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Training as a Determinant of Open Source-Software Applications Adoption in Universities

Albert Kibe

School of Human Resource Development, Jomo Kenyatta University of Agriculture and Technology, P.O. Box 62000-00200, Nairobi, Kenya
E-Mail: ambuguss@gmail.com

Abstract

There is a consensus that Information and Communication Technologies (ICTs) can play an important role in developing countries. However, in recent years, there has been an increasing agitation by sections of the society that softwares be freed from the control of the commercial developers. The adoption and use of open source software (OSS), especially in institutions of higher learning can play a fundamental responsibility in the formation of new knowledge, distribution and ultimate application of OSS in the economy and society as a whole. This study aimed at assessing the determinants of the adoption of open source software applications in universities. A survey research design was employed and both Primary and secondary sources of data were used. From the findings, most of the respondents seemed to have knowledge on OSS this is true because lately OSS has gained a reputation in terms reliability, efficiency, functionality, security that has amazed majority of consumers who are increasing by day. The findings indicated all variables under study, which were; Awareness, Perception of utilization, training and perceived usefulness had an effect on adoption. This effect was however 45.1% which means other factors influence adoption. It therefore recommended further research on these other factors.

Key Words: Information and Communications Technology (ICT), Open Source Software (OSS), Adoption, Training and Awareness.

Introduction

There is a consensus that Information and Communication Technologies (ICTs) can play an important role in developing countries. This is because it will connect people to more accurate and up-to-date sources of information and knowledge (Grimshaw & Talyarkhan, 2005), (Tongia, Subrahmanian, & Arunachalam, 2005). However, in recent years, there has been an increasing agitation by sections of the society that softwares be freed from the control of the commercial developers. Richard Stallman 1984 pioneered the idea of Open Soft Software (OSS). It was aimed at recreating the "open" environment that existed prior to software vendors deciding to distribute executable code for hardware devices without supplying source code with it. Due to his personal beliefs that computer programs should be shared freely among users Stallman founded the Free Software Foundation (FSF) in 1984.

The sharing of the code makes it possible for software developers to modify and even broaden the capability of the original product. OSS is therefore under regular improvement since anybody in the world can alter the code making it better. This kind of software development approach brings together the power of distributed peer review and transparency of process. In addition this approach to software development enhances quality, higher reliability, more flexibility, lower cost, and an end to predatory vendor lock-in common with proprietary software (Kamau & Namuye, 2012a).

Recognized examples of open source software applications include the Linux operating system, the Mozilla Firefox web browser, the OpenOffice.org office application suite, the My-SQL relational database system, and the PHP programming language. Many OSS products offer credible substitute to the equivalent proprietary products, while some, like the Apache web server, the Send mail server, and the BIND domain name system server, are market leaders in their categories.

Universities play a fundamental responsibility in the formation of new knowledge as well as the distribution and ultimate application of it in the economy and society as a whole. The use of Open Access will strengthen the institutions' of higher learning in Kenya. Open Access will improve the global science system by demonstrating alternative strategies and techniques that already exist but are not part of the mainstream science systems, but which also yield the same result with those researches executed with standard methods. Therefore, Open Access will strengthen the universities in Kenya. Open Access will improve the global science system by demonstrating alternative strategies and techniques that already exist but are not part of the mainstream science systems, but which also yield the same result with those researches executed with standard methods.

The idea of free and open source technology lends itself to making technology accessible to the masses at reasonably low cost compared to proprietary software. The prospective increase of OSS into ever more application areas makes it important for businesses and researchers to understand the factors influencing decisions about its use, and its adoption in particular settings. However, research into OSS adoption is still in its early stages ((Fitzgerald & Kenny, 2003); (Larsen, Holck, & Pedersen, 2004), and there has been little research focused on the frameworks that help us to understand and evaluate issues influencing adoption. Although there are numerous benefits associated with OSSA, proprietary software is still widely used especially due to piracy. Pirated software is distributed and shared by individuals, government departments, academic institutions and other organizations. This research sought to bring into perspective the determinants of open source software application adoption in universities in Kenya.

Statement of the Problem

People in the developed countries have relatively more real access to information and communications technology and are using it effectively than those in developing countries. This inequality of access to information and technological advantages among Kenyans is a crucial factor for development. Access to Information and Communication Technologies (ICTs) is not only hindered by the lack of infrastructure but also cost of accessing this information such as costs of softwares. Software vendors have a ready market in institutions of Higher learning such

as Universities. Hefty financial resources are set aside every financial year for purchase but also maintenance of the software. The cost of maintenance can be very high because of sensitivity of data in these institutions. These costs include software acquisition and upgrading. Some of the commercial software are very expensive to acquire and equally expensive to maintain. These institutions can however look for alternatives such as open source software which have become a handy tool to many users. It is free of charge and stable compared to commercial software. Universities are charged with training and providing an enabling environment for innovation but are ironically not embracing open source solutions. Jomo Kenyatta University of Agriculture and Technology (JKUAT), for instance uses mainly certain commercial software for Operating Systems and other commercial application programs, their vulnerability notwithstanding. This thus begs the question: why are the Universities not using open source software applications? Are there hindrances that these institutions have to overcome in order to embrace fully open source software applications? Therefore this study sought to investigate these factors and give appropriate recommendations.

Objective of the Study
To assess training as a determinant of the adoption of Open Source Software Applications in Universities.

Literature Review
A synthesis of the earlier work provides an overview of the research topic. Material is drawn from different reviews.

Research Model and Theoretical framework
There are several models existing that have been used to investigate adoption of technology. These models explain attitudinal, social, and control factor that have been advanced to elucidate IT usage. Among the many models the researcher has reviewed three of them; Theory of Reasoned Action (TRA), Diffusion of Innovation (DOI) and Technology Acceptance Model (TAM).

Adoption of Open Source Software Application
According to (Chau & Tam, 1997), the adoption of open systems in organizational computing represents a major paradigm shift in information systems development and management. He continues to say considerations involved in the decision to adopt open systems have been widely shown. However, it is still uncertain whether common perceptions and publicized facts about open systems have any impact on their actual adoption. However in (Machado & Thompson, 2005) view, economic reasons are an important drive for Institutions of higher learning (IHLs) when moving from commercial to open-source environments. Also (Mandal, Kandar, & Ray, 2011) points out, that OSS is alleged to offer considerable benefits when evaluated to typical commercial products that repeatedly stress on advancement and updating of noticeable features. The increased force in the use of technology in (Machado & Thompson, 2005) opinion to enhance students' learning within the constraints of limited budgets has encouraged many IHLs to look towards alternative approaches to teaching and learning. The purchase and maintenance of computer-based learning technologies tends to accelerate the

costs and gains. In this respect, OSS environments bring opportunities to reduce costs whilst increasing the use of educational technologies in several ways.

The benefits that OSS offer includes savings on costs, good security features and the flexibility of the software itself and this has led to many international non-government organizations to increase its support (Amant & Still, 2007). Many African states are developing and therefore the adoption and use of OSS is expected to be a natural choice due to the cost implications of proprietary/commercial softwares. However its adoption is inadequate even though many organizations have been highlighting the possible benefits of OSS to these countries (St.Amant & Still, 2007)

Awareness according to (Sobh, 2010) is a significant facilitator of the OSS adoption. If people are aware of the technological benefits of OSS, adoption will be very straight forward. However , (Spinellis & Giannikas, 2012) say , because most enterprises see technology as a proprietary differentiating element of their operation, little is known about OSS adoption in these sectors and the key drivers behind adoption decisions. Users believe that a given application may be successful, but they may, at the same time, believe that the technology is too hard to use and that the performance benefits of usage are outweighed by the effort of application (Davis, 1989). Organizations preparing to put into practice the use of FOSS, (Kamau & Namuye, 2012b) must guarantee that there is good user support before the users get accustomed to it. User resistance to the FOSS transition remains one of the key impediments to successful free open source Software migration. (Davis, Bagozzi, & Warshaw, 1989) in agreement says Perceived usefulness elucidates the user's perception to the level that the technology will improve the user's workplace performance. Meaning that the user has a perception of how useful the technology is in performing his job tasks; including decreasing the time for doing the job i.e. more efficient and accurate. This comes only if the user awareness is well endorsed through capacity building, workshops etc.

Though free open source software is growing the average computer user only directly interacts with proprietary software. One reason for this state of affair is that open source software is less usable and requires in-depth technical skill to operate it. It's important to recognize the reality that individuals possess different styles and paces at which they learn therefore a flexible training programme can be used to handle these aspects according to (Van Belle, Brink, Roos, & Weller, 2006).

Without training, users are likely to remain opposed to FOSS regardless of the level of usability of the same. Organizations preparing to put into practice the use of FOSS, (Kamau & Namuye, 2012b) must guarantee that there is good user support before the users get accustomed to it. User resistance to the FOSS transition remains one of the key impediments to successful free open source Software migration. (Fitzgerald & Kenny, 2003) in his research explain two major obstacles to this as; the change required in the mind-set of users when deploying the FOSS solution and resistance from staff who fear being deskilled by moving away from a popular proprietary system. This can be overcome by making sure the users are well trained to bring about awareness and to mitigate resistance.

Research Methodology

A survey research design was employed in this study. It is a very valuable tool for assessing opinions and trends. Therefore this design was used for its ability to describe large population and generalizability of the findings. For purposes of this study, the target population included all the staff that use ICT to perform their duties. (Ott & Longnecker, 2010) defines the target population as the complete collection of subjects whose description is the major goal of the study. The latter group was chosen because it had the fundamental knowledge needed in this research. From the total population of over 2000 employees of JKUAT a sample size was calculated statistically using the formula (Fagbenle, *et al*, 2011) n= n^1 /1+ (n^1/N) and the sample size was calculated to be 95 employees. Data was collected mainly by use of questionnaire method. The researcher used the drop and pick approach where the questionnaires were dropped in the morning and collected later afternoon after completion, this allowed the respondent to work on the questionnaire in private and when it was convenient. This study used both quantitative and qualitative methods of data analysis. To facilitate the analysis, the questionnaires were coded according to each variable of the study to ensure accuracy and minimal error margin during analysis. Data analysis was facilitated by Microsoft Excel 2013 and Statistical Package for Social Sciences (SPSS) program version 20 which has Automated Data Preparation feature (ADPF) and can provide multiple comparisons and allows table customization.

Findings and Discussion

The research was conducted on a sample of 95 respondents from the Heads of sections, Supervisors and Clerks in the organization to which questionnaires were administered. However, out of the issued questionnaires, 53 were returned duly filled in making a response rate of 55.79%, which was sufficient for statistical reporting.

General Information

Respondents Gender

In order to understand the respondents' gender distribution, the respondents were asked to indicate their gender category in which they fell. The table below shows the results.

Table 1 Gender

		Frequency	Valid Percent	Cumulative Percent
Valid	Male	30	56.6	56.6
	Female	23	43.4	100.0
	Total	53	100.0	
Missing	System	1		
Total		54		

The respondents were asked to indicate their gender by placing a mark next to the relevant option provided (male or female). From the findings, most of the respondents, 56.6% were male while their female counterparts represented 43.4%. This is a relatively close equal ratio; JKUAT can pride itself to be an equal opportunity employer.

Distribution of Respondents by Age

In order to understand the respondents' age distribution, the respondents were asked to indicate their age category in which they fell. Below were the responses.

Table 2 Age

		Frequency	Percent	Cumulative Percent
Valid	18 - 30	36	66.7	67.9
	31 - 40	14	25.9	94.3
	41 - 50	3	5.6	100.0
	Total	53	98.1	
Missing	System	1	1.9	
Total		54	100.0	

From the findings, most of the respondents were aged between 18 – 30 at 66.7%. They were followed by 25.9%. 41-50 were least at 5.6%. The findings indicate that majority of the employees at JKUAT are young and energetic and are able to run the affairs the university. This means that they the biggest consumers of open source software and therefore the best suited to enhance its adoption.

Knowledge of Open Source

The respondents were asked to indicate whether they were familiar with open source software. This would help the researcher in analyzing data on the open source issues in the study. Below were the findings:

Table 3 Open Source Knowledge

		Frequency	Valid Percent	Cumulative Percent
Valid	Yes	51	96.2	96.2
	No	2	3.8	100.0
	Total	53	100.0	
Missing	System	1		
Total		54		

The study indicated that 96.2% were familiar with open source. According to (Nichols, Thomson, & Yeates, 2001) open source softwares have in the recent past gained a reputation in

terms reliability, efficiency, functionality that has stunned majority in the software engineering world, this means more and more people are getting attracted to them. Only 3.8% said they were not familiar, the reason could be they acquired computer skills on their own, and have probably basic computer skills. In addition the study in this area asked the respondents to state the extent to which they agreed with the following statements on awareness of adoption of open source. The responses were rated on a five point Likert scale where: 1 - Strongly disagree 2 – disagree 3 – neutral 4- agree and 5- strongly agree. Findings are presented in table below.

Table 4 Awareness of open Source

Statements	Mean	Standard Deviation
I am aware that open source comes with source code	3.89	1.031
Open source has freedom of use	4.23	1.068
Open source has freedom of modification	3.72	1.183
Open source has freedom of redistribution	3.89	1.086
Open source is more secure	3.77	1.354
Open source is cheaper to get	4.40	1.044
Open source is more reliable	3.68	1.298
Open source is Upgradable without initial developer support	3.62	1.213

From the findings, most of the respondents are aware that open source comes with source code recording a mean of 3.89. They are also aware that it comes with freedom for use recording the highest mean in this category at 4.23. They are also aware that it has freedom of modification at a mean of 3.72. On freedom of redistribution, a mean of 3.89 was recorded. Security of open source recorded a mean of 3.77. On cost, the respondents are aware that open source software is indeed cheap to obtain and aware that it is upgradable without the initial developer. This brings about a revelation that undeniably information on OSS is known to users/consumers.

Table 5 Perception on Utilization

Statements	Mean	Standard Deviation
Open source is cheaper in terms of cost	4.08	1.238
Ease of installation	3.47	1.339
Offers better performance	3.43	1.435
Ease of upgrade	3.47	1.381
More reliable	3.57	1.308
Better user support	3.38	1.39
Interoperability is possible	3.43	1.2
More secure	3.47	1.234
It is scalable	3.57	1.308

From the findings, most of the respondents had a positive attitude on the adoption of open source. They agreed that is was cheaper, easy to install, easily upgradable, more reliable and more secure. Other than been aware, they had a positive mind on what open source can do for them.

Table 6 Correlation of training and adoption

Correlations

		Training	Adoption
Training	Pearson Correlation	1	.527**
	Sig. (2-tailed)		.000
	N	53	53
Adoption	Pearson Correlation	.527**	1
	Sig. (2-tailed)	.000	
	N	53	53

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

As shown there is a positive moderate correlation between training and the adoption of OSS. This shows that awareness through training is one of the significant determinants of OSS adoption. Capacity building is therefore necessary for the successful adoption of OSS.

Conclusion

The study concludes that 96.2% are familiar with open source. It further concluded that awareness through training has an effect on adoption of open source.

Recommendations

Based on the findings of the study, it is recommended that training be given more prominence since it has the highest effect on adoption. JKUAT staff should be sensitized on the benefits of open source over other software then offered training on usage. This would most likely enhance the level of utilization and perhaps do away with other software. In this regard, it is recommended that the ICT directorate develop a policy framework that would guide the university in fully adopting open source software.

Suggestion for further studies

Further research is necessary as the findings indicated that only 45.1% of the adoption of software is affected by the variables utilized in this research. These means that there are other factors those come into play regarding the whole issues of open source software adoption.

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