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THE USE OF FREE AND OPEN SOURCE SOFTWARE (FOSS) IN ZAMBIA: A CASE STUDY OF GOVERNMENT DEPARTMENTS

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ABSTRACT

Introduction-*Many governments world over have implemented policies to promote the use of Free and Open Source Software (FOSS) as a treaty to reduce the cost of running government and ensure compliance to software piracy laws. In this regard, a study was conducted to measure the FOSS in government departments in Zambia.*

Methodology-*The study employed a survey research method in which a sample of 70 IT managers and staff from government ministries, departments, commissions and quasi-government bodies were sampled and interviewed. The sampling method used was purposive; key government departments were elected for the study by virtual of their importance and one IT manager in each government department was interviewed.*

Findings-*The results reveal that 92.9% of the IT managers/staff from government departments in Zambia were aware of the existence of FOSS. Only 7.1% showed ignorance of FOSS. In terms of the use of FOSS Operating Systems, the study shows that majority (78.6%) of government departments do not use FOSS operating system. Only 21.4% use FOSS Operating systems such as Linux (Ubuntu and others). The study further established that majority government departments in Zambia do not only use Windows operating systems but also use Microsoft Office and a host of other commercial software which cost the Government of the Republic of Zambia a lot of money annually. Results from the study have shown that majority (47.1%) of government institutions in Zambia spent between ZMK 50,000 to ZMK 100,000 annually on commercial operating systems and application software. Among the factors discovered to be responsible for low use FOSS is government's departments in Zambia is the fact the use of FOSS is not backed by a policy thus making it difficult for ICT personnel to widely use FOSS.*

Conclusion-*The fact that many ICT personnel in government departments are aware of the existence of free and open source software that can replace commercial software gives hope for Zambia to join the ranks of countries such as Brazil which have completely migrated to FOSS thereby reducing the cost of running government. In this regard, the government of Zambia should develop and implement a FOSS policy that will either make it mandatory or advise the use of FOSS in all government departments. This is will go a long way in reducing the cost software.*

1. INTRODUCTION

The world of computer software has witnessed the coming of Free and Open Source Software (FOSS) which has promised to change the landscape of the software industry. FOSS grants the customers and users total freedoms such as freedom to modify, share, learn and use the software in any way. FOSS has come to liberate software customers/users that have been in bondage by commercial or proprietary software vendors. Since 1998, the open source movement has become a revolution in software development. Open source software encourages re-use, enables innovation, easy integration and drives down prices of software. FOSS is community software hence its strength because many eyes will be looking at a software making it easy to identify software defects and security vulnerabilities. The strengths of FOSS have attracted many users. Governments around the globe are turning to FOSS in face of biting economic conditions because FOSS has low cost of adoption comparing to commercial software.

In the case of developing countries that are financially impaired Zambia inclusive, the adoption of FOSS saves the meager resources needed to provide public goods and services such as health and education. Further, adoption of FOSS guarantees a country its sovereignty and ensures control about the production flow and control of information in a government. In Brazil, FOSS is viewed as a strategic source of the Brazilian Federal government since 2003, because it reduces costs (Santanna, 2003). South America and Brazil in particular has set the tone on the adoption and deployment of FOSS in government by making the using of FOSS in public departments mandatory. This is the strongest form of policy on the adoption of FOSS. This has paved way for state and Federal government departments to go flat out in adopting FOSS. Public institutions in Brazil such as Bank of Brazil have adopted FOSS. Bank of Brazil began to use FOSS in 2001 with the use of Linux servers and the squid caching proxy and since then, various initiatives using FOSS have been deployed at the Bank. Further, Bank of Brazil has deployed Open Office; an office suite on more than 60,000 stations thereby reducing the number of licenses fees paid to Microsoft for its Office Suite by 70% (Evers and Biermann, 2004).

In Zambia, the desire to embrace FOSS in accelerating national development has been captured by Zambia's Information and Communication Technology policy which was launched in 20017. The policy recognizes the importance of using FOSS in implementing various ICTs programmes in government. However, the extent to which government institutions in Zambia use FOSS is not known. It is against this background that the research was conducted to describe the picture in terms of the use of FOSS government in departments in Zambia.

2. STATEMENT OF THE PROBLEM

As already articulated in the background, the use of FOSS is prominent in many countries. FOSS has increased maturity in terms of products and services which has made it easier for both public and private sectors to adopt it (Actuate, 2008). Governments departments in countries such as Brazil, and India have adopted FOSS as a strategy to reduce cost of owning software. In a bid to mainstream the use of FOSS in government departments, Zambia's ICTs policy of 2007 in an advisory manner recommended the use of FOSS in implementing ICTs programmes. This recommendation in 2007 ICTs policy was hoped to spur the use of FOSS in government departments thus reducing the cost of software in government. It is however not known whether or not government departments use FOSS. Further, the cost of not using FOSS in Zambia is not known. The research was therefore conducted to provide answers as regards the use FOSS in government departments in Zambia.

3. OBJECTIVES

The study aimed at investigating the use of FOSS in Government departments in Zambia. In so doing, the study sought to do the following: -

a) determine the proportion of government departments in Zambia that use FOSS,
b) establish the most used FOSS in Government departments in Zambia,
c) determine if the use of FOSS in government departments is guided by policy, and
d) establish challenges government departments in Zambia face in using FOSS.

4. DELIMITATIONOF THE STUDY

This research studied the use of FOSS in government departments based in Lusaka. Government departments studied are line ministries, commissions, quasi-government departments and a local

authority. These government departments were studied in relation to the use of FOSS not commercial software.

5. DEFINITION OF CONCEPTS

The following terms in this study meant the following: -

a) **Government departments** – an institution that returns legal responsibility for ensuring that information is made available in accordance with the public scheme (Office of the Auditor General, Zambia, 2003)

b) **Information Communication Technology** (**ICT**) – refers to any device or system that allows the storage, retrieval, manipulation, transmission and receipt of digital information. For example, personal computers, digital television, email, robots. (Mmari, 1977).

c) **Free and Open Source Software** – software for which a human readable source code is available for use, study, reuse, modification, enhancement and redistribution to other users of the software (Wheeler and Dunn, 2013)

6. LIMITATIONS OF THE STUDY

The main limitation of the study is fact that it was carried out in Lusaka thereby excluding other government departments that are based outside Lusaka. The findings therefore could not be a general reflection all the government departments. However, it suffices to say that many government departments (ministries, commissions and quasi-government organisations) are based in Lusaka, therefore, the findings could be very much relied upon to describe what is happening the use of FOSS in government departments.

7. THEORETICAL FRAMEWORK

This study was guided by the Fitzgerald framework. According to the Fitzgerald framework, there are four components that would affect the adoption of FOSS. These are managerial intervention, subjective norms, facilitating conditions and uncertainty avoidance. Managerial intervention refers to the actions taken and resources made available by management for the purpose of expediting the adoption of FOSS. Actions include making adoption of FOSS voluntary or mandatory, providing training, hiring new employees or consultants to act as mentors, and championing the FOSS adoption initiative (Fitzgerald: 2011). Subjective norms refer to how individuals believe their peers and co-workers expect them to behave in relation to

technology, which can lead to enhanced efforts to learn about and adopt an innovation or to abandon a technology (Fitzgerald: 2011).

Facilitating conditions refers to the exact attributes of the innovation that Fitzgerald (2011) borrowed from Rogers's theory of diffusion of innovation. The five key perceived attributes of an innovation are relative advantage (the degree to which an innovation is seen as being superior to its predecessor), compatibility (the degree to which an innovation is seen to be compatible with existing values, beliefs, experiences and needs of adopters), complexity (the degree to which an innovation is seen by the potential adopter as being relatively difficult to use and understand) , triability (the degree to which an idea can be experimented with on a limited basis) and observability (the degree to which the results of an innovation are visible).

Uncertainty avoidance refers to the extent to which people feel comfortable with novel, unknown, surprising, and unusual situations. People in countries with high uncertainty avoidance feel great stress and anxiety when facing uncertain situations; as a result, they usually try to minimize uncertainty by enacting strict laws and rules as well as safety and security measures (Mansell and Montalvo, 2009). In contrast, people in countries with low uncertainty avoidance are more tolerant of Opinions that are different from their own.

In line with the above framework, it can be argued that if government departments have to adopt FOSS, facilitating conditions such as training and policies should be put in place by government. Failure do so, fewer or no government departments could adopt FOSS. Further, if staffs in these government departments were influenced by subjective norm; where peers and co-workers with influence expect their co-workers to embrace FOSS, the adoption of FOSS in government departments in Zambia would be promoted. In addition, if FOSS was perceived to have benefits than commercial; it was easy to learn and positive results of its use were seen by people in government departments, many government departments could adopt FOSS. Lastly, government ought to put up policies to support the use of FOSS because or else people in government departments might feel too comfortable to switch to FOSS.

8. LITERATURE REVIEW

8.1 Concept of Free and Open Source Software

Free and open source software is software like any other; however, it is distinguished by its license or terms of use, which guarantees certain freedoms in contrast to closed/proprietary software which restricts these rights. FOSS guarantees the right to access and modify the source code, to use, reuse and redistribute the software all with no royalty or other costs. In some cases, there can be an obligation to share improvements with the wider community, thus guaranteeing global benefit (Berlecon, 2002). FOSS license guarantees (1) freedom to access and modify to its source code, (2) freedom to redistribute and reuse the software, (3) freedom to use the software in any way you want, but also in some circumstances (4) an obligation to share improvements built on the work of others (Valimaki, 2003).

a. History of FOSS

The history of FOSS can be traced back to Richard M. Stallman who was a former programmer at MIT's AI Lab started the Free Software Foundation (FSF) in 1984. The main technical goal of the FSF was to create an open source Unix-like operating system called 'GNU.' Although Stallman did not finish the 'kernel' (the "central module") of the GNU operating system, he and other programmers associated with the FSF were able to produce extremely useful and popular pieces of open source software like the GNU EMACS and the GNU C compiler (Von Hippel, 1988). The GNU project promoted Stallman's philosophy regarding software development and Stallman believed that "information is community property and all software source code should be shared. In Stallman's mind, proprietary software, with its source code closed off from the public, prevented the sort of cooperation and communitarian spirit necessary for advancing software development. The FSF's solution to the 'dilemma' of closed source / proprietary software was a concept that Stallman called 'copy left'. This implied keeping source code freely available so that everyone could change and/or redistribute the software. In order to bring the concept of 'copy left' to realization, Stallman and the FSF created the first example of an open source software license called GNU General Public License (West and Dedrick, 2001).

GNU GPL gives the licensee the permission to copy, distribute, and modify the program so long as certain conditions are met. As strange as it may seem in a world where creators of intellectual property desire ever stronger intellectual property protection in order to have an incentive to produce, Stallman actually wanted to weaken intellectual property rights (West and Dedrick, 2001). Regardless of Stallman's controversial views, the present-day open source software and various open source licenses are based on both the GNU GPL and Stallman's 'free software views. Towards the end of the 1980's, in 1987, Larry Wall invented Perl, "a Unix-based programming language he created to scan, manipulate, and print text files." Initially, Wall posted Perl on Usenet under the GNU GPL. Later on, Wall decided that the GPL's terms were "too restrictive" and created his own open source software license called the 'Artistic License.'(West and Derrick: 2001).

In 1991, the dream of a Unix-like open source operating system was realized by a 21-year old Finnish undergraduate student named Linus Torvalds. With the goal of getting a Unix-like operating system running on, Linus coiled a "Unix kernel" in creating Linux; Linus Torvalds relied heavily on the toolset and the necessary subsidiary programs created by the GNU Project. In order to honor the contributions of the GNU Project, Linus released Linux under GNU. The concept of free software did not go well with Software business companies that questioned the morality behind such a concept; wondering why any product or software could be release without participating in the market for returns. This painted free software as being unreliable. This prompted Eric S. Raymond and others in consultation with Richard Stall to develop the term *open source* as a more business friendly term than *free software (*Kyle, 2014*)*. Open Source had a more inclusive meaning, in that licenses that were not as strict about the need to pass on modifications would also qualify to be launched under the Open Source Initiative. However, by 2007, Commercial Open Source Software had effectively co-opted this term, leading the community to coalesce around the term Free Open Source Software (FOSS) to bring the original visions of Stallman and Raymond back together. Others called free software as Free-Libre Open Source Software (FLOSS).

b. Open Source Software Foundations and Open License Models

Today, an organization called Open Source Initiative (OSI) has been established to oversee the release of software under open source licenses through its approved Open License Models such as Apache 2.0, GNU General Public License ("GPL") , GNU Library or "Lesser" General Public License ("LGPL"), BSD 3-Clause "New" or "Revised" license , BSD 2-Clause "Simplified" or "FreeBSD" license BSD, MIT, Mozilla Public License 2.0, IBM, and Apple, Sun, Common Development and Distribution License and Eclipse Public License (Open Source Initiative, 2015).There are also foundations that have been set to support specific free and open source software. These include: Free Software Foundation (FSF) started by Richard Stallman in 1985, Apache Software Foundation (established in 1999 to supports the development of Apache server), Linux Foundation (established by Linux Torvalds in 2000 to support Linux Kernel and other Linux software), Ubuntu Foundation (founded in 2005 to promote the other flavor of Linux called Ubuntu) and Free and Open Source Software for Africa, established in 2003 to spearhead the use of free and open source software in Africa (Opensource.com, 2015).

c. Common Open Source Software

Since the launch of GNU in 1991, many free and open source software have sprung up. Some of this software is horizontal in nature as they are applicable to many industries (Stephen, Maeve and Army, 2007). This horizontal free and open source software includes Apache Server software, Linux operating systems (Ubuntu, Red Hat, Suseetc), Open Office, LibreOffice (the two office work like Microsoft office), and Mozilla Fire Fox (internet browser). On the other hand, vertical free and open source software that only applies to specific industries exists. These include MySQL (database Management systems), Koha (library management systems), dspace (institutional repository software), and xTuple (finance, sales and inventory management software). It is now conceivable to find free and open source software replacement for commercial software. Below is the table of common FOSS software against commercial software.

Figure 1: *Commonly used FOSS cross-referenced with Commercial software*

Type of software	Commercial	FOSS
Word processing	Microsoft Office	LibreOffice, Open Office etc.
Web browser	Internet Explorer	Mozilla Fire Fox, Google Chrome etc.
Music players	Windows Media player	VLC Media Player, RealPlayer etc.
Server	Windows Server	Apache, Lighttpd etc.
Contents management system	Oracle Webcenter, Adobe digital Publishing etc.	Joomla, Drupal, Wordpress,TYPO3 etc.
Library management systems	Liberty ,Unicorn, Alice etc.	Koha, Evergreen, OpenBiblio etc.
Database management system	Oracle	MySQL, Postgresql etc.
Operating system	Windows, Macintosh etc.	Linux (Ubuntu, Red Hat Suse etc.)

d. Adoption footprints of FOSS

Many countries have released the benefits associated with FOSS thus the adoption of FOSS is gaining ground. In some countries, this switch to FOSS is backed by policies. It is however imperative to mention that FOSS prioritization as reflected by public policy initiatives varies from continent to continent and from country to country. In this regard, some continents and countries FOSS policy which encourage the use of FOSS.

i. Europe

Europe is among continents which have actively participated in the development, adoption and use of FOSS. Many successful projects in FOSS can be traced back to Europe. For instance, the project to write Linux Kernel started in Finland. Furthermore, famous contents management systems such as TYPO3 and Drupal started in Germany and Belgium respectively. European society and governments have been supportive of FOSS. Their regional body, the European Commission has also been instrumental in the development, adoption and use of FOSS among

member countries. This is evidenced by the European Commission's decision to begin using FOSS at its offices Brussels. According to Sanjeev (2013), the European Commission in 2000 defined a strategy concerning the internal use FOSS and recommended the use of Apache to power its servers in Brussels. Further, between 2007 and 2011, the European Commission established and approved the European Union Public License (EUPL) which formed the basis for the development of various FOSS foundations such as the Open Source Observatory and Repository for European public administration (OSOR.eu) (Sanjeev, 2013). OSOR.eu has coordinated and promoted the development of FOSS in public sector in Europe.

However, the adoption and use of FOSS in European countries is heterogeneous. According to Cenatic (2010), the penetration and use of FOSS in Europe vary from country to country with Western European countries doing exceptionally well than their eastern counterparts. Germany, France and Spain are leading in the adoption of FOSS in Europe. These three governments have been heavily involved in the development and promotion of FOSS in Europe. For example, Germany launched policies aimed at promoting FOSS in Public institutions and France has centralised the promotion and implementation of FOSS in public organizations (Cenatic, 2010). In Spain, the promotion and implementation of FOSS is left to individual autonomous governments but Central government has provided guidelines. Other European countries which are striving to promote FOSS include Sweden. According to Christos, Vasileios and Tselion (2012), 50% of local authorities in Sweden use FOSS.The United Kingdom (UK) is not doing well in the promotion and use of FOSS because it has lukewarm policy on FOSS. It's FOSS policy states that government will actively and fairly consider Open source solutions alongside with proprietary ones in making procurement decisions (Cabinet office-UK, 2012). The government in UK does not compel state institutions to use FOSS but just encourage them to consider them. This is the reason why UK does not rank well in the adoption and use of FOSS because the state has not taken an active role in promoting FOSS.

ii. North America

North America has been credited for initiating the FOSS movement. The first FOSS movement started in North America, in the United States of America (USA) by Richard Stallman. North America still remains the biggest contributor to the growth of FOSS in the world. Many

successful FOSS projects are domiciled in the USA. These include Red Hat, Apache and Evergreen. Cenatic (2010) observes that the USA contributes a large percentage of FOSS initiates and projects in Northern American than Canada and other countries. Cenatic further argue that North America suffers from lack of firm national commitment in the promotion of FOSS. There are no national policies like in some European countries to promote and use FOSS in public institutions. However, some individual states and public institutions promote and use FOSS. For instance, in the USA, Texas and Oregon states have passed laws to promote FOSS. Further, White House has migrated its website contents to Drupal from a commercial content management system. The Department of Defense (DoD) was reported by MITRE in Sanjeev (2013) to have been using more than 115 FOSS in its operations. Further, DoD has been actively supporting and promoting the use Alfresco, a records management system which has a community version. The private sector in the USA has been extensively using FOSS in their operations too According to Cenatic (2010), 41% of private companies in the USA use FOSS. The commonly used FOSS is Apache (43%), Tomcat (31.5%) and MySQL (30.7%).

iii. South America

In Latin American, Brazil stands out from the rest of countries in the region as regard the development and use of FOSS. Brazil competes favourably with India and China in the development and use of FOSS (Cenatic, 2010). Federal and State governments in Brazil have been actively participating in the ecosystem of FOSS by implementing laws and that favour the growth and use of FOSS. For instance, many cities and 27 states have passed laws to encourage the adoption and use of free software mainly to build up computer infrastructure (Dominik, Hangjung and Michael: 2009). Further, Brazilian government has been initiating FOSS projects ranging from inventory systems to an agricultural network and solutions like messenger tools and grid computing. Major examples include CACIC (inventory systems), CONTRA (access control system), SISAU, SACI LIVRE (administration for institutional contents) and Agrolivre(Agriculture network). Further, the Brazilian government has been preaching FOSS by encouraging government departments and units in Brazil to use FOSS. For example, the Ministry of Education has adopted Linux Debian with its educational applications packages from KDE (Dominik, Hangjung and Michael: 2009). Bank of Brazil adopted Linux servers in 2001. Further, the current voting system in Brazil runs on Linux servers (Edgy: 2009).

iv. Asia

According to the Centre for Strategic and International Studies (2008), in 2008, Asia had a total of 70 FOSS approved and proposed initiatives. Asia is home to numerous FOSS projects which include Asianux, jointly developed by Red Flag Software of China, Miracle Linux of Japan, Haansoft of South Korea and other Asian countries (Sanjeev, 2013). In Asia China is leading not only on the economic front but also in the development and use of FOSS. The Chinese government has taken deliberate steps to support the development and popularisation FOSS by prohibiting the use of foreign commercial software in government departments. This has spurred the growth of FOSS in China. Further, the Chinese government supports Red Flag Linux (Chinese Distribution of GNU/Linux) with a view to creating its local technology. Many government departments at national, provincial and local levels in China use Red Flag Linux. These include the Ministry of Statistics, China Post and China Academy of Sciences (Sanjeev, 2013).

India is not left behind and has grown to be a technology giant in the world with large software and hardware companies shifting their operations to India. Like many other governments in the world, the Government of India (GOI) has launched an ambitious project of turning India into a digital country; government is implementing e-governance. In this regard, the Indian Government considers Open Source software as a means to actualize the concept of digital India. In the bid to support the growth of FOSS, the Indian Government in 2015 announced a policy for adopting FOSS, making it mandatory to consider such software along with proprietary software in order to lower the cost of software (The Economic Times, 2016). Under this policy, Central and State departments ought to give preference to FOSS in the procurement of software as India seeks to implement e-government systems (Ministry of Communication and Technology, 2016). It is imperative to mention that prior to this policy launch, India has been home to many FOSS projects. These include BOSS (an Indian version of GNU/Linux), Koha, Dspace, Creative Computing@ School (an Educational e-journal). Even before the implementation of FOSS policy in India, some Central and State departments began migrating to FOSS and saved a lot of money in dollar terms. For example, Kerala State replaced Windows Software with FOSS on 50,000 desktops in schools across the State and saved nearly $10.2 million USD. The private sector in India has been migrating to FOSS. For instance, the New India Assurance Company

with IT infrastructure of 1,500 severs and 7,000 desktops migrated to FOSS and saved $16.67 million USA (Opensourcecom, 2016).

South Korea is also doubling its efforts in promoting FOSS. In 2003, the South Korean government announced that it would replace proprietary software on government computers and servers with Open Source Software by 200. In 2004, the government allocated US $19 million to replace Windows Operating Systems and Office productivity suites in government bodies with Open Source programmes. Many government departments in South Korea have adopted FOSS such as Linux. The switch to FOSS has made South Korea to save $300 USA millions per year (Nir and Andreea: 2007). The development and use of FOSS in South Korea is spearheaded by Korea IT industry promotion Agency (KIPA). KIPA has been supporting the development and use of local FOSS such as Linux. Further, KIPA is funding the development of various FOSS such as the National Education Information System (NEIS) used by schools in South Korea to manage students' information. KIPA is also promoting the use of FOSS in universities such as Gangwon University.

Japan has laggard a bit behind in the promoting and use of FOSS. However, it is catching up quickly because government has committed itself to promote FOSS. In 2007, the Central government of Japan announced the prioritisation of FOSS in the procurement of software. This was said to be a move to reduce dependence on Microsoft thus reducing costs associated with software procumbent in the country (Centre for Strategic and International Studies: 2010).

v. Africa

According to CENATIC Foundation Simon and Samuel (2012), Africa is lagging behind in the development and use of FOSS. This situation is partly attributed to the lack of public promotional policies and high rate of illegitimate software use. The United Nations University in its research in 2012 discovered that lack of general awareness of FOSS on the continent of Africa hampers the adoption of FOSS (United Nations University, 2011). Other factors that hinder the adoption off FOSS in Africa include lack of advocacy and poor internet connectivity. It is only South Africa that stands out in the continent with a commendable OSS index near the world

average (Simon and Samuel, 2012). In South Africa, government and none-government organisations such as Shuttle worth foundation support FOSS. South Africa is home to some important FOSS projects such Ubuntu (a popular version of Linux). In a bid to coordinate the development and adoption of FOSS on the continent of Africa, in 2003, a foundation called Free and Open Source Software Foundation for Africa (FOSSFA) under the auspices of the African Union was formed. FOSSFA has been focusing on three areas: -

a) open source in Government,
b) open source in Health,
c) open source in Education.

In this regard, FOSSFA has been working with different partners in different African countries to develop software in the above-mentioned sectors. For instance, FOSSFA has partnered with UNESCO to develop the Miftaah Memory Stick project (a memory stick developed with three Open source software saved on it) for use in countries such as Algeria, Morocco and Tunisia. Further, FOSSFAS has been involved in the development of Cybera in Burkina Faso, software for the administration of Internet cafés. Other projects include a student academic registration information system (SARIS) in Tanzania and Ushahidi in Kenya; a web based reporting system that utilizes crowd sourced data to formulate visual map information of a crisis on a real-time basis (Simon and Samuel, 2012).

On advocacy for FOSS policies, FOSSFA has been supporting the development of policy initiatives in African countries. Only a handful of African countries have policies on FOSS. Majority of African countries just mention or not even mention the use of FOSS in their ICTs polices as summarized by the table below:

Figure 2: FOSS policies among some selected African countries

Name of country	***Availability of FOSS policy***	***Year the policy was adopted***	***Type of policy***
Angola	No policy but recommends FOSS in its ICTs policy	----------	----------
Benin	No policy but encourages use of FOSS	----------	----------
Djibouti	No policy but plans to research on FOSS	----------	----------
Kenya	No policy but paper is in progress	----------	----------
Senegal	No policy but government is experimenting with FOSS	----------	----------
South Africa	Available	2001	Preference–FOSS is preferred
Tanzania	Available	2003	Preference–FOSS is preferred
Uganda	No policy but strong use of FOSS in academia	----------	----------
Zambia	No policy but ICTs policy mention the use of FOSS	----------	----------

The table above clearly shows that the continent has not done enough as regard to the promotion and adoption of FOSS. The absence of FOSS policy in many African countries largely contributes to the low ranking of Africa in terms of development, adoption and use of FOSS.

9. METHODOLOGY OF THE STUDY

This study adopted quantitative design and survey method was used in which 70 government departments in Zambia were surveyed. In this regard, 70 ICT personnel in government departments preferably ICT managers were given a self-administered questionnaire to complete. ICT managers/officers were purposively selected for the study because they manage ICTs infrastructure for these government departments thus, they were expected to have the answers as regard the use of FOSS. Data collected was analysed using the computer program called Statistical Package for Social Sciences software (SPSS). The findings were generalized to the rest of the population.

10. PRESENTATION OF FINDINGS

As indicated above, 70 IT specialists from 70 government departments were interviewed. In terms of gender representation, 72% were male while 7% were female. This affirms the assertion that males are still dominating Science based jobs and professions. The average age of respondents was between 30 and 34.The majority (58.6%) of the IT specialists were Bachelor's degree holders as shown by the table below.

***Figure 3**: Qualifications of respondents*

Name of Qualification	Percentage (%)
Diploma	22.9
Bachelor's Degree	58.6
Master's Degree	15.7
Others	2.9
Total	**100**

In terms of awareness of the existence of Free/Open source Software, 92.9% said they were aware while7.1% said they were not as shown by the table below.

Figure 4: Awareness of FOSS

N=70	Frequency	Percentage (%)
Yes	65	92.9
No	5	7.1
Total	70	100

The respondents were asked to indicate which FOSS they were familiar with. As shown in the table below,MySQL and Mozilla Fire Fox are the most known FOSS among IT personnel interviewed.

Figure 5: FOSS respondents familiar with

Software	Percentage (%)
Apache	17.9
Firefox Mozilla	20.7
Libre Office	7.1
Linux	17.1
MySQL	20.4
Open Office	13.9
No Response	3.2
Total	**100**

The respondents were asked to indicate the Operating System they use in their organisations for personal computers ingovernment departments. The results below show that 98.6% ofthe department surveyed use Windows Operating System (a commercial OS) while1.4% (1) indicated using Linux (FOSS).

Figure 6: Name of OS in use for personal computers

Name of OS	Frequency	Percentage (%)
Windows OS	69	98.6

Linux	1	1.4
Total	70	100

In terms of the estimated expenditure, 47.1% of government departments spend between ZMW50, 000 to ZMW 100,000 annually, on license fees on Windows Operating System for personal computers.

Figure 7: Estimated annual expenditure onWindows Operating System

Approx. annual expenditure	Frequency	Percentage
Below ZMW10,000	5	7.1
ZMW10,000 to ZMW50,000	27	38.6
ZMW50,000 to ZMW100,000	33	47.1
No Response	5	7.1
TOTAL	**70**	**100**

Further, respondents were asked to rank non OS FOSS they use in their departments. The results show that Fire Fox, MySQL and Apache in that order are the most used FOSS in government departments in Zambia.

Figure 8: Ranking of the used FOSS in government departments

Name of FOSS	Ranking of used FOSS
Mozilla Fire Fox	1
MySQL	2
Apache	3
Linux (Server OS)	4
OpenOffice	5
Libre Office	6

Respondents were further asked to indicate if their ICTs departmental policies support FOSS. The majority (84.3%) indicated that their departmental policies were not supportive of FOSS. Only 14.3% indicated as having departmental policies that support FOSS as shown by the table below.

Figure9: ICTs policies supporting the use of FOSS

N=70	Frequency	Percentage
YES	10	14.3
NO	59	84.3
NO RESPONSE	1	1.4
Total	**70**	**100**

The respondents were also asked to indicate any challenge they face in implementing FOSS. The challenges cited include the fear that FOSS is not secure and reliable. Others said FOSS is not user friendly.

Figure 10: Some of challenges government departments face in using FOSS

Challenges	Ranking of challenges
Not reliable and secure	1
Not user-friendly	2
Lack of management support	3
Lack of capable staff	4

11. DISCUSSION OF RESEARCH FINDINGS

From the presentations above, it is clear that many of the IT personnel surveyed are aware of the existence of FOSS.The high awareness levels among IT staff in government departments in Zambia is a right step in the right direction as regard the adoption and use of FOSS. The research has brought to the fore the fact that adoption and use of FOSS in government departments in Zambia is not wide spread. For example, 69 out of the 70 surveyed departments are still using Windows operating systems and Microsoft Office as productivity software. This is contrary to what is happening in other countries such as Brazil and India where government departments are obliged to use FOSS (The Economic Times, 2016; Dominik, Hangjung and Michael, 2009). The trend of using Windows operating systems and accompanying productivity software cost many government departments an average amount of ZMW 75,000.00 per year. Despite many government departments still married to Windows, the research as has revealed that the adoption of FOSS is gaining ground. The study has shown that Mozilla Fire Fox is the most used FOSS in government departments in Zambia. Further the study has shown that in areas such as Database and server technologies MySQL Database Management System and Apache server software are being used in government to create databases and host websites respectively.

The research has revealed that the adoption and use of FOSS is not wide spread because of lack of both nation and organizational FOSS policies. Like discovered in literature review, Zambia does not have a FOSS policy and all government departments surveyed do not have policies on FOSS. This makes it difficult for ICT personnel to adopt and use FOSS. In some government departments such as the University of Zambia, Windows Operating system and its productivity software has been designated as the sole operating system. This practice is wide spread in government departmentsin Zambia.

12. CONCLUSION

It can be concluded that the adoption and use of FOSS in government departments in Zambia is not wide spread with almost all (69/70) surveyed government departments still using Windows and Microsoft Office products as unwritten and written government policies favour such commercial software which cost government a lot of money annually. However, there is interest

for ICT personnel to use FOSS such as Mozilla Firefox, MySQL, and Apache. The use of such FOSS is not backed up by any government or organizational policy making it difficult to widely adopt and use FOSS in many sectors.

13. RECOMMENDATIONS

In view of the above findings, the following recommendations must be considered for implementation by the government of the Republic of Zambia to increase the use of FOSS: -

- Like Brazil and other countries, government must formulate and implement a FOSS policy that will encourage the use of FOSS in the country.
- ICTs Sector players in Zambia such as Zambia Information and Telecommunication Authority (ZICTA) to raise awareness about the benefits of using FOSS.
- ICTs and Computer Science Schools should begin teaching FOSS to students

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