The Adoption Footprints of Free and Open-Source Library Management Systems in Higher Education Institutions in Zambia

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Abstract
Many libraries the world over have turned to free and open-source library management systems (FOSLMS) for their automation needs. The main objective of this study was to investigate the extent to which FOSLMS were being used in libraries in Zambian higher education institutions (HEIs). Furthermore, the study sought to investigate factors that influence the adoption of FOSLMS in HEIs. The study was quantitative in design and data was collected from 142 HEIs with functioning libraries. The findings revealed that 42 (78%) out of 54 libraries in HEIs that have automated their operations use FOSLMS. Koha was found to be the most used FOSLMS and that low cost of adoption was the principal factor fueling FOSLMS's adoption in HEIs in Zambia. Given the findings, the study recommends that the Zambian Government introduces a policy promoting the use of FOSS in public institutions including HEIs; the Library and Information Association of Zambia raise awareness of FOSLMS through workshops and conferences; the Zambian library science schools include, in their undergraduate programs, modules on FOSLMS.

Keywords: Free and Open-Source Library Management Systems, Higher Education Institutions, Library Automation, Zambia

1. INTRODUCTION

Libraries have for long been using computer systems to automate their operations to improve service delivery. However, the use of computer technology in libraries was confined to big libraries, such as academic and research libraries, which could afford both the cost of hardware and software (Kochtanek & Matthews, 2002). This, however, has changed due to the omnipresence of free and open-source library management systems (FOSLMS) such as Koha, Evergreen, ABCD, SLiMS, NewGenLib, and OpenBiblio. FOSLMS provide a valuable alternative to proprietary systems and have given impetus to libraries, especially in developing countries such as Zambia, to automate their operations to improve service delivery.

1.1 Background to the Study

Like other libraries in developing countries, library automation in the higher education sector was largely limited to a few university libraries such as the University of Zambia and Copperbelt University libraries (Nkhoma, 2003). For instance, the University of Zambia began the automation of its library in 1996 using Dynix using a proprietary library management system that was donor-funded (Mwacalimba, 1996). However, in the late 1990s, the library automation landscape in Zambia began to change with the coming of a free library system called Computerised Documentation Services/Integrated Set of Information Systems (CDS/ISIS) which was sponsored by UNESCO. CDS/ISIS was widely used in the late 1980s and 1990s by libraries in Sub-Saharan African countries such as Zambia (Mutula, 2012). The dawn of the 2000 decade saw the birth of robust FOSLMS such as Koha, Evergreen, ABCD and OpenBilio. The new generation of FOSLMS is integrated and available for download from the Internet for use in library automation.

1.2 Statement of the Problem

In a bid to accelerate the process of library automation in HEIs in Zambia, cooperating partners such as the Indian Government through its Indian Technical and Economic Cooperation (ITEC) programme and the International Network for the Availability of Scientific Publications (INASP) have facilitated the adoption of FOSLMS by providing training to librarians in HEIs (Bwalya, Akakandelwa, & Mwalimu, 2019). Further, the Flemish Association for Development Cooperation and Technical Assistance (VVOB) also provided Koha training in all government colleges of education (MESVTEE & VVOB, 2013). However, the extent to which FOSLMS are used in HEIs is not known. It was against this background that a comprehensive study was conducted to accurately describe how widespread was the use of FOSLMS in library automation in HEIs in Zambia.

1.3 Objectives of the Study

The main objective of this research was to investigate the adoption footprints of FOSLMS in libraries in HEIs. In so doing, the study specifically sought to:

i. establish the extent to which libraries in HEIs use FOSLMS,
ii. establish the most used FOSLMS in HEIs,
iii. determine factors that influence the adoption of FOSLMS in HEIs.

1.4 Definition of Key Concepts

In this study, the below terms have been used to denote the following:

i. **Free and open-source software (FOSS)** -software that is publicly available for use at no cost and its source code is available for others to modify (Rankin, 2014).

ii. **Free and open-source library management system**- software that is freely available for use by libraries to collect, process, store, and distribute information to support decision making on all the activities of libraries such as circulation, acquisition and cataloging (Deshmukh, 2016).

iii. **Higher education institution (HEI)** – is an organisation providing higher, post-secondary, tertiary or third-level education (IGI Global, 2017). HEIs in this study include universities, academies, colleges, nursing schools, institutes, business, and technical colleges.

2. LITERATURE REVIEW

2.1 Concept of Free and Open-Source Software (FOSS)

The idea of using, sharing, and modifying software freely can be traced back to the year 1983 when Richard Stallman, who was a researcher at Massachusetts Institute of Technology (MIT) Computer Laboratory, began a project called GNU Not UNIX (GNU) and Free Software Foundation. According to Orloff (2009), Stallman grew skeptical of the commercial software packages that were selling at very high prices at computer stores. He advocated for the introduction of free software whose source codes can be copied by computer programmers and users to modify to improve its performance. Free software is seen as a matter of liberty (freedom) not price. It is like *freedom of speech,* not *free beer*. According to Rankin (2014), Stallman described free software as having four characteristics (freedoms), namely: -

a) the freedom to run the program for any purpose,
b) the freedom to study how the program works and adapt it to one's needs,
c) the freedom to distribute copies so that one can help a neighbor, and
d) the freedom to improve the program and release your improvements to the public so that the whole community benefits.

2.2 History of FOSLMS

The development of FOSLMS started in the late 1970s and early 1980s. According to Kochtanek and Matthews (2002), in the 1970s and 1980s, the price of computer hardware dramatically fell but the price of software rose exponentially. This resulted in many academic libraries struggling to pay for such software hence start looking for alternatives. In the 1980s, UNESCO released the first free library management software called Computerized Information Service/ Integrated Scientific Information System (CDS/ISIS) in 1985 (Nowicki, 2001). CDS/ISIS existed as the only library management system until late 1999 when versatile and integrated FOSLMS such as Koha and MyLibrary began to emerge (Londhe & Patil, 2015).

2.3 Common FOSLMS

The library management systems market is inundated with many FOSLMS today. According to Muruli and Kumar (2014), the most popular FOSLMS are Evergreen, Koha, NewGenLib, OpenBiblio, ABCD, and PMB (table1). According to Londhe and Patil (2015), Koha leads other FOSLMS as regard to the number of releases, a community of users and developers. Further, Koha is ranked first among FOSLMS because it has excellent modules.

Table 1: Some active FOSLMS

SN	Name of software	Year released	Country
1	ABCD	2008	Brazil/Belgium
2	Evergreen	2006	United States of America
3	Koha	2000	New Zealand
5	NewGenLib	2008	India
6	OpenBiblio	2002	Netherland
7	PMB	2003	France
8	SLIMS	2006	Indonesia

2.4 The adoption of FOSLMS in HEIs in Some Selected Countries

2.4.1 Some Sub-Sharan African countries

In Zambia, there is an increased trail of evidence through literature indicating that libraries are adopting Koha. According to MESVTEE and VVOB (2013), all public colleges of education in Zambia received training in Koha to automate libraries to ensure easy access to information resources by student teachers and lecturers. OpenBiblio is another FOSLMS reported to be used in Zambia by Grace Academy in Ndola (Wishart, 2012).

In Malawi, Koha has been adopted by many libraries including academic libraries. Among HEIs that have adopted Koha include Mzuzu University that began piloting with Koha in 2008 and later adopted it (EIFL, 2010).

In Kenya, Adera (2012) discovered that 67% out of the 200 libraries surveyed were using Koha. OpenBiblio and Winisis came second and third respectively. Makori and Mauti (2016) also discovered that Koha was widely used in Kenya among HEIs. On the other hand, ABCD was reported to be used by Moi University in Kenya (Marshall Breeding, 2017).

In Nigeria, 68% of 36 academic libraries surveyed were found to be using Koha (Kari & Baro, 2015). Further, Edem and Bassey (2016) found that 48.3% of the 58 universities studied in Nigeria were using Koha. Koha is said to have gained popularity in Nigerian libraries (Uzomba, Oyebola & Izuchukwu, 2015).

2.4.2 India

India has also been home to many FOSLMS such as Koha and NewGenLib. According to Kurmar and Jasimudeen (2012), Koha was first installed in India at St Joseph's College, Devvagiri in 2010. Since 2010, Koha has attracted small and big libraries in India. According to Marshall Breeding (2017), there were more than 199 libraries in India using Koha. Another FOSLMS used by libraries in India is NewGenLib. According to Muruli and Kumar (2014), NewGenLib is widely used in India. It is another choice for libraries contemplating migrating to FOSLMS.

2.4.3 United States of America

In the United States of America (USA), Koha has gained ground. It is used by many HEIs. According to Marshall Breeding (2016), Koha continues to attract a diverse demographic of small to midsized academic, school, and public libraries in the USA. For example, ByWater Solutions, a consultancy firm reported having 919 Koha clients in 2016 (Marshall Breeding, 2016). Evergreen is another FOSLMS that is widely used in the USA and it has attracted more public libraries, with 791 receiving support from Equinox (Marshall Breeding, 2016).

2.5 Factors influencing the adoption of FOSLMS

Several theories have attempted to explain factors that influence the adoption of technology. These include Perceived Attributes of Innovation Theory, Unified Theory of Acceptance and Use of Technology 2 (UTAUT2), Management Information Systems Adoption Model, and Delone and Mclean's Model of Information Systems Success. After analysing the four theories relating to the adoption of innovation and information systems, five factors that influence the adoption of technology were identified. These are the low cost of adoption, ease of use, management support, perceived usefulness, and social influence. As captured in Figure1, all the five independent variables are moderated by demographic variables such as age, gender, and level of education.

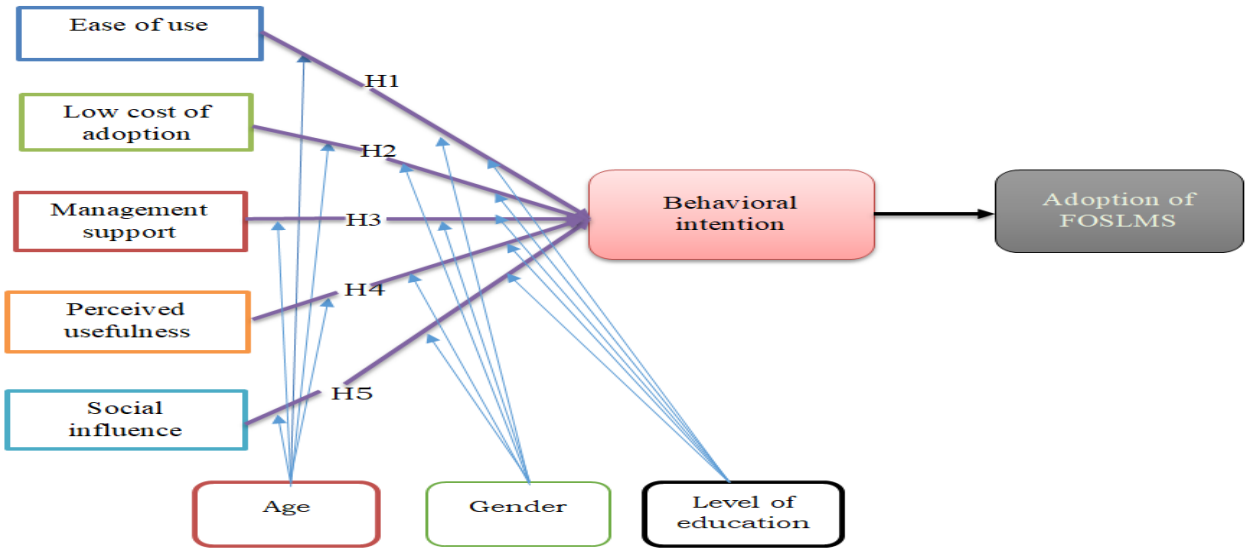

Figure 1: Proposed Model for the Adoption of FOSLMS in HEIs in Zambia

The five factors have been grouped into four namely technological, economic, organizational, and social factors.

2.5.1 Technological factors and their hypotheses

Technological factors are the design attributes of any technology (Halonen & Others, 2009; Mamary, Shamsuddin &Aziati, 2014). These include ease of use and perceived usefulness of an information system such as FOSLMS. In this regard, it can be argued that FOSLMS have to be easy to use and perform better than commercial systems if they have to be adopted by libraries in HEIs in Zambia. Therefore, it was theoretically expected that:

i. *Libraries in HEIs in Zambia have adopted FOSLMS because they are perceived useful.*

ii. Libraries in HEIs in Zambia have adopted FOSLMS because of their perceived ease of use.

2.5.2 Economic factor and its hypothesis

Economic factors such as the cost or price value of any technology matters (Venkatesh, Thong & Xu, 2012). Libraries and other institutions are struggling to have more financial resources to provide library services (Nagia, 2012). Cost in many libraries determines the type of library management system to be adopted. In this regard, if the cost of adopting FOSMLS is much lower than that of commercial library management systems, more libraries in HEIs in Zambia are likely to adopt FOSLMS. It was, therefore, proposed that:

i. Libraries in HEIs in Zambia have adopted FOSLMS because they believe that FOSLMS were cheaper

2.5.3 Organisational factor and its hypothesis

Successful implementation of an information system such as FOSLMS depends on management providing the much-needed supporting conditions (Venkatesh, Thong & Xu, 2012; Mamary, Shamsuddin & Aziati, 2014). Management support starts with a decision to adopt a given technology. Management support also includes the provision of financial support to the adoption of the new technology. In this regard, the successful adoption of FOSLMS in HEIs in Zambia requires management support. It was, therefore, theoretically proposed that:

i. Libraries in HEIs in Zambia have adopted FOSLMS because of management support.

2.5.4 Social factor and its hypothesis

Social influence plays a key role in the adoption of any technology (Venkatesh, Thong & Xu, 2012). If influential people and organisations in a society adopt an innovation, more people and institutions are likely to adopt such technology. In this regard, the adoption of FOSLMS in HEIs in Zambia could be influenced by social factors. It was theoretically, therefore, proposed that:

i. Libraries in HEIs in Zambia have adopted FOSLMS because of social influence

3. METHODOLOGY

The study was quantitative in design and a descriptive cross-sectional survey was used. A total of 154 HEIs with functioning libraries were studied; a complete census of 154 HEIs was employed.

One staff in-charge of a library filled a questionnaire. Collected data were analysed using Statistical Package for Social Science (SPSS) version 23.

4. FINDINGS OF THE STUDY

The response rate for this study was 92% (142) as 8% (12) of HEIs declined to take part in the study. As can be seen in figure 2, many (44) surveyed HEIs were colleges of education.

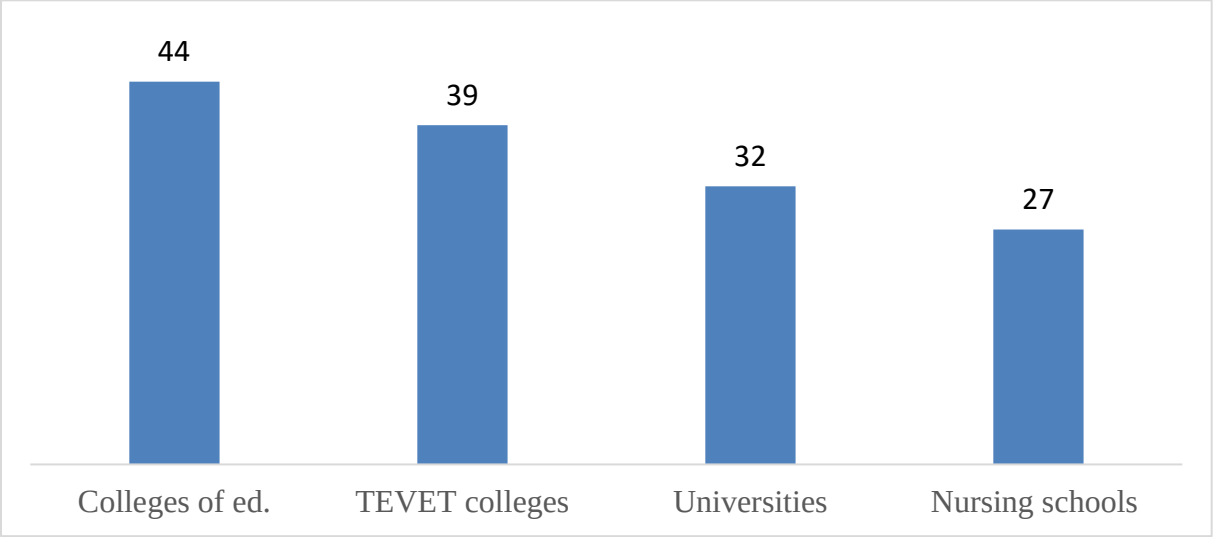

Figure 2: Types of HEIs that participated in the Study

In terms of the characteristics of the respondents, the majority (58%) were female and 52% were below the age of 35. Further, many respondents held the position of librarian and had a Diploma or Bachelor's degree qualification in Library and Information Science (LIS) (table 3).

Table 2: Characteristics of respondents

Gender Female=> 83 (58%) Male=> 59 (42%)	**Position/Job title**	Library Assistant	26 (18%)
		Assistant Librarian	35 (25%)
		Librarian	62 (44%)
		Chief Librarian	1 (0.7%)
		Others	18 (12%)
Age <35 => 74 (52%) 35-44 => 43 (30%) 45-54 => 15 (11%) 55> => 10 (7%)	**Qualifications in LIS**	Certificate	*19 (13%)*
		Diploma	47 (33%)
		Bachelor's degree	45 (32%)
		Master's degree	8 (6%)
		Doctoral degree	1 (0.7%)
		Non-LIS qualification	22 (15%)

On the issue of library automation, out of the 142 HEIs surveyed, 54 (38%) reported having automated the basic functions of their libraries (figure 4). This implies that the majority (62%) of the HEIs have not automated their libraries.

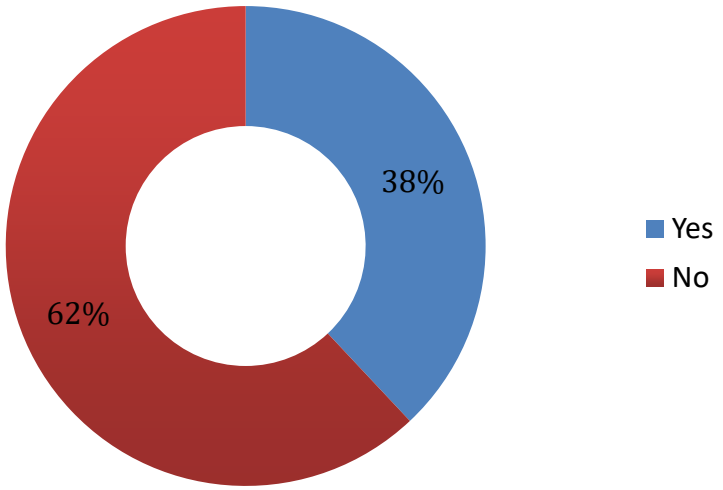

Figure 3: Library automation

Out of the 54 libraries that automated, 42 (77.8%) used FOSLMS while 12 (22.2%) deployed commercial library management systems (CLMS). The findings further show that more (14) colleges of education use FOSLMS as shown in figure 4.

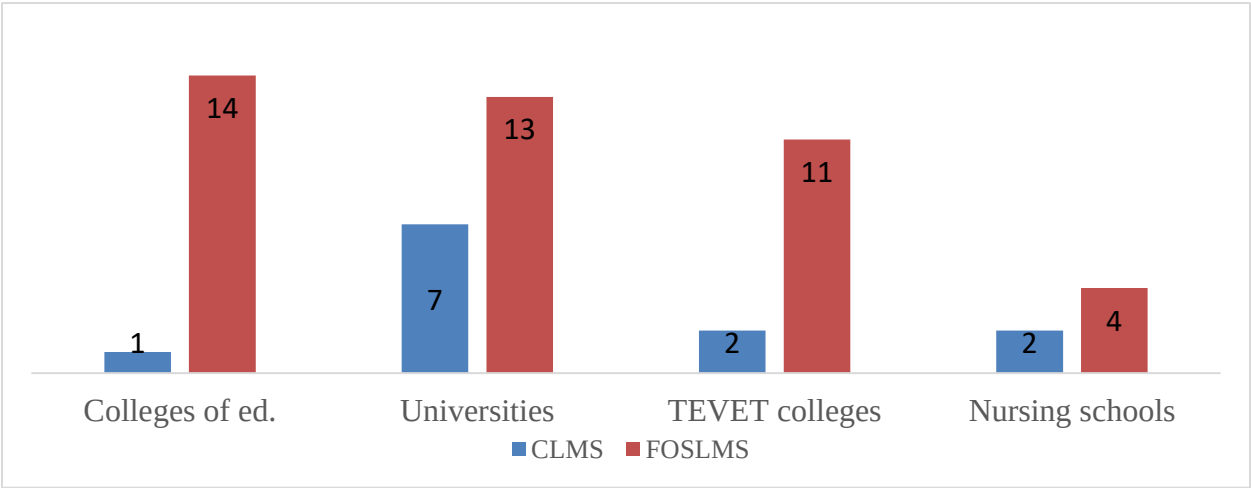

Figure 4: Types of library management systems used by the type of HEIs

Among the 42 libraries that indicated that they had automated their operations using FOSLMS, 41 libraries were using Koha while only one library was using OpenBiblio (table 3).

Table 3: Name of the library system used by libraries

		Type of library management		
SN	**Library management system name**	*CLMS*	*FOSLMS*	*Total*
1	Destiney	2	0	2
2	Liberty5	1	0	1
3	Librarica	1	0	1
4	Library gold	2	0	2
5	Koha	0	41	41
6	Unicorn-SirsiDynix	1	0	1
7	OpenBiblio	0	1	1
8	(Astria and in-house systems)	5	0	5
	Total	**12**	**42**	**54**

As regard factors influencing the adoption of FOSLMS, all the 42 respondents cited cost as the principal reason for adopting FOSLMS. Other factors that were cited by respondents include ease of use of FOSLMS, support from management, and the fact that FOSLMS were widely used in Zambia (social influence). On the contrary, the perception that FOSLMS performs better than CLMS received the lowest score (table 4). Further, a Chi-square test of association computed at 0.05 (95%) level of confidence revealed a strong association between ease of use, management support, and social influence, and adoption of FOSLMS with P-values less than 0.05 (table 4). In this regard, the three null hypotheses were rejected. Note that the Chi-square test was not conducted on the low cost of adoption because all respondents agreed that it was the main reason for adopting FOSLMS.

Table 4: Factors influencing the adoption of FOSLMS in HEIs

Factors influencing the adoption of FOSLMS	Yes	No	Do not know	Total	Null hypothesis	Chi-Square	df	P-value
FOSLMS are cheaper than commercial systems	42	0	0	42	***H0:*** Libraries in Zambia have adopted FOSLMS not because they are cheap	--	--	--
FOSLMS are easy to use	36	1	5	42	***H0:*** Libraries in Zambia have adopted FOSLMS not because they are easy to use	52.429[a]	2	*.0001*
Management provided support for FOSLMS	30	9	3	42	***H0:*** Libraries in Zambia have adopted FOSLMS not because of management support	*28.714[a]*	*2*	*.0001*
FOSLMS perform better than commercial systems	*12*	*14*	*16*	42	***H0:*** Libraries in Zambia have adopted FOSLMS not because they perform better	*.571[a]*	*2*	*.751*
FOSLMS are widely used by other HEIs in Zambia	*28*	*6*	*8*	42	***H0:*** Libraries in Zambia have adopted FOSLMS not because they are widely used	*21.143*	*2*	*.0001*

5. DISCUSSION OF THE RESEARCH FINDINGS

The research findings revealed that the majority of HEI libraries (62%) in Zambia are not automated. Most of our academic libraries are still using manual systems. However, it can be urged that the use of FOSLMS in HEIs in Zambia is widespread because 42 out of the 54 HEIs that had automated their operations were using FOSLMS. This finding contradicts the finding of Adera (2013) on the adoption of FOSLMS in Kenya which showed a 50-50 distribution in the use of FOSLMS and CLMS by libraries. It also emerged that FOSLMS is widely used among libraries from government colleges of education. This is partly because librarians from these colleges in Zambia are privileged to receive training and financial support from cooperating partners.

The findings further revealed that Koha was the most widely used FOSLMS in HEIs libraries in Zambia. It was found to be used by 41 (97.61%) of libraries in HEIs. This finding supports the

findings of many studies in Kenya and Nigeria that reported Koha to be the most used FOSLMS in library automation (Adera, 2016; Kari & Baro, 2015; Uzomba, Oyebola & Izuchukwu, 2015). Koha is widely used among HEIs in Zambia because many librarians from HEIs have received training on how to automate library operations using Koha. Further, there are more materials on Koha on the Internet and it is taught to the Bachelor's degree students in Library and Information Science (LIS) at the University of Zambia hence helping marketing it.

It has been established that four (4) factors namely low cost of adoption, ease of use, management support, and social influence are influencing the adoption of FOSLMS in HEIs in Zambia. These findings support Venkatesh, Thong, and Xu (2012); Mamary, Shamsuddin, and Aziati (2014) various studies found the four factors influence the adoption of any technology. The findings of the study however refute the assertion that the adoption of FOSLMS is based on the fact they perform better than commercial library management systems. In this regard, over 71% of the respondents did not believe that FOLSMS performed better than commercial library management systems.

6. CONCLUSION AND RECOMMENDATIONS

It can be concluded that the use of FOSLMS in HEIs in Zambia is widely spread as 78% of libraries that have automated their operations have done so using FOSLMS. The findings of the study have revealed that Koha is the most used FOSLMS in HEIs in Zambia and that low cost of adoption, ease of use, management support, and social influence are the major factors fueling the adoption of FOSLMS in HEIs in Zambia. To increase the use of FOSLMS in library automation in HEIs in Zambia, it has been recommended that:

i. The Zambian Government introduces a policy promoting the use of FOSS in public institutions including HEIs.
ii. The government should make library automation a requirement for accreditation of HEIs.
iii. The Library and Information Association of Zambia and the Library Science Schools should raise awareness about the existence of other FOSLMS such as ABCD, Evergreen, NewGenLib, PMB, and SLiMS.

iv. All Library Science Schools in Zambia should include modules in their curricula on FOSLMS.

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