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Precursors of Cloud Computing Adoption in Selected Banks in Kenya

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Abstract

Purpose: The study analyzed the precursors of adoption of cloud computing in selected banks in Kenya. Specifically, the study sought to establish the effect of data security on adoption of cloud computing in selected banks in Kenya, to establish how organizational culture affects adoption of cloud computing in selected banks in Kenya, to establish how supplier lock- in affects adoption of cloud computing in selected banks in Kenya and to establish how regulatory policy affects adoption of cloud computing in selected banks in Kenya.

Methodology: The study employed descriptive research design and inferential statistics. The target population was 366 ICT staff from 3 selected banks namely NCBA, KCB Bank and Equity bank. The selected banks had the largest market share according to published CBK supervisory report for year 2020. The sample size was 191 respondents. A structured questionnaire was used to collect the data. Responses in the questionnaires were tabulated, coded and processed by use of a computer statistical package for social sciences version 28 (SPSS) program to analyze the data. The responses from the open-ended questions were listed to obtain proportions appropriately and then reported by descriptive narrative. Descriptive statistics like mean, standard deviation were used. The ANOVA test was used to establish the findings from the study and results presented in graphs and charts.

Findings: Cloud computing adoption was evaluated for the select commercial banks across three areas namely core-banking systems, middle office and compliance systems and back-office, data science and innovation systems over a period of five years. The respondents indicated that no more than one cloud computing project was either in planning, implementation, failed or completed stages, indicating that despite the perceived benefits of cloud computing there are precursors that need to be addressed if the commercial banks are to fully embrace cloud computing.

Unique contribution to theory, practice and policy: In terms of policy, the findings of the study will be important to regulators like CA, CBK and other institutions that regulate financial institutions in coming up with relevant guidelines when it comes to handling customer data within Cloud Computing environment. It gives banking sector perspective of some of the issues that require attention if the envisaged benefits of clod computing are to be fully realized. This is important not only to the policy makers but also to the cloud service providers . Additionally, the findings give a theoretical basis of validating the antecedents of cloud computing adoption in the banking sector in Kenya and this can be extended to the rest of the world. The findings give a practical perspective of the real concerns the banks have to contend with from a practical perspective and therefore very critical in advancement of cloud computing technologies.

Keywords: *Cloud, Computing, Innovation, Adoption, Banks*

INTRODUCTION

According to Mell and Grance (2009), Cloud computing refers to a model for enabling ubiquitous, convenient, on–demand network access to a shared pool of configurable computing resources that can be rapidly provisioned and released with minimal management effort or service provider interaction. The computing resources could include applications, servers, storage, networks, etc. This description brings out five essential characteristics of cloud computing, three service models of cloud computing and four deployment models.
On-demand self-service, which refers to a situation where Computing resources such as processing power, storage, virtual machines can be acquired and used anytime without the need for human interaction with cloud service provider. Another characteristic referred to as Broad network access is a situation where the computing resources can be accessed over a network using heterogeneous devices like laptops and mobile phones. Resource pooling refers to a situation where Cloud Service providers pool their resources, which are then shared by multiple users, for example, a physical server, can be used to host several virtual machines belonging to different users.

Rapid elasticity refers to the ability of a user to quickly acquire more resources from the cloud by scaling out and scaling back in to release resources that they no longer need. This happens in such a way that the client thinks that the capabilities available for provisioning are unlimited and can be made available in any quantity and at any time. Measured services refers to a situation where Resource usage is measured using appropriate metrics like bandwidth, CPU hours, storage space, etc. This ensures that transparency between the client and the service provider is achieved through monitoring, control and even through reports.

Local Perspective of Cloud Computing

Cloud computing has been adopted somewhat in banking and education sectors in Kenya, according to Maaref (2012).The same report indicates that in African countries, Kenya included, system security is considered as a number one hindrance to cloud computing adoption by 27% of the respondents, 36% consider it as the second hindrance, while 18%, 9% and 9% consider it as the third, fourth and fifth hindrances respectively. According to the same study, Protection of personal data is considered as a the second hindrance to cloud computing adoption by 18% of the respondents, 18% consider it as the third hindrance, while 36% and 27% consider it as the fourth and fifth hindrances respectively. The study further indicated that Supplier lock-in is considered as the first hindrance to cloud computing adoption by 9% of the respondents, 9% consider it as the second hindrance, while 18% and 64% consider it as the fourth and sixth hindrances respectively.

Banking Sector in Kenya

As at 31st December 2020 there were 42 banking institutions (made up of 41 commercial banks and one mortgage finance company), nine representative offices of foreign banks, 14 microfinance banks, 3 credit reference bureaus, 17 money remittance providers, eight non-operating bank holding companies, 66 foreign exchange bureaus in Kenya according to CBK (2020). These banking institutions are regulated by Central bank of Kenya. Out of these 42 banking institutions, 40 were privately owned while the Government of Kenya owned majority shares in two institutions. Out of the 40 privately owned banks, twenty three were locally owned, while the rest were foreign owned (many having minority shareholding). The 17 foreign-owned institutions were made up of 11 local subsidiaries of foreign banks and 3

branches of foreign banks. All the licensed foreign exchange bureaus, microfinance banks, credit reference bureaus, money remittance providers, non-operating bank holding companies and representative offices were privately owned.

Statement of the Problem

The selected banks in Kenya have continued to offer their services to customers at a cost that is prohibitive to most Kenyans. Central bank of Kenya has repeatedly stressed on the need for Banks to lower the cost of credit, for example, according to Economic survey 2020, commercial banks offered loans and advances at an average rate of 13% for the period 2016 to 2020. These rates are clearly prohibitive. It points to underlying structural issues. The financial institutions are struggling with huge IT operational costs according to IBM perspective of cloud computing report (2008). This is partly due to huge investments that are required to implement and maintain huge IT systems that can effectively support the operations of these financial institutions. The costs associated with running such huge IT investments and departments are huge. The time taken by financial institutions to develop and launch financial solutions is extremely long. According to Central bank of Kenya Bank supervisory reports, the investments in equipment and property by banks , most of which goes to IT infrastructure were as follows, KES 43billion in 2010, KES 48billion in 2011, KES 48billion in 2012, KES 55billion in 2013 and KES 52billion in 2014. These huge figures could be used to finance various sectors of the economy. Unfortunately, these funds are tied down in computer infrastructure. If meaningful cost reduction and faster deployment of financial solutions is to be realized by the selected banks in Kenya, then, they will have to adopt cloud computing, an inference made from Amazon EC2 on the benefits of cloud computing.

From an IT-management point of view, cloud computing radically reduces resource management costs including electric power, cooling and system management personnel and also purchasing requirements, according to IBM perspective on cloud computing and Ghule, Chikhale and Parmar (2014). The huge fees paid to hardware and software vendors for annual maintenance of dozens of computers and servers will equally be saved. Despite these glaring benefits that financial institutions stand to benefit from cloud computing, there are challenges that need to be addressed first, based on the study by Goscinski and Brock (2010).

LITERATURE REVIEW

This chapter highlights the studies that have been done in the area of Cloud Computing and its adoption and usage by organizations and individuals. The specific areas covered are theoretical review, conceptual framework, the empirical review of past studies, critique of the existing literature and the research gap.

Theoretical Review

Theories explain, predict, challenge and extend existing knowledge within the critical bounding assumptions according to Richard (2013). A theoretical Framework is the structure that can hold or support a theory of a research study. It introduces and describes the theory, which explains why the research problem under study exists. It consists of concepts together with their definitions and existing theories that are used for the particular study according to Bendassolli (2013).

Data Security Theory

According to Kurtus (2012), security is the protection of a person, property or organization from attack. The theory of security seeks to know the types of possible attacks, to be aware of the motivations for attacks and your relationship to those motives. The security or defense against such a threat is to make it difficult to attack, threaten counter-measures or make a pre-emptive attack on a source of threat. Data security theory seeks to establish uniform risk-based requirements for the protection of data elements. This is done both within and outside the organization. It advocates for the use of tools such as data classifications and protection profiles.

According to the theory, data classification is the identification and organization of information according to its criticality and sensitivity. The classification is then linked to a protection profile. A protection profile is a description of the protections that should be given to data in each classification. The protection profile is then used to develop and assess controls within the institution and to develop contractual controls and requirements for those outside the institution who may want to access, process, store or interact with the data in one way or another. Protection profiles are also very useful when data is transported, for example, when a laptop is removed from an institution, or a removable media is used to store data. The profile in this case, should indicate when logical controls such as encryption are necessary, describe the required controls, address the contractual, the physical and the logical controls around transportation of such data. It should also address the protection of the media that contains the information. The protection profiles should be reviewed and updated periodically to reflect the changes in data sensitivity, new methods of attacks, new technologies and new controls as they are reported.
This theory addresses the first research question: To what extent does security of customer data affect adoption cloud computing in selected banks in Kenya?

Disruptive Innovations Theory

Disruption is a positive force. According to Rogers (2003), an Innovation is an idea, practice, or object that is perceived as new by an individual or other unit of adoption. According to Armbrust, Fox, Griffith, Joseph, Katz, Konwinski, Lee, Patterson, Rabkin, Stoica, Zaharia (2010), adoption is the process through which an organization decides to acquire systems or technology. Disruptive innovations are inventions that make products and services more accessible and affordable, thereby making them available to a wider population.

The theory of disruptive innovation was first introduced by Professor Clayton M. Christensen of Harvard University, through a research on the disk-drive industry. It was later popularized by his book The Innovator's Dilemma (1997). It explains how an innovation can transform an existing market or sector by introducing simplicity, accessibility, convenience and affordability where complication and high cost defined the service or product. Initially, a disruptive innovation is introduced in a niche market that may appear unattractive or inconsequential to industry incumbents, but with time the new product or idea completely becomes the game changer in the particular industry or service.

A good example is the invention of personal computers. Before their introduction, mainframes and minicomputers were the main products in the computing industry. They costed around $200,000 at minimum and required engineering experience to operate them. In the late 1970s and early 1980s, Apple invented personal computers which she sold to her customers as toys for children. At that point, the product was not good enough to compete with the minicomputers, but Apple's customers did not care because they could neither afford nor use the minicomputers. A short while later, a smaller, more affordable and easy to use personal computers were introduced, good enough to do the work that previously required minicomputers. This created a huge new market and eventually disrupted the industry. This theory relates to the second research question: How does organizational culture affect adoption cloud computing in selected banks in Kenya?

Organization Culture Theory

The term culture in the organizational context was first introduced by Jaques(1951), and it refers to customary and traditional way of thinking and doing things, which is shared to an extent by all members of the organization , and new members must learn it , and at least partially accept it in order to be accepted into the service of the organization.

According to Schein (1988), culture is a pattern of basic assumptions, invented, discovered, or developed by a given group, as it learns to cope with its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore is to be taught to new members as the correct way to perceive, think, and feel in relation to those problems. The model categorizes culture into three levels, namely artifacts, values and underlying assumptions.

Artifacts deal with organizational attributes that can be experienced as an individual enters a new culture. They are difficult to measure. The values on the other hand deal with the espoused goals, broad tendencies, ideals, norms, standards and moral principles. They are measurable. The underlying assumptions can only be leant by careful observation, otherwise, they are sometimes taken for granted and not recognized. They deal with phenomena that remain unexplained when members of the organization are asked about the values of the organization. According to Schein, the essence of organizational culture lies in this level.

This model relates to the research question: To what extent does organizational culture affect adoption of cloud computing in selected banks in Kenya?

Regulatory Theory

Principles based legislation relies on principles to articulate the outcomes to be achieved by the regulated entities. According to Black (2010), principles are general rules that are implicitly higher in the implicit or explicit hierarchy of norms than more detailed rules. They express the fundamental obligations that all should observe. Black (2010) stated that principles – based

regulation avoids reliance on detailed, prescriptive rules and relies more on high –level, broadly stated rules and principles .The purpose of principles-based approach is to shift the regulatory focus from process to outcomes. The regulators define clearly the outcomes that they require the firms to achieve, without prescribing the process or actions that firms must take. The firms and their management are then free to find the most efficient way of achieving the required outcomes.

Principles based regulation is different from rules-based regulation in that it does not necessarily prescribe detailed steps that must be complied with, but rather sets out an overall objective that must be achieved. It seeks to provide an overarching framework that guides and assists regulated entities to appreciate the core goals of the regulatory scheme. It facilitates regulatory flexibility through the statement of general principles that can be applied to new and changing situations. Compliance-oriented regulation adopts an outcomes-based approach to total regulatory design. In order to adopt cloud computing, the institutions would want to be sure to be within the bounds of the regulatory framework.

This theory relates to the research question: How does regulatory policy affect adoption of cloud computing in selected banks in Kenya?

Conceptual framework

It is conceptual model that establishes a sense of structure that guides the research. Conceptual framework is a diagrammatical representation that shows the relationship between independent variable variables and the dependent variable, according to Young (2009). According to Mugenda (2008), conceptual framework is a concise description of the phenomenon under study accompanied by a graphical or visual depiction of the major variables of the study.

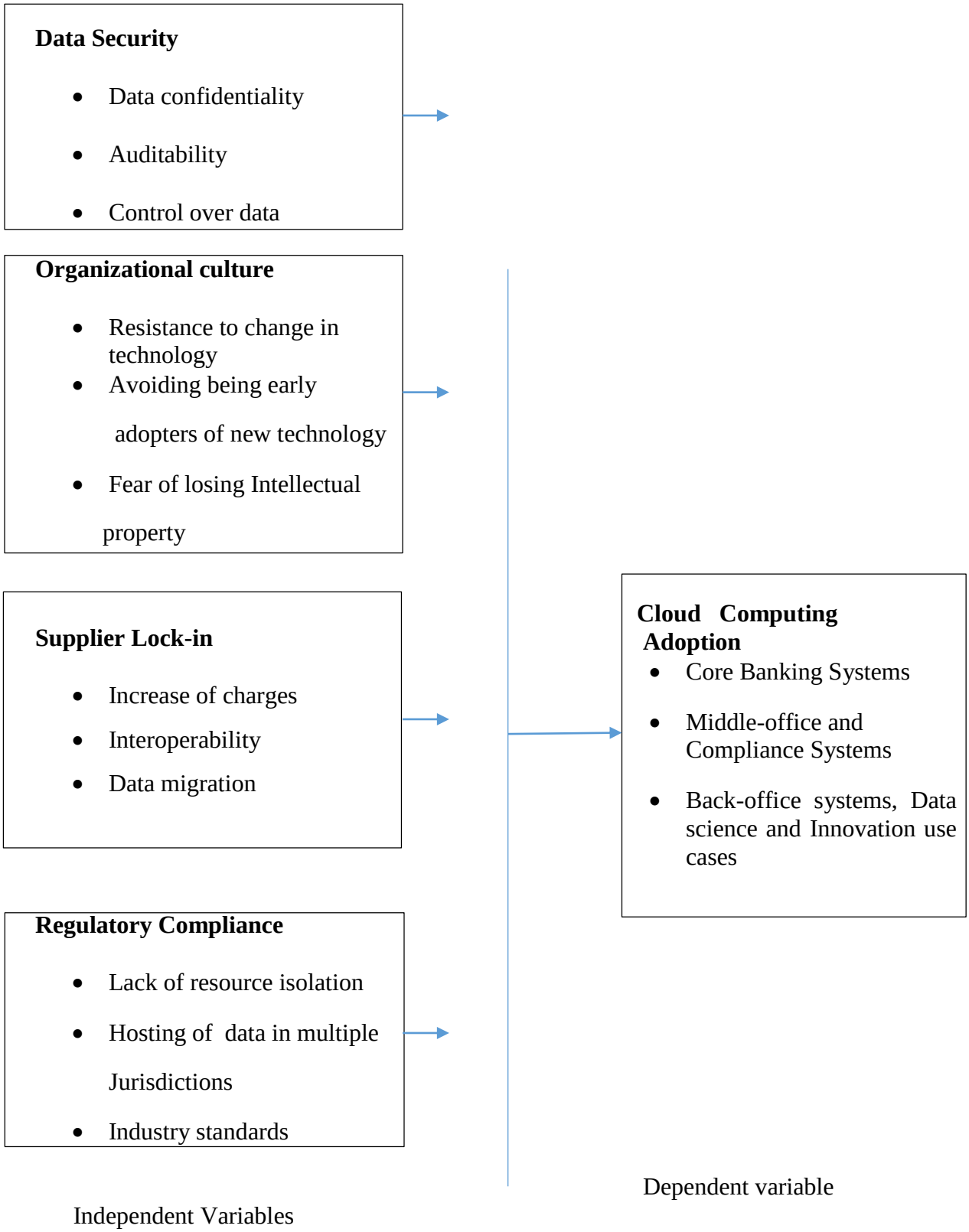

Figure 1: Conceptual Framework

Empirical Review

This section highlights a review of studies done by other researchers in the past regarding the factors affecting adoption of Cloud Computing. It identifies the studies, the authors, the areas of investigations and their findings as reported.

Data Security

Oyeleye, Fagbola and Comfort (2014) investigated the impact and challenges of Cloud Computing adoption by public universities in the south western part of Nigeria. The study revealed an adoption rate of 90 %, which agrees with Edudemic (2013) on the study of the future of higher Education and Cloud Computing, which found out a similar rate for email and Collaboration services adoption on cloud computing. In both cases, a small group that participated in the study were reluctant to expand their usage of cloud computing. The main reasons cited for reluctance were security of data on the Cloud, Privacy and the potential or perceived risks associated with Intellectual contents. In another study, Dan (2011) on cloud computing in education, 75 % of the Chief Operating officers and IT specialists consider security to be the number one risk on cloud computing. According to Sclater (2010), in a UNESCO Institute for Information technologies in Education policy brief on cloud computing in education, security is highlighted to be a major concern to the university's CIO and administrators.

Maaref (2012), on a study about cloud computing situation and perspective in Africa, Security of cloud computing was identified as a key consideration before adopting cloud computing, with 36% of the respondents indicating that it is the second most important factor after Availability of broadband at 55%.

Organizational Culture

According to Ngugi, Pelowski, & Ogembo (2010), a paltry 16% of the populace is made up of either 'innovators' or 'visionaries'. These are the early adopters of new technologies. The remaining 84% will only adopt a technology that has worked somewhere where they can reference. They will not use a technology that has not been tried and tested. Some of these companies will only adopt the technology if the old one they are used to has been declared obsolete.

Misra and Mondal (2011) conducted a study for identification of a company's suitability for the adoption of cloud computing and modelling of its corresponding return on investment. They suggested that before adopting cloud computing, the organization needed to consider the following issues.

Size of IT resources, Utilization pattern of IT resources, Sensitivity of the Data and Criticality of the work done. The study suggested that the organizations with large investments in IT resources like Datacenters would not benefit from cloud computing as much as the ones with less investment. The Size of IT resources is defined by the number of servers, the customer base supported, the annual return from IT and the number of countries the company operates in.

Utilization of the resources – Merely having a large number or small number of resources does not necessarily mean the company should adopt cloud computing. Profitability also depends on the amount of utilization of the existing resources. A large number of underutilized server resources leads to wastage and therefore makes it suitable for cloud computing. A small yet perennially well utilized servers would not be economical if the company adopted cloud

computing. According to McKinsey report, the global average server usage tops at 5-10%. The challenge is always to provision for the Peaks, the sudden spikes and the surges. It is a very difficult task accurately forecasting workload requirements. According to Armbrust, Fox, Griffith, Joseph, Katz, Konwinski, Lee, Patterson, Rabkin, Stoica, Zaharia (2009), Cloud computing is most recommended if there are highly variable spikes in resource demand.

Supplier Lock –in

Maaref (2012), on a study about cloud computing situation and perspective in Africa , Lock in concerns was identified as a key consideration before adopting cloud computing, with 64% of the respondents indicating that it is the sixth most important factor influencing cloud computing adoption.

Catteddu and Hogben (2009), On European network and Information security agency report on Benefits, risks and recommendations for information security, identified supplier lock in as a key consideration of cloud computing with 18 % of respondents indicating that they would not consider adopting cloud computing without issues of interoperability addressed, 36 % and 38% consider it to be very important and medium respectively.

Regulation

Catteddu and Hogben (2009), On European network and Information security agency report on Benefits, risks and recommendations for information security, an SME perspective on cloud computing ,identified regulation as a key consideration before adopting cloud computing with 20 % of respondents indicating that they would not consider adopting cloud computing without proper regulation of the service, 25 % indicated that they consider regulation very important, 42% consider it to be of medium importance while 13% did not consider regulation to be important.

Critique of the Existing Literature Relevant to the Study

Ghule, Chikhale and Parmar (2014) conducted a study on cloud computing in banking services, however, the emphasis was on the compelling reasons for banks to adopt cloud computing with limited analysis on the hindrances to cloud computing. The findings cannot therefore be generalized to apply to selected banks in Kenya. Armbrust (2010) – conducted a study on A view of cloud computing, this study brought out the advantages of cloud computing, with some emphasis on hindrances to CC, however, the findings may not necessarily apply to selected banks in Kenya since the operating environment is different, the regulatory landscape is also different. Oyeleye (2014) investigated the impact and challenges of Cloud Computing adoption by public universities in the south western part of Nigeria. The findings will be more relevant to the education sector and not financial sector in Kenya.

Therefore, there is need to further explore the factors affecting adoption of CC within banks in Kenya.

Summary of Literature

There are compelling reasons for banks in Kenya to adopt CC, key among them being business agility, where these institutions will be able to deploy new products faster and more efficiently. They would also realize huge cost savings by avoiding huge upfront capital expenditure associated with traditional computing and instead replace these costs with ongoing operational costs, payable on use of the CC services. Another benefit would be the effect on the environment. By adopting CC, these institutions would not run huge datacenters that produce emissions that pollute the environment.

However, before enjoying these benefits, these institutions have to pay close attention to issues to do with data confidentiality, security, regulatory compliance, interoperability and standards.

Research gaps

Kenya is known for having a robust ICT environment. However, from the reviewed literature, it is clear that the analysis of the various factors affecting the adoption of Cloud computing in banks in Kenya has not been sufficiently documented. If these factors were understood, then appropriate interventions like policy would be put in place to guide the adoption of cloud computing. Resources would also be allocated appropriately to develop CC. According to (ICTA Cloud Computing Standard Technical Committee, 2016) ICT Authority has developed CC standards, however, these standards do not adequately address the issues of Data security in CC, organizational culture in adoption of CC, Supplier lock in concerns and regulatory compliance concerns amongst other concerns in CC. The constitution of Kenya is very clear on how privacy matters should be handled, however, the standards on CC as captured by ICTA(2016) does not clearly capture the issue of privacy in CC (klrc, 2010). KNLS conducted a survey in Kenya and failed to capture CC as a trend in computing (Kenya National Bureau of Statistics (KNBS), 2010).

Ghule, Chikhale and Parmar (2014) conducted a study on Cloud computing in banking services in Nagpur. The study was focused on the benefits of cloud computing and failed to capture factors affecting adoption of computing in banking industry. Additionally, the banking environment in Nagpur is different from the Kenyan environment and therefore the findings of the research cannot be generalized to the Kenyan situation. Singh and Hemalatha (2012) conducted a study in India on CC for academic environment. His study is more relevant to the academic environment and not banking industry. The study also centered on the benefits of CC without capturing challenges of cloud computing. Armbrust, Fox, Griffith, Joseph, Katz, Konwinski, Lee, Patterson, Rabkin, Stoica, Zaharia (2009) conducted a study on A view of cloud computing, this study brought out the advantages of cloud computing, with some emphasis on hindrances to CC, however, the findings may not necessarily apply to banks in Kenya since the operating environment is different, the regulatory landscape is also different. Oyeleye (2014) investigated the impact and challenges of Cloud Computing adoption by public universities in the south western part of Nigeria. The findings will be more relevant to the education sector and not financial sector in Kenya.

This study therefore bridged the existing gaps in other similar researches already done by identifying the challenges hindering the adoption of CC and also form the basis to enrich the ICT policy in Kenya.

METHODOLOGY

This study analyzed the precursors of cloud computing adoption in selected banks in Kenya.

Research Design

The study used descriptive research design and inferential statistics. A descriptive research design has been considered as the most appropriate research design because it is a more appropriate strategy for answering research questions which ask 'how' and 'why' and which do not require control over the events which is in line with the findings of Kothari (2000). This is because such questions deal with operational links that would need to be traced over time, rather than mere frequencies or incidence. By using the case study approach, the reasons why certain decisions were made, how they were implemented and what the results were; will be identified.

Data Collection

Questionnaires were the main data collection method in gathering data. The study used both primary and secondary data. Primary data was collected using Questionnaires while secondary data was collected from published reports and journals, internet and other documents

Data Analysis and Presentation

Completeness and consistency of the questionnaire was checked before analysis. Data cleaning was performed to identify incomplete, duplicates and errors in the data. Responses in the questionnaires were tabulated, coded and processed by use of a computer statistical package for social sciences version 28 (SPSS) program to analyze the data. The responses from the open- ended questions were listed to obtain proportions appropriately and then reported by descriptive narrative. Descriptive statistics like mean, standard deviation were used. The ANOVA test was used to establish the findings from the study and results presented in graphs, charts, and scatter plots where necessary.

The study used Coefficient of Correlation (r) and Causation to identify the relationship among the variables. Confidence level (α) of 0.05 was used.

Multiple regression analysis was used to analyze the effect of the four independent variables (security, Organizational culture, supplier lock-in and regulatory compliance) on the adoption of CC (dependent variable) in selected banks in Kenya. The equation $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \alpha$, was used, where

Y= adoption of CC in the selected banks in Kenya

β_0= Constant (coefficient of intercept)

X_1= Data Security X_2= Organizational Culture

X_3= Supplier Lock-in X_4= Regulatory Compliance

$\beta_1 \ldots \beta_4$ = regression coefficient of the four independent variables

α - is the error.

FINDINGS AND DISCUSSION

Response Rate

Data collection was carried out over a period of one month between July and August 2021 following the evaluation of the questionnaires consistency and reliability in a pilot study between May and June 2021. Fifty one employees of the one hundred and fifty contacted for the study responded with duly filled questionnaires representing a response rate of 34% as presented in table 4.1 below.

Characteristics of Respondents

The first part of the questionnaire sought to establish general characteristics of the respondents like role, years of experience and gender.

Years of Experience

The study sought to establish the number years of experience of the respondents in their various workstations. The findings of the study were as shown in table 4 below. According to the study findings, most of the respondents had 2-5 years' experience, being 47.1%, followed by over 5 years' experience at 29.4% and 23.5% had experience of below 2 years. This means that the targeted respondents were in a position to provide the information required for the study.

Role of the Respondent in the Institution

The study sought to establish the role of the respondents in their institutions. The study found that 94.1% of the respondents were ICT staff while 5.9% were not ICT staff, as shown in table 5 below. This shows that the majority of the respondents were able to provide relevant and reliable information on cloud computing which is an ICT subject.

Job Title of the Respondent in the Institution

The study sought to establish the job title of the respondents in their various institutions.

The results were as reflected in the table 6 below. The study found out that 17.6% of the respondents were Unit heads, while 29.4 % of the respondents were managers and 52.9% were other operational staff. The findings indicate that the respondents reached were fairly distributed as originally targeted by the researcher. Therefore, the information obtained from the study is reliable since it was obtained from all categories of the staff under CIO department of the selected commercial banks.

Data Security and Cloud Computing Adoption

The study sought to find out from the respondents the extent to which they considered data security as an antecedent for cloud computing within their commercial banks. This objective was reviewed across the three areas of focus with regards to cloud computing adoption; core banking systems, middle office and compliance systems and back office systems and data science and innovation use cases. The respondents were asked a set of four likert-scale questions across the three areas of cloud computing adoption on a scale of one to five with one being not at all and five being very large extent.

End to End Data Confidentiality in the Cloud and Beyond is a Key Consideration in Adopting Cloud Computing in the Organization.

According to the results of the study, 92.2 % of the respondents to a very large extent considered end to end data confidentiality as an antecedent for cloud computing, while 2% of the respondents indicated that they consider it to a large extent and 3.9 % gave it moderate rating and 2% consider it to a small extent, as shown in table 1.

Table 1: Consideration of End-to-End Data Confidentiality in the Cloud and Beyond in Adoption of Cloud Computing in the Organization.

Rating	Frequency	Percentage
Very Large extent	47	92.2%
Large extent	1	2.0%
Moderate extent	2	3.9%
Small extent	1	2.0%
Total	**51**	**100%**

Visibility into Infrastructure Security and Auditability Is a Key Consideration in Adopting Cloud Computing in the Organization

The findings of the study indicated that visibility into infrastructure security and auditability is a key consideration in adoption of cloud computing in the selected commercial banks. It was rated by the respondents at varying extents with 2% of the respondents rating of moderate extent while 13.7% indicated large extent and 84.3% as very large extent.

It May Be Difficult For the Bank to Effectively Check the Data Handling Practices of the Cloud Service Provider

The study sought to find out whether ability to effectively check data handling practices of a cloud service provider is an antecedent for adoption of cloud computing in the selected commercial banks. According to the findings of the study, the majority of the respondents indicated that the ability to effectively check the data handling practices of the cloud service provider is to a large extent (41.2%) an antecedent of adoption of cc , 25.5% indicated moderate extent, 15.7 indicated a very large extent while 9.8% indicated that it was not an antecedent for cc and 7.8% considered it to a small extent, as per table 4.10 below.

Analysis of Data Security as an Antecedent in Adoption of Cloud Computing

The results in table 8 below indicate that end-to-end data confidentiality and visibility into infrastructure security had a mean score of 4.8 and a standard deviation of 0.63 and 0.45 respectively on the adoption of cloud computing in core-banking systems. Checking of data handling practices of a cloud computing service provider had the third highest mean score of 3.38

with a standard deviation of 1.21 while unauthorized exposure of bank data due to incomplete deletion of cloud data had the lowest mean score of 3.11 and a standard deviation of 1.247 in the adoption of cloud computing services in core-banking systems.

Factor Analysis on Data Security

Factor analysis was carried out to determine the factor with the highest factor loading on data security for core banking systems, middle level and compliance systems and back-office and data science use cases. The results of the analysis were presented in table 9 below. Under data security in the adoption of cloud computing in core-banking systems, the inability of the bank to effectively check the data handling practices of the cloud service provider had the highest loading of 0.902. In the adoption of cloud computing in middle office and compliance systems, end to end data confidentiality as a consideration in the adoption of cloud computing had the highest factor loading of 0.69. Under the adoption of cloud computing in back office and data science use cases, the factor with the highest loading on data security was the difficulty for the bank to effectively check the data handling practices of the cloud service provider with a loading of 0.826.

Regression Analysis Between Cloud Computing Adoption and Data Security

The mean score of all the data security likert-scale items across implementation of cloud computing in core-banking systems was calculated and regressed against the mean score of cloud computing adoption over the last five years. The results of the linear regression model were presented in table 10 below.

A review of the overall model fit statistics indicated an R-squared value of 0.331 which means that data security accounts for 33.1% of the variance in cloud computing adoption. The regression model was statistically significant at 95% confidence level with and F-statistic of 5.274 ($p=0.027<0.05$). The regression co-efficient was also found to be statistically significant at 95% confidence level ($B=-0.426$, $p=0.027<0.05$). The negative regression co-efficient indicated that a unit increase in concern on data security leads to a 0.426 unit decrease in cloud computing adoption in core banking systems.

The overall model for effect of data security on cloud computing adoption in core banking systems was represented below;

Cloud computing adoption= $3.248 - 0.426X_1$

Where;

X_1= Data security

Hypotheses Testing For Effect of Data Security on Cloud Computing Adoption

The null hypothesis for this objective was that data security has no effect on cloud computing adoption in core-banking systems. The criteria was to accept the null hypothesis if the calculated p-value is greater than the critical p-value of 0.05 at 95% confidence level and to reject the null hypothesis if the calculated p-value is less than the critical p-value of 0.05 at 95% confidence level. The results in table 10 above indicated a p-value 0.027, which is less than the p-value of 0.05 at 95% confidence level. The null hypothesis was therefore rejected and conclusion made that data security has an effect on cloud computing adoption in core-banking systems.

Organizational Culture and Cloud Computing Adoption

To analyze this objective the respondents were presented with three likert scale items on a scale of one to five for each of the three areas of focus in relation to adoption of cloud computing services i.e. core banking systems, middle office and compliance systems and back office systems and data science and innovation use cases.

There is Resistance to Change in Technology in the Organization

According to the results of the study, 9.8% of the respondents indicated that there is resistance to change in technology in their organizations to a very large extent, 31.4% of the respondents supporting the finding to a large extent; 31.4% to a moderate extent; 17.6% to a small extent while 9.8% disagreed. The responses are reflected in fig 4.2 below.

No Major Financial Institution Has Moved All Her Operations to the Cloud Environment and Hence the Reluctance

The study sought to establish whether it is true that since no major financial institution had moved all her operations to the cloud environment there was reluctance, with 23.5% of the respondents supporting to a very large extent, 37.3% of the respondents supporting the finding to a large extent; 21.6% to a moderate extent; 13.7% to a small extent while 3.9% disagreed. The responses are reflected in table 2 below.

There is Fear of Loss of Intellectual Property Rights in the Organization in Regards to Adoption of Cloud Computing

The study sought to establish whether it is true that there is fear of loss of intellectual property rights in the organization towards adoption of cloud computing, with 11.8% of the respondents supporting to a very large extent, 37.3% of the respondents supporting the finding to a large extent; 19.6% to a moderate extent; 15.7% to a small extent while 15.7% disagreed. The responses are reflected in table 2 below.

Table 2: There is Fear of Loss of Intellectual Property Rights in the Organization in Regards to Adoption of Cloud Computing.

Rating	Frequency	Percentage
Very Large extent	6	11.8%
Large extent	19	37.3%
Moderate extent	10	19.6%
Small extent	8	15.7%
Not at all	8	15.7%
Total	**51**	**100%**

Analysis of Organizational Culture as an Antecedent in Adoption of Cloud Computing

The results of the analysis summarized in table 4.15 below indicated that reluctance of banks to adopt cloud computing since no major financial institution had done it had the highest mean score of 3.58 with a standard deviation of 1.177 in relation to core banking systems. Resistance to change in technology and fear of loss of intellectual property rights had a mean score of 3.02 and a standard deviation of 1.158 and 1.323 respectively in relation to the adoption of cloud computing in core banking systems.

Factor Analysis on Organizational Culture

Factor analysis was carried out to determine the factor with the highest factor loading on organizational culture for core banking systems, middle level and compliance systems and back-office and data science use cases. The results of the analysis were presented in table 11 below. The results indicated that in the adoption of cloud computing in core-banking systems, the factor with the highest loading on organizational culture was the fear of loss of intellectual property rights in the organization with a loading of 0.867. For the adoption of cloud computing in middle office and compliance systems, no major financial institution had moved all her operations to the cloud had the highest factor loading on organizational culture with a loading of 0.868. In the adoption of cloud computing in back office and data science use cases, the factor with the highest loading on organizational culture was that no major financial organization had moved all her operations to the cloud with a loading of 0.886.

Regression Analysis Between Cloud Computing Adoption and Organizational Culture

A linear regression model was fit on the data using the mean score of all the organizational culture likert-scale items across implementation of cloud computing in core-banking systems and the mean score of cloud computing adoption over the last five years. The results of the linear regression model were presented in table 12 below.

The overall model fit statistics indicated an R-squared value of 0.127 which means that organizational culture accounts for 12.7% of the variance in cloud computing adoption. The overall regression model was found to be statistically insignificant at 95% confidence level with and F-statistic of 0.707 ($p=0.405>0.05$). The regression co-efficient ($B=-0.099$, $p=0.405>0.05$) was found to be statistically insignificant at 95% confidence level. The negative regression co-efficient also indicated that a unit increase in organizational culture leads to a corresponding -0.099 unit decrease in cloud computing adoption.

The overall model for effect of organizational culture on cloud computing adoption was a represented below;

Cloud computing adoption= $1.845 - 0.099X_1$

Where;

X_1= Organizational culture

Hypotheses Testing For Effect of Organizational Culture on Cloud Computing Adoption

The null hypothesis for this objective was that organizational culture has no effect on cloud computing adoption in core-banking systems. The criteria was to accept the null hypothesis if the

calculated p-value is greater than the critical p-value of 0.05 at 95% confidence level and to reject the null hypothesis if the calculated p-value is less than the critical p-value of 0.05 at 95% confidence level. The p-value of 0.405>0.05 in table 2 above led to the acceptance of the null hypothesis at 95% confidence level and conclusion made that organizational culture has no effect on cloud computing adoption in core-banking systems.

Supplier Lock- In and Cloud Computing Adoption

The third objective of the study was to determine how supplier lock- in affects adoption of cloud computing. Three likert scale items were presented to the respondents on a scale of one to five with one being not at all and five being very large extent. The questions covered adoption of cloud computing in core-banking systems, middle office and compliance systems and back-office and data science use cases. The responses were summarised in table 13 below.

The Cloud Service Provider Could Increase Charges Immediately the Bank Has Signed Up

The study established that there is fear of the cloud service provider increasing charges immediately the bank has signed up, with 2% of the respondents supporting to a very large extent, 29.4% of the respondents supporting the finding to a large extent; 25.5% to a moderate extent; 21.6% to a small extent while 21.6% disagreed. The responses are reflected in table 14 below.

Switching to Other Cloud Service Providers is a Challenge Should the Need Arise

The study established that the ability to switching operations from one cloud service provider to another is an antecedent in the adoption of CC in the selected banks, with 5.9% of the respondents supporting to a very large extent, 37.3% of the respondents supporting the finding to a large extent, 49% to a moderate extent, 3.9% to a small extent while 3.9% disagreed. The responses are reflected in fig 4.3 below.

Data Migration To and From the Cloud Environment is a Concern

The study established that the ability to migrate data from one cloud service provider to another is an antecedent in the adoption of CC in the selected banks, with 13.7% of the respondents supporting to a very large extent, 49% of the respondents supporting the finding to a large extent, 17.6% to a moderate extent, 15.7% to a small extent while 3.9% disagreed. The responses are reflected in table 15 below.

Analysis of Supplier Lock- In Concern in Adoption of Cloud Computing

The results in table 16 below indicated that when considering adoption of cloud computing in core-banking systems, data migration to and from the cloud environment had the highest mean score of 3.45 with a standard deviation of 1.109 followed by switching of cloud service providers being a challenge with a mean of 3.29 and a standard deviation of 0.843. The possibility of the service provider increasing charges immediately the bank signs up had the lowest mean of 2.51 with a standard deviation of 1.141.

Factor Analysis on Supplier Lock-In

In the adoption of cloud computing in core banking systems, the factor with the highest loading on supplier lock-in was the challenge to switch to other cloud service providers should the need arise with a loading of 0.867. This was similar to the factor with the highest loading on the adoption of cloud computing in middle office and compliance systems which was the challenge

of switching cloud service providers if the need arose with a loading of 0.903. In the adoption of cloud computing in back office and data science use cases, the factor with the highest loading on supplier lock-in was the challenge of switching a cloud computing service provider if the need arose with a loading of 0.901.

Regression Analysis Between Cloud Computing Adoption and Supplier Lock-In

The value for supplier lock-in to regress against cloud computing adoption was obtained by calculating the mean score of all the supplier lock-in likert-scale items across implementation of cloud computing in core-banking systems. The dependent variable in the linear regression model was the mean score of cloud computing adoption over the last five years. The results of the linear regression model were presented in table 17 below. The R-squared value of 0.253 indicated that the supplier lock-in accounts for 25.3% of the variance in cloud computing adoption. The F-statistic 2.936 ($p=0.094>0.05$) indicated that the overall regression model was statistically insignificant at 95% confidence level. The regression co-efficient ($B=-0.215$, $p=0.405>0.05$) was found to be statistically insignificant at 95% confidence level. The negative regression co-efficient indicated that a unit increase in supplier lock-in leads to a corresponding -0.215 unit decrease in cloud computing adoption.

The overall model for effect of supplier lock-in on cloud computing adoption was a represented below;

Cloud computing adoption= $2.189 - 0.215X_1$

Where;

X_1= Supplier lock-in

Hypotheses Testing For Effect of Supplier Lock-In on Cloud Computing Adoption

The null hypothesis for this objective was that supplier lock-in has no effect on cloud computing adoption in core banking systems. The criteria was to accept the null hypothesis if the calculated p-value is greater than the critical p-value of 0.05 at 95% confidence level and to reject the null hypothesis if the calculated p-value is less than the critical p-value of 0.05 at 95% confidence level. The results in table 2 above indicated a p-value of $0.094>0.05$. The p-value was greater than 0.05 and therefore the null hypothesis was accepted at 95% confidence level and conclusion made that supplier lock-in has no effect on cloud computing adoption in core-banking systems.

Regulatory Policy and Cloud Computing Adoption

The fourth objective of the study was to establish how regulatory policy affects adoption of cloud computing. To this end, respondents were asked a set of three likert scale questions on a scale of one to five with one being not at all and five being a very large extent.

The Failure of Mechanisms Separating Storage, Memory, Routing and Even Reputation Between Different Cloud Tenants Could Lead to Attacks

The study sought to establish whether it is true that the ability to ensure no attacks in cc is an antecedent in the adoption of CC in the selected banks, with 15.7% of the respondents supporting to a very large extent, 47.1% of the respondents supporting the finding to a large extent, 19.6% to a moderate extent, 13.7% to a small extent while 3.9% disagreed.

Customer Data May Be Held in Multiple Jurisdictions, Some of Which May Be High Risk

The study sought to establish whether it is true that the ability of a cloud customer to get assurance about the location of the storage of customer data in cc is an antecedent in the adoption of CC in the selected banks, with 29.4% of the respondents supporting to a very large extent, 45.1% of the respondents supporting the finding to a large extent, 15.7% to a moderate extent, 7.8% to a small extent while 2% disagreed. The responses are reflected in table 20 below.

Investments in Achieving Certain Certifications May Be Put at Risk by Moving to the Cloud For Example Certain Kinds of Compliance like PCI-DSS Cannot Be Achieved

The study sought to establish whether there is concern about existing investments in ICT infrastructure as a key consideration in the adoption of CC in the selected banks, with 13.7% of the respondents supporting to a very large extent, 39.2% of the respondents supporting the finding to a large extent, 25.5% to a moderate extent, 13.7% to a small extent while 7.8% disagreed.

Analysis of Regulatory Compliance as an Antecedent in Adoption of Cloud Computing

The results of the analysis presented in table 21 below indicated that in the adoption of cloud computing services for core-banking systems, customer data being held in multiple jurisdictions some of which may be high-risk had the highest mean score of 3.91 with a standard deviation of 1.041. Failure of mechanisms separating storage, memory, routing and reputation may lead to attacks had a mean of 3.31 and a standard deviation of 1.1. Certain types of compliance being unachievable had the lowest mean of 3.29 and a standard deviation of 1.180.

Factor Analysis on Regulatory Compliance

The results indicated that in the adoption of cloud computing in core banking systems, customer data being held in multiple jurisdictions some of which may be risky had the highest factor loading of 0.890 on regulatory policy. In the adoption of cloud computing for middle office and compliance systems, the risk of customer data being held in multiple jurisdictions some of which may be high risk had the highest factor loading on regulatory policy with a loading of 0.857. Customer data being held in different jurisdictions some of which may be high risk was the factor with the highest loading on regulatory policy in the adoption of cloud computing in back-office and data science use cases with a factor loading of 0.92.

Regression Analysis Between Cloud Computing Adoption and Regulatory Compliance

A linear regression model was fit on the data using the mean score of all the regulatory policy likert-scale items across implementation of cloud computing in core-banking systems and the mean score of cloud computing adoption over the last five years. The results of the linear regression model were presented in table 23 below. The R-squared value of 0.028 indicated that regulatory policy accounts for 2.8% of the variance in cloud computing adoption. The overall regression model was found to be statistically insignificant at 95% confidence level with and F-statistic of 0.034 ($p=0.855>0.05$). The regression co-efficient ($B=-0.02$, $p=0.855>0.05$) was found to be statistically insignificant at 95% confidence level. The negative regression co-efficient also indicated that a unit increase in regulatory policy leads to a corresponding -0.02 unit decrease in cloud computing adoption. The overall model for effect of Regulatory policy on cloud computing adoption was a represented below;

Cloud computing adoption= 1.606 - 0.022X_1

Where;

X_1= Regulatory policy

Hypotheses Testing For Effect of Regulatory Policy on Cloud Computing Adoption

The null hypothesis for this objective was that regulatory policy has no effect on no effect on cloud computing adoption in core banking systems. The p-value in table 4.17 above was 0.855>0.05. The criteria was to accept the null hypothesis if the calculated p-value is greater than the critical p-value of 0.05 at 95% confidence level and to reject the null hypothesis if the calculated p-value is less than the critical p-value of 0.05 at 95% confidence level. Since the p-value was greater than 0.05 the null hypothesis was accepted and conclusion made that regulatory policy has no effect on cloud computing adoption in core banking systems.

Correlation Analysis

Correlation co-efficient is calculated to measure the strength of a linear relationship between two variables. The correlation co-efficient lies between negative one and positive one. The closer the absolute value of the co-efficient is to one, the stronger the relationship between the two variables. The sign on the co-efficient tells whether the correlation is positive or negative. In this study, the Pearson's correlation co-efficient was calculated to determine if there was any correlation between cloud computing adoption and each of the independent variables; data security, organizational culture, supplier lock-in and regulatory policy across the three areas of implementation; core banking systems, middle office and compliance systems and back-office and data science use cases. The results were summarized in table 4.28 below:

The results in the table 24 below indicate existence of a weak negative correlation between cloud computing for core banking systems and data security (r=-0.331, ρ=0.027<0.05) which is statistically significant at 95% confidence level. The correlation between cloud computing adoption in middle office and compliance systems and data security was found to be negative and statistically significant at 95% confidence level (r=-0.387, ρ=0.009<0.05). The correlation between cloud computing adoption in back office systems was found to be negative and statistically insignificant at 95% confidence level (r=-0.061, ρ=0.689>0.05).

The analysis also showed the existence of a negative and statistically insignificant correlation between the adoption of cloud computing in core banking systems and organizational culture (r=-0.127, ρ=0.405>0.05). The correlation between adoption of cloud computing in middle office and compliance systems was established to be positive and statistically insignificant at 95% confidence level (r=-0.014, ρ=0.927>0.05). The correlation between cloud computing adoption in back-office systems was found to be negative and statistically insignificant at 95% confidence level (r=-0.086, ρ=0.575>0.05).

The analysis indicated the existence of a negative and statistically insignificant correlation between cloud computing adoption in core banking systems and supplier lock-in (r=-0.253, ρ=0.094>0.05). The correlation between cloud computing adoption in middle office and compliance systems and supplier lock-in was found to be negative and statistically insignificant at 95% confidence level (r=-0.200, ρ=0.189>0.05). This was similar to the correlation between cloud computing adoption

in back-office systems and supplier lock-in which was negative and statistically insignificant at 95% confidence level (r=-0.143, ρ=0.348>0.05).

The correlation between cloud computing adoption in core banking systems and regulatory policy was observed to be negative and statistically insignificant at 95% confidence level (r=-0.028, ρ=0.855>0.05). The correlation between cloud computing adoption in middle office and compliance systems and regulatory policy was negative and statistically insignificant at 95% confidence level (r=-0.146, ρ=0.338>0.05). This was also the case for the correlation between cloud computing adoption in back-office systems and regulatory policy which was negative and statistically insignificant (r=-0.026, ρ=0.864>0.05).

Multiple Linear Regression

A multiple linear regression model was fit on the data using the mean score of cloud computing adoption and the mean scores of each of the four independent variables i.e. data security, organizational culture, supplier lock-in and regulatory policy. The results of the multiple linear regression R-square value, overall model fit and regression co-efficient were presented in table 25 below.

The results indicated an R-squared statistic of 0.356 which means that 35.6% of the variance in adoption of cloud computing can be jointly attributed to data security, organizational culture, supplier lock-in and regulatory policy. The model also had an F-statistic of 1.447 with a p-value=0.236>0.05 indicating that the overall multiple linear regression model was statistically insignificant at 95% confidence level.

The regression co-efficient for data security was negative and statistically insignificant at 95% confidence level (r=-0.490 p=0.068>0.05) while organizational culture had a positive but statistically insignificant effect on adoption of cloud computing(r=0.135, p=0.411>0.05). The regression co-efficient for supplier lock-in was negative and statistically insignificant (r=-0.161, p=0.338<0.05) while regulatory policy had a positive but statistically insignificant relationship to adoption of cloud computing (r=0.162, p=0.301>0.05).

The multiple linear regression model was presented below:

cloud computing adoption = $2.929 - 0.490X_1 + 0.135X_2 - 0.161X_3 + 0.162X_4$

Where;

X_1= Data security

X_2= Organizational culture

X_3= Supplier lock-in

X_4= Regulatory policy

List of Tables

Table 3: Response Rate

Description	population	Percentage
Targeted	191	100.0
Contacted	150	78.5
Responded	51	34.0

Table 4: Respondents Years of Experience

Years of Experience	Frequency	Percentage
Below 2 Years	12	23.5
2 to 5 Years	24	47.1
Over 5 Years	15	29.4
Total	51	100.0

Table 5: Role of Respondent

Role of Staff	Frequency	Percentage
ICT	48	94.1%
Non-ICT	3	5.9%
Total	**51**	**100%**

Table 6: Job Category of the Respondent

Job title	Frequency	Percentage
Unit Heads	09	17.6%
Managers	15	29.4%
Other Operational Staff	27	52.9%
Total	**51**	**100%**

Table 7: It May Be Difficult For the Bank to Effectively Check the Data Handling Practices of the Cloud Service Provider

Rating	Frequency	Percentage
Very Large extent	8	15.7%
Large extent	21	41.2%
Moderate extent	13	25.5%
Small extent	4	7.8%
Not at all	5	9.8%
Total	**51**	**100%**

Table 8: Analysis of Data Security as an Antecedent in Adoption of Cloud Computing

Statement	Mean	Median	Mode	Std. Deviation
Core banking systems				
End to end data confidentiality in the cloud and beyond is a key consideration in adopting cloud computing in the organization.	4.80	5.00	5	.633
Visibility into infrastructure security and auditability is a key consideration in adopting cloud computing in the organization.	4.80	5.00	5	.457
It may be difficult for the bank to effectively check the data handling practices of the cloud service provider.	3.38	4.00	4	1.211
In a cloud environment there could be incomplete /insecure data deletion should need arise which could expose the bank's data to unauthorized access to third parties.	3.11	3.00	4	1.247

Table 9: Factor Analysis

Factor	Factor loading
Core banking systems	
It may be difficult for the bank to effectively check the data handling practices of the cloud service provider.	.902
In a cloud environment there could be incomplete /insecure data deletion should need arise which could expose the bank's data to unauthorized access to third parties.	.827
End to end data confidentiality in the cloud and beyond is a key consideration in adopting cloud computing in the organization.	-.497
Visibility into infrastructure security and auditability is a key consideration in adopting cloud computing in the organization.	-.420

Table 10: Regression Analysis - Data Security

Variable	B	Std. Error	t	sig
(Constant)	3.248	.755	4.299	.000
Data security	-.426	.185	-2.297	.027
F statistics(p value)	5.274 (0.027<0.05)			
R squared	0.331			

Table 11: No Major Financial Institution Has Moved All Her Operations to the Cloud Environment and Hence the Reluctance

Rating	**Frequency**	**Percentage**
Very Large extent	12	23.5%
Large extent	19	37.3%
Moderate extent	11	21.6%
Small extent	7	13.7%
Not at all	2	3.9%
Total	**51**	**100%**

Table 12: Analysis of Organizational Culture

Statement	Mean	Median	Mode	Std. Deviation
Core banking systems				
There is resistance to change in technology in the organization.	3.02	3.00	3	1.158
No major financial institution has moved all her operations to the cloud environment and hence the reluctance.	3.58	4.00	4	1.177
There is fear of loss of Intellectual Property rights in the organization in regards to adoption of cloud computing.	3.02	3.00	4	1.323

Table 13: Factor Analysis

Factor	Factor loading
Core banking systems	
There is fear of loss of Intellectual Property rights in the organization in regards to adoption of cloud computing.	.867
No major financial institution has moved all her operations to the cloud environment and hence the reluctance.	.779
There is resistance to change in technology in the organization.	.552

Table 14: Regression Analysis- Organizational Culture

Variable	B	Std. Error	t	sig
(Constant)	1.845	.391	4.714	.000
Organizational culture	-.099	.118	-.841	.405
F statistics(p value)	0.707 (0.405>0.05)			
R squared	0.127			

Table 15: The Cloud Service Provider Could Increase Charges Immediately the Bank Has Signed Up

Rating	**Frequency**	**Percentage**
Very Large extent	1	2%
Large extent	15	29.43%
Moderate extent	13	25.5%
Small extent	11	21.6%
Not at all	11	21.6%
Total	**51**	**100%**

Table 16: Data Migration To and From the Cloud Environment is a Concern

Rating	Frequency	Percentage
Very Large extent	7	13.7%
Large extent	25	49.0%
Moderate extent	9	17.6%
Small extent	8	15.7%
Not at all	2	3.9%
Total	**51**	**100%**

Table 17: Analysis of Supplier Lock- in

Statement	Mean	Median	Mode	Std. Deviation
Core banking systems				
The cloud Service provider could increase charges immediately the bank has signed up.	2.51	3.00	3	1.141
Switching to other cloud service providers is a challenge should the need arise.	3.29	3.00	3	.843
Data migration to and from the cloud environment is a concern.	3.45	4.00	4	1.109

Table 18: Factor Analysis on Supplier Lock-In

Factor	Factor loading
Core banking systems	
Switching to other cloud service providers is a challenge should the need arise.	.867
The cloud Service provider could increase charges immediately the bank has signed up.	.767
Data migration to and from the cloud environment is a concern.	.723
Switching to other cloud service providers is a challenge should the need arise.	.903
Data migration to and from the cloud environment is a concern.	.842
The cloud Service provider could increase charges immediately the bank has signed up.	.804

Table 19: Regression Analysis Supplier Lock In

Variable	B	Std. Error	t	sig
(Constant)	2.189	.399	5.484	.000
supplier lock in	-.215	.126	-1.714	.094
F statistics(p value)	2.936 (0.094<0.05)			
R squared	0.253			

Table 20: Customer Data May Be Held in Multiple Jurisdictions, Some of Which May Be High Risk

Rating	Frequency	Percentage
Very Large extent	15	29.4%
Large extent	23	45.1%
Moderate extent	8	15.7%
Small extent	4	7.8%
Not at all	1	2%
Total	**51**	**100%**

Table 21: Analysis of Regulatory Policy

Statement	Mean	Median	Mode	Std. Deviation
Core banking systems				
The failure of mechanisms separating storage, memory, routing and even reputation between different cloud tenants could lead to attacks.	3.51	4.00	4	1.100
Customer data may be held in multiple jurisdictions, some of which may be high risk. If data centres are located in countries lacking rule of law and or having unpredictable legal framework and enforcement, etc., local authorities could raid the data cent	3.91	4.00	4	1.041
Investments in achieving certain certifications may be put at risk by moving to the cloud for example certain kinds of compliance like PCI-DSS cannot be achieved.	3.29	3.00	4	1.180

Table 22: Factor Analysis

Factor	Factor loading
Core banking systems	
Customer data may be held in multiple jurisdictions, some of which may be high risk. If data centres are located in countries lacking rule of law and or having unpredictable legal framework and enforcement, etc., local authorities could raid the data cent	.890
Investments in achieving certain certifications may be put at risk by moving to the cloud for example certain kinds of compliance like PCI-DSS cannot be achieved.	.855
The failure of mechanisms separating storage, memory, routing and even reputation between different cloud tenants could lead to attacks.	.709

Table 23: Regression Analysis

Variable	B	Std. Error	t	sig
(Constant)	1.606	.436	3.687	.001
Regulatory compliance	-.022	.118	-.184	.855
F statistics(p value)	0.034 (0.855>0.05)			
R squared	0.028			

Table 24: Correlation Analysis

Variables	Cloud computing	Overall	Core banking	Middle office	Back office
Data security	*r*	-.281	-.331*	-.387**	-.061
	p	.061	**.027**	**.009**	.689
Organizational culture	*r*	-.091	-.127	.014	-.086
	p	.551	.405	.927	.575
Supplier lock-in	*r*	-.214	-.253	-.200	-.143
	p	.159	.094	.189	.348
Regulatory policy	*r*	-.072	-.028	-.146	-.026
	p	.639	.855	.338	.864

Table 25: Multiple Regression Model

Variable	B	Std. Error	t	sig
(Constant)	2.929	.694	4.218	.000
Data security	-.490	.262	-1.874	.068
Organizational culture	.135	.163	.830	.411
Supplier Lock -in	-.161	.166	-.970	.338
Regulatory Compliance	.162	.154	1.047	.301
F statistics(p value)	1.447 (0.236)			
R squared	0.356			

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter presents a summary of the findings of the study, the conclusions made from the analysis of the collected data and suggestions for further research.

Data Security as an Antecedent of Adoption of Cloud Computing

In regards to core banking systems, end to end data confidentiality in the cloud and beyond was regarded as an antecedent to cloud computing with a mean of 4.8. the concern on the ability to audit the cloud computing infrastructure also had a mean of 4.8. Ability to check data handling

practices of the cloud service provider had a mean score of 3.38. Under data security in the adoption of cloud computing in core-banking systems, the inability of the bank to effectively check the data handling practices of the cloud service provider had the highest effect according to the respondents.

The analysis of the responses by the respondents indicated that an increase in concern on data security leads to a decrease in cloud computing adoption in core banking systems. These findings concur with the results of the study by Misra and Mondal (2011) who indicated that before adopting cloud computing, an organization needed to consider the sensitivity of their data, size of IT resources, utilization pattern of IT resources and criticality of the work done

Organizational Culture as an Antecedent of Adoption of Cloud Computing

The results of the analysis of the responses indicated that reluctance of banks to adopt cloud computing since no major financial institution had done it had the highest mean score of 3.58 with a standard deviation of 1.177 in relation to core banking systems. Resistance to change in technology and fear of loss of intellectual property rights had a mean score of 3.02 and a standard deviation of 1.158 and 1.323 respectively in relation to the adoption of cloud computing in core banking systems. The strongest factor under organizational culture according to the study was because no major financial institution had moved all her operations to the cloud, and hence the reluctance. Overall, the study concluded that increase of organizational culture led to a decrease in the adoption of cloud computing.

Supplier Lock-In as an Antecedent of Cloud Computing

The analysis of the responses indicated that when considering adoption of cloud computing in core-banking systems, data migration to and from the cloud environment had the highest mean score of 3.45 with a standard deviation of 1.109 followed by switching of cloud service providers being a challenge with a mean of 3.29 and a standard deviation of 0.843. The possibility of the service provider increasing charges immediately the bank signs up had the lowest mean of 2.51 with a standard deviation of 1.141. The biggest concern under this category therefore is data migration to the cloud and from the cloud. The study showed that an increase in concern on supplier lock in led to a decrease in the adoption of cloud computing, which is in line with the findings of Maaref (2012), where supplier lock in was identified as a key concern.

Regulatory Compliance as an Antecedent on Adoption of Cloud Computing

The results of the analysis indicated that in the adoption of cloud computing services for core-banking systems, customer data being held in multiple jurisdictions some of which may be high-risk had the highest mean score of 3.91 (and hence the biggest concern) with a standard deviation of 1.041. Failure of mechanisms separating storage, memory, routing and reputation may lead to attacks had a mean of 3.31 and a standard deviation of 1.1. Certain types of compliance being unachievable had the lowest mean of 3.29 and a standard deviation of 1.180. The study further revealed that an increase in regulatory policy leads to a decrease in adoption of cloud computing.

Recommendations

Based on the findings of the study, the cloud service providers should address the concerns the banks have towards adopting and using cloud-computing services.

The government should also come up with relevant pieces of legislation governing the use of cloud computing services.

The banks can consider deploying some of their services on the cloud, especially services that do not need hosting customer information. The findings also indicate that some of antecedents of cloud computing adoption in other sectors like education are not necessarily the same ones in banking sector and therefore further studies need to be done on them to form a basis of new knowledge.

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