Lastly, the evaluation or monitoring of IS system outcomes occurs across two dimensions; "User Satisfaction and Net Benefits" (Rai et al., 2002)

Information Systems success refers to its capability to achieve desired results or objectives (Drucker, 2004). The achievement of organizational goals encompasses system-resource goals, user-oriented goals and end result or net benefits. Cloud-based ERP implementation in PCUs in

Kenya includes technological, organizational, and environmental components and therefore must be viewed as an institution wide project and not as a large ICT initiative (C. Yu, 2005). According to ISSM this intersection of design, use and outcome are integral for the implementation of IS in this case cloud-based ERP. Further, the cloud-based ERP should be of use to the organization, provide information accurately, timely, verifiably, consistently, and securely while being user friendly, and delivering convenience to the users.

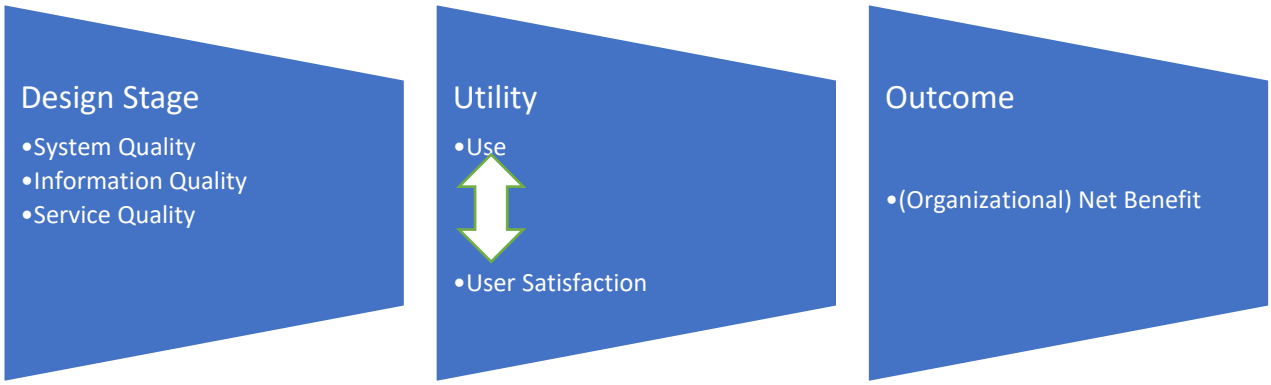

Figure 4: Information Systems Success Model (ISSM) process flow for implementation of Cloud-based ERPS in Kenyan Public Universities

Source: Author

2.6.2 Technology-Organization-Environment (TOE) framework

As per Tornatzky and Fleischer (1990), "the adoption of technology is influenced by factors that can be categorized into technological, organizational, and environmental contexts. These authors asserts that the technological context pertains to how organizations decide on technology adoption based on its availability and its compatibility with the firm's current technology". The organizational context examines the organization's features, such as its structure, human resource capacity and quality, and the influence of its size on choices related to technology adoption. The environmental context encompasses the sphere within which an institution operates, including factors like competitive pressures, industry, and government regulations, as illustrated in Figure 4 below. (Adade-Boafo, 2018) posit that the components of (a) technological, (b) organizational, and (c) environmental context vary in each study, depending on the unique characteristics of diverse industries or institutions. Nevertheless, this method of customizing and enhancing theoretical models to align with a particular study was deemed suitable by (Kinuthia, 2014).

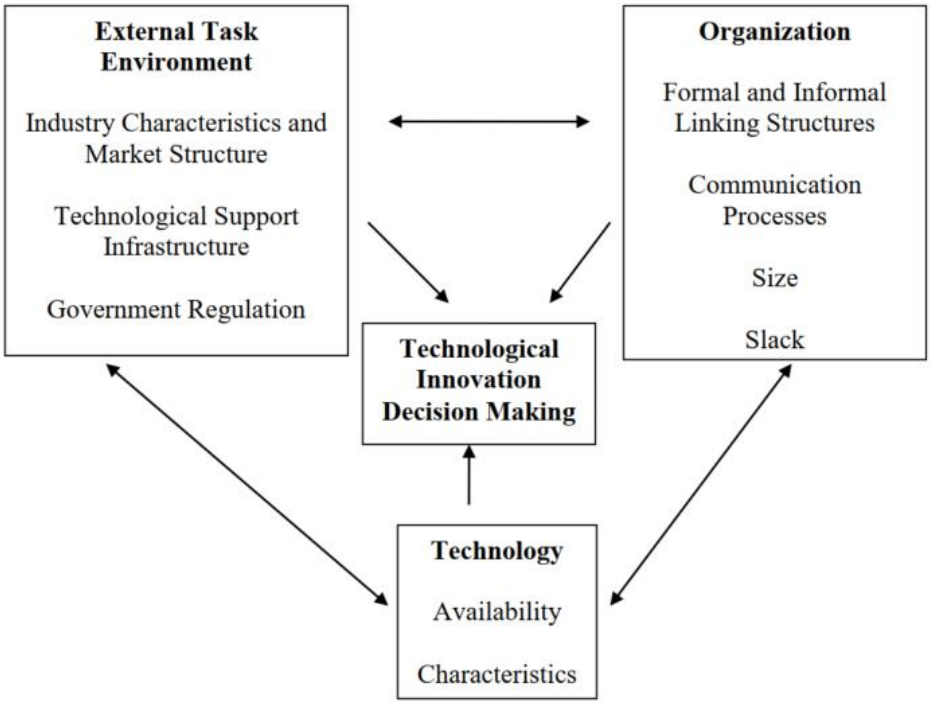

Figure 5: Technology, Organization, and Environment framework

Source: The Process of Technological Innovation (p. 153), by L.G. Tornatzky and M. Fleischer, 1990

Technology Context

This pertains to technologies within and outside the organization that have a connection to or influence on the organization, encompassing technologies accessible within the specific industry's realm.

Relative advantage or *Perceived benefits* (Rodgers, 2003) defined this as "the degree to which an innovation is observed as being better than the idea it supersedes". The majority of institutions express interest in embracing cloud-based ERP systems due to their perception that such adoption can lead to time and cost savings, improved communication, and a quicker and more effective integration of new cloud-based ERP applications compared to traditional ERP systems (AlBar & Hoque, 2019).

Compatibility is defined as "The extent to which an innovation is seen as fitting in with the existing values, experiences, and needs of potential users (Rodgers 2003)". Kinuthia (2014) argued that Organizational leaders are inclined to embrace innovations that align with their business culture, values, and prior experiences. When a new technology adoption aligns with the organization's existing technological architecture and systems, the adoption and rollout of an innovation like Cloud ERP can bring enhanced advantages to the organization (Bhatti, 2017).

Complexity. Regarding the attributes of innovation, complexity implies the extent to which an innovation is considered as relatively challenging to comprehend and employ." Due to their user-friendly nature, cloud-based ERP systems are more likely to be embraced and utilized by educational institutions.

Security Concern. Security apprehensions in the perspective of cloud ERP adoption were tackled, as investigated in a study conducted by Saeed et al. in 2011. This study emphasized that concerns over perceived security risks and the lack of data privacy was a significant factor in the decision-making process for implementing such systems. This perspective aligns with existing literature, including works by Kraemer, Dedrick, Melville, and Zhu in 2006, and Yoon and George in 2013. Within this study, the term "security concern" alludes to the level at which a cloud ERP system is observed as potentially jeopardizing storage and sharing of data and other business transactions. For instance, prospective adopters might regard the migration of their ERP system to a cloud platform as a substantial vulnerability, one that could be exploited by malicious entities. Additionally, potential adopters may be hesitant to entrust ERP Cloud vendors with sensitive customer information or proprietary business data. However, it's important to highlight those specific investigations, such as those carried out by Chang et al. in 2007 and Yoon & George in 2013, have not discovered concrete empirical proof substantiating the influence of security risks on technology acceptance and adoption. This study theorizes that institutions utilizing Cloud ERP systems will manifest diminished levels of security risk in comparison to those that have not integrated these systems.

Trialability is the capacity of an innovation to be trialed or evaluated before being rolled out to a wider audience. (AlBar & Hoque, 2019) suggested that the concept of trialability correlates positively with the utilization of ERP systems. Moreover, potential users need to be able to perceive the advancements within their respective industries to gain a clearer understanding of the appropriate version of cloud ERP that aligns with their needs.

Cost-effectiveness – Savings on costs is another technological factor to consider. (AlBar & Hoque, 2019) argued that employing Cloud ERP yields advantages in terms of cost reduction, achieved by decreasing production, infrastructure, and maintenance expenditures. Additionally, Alsharari et al., (2020) argued that employing Cloud ERP has the potential to decrease an organization's overall cost of acquisition, deployment, and maintenance in contrast to traditional on-premise ERP systems.

Organizational Context:

The available literature demonstrates that the adoption and implementation of Cloud ERP can be influenced by organizational factors, which are discussed as follows.

Top management – According to (Kinuthia, 2014), top management have the authority to furnish ample resources and requisite assistance for the implementation of emerging technologies, such as cloud ERP. The backing of top management to the implementation team throughout the organization is significant, as it positively impacts engaging end-users actively. This is particularly critical for training and fostering cross-departmental collaboration and information sharing (Alsharari et al., 2020). Embracing a new technology often brings about numerous alterations within the organization. Frequently, these changes encounter opposition within the institution. However, with a favorable stance from top management regarding technology, this resistance can be mitigated.

Organizational Readiness – This pertains to the financial and technological assets accessible to an organization. In the milieu of this research, organizational readiness signifies the quantification of financial and technological resources at the institution's disposal, which can be allocated for the implementation of cloud ERP systems. As outlined by Kinuthia (2014) and corroborated by other examined empirical research, "the evaluation of organizational readiness involves two sub-constructs: financial and technological readiness". Financial readiness assesses whether the organization possesses the necessary funds for the implementation of cloud ERP technology and any ensuing post-implementation expenses. Conversely, technical readiness gauges the degree of IT advancement in terms of usage and administration. Organizations and institutions with sophisticated IT infrastructures are more likely to have the skills and confidence to adopt and implement cloud ERP systems

Size of organization – The magnitude of an organization holds significant sway over the perceived strategic significance of cloud computing in the realm of innovative technological progress. Bhatti (2017) contends that larger enterprises possess superior resources, skills, experience, and resilience against setbacks compared to their smaller counterparts. Universities are commonly regarded as having more substantial financial, technological, and human resources in contrast to technical colleges. However, while larger organizations may benefit from resources, they can also grapple with inertia, a circumstance that renders them less agile and more resistant to rapid adaptation. Consequently, small and medium organizations might be more predisposed to embracing novel

technology than their larger counterparts. Conversely, owing to their scale, small firms can exhibit heightened innovation: they are adaptable enough to tailor their actions according to shifts in their environment, which may be more challenging for larger firms burdened with multilayered bureaucracy that can impede swift decision-making processes (Kinuthia, 2014a) (Bhatti, 2017). The adoption of IT frequently necessitates coordination, which could be relatively more attainable in smaller institutions characterized by accelerated decision-making procedures.

Environmental Context

Competitive Pressure is defined as the degree of influence an organization encounters from counterparts within the same industry. The adoption and utilization of ICT resources escalates as competing stakeholders embrace novel technologies. The external impetus originating from different stakeholders - consumers, competitors, and business partners - to embrace a specific technological aspect has been identified as a factor with a constructive effect on the adoption and utilization of ICT (Razzaq et al., 2021). Universities operate in a competitive environment where they benchmark against fellow institutions and tend to implement innovative solutions that others within the sector have done. The high-tech sector is marked by swift transformations, compelling firms to remain highly attuned to and emulate their rivals' incorporation of novel technologies. By embracing and executing cloud technology, companies stand to gain significant advantages, including enhanced market visibility, improved operational efficiency, and more precise data accumulation (Bhatti, 2017).

Vendor support – This pertains to the accessibility of services such as training concerning their supplied systems, as well as technical and user support during the implementation and utilization of cloud ERP systems. Kinuthia, (2014) postulated that institutions who have effectively implemented Cloud ERP systems are anticipated to possess a heightened degree of vendor assistance. As per a study conducted by Alsharari et al. in 2020, “the presence of external support for the adoption of Cloud ERP systems within an organization can significantly influence the decision-making process”. Aspects like training, end-user support service, technical assistance and environmental considerations provided by cloud computing providers can notably affect the success of Cloud ERP implementation for any institution. The selection of a reliable cloud ERP provider also constitutes a pivotal environmental factor that contributes to the success of the implementation. Moreover, numerous enterprises rely on their vendors for their IT systems design and implementation endeavors. According to Bhatti (2017), marketing activities, targeted

communication pitches, and success of completed projects by these vendors can considerably impact a potential client's determination to embrace IT innovations.

2.6.3 Diffusion of Innovation Model

Rogers (1995) introduced the initial process model, a five-stage framework for the integration and acceptance of innovation within organizations. The DOI model scrutinizes a range of innovations by introducing four factors: “innovation, communication channels, time, and a social system” that collectively impact the dissemination of a novel technological concept. As posited by Rogers (1995), an innovation like the utilization of cloud enterprise systems in the management of higher education institutions is categorized as a technological innovation. This stems from the shift in paradigm towards cloud-based information systems from conventional on-premise information systems.

The DOI model proposes various attributes of innovation that are presumed to aid in the dissemination of technological innovation. This model incorporates three principal components: “adopter characteristics, innovation characteristics, and the innovation decision process”. In the innovation decision phase, a sequence of steps, namely “knowledge, persuasion, decision, implementation, and confirmation”, unfolds via a sequence of communication paths among individuals within a common social network over a duration of time, as illustrated in Figure 5 below. In the context of this study, the emphasis centers on the initial three stages wherein institutions deliberate whether to adopt or reject the implementation of cloud-ERPs.

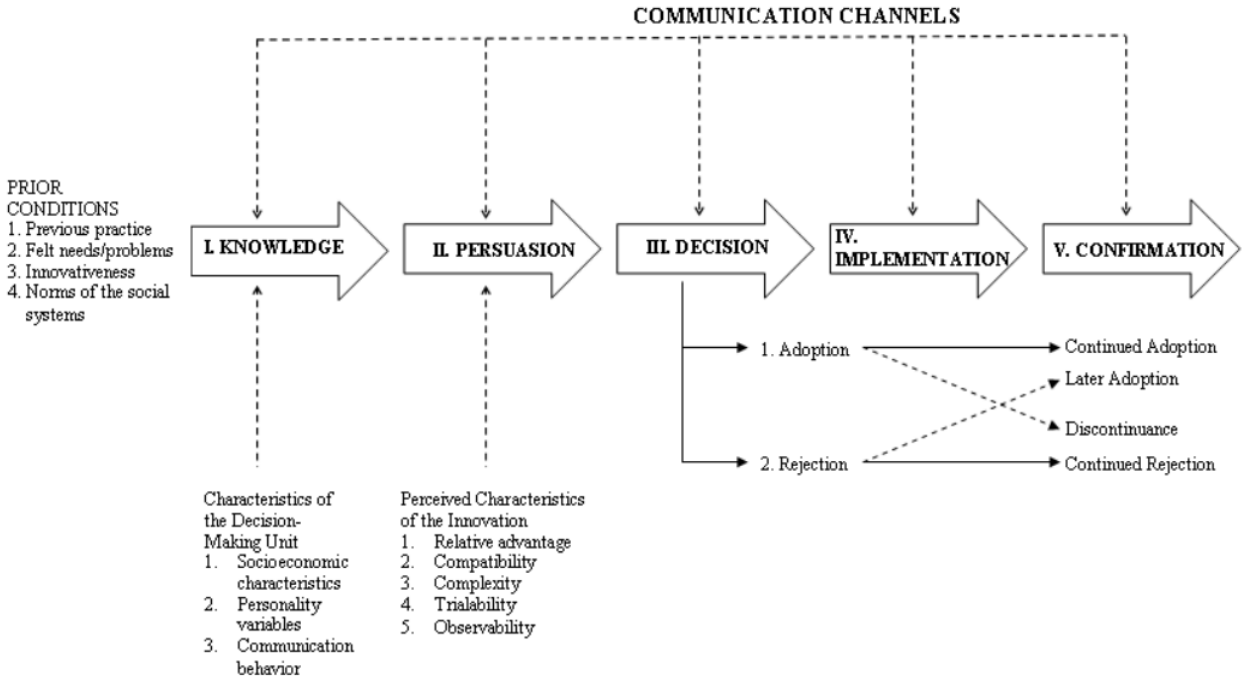

Figure 6: A Model of Five Stages in the Innovation-Decision Process

Source: Diffusion of Innovations, (Rogers, 2003)

Within the context of the innovation's characteristics phase, five principal constructs, namely "relative advantage, compatibility, complexity, trialability, and observability", have been identified as pivotal factors in the acceptance of any innovation. The DOI theory employs these five attributes of innovation to evaluate the inclination to adopt IT innovations such as Cloud ERP. These characteristics are purported to exert a significant influence on whether an institution chooses to adopt or decline a specific innovation, like Cloud ERP (AlBar & Hoque, 2019).

Regarding this study, the research framework finds its foundation in the widely recognized Technology-Organization-Environment (TOE) framework. Nonetheless, the TOE framework closely aligns with the diffusion of innovation theory, as indicated by studies such as those conducted by (AlBar & Hoque, 2019); (Kinuthia, 2014a); (Adade-Boafo, 2018).

2.7 Conceptual Framework

Technological factors in organization can be viewed as the different variables which relate to the accessibility and development of technology (Egdair et al., 2015). As the implementation of technology is an ongoing process, institutions should adapt to the changing environment yet remain competitive and provide quality through the use of technological systems. Implementing cloud-based ERPs in organizations should be geared towards the overall undertaking of institutions.

Kenyan Public universities have been tasked with the delivery of quality education to remain competitive in the global arena. Integrating the operation of cloud-based ERP systems in public universities with the current existing systems should result in reduced overall costs and heightened efficiency during their implementation.

Furthermore, organizations have different cultures that they have adopted to meet their specific objectives. Public universities in their quest for service provision have been in the frontline towards the promotion of better and quality education that are relevant and attuned with current global trends. In the implementing of ERPs, the organization becomes critical toward promoting the adoption and managing the change process. Organization changes can only work well when there is support from the management and the required resources needed toward equipping staff through capacity building in training to grow the skills in the utilization of the different ERP systems being implemented.

When ERPs are introduced in institutions, they encounter environmental changes that have been in existence and in operation. Changes geared towards regulations and the operating environment becomes critical, these laws need to be favorable and accommodating towards newly introduced systems that are in pursuit of enhancing the growth and increased productivity of organizations, policies and laws need to be flexible to accommodate the ever-changing environment as the introduction of new systems are developed. Institutions are also geared towards support that comes from the different service providers in enhancing the use of the cloud-based ERPs through integrating in the already existing environment. Technical support becomes essential in the delivery of successful ERP implementation for the institutions to remain competitive. Training and end user support that is availed on the systems, SOPs that are relayed and followed contribute to effective processes thus increases the institutions capability and capacity in the use of the systems. It is paramount for the cloud-based ERP solutions to be simple to use and operate.

Hypotheses

Drawing from the analysis of existing literature, the following hypotheses were formulated:

H1: IT infrastructure availability and compatibility with new technology is positively related to the decision to implement cloud-based ERP in Public Universities.

H2: Security Concern of data in cloud-ERPs is negatively related to the decision to implement cloud- ERP in Public Universities.

H3: Cost-effectiveness is associated with the decision to implement cloud- ERP in Public Universities.

H4: Top Management support is correlated with the decision to implement cloud-based ERP in Public Universities.

H5: Adequate User capacity/Skills is correlated with the decision to implement cloud-based ERP in Public Universities.

H6: Competitive Edge is positively related to the decision to implement cloud-based ERP in Public Universities.

H7: Regulatory and Policy Framework is positively related to the decision to implement cloud-based ERP in Public Universities.

H8: Adequate Vendor Support is positively correlated with the decision to implement cloud-based ERP in Public Universities.

Presented in Figure 7 below is the envisaged research model, depicting the variables within technological, organizational, and environmental contexts that might sway the decision-making process regarding the implementation of Cloud ERP systems.

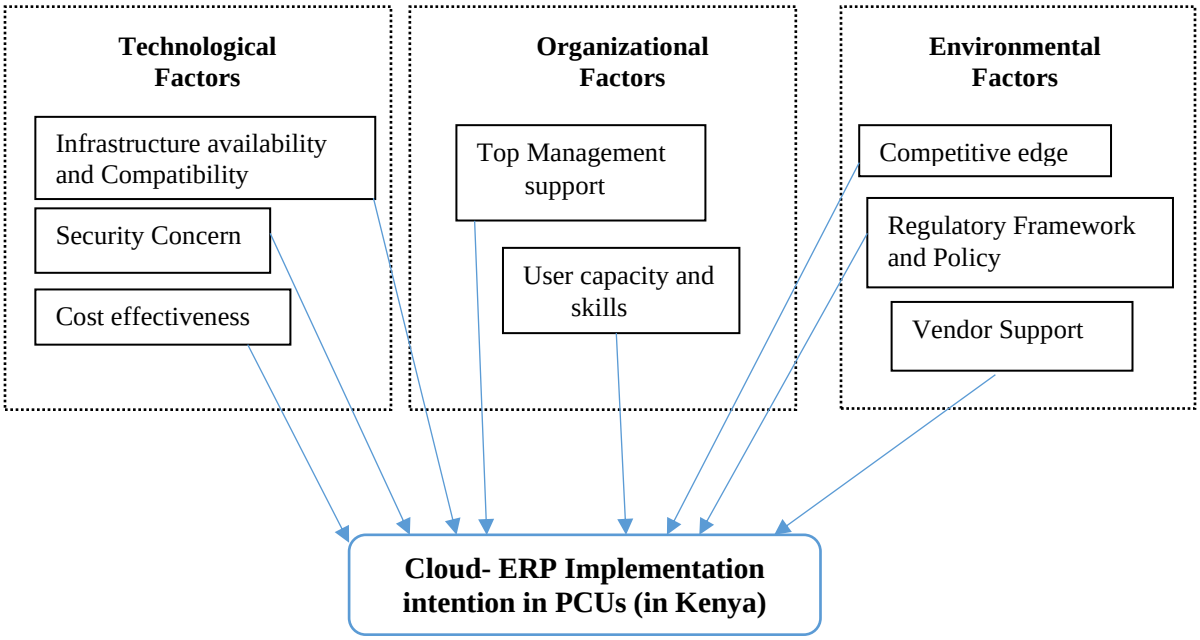

Figure 7: A conceptual framework for implementing cloud-based ERPs in Kenyan Public Universities

CHAPTER THREE: RESEARCH METHODOLOGY

3.0 Introduction

Chapter three (3) outlines the methodology employed to conduct the study. It encompasses sections concerning the research design, population, sampling framework, sample and sampling method, instruments, measurement variables, as well as data collection and processing procedures.

3.1 Research Design

Research is a systematic way of gaining new knowledge and finding answers to problems or questions (Bhattacharyya, 2006). This study adopted a non-experimental quantitative research design. Quantitative research methods yield quantifiable values (Kothari, 2007). Further the study applied descriptive and correlational designs in addressing the research questions.

Descriptive design is a method that can determine the situation in current phenomenon (Williams, 2007). The chosen method is aligned with the objective of this study, enabling the delineation and categorization of the phenomenon, the identification of its characteristics, trends, and categories (Nassaji, 2015). The descriptive method plays a pivotal role in elucidating the essential factors pertinent to the implementation of cloud-based ERP within the study's scope. Correlational design provides a method to measure and describe the degree of association among variables in the study (Creswell, 2012). Using the method, the study drew inferences between the respondents and their documented behaviors and opinions (Marczyk et al., 2005).

3.2 Target Population

The study's target population comprised the thirty-one (31) Public Chartered Universities (PCUs) in Kenya, registered by the Commission of University Education (CUE) as of December 2020.

3.3 Sampling Technique

The researcher employed a non-probability sampling technique, specifically opting for the purposive sampling method. This technique targeted the respondents, who are the employees of the PCUs the Chief Manager HR (Officer), Dean of Students, Director of ICT, ICT Manager, Registrar Finance, Finance Manager and Registrar Academic Affairs. The technique in addition facilitates the testing of hypothesis and easier collection of the respondents' data as the PCUs are

distributed over a large geographical area.

3.4 Sample size

Sample size determination involves mathematically estimating the number of subjects or units to be incorporated in a study (Kaur, 2021). (Senam & Akpan, 2014). A confidence level of 95% was assigned to mitigate potential sampling errors.

$$n = \frac{N}{1 + N(e)2}$$

n = is the sample size
N = is the population size,
e = is the level of precision (0.05)
1= is unit or a constant

$$N \quad \frac{275}{1+275(0.05)2} \qquad \frac{275}{1+0.69}$$

= 162 sample

3.5 Data Collection Instrument

For this study, a questionnaire was formulated to methodically gather data from the sampled participants regarding the different variables, particularly the independent variable. The questionnaire serves as a research tool designed to articulate the study's specific objectives into meticulously structured questions, each furnished with corresponding answers, thereby furnishing data for hypothesis testing. (Mugenda & Mugenda, 2003).

There are different ways to gather data that include tests, questionnaires, interviews, focus groups, observation, and secondary data (Osang et al., 2013). Tests give researchers the chance to match respondents' opinions to a specific interest, opening up fresh perspectives on the subject (Langkos, 2014). Using the observational approach, the investigator looks for information on their own without consulting the respondent (Ciesielska et al, 2018). If observation is done accurately, the main benefit of this method is that subjective bias is eliminated. Instead of asking a series of questions, focus groups involve group interviews where a particular topic is hosted for discussion (Lane et al.,2001). Secondary data is defined as information that has already been collected and may be utilized to answer queries for which the initial study was not anticipated (Martins et al., 2018). The oral-verbal conversations are presented during an interview, and respondents respond orally and verbally (Tuleja, 2008).

3.6 Data Analysis Plan

The quantitative data was coded before being statistically analyzed aided by statistical software, SPSS. Descriptive statistics was analyzed using frequencies, percentages, standard deviations and presented using tables, graphs and charts. The study used statistical software SPSS for preliminary analysis and the field data was totaled using Excel to help with data organization. SPSS is recommended by academics for the analysis and mining of survey data to maximize the value of the acquired information. The tests that were run as part of the research examined the variables that have an influence on public universities when the dependent variable, cloud-based ERP systems, are influenced by the independent variable (technology factors, organization factors and environmental factors). The following tests were performed: Mean tests, a measure of the averages of data sets, was used in the study as an observation of the data. Additionally, the standard deviation, which depicts the spread of data from the mean location of data sets, was calculated. Regression analysis was employed to ascertain the suitability of the model. The predictor variables (IV) was subjected to the regression model to determine their impact on the dependent variable (DV).

ANOVA (Analysis of Variance) tests were conducted to further examine whether the independent variables of the model exhibited statistical significance in predicting the dependent variable, employing the F statistics approach. The data was analyzed using a combination of qualitative and quantitative techniques due to the usage of the Likert questionnaire and the fact that a substantial portion of the data involved subjective judgments based on non-quantifiable information.

Graphs showing the ranking of the factors and their effects on the dependent variable was used to display the findings. Each item on the questionnaire was assigned a number and coded throughout the coding process in order to make entering the data into the SPSS system easier. Graphs showing the ranking of the factors and their effects on the dependent variable was used to display the findings.

3.7 Reliability and Validity

Reliability is a statistical concept that pertains to the degree of consistency in measurement, indicating how consistently an instrument will yield the same results each time it's employed under identical conditions with the same group of subjects (Mahajan 2017). The researcher used Cronbach's Alpha (α) generated by SPSS to check on the items measured by the questionnaire. The results were coded into SPSS which was used to generate the reliability coefficients. A

Cronbach's alpha value within the range of 0.6 to 0.7 indicates an acceptable level of reliability, while a value of 0.8 or higher signifies a very good level (Ursachi et al 2015). However, values exceeding 0.95 might not necessarily be favorable, as they could potentially indicate redundancy (Hulin, Netemeyer, and Cudeck, 2001).

The study's overall Cronbach's was measured and shown in the table.

3.7.1 Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.670	.692	36

3.8 Ethical Considerations

Ethical principles were thoroughly addressed before commencing the primary research, with corresponding measures taken. The research instruments underwent faculty review prior to distribution. The confidentiality and privacy of all respondents was upheld, ensuring that no personal identifiable information of all the participants was disclosed or exposed to unauthorized individuals.

CHAPTER FOUR: DATA ANALYSIS AND FINDINGS AND PRESENTATION OF FINDINGS

4.0 Introduction

This chapter presents the outcomes derived from the questionnaire distributed in the Public Chartered Universities. The data was encoded, evaluated, and conclusions were drawn using descriptive and inferential statistical techniques in accordance with the research objectives and questions.

4.1 Response Rate

Finchman (2008) suggested that a response rate of 60% or more is deemed valid for a research study. Additionally, Mugenda and Mugenda (1999) specify that a response rate of 50% is satisfactory for analysis and reporting, 60% is commendable, and a rate exceeding 70% is regarded as excellent. The study aimed to survey 275 participants, but only 162 responses were received, accounting for 74.65% of the intended responses. This signifies that the study achieved a satisfactory response rate.

The response rate obtained for the study is shown in table 1 below.

	Not filled	Returned	Total
Rate	113	162	275
Percent	41.09	58.91	100

Table 1: Response Rate

4.2 Demographic

The study evaluated the gender and age range, chartered public institution years, years of work experience, job title, employees' count and the type of ERP used in the institution. The results are show on table 2 below:

4.2.1 Age of respondents

The age of those who responded is depicted in the table below.

Age	Frequency	Percent	Cumulative Percent
24-29	28	17.3	17.3
30-34	24	14.8	32.1

35-39	32	19.8	51.9
40-44	11	6.8	58.6
45-49	21	13.0	71.6
50-54	18	11.1	82.7
55-59	17	10.5	93.2
60 and above	11	6.8	100.0
Total	162	100.0	

Table 2: Respondents' age

The responses showed ages 35-39 represented 32 percent, 24-29 was 28 percent, 30-34 was 24 percent, 45-49 was 21 percent, 50-54 was 18 percent, 55-59 was 17 percent, 40-44 and above 60 represented 11 percent. This indicated that there was a mix in the age category distributed within all age groups.

4.3 Years of Employment

The study collected data on the duration of the employees' tenure in their respective roles within the institution. The results are as shown in table 3 below:

Years	**Frequency**	**Percent**	**Cumulative Percent**
1 Year	5	3.1	3.1
1-3 Years	19	11.7	14.8
3-5 Years	56	34.6	49.4
5 and above	82	50.6	100.0
Total	**162**	**100.0**	

Table 3: Respondents' years of employment

A majority of the participants possessed considerable experience in university employment. Fifty percent of the respondents had five or more years of work experience, while 34% had between three to five years of work experience.

4.4 Job title

The study assessed the role of individuals in the institutions and the results are as shown in the table below.

Title	Frequency	Percent	Cumulative Percent
Human Resources Manager (Officer)	21	13.0	13.0
Dean of Students	20	12.3	25.3
Director of ICT	24	14.8	40.1
ICT Manager	25	15.4	55.6
Registrar Finance	27	16.7	72.2
Finance Manager	17	10.5	82.7
Registrar Academic Affairs	28	17.3	100.0
Total	**162**	**100.0**	

Table 4: Respondents' job titles

4.5 Technological Factors

The first study objective was to investigate the technological factors affecting the implementation of cloud ERPs in public universities in Kenya. The responses were indicated on a Likert scale and analyzed though different percentages, means, deviations and indicated: On the scale of 1-7, where: (1) Strongly Disagree, (2) Disagree, (3) Somewhat Disagree, (4) Neutral, (5) Somewhat Agree, (6) Agree and (7) Strongly Agree.

The results in Table 5 below indicate that 41.4% of respondents strongly agreed while 21% agreed that their institution has adequate IT infrastructure to support cloud ERP system (mean = 5.72222; std deviation = 1.47968). Further, a strong agreement was reported by 37.7% of the respondents, indicating that the choice of Implementing Cloud-ERP is compatible with the institutions' technology infrastructure (mean = 5.75926; std deviation = 1.42648). This is an indication that the institutions have the right technology infrastructure to implement cloud-based ERPs.

Table 5: Effect of technological factors on the implementation of cloud-based ERP systems.

Technological Variable	Question Items	SD%	D%	SWD%	N%	SMA%	A%	SA%	Mean	Std. Error of Mean	Std. Devn	Variance
Infrastructure Availability & Compatibility	The university has adequate IT infrastructure to support cloud ERP system?	3.1	2.5	0.9	10.7	20.4	21	41.4	5.722	0.11625	1.4796	2.18944
	Implementing Cloud-ERP is compatible with the institutions' technology infrastructure.	4.3	0.1	0.3	11.1	17.6	28.9	37.7	5.759	0.11208	1.4264	2.03485
Security Concern	Is data security and device integrity a major critical factor for cloud-ERP system implementation?	2.5	2.5	2.5	6.8	4.3	24.7	56.8	6.092	0.11444	1.4566	2.12181
	Cloud-based ERP system provides security features that ensure data integrity and privacy?	3.1	3.1	2.5	6.2	23.5	29.6	32.1	5.611	0.11526	1.4670	2.15217
Cost-Effectiveness	Is financial cost a major consideration in implementing a cloud-ERP System?	13	4.3	4.3	6.8	4.3	16	51.2	5.382	0.17207	2.1901	4.79672
	The use of cloud-based ERP systems will save the University's resources and costs	4.9	2.5	0.2	8.6	16	17.2	50.5	5.827	0.12737	1.6212	2.62833
	The university will face financial challenges in maintaining cloud-based ERP platform?	2.5	4.9	15.4	6.8	3.7	25.9	40.7	5.450	0.14121	1.7973	3.23047

In addition, 56.8% of the respondents strongly agree that data security and device integrity is a major critical factor for consideration in the cloud-ERP system implementation (mean = 6.09259; std deviation = 1.45664). Moreover, there was a strong agreement (32.1%) that Cloud-based ERP system provides security features that ensure data integrity and privacy (mean = 5.61111; std deviation = 1.46703).

Respondents further agreed strongly (51.2%) that financial cost is a major consideration in implementing a cloud-ERP System (mean = 5.38272; std deviation = 2.19014), though 13% did not agree on this premise. Furthermore, there was a strongly agreed position that the use of cloud-based ERP systems will save the University's resources and costs (50.5%, mean = 5.82716; std deviation = 1.62121).

Lastly, 40.7% of the respondents strongly affirmed that the university will face financial challenges in maintaining cloud-based ERP platform mean = 5.45062; std deviation = 1.79735). The mean of average means was 5.69224 indicating that in general, the respondents affirmed that technology

factors affected the rollout and uptake of cloud-based ERP systems. Adequacy of Information technology infrastructure (41.4%), data security and integrity (56.8%) and implementation cost and savings from use of cloud-ERPs (51.2%) are the most impactful factors of technology affecting implementation of Cloud ERPs.

4.5.1 ERPs use in Support Functions

The study was to establish the functions the institutions are using or intended to use for their ERPs. The study results indicate that 79% agreed that the university uses ERP to support financial management, (mean = 5.89506; std deviation = 1.39924). 38% of respondents also strongly agreed that the ERP was used in the student administration admission and registration process in the institution (mean = 5.97531; std deviation = 1.06293).

Moreover, academic and exam management was the main reason the ERP was used in the institution with 46.9% of the respondents strongly agreeing (mean = 6.03704; std deviation = 1.45273). Another major use of the ERP is to support human resource and supply chain management with 42.6% and 43.2% of respondents agreeing strongly.

Supply chain management is critical in institutions to streamline the procurement and supplies functions; 78.3% responded with strong agreement that the ERP is used extensively in supporting these functions within the institution to optimize efficiency of operations (mean = 6.03086; std deviation = 1.15518). The ERP is also used in many other institutional functions to improve the overall performance and efficiency of the institution. The weighted arithmetic mean was 5.84568 indicating that the respondents agreed that ERP was used in supporting the different functions on the institutions.

Table 6: Use of Cloud-based ERP on management of institutional functions

ERP Functions	SD%	D%	SWD%	N%	S M A%	A%	SA%	Mean	Std. Error of Mean	Std. Deviation	Variance
Financial Management	3.1	1.9	2.5	4.9	8.6	40.7	38.3	5.89506	0.10993	1.39924	1.95786
Student Administration – Admission and registration	0.1	1.9	0.6	3.7	24.1	31.3	38.3	5.97531	0.08351	1.06293	1.12982
Academic and Exam Management	3.1	2.1	1.9	4.8	1.1	40.1	46.9	6.03704	0.11414	1.45273	2.11042
Human Resource Management	6.2	3.1	4.9	8.6	4.9	29.6	42.6	5.62346	0.14011	1.78334	3.18032
Supply chain management	0.6	0.4	6.2	5.2	9.3	35.1	43.2	6.03086	0.09076	1.15518	1.33445
Others	3.1	3.1	5.6	3.1	17.9	47.5	19.8	5.51235	0.11222	1.42836	2.04022

4.6 Organization Factors

The second study objective was to identify the organizational factors affecting the implementation of cloud ERPs in public universities in Kenya. The responses were measured on a Likert scale (on the scale of 1-7) and analyzed though different percentages, means and deviations.

Table 7: Effect of organizational factors on the implementation of cloud-based ERP systems

Organizational Variable	Question Item	SD %	D %	SWD %	N%	SMA %	A %	SA %	Mean	Std. Error of Mean	Std. Dev	Variance
Top Management Support	University Management is receptive to new ICT technological innovations	3.1	2.5	1.9	1.2	2.5	52.5	36.4	6.006	0.104	1.335	1.782
	The university top management is interested or shown support for cloud ERP systems	4.9	4.3	5.6	13	9.3	36.4	26.5	5.327	0.133	1.693	2.867
	Have there been changes in the Level of technology and innovations within the University in the last 3 years?	6.2	2.5	1.9	8.0	16	34	31.5	5.530	0.129	1.642	2.697
User capacity and skills development	The design and nature of trainings on ERP systems have been properly structured for the users in the University	2.5	1.9	6.2	2.5	10.5	50	26.5	5.728	0.107	1.369	1.876
	Does the University have adequate skilled personnel and/or facilitate capacity building on new technologies including cloud ERP?	3.7	5.6	3.1	24.1	34.5	26	3.0	4.672	0.100	1.284	1.650

The results on Table 7 indicate that most universities' top management is receptive to new ICT technological innovations and are committed in ensuring that the ERP is utilized in streamlining processes (52.5% agree, mean = 6.00617; std deviation = 1.33513). Additionally, 36.4% of the respondents agreed that the university top management is interested or shown support for cloud ERP systems (mean = 5.32716; std deviation = 1.69336).

Furthermore, there was 34% agreement that in the last three years there has been significant investment in the level of technology (mean = 5.53086; std deviation = 1.64250). There was a response of 50% who agreed that the trainings and nature on the use of ERP systems was properly structured (mean = 5.72840; std deviation = 1.36970).

Lastly 34.5% of the respondents affirmed that there were adequate skilled personnel or capacity building facilitation on new technologies that include cloud ERP. 24% responded that there is no

adequately trained personnel nor training done on new technologies. This is an indication that more investments are needed to build capacity and skills of staff on the use of the ERP (mean = 4.67284; std deviation = 1.28455). The mean of weighted means was 5.45309 which is indicative that in general, organizational aspects play an important role in the implementation of ERP systems. The results show that top management support, appetite for new technology, level of skilled personnel and continuous training of staff are the most critical organizational factors towards decision to implement new system.

4.6.1 Importance of Information Technology (ERPs)

The study results indicate that 44.4% agree that information technology plays an important role in the fulfillment of improved stakeholder's relationship (mean = 5.17284; std deviation = 1.59417). 29% responses somewhat agree that ERPs enhanced the access of different information in the institution and effective communication. However, an equally large number of responses (25%) reported being neutral to the capacity of institutions in use of the ERP effectively (mean = 4.64815; std deviation = 1.69204). This is indicative of poor use of the ERP or lack of seamless integration making it difficult for information to be easily accessed as intended.

On the other hand, 52.5% of the respondents strongly affirmed that the use of ERP created timely reporting for departments as it was fast and well-structured (mean = 6.00617; std deviation = 1.46807). Operational costs are effectively managed and reduced through the use of ERP in the institutions, as 39% of the respondents strongly agree (mean = 5.43827; std deviation = 2.03064).

Furthermore, 59% of the respondents strongly agreed that there was improved integration with other departments through the use of cloud-based ERPs (mean = 6.04938; std deviation = 1.64110). 54% of the respondents agreed that using the ERP improved competitiveness of the institution as compared to other institutions due to streamlining of processes leading to efficient operations and timely decision making (mean = 5.85802; std deviation = 1.28473).

Most respondents (71.6%) strongly agreed that the use of ERPs resulted in improved productivity thus resulting in higher efficiency for the institution (mean = 6.40123; std deviation = 1.38070). Another resultant effect of the use of cloud-based ERPs is in improvement of institutional resource management (mean = 6.16049; std deviation = 1.46476). The mean of weighted means is 5.71682 indicative that information technology is important in fulfillment of different functions in the institution.

Table 8: Impact of cloud-based ERP systems use on overall performance of PCUs

Institutional Performance	SD%	D%	SWD%	N%	SMA%	A%	SA%	Mean	Std. Error of Mean	Std. Deviation	Variance
Improved stakeholders' relationship	4.9	6.8	1.2	11.7	17.3	44.4	13.6	5.17284	0.12525	1.59417	2.54137
Improved access to information.	7.4	3.7	8.0	25.3	29	6.2	20.4	4.64815	0.13294	1.69204	2.86301
Timely reporting	1.2	4.9	3.7	1.9	11.1	24.7	52.5	6.00617	0.11534	1.46807	2.15524
Reduced operating costs	10.5	6.8	1.9	1.9	6.8	32.7	39.5	5.43827	0.15954	2.03064	4.12350
Improved integration of information from different departments	3.1	6.2	1.9	3.7	1.2	24.7	59.3	6.04938	0.12894	1.64110	2.69320
Improved competitiveness	1.2	1.9	6.8	3.1	3.1	54.9	29	5.85802	0.10094	1.28473	1.65053
Improved productivity and efficiency in the institution	3.7	1.9	0.6	1.2	1.2	19.8	71.6	6.40123	0.10848	1.38070	1.90633
Overall improvement in resource management	2.5	1.2	0.6	3.1	3.7	43.8	45.1	6.16049	0.09509	1.21027	1.46476

4.7 Environmental Factors

The third study objective was to investigate the environmental factors affecting the implementation of cloud ERPs in public universities in Kenya. The responses were indicated on a Likert scale (1-7) and analyzed though different percentages, means and deviations.

Table 9: Effect of environmental factors on the implementation of cloud-based ERP systems

Environmental Variable	Question Item	SD %	D%	SWD %	N %	SMA %	A%	SA%	Mean	Std. Error of Mean	Std. Devn	Variance
Competitive Edge	Does cloud ERP technology improve the competitive edge of the university?	1.2	3.1	1.9	3.7	5.6	28.4	56.2	6.191	0.1027	1.30709	1.7085
	It is a strategic requirement for the university to use cloud-ERP system to remain competitive?	1.2	10.5	0.1	3.6	21	27.2	36.4	5.598	0.12582	1.60147	2.56472
Regulatory Framework	Does regulatory framework and policy affect the choice to implementation of cloud ERP systems at the University?	1.2	6.8	0.3	5.6	3.7	14.2	68.2	6.203	0.11947	1.52062	2.31228
Vendor Support	Does vendor support play a crucial role in implementation of ERP systems	1.2	8.6	1.2	4.5	1.9	55.4	27.2	5.734	0.11511	1.46509	2.1465
	Are there set criteria for consideration and selection of vendors of ICT systems at the University?	3.1	8	9.3	1.9	4.9	13.6	59.3	5.753	0.14837	1.88838	3.56598

The findings in Table 9 indicates that 56% of responses strongly agree that the implementation and use of cloud-based ERP technology improved the competitive edge of the university in the operating environment while 36% strongly agree using cloud-ERP is a strategic requirement to remain competitive. 68.2% further strongly agreed that the regulatory framework and policy affect the choice of implementing ERP. This is because laws and regulations that are favorable will aid the institutions use technology that is appropriate and streamlines processes. Moreover, for institutions to remain relevant in the market respondents strongly agreed (36.4%) that it is a strategic requirement consideration for universities to embrace cloud-ERPs.

Besides the operating environment, 55.4% respondents agreed that vendor support was crucial in the ERP implementation decision making. Consequently, vendors that provide adequate support pre and post the implementation are highly recommended to other institutions to implement the same product. Lastly, it was noted by 59.3% of the respondents that having a set criterion for selection of vendors is critical in ensuring competent and reliable vendors are selected to implement ERP in the universities. The mean of weighted means is 5.89630 indicating that environmental factors of ERP are important in the implementing of ERPs within different institutions. Overall, respondents strongly agree that competitive pressure, regulatory and policy framework, and vendor support have a great impact in the decision of implementing cloud ERPs in the public universities.

4.7.1 Effect of the use of ERP on other Functions

The use of ERP plays an important role on other institutions functions; 46.9% respondents strongly agreed that cloud-based ERPs result in the provision of efficient services. This is because automation and streamlining of processes are aligned and seamless unlike human or manual intervention which is always prone to errors and multiple inefficiencies.

Moreover, 61% of the respondents agreed that use of cloud-ERPs provides seamless automation of processes which enhances overall productivity leading to timely service delivery (mean = 6.02469; std deviation = 1.54015). Further, tasks are completed on time as stipulated creating a smooth and seamless process (mean = 5.98765; std deviation = 1.59964). 64% of the responses strongly agree. Finally, 57.4% of the respondents agree the vendor support is important for the effective usage of ERP systems in institutions (mean = 4.82099; std deviation = 1.57978).

The mean of weighted means is 5.5000 indicating that the use of ERP contributes to improvement of many other functions in the institutions.

Table 10: Impact of Cloud-based ERP systems on service delivery in PCUs

Variable	Functions	SD%	D%	SWD%	N%	SMA%	A%	SA%	Mean	Std. Error of Mean	Std. Deviation	Variance
Internal Efficiency	Efficiency in providing services	4.9	1.9	5.6	11.1	16	13.6	46.9	5.59877	0.13522	1.72111	2.96223
	Ease of use of system	14.8	0.62	1.9	6.8	25.3	22.8	27.8	5.06790	0.15570	1.98168	3.92704
	Automation and streamlining of services	1.6	5.6	0.49	5.6	16.6	8.51	61.6	6.02469	0.12101	1.54015	2.37206
	The ERP systems have improved completing of task in a smooth and seamless manner	2.5	1.9	6.8	6.2	13	5.6	64.2	5.98765	0.12568	1.59964	2.55885
	Vendor technical support is critical for effective use of cloud ERP	5.4	3.1	16.7	10.5	6.8	57.4	0.1	4.82099	0.12412	1.57978	2.49571

4.8 Collinearity and Multicollinearity

According to (Shrestha, 2020) Collinearity signifies the presence of two variables that are almost perfectly linearly correlated with each other, leading to the insignificance of these variables for the study. The presence of such items in a study should be removed as they increase the standard error of coefficient thus changes the result of the analysis. In addition (Akinwande et al 2015) state that in terms of the variance inflation factor (VIF), a value of 1 signifies the absence of multicollinearity among predictors. However, a VIF exceeding 5 indicates significant correlations that can pose challenges in the study. Tolerance is the inverse of the VIF and values obtained less than 0.1 indicate that there is multicollinearity within the variables (Sarstedt, 2014). The table indicates that there is no evidence of multicollinearity among the study variables, as the values provided lie between 1-5 for VIF. Furthermore, the tolerance factors are > 0.1 indicating no presence of Collinearity within items.

Predictor Variables	**Items**	**Collinearity Statistics**	
		Tolerance	**VIF**
IT Infrastructure and compatibility	Adequate IT Infrastructure	0.318	3.145
	Compatible with org Infrastructure	0.813	1.230
Security Concern	Data Integrity device Security	0.355	2.816
	System Provide Security Features	0.188	5.320
Cost Effectiveness	Cost	0.699	1.430
	Save Resources	0.224	4.464

	Financial challenge in cERP maintenance	0.320	3.122
Top management support	Receptive to ICT innovations	0.534	1.873
	Management Support	0.786	1.272
	Changes in Technology	0.769	1.301
User capacity and skills development	Trainings properly structured	0.446	2.242
	Adequate skilled personnel	0.373	2.679
Competitive Edge	Improved competitive edge	0.264	3.791
	Strategic Necessity	0.673	1.485
Regulatory & policy	Regulatory framework	0.240	4.160
Vendor Support	Vendor Support	0.503	1.989
	Technical support	0.292	3.420
	Set criteria for Vendors selection	0.650	1.539
Internal Efficiency	Ease of Use	0.870	1.150
	Automation and streamlining	0.236	4.236
	Completing of tasks	0.445	2.248

Figure 8: Collinearity Statistics

Regression model

Regression analysis was conducted to examine the impact of independent variables on the dependent variable, and the results are presented in the table.

Model Summary

R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
				R Square Change	F Change	df1	df2	Sig. F Change
.815[a]	.665	.572	1.12660	.665	7.136	35	126	.000

Figure 9: Regression model

Regression was performed on the effect of independent variables on the dependent variable. In figure 9, there was a very strong positive correlation (R=0.815) between the cloud-ERP implementation (dependent variable) and the eight (8) independent indicators in the contexts of technological, organizational and environmental factors of TOE framework. The coefficient of determination (R2) = 0.572, explaining 57.2 percent of cloud ERP implementation decisions in public universities in Kenya could attributed to the study's model predictor variables, and that 42.8 % of the variation in the model could be as a result of other factors not included in the model.

4.9 ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Regression	316.997	35	9.057	7.136	.000[b]
Residual	159.923	126	1.269		
Total	476.920	161			

Figure : ANOVA

In the ANOVA model, the F-statistic is found to considerably greater than 1 in the Figure 10, $F(35,126) = 7.136$, $P<0.05$. This suggests that the model is appropriate for testing the relationship between the independent variables from the technological (Infrastructure Availability & Compatibility, Security Concern, Cost Effectiveness), organizational (Top Management Support, User Capacity/Skills), and environmental (Competitiveness, Regulatory policy, Vendor Support) contexts are statistically significant in predicting the implementation of cloud-ERP system, as the depended variable.

4.10 Coefficient Analysis and Hypothesis Testing

The coefficient analysis looks at each of the predictor variables and whether they were significant in predicting the dependent variable.

Predictor Variables		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
	(Constant)	1.566	.797		0.892	.373
Technological	Infrastructure Availability & Compatibility (IA)	.481	.086	.282	3.845	.003
	Security Concern (SC)	.386	.036	.234	4.067	.001
	Cost Effectiveness (CF)	.313	.046	.216	2.345	.015
Organizational	Top Management Support (MS)	.382	.082	.323	4.343	.000
	User Capacity/Skills (UC)	.277	.029	.220	3.902	.001
Environmental	Competitiveness (CE)	.471	.292	.189	2.216	.013
	Regulatory policy (RP)	.210	.087	.148	2.252	.026
	Vendor Support (VS)	.253	.021	.146	4.470	.000

a. Dependent Variable: Cloud-ERP implementation decision in PCU (DV)

Figure 10: Coefficient Analysis

The established regression model is of the form:

$$PCU\ (Y) = \beta_0 + \beta_1 IA + \beta_2 SC + \beta_3 CF + \beta_4 MS + \beta_5 UC + \beta_6 CE + \beta_7 RP + \beta_8 VS + Ɛ$$

Y =dependent variable, β_1=Slope of the regression line, β_0 are unknown,

$$Y = 1.566 + 0.481IA + 0.386SC + 0.313CF + 0.382MS + 0.277UC + 0.471CE + 0.21RP + 0.253VS + Ɛ$$

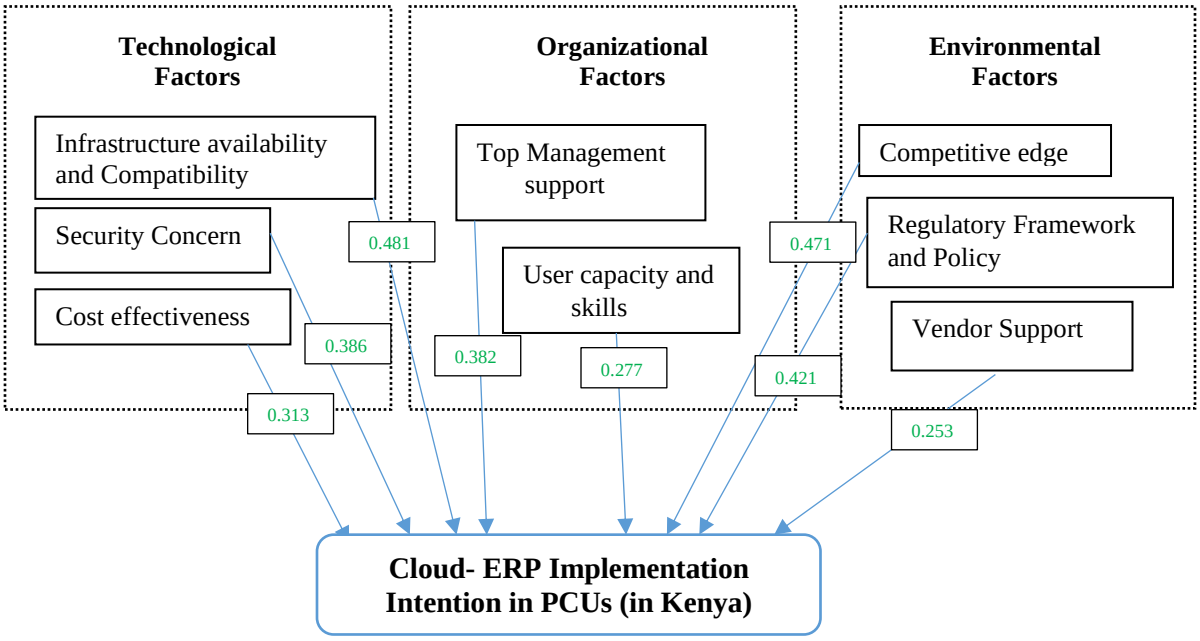

Figure 11: Results of the regression model

Assessing study result on Figure 11 for each of the variables in determining the P significant level, it is noted that each variable is statistically significant in predicting the dependent variable at a significant level where p-value of < 0.05.

Examining the result for the relationship between Infrastructure Availability & Compatibility (IA), a technological context variable, and cloud-based ERP Implementation decision (DV), Hypothesis 1 was adopted, with a p-value of 0.003<0.05 which makes the variable statistically significant in the study in predicting the decision to implement cloud-ERPs in public universities. Further, Security Concern (SC) variable had a P value of 0.001<0.05, so Hypothesis 2 was similarly accepted with statistical significance. Similarly, the Cost Effectiveness (CF) variable was statistically significant with P values of 0.015 <0.05 and hence the basis for supporting Hypotheses 3 and rejecting the null hypothesis.

Hypothesis	Path	t	Sig.	*p<0.05*
H1	IA → DV	3.845	.003	Supported
H2	SC → DV	4.067	.001	Supported
H3	CF → DV	2.345	.015	Supported
H4	MS → DV	4.343	.000	Supported
H5	UC → DV	3.902	.001	Supported
H6	CE → DV	2.216	.013	Supported
H7	RP → DV	2.252	.026	Supported
H8	VS → DV	4.470	.000	Supported

Figure 12: Hypothesis Testing

Among the organizational context variables, top management support (MS) and user skills training (UC) both have P values of 0.000 and 0.01 respectively, therefore statistically noteworthy in forecasting the dependent variable and thus the basis for adopting Hypothesis 4 and 5. Furthermore, environmental context factors i.e., competitive edge, regulatory and policy framework, and vendor support, were all found in the study to be statistically significant in forecasting the cloud-ERP implementation decision. The P values are 0.013, 0.026 and 0.000 respectively all <0.05 and thus forming the basis for adopting the Hypothesis 6, 7 and 8.

CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The chapter provides a concise overview of the study's findings, draws conclusions, offers recommendations, and proposes potential avenues for future research.

5.2 Discussion of major findings

This research aimed at establishing a framework for implementing cloud-based ERP systems in Public Chartered Universities (PCUs) in Kenya. The specific objectives were: To examine the technological, organizational and environmental factors affecting the implementation of cloud ERPs in PCUs in Kenya. The study focused on the institutional decisions and intentions to implement cloud-ERP using the factors proposed on TOE framework.

5.2.1 Effect of technology context factors

The first study objective was to examine the technological considerations affecting the implementation decisions of cloud ERPs in PCUs in Kenya. The study established that technological context factors of Infrastructure Availability and Compatibility, Security Concern and Cost Effectiveness affect the implementation of ERPs in public universities in Kenya. This finding agrees with the study conducted by (Wanjau, 2020) that embracing technology was imperative for institutions to become competitive, moreover when ERP systems are compatible with user and institutional needs, it results in improved business processes and user satisfaction rating.

Furthermore, studies conducted by (Sharma et. al, 2021) indicated that institutions that have adequate IT infrastructure are better suited in adopting ERP use and therefore its implementation is easier with the resultant effect being use of less technological resources in successful deployment of such platforms.

In addition, the place of data integrity and systems security on technology-based platforms is vital therefore for ERP implementation and institutions are keen on ensuring that their data is safeguarded from unauthorized infiltration and external threats, the study established that cloud-based ERP had technologic based security features that protected data and system integrity but in the absence of these security features that ensures data privacy and integrity, institutions will not

implement such a technology. The results concurs with the findings of (Hrischev, 2020) which averred that security features result in better collaboration between core ERP modules and other integrated systems, which in turn bolsters security for institutions from external threats.

On cost effectiveness, the study established the expected savings on costs is another technological factor found to be important. This agrees to the (AlBar & Hoque, 2019) who contended that the utilization of Cloud ERP can yield advantages in terms of cost savings by reducing expenses related to production, infrastructure, and maintenance. Furthermore, Alsharari et al. (2020) put forth the argument that Cloud ERP implementation can lead to a decrease in an organization's overall cost of ownership when compared to conventional on-premises ERP systems. The results also show that cloud-based ERPs platforms require significant monetary input, hence in most cases poses a financial challenge to institutions intending to implement or change ERP systems. According to (Svensson 2021), for institutions that do not have the adequate financial capital required for implementing and maintain cloud-ERPs from a technological perspective is expensive and thus may pose a risk to significantly the institutions finances hence operations for such institutions.

5.2.2 Effect of organizational context factors

Objective two was to identify the organizational factors affecting the implementation of cloud ERPs in the universities. The study established that organizational factors i.e., top management support and user skills capacity affect implementation decisions of ERPs in public universities. According to (Chatzoglou et al., 2016) management support is critical for the in the decision to implement of cloud-ERP platforms, the study found that decision-makers' attitude toward technology and support in regard to functions like continued learning have a direct effect in adoption and implementation of novel technologies such as cloud-based ERP platforms.

Further, the study findings indicate that there is improved user satisfaction and overall improvement of key performance indicators because of utilization of ERP systems. This finding concurs with research conducted by (Abdel-Haq et al., 2018) which illustrated that the use of ERP in institutions had resulted in greater business delivery and better response to the needs of key stakeholders of the organizations.

However, the study found that institutions with insufficient skilled personnel for capacity building on new technologies including cloud-based ERP are less likely to implement and manage such solutions. Institutions tend to adopt new technology if they have enough human capacity that are either skilled or trainable to manage the intended technology. This concurs with the findings of

Szromek (2020) that posited that the lack of skilled personnel resulted to counter-productivity, for instance damage to the system and ultimately losses on the part of the institution due to prolonged outage.

5.2.3 Effect of Environmental context factors

The third study objective was to investigate the environmental factors affecting the implementation of cloud ERPs in Kenyan public universities. The study results revealed institutions consider competitiveness as an important factor in making decisions about implementing new technologies. Implementation of cloud-based ERP is considered to significantly improve the competitive edge of public universities as universities, generally operate in a competitive environment where they benchmark against fellow institutions and tend to implement innovative solutions that others within the sector have done. This concurs with the findings of (Idoko, 2021) in which the study showed that the implementation of ERPs has an effect on organization performance thereby leading to competitive advantage over other institutions. Moreover (Rono, 2020) indicates that adoption of innovation enables institution to remain competitive by adopting new innovations for instance in procurement processes, leading to minimal costs and overall institutional efficacy.

The regulatory framework and policy in place affect the choice of technology platform to be adopted. The data protection policy requirement that institutions must host their data in the sovereign countries is such regulation that affects the choice of moving ERP systems to the cloud. This highlights the importance of regular stakeholder engagement in setting up laws and regulations for public universities, that enable institutions to use appropriate technology and streamline their processes toward accountability as well as efficient service delivery. The results align with those of a study on border management (Hadara, 2018) that emphasized the need to have similar cross border laws and regulations to ease business and data protection between border points. The study emphasized that rules and laws on data protection need to be standardized for ease of information flow and consolidation of reports of different individuals to single verifiable documents.

Finally, the study found that vendor support is another important aspect to consider in the cloud-ERP implementation decision making. Vendors who provide helpful support are significantly recommended over other similar service providers. Using ERP systems is a strategic requirement for public universities in Kenya to continue retaining their relevance in the global higher education space. This agrees with the outcomes of (Shaiti et al., 2020) this study inferred that two companies were compared one with external support and the other without, it was established that vendor

support resulted in better productivity and understanding of the systems thus leading to improved service delivery and quality.

5.3 Recommended framework for implementation of cloud-based ERPs in PCUs in Kenya

Implementing cloud-based ERP systems in public universities in Kenya requires a comprehensive framework that considers the specific needs of the institutions, technology infrastructure, data security, user skills and training, cost management, and ongoing vendor support. By following a well-structured framework, universities can harness the benefits of modern technology to enhance their operational efficiency and provide better services (Briggs & Kassner, 2017).

From the study results, below is the summarized illustration of the implementation framework for cloud-based ERPs showing the most critical technological, organizational and environmental factors to be considered and prioritized that are statistically significant in the decisions to implement cloud-ERPs in public universities in Kenya.

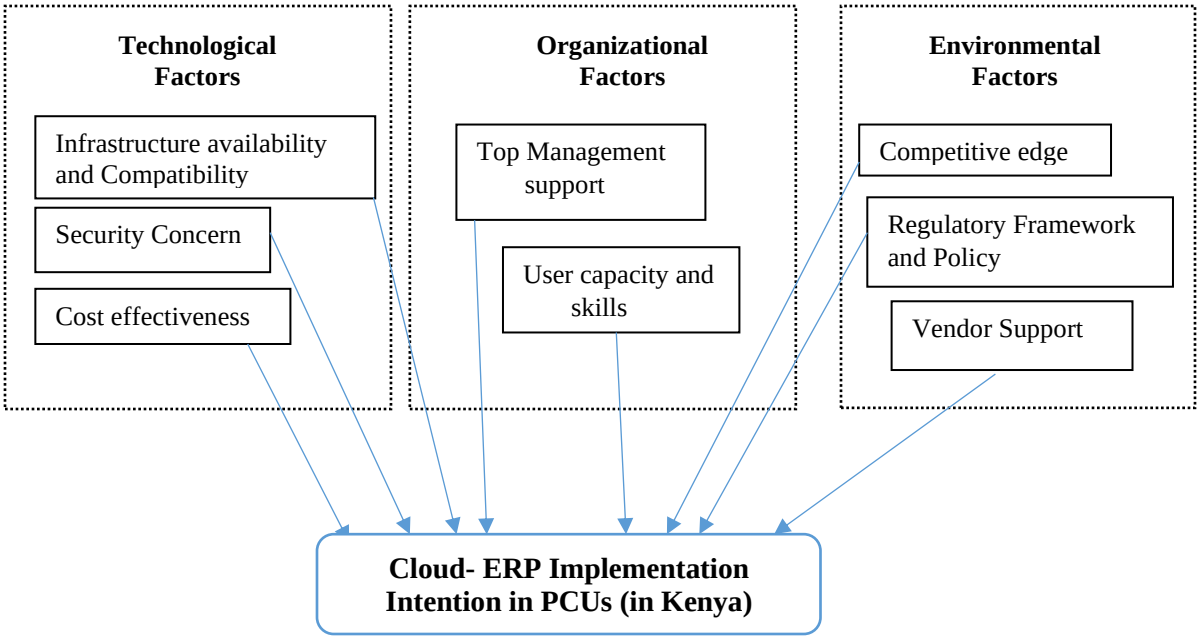

Table 11: Summarized framework of implementation of cloud-based ERP platforms

5.4 Conclusion of the Study

The research study findings conclude that the technological, organizational and environmental factors from the TOE framework plays a significant role in the implementation decisions of cloud-ERPs systems in public universities. Embracing technology and using cloud-based ERP systems that are compatible with user and institutional needs can lead to improved business processes and increased competitiveness. It is therefore imperative for institutions to invest in adequate IT infrastructure as a key component in the framework for uptake and implementation of cloud-based ERP systems.

Additionally, security is crucial for institutions of higher learning, for instance to protect data for instance research archives, institutional information, and commercial interests. The study found that cloud-based ERP systems offer security features that protect information. This aligns with the finding that security features enhance integration between core ERP modules and other administrative systems, safeguarding institutions from external threats. However, the study also reveals that ERP implementation poses significant financial challenges, particularly for small institutions, potentially impacting their ability to implement or upgrade new systems. It is therefore important in the implementation framework to empower ICT staff through continual learning on system and data security as they remain the first line of defense in regard to systems' security.

The study further established that organizational factors influenced the implementation of cloud-ERPs in public universities. Management support is crucial component for adoption and successful implementation, and companies that prioritize training achieve greater success in implementing cloud-ERP systems. Furthermore, the use of cloud systems in institutions leads to greater business delivery, improved response to individual student/staff/faculty needs, and enhanced innovation. However, this study revealed a shortage of skilled personnel for adopting, implementing, and maintaining cloud-based ERP platforms in public universities. In addition, the gap also exacerbates the lack of capacity building among staff at PCUs on technologies such as cloud-based ERP systems and must be addressed in order to successfully implement such platforms.

The findings underscore the importance of technology compatibility, IT infrastructure availability, and security in ERP implementation framework. They also emphasize the significance of top management commitment, end-user training, and skilled personnel complemented by competitive edge, regulatory framework and vendor support to influence on the cloud-ERP implementation decisions.

5.5 Limitations and Suggestions for Further Research

The study sought to establishing a framework that aid decision makers in implementing cloud-based ERP systems in Public Chartered Universities (PCUs) in Kenya. The study employed an online survey to gather data, targeting individuals who self-identified as employees of public universities in Kenya and claimed to possess expertise in Cloud ERP systems. The underlying premise is that their self-identification was accurate. The research primarily hinges on perceptions, with the underlying assumption being that the accuracy of the data is contingent upon the perceptions of the respondents. Subsequent scholars have the opportunity to replicate this study to assess the reliability of the findings.

The realm of cloud-based technologies has experienced significant growth due to the expansion of online education and the shift from traditional in-person learning to digital platforms, such as those offered by various open and online universities. Institutions that have effectively navigated and excelled in this digital landscape can serve as benchmarks to assist newcomers grappling with the same challenges. Consequently, there is potential for further research into the factors influencing user satisfaction and experiences with cloud-based ERP systems in public universities. Furthermore, to address the cost-related obstacles associated with procuring and maintaining cloud ERPs, an investigation into the advantages of implementing a shared, multitenant cloud-based ERP solution would be beneficial for public universities in Kenya.

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APPENDIX 1: QUESTIONNAIRE

A FRAMEWORK FOR IMPLEMENTING CLOUD-BASED ERP SYSTEMS IN PUBLIC UNIVERSITIES IN KENYA

Dear respondent,

My name is **Alfred Kipruto** a Master of Science Student in Information Technology at the University of Nairobi. I am conducting research on a framework of implementation of cloud-based ERPs in public Universities in Kenya. I kindly request for 10 minutes or so of your time to answer this short questionnaire. Kindly respond to each question **with (X)/ tick** where appropriate. The information obtained will be treated with utmost confidentiality for the purpose of this study.

SECTION 1: BACKGROUND INFORMATION

1. What is your gender
   - Male
   - Female

2. What is your age bracket?
   - 24-29
   - 30-34
   - 35-39
   - 40-44
   - 45-49
   - 50-54
   - 55-59
   - Above 60

3. How many years has the public university been chartered?
( ) Less than a year ( ) 1 – 3 years ( ) 3 – 5 years ( ) More than 5 years

4. How many years have you worked for the university?
( ) Less than 1 year ( ) 1 – 3 years ( ) 3 -5 years ( ) More than 5 years

5. Kindly indicate your job title in the University?

_____

_____

6. How many employees do you have in your University?
( ) < 10 ( ) 10-30 ( ) 30-50 ( ) 50- 100 ( ) >100

7. The University currently uses which of the below ERP system implementations?

- On-premise ERP system
- Cloud-based ERP system
- None of the above

SECTION 2: TECHNOLOGICAL FACTORS

a) Please indicate on the scale given by ticking [√] in the appropriate boxes the extent to which technology adoption affects the implementation of cloud ERP systems in your University?

On the scale of 1-7, where: (1) Strongly Disagree (2) Disagree (3) Somewhat Disagree (4) Neutral (5) Somewhat Agree (6) Agree (7) Strongly Agree

Statement	**1 SD**	**2 D**	**3 Somewhat Disagree**	**4 N**	**5 Somewhat Agree**	**6 A**	**7 SA**
The university has adequate IT infrastructure to support cloud ERP system?							
Implementing Cloud-ERP is compatible with the institutions' technology infrastructure.							
Is data security and device integrity a major critical factor for cloud-ERP system implementation?							
Cloud-based ERP system provide security features that ensure data integrity and privacy?							

Is financial cost a major consideration in implementing a cloud-ERP System?							
The use of cloud-based ERP systems will save the University's resources and costs							
The university will face financial challenges in maintaining cloud-based ERP platform?							

b) **To what extent does the university use ERPs to support the following functions? Kindly indicate using the scale given.** On the scale of 1-7, where: (1) Strongly Disagree (2) Disagree (3) Somewhat Disagree (4) Neutral (5) Somewhat Agree (6) Agree (7) Strongly Agree

NO	**INDICATOR**	**1 SD**	**2 D**	**3 Somewhat Disagree**	**4 N**	**5 Somewhat Agree**	**6 A**	**7 SA**
1	Financial Management							
2	Student Administration – Admission & registration							
3	Academic and Exam Management							
4	Human Resource Management							
5	Supply chain management							
6	Others							

SECTION 3: ORGANIZATION FACTORS

a) **Please indicate on the scale given by ticking [√] in the appropriate boxes the extent to which organization factors affects the implementation of cloud-based ERPs in the University?**

On the scale of 1-7, where: (1) Strongly Disagree (2) Disagree (3) Somewhat Disagree (4) Neutral (5) Somewhat Agree (6) Agree (7) Strongly Agree

Statement	**1 SD**	**2 D**	**3 Somewhat Disagree**	**4 N**	**5 Somewhat Agree**	**6 A**	**7 SA**
University Management is receptive to new ICT technological innovations							
The university top management is interested or shown support for cloud ERP systems							
Has there been changes in the Level of technology and innovations within the University in the last 3 years?							
The design and nature of trainings on ERP systems have been properly structured for the users in the University							
Does the University have adequate skilled personnel and/or facilitate capacity building on new technologies including cloud ERP?							

b) **To what extent is information technology important for the fulfillment of the following objectives in your University?** Kindly indicate for each of the following

parameters of performance using the scale given. On the scale of 1-7, where: (1) Strongly Disagree (2) Disagree (3) Somewhat Disagree (4) Neutral (5) Somewhat Agree (6) Agree (7) Strongly Agree

NO	INDICATOR	1 SD	2 D	3 Somewhat Disagree	4 N	5 Somewhat Agree	6 A	7 SA
1	Improved stakeholders' relationship							
2	Improved access to information.							
3	Timely reporting							
4	Reduced operating costs							
5	Improved integration of information from different departments							
6	Improved competitiveness							
7	Improved productivity and efficiency in the institution							
8	Overall improvement in resource management							

SECTION 4: ENVIRONMENTAL FACTORS

Please indicate on the scale given by ticking [√] in the appropriate boxes the extent to which environmental factors influences the use of cloud ERP systems in your university.

On the scale of 1-7, where: (1) Strongly Disagree (2) Disagree (3) Somewhat Disagree (4) Neutral (5) Somewhat Agree (6) Agree (7) Strongly Agree

	Statement	1 SD	2 D	3 Somewhat Disagree	4 N	5 Somewhat Agree	6 A	7 SA
	Does cloud ERP technology improve the competitive edge of the University?							
	It is a strategic necessity for the university to use cloud-ERP system to remain competitive.							
	Does regulatory framework and policy affect the choice to implementation of cloud ERP systems at the University?							

	Are there set criteria for consideration and selection of vendors of ICT systems at the University?							
	Does vendor support play a crucial role in implementation of ERP systems.							

SECTION 5: Usage of ERPs

To what extent does usage of ERP systems at the university affect the following factors? Kindly indicate using the scale given. On the scale of 1-7, where: (1) Strongly Disagree (2) Disagree (3) Somewhat Disagree (4) Neutral (5) Somewhat Agree (6) Agree (7) Strongly Agree

NO	INDICATOR	1 SD	2 D	3 Somewhat Disagree	4 N	5 Somewhat Agree	6 A	7 SA
1	Efficiency in providing services							
2	Ease of use of system							
3	Automation and streamlining of services							
4	The ERP systems have improved completing of task in a smooth and seamless manner							
5	Vendor technical support is critical for effective use of cloud ERP							