

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/333618280>

Integration of KOHA Library Management System and RfId Technology: A Review of Prospects for Modern University Libraries in Kenya

Book · June 2019

CITATIONS

0

READS

797

1 author:



Joseph M. Kavulya

Chuka university

10 PUBLICATIONS 173 CITATIONS

SEE PROFILE

Some of the authors of this publication are also working on these related projects:



Curriculum development for MSc. Information Science [View project](#)

About the author



Joseph M. Kavulya is a lecturer and Deputy University Librarian at The Catholic University of Eastern Africa, Nairobi, Kenya. He holds a B.A (Sociology and Literature) and M.Ed (Library and Information Science) from Kenyatta University, Kenya and a PhD (Library and Information Science) from Humboldt University, Berlin. His current areas research interest are social development, informatics for Development, information and digital literacy, LIS education, digital-research, scholarly communication and emerging technologies in information management.

About the book

This book reviews of the current prospects of the use of KOHA library management system in a RFID technology-driven library in Kenya. As an open source software, KOHA presents the possibility of saving money for the institution. However, due to its current limitations, there are charges for installation, customization, and training. The integration of KOHA and RFID presents potential challenges/ complications that will make it difficult for the institution to achieve its objectives in establishing a modern library. The book recommends a careful review of all options before embarking on an integration process for KOHA and RFID technology.

Integration of KOHA Library Management System & RFID Technology:

A Review of Prospects for Modern University Libraries in Kenya



Integration of KOHA Library Management System & RFID Technology: A Review of Prospects for Modern University Libraries in Kenya

JOSEPH M. KAVULYA



Finesse Publishing Ltd

© Copyright Joseph M. Kavulya, 2011

All Rights Reserved. No part of this publication may be reproduced, stored, or transmitted in any form or by any means, graphic, electronic, or mechanical, including but not limited to photocopying, recording, taping, Web distribution, or information networks, information storage or retrieval system, without the prior written permission of the publisher.

Published by:

Finesse Publishing Ltd

P.O Box 37032 - 00200

Nairobi.

Email: editor@finesseconnect.org

Designed and Printed by:

Prologue Media Ltd

P.O Box 02 - 00510

Nairobi, Kenya

Email: info@prologuemedia.co.ke

ISBN: 978-9966-7159-4-4

TABLE OF CONTENTS

EXECUTIVE SUMMARY	4
CHAPTER 1	15
INTRODUCTION	15
1.1 Background	15
1.2. The library component	15
1.3 ICT application in the university library	17
1.4 Statement of the problem	21
1.5 Objectives of the study.....	21
CHAPTER 2	23
LITERATURE REVIEW	23
2.1 Role of an integrated library management system (ILS)	23
2.3. The benefits of Radio-Frequency Identification (RFID) in Library Management	24
2.4 The principles of ILS integration with RFID system	26
CHAPTER 3	28
METHODOLOGY	28
3.1 Research design	28
3.2 Target Population	28
3.3. Description of the sample and sampling Procedures	28
3.4 Research instruments and Methods of Data Collection	29
3.5 Data analysis and presentation	30
CHAPTER 4	31
PRESENTATION AND DISCUSSION OF FINDINGS	31
4.1 Benefits of KOHA over proprietary integrated library systems	31
4.1.2 Challenges of using KOHA as integrated library system	32
4.1.3 The challenges faced by specific institutions in the implementation of KOHA	39
CHAPTER 5	49
CONCLUSION AND RECOMMENDATIONS	49
5.1 Conclusions	49
5.2 Recommendations	51
BIBLIOGRAPHY	53
APPENDENCES	57

EXECUTIVE SUMMARY

(a). Background

As part of its efforts to provide quality education a university requires to establish a high quality library to deliver relevant resources to support learning, teaching and research as well as support the University in its community service.

The central purpose of any library is to provide access to information to support the objectives of their parent institutions or interests of the communities they serve. University libraries take part directly in teaching and research process and hence are part and parcel of the innovation process, diffusion and conversion of knowledge and therefore act as tools for turning the results of knowledge into realistic productive entities.

The operations, functions and service delivery of a modern university library should ideally be underpinned by modern ICT in line with the emerging ICT dominated knowledge society. At the centre of the library functions and services is a web-based Integrated Library system (ILS), also known as Library Management System (LMS) and in recent times RFID technology which is recognized as the ideal technology for managing ICT-driven academic library of the 21st century. RFID technology facilitates innovative library services. In overall, it leads to more efficient use of human resources, better planning, control of the library processes, more accountability on the part library management, and support income generation activities of the university. These will result in higher customer satisfaction, and better return on investment.

In order for the library to function efficiently, integrated library system should be stable, and well maintained. The ILS should also support and be interfaced with other third party software applications such as RFID technology needed to support extended services. Even more important, for RFID technology to function as expected, there is need for an ILS that stable, and which supports all the functionalities of RFID.

KOHA library management system has been implemented in a number of institutions in Kenya. At the same time there are questions regarding its suitability as a university ILS of the future and whether it will assist

the university to fulfill its objectives setting up a RFID-driven library. These concerns particularly revolve around the fact that KOHA is an open source ILS. In spite of the known advantages of open source systems, they also have potential weaknesses which might compromise the overall goals of the university.

(b). Statement of the problem

There is increasing interest in use of RFID technology in libraries in Kenya. However, there are questions about its compatibility with RFID technology. For the innovative and other benefits of RFID system to be fully exploited or realized, the ILS must not only be available 24/7, but also must be constantly upgraded in line with manufacturers release of newer versions, must be compatible with newer technologies. If for any reason the ILS malfunctions, the huge investments made in the installation of RFID system will be laid to waste.

KOHA is being implemented in a number of institution in Kenya, At the same a number of issues regarding its suitability as an ILS of the future and whether it can reliably assist the university to fulfill its objectives in establishing a RFID-driven library have been raised. KOHA may present weaknesses and complications, similar to those experienced in implementing other systems. These complications will no doubt make it impossible to achieve its objectives in establishing an ultra modern library. The aim of this study therefore was to assess the suitability of KOHA as the preferred Integrated Library System (ILS) in the context of the quest for RFID driven library in Kenya.

(c). Objectives of the study

The main objective of this study was to assess the suitability of KOHA as the preferred Integrated Library System (ILS) of libraries in Kenya in establishing RFID technology-driven libraries. The study was guided by the following specific objectives:

- i. To investigate the benefits and risks of implementing KOHA in the context of a modern library concept
- ii. To assess experiences of institutions in Kenya in the implementation of KOHA

- iii. To investigate the extent to which KOHA can efficiently integrate with RFID technology
- iv. To make recommendations on the integration of KOHA and RFID technology in a library infrastructure.

(d). Research design and methodology

This study used a naturalistic research design to carry out an exploratory study on the suitability of KOHA as the preferred Integrated Library System (ILS) in conjunction RFID technology. A naturalistic design was used specifically to gather information on the experiences on KOHA in selected institutions where it has been implemented, as well as obtain the opinions of experts on the benefits, and risks involved in implementing and using KOHA. It was also used to review existing documentary evidence on the benefits and risks of using KOHA in a large library setting.

The study involved first, four (4) library managers in four institutions in Kenya where KOHA has been used or is in the process of being implemented. Secondly, it included two library managers of institutions which have implemented RFID technology with KOHA as the integrated library systems outside Kenya. Thirdly, it included a wide range of scholars who have authored peer reviewed papers on the subject of KOHA. Finally, it included a number of individuals randomly outside the country who have an interest in KOHA and therefore are participants in the KOHA community discussion group.

In the case of institutions outside Kenya where KOHA has been implemented, convenience sampling was done since in the world, two universities were identified as institutions where RFID technology was implemented with KOHA as the integrated library system. Respective representatives of these institutions were automatically selected for participation in this study. The study used interview guides, questionnaires, and documentary reviews to collect data.

Review of literature was done within the guidelines of themes relevant to this study. Current academic literature drawn from reputable sources was used. These included journal articles from e-databases such *Emeraldinsight*, *Wiley* and *Ebscohost*. Prominent KOHA weblogs were also reviewed to find out the current issues under discussion in KOHA.

The aim of this review was to obtain current views regarding KOHA and RFID technology, among library and information professionals.

(e). Findings of the study

1. The benefits and risks of implementing KOHA in the context of Modern Library Concept

The findings of the study indicate that implementation of KOHA has several advantages namely:

- i. Perceived low costs compared to proprietary systems
- ii. The possibility of users to modify and to tailor it to fit local needs
- iii. Absence of restriction on its use and distribution

However both review of literature and data collected indicates that using KOHA presents a number of risks universities may face if KOHA is used as the ILS. Some of these have to do with the fact that KOHA is an open source ILS. These include the following:

- i. Possible lack of compatibility with other systems especially in the future
- ii. Lack of control and responsibility for future KOHA development
- iii. Lack of Technical support
- iv. KOHA requirement for technical staff and training in new skills
- v. Hidden costs/Unanticipated costs
- vi. KOHA is work in progress/incomplete system
- vii. Lack of guaranteed updates/future expansion
- viii. Lack of guarantee of performance
- ix. Security concerns in KOHA
- x. Limited Usability
- xi. Loss of property intellectual property rights (IPR) over software

2. The challenges faced by other institutions in Kenya in the implementation of KOHA.

The challenges faced in KOHA implementation in Kenyan institutions are more or less similar and can be summarized as:

- None completion of implementation of KOHA in spite of the fact that implementation period is long gone. Only one (1) of the institutions has fully implemented KOHA. The implementation of KOHA has been in two (2) of the institutions slow (in one institution so far it has taken 2 years) and therefore has lost direction especially due to inappropriate implementation process
- Lack of commitment on the part of the consultant (e.g. non-availability when needed, and poor response to client needs, poor communication like keeping phone on voice mail and not returning calls, non adherence to set implementation timelines and not honouring set targets dates
- Internal infrastructural problems such as local area networks, poor internet connectivity.
- Lack of well trained ICT (especially programmers) human resource to support the system.
- Lack of upgrades and even awareness of what upgrades are available since these are not automatically reported in open sources.
- Inadequate training (in one institution they had to hire a second consultant to carry out training for staff on KOHA after the first one vanished)
- Inability to generate useful reports that can be used in planning and decision-making especially non-custom reports
- Manual library operations are being used especially acquisitions due to incomplete implementation

(Acquisitions module and , special additions not done)

- Lack of maintenance from implementing consultant and shortage of people with good understanding of KOHA source code
- Sense of being held at ransom by the consultant: Only the consultant understands the system, is aware of the available updates and how these can be implemented.
- Consultant fatigue. One institution reported that they may need to “to re-implement the system with another consultant”
- Lack of confidence in the viability of KOHA. In two institutions, it was felt that implementing KOHA was a mistake as it was demanding on ICT staff, lacks direction for the future and had not helped them much in improving library service

The respondents outlined conditions which they felt must exist if KOHA implementation is to be successful

- i. ICT personnel who is detailed/assigned to KOHA to link with KOHA user community for updates and sort maintenance on regular basis (both KOHA and Lynx)
- ii. Existence of ICT personnel in the university who is an expert in Perl and Linux to trouble shoot, upgrade and maintain the software
- iii. Existence of ICT personnel conversant with KOHA software/or thorough trained to handle all matters relating to KOHA (trouble shooting, updates, customization
- iv. A strong ICT policy/procedures which details standard practice for handling KOHA matters
- v. ICT personnel with a passion/commitment to open-source systems
- vi. A well-managed LAN network with a fulltime personnel to monitor data flow, and diagnose problems that make it slow or out of service
- vii. An efficient/reliable internet connectivity that is constantly available

- viii. A committed consultant for initial implementation
- ix. An extended implementation period which will ensure that all user requirements are met, training is done and proper conversion, testing and handover is thoroughly done

3. The extent to which KOHA can efficiently work with innovative technologies particularly RFID technology

The main role of RFID technology is to enhance the efficiency of functions of the ILS and facilitate the performance of other innovative library operations. Therefore performance level of RFID is as good as the Integrated Library System (ILS) being used in the library. This is because first, it draws all data (patron and books) from the ILS. Secondly, the ILS should be able to support all of the functionalities of RFID such as self-fine payments, self-check.

In the Kenyan situation, KOHA is particularly exposed to threat of malfunction which carries with it the risk of extended periods of denial of service or breakdown and therefore rendering the RFID redundant. This is because:

- i. There is no supplier/vendor on call on 24/7 basis to trouble shoot the problems
- ii. Some of the problems/complications that may arise are currently unknown and therefore no ready answers even from the user community. The best one does is to send a request for answers and wait for a response from the user community
- iii. There is limited documentation which does not cover all possible problems.
- iv. Many institutions in Kenya have no staff conversant with KOHA programming or administrative maintenance
- v. Shortage of personnel in the country who have a thorough programming knowledge of KOHA

Therefore, successful implementation of RFID requires a stable, well maintained ILS. In the case of system failure on the part of the ILS, then RFID will also not function and the entire library system will breakdown. Consequently:

- i. Automated library services will be impossible and it may not be possible to issue out reading materials to library patrons and accept returns of library materials

- ii. It will not be possible to efficiently collect fines
- iii. The self-checkout will be rendered impossible
- iv. Security processing will be compromised as security processing during borrowing of materials to patrons cannot be done

There is lack of definitive answer as to whether KOHA can efficiently support RFID enabled processes. However there is evidence that KOHA SIP 2 does not support RFID messages such as *Fee Paid* and *Item Status Update* (Stonewall Library and Archives, 2009). In some cases users are involved in experimentation of how to install RFID with KOHA but have not experienced success.

In overall, it is widely agreed that implementing RFID with KOHA carries significant risks of malfunction. This is because,

- i. KOHA has incomplete/limited capacity to use RFID. Therefore there will be need for programming and configuration activities to achieve successful RFID implementation which involves risks associated with experimentation. Programming will remove the element of standard which is risky in case of future requirements
- ii. KOHA version 3.0 does not support all the RFID messages notably fee paid and item status
- iii. There is no definitive documentation on how implementation of RFID in KOHA can be done.
- iv. Many institutions in Kenya have not programmed/customised KOHA for RFID implementation before and therefore there is a level of uncertainty that the consultant will do it correctly
- v. After implementation of KOHA, troubleshooting problems with the two systems will be problematic because, if the RFID system has a specialist supporting it while KOHA will enjoy no support or will be maintained by someone else
- vi. Implementation contract with the KOHA consultant gives no guarantee of performance of the system
- vii. The implementation contract with the KOHA consultant gives no warrant beyond the implementation period

(f). Conclusion

When the facts surrounding KOHA as an open source ILS, experiences of those who have already implemented it Kenya, the demands of RFID technology, and also the environment in which it is being implemented, are examined a number of conclusions can be made:

- i. As an open source software KOHA presents possibility of saving money although this may not end up being the case. Although the initial purchase fee of KOHA seems low (Ksh.1.3 Million) which includes installation, customization, and training, more money will be required for maintenance, upgrade, future training. The university will need to hire a consultant for these needs in the future or recruit and train personnel to provide this service. In the long term these costs can run into several millions
- ii. The integration of KOHA and RFID presents potential challenges/complications that will no doubt make it difficult for the university to achieve its objectives in establishing an ultra modern library.
- iii. Upon implementation, the university has no reliable source for technical support in case of system problems. The institution may rely on local staff if they are properly trained. But there are problems which they may not have answers, in case technicians are not the creators of the system. In this case they rely on the volunteer user community for answers. If these answers are not forth coming from the user community, then the library systems including RFID will be rendered redundant.
- iv. KOHA has a very high demand for staff with technical skills helpdesk maintenance, upgrades, programming activities, feature enhancement, and feature creating. Currently many universities in Kenya do not have a single staff that is versed with KOHA programming. If there is disruption, through staff turnover, or inability to provide solution to emerging problems then entire library system will not function
- v. Quality performance of the KOHA system is not guaranteed. It will take a long time to ascertain whether it fits some the requirements for the university library and compatibility with

future innovative software solutions cannot be guaranteed. Most of the functionalities in KOHA such as acquisitions, cataloguing and retrieval are not yet mature. From the available literature KOHA has high potential, but this requires not only customization but fresh programming. Until these programming is done and the system used for a lengthy period, then there is no answer to this question and nobody to ask such a question.

- vi. Future compatibility with other ILS technologies is unknown, hard to predict and therefore it may limit improvements required in an information system
- vii. The university will not be guaranteed of automatic upgrades since there is nobody specifically working on them or there is no direct way of knowing whether they are available.
- viii. The system is not reliable for integration with RFID. Manufacturers who have attempted to implement RFID with KOHA have reported some problems. The SIP II which connects with RFID is not yet fully developed and no authoritative documentation on programming of KOHA for to make it work trouble free with RFID technology
- ix. Using KOHA with RFID is a major risk because many KOHA consultants do not have any experience of programming KOHA for RFID technology. There is no guarantee that the consultant will do it correctly, and since there is no definitive documentation of how this programming is done, the process might be a costly experimentation as it is being done by members of the KOHA user community
- x. There is risk of the image of the institution in case of malfunction of the ILS and the RFID system. Any situations whereby the ILS will be out of service, other systems will be down or be incompatible with newer technologies will bring to a halt the entire library system and highly compromise the university goals in regard to the library, and deeply tarnish the image of the university and its reputation which in the first place we wish to project by setting up the library.

(g). Recommendations

Arising from the findings of this study it is highly recommended that the institutions planning to implement RFID use alternative commercial vendor-supplied Integrated Library System (ILS) which matured, whose performance is proven, and enjoys manufacturers backing as opposed of KOHA. This will guarantee benefits such as:

- i. Cost savings and predictable cost in the long term
- ii. Guaranteed service and support
- iii. Improved security and innovation
- iv. Ease of use of the system
- v. Reliable functioning of the RFID technology
- vi. Achievement of the envisioned goals of the library

CHAPTER 1 INTRODUCTION

1.1 Background

Many universities in Kenya are in the process of establishing libraries to deliver high quality learning resource to support the achievement of excellence in learning, teaching and research across the institution and support the university in its community service activities. The guiding principle of a new library is to develop requisite teaching and learning resources under one roof for better access by all students, faculty, and researchers from all departments of the university.

The broad goals of the Library are:

- i. Support students in independent active and information resource based learning
- ii. Develop in graduates transferable skills very useful in the labour market such as problem solving, effective communication, use of modern ICT, and information literacy skills (how to find and use information)
- iii. Support academic staff adapt to the shift towards independent learning, and use of modern ICTs in education.
- iv. Provide an integrated resource of academic information and university computing services, conferencing, media production, publishing and curriculum design and therefore an improved and cost-effective access to learning, research and teaching and university administrative support.

1.2. The Library Component in the University Context

The university library is one of the key components of the university. The central purpose of libraries is to provide access to information to support the objectives of their parent institutions or interests of

the communities they serve. University libraries particularly take part directly in teaching and research process and hence are part and parcel of innovation, diffusion and conversion of knowledge and therefore act as tools for turning the results of knowledge into realistic productive entities. They are indeed at the centre of the universities' core functions of research, teaching and community service.

This role is embodied in four components: information transfer, partnership in teaching and lifelong learning, partnership in research, and preservation of intellectual records. The university Library is responsible for developing, maintaining, and facilitating the access to institutional information resources. Proper management of the library holdings is therefore important for effective and efficient retrieval of information.

The goals of the Library as component of the university are:

- i. Facilitate access to information materials for learning purposes (books, journals and internet access). In the library, students, faculty members and researchers will access books, magazines, journals and electronic sources, including, DVDs, video cassette CD-Rom and Internet based subscriptions e.g. e-books, e-journals.
- ii. Provide access to the learning, specialist, teaching and statistical packages e.g. e-learning platform and SPSS.
- iii. Provide students access to appropriate external information resources to satisfy their interlibrary loans requirement, or by giving direct access to other libraries.
- iv. Provide academic information to support curriculum development and implementation. Curriculum developers will use the resource library to develop courses
- v. Provide ICT infrastructure for patrons to access the internet using personal laptop and smart phones
- vi. Develop in staff and students transferable skills such as information literacy which are critical for survival in an information/knowledge society
- vii. Carry out income generation activities such as external, patron subscriptions, external borrowings printing and photocopying services, research consultancy services, seminars and training workshops.

1.3 ICT Application in a Modern University Library

The operations, functions and service delivery of the modern university library are underpinned by modern ICT systems. This enables the library to achieve its envisaged goals and objectives, of supporting the university to achieve excellence in research, teaching and community service, in the emerging ICT dominated knowledge society.

This ICT infrastructure a typical modern library will facilitate the use of:

- i. Internet and multimedia, including internet connections including on tables, walls and carrels through the use of personal laptops
- ii. Creation and access to institutional repositories for internally generated content such as electronic theses and dissertations (ETDS: as well as Internally produced e-learning materials
- iii. Access to e-databases, e-books and E-journal subscriptions
- iv. Multimedia tools such as CDs, DVDs, TVs, VHS videos, microfilm
- v. Application softwares e.g. word-processing, statistical packages, etc
- vi. Innovative services using RFID technology such as printing, security, circulation services etc

The key ICT infrastructure components that need to be put in place in a 21st century university library are:

- i. A web-based Integrated Library System (ILS)
- ii. Related application softwares and information systems eg.(printing solutions, digital library systems and content management systems,data analysis software and GIS software)
- iii. High speed Local area network (LAN) and internet connectivity (optic fibre and wireless)
- iv. Hardware (e.g. , PCs, servers, multimedia equipment
- v. Dedicated library portal (website)
- vi. Application integration system eg.Radio-Frequency Identification (RFID)

At the centre of the functions and services provided by the university library is Web-based Integrated Library system. The purpose of the

system is to effectively and efficiently manage all library resources and facilitate provision of an efficient library services it users. The Integrated Library Management System (ILMS) does this by automating the main library functions: Acquisition (purchase) of information resources, cataloguing and classification (information processing) circulation services (patron lending/borrowing services) and information retrieval and reference services through web-based access to its open public access catalogue(OPAC).

RFID stands for Radio-Frequency Identification which involves the use of small electronic devices that consist of a small chip and an antenna to interface various applications. It interacts with the ILS to enhance the efficiency of library operations and facilitate extended related services in the context of the key functions of the library (Shien-Chiang, 2007). Therefore RFID is a System integration tool to facilitate innovative library services in and in overall it will lead to better control of the library processes, more accountability on the part library management.

Accordingly RFID technology is particularly useful by facilitating:

- i. Efficient inventory (asset) management of library collection (books, journals, and multimedia items such as CDs DVDS and VHS Cassettes: Accurate stocktaking, valuation of the collection (Kern, 2004)
- ii. Ensuring reliable security for library materials through facilitating the use of:
 - Library access control RFID enabled patron cards, which can be used elsewhere in the campus
 - RFID exit gates which are linked to the circulation services and will detect materials that have not been properly issued
 - Centralized monitoring base for all transactions e.g. books leaving the library
 - Interconnected CCTV with RFID technologies to prevent and arrest breaches of security
- iii. Efficient circulation services (borrowing and returning of library resources) to library patrons through self-service
 - Reduced queues at the front desk as issues are processed faster

- Efficient patron access of library materials through efficient shelving and re-shelving of books and journals
 - Accurate records of borrowing, retrieval of sources location missing/mis-shelved materials, journals and books.
- iv. Facilitate innovative and more efficient use of ILS to provide efficient library services e.g.
- Self payment of overdue fines which are an inconvenience to users who have to wait for accounts office to open, or join the cues to pay small amounts such as Ksh.100/= will be collected through a RFID enabled payment system using RFID ID cards and virtual accounts
 - Self-check-out system where patrons will issue themselves with library materials and return those library materials
 - Facilitate more efficient income generation activities through efficient patron services
- v. Generate operational/strategic planning management reports; Using an efficient LMS It is easy to collect, utilize statistics for the books/journals that have been borrowed and what books, what journals, specific users have borrowed. Even more importantly, library books usage statistics within the library (Shien-Chiang, 2007).
- vi. Guiding and personalized service: Combined with patron data, environment collection data, and collection data, process time and service mode facilitate management of information about people, events, times places, and objects. The library can acquire information about the patron and provide personalized service
- vii. Provision of extended services such as printing, photocopying through virtual user accounts and RFID-enabled swipe cards (Chachra, 2003; Ollivier, 1995; Kern 1999)
- viii. Reduction of the demand for manpower in library by making the library more reliant on technology rather than on human manpower (Butters, 2007).
- ix. Support income generation activities of the university

The RFID software work using the data of patrons and reading materials which is stored in the ILS database and instruct the RFID components to perform the above tasks (Shien-Chiang, 2007). It provides an interaction

between the data stored in the ILS, and specific RFID components which in turn perform the specific transactions using the data and register the changes or results in the database (Curran, and Porter, 2007).

These components include RFID Software and application server, RFID tagging machine, RFID tags (Security Tags), inventory scanner and analyzer, Programming of circuits (tagging of books), access control gates (flap gates), exit RFID Security Gates, overlays (RFID tag covers), RFID application server, and RFID self check stations, self payment stations, staff work-stations, RFID smart cards, and library book drop (Curran, and Porter, 2007)

In order for a library to function efficiently, there is need for a stable, well maintained integrated library system (ILS). According to Brown (2007):

“Back end [in the ILS] needs to be robust enough to support interfaces and user actions, else the ILS performance will suffer” (Brown, 2007)

The ILS should also support and be interface with other third party software applications needed to support extended services. For example, RFID technology to function as expected, there is need for an ILS that is stable, and which supports all the functionalities of RFID (Brown, 2007; Krishnamurthy, 2007). Similarly, for the innovative and other benefits of RFID system to be fully exploited or realized, the ILS must not only be available 24/7, but also must be constantly upgraded in line with manufacturers release of newer versions, must be compatible with newer technologies or at least, there has to be a mechanism for ensuring this.

KOHA, is an *open source* ILS, and is currently being used in over 300 libraries world-wide. KOHA was initially developed for Horowhenua Library Trust, New Zealand and was primarily aimed at small to medium sizes libraries but now it s used in many libraries across the world. KOHA includes several advanced features such as budget-based acquisitions, serials management, and circulation (Breeding, 2008).

Currently, there are questions regarding KOHA’s suitability in integration with RFID technology in libraries. These concerns particularly revolve

around the fact that KOHA is an open source ILS. In spite of the known advantages of open source systems, they also have potential weaknesses which might compromise the overall goals of the university. KOHA has well documented weaknesses (Breeding, 2008). Key among these is the limited ability of the system to interface with RFID technology. This is the focus of the current state.

1.4 Statement of the problem

In order for the library to function efficiently, there is need for a stable, properly maintained integrated library system (ILS). At the same time, for the innovative and other benefits of RFID system to be fully exploited or realized, the ILS must not only be available 24/7, but also must be constantly upgraded in line with manufacturers release of newer versions, must be compatible with newer technologies or at least, there has to be a mechanism for ensuring this. If for any reason the ILS fails to function well, the huge investments made in the installation of modern RFID system will be laid to waste.

As KOHA is being implemented across the country, there are issues regarding its compatibility with RFID technology. These concerns particularly concerns revolve around the fact that KOHA is an open source ILS. In spite of the known advantages of open source systems, they also have potential weaknesses which might compromise the overall goals of the university (Bwired, 2009). In other words, KOHA may present weaknesses and complications which will no doubt make it difficult to achieve its objectives in establishing modern university library. Therefore the objective of this study was to assess the suitability of KOHA as the preferred Integrated Library System (ILS) in the establishment of a RFID technology based library in Kenya.

1.5 Objectives of the study

The study was guided by the following objectives:

- v. To investigate the benefits and risks of implementing KOHA in the context of a modern library concept
- vi. To assess experiences of select institutions in the implementation of KOHA in Kenya

- vii. To investigate the extent to which KOHA can efficiently work with RFID technology
- viii. To make recommendations on the integration of KOHA and RFID technology in a library infrastructure in Kenya.

CHAPTER 2 LITERATURE REVIEW

2.1 The role of an Integrated Library Management System (ILS)

At the centre of the functions and services provided by the university library is Web-based Integrated Library system. The purpose of the system is to effectively and efficiently manage all library resources and facilitate provision of an efficient library services it users. The integrated library system (ILS) does this by automating the main library functions:

- i. Acquisition (purchase) of information resources
- ii. Cataloguing and classification (information processing),
- iii. Circulation services (patron lending/borrowing services) and
- iv. Information retrieval and reference services through web-based access to its catalogue (OPAC).

Specific functions of the ILS are to:

- i. Efficient management activities including decision making, fore-casting, and planning (Planning) through generation of strategic reports
- ii. Effective and efficient management of the budgeting and acquisitions process including providing up to date information on available funds (procurement/acquisition).
- iii. Provide facilities for efficient processing of books and periodicals including classification, cataloguing, of both print and electronic materials (information processing),
- iv. Fast and more efficient information retrieval services to library users including efficient and convenient searching of print materials, selective dissemination of information(SDI), provision of information on library resources, literature searches, efficient access to library resources, convenient interface between users and library services, etc (OPAC and Reference services),
- v. Provide secure and effective control of library resources in the library as well as in the hands of library users (security);
- vi. Providing facilities for access to resources outside the library and lending materials library materials to external borrowers (Borgman, 1997)

- vii. To provide the platform for innovative library services e.g. self-issue and self-return of library materials,
- viii. Act as a portal for accessing electronic resources e.g. e-books, e-journals and eternally created databases e.g. electronic theses, dissertations, and e-repositories

2.2 The Benefits of Radio-Frequency Identification (RFID) in Library Management

RFID stands for Radio-Frequency Identification which involves the use of small electronic devices that consist of a small chip and an antenna. It interacts with the ILS to enhance the efficiency of library operations and facilitate extended related services in the context of the key functions of the library (Shien-Chiang, 2007).

RFID is an old technology which has the potential to revolutionize many aspects of library (Preez, 1983). RFID technology is recognized as the ideal technology for managing ICT-driven academic library of the 21st century and which will facilitate innovative library services in and in overall it will lead to better control of the library processes, more accountability on the part library management (Chachra, 2003; Ollivier, 1995; Kern 1999)

Accordingly RFID technology is particularly useful by facilitating:

- i. Efficient inventory (asset) management of library collection (books, journals, and multimedia items such as CDs DVDS and VHS Cassettes: Accurate stocktaking, valuation of the collection (Kern, 2004)
- ii. Ensuring reliable security for library materials through facilitating the use of
 - Library entry RFID enabled patron cards, which can be used elsewhere in the campus
 - RFID exit gates which are linked to the circulation services and will detect materials that have not been properly issued
 - Centralized monitoring base for all transactions e.g. books leaving the library
 - Interconnected CCTV with RFID technologies to prevent and arrest breaches of security

- iii. Efficient circulation services (borrowing and returning of library resources) to library patrons
 - Reduce queues at the front desk and issues are processed faster
 - Efficient patron location of library materials through efficient shelving and re-shelving of books and journals
 - Accurate records of borrowing, retrieval of sources location missing/mis-shelved materials, journals and books.
 - Eliminate the problem of materials that cannot be traced and have not been borrowed.
- iv. Facilitate innovative use of ILS to provide efficient library services e.g.
 - Self payment of overdue fines which have been an inconvenience to users who have to wait for accounts office to open, or join the cues to small amounts such as Ksh.100/= services better: to a will be collected through a RFID enabled payment system using RFID ID cards and virtual accounts
 - Self-check-out system where patrons will issue themselves with library materials and return those library materials
 - Facilitate more efficient income generation activities through efficient patron services
- v. Operational/Strategic Planning: It makes it easy to collect and utilize statistics for the books/journals that have been borrowed and what books, what journals, specific users have borrowed. Even more importantly, usage statistics within the library (Shien-Chiang, 2007).
- vi. Guiding and personalized service: Combined with patron data, environment collection data, and collection data, process time and service mode facilitate management of information about people, events, times places, and objects. The library can acquire information about the patron and provide personalized service
- vii. Provision of extended services such as printing, photocopying through virtual user accounts and RFID-enabled swipe cards.

- viii. Reduction of the demand for manpower in library by making the library more reliant on technology rather than on manpower (Butters, 2007).
- ix. Support income generation activities of the university

2.4 The Principles of ILS integration with RFID system

RFID provides several benefits such as reducing queues at the front desk, decreasing repeatable tasks, increase interaction with patrons, extend internal security, procure collects and raise the efficiency of inventory and arrangement (Sarma, 2001; Ollivier, 1995; Ladt, 2001). These result in higher customer satisfaction, and better return on investment.

The RFID software work using the data of patrons and reading materials which is stored in the ILS database and instruct the RFID components to perform the above tasks (Shien-Chieng, 2007). It provides an interaction between the data stored in the ILS, and specific RFID components which in turn perform the specific transactions using the data and register the changes or results in the database (Curran and Porter, 2007).

These components include RFID Software and application server, RFID Tagging machine, RFID tags (tags / security tags), inventory scanner and analyzer, programming of circuits (tagging of books), access control gates (flap gates), Exit RFID Security gates, tag overlays (RFID tag covers), RFID application server, and RFID self check stations, self payment stations, staff work-stations, RFID smart cards, and library book drop boxes (Curran and Porter, 2007)

Therefore in order for the library to function efficiently, there is need for a stable, well maintained integrated library system (ILS). According to Brown (2007):

“Back end [in the ILS] needs to be robust enough to support interfaces and user actions, else the ILS performance will suffer” (Brown, 2007)

The ILS should also support an interface with other third party software applications needed to support extended services. For example, for RFID technology to function as expected, there is need for an ILS that

stable, and which supports all the functionalities of RFID (Brown, 2007; Krishnamurthy, 2007). Similarly, for the innovative and other benefits of RFID system to be fully exploited or realized, the ILS must not only be available 24/7, but also must be constantly upgraded in line with manufacturers release of newer versions, must be compatible with newer technologies or at least, there has to be a mechanism for ensuring this.

KOHA, created an *open source* ILS, and currently being used in over 300 libraries world-wide. KOHA was initially developed for Horowhenua Library Trust, New Zealand and was primarily aimed at small to medium sizes libraries but now it s used in many libraries across the world. KOHA includes several advanced features such as budget-based acquisitions, serials management, and circulation (Breeding, 2008).

Open source software refers to software which is distributed under a licensing agreement which allows the source code (computer code) to be shared, viewed, and modified by other users and organizations themselves according to their local requirements (Bwired, 2009; Krishnamurthy, 2007). However any developer who takes the initiative to install, customize through programming, carry out training, or provide technical support may charge for these services (Open Source Initiative, 2007).

CHAPTER 3 METHODOLOGY

3.1 Research design

This study used a naturalistic research design to carry out an exploratory study on the suitability of KOHA as the preferred Integrated Library System (ILS) in establishing RFID-driven libraries in Kenya. A naturalistic design was used specifically to gather information on the experiences on the use of KOHA in selected institutions as well as obtain the opinions of experts on the benefits, and risks involved in implementing and using KOHA. It was also used to review existing documentary evidence on the benefits and risks of using KOHA.

3.2 Target Population

This study targeted two(2) groups of people. First, it targeted experts and library and information science scholars in integrated library systems especially those who have in-depth knowledge of KOHA. Secondly, it targeted library leaders of institutions which have implemented KOHA especially in Kenya, as well as outside Kenya.

3.3. Description of the sample and sampling Procedures

The study involved first, four (4) library managers in four institutions in Kenya where KOHA has been used or is in the process of being implemented. Secondly, it included two library managers of institutions which have implemented RFID technology with KOHA as the integrated library systems outside Kenya. Thirdly, it included a wide range of scholars who have authored peer reviewed papers on the subject of KOHA. Finally, it included a number of individuals randomly outside the country who have an interest in KOHA and therefore are participants in the KOHA community discussion group.

In the case of respondents from Kenya, a random stratified sampling technique was used. Institutions where KOHA has been implemented were stratified as either special libraries or academic libraries. The final sample from Kenya included four libraries namely: one special library, a college library and two university libraries. The respective representatives of these libraries were selected for participation of this

study. For confidentiality, the real names of these libraries will not be revealed.

In the case of institutions outside Kenya where KOHA has been implemented, convenience sampling was done since in the world, two universities were identified as institutions where RFID technology was implemented with KOHA as the integrated library system. Respective representatives of these institutions were selected for participation in this study. Therefore the final sample consisted of six(6) library managers.

3.4 Research Instruments and Methods of Data Collection

3.4.1 Research Instruments

Data collection was conducted using three major tools. These are interview guides, and document/desk review guidelines

(a) In-depth Interview Guides

This tool was used to collect in-depth information on perceptions and experiences of respondents regarding KOHA. The interview schedule targeted respondents from institutions where KOHA has been implemented and the second for institutions where RFID has been implemented with KOHA as the ILS. The first interview schedule was used to obtain data on KOHA issues such as levels of automation, and reason for non-completion of implementation, level of satisfaction of the implementation process, the adequacy of the implemented functionalities, and related issues such as maintenance, upgrades, and training.

The second in-depth interview scheduler targeted respondents from institutions which have implemented RFID with KOHA as the ILS. This tool sought to collect on issues such as challenges faced in implementing RFID with KOHA and post implementation operational experiences. Finally it sought to collect data on the compatibility levels of RFID with KOHA.

(c) Document Review/Desk Review Guidelines

Review was done within the guidelines of themes relevant to this study. Current academic literature drawn from reputable sources was used. These included journal articles e-databases such *Emeraldinsight, Jstor, Wiley and Ebscohost*. Prominent KOHA weblogs were also reviewed to find out the current issues under discussion in KOHA. The aim of this review was to obtain current views regarding KOHA and RFID technology, among library and information professionals.

3.4.2 Data Collection Methods

After the relevant authorities permitted the research, the researcher personally visited the respective sampled institutions to conduct in-depth interviews with the selected respondents.

The researcher also contacted extensive desk reviews of literature of university libraries, Integrated Library Systems, open source library management systems and RFID technology applications.

3.5 Data Analysis and Presentation

Data obtained through interviews was organized into relevant themes and is presented in the using narratives.

CHAPTER 4 PRESENTATION AND DISCUSSION OF FINDINGS

4.1 Benefits of KOHA over Proprietary Integrated Library Systems in Kenya

As an open source ILS, KOHA has a number of benefits, especially over proprietary systems which are a key driving factor in its adoption by a number of universities. These include:

i. Perceived Low cost

There is no purchase cost for the KOHA software itself. There is no initial fee as the software is freely available, and therefore, the capital outlay required by proprietary software is avoided (Krishnamurthy, 2007). Also there are no automatic license fees as in the case of a proprietary ILS although most licenses under which the software is developed allow individuals or companies to distribute and support the software at a profit as well (Bretthauer, 1999. This is a huge benefit but only if within the organization “capabilities are such that you are able to implement, train and support at little cost to your organization” (Bwired, 2009)

However, this perceived low cost can be misleading since users/clients have to pay for the cost of implementation, ongoing development and support needed or additional vendor services that may be required such as maintenance, upgrading, Intellectual property and rights to use the software. There are also internal costs incurred in training programmers and technicians and employing them, or hiring a vendor to address these issues. The general assessment from literature is that in the long term, the cost of ownership for open source ILS far exceeds the cost of proprietary software (Bissels and Chandler, 2010)

ii. Users modification and ability to tailor to fit local needs

The KOHA user/client enjoys the right to modify the software to facilitate unlimited tuning and improvement of a software product and to adapt it to user needs, changing conditions, and to reach a detailed understanding of how the system works (Brettauert, 1999; Eu-connecta, 2009). The fact that the source code is freely available gives users

the freedom and flexibility to adapt the software to suit the situation, without restriction.

However, this benefit derives from the assumption that the institution in question has a pool of highly qualified programmers who are conversant with the system. At the same time, in most cases, changes to the original source code, or customizations made by the consultant limit the future support and growth of the software since future update, solution to technical problems, and modules aimed at improving the system may not apply to the local system leaving the university with “irresolvable issues” which may call for improvisations in programming which might complicate the situation further and affect efficient service delivery.

iii. No restriction on use and distribution

Unlike proprietary software, there are no contractual restrictions on how the software is used or distributed (Muir, 2005). For example, it can be passed on to other institutions including campuses, affiliated colleges, and other institutions that the university may will. However in cases where a consultant has been hired to implement KOHA, their might be restrictions by intellectual property rights (IPR) imposed by the consultant which might curtail further modifications and distribution by the client. In the case of KOHA, it has been the practice to give IPR to the implementing consultant which complicates use and distribution rights.

4.1.2 Challenges of using KOHA as Integrated Library System in Kenya

Both review of literature and data collected indicates that using KOHA presents a number of risks which the university will face if KOHA is used as the ILS in the context of the proposed library. Some of these have to do with the fact that KOHA is an open source ILS. These include the following:

i. Lack of compatibility with other systems.

According to literature, it is not always easy to get open source software to work with other applications. KOHA comes as code which one has

to customize through programming in order to fulfill user requirements. This requires expenditure of time, ICT manpower and most significantly, experimentation. This is evident in many areas where KOHA has been implemented.

In the field of library and information services, there is need to use ILS more innovatively to service requirements of patrons beyond ordinary activities of capturing, processing, storing and disseminating information. This is part of the strategy that will be used in the proposed new library. Currently, KOHA can operate with e- learning systems such as Moodle and e-database management systems e.g. *Open Journals System*. However, the future compatibility of KOHA with other relevant software and hardware is not certain. Examples include printing software solutions, Email server, SMS services, HR systems, EDI (Electronic Data Interchange). While most proprietary ILS have been confirmed to work on these, in the case of KOHA, this cannot be assured (Bissels & Chandler, 2010). In order to facilitate such linkages will call for further programming.

ii. Lack of control and responsibility for KOHA development

The development of KOHA is a volunteer project of programmers across the world who communicate via the internet to participate in the development of the software (Brettauer, 1999). Therefore, there is no final “authority” on KOHA. This decentralized distribution of open source software such as KOHA is a disadvantage in some contexts, particularly future development of the software and solving of technical problems, which become the responsibility of users/clients. The lack of central controlling hand in KOHA development also means that progress and future growth of the software is uncertain, unpredictable, chaotic and undirected.

iii. Lack of Technical support

Like any other software, it is not possible to work with KOHA without technical support (Soni, 2009). However, KOHA is created by volunteer developers spread across institutional and national boundaries, collaborating by using internet based communications and development tools. It is currently maintained by a team of software providers and library technology staff from around the globe. While in most cases

open source software has strong personal commitment to seeing the product work, the fact is that for KOHA there is no one single vendor responsible for supporting users of the KOHA suite of programs which means that technical support for software is not guaranteed (Bretthauer, 1999; Bissels & Chandler, 2010).

While in commercial vendor-based systems technical support is mandatory, in the case of KOHA, the institution has either to train technicians to provide support or to engage the current KOHA consultant or any other private consultant to maintain the system in the future. It is important to note that currently many academic institutions do not have IT persons who is familiar with KOHA to use it let alone to support from a system perspective.

Therefore technical support for KOHA is costlier compared to proprietary ILS software because consultants who provide support for free source and open source software expect to earn lots of money providing support. In fact this is the only revenue model perceived in favor of the open source software movement. Relying on internal ICT person to provide technical support for KOHA is also risky given the high staff turnover among ICT personnel which can hinder efficient functioning of the system and the library as a whole (Special Libraries Association, 2009).

Finally, although, there is an online community which is committed to KOHA, that delivers support via discussion forums and blogs which the university can turn to get technical solutions for KOHA, these do not facilitate solving technical problems in a timely manner and do not guarantee reliable service and support. Lack of timeliness in resolving problems will negatively affect the quality of library service (Bwired, 2009);

iv. KOHA requirement for technical staff and training in new skills

As an open source software, KOHA requires a lot of time to experiment and train and staff training (Bretthauer, 1999). The use of KOHA will require in-house highly skilled programming staff. Therefore there is need for fresh training or recruitment of technical programming personnel to strictly deal with KOHA. Since KOHA runs on Linux and

is based on Perl, there is need for personnel trained in Linux system administration and Perl programming. With high staff turnover in the university it may be a risky to rely on local staff.

Limited training comes with KOHA products unless a consultant that provides that service is retained. Training for KOHA is also available from consultants commercially for a fee (Liblime, 2007) which is costly. Documentation tends to be limited and aimed at developers. User documentation usually must be developed locally.

v. Hidden costs/Unanticipated costs

Like other open source systems, KOHA is not entirely free. While there is not initial purchase cost or license fees, there are costs for implementation, administration, and support. While the source code is free, later changes that are necessary require IT expertise as well as man-hours (Open Source Initiative, 2007; Bretthauer, 1999). To maintain KOHA, like other systems in the university, the institution will need to train programmers. In the event of staff turnover, which is quite high among ICT personnel, then the cost of training cannot be estimated as long as these systems are in use. Alternatively, the university may have to contract external commercial companies such as LibLime Lime who have acquired control of key assets related to KOHA including copyrights, and trademarks and support the development of KOHA (Breeding, 2008)

vi. KOHA is work in progress/incomplete

KOHA is “work in progress” and cannot be described as a mature system since it is the subject of ongoing experimentation across the globe (Pavlinusic, 2010). Its quality has not been established beyond the claims beyond the claims of its promoters and some of its users who report to have been able to do one thing or another using KOHA. Without independent verification, one has to implement KOHA and try out all the functionalities attributed to it (Breeding, 2008).

KOHA is also a rapidly changing system such that what we implement now is not what is available in the market next month. The institution will need somebody to be in constant watch for changes in KOHA projected by the global network of KOHA users and adapt it into the KOHA we implement. While this is not itself bad, it is an added cost,

and a distraction from the core activities of the library department and demanding to the ICT department.

KOHA comes incomplete and for some of the library requirements, and therefore fresh programming has to be done. This is true of the free KOHA version known as *KOHA Classic* as opposed to another version, *KOHA Zoom* which is developed by a private company, Liblime and has most advanced features and is commercially available from this company. The features available vary according to individual implementations, the version of the software in use, configurations selected (Breeding, 2008). These include functions such as, email, telephone/SMS patron notification, e-commerce, RFID support, I&R (information and referral), OAI-compliant harvesting, patron account-pay fines, reservations, and invoice processing (Breeding, 2008) but there is a possibility to develop them. However, developing them on individual implementations means that they are not standard-based which may result in lack of compatibility with other software.

The institution needs to do a great deal more work than anticipated to adapt the software to local needs. It is still unknown how much work will have to be done to provide it with the breadth of functionality that is found in proprietary products and how long this will take. Even of more concern, is what will need to be done to adapt the software to future requirements? When it is decided that more development is needed, the university may need to identify and work on the changes.

vii. Lack of guaranteed updates/future expansion

Once an institution decides to use open source software, the institution is on its own we are on our own regarding future developments. Since the institution is not paying for KOHA, nobody is bound to give us regular updates. The institution may get stuck with the same old version for years without ever getting an update. On the other hand KOHA is constantly changing on daily basis and the user community keeps experimentation. The only way to ensure constant upgrades is to assign personnel to participate in the KOHA community of users and tap new upgrades or changes in KOHA (State Library of Ohio, 2007). However it is good to remember what is reported in chatrooms, and discussion groups such that of KOHA is experimental and not definitive.

viii. Lack of guarantee of performance

Unlike proprietary ILS software, there are no guarantees of quality or performance for open source software. Currently it is evident that the performance that KOHA offers poorer compared to vendor systems (Kassblog, 2007). Experience has shown that a library may, therefore, find that open source software is not as described or the documentation is deficient that popularly though which can only be ascertained only after implementation period is over. Companies that provide support services for open source products do offer some guarantees, but no remedies similar to those offered by vendors of proprietary products. Only purchasers of proprietary products can expect financial and other contractual remedies for poor response times and loss of functionality (Kassblog, 2007).

ix. Security concerns in KOHA

Security in a library setting is very critical since slight compromise might lead to lose of valuable library book and journal materials, and unauthorized use of library services. Security in the context of a university library setting, ILS is more serious than in other departments the library using RFID will operate actual money accounts for patrons for self printing purposes such as photocopy, fine payment, etc. Any breach of security will affect not just borrowing data but also people money accounts. The fact that many internal people both users and ICT staff has access to the programming code can compromise the security of the system.

Although some of the open source softwares such as Linux have tight security, many other application software such as KOHA the security has not been proved beyond doubt and are generally viewed as having security issues (Bretthauer, 1999; Kassblog, 2007). For example one user noted that:-

We are using Mozilla Firefox 3.5.4 for KOHA access for our patrons. After one patron is done and walks away, the next patron can use the “back” button to access the previous patron’s records—if 6 patrons have used this workstation, all of their transactions can be seen by the last patron. Has the new release of KOHA addressed this security issue? Does anyone have a “one-patron session” fix for this? (Mason, 2010)

Since open source software such as KOHA is not developed in a controlled environment, but rather by individuals all over the world who might not work on it during the entire development period, there is higher likelihood of gaps. For example, the open source is not always peer reviewed or validated for use. Although users are free to verify the source code, there is no guarantee that this is thorough hence the possibility of compromise.

x. Limited Usability

Open source software has been criticized for its lack of usability which emanates from the fact that the technology is not reviewed by usability experts and does not cater to the majority of computer users. It is generally developer-centric and therefore those without system administration or programming language, the use of the software especially to fix errors is highly limited to those with technical expertise. Some functionality such as non-custom reporting will require knowledge in MYSQL to retrieve useful information from the system (Yuen, 2009).

Open source does not legally require documentation such as user manuals or guides. In the case of open software such as KOHA, support may be sometimes difficult to understand because it is frequently aimed at developers and not end users. For example, in the case of many open source software, there is lack of user documentation because development of the code end use many as compared to documentation. Without documentation, the university will be forced to rely on alternative means such as online communities but there is no guarantee that they have a solution or are willing to assist in resolving.

xi. Loss of Property Intellectual Property Rights (IPR) over software

In most cases where a consultant has been contracted to implement open source software other than the client organization doing it, there often a tussle between the client and the consultant as who owns the IPR to the customizations done to the software (Gonzalez-Barahona, 2000). In the case of KOHA, a company by the name Liblime bought and patented several of the code fragments and functionalities which it charges for use and implementation. It has developed the most robust version of KOHA known as Zebra but which it charges for consulting, programming, file migration, training, and technical support (Liblime, 2007; Yuen, 2009; Breeding, 2008).

In the case of KOHA implementation in a university setting the consultant may lay claim to the IPR to all customizations to be performed on KOHA under the contract implementation. This compromises the ability of the university to use KOHA in whichever way it wishes including distribution rights, further changing the software without reference the consultant.

4.1.3 The challenges faced by specific institutions in the implementation of KOHA.

Data was collected from four institutions that are in process or have implemented KOHA. All the institutions included in the study reported to be at different level of KOHA implementation

(a). Institution A: University Library (Kenyan)

The modules that have been implemented are: Acquisition, cataloguing and OPAC services. However a number of observations need to be made:

- KOHA implementation has stalled for 2 years
- Acquisition procedures are still done manually and not online. Instead data about acquisitions is input into the KOHA database.
- KOHA project has not been formally handed over to the client
- They have experienced problems with Z39.50 protocol which facilitates KOHA has a dedicated server which is only used for this programme.
- KOHA has not been uploaded on the web (internet) and is being operated on the local area network

(b). Institution B: Special Library

In this institution the following modules have been implemented: Acquisitions, cataloguing. The following observations can be made about the implementation.

- KOHA implementation is incomplete
- Acquisition procedures are still done manually and not online. Instead data about acquisitions is input into the KOHA database.
- There are problems with Z39.50 protocol which facilitates importing cataloguing data from internet-based databases
- KOHA has a dedicated server which is only used for this programme.

(c). Institution C: College Library

In this institution the following modules have been implemented: acquisitions and cataloguing. The following observations can be made about the implementation.

- Acquisition procedures are still done manually and not online. Instead data about acquisitions is input into the KOHA database.
- KOHA has a dedicated server which is only used for this programme.
- Updating and upgrading is done by the ICT manager on monthly bases
- They implemented basic KOHA which enables them to perform only routine functions of cataloguing, OPAC and circulation
- They are only able to generate general reports and not user defined reports, including data criteria and sorting, schedule automatic generation of reports and notices (daily, weekly, monthly)
- They have a consultant from USA who routinely does system audit annually

(d). Institution D: University Library

- This institution has implemented all the modules of KOHA: circulation, acquisition, cataloguing, and serials

- The system is maintained/updated by the Systems Librarian who has an experience of 6 years with KOHA and is an expert on KOHA implementation, programming and maintenance
- The Systems' librarian has implemented other add on softwares which are integrated in the Library Portal to facilitate services such as renewal online services

Findings indicate progress in KOHA implementation in institutions in Kenya. The challenges faced in KOHA implemented in these institutions are more or less similar and can be summarized as:

- Non-completion of implementation of KOHA in spite of the fact that implementation period is long gone. Only (1) of the institutions has fully implemented KOHA. The implementation of KOHA has been in two (2) of the institutions slow (in one institution so far it has taken 2 years) and therefore has lost direction
- Lack of commitment on the part of the consultant (e.g. non-availability when needed, and poor response to client needs, poor communication like keeping phone on voice mail and not returning calls, Non adherence to set implementation timelines, not honouring set targets dates
- Internal infrastructural problems such as local area networks, poor internet connectivity plagues some of the institutions
- Lack of well trained ICT (especially programmers) human resource to support the system is a major challenge in two institutions
- Lack of upgrades and even awareness of what upgrades are available since these are not automatically reported in open source settings. This is affecting two of the institutions
- Inadequate training (in one institution they had to hire another consultant to carry out training for staff on KOHA)

- Inability to generate useful reports that can be used in planning and decision-making especially non-custom reports
- Manual library operations are being used especially acquisitions due to incomplete implementation (Acquisitions module and , special additions not done)
- Lack of maintenance from implementing consultant or any other consultant as no contract was drawn for such purposes in two of the institutions
- Unanswered queries about the system due to lack of knowledge about the system
- The consultant appears to be very busy hence not response to needs, non-availability to the client
- Sense of being held at ransom by the consultant: Only the consultant understands the system, is aware of the available updates and how these can be implemented.
- Consultant fatigue. One institution reported that they may need to “to re-implement the system with another consultant”
- Lack of confidence in the viability of KOHA. In two institutions, it was felt that implementing KOHA was a mistake as it was demanding on ICT staff, lacks direction for the future and had not helped them much in improving library service
- Limitations of KOHA to perform complex processes such as creating comprehensive management reports

The respondents outlined conditions which they felt must exist if KOHA implementation is to be successful:

- i. ICT personnel who is detailed/assigned to KOHA to link with KOHA user community for updates and sort maintenance on regular basis (both KOHA and Lynx)
- ii. Existence of ICT personnel who is expert in Linux and therefore

- can use Linux tools to trouble shoot upgrade and maintain the Operating
- iii. Existence of ICT personnel conversant with KOHA software/ or thorough trained to handle all matters relating to KOHA (trouble shooting, updates, customization)
 - iv. A strong ICT policy/procedures which details standard practice for handling KOHA matters
 - v. ICT personnel with a passion/commitment to open-source systems
 - vi. A well-managed LAN network with a fulltime personnel to monitor data flow, and diagnose problems that make it slow or out of service
 - vii. An efficient/reliable internet connectivity that is constantly available
 - viii. A committed consultant for initial implementation
 - ix. A full time consultant to maintain/advise on KOHA
 - x. A small size library with medium size library user population (30,000-50,000)
 - xi. An extended implementation period which will ensure that all user requirements are met, training is done and proper conversion, testing and handover is thoroughly done

4.1.4 The extent to which KOHA can efficiently work with innovative technologies particularly RFID technology

The main role of RFID technology is to enhance the efficiency of functions of the ILS and facilitate the performance of other innovative library operations. Therefore performance level of RFID is as good as the Integrated Library System (ILS) being used in the library. This is because first, it draws all data (patron and books) from the ILS. The ILS should be able to support some of the functionalities of RFID such as self-fine payments, self-check. Thirdly, the ILS should be compatible with other useful software such as printing.

Therefore, successful implementation of RFID requires a stable, well maintained ILS. In case of system failure on the part of the ILS, then RFID will also not function and the entire library system will be brought to a halt. Consequently:

- i. Automated library services will be impossible and it may not be possible to issue out reading materials to library patrons **and** accept returns of materials
- ii. It will not be possible to efficiently collect fines
- iii. The self-checkout will be rendered redundant
- iv. Security processing will be compromised as security **processing** during borrowing of materials to patrons cannot be done

KOHA is particularly exposed to threat of malfunction which carries with the risk of extended periods of denial of service or breakdown and therefore rendering the RFID redundant. This is because:

- i. There is no supplier/vendor on call on 24/7 basis to trouble shoot the problems
- ii. Some of the problems/complication that may arise are currently unknown and therefore no ready answers even **from the user** community. The best one does is to send a request for **answers** and wait for a response from the user community
- iii. There is limited documentation which does not cover all possible problems.
- iv. The institution may not have staff conversant with KOHA programming or administrative maintenance
- v. Currently, the consultant of KOHA is an employee of **another** institution, and may not always be available on call. **May be he** has other sites to maintain

There is evidence that KOHA cannot efficiently support RFID enabled

processes. For example there is evidence that KOHA SIP 2 does not support RFID messages such a *Fee Paid, Item Status Update, Hold, and Renew* (Stonewall Library and Archives, 2009. This is evident in the Figure 4.1 below which outlines SIP2 messages supported by KOHA.

Figure 4.1 SIP2 messages supported by KOHA

	Message Name	KOHA Version	Note
23	Patron Status Request	3.0	
11	Checkout	3.0	
09	Checkin	3.0	
01	Block Patron	3.0	
99	SC Status	3.0	
97	Request ACS Resend	3.0	
93	Login	3.0	
63	Patron Information	3.0	
35	End Patron Session	3.0	
37	Fee Paid		
17	Item Information	3.0	
19	Item Status Update		
25	Patron Enable	3.0	
15	Hold	3.0	item-level holds not supported
29	Renew	3.0	title-level renew not supported, nor is "third party allowed"
65	Renew All	3.0	

If the KOHA Version column is blank, the SIP2 message is not yet supported. (12.6. SIP2 Integration, 2006)

Doesn't support things that are specified at the item level, such as, item level holds and all features that were added to KOHA after the SIP implementation. Almost all 3M hardware, requires and extension to the SIP2 implementation and that is also not yet supported (Atzberger, 2009)

Cases of implementation of RFID in conjunction with KOHA are very few even on a global scale. For example though The Catholic University of Eastern Africa appointed supplier of RFID has implemented RFID in over 500 sites both in Europe and Africa, only two sites (both in France) have involved KOHA and their advice is that the university seeks independent opinion from these institutions on their experience. The researcher has tried to contact these clients but there is problem of language barrier.

The subject of how to implement RFID using KOHA is the subject of ongoing discussion and experimentation among members of KOHA user group. These experimentations are cumbersome and involve trial and error activities. One user explained his experience with RFID as follows:

I have two KOHA installations using USB RFID readers-staff terminal are Unix-like systems not windows, though. The software is not generally useful yet-too many rough edges-but am willing to clean it up if there is enough interest (KOHA user, 2010).

In one library sampled for this study, a library leader in a Manhattan library, New York with a collection of 272,368 holding records and 35,767 borrowers, described the implementation of KOHA as follows:

“They tell you that KOHA SIP (software in ILS which facilitates RFID functioning) is compatible and will work with any Sip compliant product. But they do not tell you about the pain involved....The difficult part was that we actually had to change the code in order for KOHA to work with our Techlogic product. I had to work with the Programmers from KOHA and Techlogic to test the product, and get it to work to our specifications...It was a tripartite experience I call *“The Axis of evil...”* (O’Neal, et al, 2010)

In another library, CAMLIS library, Royal London Homeopathic Hospital, they report that in an effort to implement RFID on KOHA, they observed that:

- i. From testing to actual use of KOHA, they experienced **many** glitches that needed to be fixed and had to hire an **experienced** contract KOHA support companies to assist
- ii. The contract had on several occasions to wait for other developers to contribute some useful code and develop **this** code themselves

- iii. Several interfaces which had been developed by KOHA experts failed to work in their KOHA implementation and had to look for bug fixers to fix the problem for them
- iv. They had to hire another consultant to develop/programme for them the SIP (software in ILS which facilitates RFID functioning) for their KOHA.
- v. They had to user two specialist software companies to implement KOHA (Bissel & Chandler, 2010)

In another case involving over 15 public libraries, it was reported that:

...things are not currently working as intended:

- i. Holds did not initially process as expected on the Self Check machines, (this has been corrected with modifications from Liblime,
- ii. Meaningful transit/exception slips from the Smart Chutes currently do not print (i.e., send this item to this library - being corrected by Liblime)
- iii. General lack of meaningful error messages when problems arise on the Self-Checks. (usually there is an “undefined error” style message displayed). Rea, 2008)

In overall, it is widely agreed is that implementing RFID with KOHA carries significant risks of malfunction. This is because,

- i. KOHA has incomplete/limited capacity to use RFID with KOHA, therefore there will is need for programming and configuration activities to achieve successful RFID implementation which involves risks associated with experimentation. Programming will remove the element of standard which is risky in case of future requirements
- ii. KOHA version 3.0 does not support all the RFID messages notably fee paid and item status (KOHA, 2006)
- iii. There is no definitive documentation on how implementation RFID implementation in KOHA can be

- iv. Many KOHA consultants in Kenya have not programmed/ customised KOHA for RFID implantation before and therefore there is a level of uncertainty that any consultant will do it correctly
- v. After implementation of KOHA, trouble shooting problems with the two systems will be problematic because, if the RFID system has a specialist supporting it while will enjoy no support or is maintained by someone else
- vi. Implementation contract with the KOHA consultant gives no guarantee of performance of the system
- vii. The implementation contract with the KOHA consultant gives no warrant beyond the implementation period

CHAPTER 5 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusions

The main advantage of using KOHA software is in reaping the benefit of using ILS software developed by large, active developer communities to solve complex technical problems. However, from the above discussion, it is obvious that the risks associated with KOHA are serious. Given the colossal investments made in developing a modern library the expected gains from this investment, for the university to rely on KOHA within the current framework involves various risks and therefore must be carefully planned.

When the facts surrounding KOHA as an open source ILS, experiences of those who have already implemented it Kenya, the demands of RFID technology, and also the environment in which it is being implemented, a number of conclusions can be made:

- i. The implementation presents potential challenges/ complications that will no doubt make it difficult for the University to achieve its objectives in establishing an ultra modern library.
- ii. By implementing KOHA, the university may not be saving money. Although the initial purchase fee seems low about Ksh.1.3 Million equivalent to 1,300USDs which includes installation, customization, and training, more money will be required for maintenance, upgrade, future training. The university will need to hire a consultant for these needs in the future or recruit and train personnel to provide this service. In the long term these costs can run into several millions
- iii. Upon implementation, the university has no reliable source for technical support in case of system problems. The institution may rely on local staff if they are properly trained. But there are problems which they may not have answers, in case the technicians are not the creators of the system. In this case they rely on the volunteer user community for answers. If these answers are not forth coming from the user community, then the library systems including RFID will be rendered redundant.

- iv. KOHA has a very high demand for staff with technical skills helpdesk maintenance, upgrades, programming activities, feature enhancement, and feature creating. Currently many universities in Kenya do not have staff versed with KOHA programming. If there is disruption, through staff turnover, or inability to provide solution to emerging problems then entire library system will not function
- v. Quality performance of the KOHA system is not guaranteed. It will take a long time to ascertain whether it fits some the requirements for the university library and compatibility with future innovative software solutions cannot be guaranteed. Most of the functionalities in KOHA such as acquisitions, cataloguing and retrieval are not yet mature. From the available literature it has high potential, but this requires not only customization but fresh programming. Until these programming is done and the system used for a lengthy period, then there is no answer to this question no anybody to ask such a question.
- vi. The institution will not be guaranteed of automatic upgrades since there is nobody specifically working on them or we have no direct way of knowing whether they are available.
- vii. There is risk of the image of the institution in case of malfunction of the ILS and the RFID system. Any situations whereby the ILS will out of service, other systems will be out or be incompatible with newer technologies will bring to a halt the entire library and highly compromise the university goals in regard to it and deeply tarnish the image of the university and its reputation which it wishes to project by setting up a RFID-driven library.
- viii. The system is not reliable for use with RFID. Manufacturers who have provided to implement RFID with KOHA have reported some problems. The SIP II which connects ILS with RFID is not yet fully developed and no authoritative documentation on programming of KOHA to make it work trouble free with RFID technology
- ix. Using KOHA with RFID is a major risk because KOHA consultants in Kenya not have any experience of programming KOHA for RFID technology. There is no guarantee that the consultant will

do it correctly, and since there is no definitive documentation of how this programming is done, the process might be a costly experimentation as it is being done by members of the KOHA user community

- x. Future compatibility with other ILS technologies is unknown, hard to predict and therefore it may limit improvements required in an information system

5.2 Recommendations

Arising from the findings of this study, it is highly recommended that the university identifies and implements a commercial vendor-supplied Integrated Library System (ILS) which is matured, whose performance is proven, and enjoys manufacturers backing. Identifying and implementing a suitable proprietary ILS is mature, has a proven performance record will remove the risks that have been discussed, support the ongoing library objectives and work efficiently with proposed RFID technology. Some of the benefits of using this proprietary system are:

i. Cost savings and predictable cost in the long term

According to available evidence, the overall cost of a proprietary ILS is lower than that of KOHA. This is because even though the initial cost is far higher than that of KOHA, by implementing proprietary software, the university will acquire more customized software from a trusted manufacturer with better security, functionalities, continuous upgrade, and manpower. On the contrary, KOHA consultant will still charge for add-ons, additional customization, and upgrading.

ii. Guaranteed service and support

The university can count on the manufacturer's warranty, and ongoing service level support, and upgrades are guaranteed. Furthermore, a manufacturer will undertake, 24/7 maintenance of the system, will be available on call, something highly to be doubted in the case of KOHA. There is far less risk in using proprietary software since the university will be working with a manufacturer who is viable, and with complete knowledge of the ILS should any problems arise as opposed to relying on good intentions of the KOHA user community or best efforts of university's ICT staff that are yet to learn the system.

iii. Improved security and innovation

Proprietary ILS will be more secure than KOHA because it is developed by a dedicated team of experts working in an environment which controlled. The source code can only accessed and edited by this team which eliminates exposure to information system security risk posed by several people having access to the internal of the system.

The fact that neither users nor ICT staff do not view or access the source code means reliable security for of the software. The issue of security is particularly sensitive not just because of library materials can be lost or user borrowing accounts can be interfered with bust especially the fact that the institution will operate real money accounts which can be tampered with. The more people internally have access to the source code, the higher the security risk.

iv. Ease of use of the system

Unlike open source software such as KOHA which rely on experimentation by members of the user community to test usability, proprietary ILs relies on experts to test its usability. Therefore the ease of use of proprietary ILs is ranked much higher than KOHA. In addition, detailed and standard user manuals and guides which specifically users are provided which assist in continuous training.

v. Reliable functioning of the RFID technology

One critical aspect of the any ILS implemented is that it should facilitate return on investment (ROI) in RFID technology by providing robust foundation which is not subject to risks of poor performance and which has been certified as to be fully compatible with RFID technology. In the few cases where KOHA has been implemented with KOHA, KOHA has presented technical problems which prevented efficient working of the RFID technology. It is highly recommended that currently any institution planning to use RFID implements a proprietary system which is stable, well maintained and most importantly its problem implementation and functioning with RFID technology has been proved beyond any doubt.

BIBLIOGRAPHY

12.6. SIP2 Integration (2006). Retrieved December 3, 2010 from <http://KOHA.org/documentation/manual/3.0/appendices/sip2-integration>

Atzberger, A. (2009), KOHA Integration: RFID, SIP2, LDAP. Retrieved December 3, 2010 from <http://dbouman.blogspot.com/2009/04/KOHA-integration-rfid-sip2-ldap.html>

Bissels, G. & Chandler, A. (2010). Two years on: KOHA 3.0 in use at the CAMLIS library, Royal London Homeopathic Hospital. Program: *Electronic Library and Information Systems*, Vol. 44 No 3 pp. 283-290.

Bisson, C., & Eby, R. (2007). Open-source server applications. *Library Technology Reports*, 43(3), 48-53.

Boss, R. (2005). "Open source" Integrated library system software. Retrieved November 4, 2007, from <http://www.ala.org/ala/pla/plapubs/technotes/OpenSource.doc>
Guggenheim museum chooses KOHA. (2007). *Advanced Technology Libraries*, 36(5), 2-2.

Breeding, M (2008). Major open source ILS products. *Library Technology Reports* November-December. Retrieved December 3, 2010 from www.techsource.ala.org

Brown, M. (2007). ALA Annual Conference, Washington DC: LITA top tech trends update. *Library High Tech News*, No.8, pp.20-23

Butters, A. (2002), RFID systems, standards and privacy within libraries, *The Electronic Library*, Vol.25 No.4, pp. 430-439

Bwired, (2009), Open source vs. closed source (proprietary)software: White paper. Retrieved on December 28, 2010 from www.bwired.com.au

Chachra, V. (2003). "Experiences implementing the VTLS RFID solution in multivendor environment". Paper presented at the World Library and Information Congress: 69th IFLA General Conference and Council. Retrieved from www.ifla.org/IV/ifla69/papers/132eChachra.pdf on December,4 2010.

Curran, K and Porter, M. (2007), A primer on radio frequency identification for libraries, *Library Hi tech*, Vol. 25 No. 4, pp. 595-611)

E-connecta, (2009), *Advantages of open source software*. Retrieved on December 12, from http://eu.connecta/paper/Advantages_open_source_soft.html

Finkenzeller, K. (2003). *RFID Handbook: Fundamentals and Applications in Contactless Smart Cards and Identification*, 2nd ed., Wiley, Chichester.

Kassblog. (2007). Kassblog – Exploring KOHA, the open source library solution. In Kassblog. Retrieved November 5, 2007 from <http://kassblog.com/index.php?itemid=251>

Kern, C. (2004). Radio-frequency-identification in libraries, *The Electronic Library*, Vol 22 No. 4, pp.317-24

Kern, C. (1999), RFID technology; recent development and future requirements, *Proceedings of European Conference on Circuit Theory and design ECCTD99*, Stresa, 29 August-2 September, Vol. 1, pp.25-8.

KOHA. (2007a). KOHA features. Retrieved November 3, 2007, from <http://www.KOHA.org/about-KOHA/features/index.html>

KOHA. (2007b). KOHA download. Retrieved November 3, 2007, from <http://www.KOHA.org/download/>

KOHA. (2006). 12.6. SIP2 Integration. Retrieved December 6 from, <http://KOHA.org/documentation/manual/3.0/appendices/sip2-integration>

KOHA user (2010), KOHA and RFid. Retrieved on December 10, from <http://KOHA.1045719.nabble.com/KOHA-and-rfid-td3056047.html>

Krishnamurthy, M (2007), Open access, open sources and digital libraries: a current trend in university libraries around the world. *Program: Electronic Library and Information Systems*, Vol. 42 No 1 pp. 48-55.

Landt, J. (2001), “Shrouds of time: the history of RFID”, AIM, Inc. Pittsburg, PA,. Retrieved from www.aimglobal.org/technologies/rfid/resources/shrouds_of_time.pdf

Liblime. (2007). The leader in open source solutions for libraries – Liblime. In *Liblime*. Retrieved November 3, 2007, from <http://liblime.com/>

Mason, J. (2010, KOHA security issue. Retrieved December, 5 from [www.markmail.org/message/u67dvv5qqrlw65b#query:security%20issues%20in%20KOHA+page:1+mid:wkzssat7hmmvhg3x+state:results](http://markmail.org/message/u67dvv5qqrlw65b#query:security%20issues%20in%20KOHA+page:1+mid:wkzssat7hmmvhg3x+state:results)

Muir, S.P. (2005), An introduction to the open source software issues. *Library Hi Tech*, Vol. 23 No. 4. Pp.465-8)

O’Neal, S, Kushner, S, Alberse, R, Bruno, F., Kallfish, D. (2010), The hybrid open source ILS model. Paper presented at NJLA Conference, April, 27, 2010, Retrieved December 5, 2010, from <http://www.njla.pbworks.com/Handouts2010>

Open Source Initiative. (2007). Open source initiative. In *Open source initiative*. Retrieved November 5, 2010, from <http://www.opensource.org/>

Pavlinusic, D. (2010), *Comet experiment: RFID reader with KOHA data in browser*. Retrieved December 4, 2010, from

http://www.blog.rot13/2009/04/comet_experiment_RFID_reader_with_KOHA_data_in_browser.html

Preez, M. (2010). Book review: making the most of RFID in libraries. *The Electronic Library*, Vol.28 Nov 1, pp. 186-188

Rea, L. (2008), KOHA: SIP-2 support? Retrieved November 5, 2010, from <http://lists.katipo.co.nz/public/KOHA/2008-December/016396.html>

Shieng-Chiang, Y (2007), RFID implementation and benefits in libraries. *The Electronic Library*, Vol. 25 No.1 pp. 54-64

Soni, N. K (2009), Technical discussion of the KOHA open source integrated library system. Retrieved December 3, 2010 from <http://blog.gmane.org/gmane.education.libraries.KOHA.devel/month=20090401>

Sonker, S. K., & Jayakanth, F. (2003). KOHA: An open source integrated library automation system. *SRELS Journal of Information Management*, 40(2), 135-146.

Special Libraries Association, (2009), *Open source ILS overview*, Retrieved December 12, from

State Library of Ohio. (2007). *State library of Ohio ILS options discussion meeting minutes April 24, 2007*. Retrieved December 3, 2010, from <http://statelibrary.ohio.gov/ilsminutes.html>

Stonewall Library and Archives, (2009), *KOHA 3.03 Documentation*. Retrieved December, 7 from <http://bobsown.net/wordpress/wp-content/uploads/KOHA/KOHA-303-docs-draft-14.pdf>

Yuen, K. (2009), Can this economy support library changes to an open source software system. Retrieved in December 14, from <http://infosherpas.com/index.php/openandlibraries/article/views/52/76>

APPENDENCES

Appendix i: Interview Schedule for Institutional respondents where KOHA has been implemented

1. Which library operations have you automated?
2. If there are some operations you have not automated what are the reasons for non-automation?
3. Are you satisfied with the way the system was implemented by the consultant? If no which issues of the implementation process are you not satisfied with?
4. All functionalities fully implemented as planned or where some only halfway implanted.
5. Was training adequately carried out? User training, Administrator training, Programming training?
6. Who maintains your system? Are you satisfied with the level of maintenance of the KOHA system
7. Who upgrades your system and how often? Is the system adequately upgraded to address new requirements or global improvements of KOHA?
8. Where you give an adequate set of user, technical manuals
9. Are there specific problems that you are experiencing in regard to the system?
10. Are you satisfied that implementing KOHA was the best decision as opposed to implementing any other system e.g. Vendor provided system. Would you implement KOHA again if you were given another opportunity?

Appendix ii: Interview schedule for institutions that have implemented KOHA with RFID?

1. Did the your RFID implementation process present particular challenges emanating from the fact you where using KOHA?
2. Are there some RFID-based services that are not supported or are poorly supported in KOHA? Is so which ones?
3. Since the implementation has the RFID/KOHA combination presented any operational challenges? If so what challenges?
4. Do the upgrades affect the RFID functioning of RFID components?
5. Are there some RFID manufacturers whose RFID equipments are not compatible with KOHA
6. Would you recommend that we implement KOHA in conjunction with RFID technology? If not why not?

