A Framework for Cloud Computing Adoption by SMEs in Kenya

Asiema Mwavali

Abstract— **In Kenya, Cloud Computing (CC) is a current advancement, which offers a substantial opportunity for government, Organizations and Individuals to contract out their Information Technology (IT) requirements from other establishments. New technology amongst SMEs has been noted to be low because of numerous obstacles like information generation, processing and dissemination among SMEs and investors. Capital for setting up and sustaining Information Technology is also a big issue. However, Cloud computing if successfully adopted, it is likely going to solve this problem by offering ready and low cost of entry of IT solutions.**

This study attempts to investigate the level of cloud computing adoption by SMEs within Kenya by employing and utilizing a questionnaire with a convenience sample of 20 SMEs in Nairobi County that collected quantitative data to assist in determining the most applicable framework. The adapted framework is then validated through statistical analysis that confirmed a largely reasonable level of fit for the manifestations and construct legitimacy performing through convergent and discriminant validity methods. The questionnaire instrument was discovered to be trustworthy and data were analyzed where the outcome showed embracing new technology for doing business in Kenya is generally low hence the need for the Kenyan Government to develop a framework that can support the adoption of cloud computing by SMEs. If most of the Kenyan SMEs could have access to scalable technologies, they could potentially deliver products and services that in the past only large enterprises could deliver, flattening the competitive arena. The developed paradigms ideas ware founded on the Technological- Organizational-Innovations paradigms (DOI) these are paradigms that ware mostly utilized to elucidate cloud computing technology embracement. The systematic method of using literature review was employed to get new ideas on how to develop a framework and adopt cloud-computing technology.

Index Terms— **Framework, Cloud Computing, Small-to-Medium Enterprise (SMEs), Information Communication and Technology (ICT), Technology Organization Environment (TOE)..**

I. INTRODUCTION

Currently Organizations are relentlessly discovering new methods of reducing expenditures and work more competitively. Because of this, there is tremendous development in new technology usage for commercial, instructions and management constantly aspiring to stay competitive in their particular businesses by exploiting pertinent instruments to attain their aims(Johansson et al., Alajbegovic, Alexopoulo, &Desalermos, 2015) The introduction of internet has initiated the evolution of markets and contesting worldwide (Swash, 1998). In Kenya universal

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association, rivalry and the combination of enlarged computer system use has generated need to increase the utilization of the accessible resources whilst reducing the expenses (KNBS, 2016; Agboh, 2015). Unique area of developing attention for achieving these requirements is the utilization of Information technology consolidating computing and knowledge administration tasks for big physically location distributed corporations and individualistic persons(Taylor, Todd, 1995). Despite the prominence of the small businesses within Kenyan partial research, exist on the adoption, accomplishment and manipulation of Information and Communication Technology (Wamuyu, 2017). In traditional Information Technology atmospheres, increasingly more intricate management concern of software, hardware and networking paraphernalia demand for professional team for implementing and maintaining IT facilities (Think strategies, 2002). Certain profits arising from cloud computing are guaranteed and can be extremely attractive for SMEs which require to exploit the return on their saving and stay competitive in an ever challenging SMEs business atmosphere (Saya et al., 2010; Widyastuti&Irwansyah, 2018; Benlian and Hess, 2011). Should SMEs in Kenya adopt a new framework for cloud services, they will gain access to accessible new technologies, they could hypothetically gain more skills, become more knowledgeable; more equipped and finally provide products and amenities that were only provided in the past by gigantic enterprises (Mworia, 2018). Their access to the new technologies will lead to leveling fair and competitive ground in area of trading (Think strategies, 2002). Most of the companies in Kenya are SMEs technology adoption for doing business (KNBS, 2016). This SMEs needs a new framework to engage in business and for education guidance in the adoption process, this forms the purpose of this study (Think strategies, 2012).

New Technology in Cloud computing adoption is particularly appealing in the direction of governments owing towards its numerous benefits, which embrace the tall - functioning competences it presents, its small entrance expenses, pervasive openness, flexibility, accessibility, and scalability (Zhang, Cheng &Boutaba, 2010). Governments utilizing new technology by cloud computing adoption can contract out essential undertakings as well as infrastructure correlated to Knowledge in Technology that is desirable to perform commercial business (Gide&Sandu, 2015). This eradicates requirement that Government locate to an outmoded internal Information Technology infrastructure by in its place choosing leasing infrastructure, platforms including software, successfully running low-price money

spending (KNBS, 2016).

Moreover, companies, particularly SMEs, obtain entry to complicated Information Technology incomes freeing Governments of the requirement aimed at enormous infrastructural expenditures; equally minor and big companies can be able to keep wealth on capital spending, this releases out money to different extra capital savings(Alkhater, 2014). Consequently, the ensuing query is what are issues that ought to be put into consideration before cloud computing adoption? The little threats environment of new technology for cloud computing adoption doesn't necessarily discriminate it differently from the rest of technologies whereby cloud computing acceptance is impartial comparable to several other technologies threats if there isn't relationship among their features that is going to be put into consideration and what the government actually desires (Chen, & Wu, 2011).

II. LITERATURE REVIEW

The section gives reports on how SMEs in Kenya can utilize cloud computing by coming up with a framework that could improve on the existing framework for cloud computing adoption by SMEs, which will eventually aid in solving the current challenges experienced by SMEs. Various aspects of all Knowledge are looked in to, including literature, hypothetical and experimental findings, models and frameworks of cloud computing. Technology in Cloud computing has five essential physiognomies viz.: Fast, Self-amenity, Wealth attractive, comprehensive access to network, and measured amenity (Mell&Grance2012; Wambugu, 2018).

Advantages of Cloud Computing

There are so many profits that come with cloud computing (Klein, 2003). Some the notable benefits include purchase of inexpensive software and hardware which is very low (PWC, 2013). It is also noted that developing, customization, deployment and maintenance costs and time for cloud computing services are very low compared to traditional resolutions (Ricketts, 2015). And these are some of the benefits that encourages many organizations to adopt cloud computing.
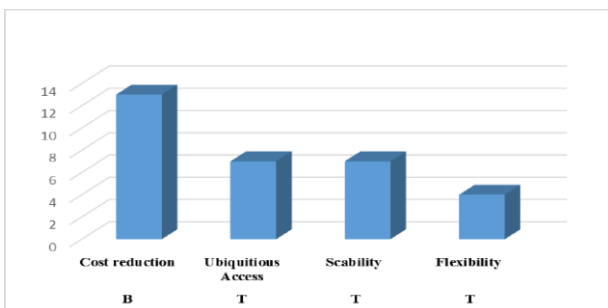
Figure 2 Reasons for Cloud computing adoption

SMEs Adoption of ICT and Cloud Computing

As (SMEs) clarifications vary from one place to a different one, in this research, SMEs are deliberated to be private businesses with less than 250 employees (Berisha& Pula, 2015). SMEs Adoption of ICT has been established to have a number of advantages as discussed above. These advantages of adoption of ICT are by extension, also received through the adoption of cloud computing amenities because cloud computing falls in the broader context of ICT. SMEs can therefore gain the benefits derived from ICTs through adoption of cloud computing amenities.
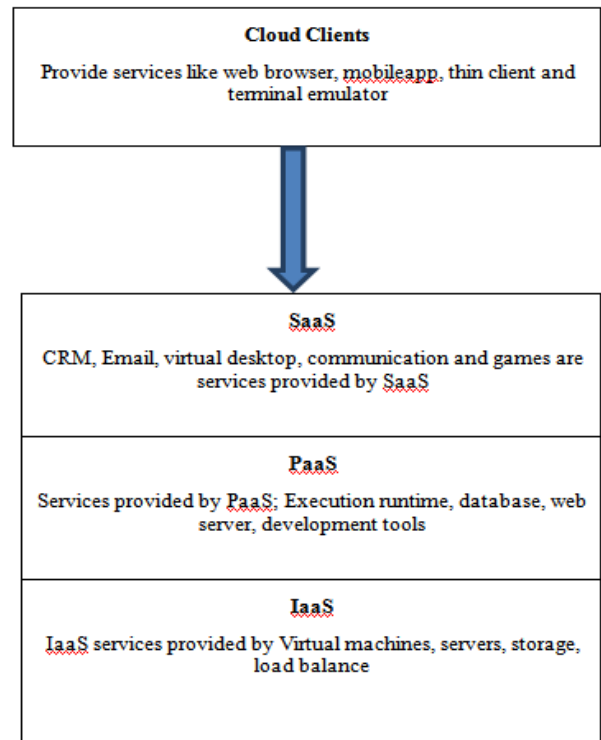
Figure 1; Cloud Computing Models

Cloud Computing Models

The greatest essential computing models comprises of a group of IaaS (infrastructure as a service), PaaS (platform as a service), and SaaS (software as a service) (Gorelik, 2013). These provision models have collaborations among each other's interdependent. *As shown in Figure above.*

III.   CLOUD COMPUTING LIMITATIONS

No	Limitations	Description	References
1	Increased security vulnerabilities	Data safety is a common obligation among SMEs and the supplier of cloud amenities if SMEs firms move business to cloud computing. The extension incorporates public cloud, which presents safety weakness features.	*(Erl et al. 2013; Kumar, 2017; Marston, 2011; Fujistu, 2011;*
2	Reduced control over resources	SMEs, which have moved their business to cloud computing, have partial regulation over the IT resources as they can only subscribe for the amenities risking their data to provider's run cloud atmospheres.	*(Akin et al., 2014; El-Gazzar, 2014; KNBS, 2016)*
3	The Limitation between portability of providers	Technology is a threat for SMEs movability due to lack of regulations standards that are referred to as vendor's lock-in, for example when technology users move from individual cloud to alternative cloud, it poses a movability threats to SMEs.	*Kumar, (2016) Wilson, (2015)*
4	Internet Connectivity issues		*Wilson, (2015) Hinde, (2012*

Figure 3. Limitations associated with Cloud computing

Theories of Technological that explain the Adoption of Frameworks

We have several theories which have been utilized to elaborate adoption of knowledge and modernization. Due to their strength and weakness, the theories have been utilized in various contexts. Certain theories have been linked to Individual Level of Analysis while others are linked to Organizational Level of Analysis and they include, Theory of Reasoned Action, Theory of Planned Behavior, Diffusion of Innovations theory (DOI), Unified Theory of Acceptance and Use of Technology (UTAUT), Technology of Acceptance Model and Technological Organizational-Environment (TOE).

The Analysis of Frameworks Appropriateness for this research

The reason for researching on cloud computing amenities in correlation to SMEs is in the interest of developing a framework to assist in the adoption of cloud computing by SMEs. In this case the research is going to focus on an organizational level for adoption while aiming on the internal and external factors of SMEs. As we were focusing on the problem statement and research objectives, the theories that describe adoption of technology like TAM, TPB, UTAUT, and TRA were found to be unsuited for this study (Lai, 2017; Kumar, 2017). DOI and TOE Framework were proved to be appropriate as they inclusively describe adoption of technology and innovation from an organizational level

perspective. Nonetheless, the appropriate model for this research was TOE Framework due its internal and external factors of an organization that include; Organizational and Environmental (DePietro, Wiarda, & Fleischer, 1990; Hassan, Nasir, Khairudin, &Adon, 2017). DOI is noted to be focusing on social factors and market level (Lai, 2017; Kumar, 2017).

Conceptual Framework

This framework examines and explains how cloud-computing adoption has affected the development of SMEs in Kenya either positively or negatively in correlation to the contexts of cloud technological experience, Perceived usefulness, Ease to use, Access to Internet and Decision makers.

Independent Intervening Dependent
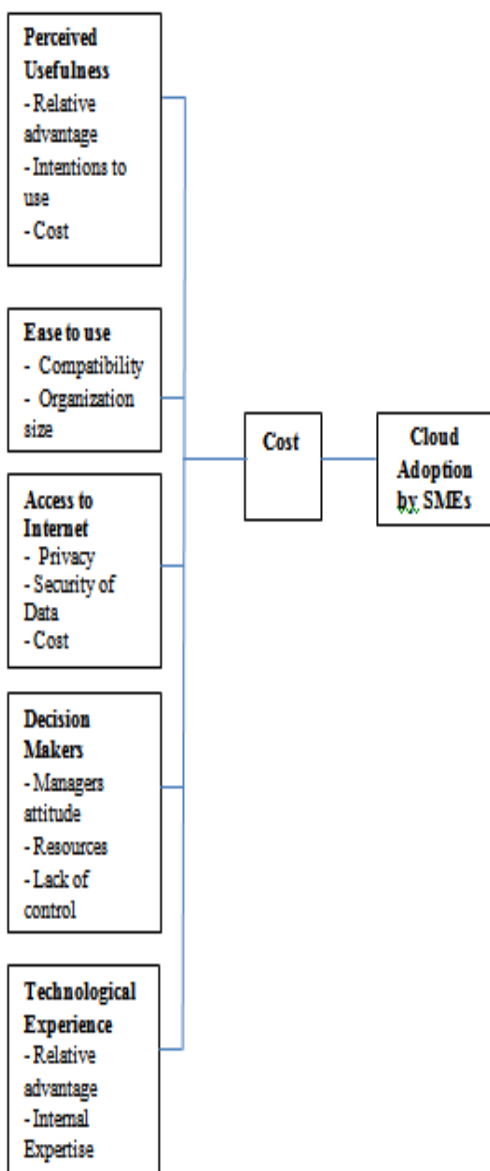**Variables   Variables   Variables**

Figure 4. Conceptual Framework; (Jeyaraj, 2006)

IV.   RESEARCH METHODOLOGY

In order to achieve the objectives of this research, the method used was to review the limitations with the existing frameworks that have adopted cloud computing and innovations of new technology. The best and relevant framework and theory was adopted by this research to lead to the development of a framework that would address the limitations with the existing framework. Different researchers looked at factors of various theories and frameworks like TOE, DOI, TAM, TPB, UTAUT and TRA. The anticipated framework was then subjected to validation through the Questionnaires to explore the limitations factors that would be appropriate to build a framework to address the limitations with existing framework.

Data Analysis

Descriptive analysis employing mean and mode were utilized to comprehend and interpret variables. Standard deviation and use of spearman's coefficient of correlation were employed to comprehend correlation among the variables of the research. Data was evaluated and the findings will be presented using frequency tables, pie chart and bar graphs appropriately.

I.   Population of the Study

I selected ease sampling strategy as it is endorsed for research studies where constrained on budgets and limited time is met (Lund Research Ltd, 2012; Bornstein, Jager, &Putn, 2013).The research population entailed of an accessibility sample of selected SMEs within the Nairobi County between February to April 2018. The sample was preferred due to its closeness of the researcher to the sample population and accessibility of the study participants. The research targeted various businesses within the county where various types of respondents like SMEs owners, IT personal, Managers, as well as employees of the given firms were targeted.

Targeted Population

Business Type	No. of Targeted Population
Manufacturing,	2
Information Technology / Computer retail	5
Transportation	5
Clothing (new and old)	5
Retail/ Wholesale	3
Total	20

Developing and Validating the Cloud Computing Adoption Framework

Through interviews and questionnaires conducted to SMEs, various factors were reached in to. These factors were used to design the framework. Every factor was further subdivided into the characteristics that it is associated with. Such factors included, Users in Organization Factors, Cloud Computing Technological Factors, Industry Factors, and Perceived Relative advantages. Average values for each factor were analyzed with the dependent variable and Users in Organization did not come out significant in influencing Cloud Computing Adoption by SMEs. Industrial factors also did not come out very significant in influencing Cloud Computing Adoption by SMEs.

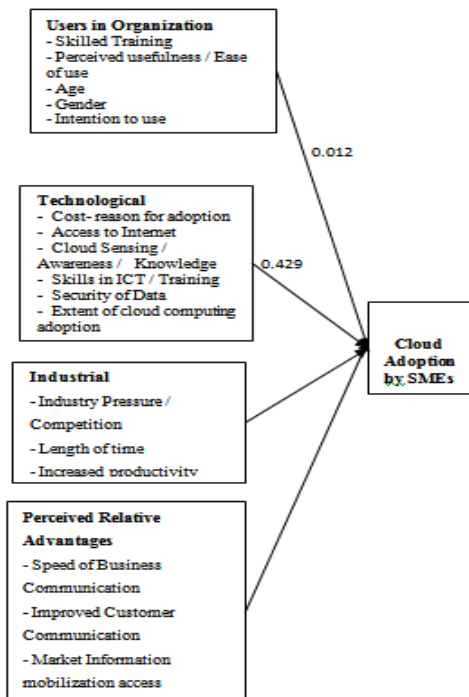**Independent Variables**   **Dependent Variable**

Figure 5 Cloud Computing Adoption Framework

The factors that remained: Technological and Perceived Relative Advantages were broken down Technology sensing capability, Top management support, Cloud computing awareness, Cost and each variable inside was associated with

Cloud Computing Adoption independently. The following factors came out as significant: Perceived relative advantage, Industry pressure, involved, Cloud data security and Poor Internet Service.

The framework was tested using a subset of the sample data to check that it fits the Kenyan SMEs adoption environment. Correlation analysis of variables is a good way of validating if an adoption framework is valid. **Figure 6 below** a table showing Results that most of the variables are correlated in a way that makes sense in the real world. For example, the highest positive correlation happens between perceived relative advantage and cloud computing adoption (0.641). The highest negative correlation happens between cloud computing adoption with poor internet service and with cost involved. Technology sensing capability increased; the level of top management support also increased significantly. Top management support increased adoption but decreases the cost involved by a small margin. Some factors are negatively correlated such as cost involved and perceived relative advantage, as well as poor internet service and cloud computing awareness.

Figure 6 bellow, is a table showing an Effects of Correlation and Decision Co-efficients (PRA= Perceived relative advantage, IP= Industry pressure, TCS= Technology sensing capability, TMS= Top management support, CCA= Cloud computing awareness, CI= Cost involved, CDS= Cloud data security, PIS= Poor Internet Service)

Indirect Effect
Adoption PRA IP TSC TMS CCA CI CDS   PIS
Adoption 0.**641**   0.265 0.114   **0.529**   0.243-**0.486**0.337-**0.355**
PRA0.6410.2730.1310.2900.2270.012-0.134-0.017
IP0.265**0.461**0.1170.1720.0260.079-0.086-0.022
TSC0.114-0.1210.088**0.511**0.2250.309-0.203-0.091
TMS0.5290.109-0.1200.1070.421-0.076-0.089-0.126
CCA0.2430.4340.1830.0910.254-0.1210.101-0.092
CI-0.286-*0.231*0.011-0. 071-0.129-0.213-0.0710.112
CDS-0.337*0.114*-0.0220.1040.3100.083-0.088-0.201
PIS -0.355-0.210-0.092-0.110-0.123-0.1190.132-0.401

Figure 7 below showing a table with results of the framework which is good to a big extent after testing out the high values of R, R Square and Adjusted R Square. The R statistics is 0.872 for measuring the dependent variable Cloud Computing Adoption. The R Square statistics is 0.764 which is above 0.5 the middle value. The Adjusted R Square is 0.702.

Framework	R	RSquare	Adjusted R Square	Std. Error of the Estimate
1	.872[b] Perceived relative advantage, Industry pressure, Technology sensing capability, Top management	.764	.702	3.45381
a. Independent variables are management support, Cloud computing awareness, Cost involved, Cloud data security and Poor Internet Service				
b. Dependent variable is Cloud Computing Adoption				

Figure 7. Summary of the Correlations

V. Discussion of the Results

From the above results and analysis, it was ascertained that the reason why cloud computing is not popular among SMEs was inadequate knowledge according to KNBS (2016) that discovered luck of knowledge as the main purpose for not embracing new technology. This therefore confirmed that having ICT skills or training in ICT can contribute to on how an individual operating in the SMEs perceived ease of use of ICT and hence embracing an adoption of cloud computing. We have evaluated trends in cloud computing by SMEs acceptance in various physical localities and noted that price decrease and ubiquitous admission are main issues for embracing cloud-computing adoption by SMEs technology. Emerging nations as well as SMEs bear incomplete information of advantages of cloud. Asset and environmental situations play a great role as a barricade for enchanting benefits from cloud amenity.

Achievements & Contribution

The contribution of this Framework aids SMEs organizations to achieve their Knowledge Management objectives in a cost-effective way by exploiting cloud computing for decision-making. Expertise workforces can easily incorporate spontaneously materials on private and public Clouds, by utilizing Web tools and structuring their own virtual working place to facilitate education interchange through cloud computing adoption. These expertises have also a prospect to fast track economic access application and resources from cloud services platforms by using online or web pages. The study has offered a framework with very important factors for SMEs to utilize for adoption of cloud computing in Kenya. I believe the discoveries of this study offer the best guideline for future scholars and researchers on the adoption of cloud computing in order to improvise their business and services.

VI. Recommendation and Conclusion

The research centered on a Framework for Cloud computing adoption by SMEs in Kenya. The research therefore should further focus on cloud computing investigation on the sustainability of computing programs in Kenya. The study should also explore the effectives of cloud computing in generating reasonable SMEs businesses improvement in future. The study concludes that a Framework for Cloud computing adoption needs to be taken by SMEs to realize the benefits associated with it. This study has revealed the factors that SMEs need to put into consideration for its adoption. It has also looked at SMEs trends of various regions, its success factors and barriers associated with it. Also other factors looked into by this study include gender, age, length of time in ICT industry and extents of cloud computing adoptions.
Use

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