

FACTORS INFLUENCING THE ADOPTION OF CLOUD COMPUTING IN SOFTWARE DEVELOPMENT COMPANIES IN KENYA

Samuel Nzoya Munguti

Msc. Student, College of Biological and Physical Sciences School of Computing and Informatics (Sci), University of Nairobi, Kenya

Dr. Elisha Opiyo

College of Biological and Physical Sciences School of Computing and Informatics (Sci), University of Nairobi, Kenya

©2018

International Academic Journal of Information Systems and Technology (IAJIST) | ISSN 2518-2390

Received: 2nd July 2018

Accepted: 11th July 2018

Full Length Research

Available Online at:

http://www.iajournals.org/articles/iajist_v2_i1_126_144.pdf

Citation: Munguti, S. N. & Opiyo, E. (2018). Factors influencing the adoption of cloud computing in software development companies in Kenya. *International Academic Journal of Information Systems and Technology*, 2(1), 126-144

ABSTRACT

The main aim of this study was to establish the factors that influence cloud computing adoption in the software development companies in Kenya. The study was guided by four specific objectives; to establish the organizational factors influencing the adoption of cloud computing in software development companies in Kenya, to assess the environmental factors influencing the adoption of cloud computing in software development companies in Kenya, to determine the technological factors influencing the adoption of cloud computing in software development companies in Kenya and to evaluate the risk factors influencing the adoption of cloud computing in software development companies in Kenya. The target population of this study composed of the 283 software development companies in Kenya. The sample size of this study comprised of the entire 283 Software Development Companies, which were provided with questionnaires in order to provide the information required, here the ICT managers were the participants. Since the study used primary data, the data was collected using a questionnaire as the main data collection instrument. The study generated both qualitative and quantitative data. Quantitative data was coded and entered into Statistical Packages for Social Scientists (SPSS Version 21) and analyzed using descriptive statistics. Qualitative data was analyzed based on the content of the responses. The study concludes that organizational related factors, (top management commitment, worker attitudes and right skills) environmental (industry competition and trading partner

pressure) technological factors (perceived benefits, complexity and compatibility influenced the adoption of cloud computing technology within organizations. The Study also concludes that policy and organisational risks, technical risks and legal risk influenced the adoption of cloud computing technology within organizations. In order to promote cloud computing, service providers should provide successful case studies and statistics in order to help companies realize the potential benefits, to achieve agreement on an industry standard perhaps is the priority in the sector. The standardization will reduce uncertainties and hence encourage adoptions. Trust being a critical factor in cloud. It is the emergence of the mitigation strategies. Risk mitigation strategies include audit controls, policies and procedures, service Risks and service level arrangement for similar type risks. Like other information technology adoptions in businesses there are issues other than the technology that need to be taken into account for example compatibility of the technology with organizational policy, structure, value and most importantly products and services. Data security is an essential factor that should be considered during any Cloud Computing implementation, with the current security and privacy issues in the Cloud, this factor must be considered carefully, Companies will have to assess the necessity of cloud computing to their business first and then its compatibility.

Key Words: *cloud computing, risk factors, worker attitudes, industry competition, technical risks, standardization, risk mitigation, data security*

INTRODUCTION

Global competition places huge pressure on organizations to reduce cost, increase profitability and enhance productivity, in order to survive in this rapidly changing environment (Misra & Mondal, 2011). This has encouraged information technology (IT) managers to adopt the most up-to-date technologies that enable them to reduce costs, sustain competitive advantage and improve the bottom line. The use of information Technology can improve the effectiveness of businesses and provide a positive advantage to organizations. As information technology services are becoming increasingly expensive and time consuming, adoption of cloud computing has evolved as a major technological innovation to reduce these processing costs through enhancing reliability, flexibility, availability and processing throughput (Choudhary & Vithayathil, 2013).

Recently, cloud computing has been an important concept in the field of Information Technology; it is recognized as an important area of Information Technology investment. Cloud computing is considered a new phenomenon that provides opportunities for organizations, by offering a large collections of easily accessible virtual computer resources, and it has the possibility for facilitating economic growth by offering existing implemented remote infrastructure for computing and data management needs with lower initial investment capital (Oliveira, Thomas & Espadanal, 2014). Nevertheless, the challenge remains to determine the factors that lead organizations to adopt and deploy cloud computing.

The emergence of Information Technology (IT) is increasingly being used as a key tool to automate business processes at various levels of organizations. Due to severe market competition and dramatically changing business environment, firms have been prompted to adopt various state-of-the-art Information Technologies to improve their business operations (Sultan, 2010). In modern technology arena therefore, cloud computing has cut a great and specific niche in businesses. Due to the intense market competition and a rapidly changing business environment, firms have been driven to adopt various modern information technologies in order to improve their business operations and increasing their productivity.

There has been an increased awareness on IT knowledge among employees with the connectivity potential with mobile devices on the increase, the potential of IT managers to control and dictate the use of these devices and services among organizations employees will decrease (Alsanea & Barth, 2014). There is a distinction between the IT departments providing support to such employees and teams adopting these services and also their attempts to block these trends or explore the available opportunities. The availability of these devices for the individual means that they no longer require support from IT departments when using these devices at their workplace. It has been estimated that over 40% of knowledge workers had adopted non-company equipment on company systems and networks (Armbrust, 2010).

The most definitive description of cloud computing can perhaps be associated with that of the US National Institute of Standards and Technology (NIST) definition (Mell & Grance, 2011) that is more pronounced in research and viewed as one of the more articulate, clear yet

comprehensive classifications of cloud computing, and as Sriram and Khajeh-Hosseini (2010) state, has captured the commonly agreed aspects of cloud computing. This definition, which will be the one adopted in this study, describes cloud computing using; Five characteristics: on-demand self-service, broad network access, resource pooling, rapid elasticity, and measured service; Four deployment models: private clouds, community clouds, public clouds, and hybrid cloud and comprises three service models: Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS).

Microsoft has been offering cloud computing accessibility in Kenya, which has however been hampered by the poor knowledge of cloud computing among its targeted consumers. Reporters and journalists in the IT field also have no strong perceptions of cloud computing and therefore avoid the topic. There is a potential for cloud computing adoption among users but this has been mitigated by their poor comprehension of what cloud computing is all about (Hoikkanen, 2010). Cloud computing service providers have often been observed to exaggerate their capacity to promote their competitiveness while making a profit. As a potential user of cloud computing, the end user should ensure that the provider indeed has the capacity to deliver what they promise. In regard to the provider, there is no need to have a huge capacity which cannot be used and remains idle. The best practices approach has been to have load testing and active metrics for cloud services testing. It is also prudent to undertake traditional market research before embarking on cloud computing business. IPv6 is fast growing which requires that cloud computing services should be IPv6 compliant. In Kenya, and other developing regions, the use of the IPv4 is still largely used. The IPv6 provides the infrastructure to provide technical flexibility and unlimited addresses required to succeed in the sky. The predominant advantage of adoption of cloud computing for the organizations is that it eliminates the need for IT employees. Maghiros (2013) finds that existing IT departments would not require services of their 70 % to 80 % of their IT workforce posing an eminent threat to existing IT staff.

Despite the many benefits of cloud computing, today, many organizations in Kenya and other developing countries are struggling to muddle through the rapid market variations. Organizations find it difficult to meet customer expectations alongside growing business requirements (Omar et al., 2015). Despite the many advantages that organizations may benefit from cloud computing, the adoption rate is however relatively low in some developing countries (Senarathna et al., 2016). However, organizations in the developing countries need to benefit from cloud technology in order to realize increased productivity and enhanced efficiency in businesses operations. This has been a major hurdle for organizations to overcome, which therefore requires great attention.

STATEMENT OF THE PROBLEM

The process of purchasing, maintaining, and monitoring computing assets requires a large investment of financial and manpower resources for any institution. An option which centralizes computing assets and can lower the costs and manpower requirements for the organizations is the use of centralized computing assets provided as cloud computing (Jeffrey

& Neidecker-Lutz, 2010). Currently, many institutions are interested in using cloud computing capabilities, but they do not know where to expect changes when choosing for the cloud computing concept. This research seeks to identify the factors taken into consideration by software development companies, when making decisions on the adoption of cloud computing technology.

Over the last decade, Kenya's ICT sector has grown phenomenally, attracting global attention, especially after the introduction of mobile money. Today, Kenya has the largest mobile money platform in the world. An estimated 25 million mobile phone users are expected to be using mobile money by end 2020, the equivalent of three out of every four adult Kenyans (Demombynes & Thegeya, 2015). Kenya has positioned itself to become a global ICT hub, attracting investors who want to extend the ICT revolution domestically as well as look for applications in other developing countries. Past studies have shown that there has been adoption of cloud computing in the personal aspect ignoring the adoption of cloud computing in the organizations. Authors contend that this require an investigation into the organizational, technological and environment influence on the adoption of cloud computing in today's organizations. Cloud computing provide the opportunity for companies to reduce their IT associated costs through offloading. Despite these opportunities most organizations are reluctant to do so mostly owing to security issues.

Several studies have been conducted on adoption of cloud computing. Willcocks (2013) sought to establish the factors that drive and inhibit the adoption of cloud computing. The paper drawn on a composite research based in the UK included two detailed surveys and interviews with 56 participants in the cloud supply chain undertaken between 2010 and 2013. Alshamaila, Papagiannidis and Feng (2013) studied Cloud computing adoption by SMEs in the north east of England. This qualitative exploratory study used semi-structured interviews to collect data in 15 different SMEs and service providers in the north east of England. Locally, Mungai (2012) indicated that Kenyan financial institutions have not taken keen interest in cloud computing. He recommended further studies to be done on implementation risks of cloud computing. Although the potential for cloud computing is evident and much of the extant research has been carried out on cloud computing adoption, empirical studies on the factors that influence cloud computing adoption in Kenya are lacking. This study aims to contribute to a growing body of research on cloud computing by studying the factors that influence cloud computing adoption in the software development companies in Kenya.

GENERAL OBJECTIVES

1. To establish the organizational factors influencing the adoption of cloud computing in software development companies in Kenya
2. To assess the environmental factors influencing the adoption of cloud computing in software development companies in Kenya
3. To determine the technological factors influencing the adoption of cloud computing in software development companies in Kenya
4. To evaluate the risk factors influencing the adoption of cloud computing in software development companies in Kenya

LITERATURE REVIEW

Cloud computing is paradigm which combines several existing IT technologies into one service. The term, cloud computing, first emerged in the early 20th century as a commercial web service that allows small companies to have a platform to run their business applications from their own personal computers. The National Institute of Standards and Technology (NIST) defines cloud computing as a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction (Mell & Grance, 2012). Since then, various definitions have emerged to fit the various aims of studies on cloud computing. Nonetheless, these definitions revolve around the main characteristics of cloud computing, which include on-demand self-services, broad network access, resource pooling, rapid elasticity, and measured service (Mell & Grance, 2012).

Cloud services denote various layers of the cloud computing architecture, including infrastructure as a service (IaaS), platform as a service (PaaS), and SaaS. IaaS refers to the basic level of cloud services that deliver infrastructure services to customers over a network; PaaS offers online access to all the resources that are required to build an application; while SaaS provides users a piece of software over a network (Gangwar, Date, & Ramaswamy, 2015). Recent studies have shown that cloud for end-user services, such as e-mail or office applications, is increasingly being adopted by the organizations for daily business activities, which create both opportunities as well as challenges (Alshamaila, Papagiannidis, & Feng, 2013). A point to note is that cloud computing has unique characteristics compared to other IT innovations in terms of its customer targets (could be small, medium or large organizations), its interoperability (quality of services), its pricing mechanism (pay-as-need), and its delivery models (public, private or hybrid cloud) (Hsu, Ray & LiHsieh, 2014).

There are several benefits and advantages of adopting cloud computing for organizations. Firstly, the cloud can reduce costs and save money for both small and large enterprises because it offers an outsourcing model which allows them to rent resources and pay only for the service that they use, rather than building up in-house IT infrastructure. Moreover, the maintenance of IT resources and the upgrades are managed by a third party, which allows organizations to transfer responsibility and save money. Another advantage of cloud migration is that it enables enterprises to grow and scale their services easily without delay and according to their specific needs. For example, sales staff can provide new products and sell them easily and quickly in the cloud environment. Furthermore, by using a cloud environment in organizations, the numbers of IT infrastructure resources, such as servers, will be minimized, and consequently the cost of energy consumption will be reduced. In addition, cloud computing allows the enterprises to run their applications with a minimum failure rate. Finally, the flexibility of delivering computing services is the key benefit that drives organizations to migrate their IT systems to the cloud (Mell & Grance, 2012).

THEORETICAL FRAMEWORK

Technology-Organization-Environment Framework

The TOE framework was proposed by Tornatzky and Fleischer (1990), to analyze the adoption of new IT technologies at an organizational level. This framework investigated the impact of three factors (Technology, Organization and Environment) on the organization's decision to adopt a new technology. The technology aspect describes the effect of internal and external technologies of the firm and how adopting new technology can influence the firm (Chau & Tam, 2007). The organizational context refers to different measures of the organization. For example, firm size, scope and complexity of managerial structure. These measures have a significant impact on the adoption decision. Lastly, the environmental context is the field where an organization runs its business; the industry, competitors and government regulation define the environmental context.

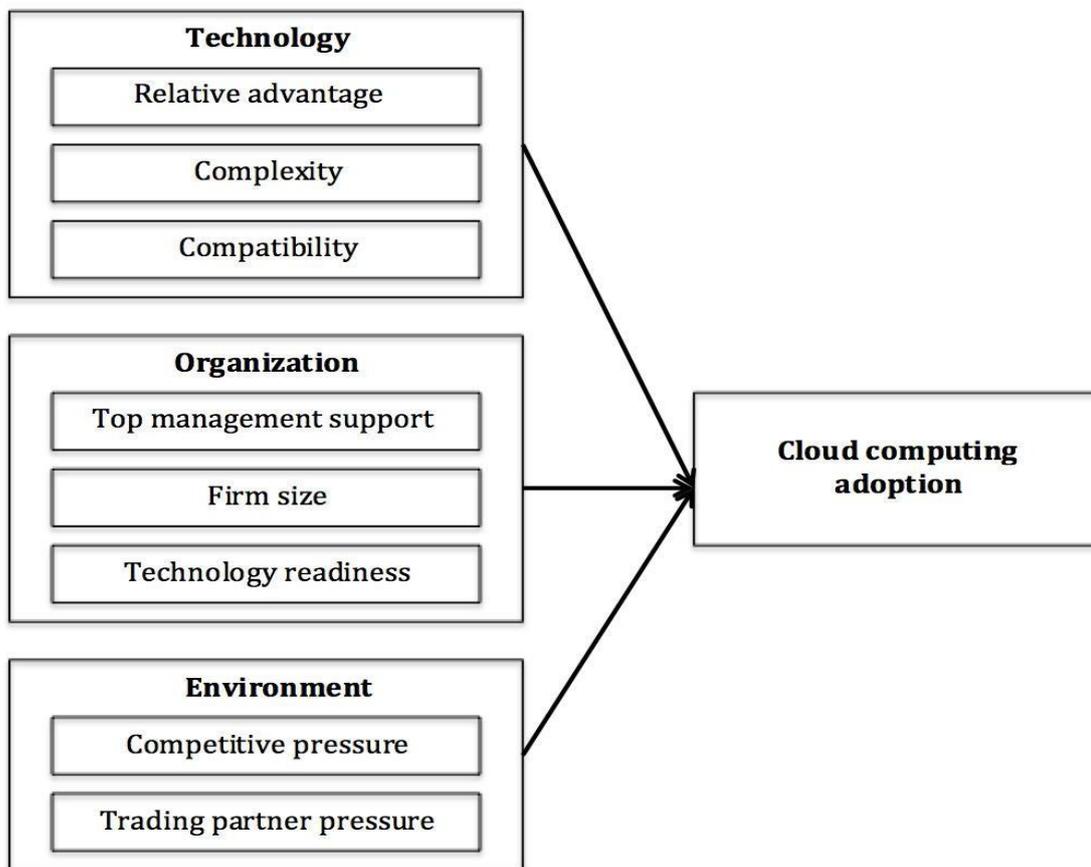


Figure 1: The TOE Framework of (Tornatzky and Fleisher 1990) adapted by (Low, Chen and Wu 2011)

There are several reasonable motivations which make TOE framework feasible for Cloud Computing adoption. Cloud Computing adoption is a different scenario to conventional innovation adoption and diffusion (Feuerlicht, 2010). Cloud computing services are usually offered to firms and organizations by a third party (cloud service provider). Thus, Cloud

Computing technology compared to other conventional innovations consists of three foremost players: cloud-based services, cloud users (clients), and cloud service providers (Dargha, 2013). As a result, adoption of Cloud Computing is influenced by three major factors which include the characteristics of Cloud Computing technology as a technological context, the characteristics of firms and organizations as an organizational context, and the characteristics of a third party as an environmental context (Low, et al.; 2011). However, because of the nature of socio-technical factors in cloud-based services, organizational and environmental factors are equally as important as technological factors (Low et al. 2011). TOE framework explains the adoption of technology through three elements: technological, organizational, and environmental contexts. Therefore, TOE framework compared to other adoption and diffusion theories is a much more relevant analytical tool to classify all determinants of Cloud Computing adoption in technological, organizational, and environmental contexts. In addition, the TOE framework is a useful analytical tool for explaining the adoption of innovation by firms and organizations.

The Technology Acceptance Model (TAM)

It is an information systems theory that models how users come to accept and use a technology. The model suggests that when users are presented with a new technology, a number of factors influence their decision about how and when they will use it, notably: Perceived usefulness (PU) - This was defined by Fred Davis as the degree to which a person believes that using a particular system would enhance his or her job performance. Perceived ease-of-use (PEOU) - Davis defined this as the degree to which a person believes that using a particular system would be free from effort (Davis 1989). TAM has been continuously studied and expanded-the two major upgrades being the TAM 2 (Venkatesh & Davis, 2000 and Venkatesh, 2000). A TAM 3 has also been proposed in the context of e-commerce with an inclusion of the effects of trust and perceived risk on system use, (Venkatesh & Bala, 2008).

TAM posits that perceived usefulness and perceived ease of use determine an individual's intention to use a system with intention to use serving as a mediator of actual system use. Perceived usefulness is also seen as being directly impacted by perceived ease of use (Venkatesh & Bala, 2008). Perceived usefulness is the degree to which a person believes that using a particular system would enhance his or her job performance; people are more likely to use an information system that they believe will help them perform their job better. Perceived ease of use is the degree to which a person believes that using a particular system would be free of effort. Therefore, even if a system is believed to be useful by an individual, if the system is too difficult to use, the potentially enhanced performance benefits to be derived from the system are outweighed by the effort required of having to use it.

Unified Theory of Acceptance and Use of Technology (UTAUT)

This is a technology acceptance model formulated by Venkatesh, (2000) and others in "User acceptance of information technology: Toward a unified view. The UTAUT aims to explain user intentions to use an information system and subsequent usage behavior. The theory holds that four key constructs: performance expectancy, effort expectancy, social influence, and

facilitating conditions; the first three being direct determinants of usage intention and behavior, and the fourth a direct determinant of use behavior. Gender, age, experience, and voluntariness of use are posited to moderate the impact of the four key constructs on usage intention and behavior.

Venkatesh, et al (2008) thinks that the purpose of UTAUT model is to offer the manager with using tools, the manager can use UTAUT to weigh the introduction of new technology and predict and explain the user's behavior of accepting Information and Communications Technology. From previous empirical test results, Koivumäki et al (2008) found that the explanatory power of this UTAUT model is up to 70% with regard to technology using behavior, it is more effective than any of the models that are known before; and the use of UTAUT model has become more extensive in recent years, it is no longer confined to the discussion of the use of information system, such as mobile commerce, online learning and wireless network; and the problem of this study takes user's prevalence and influence factors for Cloud Computing as the core

RESEARCH METHODOLOGY

This study used descriptive cross-sectional survey research design. This design normally describes and reports the way things are. It is characterized by a systematic collection of data from members of a given population mainly through questionnaires (Ogula, 2012). This design has been chosen in this study for the following reasons that: The design is ideal in describing the characteristics of the targeted population, it is appropriate for a large sample which is expected to participate in the study, the design also accommodates both quantitative and qualitative approaches of analysis.

The target population of this study used 283 software development companies in Kenya. The sample size of this study was the entire 283 Software Development Companies, which was provided with questionnaires in order to provide the information required, here the ICT managers were the participants because they are deemed to have the relevant information regarding adoption of Cloud Computing by the Software development Companies.

Since the study used primary data, the data was collected using a questionnaire as the main data collection instrument. To ensure validity of the instrument, the instruments were given to the supervisors, colleagues, and other experts in research to check on content and face validity. This helped to determine the degree to which the instrument gathered the intended information. The feedback from the supervisors, colleagues, and other researchers and scholars were used to make the necessary adjustments on the instrument for instance by removing the ambiguous items, spelling mistakes and other typographical errors that might have been made. The questionnaires were subjected to overall reliability analysis of internal consistency. This was measured using Cronbach alpha as a coefficient of internal consistency. Internal consistency measures the correlations between different items on the same test (or the same subscale on a larger test) and whether several items that propose to measure the same general construct produce similar scores. Castillio (2009) provide the following rules of the thumb: >0.9 – Excellent, >0.8 – Good, >0.7 – Acceptable, >0.6 –

Questionable, >0.5 – Poor and <0.5 – Unacceptable. The acceptable value of 0.7 was used as a cut-off of reliability for this study.

The researcher sought approval to perform the study from; the university, and the targeted organizations. For this to succeed, the researcher provided a final proposal to the university and received a letter to take to the organizations. The study adhered to ethical issues that are the baseline of any research. The researcher informed the respondents that they have a right not to participate in the study if they so wish. The researcher also informed the respondents that they have a right to withdraw from the study at any time without giving a reason as to their withdrawal.

Quantitative data was coded and entered into Statistical Packages for Social Scientists (SPSS Version 21) and analyzed using descriptive statistics. Qualitative data was analyzed based on the content of the responses. Responses with common themes or patterns were grouped together into coherent categories. Descriptive statistics involved the use of absolute and relative (percentages) frequencies, measures of central tendency and dispersion (mean and standard deviation respectively). Quantitative data was presented in tables and graphs and explanation were presented in prose.

The study used correlation to show the degree of association between the independent variables and the dependent variable. Correlation is used when a researcher wants to predict and describe the association between two or more variables in terms of magnitude and direction (Oso, 2009). The researcher further employed a multivariate regression model to study the relationship between adoption of cloud computing and factors that influence its adoption. The research deemed regression method to be useful for its ability to test the nature of influence of independent variables on a dependent variable. Regression is able to estimate the coefficients of the linear equation, involving one or more independent variables, which best predicted the value of the dependent variable. The researcher used a multivariate regression model to analyze the data. The regression model was as follows:

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \varepsilon$$

Where: Y = Adoption of Cloud Computing; β_0 = Constant Term; β_1 , β_2 , β_3 and β_4 = Beta coefficients; X1 = Organizational Factors; X2 = Environmental Factors; X3= Technological Factors; X4 = Risk Factors; ε = Error term

RESEARCH FINDINGS

Pearson's Correlation Analysis

The researcher conducted a Pearson correlation to establish the strength of the relationship between adoption of cloud computing and organizational, environmental, technological and risk factors in software development companies in Kenya. The Correlation coefficients were as presented in Table 1.

Table 1: Correlations

		Adoption of cloud computing	Organizational factors	Environmental factors	Technological factors	Risk factors
Adoption of cloud computing	Correlation Coefficient	1.000	.553	.711	.672	-.644
	Sig. (1-tailed)	.	.476	.439	.335	.958
	N	249	249	249	249	249
Organizational factors	Correlation Coefficient	.553**	1.000	.142	.037	.001
	Sig. (1-tailed)	.001	.	.000	.003	.002
	N	249	249	249	249	249
Environmental factors	Correlation Coefficient	.711**	.142	1.000	.046	.008
	Sig. (1-tailed)	.003	.001	.	.000	.000
	N	249	249	249	249	249
Technological factors	Correlation Coefficient	.672**	-.037	.046	1.000	.124
	Sig. (1-tailed)	.002	.000	.001	.	.002
	N	249	249	249	249	249
Risk factors	Correlation Coefficient	-.644**	.001	.008	.124	1.000
	Sig. (1-tailed)	.000	.001	.003	.000	.
	N	249	249	249	249	249

** . Correlation is significant at the 0.01 level (2-tailed).

On the correlation of the study variable, the researcher conducted a Pearson moment correlation. from the finding in the table above, the study found that there was strong positive correlation coefficient between adoption of cloud computing and organizational factors as shown by correlation factor of 0.553, this strong relationship was found to be statistically significant as the significant value was 0.001 which is less than 0.05, the study found strong positive correlation between adoption of cloud computing and environmental factors as shown by correlation coefficient of 0.711, the significant value was 0.003 which is less than 0.05, the study found strong positive correlation between adoption of cloud computing and technological factors as shown by correlation coefficient of 0.672, this too was also found to be significant at 0.002, and finally the study found strong negative correlation between adoption of cloud computing and risk factors as shown by correlation coefficient of 0.644 at 0.000 levels of confidence the findings concur with Franks and Curswoth, (2003) who found out that strong positive correlation between technological factors and Adoption of cloud computing. The findings further agree with Ayodele (2011) who found out that strong negative correlation between risk factors and Adoption of Information technology.

Regression Analysis

Table 2: Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.874	.763	.746	.223

Adjusted R squared is coefficient of determination which tells us the variation in the dependent variable due to changes in the independent variable. From the findings in the above table the value of R squared was 0.763 an indication that there was variation of 76.3 percent on adoption of cloud computing in software development companies in Kenya due to changes in organizational factors, environmental factors technological factors and risk factors at 95 percent confidence interval. This shows that 76.3 percent changes in adoption of cloud computing in software development companies in Kenya could be attributed to organizational factors, environmental factors technological factors and risk factors.

Table 3: Analysis of Variance

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	2.188	4	.547	4.841	.001b
Residual	27.572	244	.113		
Total	29.76	248			

Critical value =2.50

From the ANOVA statics, the study established the regression model had a significance level of 0.1% which is an indication that the data was ideal for making a conclusion on the population parameters as the value of significance (p-value) was less than 5%. The calculated value was greater than the critical value (4.841>2.50) an indication that organizational factors, environmental factors, technological factors and risk factors All affects the adoption of cloud computing in software development companies in Kenya. The significance value was less than 0.05 indicating that the model was significant.

Table 4: Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.342	1.023		1.312	.001
1 Organizational factors	.711	.118	.213	6.025	.002
Environmental factors	.841	.125	.207	6.728	.000
Technological factors	.622	.124	.206	5.016	.001
Risk factors	-.536	.114	-.211	-4.702	.000

From the data in the above table the established regression equation was

$$Y = 1.342 + 0.711X_1 + 0.841X_2 + 0.622 X_3 + (0.536 X_4)$$

From the above regression equation it was revealed that holding organizational factors, environmental factors, technological factors and risk factors to a constant zero, the adoption of cloud computing in software development companies in Kenya would be at 1.342, a unit increase in organizational factors would enhance the adoption of cloud computing in software development companies in Kenya by a factor of 0. 711, a unit increase in environmental factors would enhance the adoption of cloud computing in software development companies in Kenya of -0.841, a unit increase in technological factors would enhance the adoption of cloud computing in software development companies in Kenya by a factor of 0.622 and that

a unit increase in risk factors would negatively affect the adoption of cloud computing in software development companies in Kenya by a factor of - 0.536 and. all the variables were significant as their significant value was less than ($p < 0.05$).

DISCUSSION OF THE FINDINGS

In line with the first objective, the research investigated the extent to which organizational factors influenced the adoption of cloud computing technology within organizations. The organisational context was assessed under the sub measures top management, change of attitudes, and availability of right skills and competence. Descriptive results revealed that organizational related factors influenced the adoption of cloud computing technology within organizations to very great extent. company's top management in most of the organisation provided strong leadership in the process of adoption (mean = 4.25) it also created a conducive environment for adoption of new technologies (mean = 4.02,) and that the management creates a conducive environment for adoption of new technologies (mean = 3.89, std dev = 0.38). The findings are in line with the findings by Alshamaila et al., (2013) Top management support is essential for providing the resources needed to adopt a new technology

However, the findings of this research noted that in majority of the respondents disagreed top management team has nothing to do with the cloud computing adoption project (mean = 1.55), that It is not essential for the top management team to be involved in reviewing a consultant's cloud computing recommendations (mean = 1.75) and that the management approves sufficient financial investment for adoption of cloud computing (mean = 2.08). The findings are in support of the findings by Grandon & Pearson, (2014) that Lack of top management support would therefore, lead to the failure of implementation.

Relating to change of attitude and adoption of cloud computing, results obtained show that that using the cloud computing solutions improves user performance (mean = 4.26,) using cloud computing solutions promotes service stability (mean = 4.19), using the cloud computing solutions makes work easier (mean = 4.17) and using the cloud computing solutions is attractive (mean = 4.15) The findings are in support of the findings by Oliveira & Martins, (2010) adoption of cloud computing is highly depended on employee competence and the positive attitude towards technology. The study also revealed that using the cloud computing solutions is secure (mean = 3.98), using cloud computing is a symbol of being technologically receptive (mean = 3.95), using the cloud computing solutions is a way to increase employee confidence (mean = 3.85,). The findings are in line with the findings by Tweel, (2012) the attitude plays a significant role in the technology acceptance decisions.

On influence of skills on adoption of cloud computing, the findings show that learning to operate the system is easy for most of the employees (mean = 4.16), employees find the system to be flexible to interact with (mean = 4.10,) human resources provided the knowledge and skills to implement cloud computing-related it applications (mean = 4.10) and that employees find it easy to get the system to do what they want it to do (mean = 3.98). The findings are in line with the study findings by Low, Chen, & Wu, (2011) human

resources provide the necessary skills, experience and knowledge base required to implement and integrate a new cloud computing service. However the findings show that it's not easy for the employees to become skillful at using the system (mean = 2.18,) and that employee interaction with the system is not very clear and understandable (mean = 2.20,) The findings concurs with the study findings by Wang et al., (2010) adoption of new IT innovations is depended on readiness of an organization, which includes the technological infrastructure and IT human resources.

In line with the second objective, the study investigated the extent to which environmental factors influenced the adoption of cloud computing technology within organizations. Results obtained show that environmental factors influenced the adoption of cloud computing technology within organizations to great extent. having the system is a status symbol in within the organization (mean = 4.35), competitors in the industry that use the system have more prestige than those who do not, (mean = 4.28) the system has given the company a competitive advantage (mean = 3.97,) competitors in the industry who use the system have a high profile (mean = 3.90,) and that research and development driven by ICT innovation is good for the industry (mean = 3.88). The findings are in line with the findings by Laforet (2011), Low, Chen and Wu (2011) suggest the pressure from both competitors and trading partners on the business to stay current and adopt new technologies.

The findings further shoe that that industry players believe use of innovative systems bring competitive advantages (mean = 4.48,) the organization relied on the experience and skills of trading partners when looking to adopt cloud services (mean = 4.26,), trading partners relate to the cloud service providers (mean = 3.99,) and the system allows for reliable interaction with trade partners (mean = 3.78,). The findings are in support of the findings by Gutierrez, Boukrami, & Lumsden, (2015) This competitive pressure has resulted in many organizations outsourcing their IT infrastructure to not only improve effectiveness but also to enable lower prices to be offered, as an attempt to increase their market share

The research demined the extent to which technological factors influence the adoption of cloud computing in the organization. Descriptive results findings show that technological factors influenced the adoption of cloud computing technology within organizations to very great extent. Using the system enables employees to accomplish tasks more quickly (mean = 4.36,), the technology has created better customer communications (mean = 4.22, using the system improves employee job performance (mean = 3.98), adoption of the technology has improved efficiency in inter- organization coordination (mean = 3.95) and that the technology has enhanced access to market information mobilization (mean = 3.66). The findings concurs with the study findings by Hassan and Ismail (2015) discovered that cloud computing leads to strategic (e.g. helping organizations to create competitive advantage and establishing useful links with other organizations) and informational (e.g. easier access to information and improve information accuracy) benefits.

The findings also show that agreed that learning to use the cloud computing system is easy for the employees (mean = 4.46,) however responds disagree that when the firm uses cloud

computing, is find it difficult to integrate the existing work with the cloud-based services (mean = 1.44), it takes too long to learn how to use the cloud computing to make it worth the effort (mean = 1.37,) in general cloud computing is very complex to use (mean = 1.35 std dev = 0.35) and that the use of cloud computing is complicated, it is difficult to understand what is going on (mean = 4.17) The findings concurs with the study findings by Oliveira & Martins, (2010) The complexity of integrating different Cloud services with the existing infrastructure is a real challenge to many organisations.

Further the study findings show that cloud computing services is compatible with the business routine works (mean = 4.46), cloud computing fits well into the company's work style (mean = 4.17) cloud services are compatible with existing technological architecture of the company (mean = 4.14,) and that there is no difficulty in exporting applications/ data to cloud services (mean = 3.95). The findings concur with the study findings by Peng, Xiong, & Yang, (2012). Increased compatibility between an innovation and adopters' needs facilitate an easy integration of the technology within the organization and business functions

In line with the fourth objective, this research investigated the extent to which risk factors influenced the adoption of cloud computing technology within organizations. Descriptive findings show that risk factors influenced the adoption of cloud computing technology within organizations to very great extent. There is a risk of inability of organisations to move their data or programs away from a cloud computing service provider (mean = 4.48,) customers are vulnerable to price increases (mean = 4.25) there is a risk of providers going out of business (mean = 3.88) and that loss of governance is a top security risk (mean = 3.85). The findings are in line with the findings by Armbrust, (2010) policies and procedures related to cloud computing services should determine the procedures related information to management approaches that are acceptable and auditable from both client and organizational perspectives.

On the influence of technical risks and adoption of cloud computing, the findings show that that virtual machines and operating systems is that they do not provide a programmatic way to ensure all threads of a program run simultaneously (mean = 4.35) there is the risk of unavailability of service (mean = 4.18) and that availability, scalability and performance are conflicting goals as the requirements for each of these individual needs are rigorous (mean = 3.73). The findings concurs with the findings by Armbrust (2010) believes the problem with virtual machines and operating systems is that they do not provide a programmatic way to ensure all threads of a program run simultaneously.

Relating to legal risk and adoption of cloud computing, research findings show that computer systems may be confiscated by law enforcement agencies or through civil suits (mean = 4.28) some businesses may not like the ability of a country to get access to their data via the court system (mean = 4.05) compliance challenges (mean = 4.05,) and that changes of jurisdiction (mean = 3.95). The findings are in line with the findings by Betcher, (2010) the centralization of storage and shared tenancy of physical hardware imparts more risk of unwanted data disclosure to cloud computing clients

The study also noted that cloud computing services have helped us improve, protect and grow the business as users carry out their duties with minimum capital (mean =4.28), cloud computing is a force that is reshaping it and powering innovation (mean = 4.03), at macro level, cloud computing has been beneficial for the economy and environment (mean =3.95) at micro level, the diffusion of cloud has been advantageous for our company (mean =3.88,)and the most of the organisations had adopted cloud for end-user services, such as e-mail and office applications, for daily business activities (mean =3.87). The findings concurs with the findings by Senarathna et al., (2016) organizations in the developing countries need to benefit from cloud technology in order to realize increased productivity and enhanced efficiency in businesses operations. most of the organization has adopted Platform-as-a-Service (PaaS) (78%) Software-as-a Service (SaaS) (56%) Infrastructure-as-a-Service (IaaS) (40%) and Hardware as a service (HaaS) (42%). The findings are in line with the findings by Omar et al., (2015) Despite the many advantages that organizations may benefit from cloud computing, the adoption rate is however relatively low in some developing countries Armbrust et al., (2009) The introduction of a cloud computing technology has significantly impacted on organizational performance and has had a fundamental contribution to growth and competition amongst organisations.

CONCLUSIONS

Organizational related factors

Based on the study findings the study concludes that organizational related factors (top management commitment, worker attitudes and right skills) pose significant influence on adoption of cloud computing technology within business firms. The top management team has a big task in steering the cloud computing adoption project, adoption of cloud computing is highly depended on employee competence and the positive attitude towards technology and that human resources should provide the necessary skills, experience and knowledge base required to implement and integrate a new cloud computing service. However the study that concludes that it's not easy for the employees become skillful at using the system and that employee interaction with the system is not very clear and understandable.

Environmental factors influenced

The study concludes that environmental related factors such as industry competition and trading partner pressure influenced influence on adoption of cloud computing technology within business firms. The study concludes that competitors in the industry that use the system have more prestige than those who do not, the system allows for reliable interaction with trade partner and that this competitive pressure has resulted in many organizations outsourcing their IT infrastructure to not only improve effectiveness but also to enable lower prices to be offered, as an attempt to increase their market share

Technological factors

The study concludes that technological factors such as perceived benefits, complexity and compatibility influenced the adoption of cloud computing technology within organizations. cloud computing leads to strategic e.g. helping organizations to create competitive advantage and establishing useful links with other organizations and informational e.g. easier access to information and improve information accuracy. The complexity of integrating different Cloud services with the existing infrastructure is a real challenge to many organisations and that increased compatibility between an innovation and adopters' needs facilitate an easy integration of the technology within the organization and business functions

Risk Factors Influencing the Adoption of Cloud Computing

The Study concludes that policy and organisational risks, technical risks and legal risk influenced the adoption of cloud computing technology within organizations. They also study concludes that there is a risk of inability of us to move our data or programs away from a cloud computing service provider, there is the risk of unavailability of service and that availability, scalability and performance are conflicting goals as the requirements for each of these individual needs are rigorous and that centralization of storage and shared tenancy of physical hardware imparts more risk of unwanted data disclosure to cloud computing clients.

RECOMMENDATIONS

In order to promote cloud computing, service providers should provide successful case studies and statistics in order to help companies realize the potential benefits, to achieve agreement on an industry standard perhaps is the priority in the sector. The standardization will reduce uncertainties and hence encourage adoptions. Trust being a critical factor in cloud

Computing adoption; it is the emergence of the mitigation strategies. Risk mitigation strategies include audit controls, policies and procedures, service Risks and service level arrangement for similar type risks. Like other information technology adoptions in businesses there are issues other than the technology that need to be taken into account for example compatibility of the technology with organizational policy, structure, value and most importantly products and services. Data security is an essential factor that should be considered during any Cloud Computing implementation, with the current security and privacy issues in the Cloud, this factor must be considered carefully, Companies will have to assess the necessity of cloud computing to their business first and then its compatibility.

REFERENCES

- Alsanea M., & Barth J. (2014). Factors Affecting the Adoption of Cloud Computing in the Government Sector: A Case Study of Saudi Arabia. *International Journal of Cloud Computing and Service Science*, 3(6).
- Alshamaila, G., Papagiannidis, C. & Feng, L. (2013). Cloud computing adoption in northern England. *Industrial Management and Data Systems*, 58, 365-378.

- Betcher, J. T. (2010). *Cloud Computing: Key IT-Related Risks and Mitigation Strategies for Consideration by IT Security Practitioners*.
- Chau, P. Y. K. & Tam, K. T. (2007). Factors affecting the adoption of open systems: an exploratory study, *MIS Quarterly*, vol. 21, pp. 1–24.
- Choudhary, V. & Vithayathil, J. (2013). The Impact of Cloud Computing: Should the IT Department be Organized as Cost Centre or a Profit Center? *Journal of Management Information Systems*, 30, 67-100.
- Dargha, R. (2013). Cloud computing: Key considerations for adoption. Feb 2018. Retrieved from www.infosys.com.
- Feuerlicht, G. (2010). Next generation soa: Can Soa survive cloud computing? Advances in intelligent web mastering -2. In V. Snášel, P. Szczepaniak, A. Abraham & J. Kacprzyk (Eds.), (Vol. 67, pp. 19-29): Springer Berlin / Heidelberg
- Gangwar, H., Date, H., & Ramaswamy, R. (2015). Developing a cloud computing adoption framework. *Global Business Review*, 16(4), 632-651.
- Grandon, E. E., & Pearson, J. M. (2014). Electronic commerce adoption: An empirical study of small and medium US businesses. *Information & Management*, 42(1), 197-216.
- Gutierrez, A., Boukrami, E. & Lumsden, R. (2015). Technological, Organizational and Environmental Factors Influencing Managers' Decision to Adopt Cloud Computing in the UK. *Journal of Enterprise Information Management*, 28, 788-807.
- Hassan, H., & Ismail, N.A. (2015). Cloud computing: Use and impact of technology. *Paper presented at the 5th International Conference on Computing and Informatics (ICOICI) 2015*, Istanbul, Turkey.
- Hsu, P. F., Ray, S., & Li-Hsieh, Y. Y. (2014). Examining cloud computing adoption intention, pricing mechanism, and deployment model. *International Journal of Information Management*, 34(4), 474-488.
- Jeffrey, K & Neidecker-Lutz, B. (2010). The future of cloud computing: opportunities for European cloud computing beyond 2010.
- Koivumäki, et al. (2008). The perceptions towards mobile services: An empirical analysis of the role of use facilitators, *Personal & Ubiquitous Computing*, vol. 12, no. 1, pp. 67– 75.
- Laforet, S. (2011). A Framework of Organizational Innovation and Outcomes in SMEs. *International Journal of Entrepreneurial Behavior and Research*, 17, 380-408.
- Low, C., Chen, Y., & Wu, M. (2011). Understanding the determinants of cloud computing adoption. *Industrial Management & Data Systems*, 111(7), 1006-1023.
- Mell, P., & Grance, T. (2012). The NIST definition of cloud computing. *National Institute of Standards and Technology*, 53(6), 50.
- Mungai C. K. (2012). Cloud computing Adoption in Kenya's financial institution: A survey study in Kenya's banking sector. *Unpublished Masters Project*. University of Nairobi.

- Oliveira, T., & Martins, M. F. (2010). Understanding e-business adoption across industries in European countries. *Industrial Management & Data Systems*, 110(9), 1337-1354.
- Oliveira, T., Thomas, M., & Espadanal, M. (2014). Assessing the determinants of cloud computing adoption: An analysis of the manufacturing and services sectors. *Information & Management*, 51(5), 497-510.
- Peng, R., Xiong, L. & Yang, Z. (2012). Exploring Tourist Adoption of Tourism Mobile Payment: An Empirical Analysis. *Journal of Theoretical and Applied Electronic Commerce Research*, 7, 21-33.
- Sultan, N. (2010). Cloud computing for education: A new dawn. *International Journal of Information Management* 30(2), 109–116.
- Tornatzky, L. & Fleischer, M. (1990). *The process of technology innovation*, Lexington, MA, Lexington Books.
- Tweel, A. (2012). Examining the Relationship between Technological, Organizational, and Environmental Factors and Cloud Computing Adoption. *Ph.D. Thesis*, North central University, San Diego.
- Venkatesh, V.; Morris; Davis; Davis (2008). User Acceptance of Information and Communications Technology: Toward a Unified View, *MIS Quarterly* 27 (3), pp.425–478
- Willocks, S. P. (2013). Identifying Cloud computing adoption risks. *Journal of Entrepreneurship and Business*, 4, 58-72.
- Yigitbasioglu, O. M. (2015). The role of institutional pressures and top management support in the intention to adopt cloud computing solutions. *Journal of Enterprise Information Management*, 28(4), 579- 594.
- Youseff, L., Butrico, M., & Da Silva, D. (2008.) Toward a unified ontology of cloud computing. *Grid Computing Environments Workshop*, 2008