

Open Source Learning Management System Selection Framework for Higher Learning Institutions: A Case of Selected Public Universities in Kenya

Emily Chepkorir^{1*}, Harrison Bii², Damaris N. Odero³

¹Department of Computing and Information Technology, The Eldoret National Polytechnic,

²Department of Computing, Information Sciences and Knowledge Management, University of Kabianga,

³School of Information Sciences, Moi University

*Corresponding author email: millyngenol@gmail.com

Published online: 4th July, 2023

Abstract

The selection of the most appropriate learning management system (LMS) is a strategic decision that has a crucial role in the future success of the Computer Aided Learning (CAL) programmes. A literature search reveals that little research has been reported on the selection of open source LMSs. However, there is a wide range of open source software systems for learning management. These products must be selected for adoption and use in higher educational institutions. Kenya's universities have embraced and use open source LMSs but many of them still find it a major challenge to effectively select an appropriate open source LMS. This paper reports a study carried out to propose a model for open source LMS selection and adoption in Kenya's public universities. The specific objectives of the study were to: examine open source LMS adoption in public universities in Kenya; determine the factors considered in their selection; and to develop a model to aid selection and adoption of open source LMSs in public universities in Kenya. The study employed a descriptive approach involving multiple cases to gather and analyze data. The study found that open source LMSs have gained some acceptance and are increasingly being adopted for use in public universities in Kenya. When selecting open source LMSs for adoption, public universities consider many factors including compatibility with existing systems, ease of use, user requirements, security, and cost. Each of these factors was weighted differently by different respondents. The findings were then used to develop the proposed model to aid open source LMS selection.

Keywords: Selection, Learning Management System, Open Source, Open Source Learning Management Systems, Model.

Introduction

Over the past few years, learning management systems (LMSs) have had a significant role in institutions of higher learning. This is due to the emergence and rapid growth of computing and communications technologies such as the internet and its connectivity and software that facilitates learning activities. These technologies recorded increased usage due to emergence and spread of COVID-19 and its attendant restrictions. In addition, college and university students are increasingly becoming more technically savvy and demand their faculties to implement the use of technology in teaching and learning processes (Ganjalizadeh & Molina, 2006). Some researchers observe that a large percentage of students in public institutions of higher learning in Kenya prefer e-learning compared to other methods of teaching and learning (Makokha & Mutisya, 2016). This preference for e-learning methods may be one of the reasons behind the decent amount of LMS platforms that are available to colleges, universities and the general public. These LMSs come in two categories: proprietary, which is licensed, available for a fee and prohibits the access to distribute and modification of the source code (Owais, 2005; Murrain, 2007); and open source that any individual or institution may access, use, modify, share, and redistribute the source code freely (Cavus & Zabadi, 2014). The rapid growth, adoption and popularity of open source software (OSS), in general, and open source LMSs, in particular (Fakhereldeen, 2013), has led to the availability of a variety of open source LMSs.

Statement of the Problem

Extant literature reveals the availability of many models for evaluating LMSs. However, the literature has very little research reported on the selection of open source LMSs, especially in institutions of higher learning. Users of these systems, therefore, face a number of challenges when choosing them, especially as they take into account cost and their institution-specific requirements (Atos Origin, 2006; Cavus & Zabadi, 2014; Kumar & Lamba, 2013). Although most universities in Kenya have embraced open source LMSs, many of these institutions still find it challenging to effectively select appropriate LMSs for their use. There exists a trend in which these universities have moved from one open source LMS to another (Tarus, Muumbo, & Gichoya, 2010). In view of the foregoing observations, this study was designed to develop and propose a model that may facilitate effective open source LMSs selection for adoption and use in Kenya's public universities.

Objective of the Study

The objectives that this study sought to achieve were:

- 1) To establish the extent of open source LMSs adoption in public universities in Kenya;
- 2) To determine the factors that public universities in Kenya considered in selection and adoption of open source LMSs; and
- 3) To propose and develop a model for selection and adoption of open source LMSs in public universities in Kenya.

The above objectives were achieved in two broad ways, through a critical literature review and primary data collection as described in the subsections below.

Literature Review

Open Source LMSs in Public Universities

Literature revealed that public universities in Kenya have already deployed LMSs to support their learning and teaching activities. However, their adoption of these systems has been rated to be at the infancy stages (Makokha & Mutisya, 2016). This may be due to a number of factors such as inadequate ICT and e-learning infrastructure, financial constraints, lack of universities e-learning policy, and low usage of e-learning facilities by lecturers and students, among others (Kibuku, Ochieng & Wausi, 2020).

The state of open source LMSs' adoption by these universities has shown a considerable increase (Odhiambo, 2009; Tarus, 2011). The universities opted for open source systems for different reasons that revolve around the potential benefits and opportunities accrued from these types of systems. Some examples of open source LMS platforms that have been implemented by universities include Moodle, Claroline, Ubuntu, and Chisimba (Odhiambo, 2009; Omwenga, 2010; Tarus, Muumbo & Gichoya, 2010; Njenga & Fourie 2010; Kibuku, Ochieng & Wausi, 2020).

Factors Considered in Selection of open source LMSs

From the literature reviewed on selection of LMS, it was deduced that some factors are key determinants of a platform to be adopted. These factors include flexibility, security, stability, performance, maturity and durability, reliability, technical support, ease of use (EoU), compatibility/interoperability, and efficiency. Others are documentation, usefulness, user friendliness, cost, market share, functionality/user requirements satisfaction, customizability, and accessibility (Karagoz et al, 2017; Kasim & Khalid, 2016; Cavus & Zabadi, 2014; Berking & Gallagher, 2013; Martin et al, 2008; Atos Origin, 2006). In terms of importance,

these factors are weighted differently by the users when selecting the desired LMS (Aberdour, 2007; Atos Origin, 2006; Larry, 2010).

Methodology

This study employed a multiple-case study design. Four public universities with well-established ICT and Open, Distance and E-learning directorates were sampled. These were Moi University, University of Nairobi (UoN), Jomo Kenyatta University of Agriculture and Technology (JKUAT), and Kenyatta University (KU). The study targeted a population consisting of all the personnel in the ICT and ODL directorates. At the time of the study, there were 4 heads of ICT centres and 4 heads of directorate of ODL (DODL) in the four universities. In addition, we sampled 4 non managerial staff from ICT centres and 4 from DODL centres. In all, the study had a total of 16 respondents (N=16). Semi-structured interviews were undertaken with the sampled respondents and data was recorded. The recorded data was then thematically arranged and systematically analyzed to reveal patterns and relationships. The results were presented in tables, figures and prose.

Results and Discussion

As noted above, this study sought to establishing the extent of open source LMS adoption, identify factors considered by public universities in selecting open source LMSs, and develop a model that aids the selection of open source LMSs by public universities. The following subsections present the results of data analysis.

Adoption of Learning Management Systems in Public Universities

The results of this study revealed that the sampled public universities have, to a very large extent, acceptance and adopted LMSs. All of them have adopted and used open source LMSs. This finding is in agreement with the observations of other researchers that Kenya's institutions of higher learning are adopting open source LMSs because of the software's importance and advantages (Odhiambo, 2009; Tarus, Muumbo & Gichoya, 2010). When asked for reasons behind their adoption of the open source LMSs, our respondents gave the responses summarised in Table 1 below:

Table 1: Why did you Adopt open source LMSs? (n = 13)

Reason	Frequency	Percentage (%)
Reduced cost	13	100
Ready support from developers	13	100
Capability to be redesigned (customize)	10	77
Support advanced multimedia, audio and video streaming	5	38
More options/modules	5	38
Flexibility and easy to use.	4	31
Freedom	2	15
Compatibility to integrate with major world libraries	1	8
Robustness	1	8
Facilitate exercise and practice for students	1	8

From the above table, it is clear that most of the respondents embraced and adopted open source LMSs due to their low cost, availability of support, and the possibility of customizing the software to better meet their requirements.

When asked whether their choice and adoption of open source LMS was guided by any open source systems policy, most respondents indicated that they had no such policy in place then. Some of them indicated, however, that their university had an ICT policy that was yet to be approved by their university senate while others said that their ICT policy had been approved but it had no specific provisions for open source software systems. Due to this, they did not reference nor utilized the policy in their choice and adoption of the LMS they had implemented.

I. Factors Considered in the Selection and Adoption of open source LMSs

The second objective of this study determined the factors that the respondents considered in selecting and adopting open source LMSs. The data revealed that the respondents considered a number of factors as presented in Table 2 below:

Table 2: Factors considered in selection of open source LMSs

Factor	Frequency (n=13)	Percentage Response (%)
Cost	13	100
Compatibility	13	100
Ease of Use	13	100
Security	12	92
User requirements	12	92
Technical Support	11	85
Reliability	11	85
Documentation	11	85
Ease of customization	10	77
Functionality	10	77
Flexibility	9	69
Capacity	3	23
Learnability	3	23
Efficiency	2	15
Learning features	1	8

It is clear from the above table that the sampled universities considered a variety of factors during selection and adoption of OSLMSs.

II. Weights and Priorities attached to factors considered in selection

The respondents were asked to rank and assign weights to the factors they had cited. As shown in Table 3 below, the respondents had varying factors, which they prioritized and weighted differently on a scale of zero to ten with respect to importance.

Factor	Weights Attached (from R1 to R13)													Mean
Compatibility	10	10	10	10	10	10	10	9	8	10	10	7	9	9.46
Ease of use	10	9	10	10	10	10	10	8	8	10	10	9	9	9.46
User requirements	10	10	10	10	0	10	9	10	10	9	10	9	9	8.92
Security	10	9	9	10	0	10	9	10	9	10	9	7	10	8.62
Cost	9	5	4	10	9	8	8	5	5	5	7	9	8	7.08
Reliability	10	0	8	10	0	10	10	10	7	9	0	7	9	6.92
Technical Support	9	7	8	7	0	8	5	10	8	7	0	9	9	6.69
Functionality	9	10	9	8	0	2	9	10	0	10	6	10	0	6.38
Source code & Ease of customization	7	9	8	10	0	8	6	10	5	8	0	0	10	6.23
Documentation	9	4	4	7	0	4	4	8	10	9	7	5	9	6.15
Flexibility	0	0	0	10	0	10	7	9	8	9	0	9	0	4.77
Learning features	0	0	0	0	0	0	0	0	8	0	9	0	10	2.08
Capacity	0	0	0	0	0	0	10	0	0	0	10	0	0	1.54
Efficiency	9	0	0	0	0	0	0	9	0	0	0	0	0	1.38
Learnability	0	0	0	0	0	0	0	0	0	0	10	0	0	0.77

Table 3: Weights Attached to the Factors Considered in Selection of OS LMSs

From the results in Table 3, respondents in the selected universities attached some degree of importance to each of the factors considered in the selection of open source LMSs.

Proposal and Development of the OS LMS Selection Model

This study sought to propose and develop a model to guide open source LMS selection. The proposed model was built based on the factors cited and ranked by the respondents as presented in Table 3. Initial ideas for the development of the model were formulated using the Technology Acceptance Model (TAM) (Davis, 1989) and Innovation Adoption Theory (Rogers, 1983) as guides.

The model was reached at by, first, creating the initial model which was later on refined and became the final model. Initial framework was based on triangulation of the study results and the key aspects of guiding theories. The following activities were undertaken to design the initial framework:

- a) The factors identified were examined to establish their relationships.
- b) The weights and priorities were determined to establish the most important factors.

- c) A Likert scale was used to determine the significance of the cited factors.
- d) Based on the adopted theories, and selected factors the initial framework was built.

After carrying out the mentioned activities, the results obtained pointed out the factors that were crucial in the development of a model for open source LMS selection. Figure 1 below shows a functional decomposition diagram representing the initial model for open source LMS adoption.

Figure 1: Initial Model

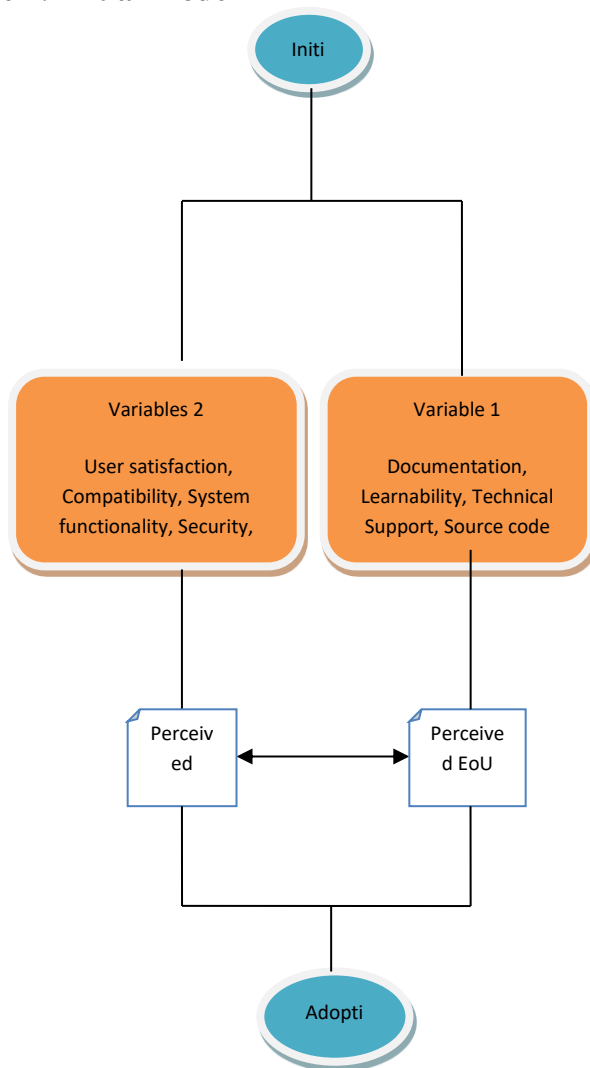


Figure 1: The initial model for OS LMS selection.

I. Functional Sections of the Model

The model has four basic functional levels with which when accomplished, would successfully provide for effective selection of a preferred OSLMS. The levels are described in Figure 2.

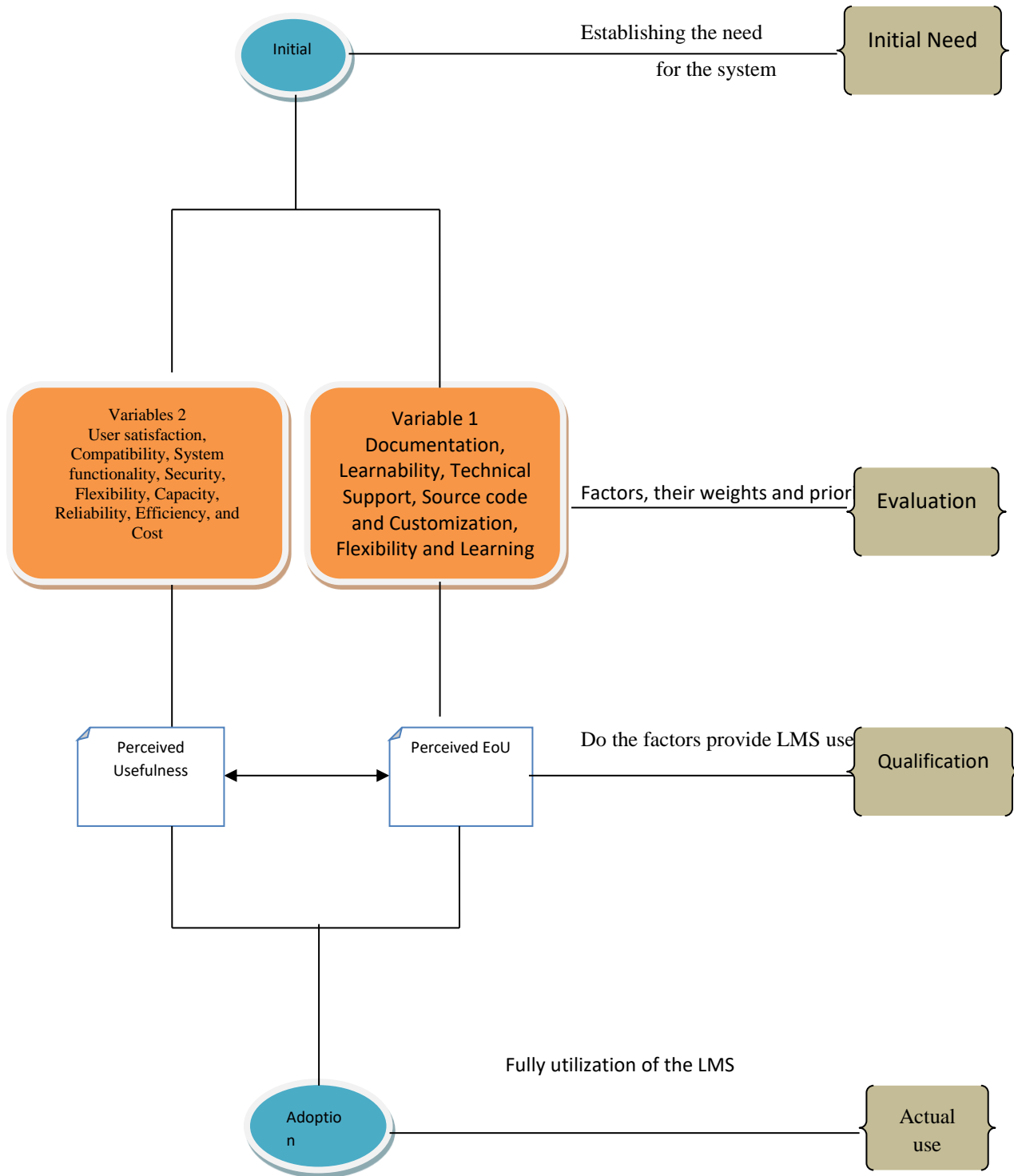


Figure 2: Functional Sections of the Proposed Model

Initial Need: The lowest level of the model where the institution triggers the need for OSLMS adoption.

Evaluation: The institution is trying to qualify the system by providing own preferred factors with their attached weights and priorities.

Qualification: Qualifying the factors identified to establish if they provide system usefulness and ease of use.

Adoption: Highest level where the users adopt the selected system based on the results from the previous stages. The full utilization of the system begins.

a) Determinant of Ease of Use and Usefulness

From the initial model, the factors were already categorised into two as variable 1 and variable 2 depending on whether they impact on system usefulness or EoU. Dastjerdi(2016) observe that EoU and perceived usefulness are determined by external factors such as software and hardware features, support from other people in using technology and also organization and social factors. In the same study, Dastjerdi(2016) observe that individual ability and quality of the system determine its usefulness. From the finding of this study, it can be argued that the factors that affects the quality of the system determines system's usefulness.

II. Creating a Refined Model for OS LMS Adoption

From the adopted models (TAM and IAM), initial model, and the factors analyzed, the refined model for OSLMS selection was developed as presented in figure 3. This refined model suggests possible selection process that can aid adoption of OSLMSs within public universities in Kenya.

The following activities and steps were carried out in an attempt to develop the refine model:

- The researcher first collect and analyzed the factors considered.
- These factors were too general thus, they were further examined to draw their relationships.
- The factors were then reduced using their weights and priorities to identify the factors used to build the final model

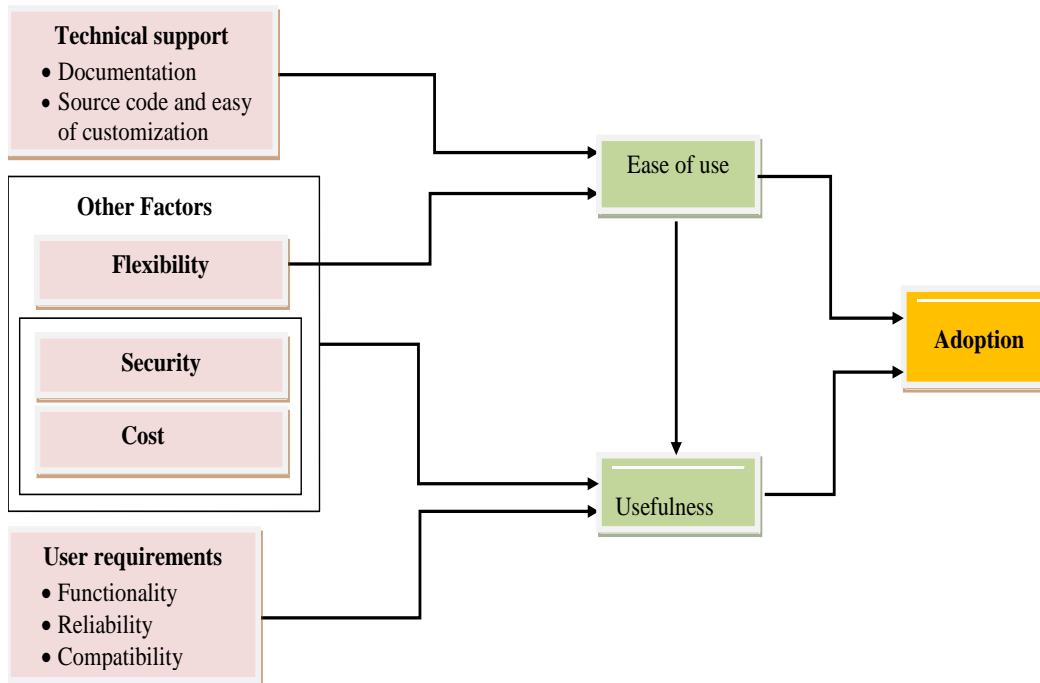


Figure 3: Refined Model for OSLMS Adoption

b) The Degree of Importance Attached to Each of the Factors

A likert scale was designed and used to represent the degree of importance attached to each of the factors considered based on their weights and priorities as presented in Table 4.

Table 4: Designed Likert Scale for the Study

Values assigned	10	9	8	7	6	5	4	3	2	1
Degree of Importance	Most Important		Important		Somewhat Important		Of little Importance		Least Important	
Degree of Acceptance	Strongly Agree		Agree		Unsure		Disagree		Strongly Disagree	

Using the scale developed, the factors and degree of importance attached to them, the results were as presented in Table 5.

Table 5: Degree of Importance Attached to Each Factor

Factor	weights Attached(Average)	Likert Scale
Compatibility	9.46	Most Important
EoU	9.46	
User requirements	8.92	Important
Security	8.62	
Cost	7.08	
Reliability	6.92	Somewhat Important
Technical Support	6.69	
Functionality	6.38	
Ease of customization	6.23	
Documentation	6.15	
Flexibility	4.77	Of Little Importance
Learning features	2.08	Least Important
Capacity	1.54	
Efficiency	1.38	
Learnability	0.77	

c) Establishing Factors' Relationship

Using Innovation Adoption Theory, relationships among the significant factors were drawn and the factors that could lead to determining another factor were categorized.

Conclusion

This study set out to examine OSLMS adoption in public universities in Kenya, determine the factors considered in their selection and to develop a model to aid selection and adoption of OSLMS in public universities in Kenya. The study concludes that OSLMS have gained great acceptance, adoption and use in public universities in Kenya. The selection and adoption of OSLMs public universities considers many factors including compatibility, ease of use, user requirements, security, and cost, among others. Each of these factors is weighted differently by the public universities. The findings of the study were used to develop the proposed model to aid OSLMS selection.

Recommendation and Future Work

Although the stakeholders who are the decision makers in public universities in Kenya are aware of the importance of selection process in OSLMSs adoption, the study revealed an ad hoc way in doing this exercise. The factors discussed above have been identified by the key

decision makers as of importance in the selection of OSLMSs. The proposed model reflects these factors. If the stakeholders would refer to the proposed model as a guideline to decision making during their selection of OSLMSs then the appropriate OSLMS would be acquired.

The study also established that there existed documented materials to be utilized by stakeholders to guide ICT processes. For instance, the ICT policy documents that can give guidance on the selection of LMSs. The study further noted that the stakeholders rarely make the most of such documents during acquisition process. This triggers the need for further research to establish the reasons for poor usage of these documents.

References

- Abbab M. (2011) *A conceptual model of eLearning Adoption*; *iJET* – 6(2): EDUCON, May 2011.
- Aberdour, M. (2007), *Open Source Learning Management Systems*. Epic press, United Kingdom.
- Atos Origin (2006), *Method for Qualification and Selection of open source software (QSOS)*.Version 6
- Berking P. and Gallagher S. (2013) *Choosing a Learning Management System*. Advanced Distributed Learning (ADL) Co-Laboratories, 02 EA3TTAN MP(3).
- Cavus N., Zabadi T. (2014) *A Comparison Of Open Source Learning Management Systems-Social and Behavioral Sciences*, 2014; 521-526.
- Estrin L., Foreman J. & Garcia S. (2003), *Overcoming Barriers to Technology Adoption in Small Manufacturing Enterprises (SMEs)*. (CMU/SEI-2003-TR-012). Retrieved February 15, 2021: <http://resources.sei.cmu.edu/library/asset-view.cfm?AssetID=6655>
- Karagoz E., Oral L.O., Kaya O.H., & Tecim V. (2017) “LMS Selection Process for Effective Distance Education System in Organizations,” *EBEEC Conference Proceedings*, The Economies of Balkan & Eastern Europe Countries in the Changed World, KnE Social Sciences, pages 347-356. DOI 10.18502/kss.V1i2.668
- Kasim N.N. M., & Khalid F. (2016) choosing the right learning management system (LMS)for high education institution context: a systematic review: *international journal of Emerging Technologies in learning.*, 2016, 11(6)
- Kibuku R.N, Ochieng D. O. & Wausi A. N. (2020) e-Learning Challenges Faced by

- Universities in Kenya: A Literature Review: *The Electronic Journal of e-Learning* 18 (2) 2020. DOI: 10.34190/EJEL.20.18.2.004
- Lewis J. (2008), Factors Affecting the Adoption of Open Source Content Management Systems in Japanese Universities: *The Hitotsubashi Journal of Social Studies* 40, 2, 2008.
- Martin L., Martinez D. R., Revilla O., Jose M., Santos O.C. & Boticario J.G. (2008). Usability in e-Learning platforms: heuristics comparison between Moodle Sakai and dotLRN, in the proceedings of international conference and workshops on community based environment
- Njenga, J. K. & Fourie, C. H. (2010) The Myths about e-Learning in Higher Education. *British Journal of Educational Technology*, [e-journal] 42(2), pp 199-212. <http://doi.org/10.1111/j.1467-8535.2008.00910.x>
- Odhiambo, O. O. (2009) *Comparative Study of the E-Learning Platforms Used in Kenyan Universities: Case Study Of Jomo Kenyatta University of Agriculture and Technology and United States International University.*
- Omwenga, E. (2010), ICT for Educational Use, 5th *eLearning Africa Conference on ICT for Development, Education and Training conference Proceedings*; Lusaka, Zambia.
- Rooij (2011), Open-source learning management systems: a predictive model for higher education. *Journal of Computer Assisted Learning*, 28(2), April 2012, pp 114-125: <http://doi.org/10.1111/j/165-2729.2011.00422.x>
- Suebsin, C. & Gerdri, N. (2009), Key Factors Driving the Success of Technology Adoption: Case Examples of ERP Adoption. PICMET '09 - 2009 Portland International Conference on Management of Engineering & Technology; Portland, OR, USA
- Tarus, J., Muumbo, A. & Gichoya D. (2010), Adoption of Open Source Software to Support E-Learning in Kenyana Public Universities: A Case of Moi University. 5th *International Conference on ICT for Development, Education and Training* .Lusaka, Zambia.