OPEN SOURCE TECHNOLOGY: AN EMERGING AND VITAL PARADIGM IN INSTITUTIONS OF LEARNING IN KENYA

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ABSTRACT

Open Source Software is the major rival in the software market previously dominated by proprietary software products. Open Source Software(OSS) is available in various forms including web servers, Enterprise Resource Planning systems (ERPs), Academic management systems and network management systems and the development and uptake of such software by both commercial and non-commercial companies and institutions is still on the rise. The availability of OSS applications for every common type of enterprise, minimal licensing issues and availability of source code as well as ease of access has made the technology even more attractive in learning and teaching of software based courses in institutions of learning. Through embracing this technology, institutions of learning have been able to minimize general operations cost that could have otherwise been incurred in procuring similar proprietary software. Students and teaching staff can nowadays interact and modify the readily available source code hence making learning and teaching more practical.

KEYWORDS

Information and Communication Technology(ICT),Apache Internet Information Server (IIS), MYSQL, Open Source Software (OSS), Open Source Technology, Return on Investment (ROI).

1. INTRODUCTION

According to [16] open source development is an approach to software development in which the source code of a software system is published and volunteers are invited to participate in its development process. Its roots are in the Free Software Foundation (www.fsf.org), which advocates that source code should not be proprietary but rather should always be available for users to examine and modify as they wish. Open source software extended this idea by using the Internet to recruit a much larger population of volunteer developers. Many of them are also users of the code. As a result, more and more product companies are using an open source approach to development. Their business model is not reliant on selling a software product per se but on selling support for that product as they believe that involving the open source community will allow software to be developed more cheaply, more quickly and will create a community of users for the software.

Thus, the term open source software can be well described by first understanding the meaning of the term open source as a technology or culture It is usually understood differently by different people depending on the context. According to[1], the term open source software refers to software comes with licenses that provide existing and future users the right to use, inspect, modify, and distribute (modified and unmodified) versions of the software to others. He further

emphasizes that it is not only the concept of providing "free" access to the software and its source code that makes open source software the phenomenon that it is, but also the development culture. On the other hand,[2] defines open source as a software development method that makes source code available to a large community that participates in development by following flexible processes and communicating via the Internet. For the purpose of this study, open source software was considered as any software whose source code is published and made available to the public, enabling anyone to copy, modify and redistribute the source code without paying royalties or fees. This is not to be confused with software which is available to the end user at no cost, which is known as freeware whose source is not available for editing and redistribution. However, free software may be distributed with or without charge. Open source code evolves through community cooperation. These communities are composed of individual programmers as well as very large software houses.

In a world where Microsoft Corporation increasingly threatens to dominate computing and the Internet, the strongest potential rival to its dominance is no longer its traditional commercial rivals but Open Source Software. The announcement of the liberation of Netscape Communicator, in 1998, was the starting point of a rush of many big companies to appreciate the significance of Open Source Software[3]. Since then, Open Source Software has grown to command a substantial market share. Gartner [4] shows that 85% of companies are already using Open Source Software, with most of the remaining 15 percent expecting to do so within the next few years. Apache (an Open Source web server) is running on 62.71% of the world's web-servers while Microsoft's Internet

Information Server (IIS) is running on 18.37% [3].The use of Open Source Software, especially as a supporting infrastructure for proprietary products, is a widely used and essential element of the business strategies of major companies from IBM to Apple and Oracle [5]. Today, most of Dell laptops are sold pre-installed with Linux (Ubuntu), which is an open source operating system.

Open source technology has grown with time and its applications are now available for every common type of enterprise software including databases, application servers and Web servers, Web browsers, office applications, network monitoring software and security management software. Information management Systems and academic management systems are also available in various forms and versions [6].

Open Source Software and tools despite being easily available has it's cons too. Availability of the source alongside such systems means institutions and companies can modify the systems to suit their requirements. However this form of modification means the institutions in question must have the expertise to modify the available source code. This comes as an extra cost since the companies have to recruit personnel with the desired skills or outsource the service from renowned software development companies. However, the freedom with which the source codes can be changed and ease of access of Open Source software and tools makes the technology more attractive. The cost of customizing an open source software and reduced vendor dependency cannot be compared to the cost of acquiring fully developed proprietary software also coupled with vendor dependency and locked source code.

The purpose of this paper is to present the benefits that learning institutions in Kenya can reap by adopting the use of Open Source Technology and its products. The paper also details a list of Open Source Software and tools available for use in learning and teaching as well as general operations in institutions of learning in Kenya. The paper is based on the findings of a research conducted in two major public Universities in the country. The study aimed to answer the following research questions:

What are the various forms of Open Source Software being used in Kenyan institutions of higher learning?

What are the reasons underlying the use of Open Source Software in institutions of higher learning in Kenya?

The objectives of the study were to find out the various forms of Open Source Software and tools available in the software market as well as the reasons why many users opt to use such products. The study was based on a conceptual framework with Open Source Software and its various forms as the independent variable and its impact as the dependent variable. Age, education level, working or teaching experience and technological exposure were considered as moderating variables.

2. PROBLEM STATEMENT

Training and producing competent programmers and software developers in general from institutions of learning requires exposure to the practical programming world and the source code behind the various software in existence. As a complement to the many available proprietary software, open source technology has addressed this major concern of availing source code.

Today, Open Source applications are available for every common type of enterprise software and the development and use of such software is still on the rise[6]. Most of these software solutions are readily available as free downloads hence making them easily accessible.
There is, therefore, the need to inform learners as well as academic staff on the available open source software and tools as well as their benefits and impact on learning and teaching. Hence, this paper presents an evaluation and in-depth exploration of the impact that Open Source technology and its products have had on institutions of higher learning in Kenya.

3. METHODOLOGY

A case study approach was employed in this research. Yin [7] defines the case study research method as an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used. The target population consisted of academic staff and students as well as heads of ICT sections, and directorates in the two institutions. The choice of this population was suitable for this research because institutions of higher learning exhibit most of the possible areas of open source software application and effect. These institutions were purposively sampled in order to represent institutions of higher learning in Kenya.

A sample size between 30% and 50% of the aggregate population was deemed reasonably sufficient and representative enough, especially in descriptive and correlation studies [8]. Therefore, in this study, at least 50% of the lecturers in charge of computer-based courses and the students undertaking such courses were selected. In addition, heads of ICT sections or directorates were selected and interviewed. Therefore, a total of 400 students and 50 teaching staff were issued with questionnaires while two heads of ICT sections were interviewed. This sampling technique was suitable for this study in that it enabled the researcher to effectively capture the target population and also identify only those respondents with appropriate knowledge in the research area.

In order to collect primary data, both questionnaires and interview schedules were employed during data collection. Questionnaires were appropriate for this study because they could be used to collect a wide range of data. Questionnaires were also quick to administer and offered a

standardized form of response [9]. Questionnaires were also suitable for collecting data over a large sample [10].

Descriptive statistics was used to provide a concise summary about the samples used in the study as well as the measures. This is because descriptive statistics are best suited for simplifying a large amount of data in a sensible way [11]. The qualitative data from open-ended questions in the questionnaires was analysed by reading through them to identify any information relevant to the research objectives and then frequencies were tallied to tabulate data from respondents. SPSS was then used to analyse the simplified data and draw the required figures and graphs. Available literature was also reviewed in order to obtain the opinion of other researchers. The results of the analysis were then presented using pie charts and bar charts so as to aid the researchers in drawing valid conclusions.

4. RESULTS, DATA ANALYSIS AND PRESENTATION

Available literature shows that Open Source technology has had a huge uptake rate despite having mature and viable versions of proprietary software and tools in the market. Proponents of Open Source technology have put forward several reasons to support the increased embrace of the technology. Enterprises find that they consistently get great value and the desired return on investment (ROI) from Open Source Software [12]. The quality of Open Source Software met or exceeded the expectations of 92% of the respondents to a recent survey[12]. Meanwhile, 87% of the respondents said that Open Source Software delivered the cost savings they were hoping for. Open Source applications can be even more secure than their commercial equivalents [6]. Open Source communities fixed security vulnerabilities twice as quickly as commercial software vendors do [13]. These features and the desire to reduce dependence on software vendors and to have open license for acquired software have been the steering factors to widespread development and use of Open Source Software. The favourable acceptance of Open Source products by business and the direct involvement of major IT vendors in Open Source Software development have transformed Open Source technology from a fringe activity, developed for public good, to a mainstream, commercially viable form [14]. On the other hand, the collaborative nature of the Open Source Software culture makes use of a wide volunteer community, which conducts its development activities in a decentralized environment that has the direct result of effectively lowering production costs and improving the software quality [15].

However, for learning institutions, the reasons vary due to mode and area of application. This is because institutions of higher learning use the technology both in learning and teaching as well as day to day operations and administration of the institutions. Institutions of higher learning have special reasons for using open source software. This is because institutions of higher learning have found open source software to be cost-effective and can save them money. Even in the richest countries, schools are short of money. Open source software gives schools, like other users, the freedom to make copies and redistribute the software, so the school system can make copies for all the computers they have. In poor countries, this can help bridge the digital divide. This rather obvious reason, while important, is shallow and, therefore, should not be considered as a key reason for choosing this kind of software because a learning institution is more than just operation cost. In reality, today's open source movement is more mature, and the trends underlining it are more advanced and widely engaged. The revolution has had a significant impact, and to treat Open Source as if it is still about saving a few bucks on a software license or socking it to Microsoft is to misunderstand how far the Open Source movement has come.

Consequently, Open Source Software has found more use in these institutions because it permits faculty and students to learn how the software works. To learn to write software well, students need to read and write a lot of source code. They need to read and understand real programs that people really use. They will be intensely curious to read the source code of the programs that they use every day. Such opportunity is not possible with proprietary software, thus learning

institutions may prefer using Open Source Software for learning purposes. This is because Open Source Software encourages everyone to learn.

According to the data obtained from the study, the students and members of teaching staff cited ease of access, ease of use, lack of vendor dependency and enhancement of learning and teaching as some of the major reasons why they prefer using Open Source Software and tools in learning and teaching, respectively. Out of the students involved in the study, 366(91%) affirmed that they always use Open Source Software and tools in learning while 48(96%) of the members of staff affirmed that they always make use of Open Source Software and tools in teaching as shown in Figure 1 and Figure 2, respectively.

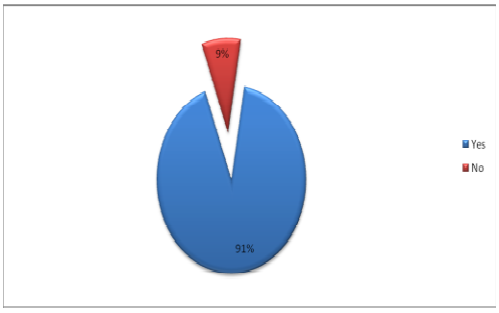

Figure 1: Students' responses to their use of Open Source Software and tools in learning

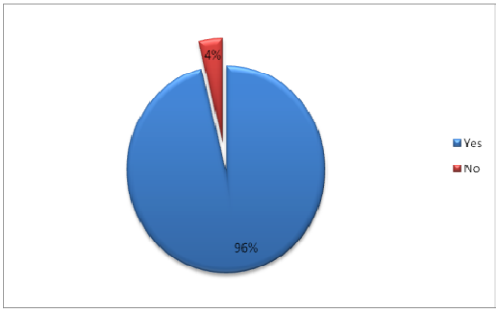

Figure 2: Teaching staffs' responses to their use of Open Source Software and tools in learning

Students were also required to rate the relevance Open source software and tools has had in learning. Their responses are as shown in Table 1.

Table 1: Students' responses to relevance of Open source software and tools in learning

Relevance of OSS	F	%
Very relevant	159	39.75
Relevant	181	45.25
Fairly relevant	56	14.00
Irrelevant	1	0.25
Very irrelevant	3	0.75
TOTAL	400	100.00

The fact that Open Source Software and tools are readily available as free downloads makes them affordable by students hence making them easy to acquire. Such software and tools also come bundled with their source code which the students can review and modify hence making them a major resource in learning of software-based courses. In addition to students and teaching staff, the study also focused on heads of information and communication technology (ICT) sections with a view to establishing why they use open source technology in the daily operations of the institutions. It was established that the institutions of learning prefer using products of open source technology because they are flexible since the source code can be modified to suit the needs of the users; there are automatic updates and security patches readily available online; and also because open source comes in versions compatible with the various operating system platforms. This gives users the freedom to use Open Source Software and tools without worrying about their operating system platforms. The data obtained indicates that

300(81.96%) of the students use OSS because they are easy to acquire, 350(95.63%) said they use OSS because they are easy to use while 280(76.5%) and 290(79.23%) of the students said they use OSS because there is no dependence on vendors, and they enhance learning, respectively as shown in Figure 3.

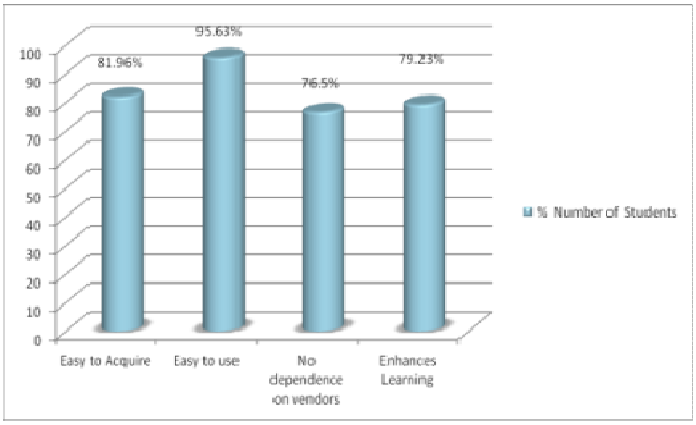

Figure 3: Students' responses to why they use Open Source Software and tools in Learning.

On the other hand, 48(100%) of the teaching staff said OSS is easy to acquire, 44(93.75%) said OSS are easy to use while 45(93.75%) of the staff said there is no dependence on vendors while using OSS. In addition, 48(100%) of the staff said that OSS enhances teaching of software based courses as shown in Figure 4.

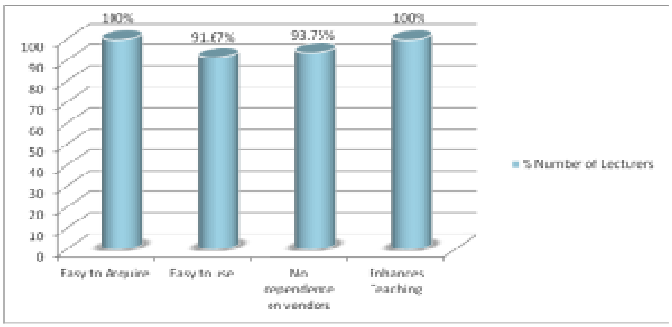

Figure 4: Teaching staffs' responses to why they use Open Source Software and tools in teaching

The participants of the study also mentioned the availability of open source software and tools in a wide range of forms and versions, which are readily available as free downloads as another major reason why they widely use the technology in learning, teaching and general daily operations of the institutions. Some of the mentioned software and tools include web servers, Operating systems, content management systems, MYSQL tools, network management systems, security management systems and browsers among others. In this regard, 300(81.97%) of the students said they have used OSS's web servers which includes Apache, 280(76.5%) said they have used OSS's Operating systems which include Linux while 200(54.64%) of the students said they have used content management systems such as Joomla. The data also indicated that 350(95.62%) of the students said they have used query language tools such as MySql admin and Navicat, 250(68.31%) said they have used OSS's Network Management systems such as Squid while 240(65.57%) and 220(60.11%) of the students said they have used security management systems and enterprise resource planning systems, respectively. The students stated having used ERP in relation to learning and not office use. This is as shown in Figure 5 and
Figure 6, respectively.

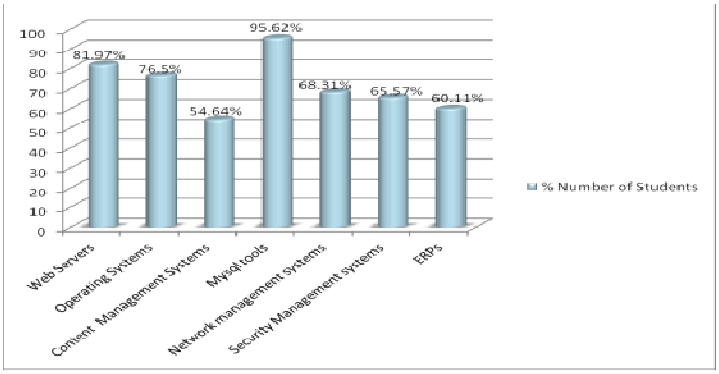

Figure 5:Students' responses to the types of Open Source Software and tools they use in learning.

This is because ERP offers a good tool for learning modular method of programming since its design and development is based on modules that represent the various sections of use in an organization. This data clearly presents the various forms of Open Source Software and tools available for use in institutions of higher learning in Kenya.

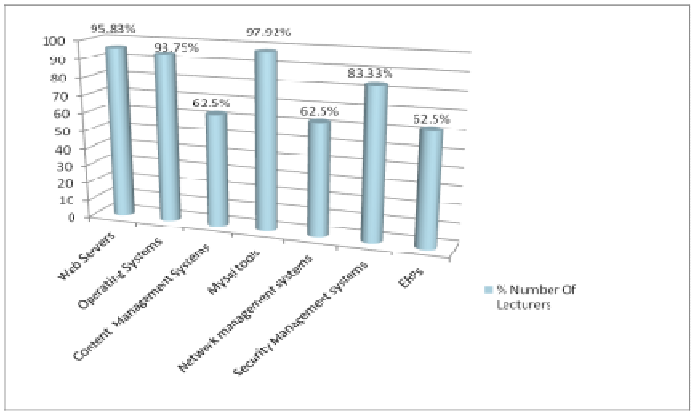

Figure 6: Teaching Staffs' response to the types of Open Source Software and tools they use in teaching

All the individuals involved in the study rated open source technology products as either very relevant or relevant, respectively. This clearly shows that emergence of Open Source technology has had a huge uptake and positive impact in teaching, learning, and daily operations in institutions of higher learning in Kenya.

5. DISCUSSION OF FINDINGS

The main purpose of this paper is to present the benefits Institutions of higher learning can leap from adopting Open source technology in academia as well as general day-to-day operations. The findings of the study clearly shows that there is a wide range of open source tools currently available for use by both staff and students. These tools which range from web servers to operating systems. This finding answered the question What are the various forms of Open Source Software being used in Kenyan learning institutions? This was one of the research questions. In addition the study established that many users prefer using open source software and tools because they are readily available, updates and patches can be easily obtained online and also reduces dependency on vendors. These findings were based on the question, What are the reasons underlying the use of Open Source Software in institutions of learning in Kenya? Open source technology has gained popularity and its adoption continues to increase. The answers to these two major research questions as obtained from the findings of this study clearly confirm this.

6. CONCLUSION

Access to readily available open source software and tools together with their source code has enabled students in institutions of learning to review and modify such codes. This has in addition to imparting them with practical skills in programming, exposed them to the various frameworks behind such systems. Open Source technology reduces the time frame required in coming up with a functioning software. All a developer needs is customize an existing software to suit a client's requirements. However, to gain such skills students need to interact with as much source code as possible. This has been possible with existence of Open Source software and tools. By embracing Open Source technology, institutions of learning can train and produce market ready programmers who can take advantage Open Source customization and emerge as qualified software developers.

The findings discussed in this paper have clearly outlined the benefits which many companies reap by utilising this technology. Such benefits are far reaching for institutions of learning since they exhibit both sides of the software utilization (Learning/teaching and general daily operations of the institutions). By embracing Open Source technology, these institutions are, therefore, able to minimize general cost of operations that could have otherwise been incurred in procuring suitable proprietary software and tools for learning and teaching and general operations in these institutions. Students and teaching staff are nowadays able to access the source code behind an application and, therefore, making learning and teaching easier, interesting and more practical. Such applications are within reach of the students as well as the teaching staff for free. They do not have to fully depend on one vendor for support since updates and new versions are regularly availed through the Internet. There is also flexibility to review or change the source code to suite the institution's desired output. This coupled with security, deployment, easier customization, greater interoperability, performance and greater longevity have seen the uptake of Open Source Software and tools become huge thus making the technology very attractive as compared to proprietary products. Today, there is an open source application for use in almost every sector including networks, security, academia as well as cloud computing. The users of open source software or products no longer have to worry about copyright infringement issues. This is because legal hassles, in terms of having unauthorized copies, breach of licenses, unintentional copyright forging, all are almost eliminated when you use open source product. This paper,

therefore, highly recommends all learning institutions to embrace the use of Open Source products in learning and teaching as well as general operations since the benefits of this technology are huge and far reaching. There is need for all students undertaking software-based courses to use Open Source products for learning because they will have the freedom to review and modify the available source code hence acquiring much market needed skills in software development. The institutions of learning will therefore be sure to produce market ready programmers already equipped with the relevant programming skills.

7. RECOMMENDATIONS OF THE STUDY

Based on the foregoing findings of the study, there is need for learning institutions to adopt teaching of open source technology in their syllabus so as to increase the uptake of open source products in the academia and make learning of software based courses easier and practical. In addition, faculties and academic departments should embrace open source technology in teaching software based courses so as to equip their students with the market desired practical skills. Students also should increase their interaction with open source tools and their source codes in order to increase their programming skills and equip themselves with the market desired skills in software development.

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BIOGRAPHY

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