UNIVERSITY OF NAIROBI,

SCHOOL OF COMPUTING AND INFORMATICS

A FRAMEWORK OF OPEN SOURCE SOLUTION AS TOOL FOR COST REDUCTION AMONG SMES IN NAIROBI: CASE OF AINUSHAMSI ENERGY

BY

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A PROJECT REPORT SUBMITTED TO THE SCHOOL OF COMPUTING AND INFORMATICS IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF THE DEGREE OF MASTERS OF SCIENCE IN INFORMATION TECHNOLOGY MANAGEMENT OF THE UNIVERSITY OF NAIROBI

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DECLARATION

This research project report is wholly my work and has not been submitted for any award in another university.

Signed ..... Date.....

Gibert Kiplangat Mutai

Reg No: **P54/85885/2016**

This research project report has been submitted for examination with my approval as the University Supervisor.

Signed..... Date.....

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DEDICATION

This project is dedicated to my helpful and supportive family. Thank you for the advice, support and trusting in me during the course of this study.

ABSTRACT

This study focuses on the open source business solution adoption as a tool of cost cutting by SMEs in Kenya due to increasing costs and shrinking IT budgets. The adoption will be aim to help these organization to ensure survival and compete effectively by bringing down cost of running technology software; right from acquisition, licensing, maintenance and updates. SMEs in the 21st century face a number of operational challenges mostly because of comparatively high associated costs as a result they turn to cost cutting measures. Their economies of scale do not necessarily favor high spending - which tends to limit profits as well as further business expansion. cost of running proprietary industry specific software on average falls between 15 - 28% of gross costs high for SMEs (Ainu Shamsi Energy Limited, 2016). It could be argued that one of the reasons for the sharp fall in annual returns on investments as in the study by Norfund, is the cost of running proprietary software (Saran, 2016). Open-source software is available with a license and the owner of copyright provides the rights to make change as well as distribute the software to anyone and for any intention. Open-source software is developed in a collaborative community manner (M. St. Laurent, 2004). In this study, three contexts were studied, that influence effective use of open source system as a tool of cost cutting within an SME environment. The context includes Organizational context, Technological context and Environmental context. The case study SME was Ainu Shamsi Energy Company Limited. The arithmetic mean was used to analyze the user opinions on the select context. The research methodology used in this study was purposive sampling. This is a form of nonprobability sampling where the decisions regarding the persons to be used in the sample are taken by the researcher, based on variety of criteria that include professional knowledge of adoption of open source in regard to cost cutting. A total of 50 questionnaires were self-administered to the respondents accompanied. The semi structured questionnaires were constructed using the Likert scale type of statements. For the purpose of this study, 37 respondents were achieved which is 74% of the target population. The data was analyzed using a statistical software and the findings were presented in frequencies and percentages which were used for hypotheses testing. The result indicated that 94% of the 37 respondents can influence decision making in IT, hence can influence the adoption of OSS as a tool of cost cutting. The study found out that 13 hypothesized relationships in the conceptual framework were completely supported by the data collected and analyzed. The results of this study provide positive contribution to open source adoption by SMEs as a tool of cost cutting. The study recommended further research on adoption of open source as a cost cutting tool in large and public institution. The study finally will recommend the open source adoption as a tool of cost cutting based on the studied advantages.

ACKNOWLEDGEMENTS

It is with great pleasure and honor to take this special opportunity to thank my supervisor Dr. E. Opiyo for his continual guidance, encouragement and generous support throughout my master's research project. I extend my deepest gratitude to the entire Panel lead by Dr. Oboko, Dr. Wausi and the entire team for great work of reviewing my progress and continually giving guidance in the process of my research work. I sincerely appreciate all people who continuously helped me in making this journey of research project possible. I am grateful and truly appreciate my dear family; my daughter Grace, Gibson and my dear wife Gertrude. Thanks to my sisters Margaret and Betty with their family, Brother Amos, Sister and Brother in Law and my neighbor Erine for prayers and encouragement. Special dedication of this thesis to my parents Wilson Chepkwony and Alice Chepkwony for their constant blessings and support during my childhood life.

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ABBREVIATIONS AND ACRONYMS

OSS	Opens Source Software
UK	United Kingdom
PwC	PricewaterhouseCoopers
OS	Operating system
IT	Information Technology
CRM	Customer Relationship Manager
ERP	Enterprise Resource Planning
CMS	Contents Management System
SME	Small to Medium Enterprise
CFO	Chief Finance Officer
CSS	Cascading Style Sheet

CHAPTER ONE

1.0. Background

A number of research and study exercises have been made on the contribution of open source software in the modern business organizations where cost cutting takes the center stage of many an organization's operations. According to research report on Rackspace by Vanson Bourne, businesses are making significant savings on the cost of productions with use of open source software (Saran, 2016). For instance, 20 percent of the respondents in a study undertaken by Vanson Bourne among 300 organizations in UK reported cost savings as the significant benefits, lowering the mean cost per company's task by approximately £30,000. (Saran, 2016)

Van Lindberg who is the vice-president as well as the associate general counsel at Rackspace, who also chairs the Python Software Foundation at the OpenStack Foundation, thinks the enterprise is now ready to adopt open source (Rackspace, 2018). "Open source is becoming more accessible because enterprises have seen a number of their peers use it and the sky didn't fall in," he said in an OpenStack summit in Barcelona, "…and it makes it cheaper and easier to innovate. According to Lindberg, it is a huge indictment of the traditional commercial software business model that no one wants to use the very expensive software stacks that corporate IT used to deploy. "People say they can do things better, faster, cheaper and more efficiently using community-oriented open source software," he said (Saran, 2016).

According to a PwC research published in 2017, adoption of open-source software is proliferating across industries. 48% of the financial services firms in Kenya take advantage of open-source software in developing affordable IT services and improve the infrastructure scalability. It was a bit eye-opening, however, to find that 45% of those who uses open-source technologies confirm that it has enhanced their cybersecurity posture. Over a third of financial services firms said they plan to invest in open-source software solutions over the next 12 months (PwC, 2017).

1.1. Problem Statement

SMEs in the 21st century face a number of operational challenges mainly due to high comparative associated costs with them. Their economies of scale do not necessarily favor such high spending - which tends to limit profits as well as further business expansion. Therefore, the possible existence of more affordable yet equally reliable bi-products of their respective final market outputs, would be a highly welcome path of pursuit for SMEs. SMEs play a huge role in emerging economy just like in Kenya; They play a vital role in addressing the impediments of job creation, inequality and poverty. They are a significant source of employment, especially for women, low skill workers and the youth.

A study by Norfund on SMEs and their Growth in Sub-Saharan Africa found out that the annual return on investment has greatly gone down as compared to a decade earlier (Sveinung, Leo A., & Chris (SQW) , 2010). In addition, the cost of running proprietary industry specific software on average falls between 15 - 28% of gross costs (Ainu Shamsi Energy Limited, 2016) – very high for SMEs with an average revenue downward of 10% of

their larger fortune global counterparts. For this thesis, it could be argued that one of the reasons for the sharp fall in annual returns on investments as in the study by Norfund, is the cost of running proprietary software; right from acquisition, licensing, maintenance and updates. This does not have to be the case. SMEs are sensitive to increase in cost since they don't have the financial muscle like big organizations. The cost of Proprietary solution is way above the financial value of the SMEs.

The table below is a brief comparison in terms of cost for the top most used business solution in Ainu Shamsi Energy, our case study. Ainu Shamsi Energy being one of the SME is spending a lot on the proprietary business solutions. We work with the

Information Technology team to implement an open source IT management portal. The equivalent cost of the solution could have costed the company $ 2995 per month. In addition, the Open source allows the advancement of technology, typically offering different ways to cope up with emerging challenges arising in the businesses. Furthermore, it has solid information security record and enable enterprises to compete on agility and speed of services execution.

Table 1: Comparison of open sources vs proprietary software

Proprietary Software's	Unit Cost	Total No. Units	Total Cost	Open Source Software's	Unit Cost
Microsoft Office	30,000.00	70.00	2,100,000.00	Open office	Free
Microsoft OS	15,000.00	70.00	1,050,000.00	Linux OS	Free
Microsoft Server	80,000.00	5.00	400,000.00	Servers OS	Free
SQL Databases	280,000.00	5.00	1,400,000.00	MYSQL	Free
Manage Engine IT management portal	US$ 2995 per month	5	US$ 2995 per month	ITOP	Free

In view of the latter, the benefits that SMEs stand to gain from open source other than cost reduction are numerous. As such, our study is to work out a framework of open source business solutions adoption as a tool for cost reduction among the SMEs.

1.2. General Objective

This study focuses on the adoption of open source business solution as a tool of cost cutting by SMEs in Kenya due to increasing costs and shrinking IT budgets. The adoption will be aim to help these organization to ensure survival and compete effectively by bringing down cost of running technology software; right from acquisition, licensing, maintenance and updates.

1.3. Research Objectives:

1. To identify the SME's attitude towards adoptions of open source business solutions in Kenya as a tool of cost cutting base on Organization context, Environmental Context and Technological context
2. To identify other measures employed as means of reducing cost by the SME and the effect to organization
3. To formulate and verify the framework of open source adoption by the SME community in Kenya with objective based on the findings in order to reduce cost.

1.4. Significance of the study

It is envisaged that the study will promote formal adoption of Open-source software (OSS) technologies and products especially by small business enterprises in Kenya with a particular emphasis on cost reduction. This will provide means of SME to survive in the expensive economy through better means of cost reduction instead of retrenchment and downsizing.

The study will mainly improve use of products which support well-recognized, documented and especially open technical specifications that can be adopted, implemented and customize.

Interoperability will as well be a critical issue of concern for the business operations.

1.5. Scope of the study: case of Ainu Shamsi Energy

The scope of the research will be split into four major areas as specified blow:

- **Geographical Scope** - The study will cover SMEs in Nairobi region.

  Nairobi has been selected because it represents most diverse commercial business activities in Kenya.

- **Topical Scope** - The study will be restricted to cover the various open source IT solution used by SMEs within Nairobi region.
- **Analytical Scope** – The study is to focus on the theme of the study through various techniques: classification of the data collected, presentation, percentage calculation, assessment and testing of hypothesis using the statistical devices. The statistical data collected will be used to establish findings related to the objectives of this study.
- **Case**- Ainu Shamsi Energy Limited (ASEL), an SME by nature (Ainu Shamsi Energy Limited, 2016), is an Oil Marketing Company, duly registered to deal in the business of import, export, wholesale & retail of petroleum products in Kenya as well as in the wider Eastern Africa region. The organization has been operational for over six (6) years' operating in Kenya, South Sudan, Uganda, Burundi, Rwanda and The Democratic Republic of Congo. ASEL has been selected as a result of its experimentation with OSS in a bid to improve their general business effort.

CHAPTER TWO

2.0 Review of Literature

According to techtarget.com (Rouse, 2016), Open source software (OSS) can be defined as software that is established, assessed or improved by the public with the aim of being distributed and shared with the public, thus safeguarding collaboration among different business enterprises. For instance, different versions of UNIX operating system were developed as result of collaborators in the academic environment led by Richard Stallman of Free Software Foundation to freely choose and distribute programs as open source software.

As portrayed by M., Yaseen (Fazli Baharuddin, Adil Tengku, & Shamsul, 2018), OSS has grown over time to become highly popular through the effective replacement of proprietary software in many domains, as well as being of great importance for most software engineering activities. The provision of sustainable solutions to business problems has also been a great plus. Currently the following business solutions exist as open source (M. Gichira, Kahonge, & Miriti, 2012);

- Open source CRM
- Open source Business Intelligence
- Open source ERP
- Open source Office Software
- Open source HR Software
- Open source Desktop Publishing
- Open source Archiving
- Open source Web Collaboration

A number of consulting entities on open source have also emerged. They provide business organizations with consultancy services such as customization and implementation of open source systems. These entities charge organizations consultancy fees and most times in return, these entities offer subscriptions to support the open source communities.

Various governments around the globe especially in developed countries have not only adopted this open source software but have promoted aggressively to their public institutions due to many benefits associated with it (Gov India, 2015). However, this is not easily the same case in Africa as many different entities are yet to adopt OSS. Consequently, it is highly important to undertake research in resource-limiting environments to understand the factors that can promote OSS adoption as a tool of cost cutting in such areas.

Previous studies have investigated the factors that may lead to the right decision on the adoption of the OSS specifically in the different industry sectors globally (Yasee & Bahari, 2014), documented that OSS is the most widely use software for business because it is obtained free of charge from the internet. This then begs the question, “Why the dismal OSS adoption rate in Africa?”

Adoption of OSS products over time has increased among advance users in Kenya (Wachira Kamau & Douglas Sanders, 2013). Furthermore, the server applications and the development tools for the OSS have been gaining popularity amongst them. There is however considerably slow uptake of the same OSS especially amongst ordinary users in Africa. Thus, this study has the potential to provide significant insight into the dismal OSS adoption rate in Africa. This then also makes it safe to state that usability and or understandability issues are some of the potential stumbling blocks to OSS adoption (Wachira Kamau & Douglas Sanders, 2013).

The 'Empirical Investigation' (Wachira Kamau & Douglas Sanders, 2013) indicated that the use of OSS among students in many Universities in Kenya is still very low. About two thirds of users have only proprietary products installed on their computers which is quite high. The same statistics closely apply to the other countries in Africa (M Karume & Mbugua , 2012). The OSS adoption is low among Sub-Saharan countries as compared to emerging and unindustrialized economies' countries such as India, China and Brazil. Interestingly, Brazil became the first country in the world to constitutionalize the use of OSS (Birkinbine, 2016). This has greatly promoted use of open source in the country. The decision to adopt OSS has significantly lowered the high cost of Brazilians spending on software licensing fees which was initially over $1.1 billion every year. African countries are greatly missing out on the cost saving opportunity.

Even though most business enterprises' managers are aware on the potential merits of the OSS that include reduction of both cost and software piracy of the businesses, they are yet to embrace shift from proprietary to OSS hence is still very limited (Kamau & Namuye, 2012). This is because companies like Microsoft have continued to lure customers in both public and private sectors in many countries – Kenya included

Further, as evidenced by Ainu Shamsi Energy Limited (ASEL), most Kenyan SMEs still largely use proprietary software mostly from giant corporations. "If possible, expenses on proprietary software such as the initial purchase cost, maintenance and licensing costs could be diverted to other revenue generating activities in our business," laments the ASEL Group CFO.

ASEL has for the last 6-months been experimenting with the idea of moving a considerable amount of their IT operations to customized OSS. This is after a noticeable drop in profits against an ever-increasing cost in proprietary IT expenditure.

As denoted previously, this thesis will focus on OSS adoption as a tool of cost cutting by SMEs in Kenya. The main aim is to promote OSS adoption in an attempt to reduce the cost of IT expenditures in proprietary software, hence increase the profit margins of the SMEs. This will be done through clearly sort out best-practice

recommendations and an eventual proposed framework of OSS adoption suitable to the Kenyan environment, in relation to experiences from other non-African organizations already ahead in the OSS adoption curve.

2.1 Theoretical Framework

The researcher, in line with objectives of the study, examined various tested and tried frameworks of technology adoption. These frameworks include: Fitzgerald, Tornatzky & Fleischer's frameworks as well as the Technology Adoption Model.

2.1.1 Fitzgerald framework

According to the Fitzgerald framework model (L., Fleischer, A. Tornatzky, & Chakrabarti, 1990), there are four components that affect technology adoption at both organization and country level. These findings indicate that the subjective norms and facilitating conditions are factors that influenced at the organization level. The results show that the managerial intervention tends to affect adoption also at organization level. Another factor is uncertainty avoidance which is likely to affect adoption OSS at the country level only.

The connection of these four components on OSS adoption is shown in the figure below (no):

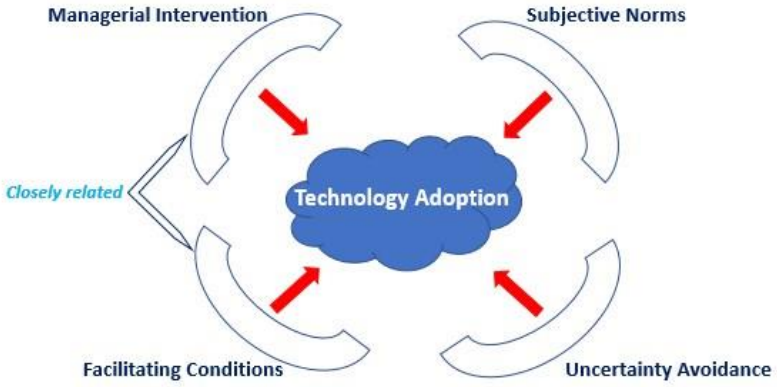

Figure 1: Fitzgerald framework

2.1.2 Tornatzky and Fleischer's framework -Technology Organization Environment (TOE): Tornatzky and Fleischer (Lai, 2017) came up with TOE framework in 1990 that explain three aspects that influenced the way a firm can adopt and implements the innovation of its technology. These contextualization factors include technology, organizational and environmental. They described technological context as those internal and external technologies such as equipment and existing practices that are relevant to business enterprises. Organizational context is defined as the descriptive features and resources about the firm such as size, managerial structure, personnel, formal and informal linkages among employees, and communication processes. The environmental context explained how the firm conducts its business operations in relation to external such

as government's regulations, characteristics and its market structure of the industry and the level of firm's competition (DePietro, Wiarda, & Fleischer, 1990). The three elements present both constraints and opportunities for technological innovation. These three basics affect the way an organization sees the need for, searches for, and adopts new technology.

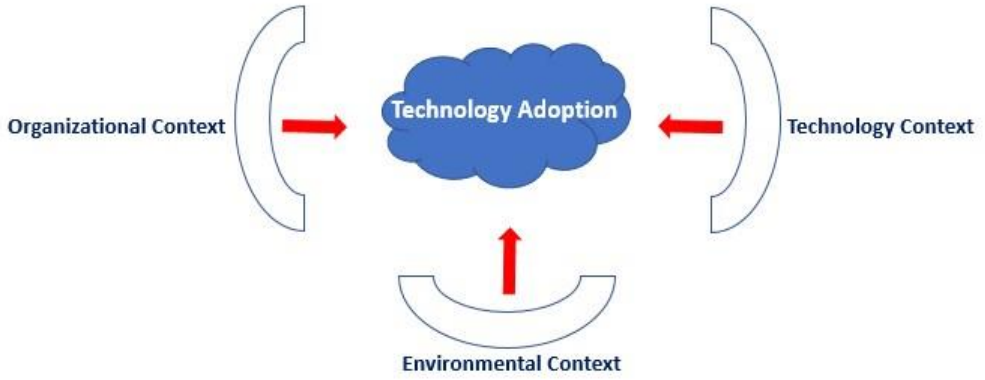

Figure 2: Tornatzky and Fleischer's framework

2.1.3 Technology Adoption Model (TAM)

This model theory was established by Davis (1989) and was a consequent from the Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975). It was proposed by Davis that his model, both the independent variables perceived ease of use (E) and perceived usefulness (U) had an influence on people's intention to use (BI), ultimately contributing to the use or non-use. The theory asserts that usefulness is strongly affected by end-users than ease of use. It goes further to state that perceived usefulness is used to measure acceptance of technology by users.

An important merit of this model is that it supports the adoption of information systems and has leeway for extension relatively to competing models. The disadvantage is that it does not account for some of the obstacle that inhibit the adoption of technology. Due to its ease, over time it has been used at the cost of other models. Lee (2003) writes the use of this model in IS research:

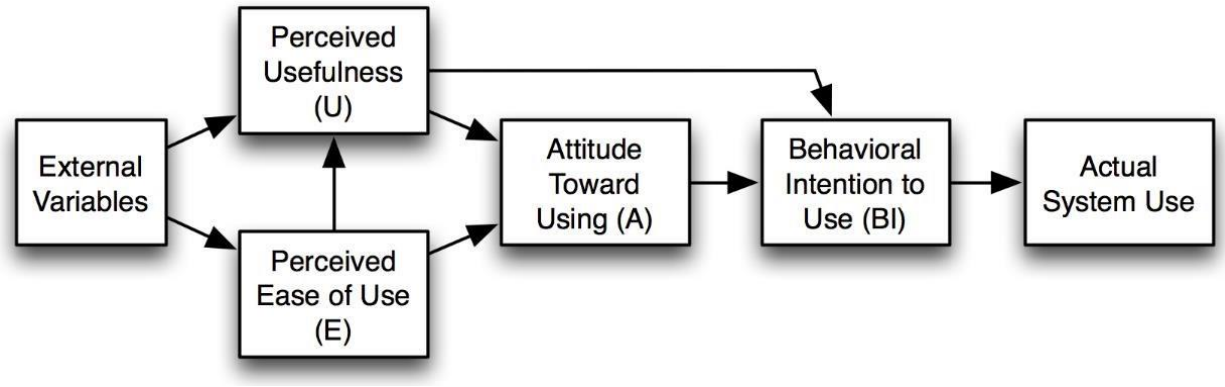

Figure 3: Technology Adoption Model (TAM)

2.2. Conceptual Framework

The researcher will greatly borrow from the Tornatzky and Fleischer's framework (TOE) to form an objective study of OSS adoption by SMEs in Kenya. This is because in the researcher's view, it is the most comprehensive framework that depicts various issues that affect technology adoption and its likelihood.

According to TOE as seen earlier, describe the process by which users within the context of the firm adopt OSS from innovation to implementation. There are three independent variables that influenced adoption decisions; organizational context, technological context and the environmental context. Key to note is that for this thesis, OSS adoption is the dependent variable. This thesis will also use the TOE framework in expounding on the Total Cost of Ownership of Business Solution as a sub-factor in Organizational context. Consequently, the following diagram forms the basis of the study:

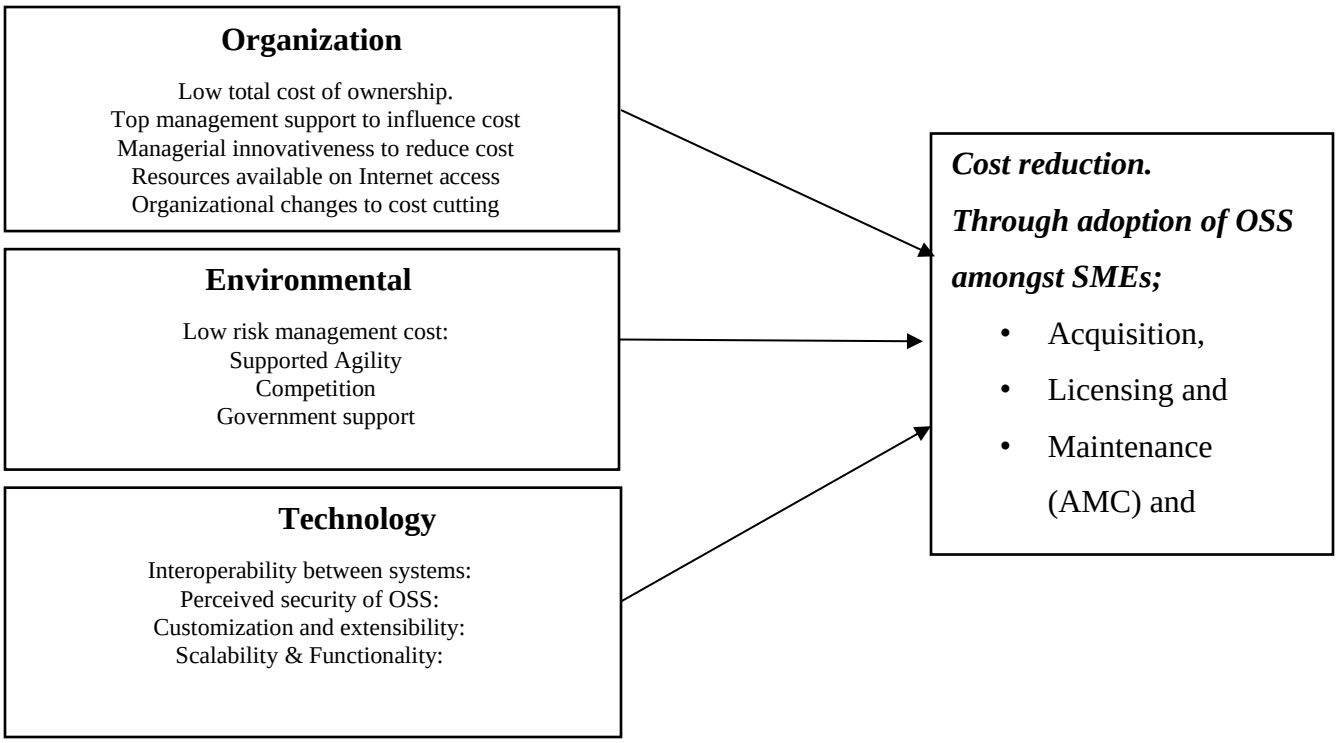

Figure 4: Conceptual Framework

2.2.1 Organizational Context

Organizational context describes the characteristics and resources within the context of a firm that influence the success or failure of the adoption and implementation of innovation. They are not static but rather the dynamic features of the organization that can grow or decline. These include partnering among different departments within an organization, size of the firm, formal and informal linkages to different functional teams and employees, communication processes, degree of centralization, human resources and information technology. The existing literature about these organizational factors lack specificity on how and when these factors affect business enterprises of different settings. However, there are hypotheses in the organization context as stated below

Low total cost of Ownership: The cost of Acquisition, implementation and maintenance of OSS is relatively cheap compared to the proprietary solutions.

Top management support: Top management key objective is to maximize the marginal returns. Regulating the cost is an essential step toward economizing the business' loss. Management can promote adoption of OSS as an initiative of cost reduction.

Managerial innovativeness: This is the extent in which the business enterprise is willing to take risks and is actively initiating and introducing new innovations in attempt to reduce the cost. Thus, top management that welcome changes and innovation can promote the adoption of OSS.

Technical expertise of IT staff: Knowledge on OSS customization is available through community forums. Organization don't have to pay for the training as in proprietary solution where the organization have to incur training and maintenance charges.

Internet access: This facilitate access to OSS material, user guide updates and access to OSS community forums without extra cost a part from the bandwidth. Therefore, Internet access enhances OSS adoption.

Organizational changes: Organization changes are triggered by number of factors, one of them is cost of operation. Open source adoption can be part of building a more agile firm able to innovate and react to change.

2.2.2 Technology Context

In this proposed model, the technology context is described as features of technologies that include the internal technologies that are currently in use and new technologies that are important to the organization. These technologies might include both process and equipment. The following are the hypothesis.

Interoperability between systems: Organization prefers adoption of OSS because of its flexibility, costs reduction and ease of its development.

Perceived security of OSS: The importance of improving security is to prevent OSS from being attack by virus, spam. The organization can save money which should been spend in ensuring the security of proprietary software.

Customization and extensibility: OSS remove the costly pricing tricks and traps that come with commercial sales and negotiations.

Scalability: Proprietary solutions offer comparatively poor scalability; their customization typically entails both increased cost and complication as well as reduced performance and dependability.

Functionality: Accessibility of more functions on OSS improves adoption. OSS removes the costly pricing tricks and traps that come with commercial sales and negotiations.

2.2.3 Environmental Context

The environmental context refers to a place where an organization does its business. These consist of the structure and size of the industry, the organization's competitors, the regulatory environment and the macroeconomic context.

Risk management: Open source ICT solutions permit an organization to manage risk during the selection stages in that concepts can be tested, others practices can be freely borrowed hence direct costs are minimal and standards compliance relatively high, prototypes and mock-ups can be freely built.

Supported Agility: Reply time for bugs fixes and queries are quite good compared to proprietary software companies who depend on their own cycles of product development. Time saved equal to cost saved.

Competition. Open-source solution are very effective not just as a way to grow markets but as a strategic maneuver for competitive advantage. Some of the business tactics are not directly as income generators but as ways to get into and change markets structures hence reducing cost.

Government support: As part of creating enabling environment through cost management government policy on open source promotes adoption of OSS.

CHAPTER THREE

3 Research Methodology Choice

The sampled SME for study was Ainu Shamsi Company limited based in Nairobi County. The company was chosen because it has all the essential characteristics that any other SME is expected to have. The World Bank describes SMEs as those firms with a maximum of 300 employees, $15 million in annual income, and $15 million in assets (1). Ainu Shamsi energy has approximately 200 staffs and annual revenue is between $6 to $9 Million Dollars. This qualify the company to be an SME. In addition, the company has gone through phases of cost cutting in attempt to adopt the current economic challenges most SMEs are facing which is due to high cost of operations in the industry in Kenya. Therefore, it would be a revelatory survey to understand adoption of open source as means of cost cutting. The methodology applied in the collection of data was descriptive survey method based on primary and secondary source of data collection. The design was most appropriate as it helped in establishing the views and opinions of the respondents. According to William, (2006) descriptive surveys are more formalized and typically structured with clearly stared investigative question. Descriptive research was used to investigate the determinants of cost cutting through OSS adoption among the SMEs. Descriptive research allows the description of phenomena as they naturally emerge and without interference from the researcher (Bernard,2005). The study targeted the staff who are involved in the decision-making process of ICT implementation in the organization. The total target population was 50 respondents, which included mainly ICT staffs, head of department, managers and finance staffs. For the purpose of this study, 37 respondents were achieved which is 74% of the target population. This being more than 50% of the target population will be considered appropriate to help determine the objective of the study.

Table 2: participant distribution structure

Director	Senior Manager	Head of Department	Middle Manager	IT Specialist	Finance/Ac Specialist	Bioinformatician	Total
1	4	9	7	10	5	1	37

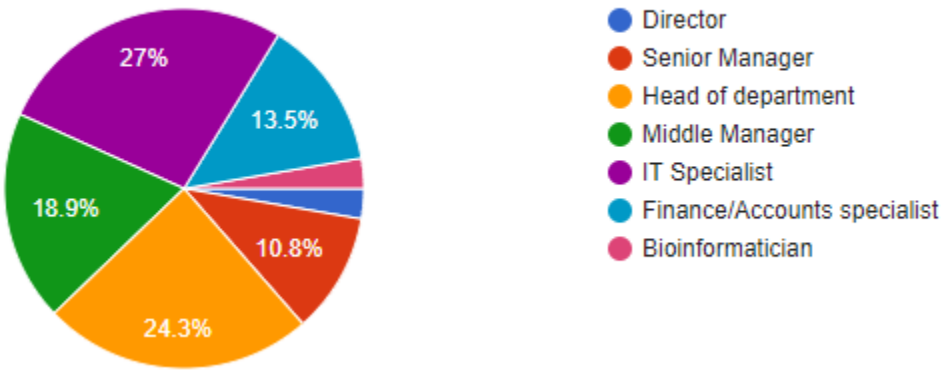

Figure 5: participant distribution structure

Purposive sampling was employed in identification of the sample. This is a form of nonprobability sampling where the decisions regarding the individuals to be used in the sample are decided by the researcher, based upon a variety of standards which may include professional knowledge of the research issue. In this study it was based on the understanding of the open source and cost cutting measures.

A total of 50 questionnaires were self administered to the respondents accompanied. The semi structured questionnaires were constructed using the 1-10 Likert scale type of statements, where the respondents were required to either to indicate strongly agree (10) and the least 1 Strongly disagree, the questionnaire had also close ended questions to establish the opinion of the respondents. For the data analysis the total of the strongly agree and agree statement were treated together while the response for disagree and strongly disagree were also treated together.

In order to test the reliability of the instrument the alpha reliability coefficient was performed using the Microsoft Office excel 2016, An alpha reliability coefficient of 0.7 was accepted for this study as provided by (Kathuri & Pals, 1999).

Table 3: Cronbachs alpha reliability table.

Cronbach's Alpha	N of Items
84	37

The cronbach's alpha reliability score was used to test the internal consistency of the questionnaires. The overall reliability coefficient was calculated using Microsoft Excel Data Analysis which yielded a coefficient of 0.84 as shown in the reliability table above hence the instruments were accepted as being reliable.

CHAPTER FOUR

4 RESULTS AND DISCUSSIONS

The study sought to examine the organizational determinants in the adoption of open source software in institutions as a tool for cost cutting. It sought to meet the following objectives; Analyze the effect of organizational structure, Technological factors and Environmental factors on the adoption of OSS as a tool of cost cutting for SME organization. The results of the overall study are discussed in details.

Distribution of the respondents

The study respondents were distributed as shown in the table below

Table 4: Distribution of the study respondents

Director	Senior Manager	Head of Department	Middle Manager	IT Specialist	Finance/Ac Specialist	Bioinformatician	Total
1	4	9	7	10	5	1	37

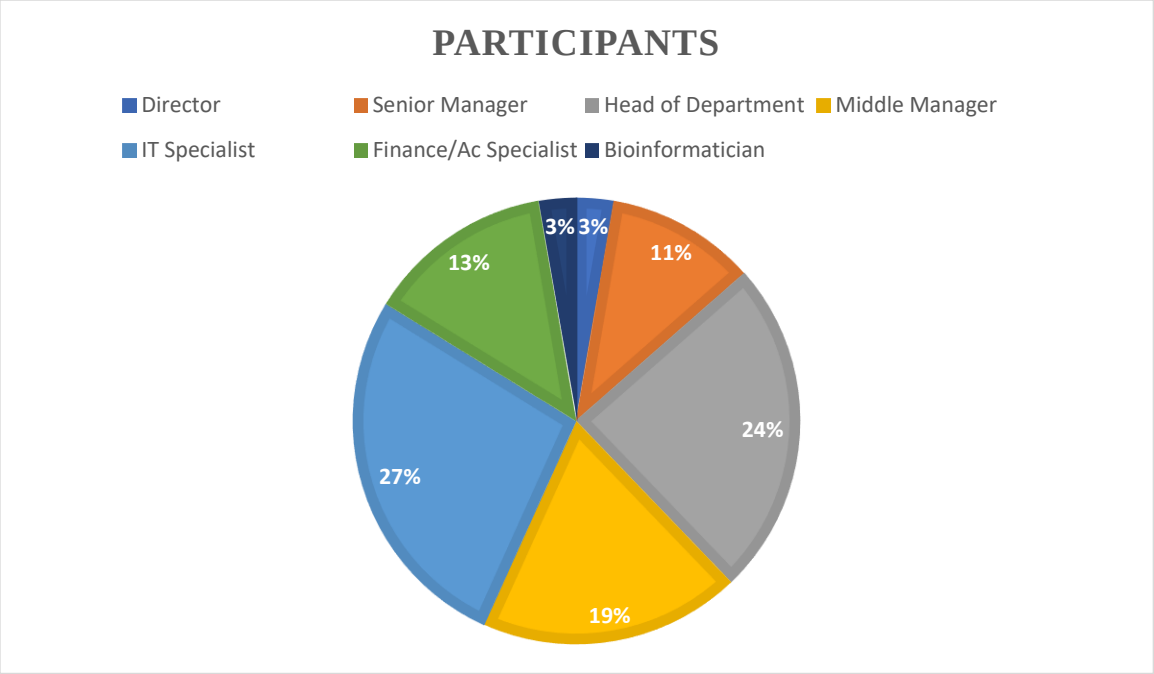

Figure 6: Distribution of the study respondents

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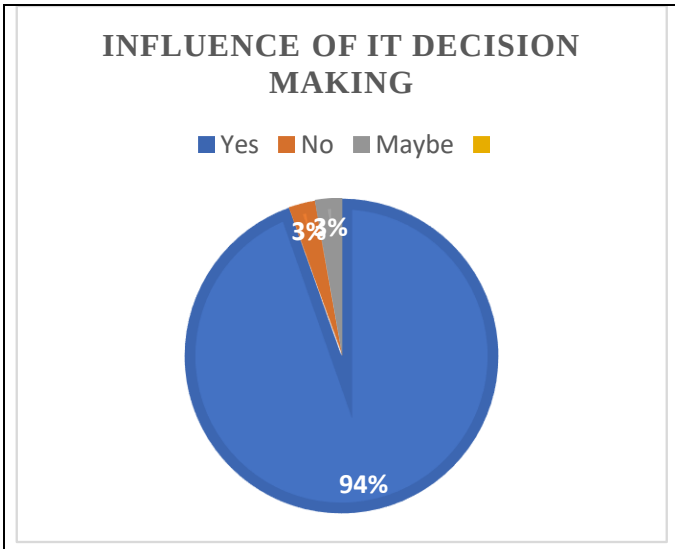
Influence IT related Decisions

In order to get accurate result, we needed to test the ability of the respondent to influence OSS adoption. In this study it was based on the understanding of the open source, cost cutting measures and ability to influence the same.



Ability Influence IT related Decisions

Yes	No	Maybe
35	1	1

Ability Influence IT related Decisions

Figure 7: Influence of Decision making in IT related implementation.

From the result represented in the above table and pie chat, it indicates that 94% of the respondent can influence decision making in IT, hence can influence the adoption of OSS.

Cost cutting measures employed in the organization in the past.

This section sought to establish if organization have carried our cost cutting measures in the past and which measures were used to implement the cost cutting. Following option were given; Retrenchment, Reduction of Operating Cost e.g. advertisement, Adoption of open source and None of the above. See the result below

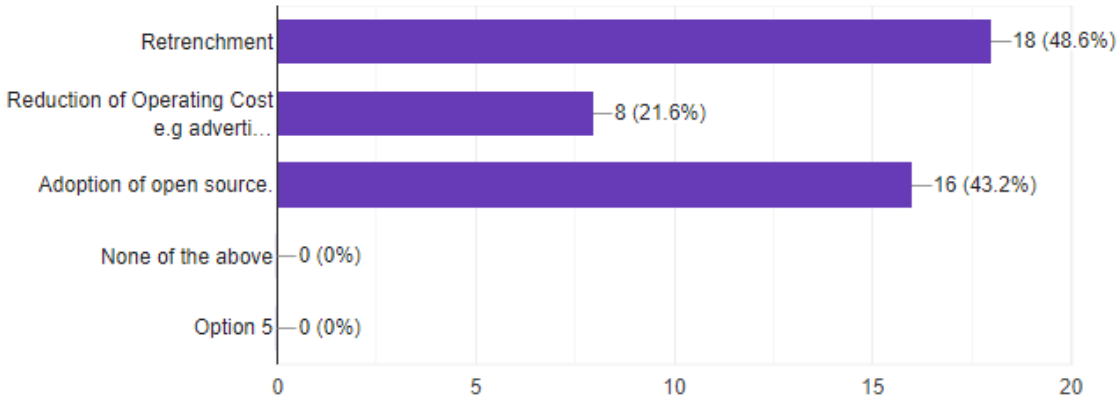


Figure 8: Cost cutting measures employed in the organization in the past.

From the result, we noted that all the options have been applied in the past. Retrenchment was the leading with 18 respondents, which is 48.6%. It was followed by the Adoption of the open source 16(43%) and finally reduction of the operating cost 8 (21.6%). We then wanted to get the feel of the responded in terms of which was effective. See the result below. Open source was the leading in terms of effectiveness. Retrenchment was the last. This attributed to retrenchment creating fear for job security in the remaining staff. IT also causes the loss of the talented staffs and it is expensive to replace. Reduction of the expenses also was noted effective but has limitation in terms of how much the organization can save.

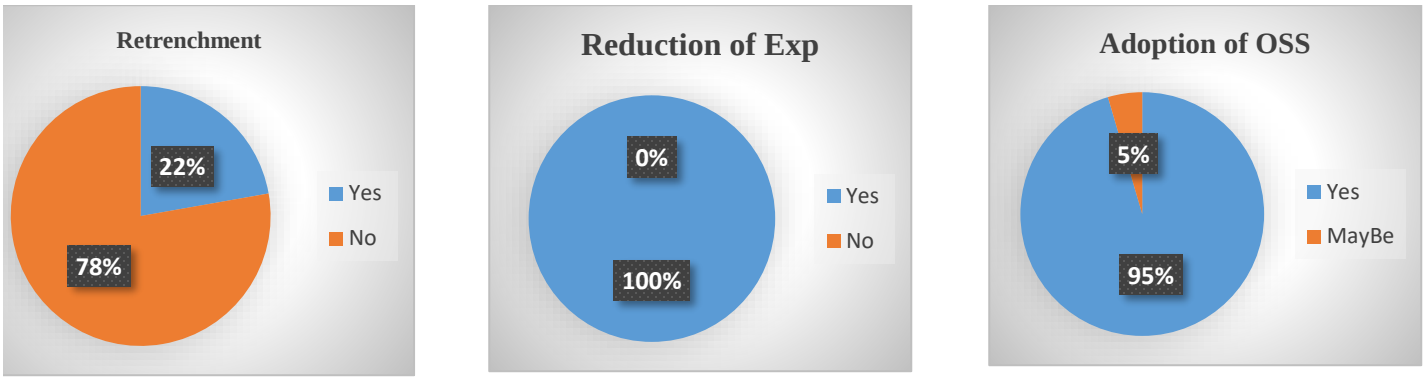


Figure 9: effective of measure used in cost cutting above.

4.2 OPEN SOURCE ADOPTION IN REGARD TO ORGANISATIONAL FACTORS

This section seeks to understand to what extent does the respondent agree or disagree with the following views regarding the organization's appetite to open source adoption.

Top management appreciate the strategy of cost reduction through adoption of Open Source technology solutions.

It was also important in the study to establish the role of management in enhancement of OSS adoption in the organization and what drive the management attitude to support the adoption of the OSS. In a scale of 1 (Strongly Disagree) to 10 (strongly agree) the respondent was expected to provide feedback. The result was as shown in the chart below.

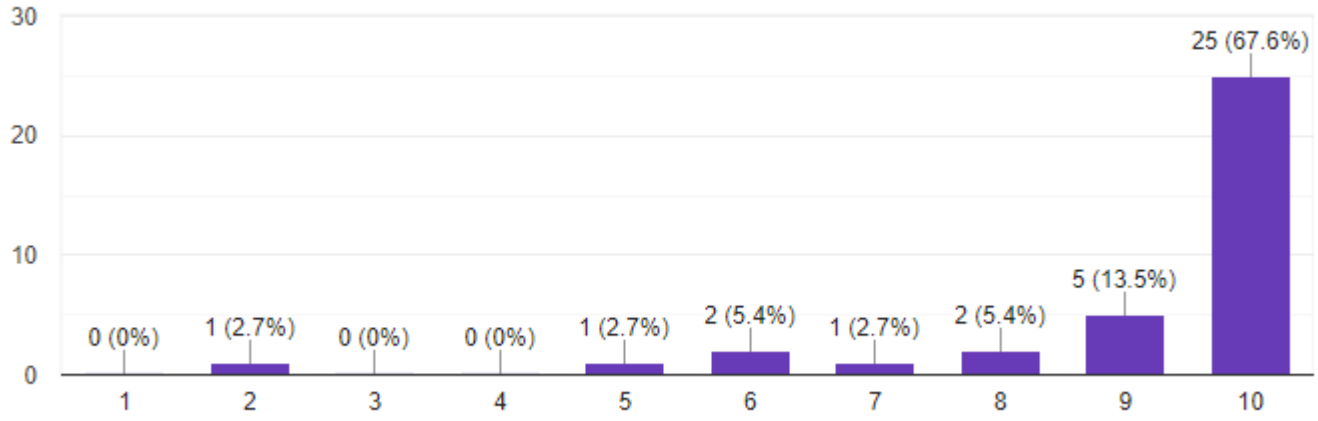


Figure 10: Top management appreciate the strategy of cost reduction through adoption of OSS

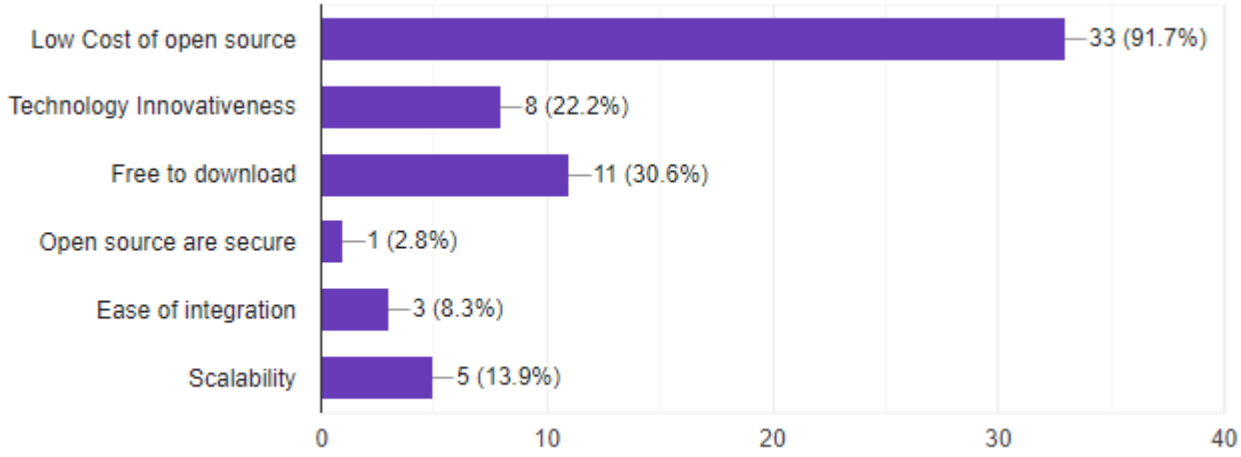


Figure 11: what drive the attitude of management to support OSS adoption.

As per chart 4.4 25 (67.6%) of the of the responded strongly agree that the management support adoption of OSS. Management embraces any measure that provides mean of cost without adverse effect of the operation of the organization. Chart 4.5 indicate that 33 (92%) of the respondent agree that management support adoption of OSS as

means of cost reduction. Low cost of open source and free download take the lead. Only one respondent 1(2.7%) disagree that management support the adoption of the open source.

Cost of Open source Maintenance

It was important to establish if organization pay maintenance for OSS and to what extend so as compared to proprietary solutions. See the result below;

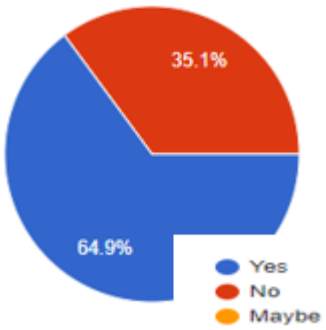


Figure 12: Does organization pay maintenance for OSS

The result shows that 24 (64.9 %) of the respondent agree with the statement that the organization pay for the open source maintenance. 13 (34%) of respondent does not pay for the maintenance. We went further and inquire in a scale of more than a million and less than a million pay of maintenance per year. The result indicates that out of the 24 respondents above

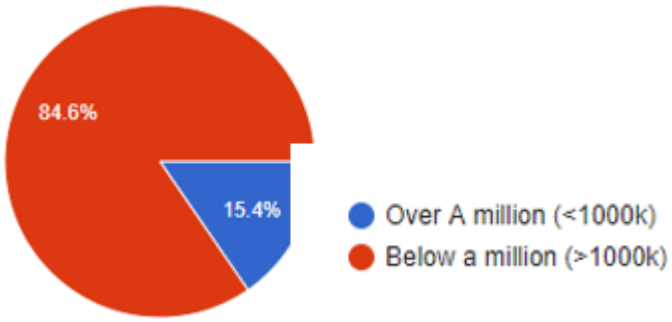


Figure 13: what extend is the pay of OSS maintenance per annum.

We went further and inquire in a scale of more than a million and less than a million pay of maintenance per annum. The result indicates that out of the 24 respondents above 22 (84%) pay below a million ksh. 2 (15%) pay above million ksh. Therefore, this indicate that the cost of maintenance still low for the OSS.

Effectiveness of OSS as a tool of cost cutting.

It was important for the researcher to establish the respondent feel for the OSS as a tool of cost cutting. See the result below. 30 (81%) of the respondent strongly agree that OSS is effective tool of cost cutting. 7 (18%) fairly agree that OSS can be effective tool of cost cutting.

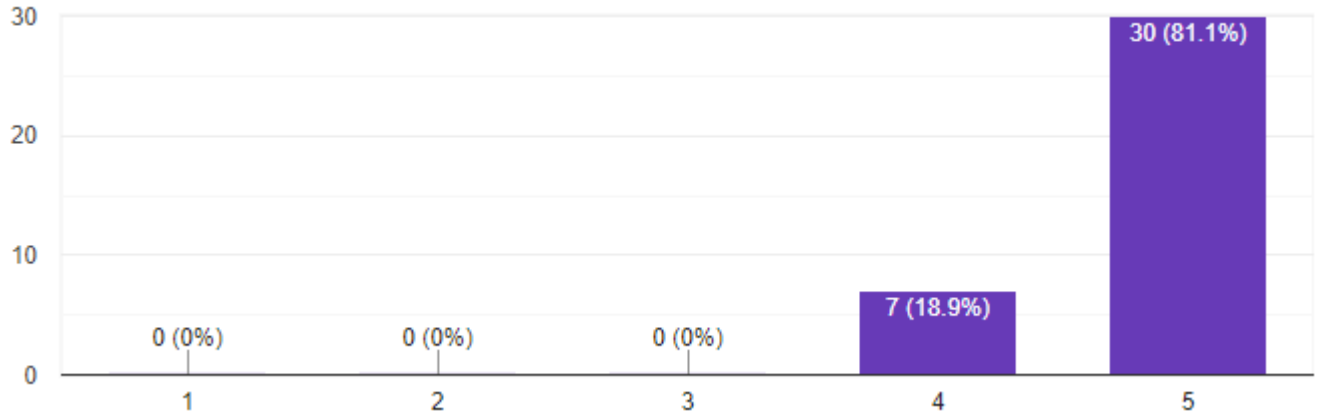


Figure 14:open source is effective tool of cost cutting.

Cost of acquisition and maintenance of the proprietary software.

It was also important for the researcher to establish the respondent feel for the proprietary IT solution in terms of cost acquisition and maintenance in order to get the contrast with the acquisition and maintenance for the open source as per the chart above. See the result below. 31 (84%) strongly agree that cost of acquisition and maintenance of the proprietary software are very high for SMEs

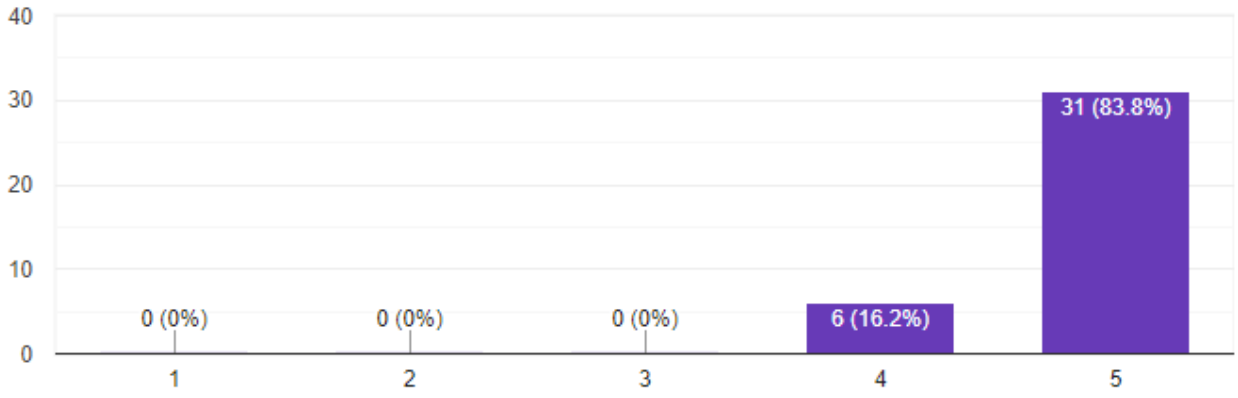


Figure 15: Cost of acquisition and maintenance of the proprietary software.

4.3 OPEN SOURCE ADOPTION IN REGARD TO TCHNOLOGICAL FACTORS

This section seeks to understand what extent do respondent agree or disagree with the following views regarding your organization's appetite to open source adoption about technology.

What drive the cost in the four-key strength of OSS solution

Respondent were ask if the organization will adopt the OSS what will drive the adoption. Choices given were flexibility, Low cost, scalability and security of the OSS. See the result below. Cost took the highest number of respondents 28 (78%), followed by flexibility 6 (16%), then scalability 2 (5%) and finally security 1(3%)

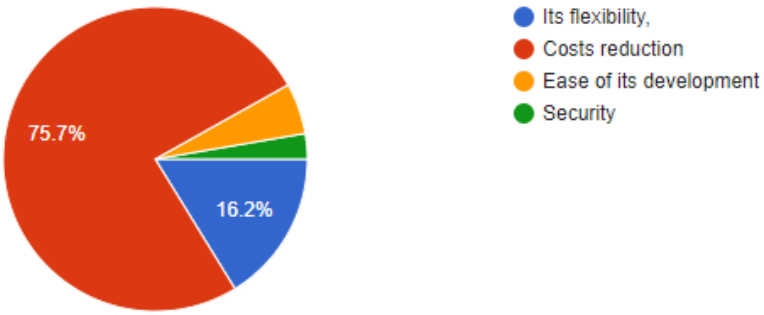


Figure 16: What drive the adoption of the open source.

Security of open Source reduce the risk hence reducing the cost

Perceived security of OSS for the organization can save money which should been spend in ensuring the security of proprietary software. The respondent results are shown below; 26 (70%) of the respondent strongly agree that since OSS are secure, they are more affordable by SMEs as compared to proprietary which has additional cost of securing such as the cost of antivirus.

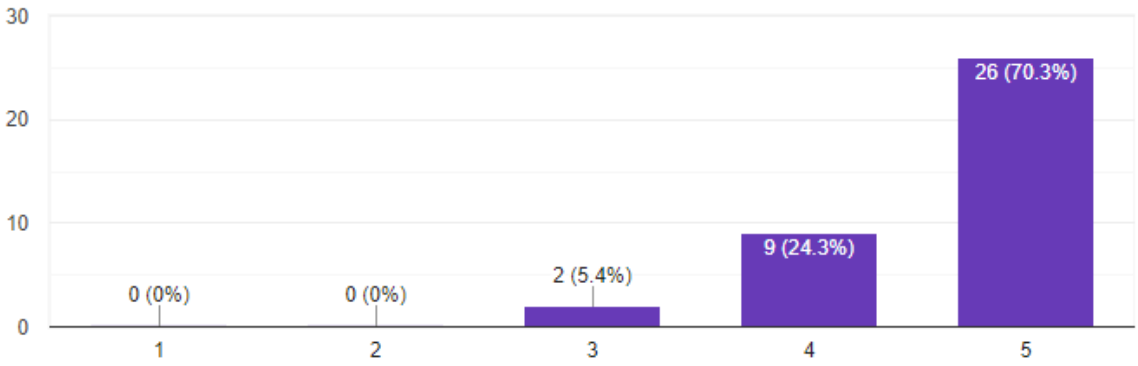


Figure 17: Security of open Source reduce the risk hence cost

OSS open source code makes OSS affordable as compared to closed code of proprietary

24 (65%) of the respondent strongly agree that the current limitations of the proprietary solutions that include high prices and poor quality of existing closed source code software technologies could be promoting adoption of OSS.

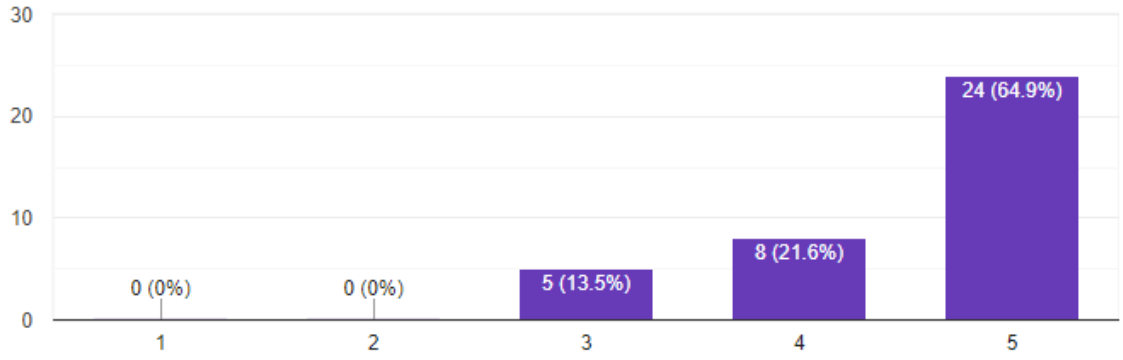


Figure 18: OSS open source code makes OSS affordable as compared to closed code of proprietary

Poor Scalability of the Proprietary solution accompanied by huge cost

Proprietary solutions offer comparatively deprived scalability, their expansion naturally entailing both increased cost and complication as well as reduced performance and reliability. 22 (61%) of the respondent strongly agree that proprietary solution is expensive to scale up or integrate with other solutions. 10 (27%) agree with the statement. See the results below.

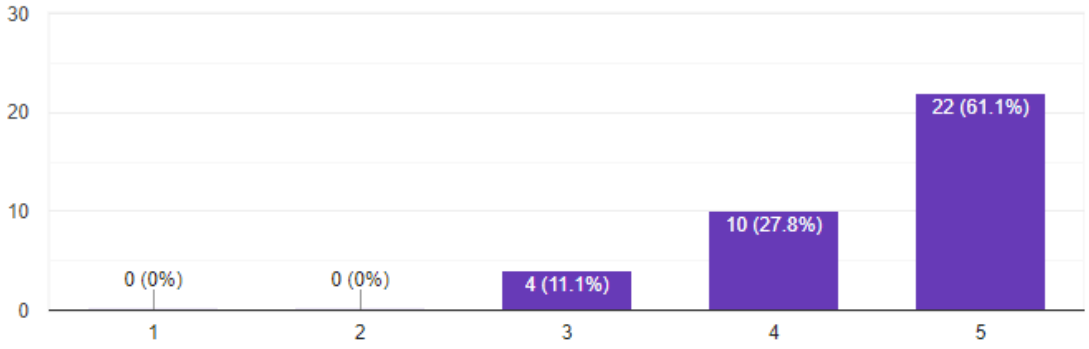


Figure 19: Poor Scalability of the Proprietary solution accompanied by huge cost

OSS has no costly pricing games and traps

Accessibility of more functions on OSS increases adoption. OSS eradicates the costly pricing competitions and traps that come with commercial sales and negotiations. 22 (60%) of the respondent strongly support with the statement and 9(24%) agree with the statement. See below

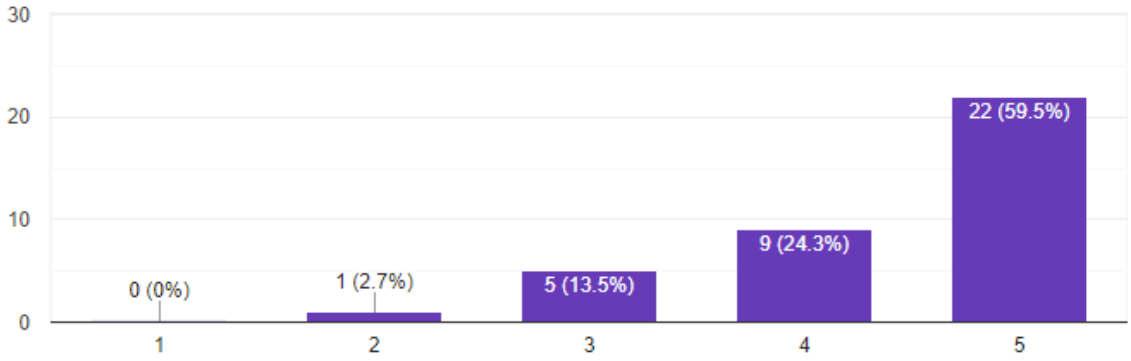


Figure 20: OSS has no costly pricing games and traps

4.4 OPEN SOURCE ADOPTION IN REGARD TO ENVIRONMENTAL FACTORS

This section seeks to understand to what extent do the respondent agree or disagree with the following views regarding the organization's appetite to open source adoption in regard to environment

Open source allow organization to manage risk hence reducing the cost

Open source software allow an organization to manage risk during the selection stages in that concepts can be tested, others practices can be freely borrowed, and since software direct costs are minimal and standards compliance generally high, prototypes and mock-ups can be freely developed. 26 (70%) of the respondent strongly agree with the statement and 7 (19%) agree with the statement. See below

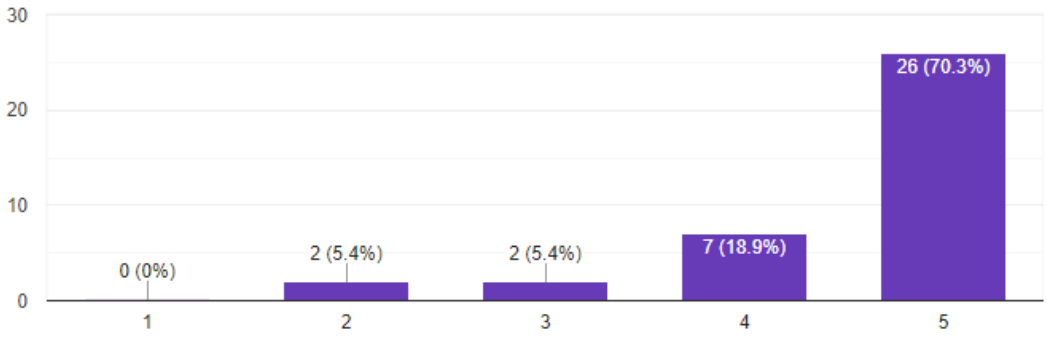


Figure 21: Open source allow organization to manage risk hence reducing the cost

Time saved in bug fixing equal money saved

Response time for bug fixes and support queries are amazing compared to working with proprietary software companies who are defined or limited by their own cycles of product development. Time saved equal to cost saved. 25 (68%) of the respondent strongly in agreement with the statement and 7 (19%) agree with the statement. See below

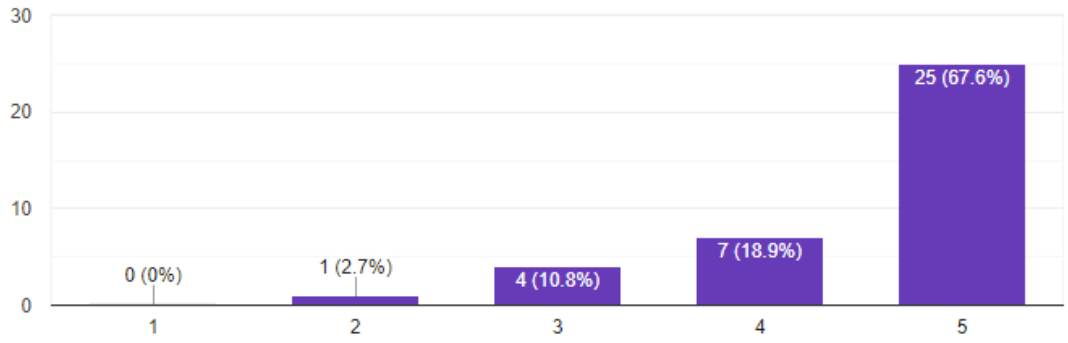


Figure 22: Time saved in bug fixing equal money saved

Open-Source is effective strategic maneuver for competitive advantage

Open sourcing is effective not just as a way of growing the markets but as a strategic maneuver for competitive advantage. Some of the business tactics are not directly as income generators but as ways to get into and reshape markets hence reducing cost. 24 (65%) of the respondent strongly agree with the statement and 11 (29.7%) agree with the statement. See below

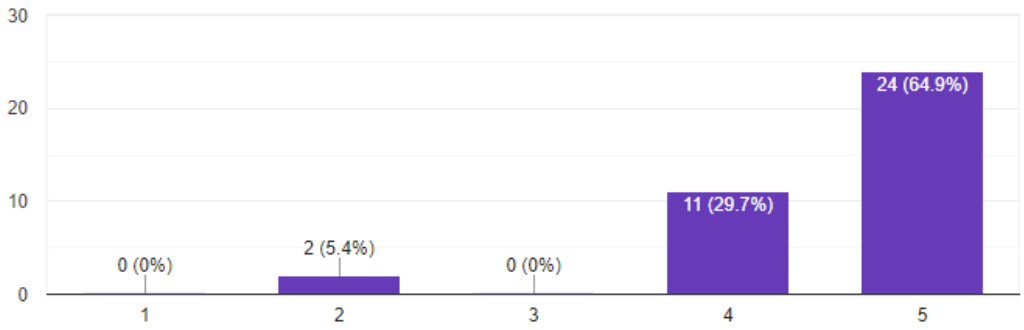


Figure 23: Open-Source is effective strategic maneuver for competitive advantage

Government should promote adoption as cost management policy for SMEs.

As part of creating enabling environment through cost management government policy on open source should promotes adoption of OSS. 24 (65%) of the respondent strongly agree with the statement and 12 (32.4%) agree with the statement. See below

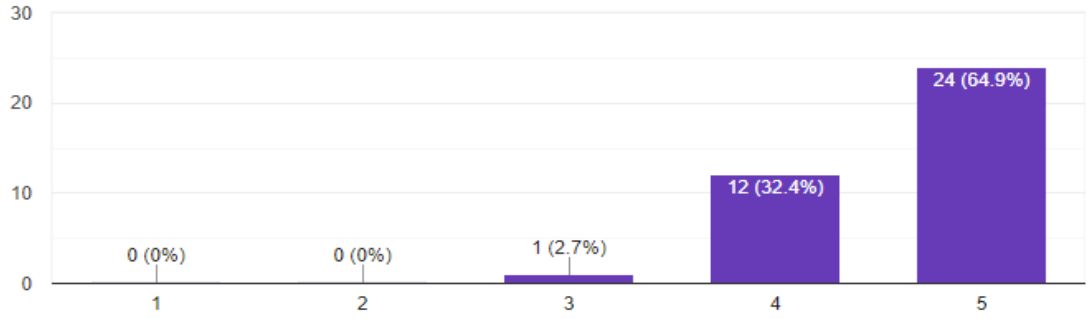


Figure 24: Government should promote adoption as cost management policy for SMEs

4.4.2 Correlation between the adoption of OSS as a tool of cost and contexts; Organization Context (OC), Technological Context (TC) and Environmental Context (EC)

We used the SPSS analysis to find out the correction among the three contexts; below are the results of our analysis.

Correlation between the TC and adoption of opensource as a tool of cost cutting (Positive correlation of 0.785)

		TC	EC
TC	Pearson Correlation	1	.785**
	Sig. (2-tailed)		.000
	N	37	37
Adoption of OSS	Pearson Correlation	.785**	1
	Sig. (2-tailed)	.000	
	N	37	37

Correlation between the OC and adoption of opensource as a tool of cost cutting (Positive correlation of 0.654)

		OC	EC
OC	Pearson Correlation	1	.654**
	Sig. (2-tailed)		.000
	N	37	37
Adoption of OSS	Pearson Correlation	.654**	1
	Sig. (2-tailed)	.000	
	N	37	37

Correlation between the OC and adoption of opensource as a tool of cost cutting (Positive correlation of 0.535)

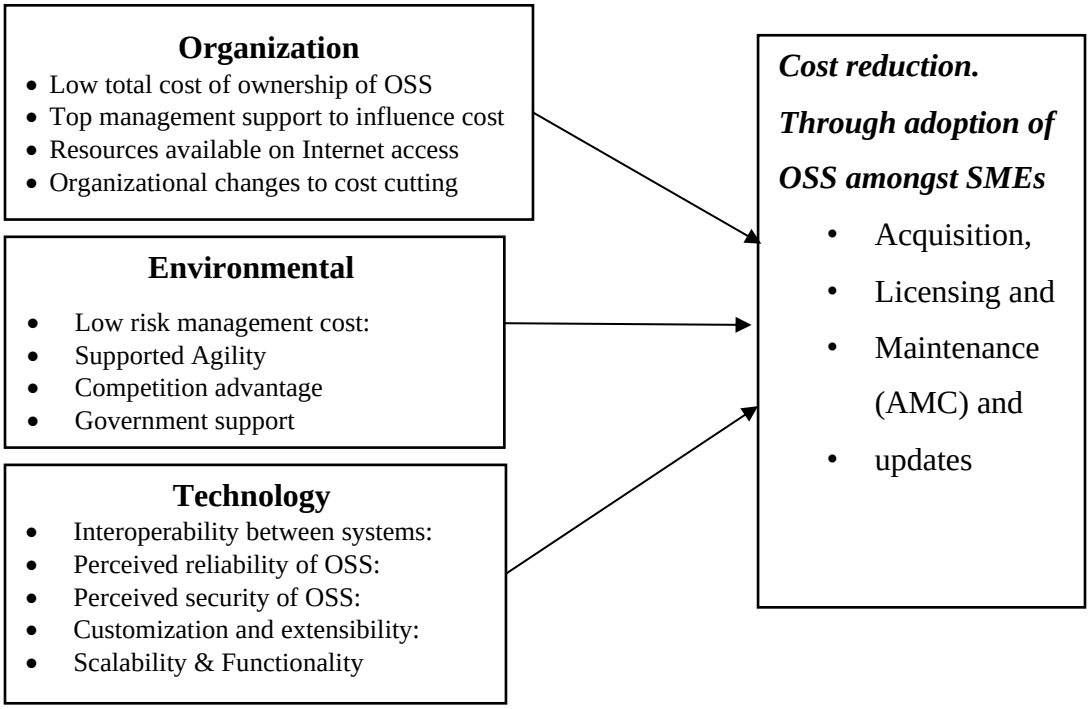
		OC	TC
OC	Pearson Correlation	1	.535**
	Sig. (2-tailed)		.001
	N	37	37
Adoption of OSS	Pearson Correlation	.535**	1
	Sig. (2-tailed)	.001	
	N	37	37

From the results presented above It is demonstrated clearly that there is a positive correlation of 0.785,0.654 and 0.535 which is significant at a p-value between each context and the adoption of OSS by the SMEs.

4.5 A FRAMEWORK FOR ADOPTION OF OSS BY ORGANIZATIONS IN KENYA

Based on the data collected and analyzed below is the framework for adoption of OSS as tool for cost cutting by SMEs in Kenya.

Figure 25: A Framework for Adoption of OSS by Organizations in Kenya



CHAPTER FIVE.

5 CONCLUSION, RECOMMENDATION AND FURTHER STUDIES

This study was to identify how low cost of OSS may influence the adoption decision and process in the organizational context of the SMEs in Kenya as a tool for cost cutting measure. Our solemn aim was to prove that OSS can be used in reducing costs especially in 21st century where cost reduction takes the center stage in profit making organization including the SMEs.

5.2 CONCLUSION

Adoption of open source business solution power the SMEs systems in the wake of increasing costs and shrinking IT budgets. The study concludes that Open Source Business Solution is affordable yet equally reliable cost reduction method that can be adopted by SMEs in Kenya. This adoption help increase the return on investment and enable SMEs invest fund in business expansion and competition strategy. Senior management embrace this means of cost cutting over retrenchment and expenses reduction since it does not affect the structure of organization in any way and it sustainable for long period of time. OSS has a lot of benefits from ongoing community support.

5.3 RECOMMENDATION

It is desirable that the SME Organization to have strategy to adopt OSS as a tool of cost cutting and expand their capacities to accommodate more innovations. There is need to institutionalize support of the OSS Solutions adoption to ensure continued growth and expansion over increasing cost of operation especially in technology driving the business. National governments should be engaged with open source software and communities. They should promote resources that will help departments and agencies understand the value of open source software as a tool for cost cutting within the SME sector, as well as how these institutions can engage with, and implement similar initiatives to realize the greatest returns for their citizens.

5.4 SUGGESTIONS FOR FURTHER STUDY

Although the study research thoroughly into three context, Organization, Technology and Environment, as determinants of OSS adoption for cost cutting in SMEs there are limitation which includes the ability of the business users to cope with open source technology and escalation support since open source are mainly supported freely by the community. The study focused only on the SMEs and therefore the influence is on limited to organization with SMEs characteristics. Future research should be conducted to find out whether these findings also hold in large and public business institution.

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APPENDICES

Project Timeline:

Items	***Days***
Research Project	
Develop Research Proposal and obtain approval	13th Oct- 19th 201***8***
Finish collecting basic information and literature review	23rd Dec 2018 -10th Jan, 2019
Develop and test questions	12th – 19th Jan
Develop and test tool	20th Jan- 14th Jan
Obtain participants	15th Jan– 23rd Jan
Administer instrument(s)	2nd – 9th Feb
Ongoing data collection and analysis	10th Feb - 3rd March
Final collection of data	4th March- 18th March
Research Report	20th March -2nd April
Report Publish	April

Questionnaire

A framework of open source solution as tool for cost reduction among SMEs in Nairobi

1. A. Which position below do you hold in the organization? ***Mark only one oval.***

- **Director**
- **Senior Manager**
- **Head of department**
- **Middle Manager**
- **IT Specialist**
- **Finance/Accounts specialist Other:**
- _____

1. B. Do you influence IT related Decisions ***Mark only one oval.***

- **Yes**
- **No**
- **Maybe**

C. What cost cutting measures has been employed in your organization in the past? Tick at least one

Check all that apply.

- ☐ **Retrenchment**
- ☐ **Reduction of Operating Cost e.g. advertisement Adoption of open**
- ☐ **source.**
- ☐ **None of the above Option 5**
- ☐

D. In your opinion, do you think the above measure(s) (1. C) were effective? ***Mark only one oval.***

- ◯ **Yes**
- ◯ **No**
- ◯ **Maybe**

2. What extent do you agree or disagree with the following views regarding your organization's appetite to open source adoption?

A.Top management appreciate the strategy of cost reduction through adoption of Open Source technology solutions.. ***Mark only one oval.***

	1	2	3	4	5	6	7	8	9	10	
Strongly Disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	**Strongly Agree**

C. Adoption of open source is driven by OSS having low total cost of ownership from acquisition, implementation and licencing. Do you agree. ***Mark only one oval.***

	1	2	3	4	5	6	7	8	9	10	
Strongly Disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	**Strongly Agree**

E. Does your organization pay for maintenance of open source software's ? ***Mark only one oval.***

- ◯ **Yes**
- ◯ **No**
- ◯ **Maybe**

If Yes What is the maintenance cost? ***Mark only one oval.***

- ◯ **Over A million (<1000k)**
- ◯ **Below a million (>1000k)**

F. Adoption of open source business solution is an effective tool of cost cutting since it freely available for download over the internet. What extent do you agree or disagree? ***Mark only one oval.***

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	**Strongly Agree**

G.Cost of acquisition and maintenance of the proprietary software are very high for SMEs hence management can inventively use OSS as alternative means of cost cutting. What extent do you agree or disagree? ***Mark only one oval.***

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	**Strongly Agree**

H. What is the attitude of your organization senior management towards open source adoption in your organizations ***Mark only one oval.***

- ◯ **Supportive**
- ◯ **Not Supportive**
- ◯ **Management are not aware about open source.**

I. If your answer in (2. H) is A, what drive the management attitude in your opinion towards adoption I. If your answer in (2. H) is A, what drive the management attitude in your opinion towards adoption?

Check all that apply.

- ☐ **Low Cost of open source**
- ☐ **Technology Innovativeness**
- ☐ **Free to download**
- ☐ **Open source is secure**
- ☐ **Ease of integration**
- ☐ **Scalability**
- ☐ **Other: _____**

3. What extent do you agree or disagree with the following views regarding your organization's appetite to open source adoption about technology.

A. Your organization would prefer adoption of OSS because of? ***Mark only one oval.***

Strongly Disagree	◯	◯	◯	◯	◯	**Strongly Agree**

- **Its flexibility,**
- **Costs reduction**
- **Ease of its development**
- **Security**

B. Perceived security of OSS for the organization can save money which should been spend in ensuring the security of proprietary software. ***Mark only one oval.***

	1	2	3	4	5	
Strongly Disagree						**Strongly Agree**

C. The current limitations of the proprietary solutions that include high prices and poor quality of existing closed source code software technologies could be promoting adoption of OSS. ***Mark only one oval.***

	2	2	3	4	5	

D. Access to the source code to customize, extend, add, and modify an existing function enhance adoption of OSS ***Mark only one oval.***

	1	**2**	**3**	**4**	**5**	
Strongly Disagree						**Strongly Agree**

E. Proprietary solutions offer relatively poor scalability, their expansion typically entailing both increased cost and complication as well as diminished performance and reliability. ***Mark only one oval.***

	1	2	3	4	5	
Strongly Disagree						**Strongly Agree**

F. Availability of more functions including integration & open APIs on OSS enhances adoption. OSS eliminates the costly pricing games and traps that come with commercial sales and negotiations. ***Mark only one oval.***

	2	2	3	4	5	
Strongly Disagree						**Strongly Agree**

4.What extent do you agree or disagree with the following views regarding your organization's appetite to open source adoption in regard to environment

---

A. Open source software can allow an organization to manage risk during the selection process in that ideas can be tested, others experiences can be freely borrowed, and since software direct costs are low and standards compliance generally high, mock-ups and prototypes can be freely built. ***Mark only one oval.***

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	**Strongly Agree**

B. Response time for queries and bug fixes as astounding compared to working with proprietary software companies who worked to their own cycles of product development. Time saved equal to cost saved ***Mark only one oval.***

	2	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	**Strongly Agree**

C. Open-sourcing can be effective not just as a way to grow markets but as a strategic maneuver for competitive advantage. Some of the business tactics are not directly as revenue generators but as ways to break into and reshape markets hence reducing cost. ***Mark only one oval.***

	1	**2**	**3**	**4**	**5**	
Strongly Disagree	◯	◯	◯	◯	◯	**Strongly Agree**

D. As part of creating enabling environment through cost management government policy on open source should promotes adoption of OSS. ***Mark only one oval.***

	1	**2**	**3**	**4**	**5**	
Strongly Disagree	◯	◯	◯	◯	◯	**Strongly Agree**