LIBRARIANS' ACCEPTANCE OF OPEN SOURCE LIBRARY INFORMATION SYSTEM USING THE OSIS-UTAUT MODEL

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ABSTRACT

Research on technology acceptance is rapidly developing in multidisciplinary fields. Technology acceptance is focused either on users' beliefs or for the betterment of system development. Both aspects are considered equally important to determine the users' acceptance of a system. This research aims to investigate acceptance of open source library information system, like, Koha using an expanded UTAUT model called the OSIS-UTAUT model. The unified theory of acceptance (UTAUT) and use of technology model is applicable for both. The UTAUT model is widely used to test end-users' 'acceptance and use' of a system, whereas the user acceptance test (UAT) focuses on functional and technical aspects of the system. In this study the UTAUT model is extended to include the system's success, user skills and system cost aspects to measure librarians' acceptance of Koha OSLIS (open source library information system). The proposed model known as the open source information system (OSIS). The model test the influence of system quality (SQ), information quality (IQ), Information technology skill (ITS) and cost (C) in addition to the constructs from UTAUT model, namely performance expectancy (PE), effort expectancy (EE), social influence (SI), self-efficacy (SE) and attitude towards using technology (ATUT). The survey instrument consist of 61 items representing all ten constructs. In the initial stage four expert validation of the survey instrument was performed. The respondents are Koha OSLIS librarians' from selected academic libraries of public and private universities in Malaysia. A pre-test performed using the SPSS version 22 on a sample of 30 pioneer users' of Koha OSLIS obtained a cronbach alpha's value of > 0.7. The sample is considered moderately skewed-left hand tail with aleptokurtic distribution-heavier tail (kurtosis >0). A total of 215 responses were subjected to Partial Least Square (PLS) Professional version 3.0 software. Bootstrapping is performed to check the discriminant validity. Several items were removed and the final instrument has 56 items. The R^2 value indicates a strong relationship between the variables and data used to build the proposed model. The R^2 value of 79% represents the amount of variance in the dependent variable of user acceptance of Koha open source library information system is explained by the independent variables. Path analysis supported five of the proposed relationships, namely ATUT, PE, SQ, SI and IQ. Four other relationship, C, EE, ITS and SE were not supported for this dataset. This study contributes to the measure of user acceptance of open source library information system from both user behavioral aspect and system success aspect. The OSIS-UTAUT model is shown to be applicable for the measurement of librarians' acceptance of Koha OSLIS. It is hoped this understanding will contribute to better management of OSLIS acceptance and use in academic libraries.

ABSTRAK

Penyelidikan penerimaan teknologi sedang berkembang pesat dalam arena pelbagai disiplin. Penerimaan teknologi difokuskan sama ada pada kepercayaan pengguna atau untuk penambahbaikan pembangunan sistem. Kedua-dua aspek ini memainkan peranan yang sama penting untuk menentukan penerimaan pengguna terhadap sesuatu sistem. Tujuan penyelidikan ini untuk menyiasat penerimaan sistem maklumat terbuka, seperti Koha dengan menggunakan model UTAUT yang diperluaskan serta dikenali sebagai OSIS-UTAUT. Teori gabungan penerimaan dan penggunaan teknologi (UTAUT) boleh digunapakai untuk kedua-dua aspek. Model UTAUT telah banyak digunakan untuk menguji penerimaan dan pengguna sistem oleh pengguna akhir manakala ujian penerimaan pengguna (UAT) difokuskan pada aspek fungsi dan teknikal sistem. Dalam penyelidikan ini, model UTAUT telah dikembangkan untuk aspek kejayaan sistem, kemahiran pengguna dan kos sistem untuk mengukur penerimaan sistem terbuka Koha (sistem terbuka sistem maklumat perpustakaan) oleh pustakawan. Model yang dicadangkan ialah sistem maklumat terbuka (OSIS). Model ini akan menguji kualiti sistem (SQ), kualiti maklumat (IQ), kemahiran teknologi maklumat (ITS) dan kos (C) sebagai penambahbaikan kepada konstruk dari model UTAUT, dengan ‘performance expectancy’ (PE), ‘effort expectancy’ (EE), ‘social influence’ (SI), ‘self-efficacy’ (SE) dan ‘attitude towards using technology’ (ATUT). Terdapat 61 item dalam instrumen kaji selidik yang mewakili 10 konstruk. Pada peringkat awal, pengesahan instrument oleh empat pakar telah dilaksanakan. Responden dalam penyelidikan ini merupakan pustakawan Koha OSLIS di perpustakaan akademik dari universiti awam dan swasta di Malaysia. Ujian pra dilaksanakan dengan perisian SPSS versi 22 terhadap 30 pengguna terawal Koha OSLIS dengan nilai Cronbach alpa > 0.7. Hasil data ini menunjukkan ‘moderately skewed-left hand tail’ dengan ‘aleptourtic distribution-heavier tail’ (kurtosis >0). Sebanyak 215 jawapan telah diuji dengan perisian ‘Partial Least Square’ (PLS)

Professional versi 3.0. Bootstrap dilaksanakan untuk menyemak kesahan diskriminan. Beberapa item telah dibuang dan terdapat 56 item dalam instrument akhir. Nilai R^2 menunjukkan terdapat hubungan yang kuat di antara pembolehubah dan data yang digunakan untuk membina model. Dapatan R^2 sebanyak 79% mewakili jumlah varian dalam pembolehubah 'dependent' untuk penerimaan pengguna terhadap sistem terbuka sistem maklumat Koha perpustakaan diterangkan dengan pembolehubah 'independent'. Analisa 'path' menyokong lima hubungan yang dicadangkan iaitu ATUT, PE, SQ, SI dan IQ. Empat hubungan lain yang tidak menyokong data yang digunakapai ialah C, EE, ITS dan SE. Penyelidikan ini meyumbang kepada ukuran terhadap penerimaan sistem terbuka sistem maklumat perpustakaan dari aspek perilaku pengguna dan kejayaan sistem. OSIS-UTAUT model telah terbukti dalam menilai penerimaan pustakawan terdapat Koha OSLIS. Diharapkan pemahaman ini akan menyumbang kepada penambahbaikan pengurusan penerimaan OSLIS dan penggunaan di perpustakaan akademik.

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LIST OF SYMBOLS AND ABBREVIATIONS

ATUKOSLIS	:	Acceptance of Koha open source library information system
ATUT	:	Attitude towards using Technology
C	:	Cost
CFA	:	Confirmatory Factor Analysis
CMB	:	Common Method Bias
EE	:	Effort Expectancy
IQ	:	Information Quality
IS	:	Information System
ISO	:	International Standard of Organization
ITS	:	Information Technology Skill
LIS	:	Library Information System
NRB	:	Non Response Bias
OSIS	:	Open Source Information System
OSLIS	:	Open Source Library Information System
OSS	:	Open Source System
PE	:	Performance Expectancy
PLS-PM	:	Partial Least Square-Path Modeling
SE	:	Self-Efficacy
SEM	:	Structural Equation Modeling
SI	:	Social Influence
SQ	:	System Quality
SAT	:	System Acceptance Test
UAT	:	User Acceptance Test
UTAUT	:	Unified Theory of Acceptance and Use of Technology

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CHAPTER 1: INTRODUCTION

Research is to see what everybody else has seen,
and to think what nobody else has thought.
- AlbertSzent-Gyorgyi.

1.1 Chapter Introduction

The foreword to this research begins with a brief introduction of this thesis in twelve sections. The chapter overview discusses and explains this research from library perspective and the urged for the interdisciplinary field of study. The research background studies the entire research scenario from the area of this research to the in-depth of the technology and users. The users' demand and technology advancement are the next level discussion which motivates this research. Motivation also defines several problems for this research. The problems are related to library users' and system developers' on the technology acceptance. Hence, statements of problems are introduced to identify the research gap for this study. The research problems are fulfilled by creating research objectives to meet the purpose of this study. The aim of the research is clearly defined and stated in research objectives. Next, is to postulate the appropriate research questions to answer and address the research objectives. The quality and contribution of this research are being discussed in section significance of the research. This research has huge significance to the multidisciplinary field of studies. The contributors and models are adopted from three main fields of research which are the management, information system and library information science. The scope and assumptions of this research are within the boundary of an open source library information system, library automation area, the scope of digital library and the intention categories of organizational, technological and individual are used for mapping the model from multidisciplinary field of studies. Some important definitions of terms for this study is introduced followed by thesis structure and ended up the section with a brief summary.

1.2 Chapter Overview

What is the future for library automation? The library is transiting from conventional to the digital library. The timeline and present situation describe the futurists' intention and impacts on the library and information system. A successful service provider must indicate a high level of interest in the information services and system. The degree of interest in the information services will generate a level of acceptance and usage of an information system. The intention of the service provider is to deliver the information service directly to the patrons. Is it possible to do so if the service provider is not well-versed with the system and refuses to accept the information system? The interaction tone between the service provider and the system users must be at a level of acceptance for usability and applicability. The service provider has to be in the Blue Ocean in terms of skills, information technology, services, make competitors irrelevant, uncontested market space and decrease costs. The information golden age is an opportunity for the service provider towards the acceptance of information system technology with current capabilities and expertise for service delivery. The library is a universal service provider for knowledge and its role has been expanded from cataloging to information provider and finally to a service provider. This indicates that there are demands on the library information system. The motivation to adopt an information system in the library has urged this study of user acceptance of an information system.

1.3 Research Background

The research background will discuss the area behind this study that contemplate the librarians' acceptance of open source library information system. The open source technology has had a great influence on the library industry. Open source systems are built on various technology platforms. The rapidly changing technology has urged libraries to adopt the latest technology to meet the needs and services in the library. The success or failure of an implemented system depends on the information system

(Ginzberg, 1993). In any system implementation there is disparity between developers and users. Information system from the users' view is a device for data input (Rowley, 1993). There are several library open source system such as Koha, ABCD, Evergreen, LibLime, OpenBiblio, MarcoPolo and PhpMyLibrary (KOHA-WordPress). The Koha open source library information system is the main information system which has captured the world library market (Bakar, Rahmad, & Mohd Amin, 2015; Alves, Reais, & Alves, 2012; Biju, Jasimudeen, & Vimal Kumar, 2012; Egunjobi & Awoyemi, 2012; Jasimudeen, 2013; Macan & Fernandez, 2010; Qiang, 2011; Singh & Sanaman, 2012; Vimal Kumar & Jasimudeen, 2012). The Koha open source library information system was initially developed by Katipo Communications (Rafiq, 2009; Riewe, 2008; Vimal Kumar & Jasimudeen, 2012). The Katipo.com Koha library system decided to release Koha a free open source software. Therefore, the advantage lies in the users' ability to manipulate the software for efficient and effective use. The Koha system was developed for the Horowhenua Library Trust, New Zealand. It was initiated in January 1999, and the main idea of open source was to overcome the cost of proprietary software and to fulfill the lacking features in the library system (Breeding, 2009). Assumption on the open source software which contributes to a better output in comparison to traditional or proprietary software development (Braccini, Silvestri, & Za, 2009; Fuggetta, 2003; Mockus, Fielding, & Herbsleb, 2002; Stamelos, Angelis, Oikonomou, & Bleris, 2002) has led this study to perform an in-depth and insight research on the open source system. The Koha license is available online and free to users. This is to overcome the maintenance issue of proprietary systems (Breeding, 2009). The early users and adopters of Koha system are the system developers. The features of Koha are well developed compared to proprietary system in terms of data handling via Z39.5, MARC formats and system quality, whereby the program code of Koha is available to users. Presently, Koha is maintained by a team of software providers and library technology staff all around the world (Rafiq, 2009; Riewe, 2008; Vimal Kumar & Jasimudeen, 2012). Koha movement is believed to be leading to the next major paradigm shift in the library software industry (Dennison, 2011; Jaffe & Careaga, 2007).

The acceptance and use of a technology in the library by means of practice is by a tender lowest bidding procedure and by evaluating the technical specification of the system (Adnanh & Lee, 2015; Rahman, Jamaludin, & Mahmud, 2011). This method of acquisition has omitted the users' acceptance view and the non-technical aspects of the system. Information system failures in the implementation stage is due to non-technical factors (Martinsons & Chong, 1999). A new information technology system has to meet the technical specification and also meet the users' expectations. The benefits of information technology system is to be able to capture the interest of users', preferable outcomes and technological capabilities.

Therefore, there exist a theory for the technology acceptance known as the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh, Morris, Davis, & Davis, 2003). The UTAUT is used by researchers to explain the users' acceptance of a technology based application. This acceptance theory studies the behavioral aspect of user acceptance of a technology based application. The constructs of the UTAUT are performance expectancy (PE), effort expectancy (EE), social influence (SI), self-efficacy (SE) and attitude towards using technology (ATUT). These constructs are used further in this thesis to test the applicability of the model in the library environment and to adapt the model with inclusion of several information system constructs to indicate the disparity method used for information system acceptance.

A study of libraries in universities will eventually highlights the contribution of this research because the library supports the university in terms of research and technology adoption in various service departments. There is assumption that the library will always support proprietary system and the allocation for the system is always available (Bailey, 2011). The technological advancement and financial restriction by government in the last few years have affected the deployment of library systems. Hence, the library has to move on with services and library operations relying on alternative methods. The alternatives to the proprietary technology is the open source technology advancement which has urged the library to open up a broader scope for adopting newer technology based systems.

The library management has to make a decision to either continue to use the proprietary system or to look at the increasing needs of information system in the library (Bailey, 2011). Hence, a study for decision making and to evaluate the factors for information system adoption is crucial based on the budget constraints faced by public and private universities.

1.4 Research Motivation

The desire to conduct the acceptance of open source library information system research is appropriate to the demands of latest technology for the information system (Jackson, Chow, & Leitch, 1997). Technology will change overnight and users' demands for up-to-date technology is high for services delivery. The trends of service delivery and information solutions has urged the service provider from information technology and library to adopt and deploy an information system.

The trend has motivate to conduct a study and grasp more on librarians' view on the acceptance of an open source information system (Abu Bakar et al., 2015). The intentions of organization, technology and individual on information system and the librarians' acceptance for using the open source technology for the library application system highly inspire the researcher to regulate this research.

This study will be conducted in public and private academic university libraries in Malaysia. This research supports the interdisciplinary study on information system and library information science. The trend for information system is moving towards open source system and in the year 2014, the University Science Malaysia library has adopted the Koha library open source system for the entire library application system for the main campus, engineering campus, medical campus and Advanced Medical & Dental Institute (IPPT).

In the year 2009, the university won the award at MyGOSSCON, for the National Open Source Software Case Study (IPPT-USM, 2009). The IPPT has implemented the Koha open source system for the library automation. The project was headed by Mohd Nasir Hj. Md Rashid, Deputy Chief Librarian. The success of open source implementation was in saving management and operational costs of more than 10 000 books and reading materials at the IPPT library and enabled the library operation effectively. The IPPT USM library is the first in the public university library to use the open source system for the library operation for data and information processing. The positive outcome from the IPPT-USM has urged the entire USM library to adopt and implement the Koha open source library system.

Hence, this research has grasp the chance to study the librarians' acceptance on the library open source system and blast it to the market that the future for library system is the open source technology. The librarians' acceptance study will be able to highlight the turnover intention for an organization decision making for an application system solution. The intention will prepare the organization to be equipped with technological advancement in the future and absorb the technology accordance with system skills.

1.5 Research Problem

There is dearth of research in the context of open source systems which focus directly on the users of a system. Several issue that impend open source library information system's success.

Firstly, it is acknowledged that the uptake of open source library information systems worldwide and especially in Malaysia has not been as expected. The use of open source library system is flexible and customizable for each library's unique needs and patron needs (Carlock, 2008), and has implications on reduce costs, license costs saving and improve efficiency in circulation and inventory (Alves et al., 2012). Open source software integrated library systems (OSS-ILS) has become a popular alternative to traditional and proprietary systems because the systems are more cost-effective and easier to customize. However, there are several barriers that libraries are facing when considering the adoption of open source therefore the library continue to use the traditional systems or migrating to other proprietary systems (Singh, 2014). The influence of open source took many years to capture the library market, as the complexity of library process placed a high demand on the functionalities of the system. The first open source library software, Koha was developed in 1999, and with its limited capabilities, was considered for use in small libraries, while larger libraries continued to use and pay exorbitantly for proprietary systems. In 2007, the use of open source systems saw an increase and Wayne Gould (2012) predicted this trend of open source will increase significantly in the coming years. Continual improvements in open source software, such as Koha and Evergreen, brought forth systems that were comparable to proprietary products (Breeding, 2009). In Malaysia, the use and adoption of Koha has been limited to small libraries, though larger libraries, specifically university libraries, are now considering Koha as budget constraint are having an impact on continual use of proprietary library management systems.

Furthermore, there seems to be a lack of understanding of open source technology and system acceptance among librarians. The biggest challenge or issue libraries perceive with open source library systems relates to library staff (Singh, 2014). There is not enough training, technical expertise, or support to migrate the present used system to open source system. Librarians anticipate great difficulty with migration and maintenance and this deters them from adopting an open source system. The open source software was specifically designed for the technically adept users' (Raza & Capretz, 2015). The argument is whether the open source users' are technically skilled to use the system. The key decision-makers, who are the top management of the library, have a definite preference for proprietary library information system over open source system. There are open source adoption studies in various field such as the public sector (Adnanh & Lee, 2015; Jayawardena & Dias, 2011), tourism (Chib, 2013), schools (Johnston, Begg, & Tanner, 2013), colleges (Dennison, 2011) and public organizations (Zhussupova & Rahman, 2011). However, in the case of open source library system acceptance and use, the studies are biased towards the software developers, as such very few studies have conducted acceptance testing among librarians, the actual users of this system.

The budget issue has eventually diverted the public and private university libraries to the cost effective and cost saving solution with greater independence on an organization for the open source solution in Malaysia (Adnanh & Lee, 2015), Pakistan (Rafiq & Ameen, 2009), Kazakhstan (Zhussupova & Rahman, 2011), Europe in the cities of Vienna, Munich, Schwabisch Hall and Treuchtlingen (Cassell, 2008), Sri Lanka (Jayawardena & Dias, 2011), Western Cape School in South Africa (Johnston et al., 2013), India (Vimal Kumar & Jasimudeen, 2012) and Polytechnic Institute of Braganca in Brazil (Alves et al., 2012). These studies outcome are biased to the software developers when the developers' perception shows the advantages is more on the availability of source code, ease of maintenance and software customization (Adnanh & Lee, 2015).

Does software developers' perception lead to the user acceptance of a technology? The developers' perception is the reflection on system and never indicates the user acceptance of a system.

Another evident problem is the disparity among system developers and system users. The study on open source developers, reveal that the system developers do not focus on users' intention. This creates a distinct decision between developers and users on open source system adoption. Hence, the argument between developers' and users' are in the methods used for information system acceptance for adoption and implementation (Ashburner, 1990; Martinsons & Chong, 1999). This disparity impacts the information system success. Raza and Capretz (2015) and Braccini et al. (2009) have examined the users' feedback on open source software project focusing on functionality, reliability, usability, efficiency, maintainability and portability. These features are used in the software engineering to evaluate the software quality (programming) (Sommerville, 2007). These studies reveal that the open source developers do not consider human factor issues related to usability as priority, which are significant to open source system users' and community (Raza & Capretz, 2015). Therefore reliability studies and measuring defects provide neither an analytical nor a prior method of measuring and predicting quality (Ferdinand, 1993, p.270). An assumption is made that the defect might remain in a system when it is put into productive use and this will increase organization's cost, hence the developers were paid to make the defects and also paid again to remove the defect. The defect measuring and control is a method used to control cost by software developers company and to reduce development period (Ferdinand, 1993, p.270). This approaches do not define quality. The satisfaction is imbedded with an assumption of a system quality and need to be measured and scaled in behavioral study. The challenges is understanding the users' opinion, improve usability and new approach for open source acceptance (Çetin & Gokturk, 2008; Raza & Capretz, 2015) . Therefore the developed open source software will definitely have some loop holes. Open source study on users are still young (Braccini et al., 2009). Does the software quality determine the user acceptance of a system? The open source system argument in Figure 1.1 is between developers and users on the users' acceptance. In the field of Information Systems, the user acceptance test (UAT) is solely based on what the system needs and fulfills. Whereas within the information science field, a more behavioral approach, based on the unified theory of technology acceptance, the focus is on what the users want and do (Figure 1.1).

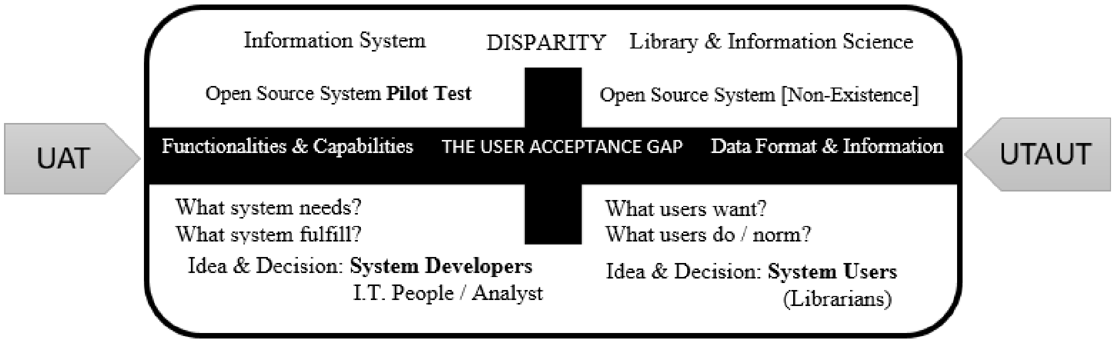


Figure 1.1: Method Disparity between System Developers and System Users

A successful user interaction with open source software never depends solely on software quality and software correctness (Braccini et al., 2009). The software quality is the technical feature and user acceptance is the behavioral aspect. Does the usability feedback fill the gap on users' acceptance of open source system? Raza and Capretz (2015) conclude that the open source developers will need to understand users' expectations and requirements to achieve users' satisfaction in the decision of open source system adoption. There is a need to fill the gap evident between both these approaches.

Lack of user acceptance is a significant impediment to the success of new information system and the user acceptance has been viewed as the pivotal factor in determining the success or failure of any information system adoption (Davis, 1993; Komsky, 1991). The acceptance concept and theory define the users' willingness to utilize a specific system when alternative systems are available and involve in a system development (Komsky, 1991). The users are willing to select a particular system and indicate the success of the implementation process of system acceptance. The use concept is an objective measure of acceptance and the frequent use of the system will indicate the success of system acceptance (Komsky, 1991; Markus & Bjørn-Andersen, 1987). Therefore, the actual usage is usually likely to deviate slightly from idealized and planned usage. The essence of acceptance theory is that the deviations are not significant, therefore the process of users' acceptance of any information technology can be modeled and justified. The unified theory of technology acceptance and the UTAUT model are mainly to study the behavioral aspect of the users'. The UAT in information system is used to study the system acceptance by users' focusing on technical perspective of a system. Both approach differ in terms of users' acceptance and use of technology. There is a need to study the users' acceptance of a system based on what the users want? The answer to this argument is the proposed OSIS-UTAUT model.

There is early research on system acceptance on structure and function of the system rather than direct-user acceptance. There are studies based on UTAUT on the user acceptance and intention to use digital library by postgraduate students in Malaysia (Rahman et al., 2011). There is also a UTAUT based study on the use of electronic library services (Tibenderana & Ogao, 2008). To date there has been no effort to investigate librarians' acceptance and intention to use an open source library information system using a behavioral model such as UTAUT or UTAUT2.

The open source developers will also need to have thorough realization of user expectation (Bødker, Nielsen, & Orngreen, 2007). Therefore, this study fills the gap on the non-technical aspects of user acceptance of open source system adoption and implementation solution focusing on information system field of study. Figure 1.1 illustrates the argument by software developers and system users’ in any system implementation (Limaye, 2009; O'brien, 1993; O'brien & Marakas, 2007; Simon, 2000). This argument is supported by MAMPU (Malaysian Administrative Modernization and Management Planning Unit) in the structure of the open source system team (MAMPU, 2004). The MAMPU tagline for open source team is that the team must include the system users’ and software developers.

A successfully implemented open source software at public sectors in Malaysia still raise a lot of problems, barriers and issues (Adnanh & Lee, 2015). The problems are related to open source implementation rejection, policies, system downtime, open source knowledge, information technology skill for software developers and non-I.T. users, open source capabilities and system users’ perceptions.

Hence, there is a need to understand the acceptance of open source library system from both the systems’ acceptance testing and users’ behavioral acceptance. This research has undertaken the challenge to fill the gap by conducting a study on open source library information system acceptance (by librarians) focusing on user behaviour and technology acceptance.

1.6 Research Objectives

Library information system is decisive for the entire library services. Library information system is evaluated by means of acceptance of the library system, both from the system and user approach. This research aims is to investigate acceptance of open source library information system using the OSIS-UTAUT model. This research objectives are:

1) To identify factors influencing the user acceptance of Koha open source library information system.
2) To identify the relative importance of the factors influencing the user acceptance of Koha open source library information system.
3) To examine the applicability of the proposed model for users' of Koha open source library information system in academic libraries at public and private universities in Malaysia.

1.7 Research Questions

The formulation of research questions is to seek the answer for the research problems and address the research objectives. To identify the factors influencing the user acceptance of Koha open source library information system, the following questions are developed:

1) Is there a relationship between performance expectancy and the user acceptance of Koha open source library information system?
2) Is there a relationship between effort expectancy and the user acceptance of Koha open source library information system?
3) Is there a relationship between social influence and the user acceptance of Koha open source library information system?
4) Is there a relationship between self-efficacy and the user acceptance of Koha open source library information system?
5) Is there a relationship between attitude toward using technology and the user acceptance of Koha open source library information system?
6) Is there a relationship between cost and the user acceptance of Koha open source library information system?

7) Is there a relationship between information technology skill and the user acceptance of Koha open source library information system?

8) Is there a relationship between information quality and the user acceptance of Koha open source library information system?

9) Is there a relationship between system quality and the user acceptance of Koha open source library information system?

To address the second research objective, the research question is stated as:

10) Which attributes do users' perceive to be relatively more important in the acceptance of Koha open source library information system at academic libraries of public and private universities in Malaysia?

Finally, to ascertain of the proposed model as indicated in objective three, the question posed is:

11) Is the proposed model applicable for users' of Koha open source library information system at academic libraries of public and private universities in Malaysia?

The theoretical framework proposed to test the third objective is known as the OSIS-UTAUT. The model is the combination of the original UTAUT model from management field of study and UAT test from information system field of study. The UTAUT model is focused on user behavioral aspects for technology acceptance and the UAT test is for system acceptance by user focusing on functionalities and capabilities of a system. The constructs from UTAUT and UAT are studied to identify the best suitability for the user behavioral on technology acceptance for this research.

1.8 Significance of the Study

This research is noteworthy with a number of rationale. Figure 1.2 explains the research significance in a schematic manner.

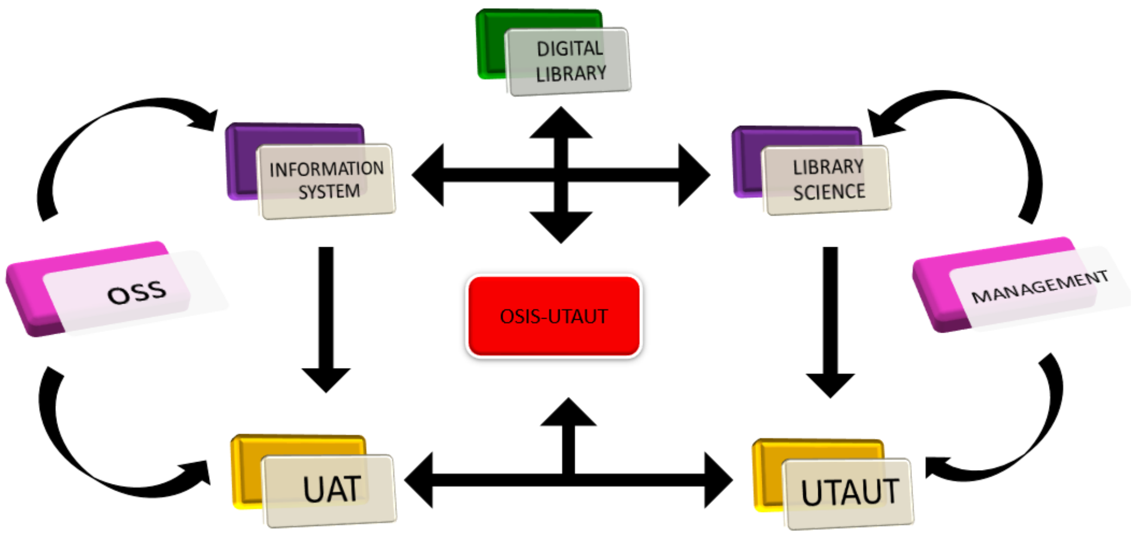


Figure 1.2: Research Significant

Studies on open source library information system were focused to software developers (Alves et al., 2012; Gallego, Luna, & Bueno, 2008; Vimal Kumar & Jasimudeen, 2012) and have used the TAM model which actually omitted the importance of system users' acceptance. The UTAUT model by Venkatesh (2003) which is the combination of 8 other models for technology acceptance is applied in this study. The model adopts the elements of system features from UAT and elements of user behavior from UTAUT to study the librarians' acceptance of an open source library information system.

The proposed model is known as Open Source Information System - Unified Theory of Acceptance and Use of Technology (OSIS-UTAUT). This model is an extension of the UTAUT model. Previous study indicates that the adoption rate in public university in the world is demanding (Breeding, 2009) and this study is for the Malaysian context. It focuses on public and private academic libraries from Malaysian university that have adopted the Koha open source library information system. Information of Koha users' in Malaysia is collected for this research. This research aim is to fill the gap on the what is needed by the system users' and what is delivered by the software developers and a remarkable contribution to the multidisciplinary field of study.

The proposed model, OSIS-UTAUT will serve as a basis for the selection of appropriate open source information system in the future for any open source library information system. This will fill the argument gap between developers and users' on the system acceptance and user acceptance for an information system. Furthermore, the research investigation is on the influencing factors and the relationship between influencing factors and acceptance of an open source library information system in the context of use behavioral.

The system developers' perspective on the software acceptance is positive findings (Gallego et al., 2008). Hence, if this study findings signify a positive and direct influence between influencing factors and acceptance of an open source library information system, the result can eventually be used as a motivation to penetrate the library market, public and private academic libraries on the adoption and implementation of open source library information system.

The findings of this study will also be able to guide the library in making the most of the library information system in enhancing the library service and staffs performance on the job. The organization would be able to reduce cost, processing time and staffs training on an information system. This research would be able to forecast whether Malaysian academic libraries at public and private universities would give a priority to open source library information system to be implemented in the libraries.

Upon research completion, a broader view on the acceptance of an open source technology for library information system will be embarked. The library information science field of study and library industry will be on demand based on the proposed model, OSIS-UTAUT solution. The information system field of study has contributed some elements to the use behavioral research. Hence, it is important in use behavioral study related to users' or end-users' for open source system and to consider the UAT and UTAUT elements.

A user acceptance study will complement the decision making process for an organization upon adoption, intention to use or evaluation on implemented system. The beneficiaries of the successful implemented open source library information system are the organization, librarians, open source developers, researchers, technological developers and library industry.

1.9 Research Scope and Assumptions

Scope is to identify boundaries and limit the coverage within boundaries in a research. The scope is to indicate subject matter of research, research time frame, locale, research direction and to whom research is directed to, justify the research benefits and identify the beneficiary of this research. Assumption is to set the creation of the boundaries for a research. What is contained within a study is the assumption. Key terms are used within the boundaries to narrow the research topic (Haron, Khalid, & Ganesan, 2011, p.7).

In this thesis, the research area refers to the Library Automation. The research scope is the boundary of open source library information system. The scope digital library is used to direct the research objectives and questions. The key terms library automation, digital library, library information system, open source system, open source Malaysia, academic library information system, library technology, UAT and UTAUT are used to gather the literature. Locale of research is at academic libraries of public and private universities in Malaysia. The direction of this research is from the perspective of acceptance model by Venkatesh (2003) and idea from Sommerville (2008) for an interdisciplinary study on system behavior and the user study is from Gallego (2008) for the open source software acceptance by developers.

The intention categories for this study are the organization (library), technological (open source) and individual (librarian) with the influencing factors adopted from UTAUT model and UAT elements. The influencing factors are performance expectancy, effort expectancy, information technology skill, system quality, information quality, cost, social influence, self-efficacy and attitude towards using technology. In the library, not all the librarians' hands-on with the system. The librarians' in this study are limited to system librarians. This research is directed to librarians who are directly involved with the implementation of Koha open source library information system. The beneficiary of this research is the library management, librarians and I.T. experts in the library and the institution community. In this research, the library is referred to as the business or organization. The users or end-users are the librarians. The acceptance of a system is being studied after an application system has been implemented (O'brien & Marakas, 2007; Simon, 2000; Venkatesh et al., 2003; Wilson, 2001)

Assumptions for this research are made to suits the nature of the library automation research. Apparently the latest technology for information system is the open source (Braccini et al., 2009; Fuggetta, 2003; Mockus et al., 2002; Stamelos et al., 2002). Librarians answering the questionnaires are the respondent and the librarians are expected to share the perception and best practices, truly and honestly in the survey and never exaggerate the questionnaires for a desirable outcome to suit this research. Librarians' completed survey are confidential and anonymous.

Self-assessment on a particular system is good. This evaluation reflects the individual attitude, self-efficacy, social influence, skills and information technology proficiency, effort, job performance and service quality for an organization. The outcome of these evaluation represent the organization's actual performance. The nature of library is on the system evaluation which lead to a service performance (Hsieh & Hsu, 2013; Mohideen & Kaur, 2015; Mohideen, Muhamad, Ghadzali, Arshad, & Rafie, 2012; Tefko Saracevic, 2000). This assumption can be considered valid as the library has the power and knows insight to the entire services. The assumption is used widely in the libraries (Borgman, 1999; Cooper, Dempsey, Menon, & Millson-Martula, 1998; Fox & Marchionini, 1998; Gonçalves, Moreira, Fox, & Watson, 2007; Hashim, Rusuli, Saufi, & Rosmaini, 2012; Lee, Kozar, & Larsen, 2003; Mohideen et al., 2012; Tefko Saracevic, 2000; Youngok & Rasmussen, 2006).

This research is assumed to be the first study on the librarians' acceptance of Koha open source library information system in Malaysian academic libraries. There will not be a large scale of data collection for this study and it is assumed to be reasonable as the users' are limited to system librarians among Koha OSLIS users' only.

The pre-test and testing of quantitative data will be conducted using the structural equation modelling (SEM). The SEM is suitable for this research as it is predicting a number of factors and explain the librarians' acceptance in the context of use behavioral study. There are 2 types of SEM. The covariance based (CB-SEM) and partial least square (PLS-SEM). The CB-SEM is used for theory testing and confirmation whereas the PLS-SEM is for prediction (Hair, 2014; Hair, Ringle, & Sarstedt, 2011). The PLS accommodate smaller data better compared to CB-SEM (Chin & Newsted, 1999; Goodhue, Lewis, & Thompson, 2006; Qureshi & Compeau, 2009). In PLS, there is bias when small size of data is used to estimate path coefficient and to predict accuracy. Due to small size of data, there will be a downward bias *"the resulting is smaller than actual"* in the path coefficient estimation (Hair, 2014). Hence, the PLS - SEM will be used in testing phase. Therefore, the adoption of proper statistical software will eventually reflects the research hypothesis outcome and provides a good findings interpretation.

1.10 Definition of Terms

There are a quite number of definitions that reflects the key terms for this interdisciplinary study. These definition are adopted from the relevant studies that is in the field of information system and management:

Acceptance

Acceptance is also known as use behavior (Venkatesh et al., 2003). This acceptance is on users' behavior towards an implemented system. The willingness of users to utilize a specific system when alternative systems are already available (Komsky, 1991). Users are willing to select a particular system, in this case Koha open source library information system, and indicate the success of the implementation process of system acceptance.

Attitude towards using system

Individual positive or negative feelings about performing the target behavior in using a system (Venkatesh et al., 2003). Individual's overall affective reaction to using system (Dulle & Minishi-Majanja, 2011). It is measuring the librarians' favor or disfavor, way of thinking and habits on the use of Koha open source library system.

Behavioral or Behaviour

Individual, organizational, technological and system action (Venkatesh et al., 2003). There are 2 domains in the behavioral study which are the intention to use technology known as behavioral intention and acceptance of technology known as the use behavioural.

Behavioral Intention

The degree to which a person has formulated conscious plan and yet to decide on implementation for future behaviour (Venkatesh et al., 2003). A system has been developed and yet to be test and use.

Cost

The amount of price or value added for money (Business-Dictionary, 2015a) for the entire system development and maintenance. It is indicating the technological cost for development, training and maintenance for the Koha open source library system.

Digital Library

The pioneers, Vannevar Bush and J.C.R. Licklider have mentioned that digital libraries are an electronic libraries focused on collections of digital objects including text storing, finding and retrieval of information (Arm, 2000) . These process is being done by librarians' using an information system. A library to transform to a digital library is influenced by users' belief and perceptions (Lee et al., 2003).

End-Users'

The end-product users' and known as customers (Limaye, 2009). End-users' are the patrons for the library. The patron uses the front end of the Koha open source library system. The patrons are the end-users' for the Koha open source library information system. The patrons used the processed information by the direct users' who are the librarians.

Information System

An organized combination components of people, hardware, software, communication networks, data resources and policies and procedures that stores, retrieves, transforms, and disseminates information in an organization (O'brien & Marakas, 2007, p.4)

Information Technology Skill

The skill gap which exist between the present information technology skill, knowledge and the required skill to fulfill the organizations needs and objectives (CompTIA, 2015; IT-Skill, 2015). The information technology skills referred to the librarians' I.T. knowledge, computer skill, technical skill to develop, organize and maintain the Koha open source library information system.

Information Quality

The emerging discipline theory and practice concerned with the process of maximizing the value of an organizations information assets and assuring the information system created by the organization meet the users' expectation (Burton-Jones & Straub, 2003; DeLone & McLean, 2002, 2003; Seddon, 1997; Talburt, 2011). The input and output of a system and is for the users' view who are the librarians' before the information is released to end-users'. The Koha library open source system's ability to read and produce the library data format, information organization and data accuracy for librarians'.

Intention to use

The intention to use is also known as behavioral intention. The degree to which a person has formulated conscious plan to perform or not perform some specified future behaviour. The decision making process for system adoption and has gone the pilot study (Venkatesh et al., 2003; Venkatesh, Thong, & Xu, 2012). The outcome of this study will influence other libraries intention to use the Koha open source library system.

Quality

Fitness for use, no defects, works as expected, matches the concept of organization cost and service delivery (Limaye, 2009, p.5) The degree to which a system, component or process meets a specified requirements and users' needs and expectations (Gordon

Schulmeyer & James, 1999, p.3). The task effort meets the task objective which is determined by the Koha Users'.

Software

The computer programs, procedures, documentation and data pertaining to the operation of a computer system (Galim, 2004). This is describing the software developers' evaluation on a developed software.

Use

It is an objective measure of acceptance (Komsky, 1991). Frequent use of the system is the requirement for the success of system acceptance (Komsky, 1991; Markus & Bjørn-Andersen, 1987)

Use Behavioral

The degree to which a person has formulated conscious plan and implement it (Venkatesh et al., 2003). This measure the user acceptance of an implemented system. The implemented system has gone through the system pilot test which indicates the system acceptance but yet to perform the user behavioral test to indicate the user acceptance.

Users'

Users' are the system users' (Sommerville, 2007). In this study, the users' are the librarians' of Koha open source library information system who uses the back-end of the system interface. Users are known as system librarians in this research. A new definition terms is also introduced for system librarians' as Cybrarians'. The Cybrarians are the librarians involved with system and information (Reitz, 2016).

1.11 Thesis Structure

In this thesis there are five chapters. Each chapter is presented by an introduction and ends with a chapter summary. The chapters are Introduction, Literature Review, Methodology, Finding of Quantitative and Discussion and Conclusion. Every chapter will begins with introduction and ends with a summary.

Chapter one provides the brief introduction to the entire research. The research background, research problem, research proposed model, research objectives, research questions, significance of the study, research scope and limitations, research assumptions, research motivation, research approach and research definition terms.

Chapter two presents the literature review on the theoretical and empirical findings of prior studies. Important theories related to the information system and management fields of studies are reviewed and used as foundation to build the theoretical framework for the technology acceptance model. This chapter is streamlined to library automation, information technology, digital library, information system, open source software (OSS), the user acceptance test (UAT) and the unified theory of acceptance and use of technology (UTAUT).

Chapter three provides the research design descriptors, methodology, theoretical framework, research design, research instruments, statistical technique and the analysis and formulations of research hypotheses and quantitative strands for pre-test and data analysis using the partial least square path modelling.

Chapter four reports on the quantitative findings. Research instruments, statistical technique, analysis of the quantitative method, model fit and further in-depth, measurement model, structural model and insight discussion.

Chapter five is the summarization of the entire research. Discussion is on the output and answers to the research questions and research findings. Research limitation and research contribution are addressed and concluded with the scope for future research.

1.12 Summary

Chapter 1 reflects the prospectus for the entire research. This chapter is the engine which drives the rest of the research. There is empirical arguments and proof throughout the discussion. The terms, phrase and word are introduced and it is used throughout this research. The users' gap which lead to this research is identified from information technology and information system (O'brien & Marakas, 2007; Sommerville, 2007, p. 4). Both the information technology and information system in this research is referred to open source technology and open source library system. The open source technology and open source library information system in Malaysian academic library is still new and hence not much research has been conducted to foresee the acceptance success among Malaysian academic librarians in public and private universities. This highlights insufficient research in this area of library automation specifically in the Malaysian context. The anchor concepts for open source system are based on Gallego (2008), Vimal Kumar (2012) and Zhussupova (2011) and for information system is from O'brien & Marakas (2007). Finally, the research problems are highlighted and respective objectives are developed for this research to be conducted.

CHAPTER 2: LITERATURE REVIEW

Research is creating new knowledge.
- Neil Armstrong.

2.1 Chapter Overview

Scholarly papers with the past and present research knowledge including findings, theoretical underpinnings for the conceptual model and methodological approach are the main contributions in this section that reviews the literature to reveal research gaps for the direction of this study. Firstly, the research model is presented to assist in understanding the entire research flow. This is followed by the presentation of relevant literature that supports and justifies the intent of this study. There are four main sections to be discussed with evidences from the supporting literature. The sections are library automation, library systems, user acceptance test (UAT) and unified theory of acceptance and use of technology (UTAUT). Library automation and the evolution of information technology for the past decades is presented to establish the need for libraries to evolve the library information systems accordingly. Next the concept of information system is discussed from the general point of view to the latest technology, the open source technology for libraries. Then, issues of open source information system in the library are outlined. The subsequent section reviews the user acceptance test (UAT) to capture the factors influencing open source information system acceptance. Then, the UTAUT model is scrutinized to understand the domain of user behavioral constructs for an open source information system. The process of adapting the UTAUT constructs with the constructs of UAT is explained in detail with justifications for proposing a new model in assessing the acceptance of open source information system in a university library setting.

2.2 Underlying Concept of User Acceptance Model

There exist an underlying concept for user acceptance model (Venkatesh et al., 2003).The importance of understanding the underlying concept of acceptance model is to know the reaction on how and why users adopt a new information technology based system. This underlying concept is created to define the flow of "lead" and "need" for the user acceptance study. The final model of the user acceptance study will emphasize on the actual use of an information system. Figure 2.1 shows the underlying concept which supports the user behaviour and acceptance of information technology in this research. This underlying concept is created to clearly differentiate the technology acceptance test using the system pilot test and technology acceptance test using the unified theory of technology acceptance test. The user behaviour and technology acceptance are used to fill the gap for both the technology acceptance tests.

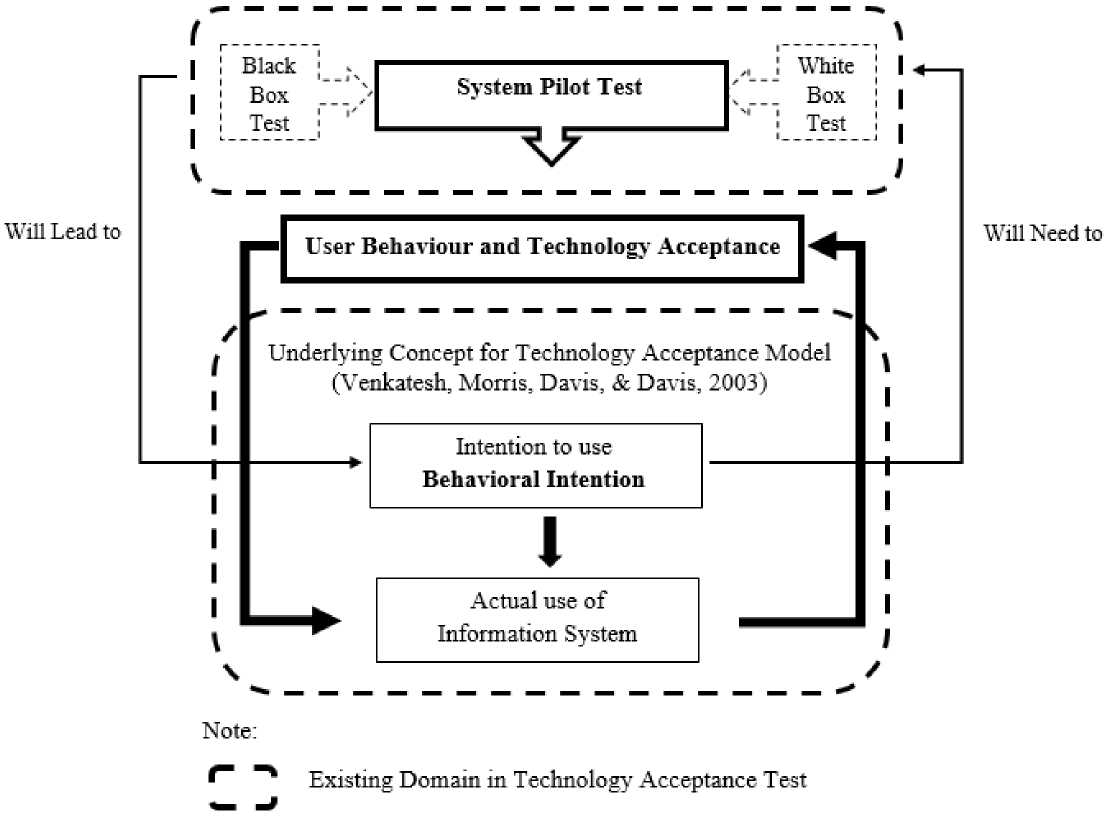


Figure 2.1: Underlying Concept of User Acceptance Model

The decision to adopt a system begins from the organization's management. The action is undertaken by a technical division to invite vendors of a proprietary system for a system pilot test. This will consume some cost depending on the vendors. The system pilot test is carried out only to evaluate the aspect of system functionalities and capabilities. The technical aspects of the proprietary system is only evaluated during the pilot test without any enhancement. The outcome will give the vendor a broader scope to enhance the system. There is no user evaluation performed after the system pilot test. The users for system pilot test are selected and the system is tested on various aspects of system quality.

In the open source technology system, the pilot test is within the organization and users are the owner of the system. Therefore, a system pilot test is still needed for open source and will be followed by individual acceptance test to evaluate the system acceptance. During the system pilot test, voluntary users are those willing to test the system quality and information quality according to their understanding, feeling and reaction are recruited. The technical aspects of the open source system are evaluated throughout the entire stage of a pilot test with enhancement and modification to suit the organization needs.

The underlying concept clearly highlights the importance of user behaviour test for wise decision making process for technology adoption in an organization. This concept is supported by a unified theory of technology acceptance to understand the users acceptance in the context of behavioral aspects (Venkatesh et al., 2003). The unified theory is known as the unified theory of acceptance and use of technology (UTAUT). This concept also traces the development of a system from the scratch to the end product compared to a proprietary system. This concept is likelihood of information technology acceptance success and drives the users and organization to a mutual understanding and devote the benefits to all.

2.3 Library Automation and Information Technology

Digital Environment in Malaysia supports Libraries to embrace digital technologies. Strategies and new roles of libraries and librarians leveraging on digital technologies to contribute in era of vision 2020.

-International Digital Library Conference, 2014
Ybhg. Dato' Sri Dr. Halim Shafie
Chairman of National Library of Malaysia
Advisory Board at Internal Digital Library

Digital Library is the most complex and advanced form of information system and addresses on technical, informational, organizational and social challenges.

- *(Fox & Marchionini, 1998)*

Library and Information Science (LIS) is highly interdisciplinary by nature (Prebor, 2010; Tefko Saracevic, 1995) and the endless evolution of technologies has affected it. The information technological system is used by computer professionals, while information science is concerned about information users, therefore both areas should be covered by one field (Saracevic, 1999).

The evolution of digital library and digital information has urged LIS and information system (IS) to associate on the basis of reaching practical solution to meet users' demands and expectations (Chudnov, 1999; Mohideen & Kaur, 2015).

The major differences between LIS and IS are information, users, the field of study, system, information technology and management (Prebor, 2010). The information system is comprised of a group of system providers as developers whereas the library information science is a group of system users. Every information system has various elements. The characteristic of an information system is used to perform the daily organization task by system users.

Studies on user involvement and information satisfaction report significant relationships (Communications & Guthrie, 1972; Franz, 1979; Gallagher, 1974; Kaiser & Srinivasan, 1980; Maish, 1979; Powers & Dickson, 1973; Swanson, 1974) and studies on examining system usage and user involvement also report significant findings (Lonnstedt, 1975; Swanson, 1974).

The users of digital libraries are specialist librarians in the information system. The librarians in digital libraries are guardians of information and are known as Cybrarians (Mohideen & Kaur, 2015; Sreenivasulu, 2000). Technology advances have distinguished the role of librarians and Cybrarian.

The information, communication and technology (ICT) have enthralled the development of information systems. This ICT development is a captivating period for any organization or business using a system. The library is one of the organizations which uses an automation system for operations and services. The ICT developments, users' demands and expectation and information system predicted the future needs for a library. This has lead the library to adopt integrated library systems and move towards a digital library platform.

Technology adoption in an organization creates positive relationships between information technology and the organizational performance (Kijsanayotin, Pannarunothai, & Speedie, 2009; Sargent, Hyland, & Sawang, 2012; Tan & Teo, 2000). Information technology is used to assists in the communication, integration, productivity and service delivery. A study by the National Institute of Standard and Technology (NIST) on information technology adoption, reveals that cost and performance eventually improve the information technology use (Sargent et al., 2012). The evidence is based on 74 companies that have adopted information technologies and have positive impact on their business.

The professionals in an organization are willing to change according to the development of information technology (Davis, Bagozzi, & Warshaw, 1989). The assumption is to overcome the business limitations. The information technology does not justify the time and cost spend over the technology adoption, however, the information technology will ensure the effective management of operations and services. The critical success factor is an argument in the information technology acceptance. The user acceptance is considered as a critical success factor for information technology adoption and implementation by predicting the acceptance factors (Davis et al., 1989; Venkatesh et al., 2003).

Information technology continuance is also determined by the technology habit, task complexity, the importance of usage and the priority of information and use (Lankton, Wilson, & Mao, 2010). The information technology is robust within the scope of habit and task complexity. The support on the organization data set eventually predicts the continuance of information technology use. The information technology models depict the system acceptance and user behaviour. The user behaviour creates a direct positive relationship in technology acceptance.

A study in Bangladesh by (Siddike, Munshi, & Sayeed, 2011) on the adoption of information technology in the library, discuss the traditional methods used to the present new technologies in the public and private universities in Bangladesh. Among the issues raised in the delay of information technology adoption is due to administrative factor, human factors, lack of funds, lack of support, lack of information technology skill, lack of support to internet connection, lack of information technology knowledge, high cost for infrastructure, lack of training and dispute of library standards.

In a neighboring country, Pakistan, Information technology adoption in public and private universities libraries by Qutab, Bhatti, & Ullah (2014) revealed in Pakistan the current status of ICT used for operation and services is the problems for ICT adoption. The findings reports that the library operations and services are giving opportunity to the technology adoption.

2.4 Library System

A system is a set of interrelated components with a clearly defined boundary, working together to achieve a common set of objectives

- *O'brien & Marakas, 2007, p.4*

The technology and information systems are business imperative. Information technologies and information system are distinct concepts (O'brien & Marakas, 2007, p.7). An information system is influenced by information technology advances (Martinsons & Chong, 1999). The information technologies and systems have great intention, role and influence in an organization (O'brien & Marakas, 2007; Simon, 2000). The main intention of information technologies and information systems are to improve the organization's business operations and services, staff performance and competitive capacity (Galandere-Zile & Vinogradova, 2005). Therefore, it is important for an organization to decide and absorb the latest trend of information system in the market. The technology advances have disappointed the information system in terms of performance. The failure of an information system is due to nontechnical factors (Martinsons & Chong, 1999). The information technology assimilation has an influence on human and the organization. The social and psychological influencing aspects on human and organization are the main intention of the information technology (Martinsons & Chong, 1999; Rahe, 2006; Steier, 1989; Swierczek, 1991; Walton & Vittori, 1983). The method used for system implementation will give impact to the success of an information system (Ashburner, 1990; Martinsons & Chong, 1999). Therefore, the information technology acceptance reinforces the existence of the non-technical aspects that influences the organization and individual to use an information system.

A system which include software comprises of two categories (Sommerville, 2007). The technical system and the socio-technical system. The technical systems are the hardware and software components. An example of a technical system is the smartphone or computer software. The socio-technical systems are the operational processes and the people using the system, which may include some policies and rules. An example of a socio-technical system is the library information system.

The socio-technical system reflects a distinct gap between the software and people. This gap reflects the emergent system properties which are affected by system engineering issues. There are 2 types of emergent properties (Sommerville, 2007). The functional emergent properties and the non-functional emergent properties. The functional emergent properties are referred to as the components of the system which works together and are tested through a user acceptance test (UAT). The non-functional emergent properties is referred to as the behaviour of the system and is tested at the operational level. In a software engineering study, the non-functional emergent properties are actually indicating that there is a need for a management field of study related to behavioral aspects of the system. The success or failure of a system can be traced from the perspective of software development which actually omits the non-technical aspects (Vliet, 2008).

There are several types of systems. Two main classified system groups are the operation support systems (OSS) and management support systems (MSS) (O'brien & Marakas, 2007; Simon, 2000). This research path is on the Operation Support System. Every system is either manual or computerized and the system will have two groups of users. The groups are the system users and end-users. The system users are the librarians who use the operational or back-end of the system; and end-users are those who use the front-end of a system. The users prepare the data and information for end-users' usage. A system must be up to the expectations and be desirable to users. The system is what the users' input and service is what the end users' want (Mohideen & Kaur, 2015). This is an indication that the users' acceptance of a system is crucial before the information is delivered to the end-users.

The concept of *"garbage in, garbage out* (GIGO)*"*(Software-Quality, 2015; Tech-Terms, 2015) from computer science study is an exact phrase to be used in a multidisciplinary study to determine a viable system and service. The GIGO means the quality of output is determined by the quality of input (Business-Dictionary, 2015b). The input is dependable on the quality of a system. The quality of a system or system evaluation is conducted via a pilot test, known as the user acceptance test (UAT) by system developers. This UAT for system is biased towards the developers and focus on system functionalities and capabilities (O'brien & Marakas, 2007; Sommerville, 2007). Does the UAT test indicate the users' acceptance through users' behaviour? Does the system pilot test capture the main intention of the information technology adoption? The non-technical aspects on social and psychological (Martinsons & Chong, 1999; Rahe, 2006; Steier, 1989; Swierczek, 1991; Walton & Vittori, 1983) from the organizational, technological and individual aspect for a system adoption decision is being omitted in the system pilot test using the UAT test.

The system evaluation and acceptance varies in discipline. In any system, there is no system view on how quality behaves as a parameter or function which influence the system (Ferdinand, 1993, p.269). Six Sigma is a methodology used in business, statistical theory and quality control to improve business procedures (Six-Sigma, 2015). In Six Sigma quality means low cost approach and higher product quality to customers. Quality is a prime driver behind the users' acceptance of product and services (Ferdinand, 1993, p.1). The quality has direct effect on customer satisfaction, production and service delivery (DeLone & McLean, 1992; Ferdinand, 1993, p.1). Quality is the tie breaker for competitiveness in an organization.

Gallego's (2008) study had two aims, first is to identify the variables and second was is to identify the factors which have direct effect on developers' attitude towards open source software adoption, and both variables and factors are considered to be viable solution for information management in an organization. The study used the technology acceptance model (TAM) by Davis (1989). The selected factors are perceived usefulness (PU), perceived ease of use (PEA) intention to use (IU) and usage behaviour (UB). The open source software under study is the Linux operating system.

Gallego (2008) sought to identify the external constructs which influences the software developers' intention to use the open source software solution. The developers' acceptance of the Linux open source software is influenced by the software quality (SQ), system capability (SC), social influence (SI) and software flexibility (SF) (Gallego et al., 2008). The selection on the external constructs are based on technology acceptance studies such as the enterprise resource planning (Amoako-Gyampah & Salam, 2004; Calisir & Calisir, 2004), tax payers (Chang, Li, Hung, & Hwang, 2005), internet banking (Cheng, Lam, & Yeung, 2006), information technology (Davis, 1989), computer technology (Davis et al., 1989), use of website (Lin & Lu, 2000), wireless internet (Lu, Yu, Liu, & Yao, 2003), mobile banking (Luarn & Lin, 2005), broker workstation (Lucas & Spitler, 1999), course website (Selim, 2003) which have applied the TAM model and mobile commerce (m-commerce) user acceptance using UTAUT model in China (Min, Ji, & Qu, 2008).

High priority for information systems embraced by organizations, technologies and individuals are high rank issues in acceptance studies (Venkatesh & Davis, 2000; Venkatesh et al., 2003; Venkatesh et al., 2012). Significant progress has been obtained in the last decade for user acceptance of information technology at work (Venkatesh & Davis, 2000). The acceptance gap between the software developers and system users are precisely identified in the information system acceptance. A study by Min et al. (2008) proposed that the cost, system quality and information quality are recommended for future UTAUT model to evaluate the technology acceptance in the context of mobile commerce in China.

Librarians are less exposed to the open source training, technical skills solution and awareness of the open source systems (Biju et al., 2012). This may be the cause of slow uptake of open source usage in the library. Most studies in the field of library science are focused on the system users and not the software developers, but the constructs are applicable to software developers too with some modification to suit the software developers' acceptance of open source software.

The information system embraced an organization remains high-priority research issues (Venkatesh & Davis, 2000). In an organization, significant progress exists on the system user acceptance of information technology. In this study, the users are in the context of system users, specifically librarians and not the software developers. The data and information are important but experience with information technology skill is a token which actually leads to an acceptance decision (Galandere-Zile & Vinogradova, 2005) .

Experience can be good and bad. What determines the experience? Experience can only be attained by users with an implemented system. The experience evaluation is actually the acceptance study (Venkatesh et al., 2003; Venkatesh et al., 2012). In information study the experience of users are omitted and the aim is on technical solution of the system that is biased towards system developers. In this study, the users' experience is the users' acceptance of the implemented open source library information system.

The library as the leader of this information age should be able to absorb the latest technology for information system and solve the negative views of users and build the confidence in open source system by conducting the UTAUT user acceptance test and convincing other service provider to adopt the open source library information system. By conducting this test, the system users are aware of the technological advancement and work accordingly to achieve the organizational mission and vision and enhance the individual job performance and target. Indirectly the pioneer system users will be the advisors and developers for open source system for the library and contribute to the library's open source community projects.

The Information technology skill gap was presented on February 2012 by CompTIA - Computer Technology Industry Association (CompTIA, 2015). The purpose of the study was to identify the existing and forthcoming IT skills shortages and to understand the IT skills needs in an organization. The focus of the study is on IT and business managers involved in managing IT and IT staffs in an organization. The study is conducted in Canada, Japan, South Africa, United Kingdom and the United States. The key point from CompTIA is on the importance of technology to an organizations success, to utilize staff skills with technology advancement and both the IT staff and users' will require sufficient knowledge bases and skills to the technological implementation. The technological intention is to sit at the center of organization strategy. The technology success trend is upward in an organization. The failure of decision makings in technology investment would lead to non-optimal integration with legacy technology. The majority of the organizations seek an opportunity to improve the use of technology and skills of the IT. CompTIA statistic shows that 50% is for technology use and 46 % is on IT staff skills. 93% of staff indicate that there is an overall skill gap among IT staffs. 80% organizations indicated the IT skills gap affects staff productivity (41%), customer service (32%) and security (31%). Lack of resources for the staffs' professional skills development is the evident. Some organizations are unaware of IT skills needs in emerging areas. This suggests for self-awareness and recognition of the organizational issues.

Organizations are keen to improve the hard and soft IT skill gaps. The organization is concerned to measure and understand staff productivity, the value of time and return on investment (ROI) of training. The findings show more attentive IT skills gap outside the IT organization which deployed the system technology and budget restraints are the main issue. Hence, one of the elements in this research is librarians' IT skilled. This skill is the key influencing factor for the acceptance of an open source.

In public and private university libraries, information quality is a survival issue (MIT-IQ, 2015). Studies in the academic sector have highlighted the contribution of the library to the success and the value of libraries in supporting research, therefore this research has chosen the academic sector to study users' acceptance of information system. When times are good, it is easy to be complacent about budgets for library resources and staffing levels. Librarians' assumption is that there will always be money for library information system (Bailey, 2011). In the last few years, libraries have been looking hard not only in the resources and collections but also at whether the proprietary information system technology is necessary for library operations and services (Bailey, 2011; Mohideen &

Kaur, 2015). The information quality is a non-technical issues. There is no consensus on the distinction between data quality and information quality. The data quality is referred to technical issue and is catered for by software developers, whereas the information quality is a non-technical issue and managed by users (Zhu, Madnick, Lee, & Wang, 2014). In 1980s, the data and information quality begun to attract the researchers (Zhu et al., 2014). The issues related to matching record, information integration and record linkage are of main concern to the librarians. The initiatives were taken by software developers to adopt the data technologies in the software products and services. Studies on information quality and organizational outcomes prove that the information quality can be used to predict the organizational performance (DeLone & McLean, 1992; Gorla, Somers, & Wong, 2010; Rahman et al., 2011; Slone, 2006). Another study on information quality is related to the knowledge and experience owned by the individual affect the work performance (Slone, 2006). The information system and information quality have not been explored in terms of technological intention (Gorla et al., 2010).

A system is highly interrelated to technological advancement (Mohideen & Kaur, 2015; Sulayman et al., 2008). The technological advancement has impact and influence on organization and individual (Delone & McLean, 2003). The organizational and individual concern on library information system are mainly on quality of the system, the cost of proprietary system and maintenance cost that are increasing over the year due to system enhancement and librarians' demand for new features and the information quality which resides in the system with specific data format are inaccurate and non-supportive to multidimensional library data format from MARC21 to resource description access (RDA) format (Mohideen & Kaur, 2015; Mohideen et al., 2012). The users' concern on proficiency with the computer is doubtful, less-training on the system, lack of confidence with system, librarians' expertise on the system is questionable, librarians' attitude which is neglect to change the habits and norm of performing a task, social influence on the information system and self-efficacy in using a system is low. These obstacles are from the perspective of organization in decision making process, technological advancement and individual perception (Mohideen & Kaur, 2015; Rahim, Zairah, & Alias, 2006; Rahim, & Alias, 2006; Sulayman, Ioannis, & Ioannis, 2008; Zhussupova & Rahman, 2011).

Therefore, this study adopted the elements of a system from UAT which focus on the non-technical aspects which influences the intention of the organization (library), technology (open source) and individual (librarian) and studied the librarians' acceptance with a technology acceptance model known as the unified theory of acceptance and use of technology (UTAUT) by Venkatesh et al. (2003). These elements will be used to test the system evaluation by librarians' which indicates the technology acceptance for adoption and implementation. The level of acceptance of a system by users would deliver the appropriate information for end-users. A desirable system is then delivered as services to the end-users for information retrieval.

2.4.1 Information System

An information system can be any organized combination of people, hardware. software, communication networks, data resources and policies and procedures that stores, retrieves, transforms and disseminates information in an organization

- *O'brien & Marakas, 2007, p.4*

In the information system, the field is not bound to any particular technological based system and yet the problem is always tied up to the idea of technological changes in information system (Mats Alvesson, 1992, p.159). The way an information is expressed is influenced by technology acceptance and the technology used solely depends on people (Arm, 2000, p.2). The developer and users have disagreement in the technology interaction. The development of information technology has allowed the new arrangements in an organization and transform the organization with technology based information system (Mats Alvesson, 1992, p.161).

A summary of information system acceptance studies is available in appendix A. Martinsons & Chong (1999) quoted by Walleigh (1990), argued on the decision to deploy an information system will create a competitively disadvantaged and internally stressed environment. The decision and action affect the organizational operations and services (Hsieh & Hsu, 2013). The mentoring and adaptation of information system argued on users' intention to use an information system (Hsieh & Hsu, 2013). The users' intention is on the types of information system (i.e. proprietary, third party system, open source system) or to adopt the new technology.

An information system is important for operations and management (Nickerson, 1998). The information system effects the individual action on the operations and services. The individual intention precisely indicates there is a gap for an information system deployment. The decision gap exist between users and management for information system adoption. The identified gap reflects users' acceptance. This gap has not been tested in the library information system context. There exist a causal relationship and interdependent among organizational, technological and individual aspects (Delone & McLean, 2003; Heeks, 2002; Petter, DeLone, & McLean, 2008; Seddon, Staples, Patnayakuni, & Bowtell, 1999; Venkatesh et al., 2003). This causal relationship lead to positive impacts on organizational, technological and individual productivity improvements. The purpose of highlighting the success taxonomy with the influencing factors is to aid this research and provide a parsimonious exposition of the causal relationship. The adoption and implementation of an information system are to meet the evolving needs in an organization (DeLone & McLean, 2002). Successful acceptance of information system upon implementation indicates the existence of some influences to the organizational, technological and individual. The influences have lead to the establishment of some indicators for the information system acceptance. These indicators are known as determinants for the key influencing factors for an information system adoption and implementation. Therefore, an understanding of a business is limited without knowing and understanding information system (Nickerson, 1998). Hence, a technology is critical to determine the success of a business.

The successful information system is elusive when an application is developed effectively but the system is poor in performance (Martinsons & Chong, 1999). Information technology and system benefits are to improve organization performance and services (Galandere-Zile & Vinogradova, 2005; Martinsons & Chong, 1999). Information technology helps people and organization to perform and deliver better job and services if and only if the people are willing to use and are well versed with the technology. The individual intention has become the most critical category of information system's success (Galandere-Zile & Vinogradova, 2005; Hurst, 1991; O'brien & Marakas, 2007, p.17; Seilheimer, 1987; Steier, 1989). The influence on individual intention reflects the user behaviour and is a non-technical aspect for the information system acceptance and success (Galandere-Zile & Vinogradova, 2005; Hurst, 1991; Seilheimer, 1987; Steier, 1989). The measure to the individual intention is a user behavioral study for the information system acceptance. The processes, practices, routine and norm are the fluid mix of experience for information systems success in an organization (Galandere-Zile & Vinogradova, 2005).

Trends in the acceptance of information systems have expanded significantly over the years. Therefore, information system and user studies are becoming a vital research agenda in technology acceptance.

An information system is evaluated based on the importance of usage and complexity of the system. Information system explore the relationship between the system and users' perception (Kaplan & Duchon, 1988). The argument by Kaplan and Duchon (1988) is on the factors that affect the user acceptance and use of information system. The information system means direct attention to the important aspects of organization's performance, measure of the objectives and shape the users perception and behaviour (Mats Alvesson, 1992, p.164). The advantages of an information system are the value for money and smoothen operations and services in an organization. The organization work load is evenly distributed within the system librarians. The service level agreement is meet and the service quality is monitored.

In any field of study, the information system is an essential course which constitutes the system, information and management (O'brien & Marakas, 2007, p.4). The information technology underpins the software developers, users', end-users' and organizations activities. Therefore, this research has capture the users' demands on information system by conducting the technology acceptance study.

2.4.2 Information System vs Management System

There are many terms used to define a library system such as library management system, library system, library information system, integrated library system and integrated library management system. These terms are used and defined in various perspective to understand library operations and services. In this study, the Koha is referred to as a Library Information System rather than Koha Library Management System. An information is defined within the context of its use. In the library, the information is for end-users who are known as patrons. Information is used by patrons who come to the library or search for details in a digital manner. The message conveyed by a means of communication is known as information (Reitz, 2016).

Information management by definition indicates the skill or exercise to handle the library system modules such as acquisition, organization, storage, security, retrieval and organization of information to ensure the operations of a library including record management, technical infrastructure and documentations (Reitz, 2016). Therefore information management is actually indicating the entire process in the library. An information system research is a usage evaluation study in an organization and the generic problem is related to information processing (Mats Alvesson, 1992, p.160). Traditionally, the information system concept is interpreted in managerial terms and limited to information system activities evaluation (Mats Alvesson, 1992, p.161). An information system by definition refers to the hardware and software of a computer which is used as a tool for accepting, storing, manipulating, analyzing and reporting. Information system consists of the main components such as data, storage and sub systems. The main concern of an information system is the data (Reitz, 2016).

Data is raw materials in th production of information (Oz, 2008). Data has a stage of manipulation by the direct users and is inputted to a system for end-users view. The data carry weightage to the direct users at operational level in an organization. The data reflects the idea to produce information. Handling data will need special skills and it is time consuming. The accuracy and the proper management of data using a specified meta-data in a system will reflect the level of information accuracy and acceptance by end-users. The data has no meaning to end-users of a system. The data can only be read and understood by the direct users of a system.

Referring to the four terms of information, information management, information system and data, in this research the Koha is clearly defined as Library Information System. The focus is on the data handled by the librarians to produce the information which is accurate and relevant to the patrons. This gives an account of librarians' acceptance of a system which is identified by the way the data is read, stored and manipulated throughout the system. This research contest the claim that the system acceptance is based on the functionalities and interface design by system developers as such the study on open source software implementation (Adnanh & Lee, 2015), adoption on koha and RFID (Alves et al., 2012), open source softwarepilot study-end user perception (Braccini et al., 2009), user acceptance model of open source software (Gallego et al., 2008), integrated open source software (Li-ping, 2009), case study on open source software development (Mockus et al., 2002), open source software system (Nakakoji, Yamamato, Nishinaka, Kishida, & Ye, 2002), open source software (Oberg, 2003), case study open source software in Malaysian public sector (Rahim, Zairah, & Alias, 2006), open source point of free software (Stallman, 2009), code quality analysis in open source software development (Stamelos et al., 2002) and open source development (Von Krogh, 2003)

There are closed systems and open systems depending on the nature of the information (Oz, 2008). A closed system is a standalone system and there is no connection or integration with other systems. An example of a closed system is the check-producing system. The open system is a multi-interaction system which interacts with other systems. The library is an open system whereby it interacts with various modules such as acquisition, cataloging, circulation, serial control, OPAC, web-OPAC, radio frequency identification system (RFID) and inter library loan (ILL). The existence of sub system defines the open system. Therefore, Koha is also known as an open system for the library. What defines the open system and open source system? In order to understand the open source system, the terminology of software need to be justified.

2.4.3 Software

Software is a term equate to computer programs, documentation and configuration data which makes the programs executable. A software product is developed for a particular customer or for a general market.

- *(Sommerville, 2001)*

The software is an oxymoron. Misconceptions often confuse the users. There are two types of computer software, the application software and system software (O'brien & Marakas, 2007). The application software is used by users and end-users. The system software is used by system experts. In this research, the application software is known as the information system and the users are the librarians. The key to successful evaluation of software is close scrutiny of educational and knowledge on the software (Florence & Alonzo, 1982).

In the 20th century, software is one of the most troubling technologies and yet the most important (Jones, 1996). The success and failure of software are found in the industries of system software, information system software, military software, outsourced software, commercial software and end-user software. The effective software is based on the evaluation of acceptance (Florence & Alonzo, 1982). The software evaluation is on the complexity and depth information. The software producers will develop the software application based on market demands (Florence & Alonzo, 1982). The initial step in software evaluation is to determine the users of the application system. Next, is to scrutinize the software using a specific form that is based on the users' needs. The user acceptance form is designed based on a set of questions specifically designed for the software evaluation focused to the functionalities and capabilities of the software. The users' acceptance findings on the particular software are used in the organizational decision makings for system adoption. Does this decision reflects the user acceptance of the system or approves the system functionalities and capabilities? By means of practice in any system adoption, solely depends on the software evaluation and omitted the user acceptance of the system.

A software or program's objective is to solve a problem (Brookshear, 2010; Wilson, 2001). There are hard problems and soft problem in an application system (Wilson, 2001). The hard problems refer to the software design and the soft problem refer to the information which is used to meet the organization needs.

Software has human interaction and contribution. Human factors is also considered in software development. The users define by software are the users who use the system in a social and organizational environment with other social and technical systems (Farrell-Vinay, 2008, p.38). The critical concern of developer is on the appropriate user interface design for users to test the system for successful system operation. The argument is on the system interface which is defined by developers as a concern to users for successful system operation? (Farrell-Vinay, 2008, p.39). This argument is supported by some points to be taken into consideration as human factors. There are 4 human factors in software development:

i. Does the software require influence the work process in the organization?
ii. Does the software influence the political power in the organization?
iii. Does the software influence users' to change the way they work?
iv. Does the software influence the users' skill in the organization?

These human factors are critical for software developers to determine whether the software successfully meets the purpose and objective. However the prediction on the factors are often difficult. Therefore, the developers have taken the system reliability, functionality and capability into consideration of system success (Farrell-Vinay, 2008).

In this research, the users and community perception is on the open source information system, eventually influencing the acceptance. Over the years, the library has been using the manual, proprietary and hybrid system to support the entire library services (Mohideen & Kaur, 2015; Mohideen et al., 2012). These systems have yet to meet the librarians' demands and expectation (Mohideen & Kaur, 2015). There exist a study on user acceptance of open source software focusing on open source system developers as users using the TAM model for information management (Gallego et al., 2008). The study shows there is less intention on the acceptance of open source technology. The less intention on the acceptance of open source system whether from developers or users are not being mentioned specifically. The word open source software clearly shows that it is for developers and the open source system is for users (Gallego et al., 2008). The acceptance of open source software by Gallego (2008) focused on the Linux operating system, apache web services and MSQL database. The user acceptance study by Gallego (2008) is biased on developers. Most of the open source software rely on work of volunteers (Sulayman et al., 2008). Developers' contributions on technical skill and time spend for development are paramount importance. The voluntarily characteristic varies from employed staffs who rely on organization force and traditional software development. The solution which exists to streamlined the developers and users are the strategic information system implementation (SISI) (Rowley, 1993).

The SISI is an approach to effectively manage the users and system implementation (Rowley, 1993). The reason of SISI is the information system has to reflect and achieve the organizational objectives. Is there a solution for the acceptance of information system in an organization? This again clearly highlights the users gap on the system acceptance.

The gap between the software developers and system users. The software developers' focus is on software functionalities and capabilities (Florence & Alonzo, 1982; Gallego et al., 2008; O'brien & Marakas, 2007) whereas the users' focus are on the data and information, social and psychological aspect (Martinsons & Chong, 1999; Rahe, 2006; Steier, 1989; Swierczek, 1991; Walton & Vittori, 1983).

2.5 Open Source System

The open source system by definition is 'free application or free source code for the users' to use and manipulate according to the organization's need' (Chudnov, 1999). The open source brings new opportunities and new challenges to technology advancement. The definition of open source has 9 clauses (OSS-Definition, 2005):

i. The software is free for distribution without royalty or fee
ii. The availability of source code and permits the developers for modification
iii. Source code modification is distributed under the term original software
iv. Source code integrity must be maintained and distribution of patch files will have version number
v. No discriminant against developers
vi. No discriminant against any field of study
vii. License applied to anyone without permission
viii. License not specific to any particular open source product
ix. The license of open source not applied to any other software

The open source system is a solution to the issues faced by many libraries with proprietary system (Chawner, 2004). It is an aid for data and information solution for librarians (Bonaccorsi & Rossi, 2003). The open source system is able to run under various platform such as Windows, Linux, Unix and Mac due to the language such as Perl and PHP that are supported by the platforms (Chawner, 2004).

Risk is not an issue in the open source system environment. The proprietary system vendor can withdraw the product or discontinue it based on the demand on the proprietary system and maintenance payment. The open source system does not require sophisticated hardware to support the application compared to a proprietary software (Chudnov, 1999). The technical advantage of open source is the platform which is considered stable and does not need regular re-booting (Brice, 2002; Sisler, 2000). What is important in open source application is to know the system behaviour, which is captured by the software behaviour (Brice, 2002).

The main issue in adopting an open source system is on the support level and technical knowledge required for installation, modification of source code and training (Adnanh & Lee, 2015; Chudnov, 1999; Rahim, Zairah, & Alias, 2006; Rahim & Zairah, 2009). The open source community, system developers and users have to work together and provide a solution for the decision to adopt and implement an open source system. Noted that there are always limitations to the community support, therefore, the users' expertise, skill and knowledge on information technology are crucial (Brice, 2002).

Regardless of limitation issues, the open source system can succeed (Bonaccorsi & Rossi, 2003). The open source technology advancement can be explained using the development in theories on central authority, technology diffusion and technology acceptance (Bonaccorsi & Rossi, 2003; Chudnov, 1999; Gallego et al., 2008). Therefore, a study on open source using the unified theory for technology acceptance model to investigate acceptance and use is viable.

2.5.1 Open Source Solutions in Libraries

The chronology of open source systems in libraries begins in the year 1996 and explodes once Koha was founded in the year 2000 (Jaffe & Careaga, 2007). In 1997, the Scholarly Publishing and Academic Resources Coalition (SPARC) was founded by the Association for Research Libraries (ARL). The function was to respond to the dysfunctions of scholarly communication system.

The Association of Research Libraries (ARL) initiated the keystone principles for the innovation for information systems and the development of open source solution in the year 1999. Open Source Systems for libraries (OSS4Lib), was also founded in 1999. The function of open source systems for libraries at that time was for information exchange, mainly to create the interest on open source software solutions among librarians. The first publication by Chudnov (1999) on open source library system alerted librarians on the latest approach in library system development. A document delivery software was then developed as an extension to the open source of proprietary system known as Ariel ILL software.

In 2000, the open source systems interest group was developed by the Library Information Technology Association (LITA). The idea of LITA is to promote the open source solution adoption in the libraries. The first open source integrated library system (ILS) was developed for the Horowhenua Library Trust in New Zealand. In 2002, the open source software and efforts in the libraries warranted a special issue in Information Technology and Libraries.

From 2003 until 2006, the Sakai Project was launched for the open source solution and management. The purpose of the project was to fill the gaps between digital content and library license. The project also released and offered a customizable open source template which was able to identify the worldwide library holding across the internet. (Jaffe & Careaga, 2007).

The studies on open source system worldwide are focused on various end-users and have omitted the direct users' perspective. Most of the studies are qualitative based and the outcome is biased to developers and end-users of an application system. Examples of open source studies are e-learning open source (Mohamed & Karim, 2012), small and medium tourist enterprise (Chib, 2013), Koha library management system using live CD (Biju et al., 2012), Koha Web based study (Sheeja, 2009), open source interface politics (Zilouchian Moghaddam, Twidale, & Bongen, 2011), developers' behaviour in open source (Meissonier & Houze, 2010), open source software adoption in academic perspective (Satyarajan & Akre, 2011), desktop open source software (Kamau & Sanders, 2013), open source software to overcome digital poverty (Kinyondo, Van Biljon, & Gerber, 2012), open source adoption in hospital (Munoz-Cornejo, 2007), open source software in Malaysian public sector (Rahim & Zairah, 2009), open source implementation in Malaysian public sector (Adnanh & Lee, 2015), open source for public sector in Sri Lanka (Jayawardena & Dias, 2011), open source software in Western Cape School (Johnston et al., 2013), perspective of open source in Malaysian public sector (Rahim & Zairah, 2009), open source library management system in Thai university (Kiriyanant, 2012), open source acceptance among users in Thai (Bhatiasevi & Krairit, 2013), open source digital library adoption (Jose, 2007), open source software adoption using OSSAM model (Ennajeh & Amami, 2014) and ABCD - open source software for modern libraries (Dhamdhere, 2011).

The open source system often offer significant benefits compared to proprietary system (Deek & McHugh, 2007). The open source is free at cost and early adopters will have to learn the open source skills and techniques for adoption. The open source system is superior to portability. The open source system is argued in terms of security and reliability compared to the proprietary system and have advantages over the hardware and operating system platform as such the study on open source software implementation (Adnanh & Lee, 2015), the success of open source software (Bonaccorsi & Rossi, 2003), the viability of open source system (Breeding, 2009), measurement of pen source project in terms of assessment and usability (Çetin & Gokturk, 2008), the challenges of free open source software-breaking the boundaries, integration and interoperability (Chawner, 2004), open source adoption ate Western Cape School and the factors influencing the implementation and adoption (Johnston et al., 2013), survey on open source adoption at Thai university (Kiriyanant, 2012), case study open source software in Malaysian public sector (Rahim, Zairah, & Alias, 2006), the study on whether the open source developers listen to user (Raza & Capretz, 2015) and a review on open source library management system software (Vasupongayya et al., 2011)

The issues of quality vendor, customization, support, service level agreement, maintenance, documentation and policy for the proprietary system users are no longer an argument issue for the open source system users. The open source system considered the implication of cost, usefulness and convenience in the system adoption stage for an organization as such the study on the open source software implementation (Adnanh & Lee, 2015), the budget pressure and the possibility for open source adoption (Ahmed & Alreyaee, 2014), the viability of open source while budget is an issue (Breeding, 2009), government innovate open source adoption and implementation of open source (Cassell, 2008), the future library system cost saving (Chudnov, 1999), standing up and support for open source (Jaffe & Careaga, 2007), the simple approach and economic way for open source (Lerner & Triole, 2000), the comparison in terms of costing ABCD and Koha open source (Macan & Fernandez, 2010), Malaysian administrative on technical and cost effectiveness approach for open source software (MAMPU, 2004), the funding for proprietary and open source (OSS-ORG, 2015), costing issue open source (Rafiq, 2009), perception on open source software (Rafiq & Ameen, 2009) and survey on open source at public administrative (Tosi, Lavazza, Morasca, & Chiappa, 2015).

In most of the libraries, the back end and front end system for the library information system are the same system platform. There are various option for open source software (O'brien & Marakas, 2007, p.128). The selection of the open source technology for the library is based on the information technology expertise and in-house development team in an organization (Gallego et al., 2008; Rowley, 1993). The open source development also involve voluntary, business model and legal questions (Deek, McHugh, & Tepper, 2008, p.11). Example of open source solution for library systems are Koha, Evergreen and Open Library Environment Project (OLE-Project) (Jaeger & Metzger, 2002).

There are distinct users in the context of software and system. The software users are refer to the software developers while system users are the users of the application system built on an open source platform. In user acceptance studies, this distinction and the outcome based on these two types of users need to be heeded. A study by Gallego (2008) on the software developers' acceptance of open source software indicate that there is radical changes in the software industry and the perspective of business development model and software distribution. This change is a weapon for software developers to capture the information system market. The technology, open source, software, information and system have become the most debated topics among developers and users (Gallego et al., 2008; O'brien & Marakas, 2007; Simon, 2000). The period of software development and business cycles eventually leads to a gap on what is needed and what is delivered (Lewis, 2005, p.99). As such reliance on developers' acceptance is not adequate for open source systems. The users of the system, in this case the librarians, must also play a role in the assessment of a system acceptance.

The open source library information system has not yet penetrated the larger libraries (ALA-TechSource, 2014). This warrants an investigation into user acceptance of open source library information system that penetrate the academic libraries.

2.5.2 Koha Library Open Source System

There are various open source system available in the market. The open source systems are Koha, Lucidea, Mandarin, OPALS, OpenBiblio, NewGenLib, Evergreen, ABCD, MarcoPolo and PhpMylibrary (Chawner, 2004; Jaffe & Careaga, 2007). The Koha is known as an integrated library management system. It was developed by Katipo Communications Limited of Wellington, New Zealand for the usage of Horowhenua Library Trust (HLT). The regional library is located in Levin and about 100 kilometers from north of Wellington. The initiative of Koha initially was to replace the DOS-based system that increased in cost over the years. Open source tools such as Perl, MySQL and Apache were introduced by Katipo for developing a new system. These tools runs under the Linux platform and uses a Telnet function to communicate with branches library. On 3rd of January, 2000 a new software was released. This software is known as Koha.

Koha was released to worldwide users using the General Public License (GPL) license in July 2000. Since then, internationally there has been a high demands for the Koha system. The early adopters of Koha system are from New Zealand, Australia, Canada, United State of America, India, Thailand, United Kingdom and France. The Koha adopters were from small and medium libraries such as school and special libraries. Various versions of Koha were released to the Koha community for adoption and implementation. The Koha system supported the MARC21 format since August 2002. The community either undertake the development by themselves or contribute to existing Koha projects.

The first open source information system for the library is the Koha (ALA-TechSource, 2014). Open source is a wakeup call for librarians and potential solution for practical advantages including a solution for issues which has been frustrating the librarians over the years (Jaffe & Careaga, 2007; Morgan, 2002) . The open source adoption rate by the library is far below the other sectors and have yet to commit for open source solution and development (Jaffe & Careaga, 2007). The open source solution will create and establish the relationship between open source and libraries (Chawner, 2004). The key point is that the librarians and the organization hesitate to adopt and implement the open source information system due to varies of perception between developers and users (Jaeger & Metzger, 2002; Jaffe & Careaga, 2007). The developers are focusing on software strength and users are concerned with job performance, satisfaction, system and information quality and organization objective. This indicates that the library will continue with proprietary and expensive system. The reasons are lack of understanding, social influence, attitude towards using technology, understanding and influence of open source is only for small organization with least book collections, self-efficacy, open source system is for small libraries and less appreciation on the potential solution for libraries and evidence of failure open source projects has created the doubt on the open source technology application (ALA-TechSource, 2014; American-Libraries, 2014; Chawner, 2004; Jaeger & Metzger, 2002; Jaffe & Careaga, 2007). In Turkey public libraries 1,118 Koha projects were implemented by the Ministry of Culture and Tourism (American-Libraries, 2014). The Nelsonville Public Library in the United States is the first public library to implement Koha on 26 August , 2002 (ALA-TechSource, 2014). In the United State and Canada the Koha, Open Source Automated Library System (OPALS) and Evergreen open source dominate the library market (Breeding, 2009). The Evergreen and OPALS have not found any adoption outside the United State and Canada whereas the Koha finds the use in libraries worldwide (Breeding, 2009). This clearly highlights the demands for open source and specifically Koha open source library information system. The majority users of information system in the world and specifically United State of America leading with Koha open source system. The Koha has 126 users from public sector in the Unites State of America. A total of 208 libraries in the United State of America has adopted and used the Koha open source system. Table 2.1 reflects the library open source information system in the United State as the Figures taken on September, 2008 (Breeding, 2009). This shows that the open source system is well accepted in the United State of America. The market for open source system is wide and there is demand for open source technology.

Table 2.1: Libraries Open Source System Usage in the United State of America

Libraries	Koha	Evergreen	OPALS
Public	126	58	-
Academic	23	-	3
School	32	-	51
Museum	12	-	-
Medical	3	-	-
Church	2	-	2
Other special	10	-	3
Total	208	58	59

There are 8 groups of the Koha worldwide users are categorized from the North America (70 users), Central America (1 user), South America (11 users), Oceania (28 users), Asia (49 users), Europe (55 users), Africa (18 users) and Middle East (1 user) (Worldwide-KOHA-Users, 2015).

The open source is a shape shifter for raising awareness among librarians and setting up strategies for libraries and finding a new path for library solution and to ensure the libraries future is not a repetition of the past (Chawner, 2004; Chudnov, 1999; Jaeger & Metzger, 2002; Jaffe & Careaga, 2007). The adoption trends of Koha open source system is merely for small to mid-sized of public and academic libraries and gradually is penetrating to huge collections and complex libraries (ALA-TechSource, 2014). Figure 2.2 shows the world wide users' of Koha from public, academic and other libraries with an estimation of 16,000 users' (KOHA-WordPress, 2015). The trend shows that higher adoption of open source in the United State of America and the least adoption is at the Middle East. The open source attracts the organization with least budget and high cost of maintenance for the proprietary system (Breeding, 2009; Zhussupova & Rahman, 2011). However there is factor which holds the open source adoption. This factor is based on the non-technical aspects of users acceptance which reflects the behavioral aspects of the open source system (Zhussupova & Rahman, 2011). In any open source system, the information technology skill is developed only with strong management support (Adnanh & Lee, 2015).

Figure 2.2: Koha Worldwide Users

2.5.3 Koha Library Information System in Malaysia

The open source software is unsafe and unreliable, it won't fly with government regulators and it lacks a support infrastructure

- *O'brien & Marakas, 2007, p.128*

Notion by O'brien and Marakas (2007) on the open source software on the "*it won't fly with government regulators"* is disputed in Malaysia. In Malaysia the development of open source information system (OSIS) is supported by Malaysian Administrative Modernization and Management Planning Unit (MAMPU). The open source information system is only focused to the public sector in Malaysia. An Open Source Competency Center (OSCC) under MAMPU was developed on 19th June 2002.

The purpose of Open Source Competency Centre (OSCC) is to:

"guide, assist, coordinate and monitor the implementation of open source system in the public sector"

- *(OSCC, 2014)*

There are 7 objectives to be achieved upon implementation of open source system (OSCC, 2014). One of the objective is to *"increase growth of open source system user and developers community" (OSCC, 2014).* This particular objective is the motivation for this research. This objective also reflects the study gap between software developers and users. The word public sector, open source system user, open source software developers have lead this study to search for a community - the universities in Malaysia. There are a total of 20 public universities in Malaysia and 5 of them are research universities (Malaysian-University-Guide, 2015). These universities vary in terms of information system in various fields of application and studies. The university is a body of knowledge and it delivers knowledge in various fields of studies, helps in research, technology services and information services. The knowledge servicing department in the university is the library. The library delivers the appropriate services through a system. This system is known as library information system (LIS). There are various systems used in the libraries. Among the implemented library information system in the 20 public universities are the SirsiDynix, Virtua, Sierra, ILMU, Millennium and LibSys. These information systems are either client based systems, web based systems or proprietary systems. Will these systems be able to continually serve the library, decrease the maintenance support cost and meet the future users' demands of technology for library operations and services? The answer is that the information system adoption and implementation solely depends on technology advancement acceptance (Mohideen & Kaur, 2015). The list of public university and the implemented library information system is shown in Table 2.2. The information is gathered from the university library website and Malaysian Information Systems Librarians - Special Interest Group (MySyL - SIG) lead by Mr. Hazmir Hj. Zainal, the head of System and Information Technology Division of Library, University Kebangsaan Malaysia. The only public university which has adopted the MAMPU objective and deploys the open source information system as the library information system is the University Science Malaysia (USM), the APEX University (Accelerated Programme for Excellence). This research has broadened the MAMPU focus which is limited to the public sector as in Table 2.2 and expand the scope to the private sector. One of the service providers for the open source library information system in Malaysia for the university libraries is the University Science Malaysia Library. Therefore, the private universities that have adopted the open source library information system are in a pool of open source community and users in Malaysia. The benefits of expanding the scope will increase the number of open source users and software developers, generate income, increase technology awareness, will decrease the maintenance support cost, conquer the open source library information system market, support in-house system training, enhance information technology skill and sustain the information system in Malaysia.

Table 2.2: Public Universities Library Information System

Public Universities	Abbreviation	Library Information System
University Science Malaysia	USM	Koha Open Source
University Malaya	UM	SirsiDynix
University Technology Malaysia	UTM	SirsiDynix
University Kebangsaan Malaysia	UKM	Virtua
University Putra Malaysia	UPM	Virtua
University Utara Malaysia	UUM	Sierra
University Islam Antarabangsa Malaysia	IIUM	SirsiDynix
University Technology Mara	UITM	LibSys
University Malaysia Kelantan	UMK	Virtua
University Sultan Zainal Abidin	UNISZA	ILMU
University Malaysia Terengganu	UMT	ILMU
University Pertahanan Nasional Malaysia	UPNM	Virtua
University Technical Malaysia Melacca	UTEM	ILMU
University Science Islam Malaysia	USIM	Virtua
University Malaysia Pahang	UMP	Virtua
University Pendidikan Sultan Idris	UPSI	ILMU
University Malaysia Perlis	UNIMAP	Virtua
University Tun Hussein Onn Malaysia	UTHM	SirsiDynix
University Malaysia Sabah	UMS	Virtua
University Malaysia Sarawak	UNIMAS	Virtua

There are 4 roles and responsibilities given by MAMPU (2004). The role and responsibility that interests this research is that “become the open source champion” and “construct the term of reference of agency for open source project”. This means, the public sector which win the open source project should be able to lead and guide other public sectors in terms of open source adoption and implementation. The success open source model should incorporate the information system elements.

There are multiple perspective of open source software in academic libraries at universities in public sector (Rahim, Zairah, & Alias, 2006; Rahim & Zairah, 2009). The evidence proved that the Koha system attracts more public libraries than others. Malaysian MySyL Group and Koha wordpress (KOHA-WordPress, 2015) posted on 25th of September 2010, the users of Koha open source library system as in Table 2.3.

The usage of identified library system is also confirmed with the management of each university library. The University Science Malaysia (USM) is the first academic library at university in public sector which has implemented the Koha open source library information system. The adoption of Koha system in USM library initially is to support the Ultra-High Frequency (UHF) Radio Frequency Identification System (RFID). The RFID system is used for tracking and stock take in the library. This system is a separate tool to support the library operations for books monitoring. This RFID provides an overview of the reporting for the entire library stock take and mainly helps the circulation division for tracking procedure.

In the year 2015, latest adoption for Koha open source library information system is from the University Kuala Lumpur (UNIKL) and University Tenaga Nasional (UNITEN). The adoption begins with the pilot test conducted by University Science Malaysia (USM). Latest updates on Koha in the year 2017, is at the Penang State Library which is performing the pilot test of Koha open source library information system.

Table 2.3: Koha OSLIS in Malaysia

Koha Users	Private University	College	Public University	Special Library	Others
Total Users (27)	4	14	2	4	3
Terengganu Skill Development Centre (TESDEC)		√			
International Institute of Advance Islamic Studies (IAIS) Kuala Lumpur				√	
Kelantan State Library Corporation					√
Polytechnic Kota Bharu		√			
University Science Malaysia Pulau Pinang			√		
12 Regional Libraries, School of Distance Education- University Science Malaysia			√		
Al-Madinah International University, Shah Alam	√				
Asia e-University Knowledge Centre Kuala Lumpur	√				
University Kuala Lumpur	√				
University Tenaga Nasional	√				
Faculty Resource Center, UPM Serdang				√	
Institute Al-Quran, Terengganu		√			
Unity College, Petaling Jaya		√			
Kelantan Public Libraries (6 branches)					√
Malaysian Agriculture, Research Development Institute (MARDI)				√	
KADIR, ANDRI & Associates, Kuala Lumpur				√	
Malaysia SMART School (88 libraries)					√
Polytechnic Seberang Perai Pulau Pinang		√			
Kolej University Poly-Tech MARA Kuala Lumpur		√			

Table 2.3 continued

Koha Users	Private University	College	Public University	Special Library	Others
Kolej University Poly-Tech MARA Bangi Selangor		√			
Kolej University Poly-Tech MARA Kuantan Pahang		√			
Kolej University Poly-Tech MARA Kota Bharu		√			
Kolej University Poly-Tech MARA Ipoh		√			
Kolej University Poly-Tech MARA Batu Pahat Johor		√			
Kolej University Poly-Tech MARA KESEDAR Kelantan		√			
Kolej University Poly-Tech MARA Alor Setar Kedah		√			
Kolej University Poly-Tech MARA Semporna Sabah		√			

Evidence from Table 2.2 and 2.3 reflect that the users of Koha system in Malaysia has huge demands in the private sector and in the public university demands for proprietary system remains strong especially for huge libraries and this trend is strongly supported from the studied done by Breeding (2009). The demands for Koha system in America as shown in Table 2.1 also reflects the equivalent influence in Malaysia public and private universities and colleges.

The University Science Malaysia has been awarded the APEX University on 3rd September 2008 (APEX-USM, 2015a). The APEX transformation agenda is to achieve the University Science Malaysia's mission in the implementation of the APEX program in becoming the pioneering university, trans-disciplinary and research-intensive based university (APEX-USM, 2015b). The trans-disciplinary is the key that attracts this research.

The definition of trans-disciplinary is to involve more than one discipline of study (O'brien & Marakas, 2007; Online-Dictionary, 2014; Tefko Saracevic, 1995; Saracevic, 1999; Tefko Saracevic, 2000). The meaning of trans-disciplinary is similar to the interdisciplinary mentioned by Saracevic (1995, 2000) and O'brien (2007). Above mentioned evidence strongly supported this study on librarian acceptance of an open source library information system that has adopted the interdisciplinary field of study related to the information system, management and library information science.

This study will focus on the open source system as this open source system is widely used by academic libraries in public and private sectors in Malaysia. Table 2.4 shows the Koha open source library information system users at academic libraries in Public and Private Universities in Malaysia. There are 5 universities in Malaysia that are known as early adopters of Koha library information system. This research has used these universities libraries to conduct the Koha OSLIS research. The outcome from these universities libraries will be used as a benchmark for Koha open source library system acceptance in Malaysia.

Table 2.4: Koha OSLIS Users at Public and Private Universities in Malaysia

Universities	Koha Users
University Science Malaysia (USM) (Main campus, Medical campus, Engineering campus , IPPT)	143
Al-Madinah University (Shah Alam)	10
Asia e-University Knowledge Centre	5
University Kuala Lumpur (UNIKL)	56
University Tenaga Nasional (UNITEN) (Selangor, Kajang, Putrajaya, Bandar Muadzam Shah, Pusat Sumber TNB HQ)	40
Total	254

There are less than 2% of open source adoption an implementation compared to proprietary system (Breeding, 2009; Pace, 2005). In Malaysia there are 3 phase for the open source implementation strategy (OSS-ORG, 2015). This strategy will undergo for 5 years of implementation. Phase I is setting a foundation for implementation of pilot project, phase II is adoption and phase III for self-reliance upon open source implementation. In July 2010, the open source adoption in Malaysian public organization has reached 97% and 703 out of 724 agencies already used the open source system in the organization. The software developers and system users share the equal access of information system in the open source technology (Riewe, 2008).

The purpose of open source is to reduce the system application maintenance cost (Adnanh & Lee, 2015; Riewe, 2008). The issue on the adoption an implementation of open source may reduce cost and on the technological perspective, the open source may demand for increase in cost due to training and technical elements of the open source (Riewe, 2008). This issue is true in private sector but in public sector it is not an issue as the MAMPU has given the supports on the open source technology adoption (OSCC, 2014). The implemented Koha open source library information system by University Science Malaysia might be useful for the future of other public universities in Malaysia to adopt and implement the open source system for the library. This research will be the benchmark to lead and reflect the open source acceptance for the library.

In the context of open source software, there is a dearth of sufficient research to examine the users acceptance (Gallego et al., 2008) . There is not much studies on the acceptance of open source focusing to the library open source information system. Hence, this study has undertaken this opportunity to conduct the librarians' acceptance of open source library information system.

2.6 Open Source Software Developers vs System Users

Who control who in the open source system scenario? There are 2 main entity in the open source scenario. The developers and the users. In the proprietary system approach there is separate entity between developers who are the vendor and the users who are the data provider. In open source scenario, the developers listen to users or the users rule the developers? (Eckhardt, Laumer, & Weitzel, 2009; Raza & Capretz, 2015).

There is no separate entity in open source. The developers are users too and the users are also the developers (Chudnov, 1999). Hence, there exists an open source community that equipped with technical and non-technical users. This contest the claim that the open source system is designed for technically adept users and there is a distinct between developers and users (Eckhardt et al., 2009; Raza & Capretz, 2015). In an open source environment the uniqueness of the users are being the main entity in an organization in all aspects.

2.7 User Acceptance Test

> *User Acceptance Test (UAT) defines the criteria of acceptance or rejection of software and testing whether the software development is good or bad.*
>
> \- *(Limaye, 2009)*

The user acceptance test (UAT) is a regular test performed by system developers for any systems to ensure the functionalities of the programming to meet the users expectation on a system (Ganesh, Mohapatra, Anbuudayasankar, & Sivakumar, 2014; Lewis, 2000). The User acceptance test (UAT) is conducted when the software is ready to be tested by users for functionalities and capabilities (Beizer, 2003; Farrell-Vinay, 2008; Jorgensen, 2013; Lewis, 2000; Limaye, 2009; Marciniak & Shumskas, 1994; Patton, 2006; Young, 2008). The UAT indicates the final stage of software development.

There are 2 types of UAT test. The functional test and structural test (Beizer, 2003; Farrell-Vinay, 2008; Jorgensen, 2013; Lewis, 2000; Limaye, 2009; Marciniak & Shumskas, 1994; Patton, 2006; Young, 2008). The functional is known as black box and the structural is the white box text. Both the test are evaluating the system functionalities and capabilities. The black box test is focusing at the set of valid inputs whereas the white box test is on the system. The UAT is an embedded programming which does not indicates any value to system users and system users are unaware of the test. The outcome of the UAT helps the system developers to modify and enhance the system to meet users system requirements (Beizer, 2003; Farrell-Vinay, 2008; Jorgensen, 2013; Lewis, 2000; Limaye, 2009; Marciniak & Shumskas, 1994; Patton, 2006; Young, 2008).

Most libraries are concerned with the in-house system (Rowley, 1993). The in-house system is preferably due to influence factors of system cost, information technology skill, information quality and output quality (Martinsons & Chong, 1999; Rowley, 1993). Over the years, the role of users is a source of information on system requirements and as an entity for data input whereas the developers are responsible for the system designs and functionalities (O'brien & Marakas, 2007, p.17). The functionalities and capabilities of a system which eventually answers on how the system works. The answer is a key answer for developers upon user acceptance test (UAT) for a system. The user acceptance test (UAT) is testing a system without users' awareness. In the user acceptance test, the system acceptance indicates the success rate of a system pilot study. System testing or pilot study is only ensuring the functionalities of the system and it does not apprise the users acceptance of a system (O'brien, 1993). By means of practice, an application system is adopted and implemented based on system pilot test or study. A system pilot study is conducted when there is an intention to use an application system. A system pilot study is a system test to evaluate the feasibility, time, cost, data effect size, performance, functionalities, capabilities and human effort (Limaye, 2009; Young, 2008). There exist a rule barrier between users and software developers, users demands and acceptance are viewed as "programming" and not being verified prior to implementation and functionalities of a system does not meet the users expectation (Albert, 1986, p.7; Mohideen & Kaur, 2015). There exist a system pilot test for developers to know the system acceptance and not user acceptance test for a user to indicate the system is accepted and reflect their job performance in an organization. This research will fill the gap by studying the user acceptance of open source library information system in the library. UAT is a process to ensure that a software has meet the users agreement, functional and specification of software life cycle (Marciniak & Shumskas, 1994).

2.7.1 Testing of Proprietary System

A proprietary software is a mixture of new, legacy and/or bought in program source code. A proprietary system is a system developed by a third-party or a software company. A proprietary system is known as "applications such a word and are not mission critical" (Farrell-Vinay, 2008). There are 2 types of test for a proprietary system. The test in known as functional test or black box test and structural test or the white box test.

2.7.1.1 The Black Box Test or Functional Test

The black box test is testing the program function build by developers for a system. The technique is applied by evaluating users input. There are classes of data to be tested and to ensure the system functions and response accordingly with users input.

The objective of the black box test is to demonstrate whether the system do possess the function features defined in the technical specification documentation. The black box is the central of a system testing phase and also can be implemented in the system integration testing in the unit testing phase. The Figure 2.3 shows the black box testing. The users will test the library system and the test is unknown to users. The developers are aware of the test the feedback from users are the output to developers.

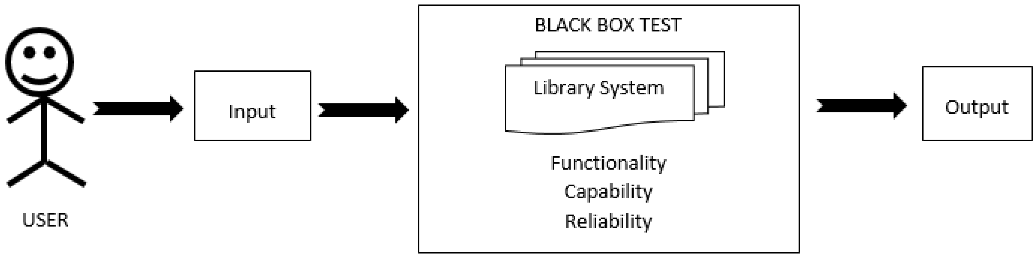


Figure 2.3: Black Box Testing

The outcome and findings of the functional test is used to modify the source code for the system. The developer will find the fruitful bugs from user interaction with the system using a standard data. The input process in various classes to ensure the test case developed in the program is workable. The cause and effect graphing, database design and the logic of the data flow is defined the program. Random data is used for the black box testing and to ensure the capability of the system to handle the random quantity of data. This is to ensure the system works accordingly to some information system theory and practice (Farrell-Vinay, 2008; Khan & Khan, 2012).

The types of test in functional test are boundary value analysis, generalizing the boundary value, limitation of boundary value, robustness testing, worse-case testing, special value testing and random testing (Jorgensen, 2013; Khan & Khan, 2012). These test is to ensure that the program input from a domain and output from the range of domain. Therefore, this process of inputting testing is known as functional testing technique. Therefore, the outcome of the black box test has no benefits to users of a system. The users are only the tester of a system to ensure the system functions as required by the work flow of users' data. In this black box test, the test is bias to developers' and the users are only given an opportunity to evaluate the system based on the functionality capability and reliability of a system.

2.7.1.2 The White Box Test or Structural Test

The white box is testing the structural of a system. The white box test is performed after the black box test is done (Farrell-Vinay, 2008; Jorgensen, 2013; Khan & Khan, 2012). The structural test is performed to test the path or flow of the system. The Figure 2.4 shows the white box testing.

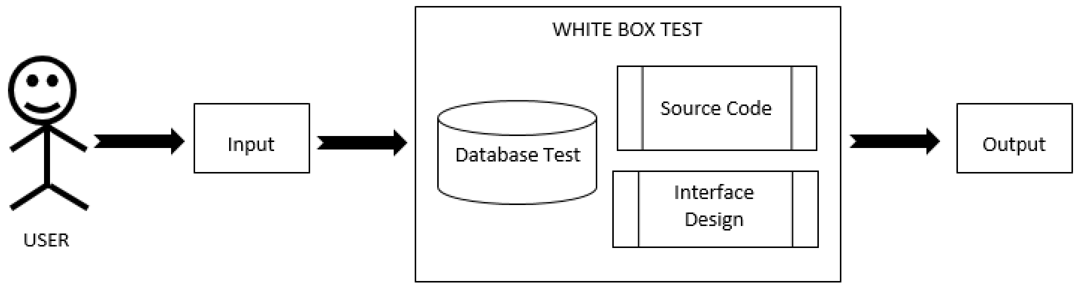


Figure 2.4: White Box Testing

The data flow of the system is observed during the white box test. The white box test is to verify the expected outputs, conditional loops in the source code, check the functionality of the application and verify each section in the system flow. The white box test is more to branch testing, statement testing and decision testing. Both the test has no meaning to users of a system.

The outcome is for further enhancement of the proprietary system. Table 2.5 shows the comparison of the black box and white box test. Both test indicate the system functionalities and capabilities and neither reflecting the user acceptance test in behavioral aspect. Based on the comparison, the UAT and SAT in the black box test are conducted without users' acknowledgement. This clearly reflects that the UAT and SAT do not capture the need of users as mentioned in Chapter 1, Figure 1.1.

Table 2.5: Comparison Test - Black Box and White Box

Black Box Test	White Box Test
Functional Test	Structural Test
Software Testing	Software Testing
Test of function, capability and reliability	Test of internal structure, design, implementation
Not known to user	Known to user
User Acceptance Test (UAT) and System Acceptance Test (SAT)	Unit Testing and Integration Testing
System User	Software Developer
I.T knowledge and skill not required	I.T knowledge and skill required
Box or data driven testing	Clear box or structural testing
Trial and error method or pilot test	Test on random data

The user acceptance test for the system acceptance is different from user acceptance test used for the behavioral test known as unified theory of acceptance and use of technology (Venkatesh et al., 2003). The user acceptance test for the system acceptance is on the functionalities and capabilities focused to technical aspects and most researchers used the element of a system such as quality of system and information quality for the technical evaluation (DeLone & McLean, 1992, 2002, 2003; Iivari, 2005; McGill, Hobbs, & Klobas, 2003; Petter et al., 2008; Seddon & Kiew, 1996; Seddon, 1997).

It is argued that the focus on system quality and information quality are more favorable to users' expectations. The librarians are the main entity holder of the library data and system, therefore, the librarians know what they want for a system. The decision is of the librarians and not of the system developers'. In the open source system the users' are also the developers.

2.7.2 Constructs in UAT

The constructs used in the user acceptance test (UAT) are adopted from information system studies and information system acceptance model (DeLone & McLean, 1992; Seddon & Kiew, 1996). These models are used to test the technical aspects of a system. The identified constructs are:

System Quality – a construct used in DeLone and McLean's model to measure system reliability, functionality, bugs, quality of source code maintenance and accuracy. The system quality in the model critically examines the view of software developers using the black box and white box text. The outcome of system quality is used mainly to modify the source code and enhance the system for future use.

Information Quality – also used in DeLone and McLean model. The information quality is testing the random data set input by users. The information quality is concerned with accuracy of information, the relevancy of information and the timelines for information processing. The critical point of information quality is that this construct is only applied to the decision making system.

The information technology skill – is widely mentioned in qualitative studies (Adnanh & Lee, 2015). The information technology skill is useful in the handling of the system and respective data. This construct is critically examined in the open source technology systems as the users' are also the developers, thus their technology skill is of importance in system acceptance and use.

The cost – is identified in the open source technology acceptance as the cost of the system compared to proprietary system (Bailey, 2011; Jayasingh & Eze, 2010; Martinsons & Chong, 1999).

2.8 Unified Theory of Acceptance and Use of Technology

The Unified Theory of Acceptance and Use of Technology is a theory used to test the users' acceptance of a system. The users' are defined as end-users of a system (UTAUT)

- *(Venkatesh et al., 2003; Venkatesh et al., 2012)*

Today's theory may become practice tomorrow. User behaviour towards the acceptance and use of a system are explained by several models. The selected unified theory of acceptance and use of technology (UTAUT) model is the result of a combination of 8 models which are the technology acceptance model (TAM), combined technology acceptance model and theory of planned behaviour (C-TAM-TPB), theory of planned behaviour (TPB), theory of reason action (TRA), motivational model (MM), model of PC utilization (MPCU), innovation diffusion theory (IDT) and social cognitive theory (SCT) (Dulle & Minishi-Majanja, 2011; Venkatesh et al., 2003).

The UTAUT has been tested in open access technology use (Dulle & Minishi-Majanja, 2011), use of I.T (Al-Gahtani, Hubona, & Wang, 2007), consumer acceptance of PDAs (Kulviwat et al., 2007), information technology infrastructure library (ITIL) adoption (Al Hilali, Qutaifan, & Amer, 2012a), solar water heater (Saleh, Haris, & Ahmad, 2013) but not for library open source information system. In this research, the UTAUT model has 9 constructs known as key influencing factors. 5 influencing factors are adopted from Venkatesh (2003) and 4 are the contributions factors adopted from the UAT system acceptance perspectives.

The UTAUT citation comprises of 450 studies and there are 16 studies with complete usage of UTAUT model in various field of studies such as banking (Abu-Sahab, 2009), speech recognition by physicians (Alapetite, & Hertzum, 2009), information technology in Saudi Arabia (Al-Gahtani et al., 2007), clinical decision support system (Chang, Hwang, Hung, & Li, 2007), web-based learning (Chiu, & Wang, 2008), online auctions (Chiu, Huang, and Yen, 2010), social media adoption (Curtis, 2010), PACS monitoring (Duyck, 2010), ICT adoption (Gupta, 2008), E-Government services (Hung, 2007), health information technology (Kijasanayotin, 2009), IT adoption and analysis (Laumer, 2010) , digital television adoption (Sapio, 2010), US tax payers' intention (Schaupp, 2010), information kiosks (Wang, 2009) and ITF mobile banking (Zhou, 2010) with significant outcomes and findings.

In a simplified term, the organizational, technological and individual have great impact on the acceptance of information system in the library. The adopted constructs as the key influencing factors from UTAUT model by Venkatesh (2003) and added value constructs to the key influencing factors from UAT will study the librarians' acceptance of an open source library information system.

The aim of this study to adopt and combine the entity from information system and management fields to the implementation scope of library information science on the librarians' acceptance of an open source library information system. The study combines the UTAUT and UAT constructs and proposed a model known as open source information system unified theory of acceptance and use of technology (OSIS-UTAUT). Appendix B provides the summary of technology acceptance studies.

The theory of acceptance exist during the development of information technology (Venkatesh et al., 2003). Users' perception on information technology exists only upon the development of unified theory of acceptance and use of technology by (Venkatesh et al., 2003). Appendix C explains the unified theory as the combination of eight technology model. Sundaravej (2010) highlights the importance of unified theory for the acceptance study. This paper argues on the factors used to determine the user acceptance of a technology based application on intention to use Blackboard known as MyGateway at university in the Midwest area among 394 business administration students. This paper contests the claim that the validity and reliability of the instrument was potential and the Cronbach alpha's value is above 0.7 to determine the behavioral intention to use the system. Sundaravej (2010) final analysis attempts to show that only 4 factors which are the performance expectancy (PE), effort expectancy (EE), self-efficacy(SE) and anxiety are accepted at the level of significance of 0.01 whereas the attitude and social influence were not supported. This finding gives an account that there is no accurate model which exists for technological and organizational decision makings (Sundaravej, 2010). The results and findings were contradict to the results obtained from empirical study (Venkatesh et al., 2003). The UTAUT investigates the factors performance expectancy, effort expectancy, social influence significantly influence the behavioral intention of technology acceptance whereas the facilitating condition, attitude towards using technology, self-efficacy and anxiety were insignificant for the behavioral intention of technology acceptance (Venkatesh et al., 2003). The challenges of UTAUT is on the information system researchers on the specific factors which influence the technology acceptance (Sundaravej, 2010). This paper reviews the evidence for technology acceptance factors for use behavioral study. Therefore, there is a purpose and urge for further enhancement on the instrument and recommendation for confirmatory research approach for use behavioral study for technology acceptance.

There has been studies on management information system (MIS) to identify the organization characteristics which lead to decision of information system success and failure (Ginzberg, 1993). Study on open access provides an overview of the UTAUT model acceptance at public universities in Tanzania (Dulle & Minishi-Majanja, 2011). A random sampling technique is used to explore the ways of data collections with 30 items and 544 respondents. This paper investigates the factors that determine the open access adoption by considering the performance expectancy, attitude, effort expectancy, social influence, self-efficacy, facilitating condition, age, gender, position, awareness and experience. This paper critically examine the factors of UTAUT considering the moderators age, awareness, gender, experience and position. This paper assess the significance of age, awareness, behavioral intention, facilitating condition and social influence were significant for open access adoption and implementation. The implication of moderators critically examines only when the technology usage is mandatory (Tibenderana & Ogao, 2008; Venkatesh et al., 2003). The findings have created the awareness of open access usage and validate the UTAUT technology model for open access adoption in Tanzania. This approach has been adopted in Koha OSLIS research to study the UTAUT for librarians' acceptance of Koha open source library information system using the extended UTAUT model with new constructs. The moderators are omitted in Koha OSLIS as the technology adoption decision is not a mandatory in the library. The attitude is a newly introduced construct is the open access and it reflects the usage behaviour of users and reaction towards using a system (Dulle & Minishi-Majanja, 2011).

There are models to test the users agreement of information (Ginzberg, 1993; Melone, 1990). Study on information reviews the evidence for visitor management system (VMS) by using only 2 constructs from UTAUT model which is the performance expectancy and effort expectancy with the contribution of perceived enjoyment construct (Anwar, Masrek, & Rambli, 2012). This study reports on the determinants of user acceptance of VMS system. The VMS research considered the implication of VMS on saving time, user friendly system, fast and easy information query activities and effective information storage (Anwar et al., 2012). This VMS is critically examined using the UTAUT by considering the decision to develop a VMS system and support the link with department in an organization. Therefore, in Koha OSLIS research the performance expectancy and effort expectancy are useful for a system acceptance study.

There is a model to test and evaluate the service oriented for technology acceptance study (Ali & Sreenivasarao, 2013). A Case study on service oriented UTAUT model for the acceptance ad use of electronic library services at Bahir Dar University (Ali & Sreenivasarao, 2013). This study traces the development of ICT in the library environment. The paper discuss the case on the ICT services and to satisfy the users needs. The reports is on the global transformation of information to a digital era. This paper reports on the development of information technology and considered the implication of electronic information in the library. The design and implementation of SO-UTAUT agreed to the research findings with positive path coefficient with relevance constructs such as social influence, relevancy and facilitating condition (Ali & Sreenivasarao, 2013; Tibenderana & Ogao, 2008). SEM approached is used for the analysis of data. The SO-UTAUT examines the relationship between in constructs and confirmed the efficiency and robustness of UTAUT model to determine the acceptance and use of technology.

A study on empirically testing the UTAUT model for the acceptance of Moodle among students in the University of Science and Technology, Taoyuan (Hsu, 2013). This study reports on the evidence of UTAUT model with computer-mediated communication framework. This study investigates the factors that determine the Moodle acceptance among students. The factors are performance expectancy (usefulness of tool), effort expectancy (ease of use of tool), social influence (teachers and students) and facilitating condition (technological support). The relationship is between the student acceptance of technology and the constructs used. The Moodle is well accepted and is recommended for the usage of learning. The factors provide an overview of the importance of Moodle in the University. The factors also highlights the level of usage of Moodle and considered Moodle as an aid in the teaching and learning at the university.

2.8.1 Constructs in UTAUT Model

The constructs used in the UTAUT model is similar to the constructs in 8 models defined in Appendix C. The constructs are widely used and have critically examined the view of users technology acceptance (Davis et al., 1989; Venkatesh et al., 2003).

Performance expectancy (PE) is used in TAM, combined TAM-TPB, extrinsic motivation (MM), job fit (MPCU), relative advantage (DOI) and outcome expectancy (SCT). The performance expectancy is a great predictor and provides significant findings in the models.

Effort expectancy (EE) is used in perceive ease of use in TAM and complexity in DOI and MPCU. This construct is significant for voluntary and mandatory setting in the technology acceptance.

Social influence (SI) is used in subjective norm in TRA, TAM2, TPB and combined TAM-TP, social factors (MPCU) and image in DOI. This social influence construct reacts similarly to effort expectancy and is significant for voluntary context and greatly significant in mandatory setting of technology acceptance.

The facilitating condition has been omitted in this study as this construct is focused to environment settings for technology acceptance. Hence, the facilitating condition has been removed from the UTAUT. The facilitating condition is widely used in perceived behavioral control in TPB and TAM-TPB, MPCU and DOI.

Attitude towards using technology is mainly used in UTAUT studies and reflects a great significant in the users' technology acceptance studies. The attitude is the ideal construct in the UTAUT and reflects the users' characters in the technology acceptance study.

The moderators are also omitted in this study as the moderators are only important when the system usage is mandatory (Venkatesh et al., 2003). In this study, the open source system usage is not mandatory as there is an alternative system in the market.

Venkatesh et al. (2003) reported that the empirical test of UTAUT revealed 70% of the variance in the constructs strongly support the intention to use. There is limitation with UTAUT model and it is recommended to enhance the UTAUT with other relevant construct in various field of studies focusing on use behavior.

2.8.2 Behavioral

The action by an invidual, organizational, technological and system (Behavioral)

- *(Venkatesh et al., 2003; Venkatesh et al., 2012)*

Librarians are exposed to various obstacles during service delivery (Mohideen & Kaur, 2015), namely budget constraints for proprietary system maintenance, wastage in-house expertise and efforts on system applications developments, unmeasurable in-house information technology expertise performance, underutilization of librarians' information technology skills, job performance not to the expectations, service delivery that cannot meet the demands and expectations of patrons (Mohideen & Kaur, 2015; Sulayman et al., 2008).

O'brien & Marakas (2007) mentioned that it is crucial to understand the elements of behavioral, technical and business and managerial to develop and implement an information system. There is strong relationship between information system and software products (O'brien & Marakas, 2007; Simon, 2000). These elements and system visualize are the complexity of an information system.

The questions on the organization needs, what the system can deliver and do, users job performance using a system, user technology skill and attitude on system usage, users social influence on a system and the users expectation on the system will envision the users' needs, users' acceptance and system acceptance (O'brien & Marakas, 2007; Simon, 2000; Wilson, 2001). Implemented system analyzation is the important key to answer those questions. Users' judgment and evaluation on the system acceptance is the only solution for these questions. Alves et al. (2012) studied the problem on the user acceptance of the Koha open source library information system with RFID among the librarians in public universities. The adoption is a great challenges and focuses on technical perspective related to RFID and catalog migration (Alves et al., 2012). The conclusion was license cost saving and the adaptation is dependable on institution needs to improve efficiency in circulation and inventory. The finding is focused merely on technical solution and omitted the non-technical perspective of users' acceptance of open source system.

The evidence clearly highlights the reason for the open source system selection for this study. Therefore, the well-known Koha open source library information system is specifically selected for this research because most of the open source library information system studied the Koha compared to other open source such as the Evergreen, Lucidea, ABCD, MarcoPolo, Open Biblio and PhpMyLibrary as such the study on open source solution in Saudi Arabia focusing on Koha based on cost effective solution (Ahmed & Alreyaee, 2014), open source Koha with RFID solution for the library (Alves et al., 2012), study on managing Koha open source library system (Biju et al., 2012), the new opportunities and challenges with Koha open system (Chawner, 2004), Koha for small private college (Dennison, 2011), library automation with Koha (Egunjobi & Awoyemi, 2012), digital library at Afghanistan with Koha integrated library system (Han & Rawan, 2013), open source practice with Koha (Jaffe & Careaga, 2007), adoption of Koha library management system in India (Jasimudeen, 2013), Koha survey at Thai university (Kiriyanant, 2012), ABCD versus Koha an option for library system (Macan & Fernandez, 2010), Koha for medium and small libraries (Qiang, 2011), survey on Koha for open access solution (Riewe, 2008), comparison Koha and NewGenLib (Singh & Sanaman, 2012) and Koha adoption and user perception in India (Vimal Kumar & Jasimudeen, 2012).

The view of proprietary system developers are also being diverted to the open source technology. The argument is on how are the proprietary system developers going to market the open source library system? This will trace the development and enhancement of open source system modified by vendors. Another argument is based on the open source system which is developed by vendors. Issues on the cost, support service and maintenance which are clearly stated in the open source policy by Katipo (OSS-Definition, 2005) that indicates the open source software is free and not chargeable and the support is available throughout the open source community. Vendors are charging the users for development and maintenance. This practice is contradict to the open source policy and agreement. Therefore, there is a need to foresee the policy makers and open source adopters upon adopting and implementing open source system in an organization.

2.9 Research Model

A specific research model is developed as in Figure 2.5 to conduct the entire literature study. This research model reflects the field of study, area, scope, research questions, constructs used and research design. The field of study is library & information science. The research area is bound to library automation. The research scope is open source library information system, specifically Koha system. The constructs are being categorized as an extension of UTAUT constructs by adapting UAT constructs to add value to the original UTAUT model for it to be applicable to open source information systems (OSIS). The research outcome is to explain the applicability of the OSIS-UTAUT model in library automation and determine the relevance of the influencing factor for the Koha open source library information system.

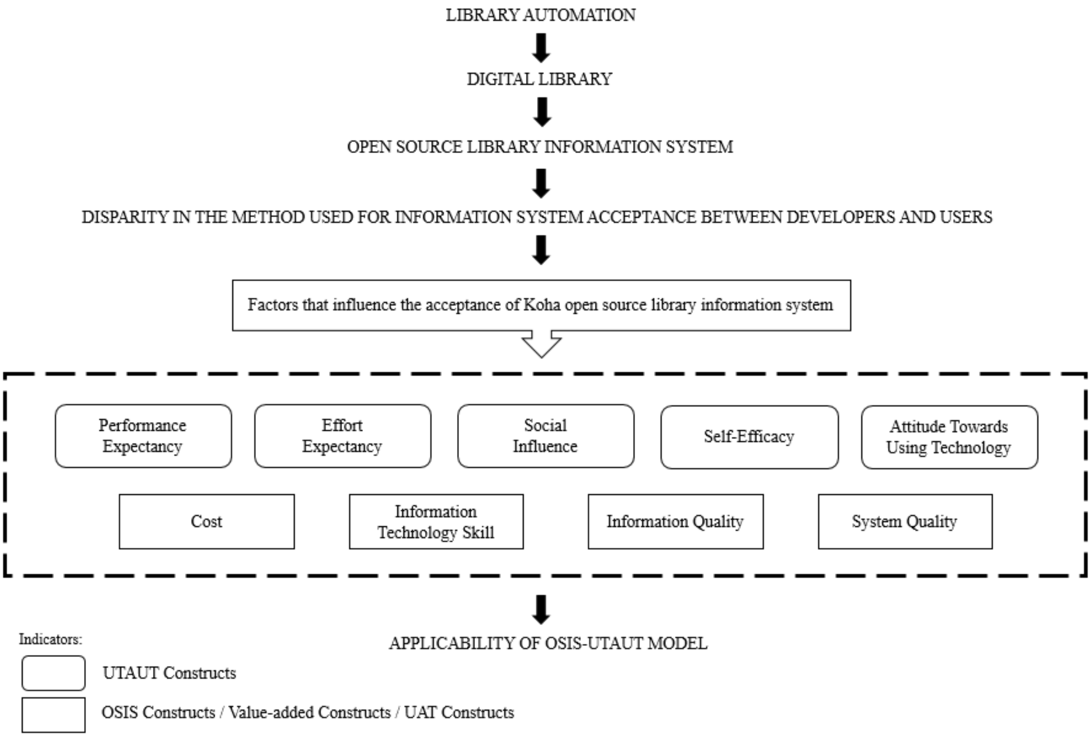


Figure 2.5: Research Model

A research model was initially developed to direct the search for relevant literature and the model is refined based on findings from the literature that justifies the possible proposed model as in Figure 2.5. The research model framework emphasizes on the entire research solution and flow of interdisciplinary research. The development of the entire research and the link between UTAUT and UAT is illustrated. The initial step of this research is to fulfill the interdisciplinary scope between management and information system. There are 2 main fields that have been adopted for this research and presented in the Figure 2.6. The management filed and information system filed of studies. The management model is from Venkatesh et al. (2003) and the system base is adopted from

O'brien and Marakas (2007). There are three main approaches in the management perspective of a user acceptance study - *organizational, technological* and *individual*. There are five elements in the information system's perspective - *organizational* or individual known as people; *technological* identified by hardware and software; and *system* based on the program process and procedures. This indicates that there is a link between the management approach and information approach for user acceptance studies. The main argument in this study is the *people*. The people in management approach is the user, direct user and end-user. Whereas in the open source technology system approach, the people is the developer. The expert in open source system is the direct user of system and the dependencies on information system developer does not exist. The concern is that the method used for user acceptance test, for both developers and users, is considered as a single test. The system test for users is considered as an outcome for developers to carry out system modification. The method for system adoption for open source technology solely based on user acceptance rather than system acceptance test using the black box testing.

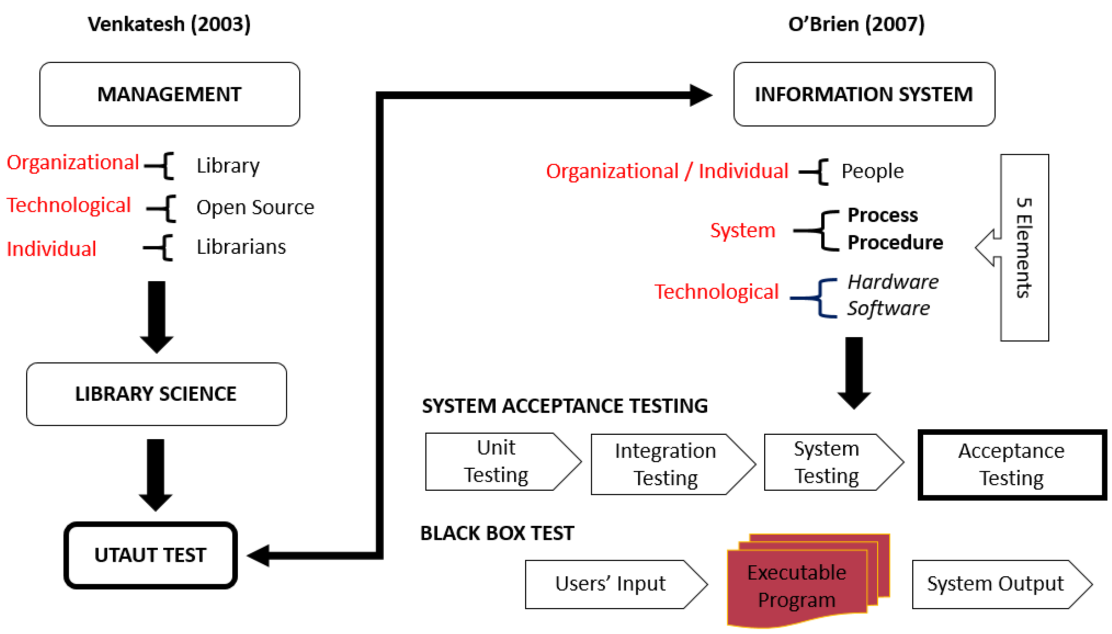


Figure 2.6: Research Model Framework

2.10 Summary

The literature for the Koha OSLIS research reflects that there has been demand, growing and ongoing interest on open source system and technology acceptance test using the unified theory of acceptance and use of technology (UTAUT). The literature is considering the UTAUT model based on information system study which is bias to system developers for the system acceptance testing findings (Gallego et al., 2008). The users acceptance based on system behavioral aspect (non-technical aspects) focused to the information quality and system quality for an open source technology has been omitted in many aspects of system acceptance testing. In the present technology advancement, the information system and information technology market is capturing the open source technology acceptance and demands. Therefore, there is a need for a framework which can illustrate the direct users acceptance based on system behavioral study for open source technology. Previous study on technology acceptance has tackled some issues which is relevant to open source technology acceptance to some extent (Biju et al., 2012; Vimal Kumar & Jasimudeen, 2012). Previous studies have also ignored the link to system acceptance focused on non-technical aspects of a system using direct users for the system acceptance test. In Malaysia, there is a comprehensive study on open source system using qualitative method (Adnanh & Lee, 2015) and intention to use digital library using UTAUT model (Rahman et al., 2011). None of the study in Malaysia has explored library open source system acceptance using the UTAUT model. Therefore, this research aims to investigate the applicability of the UTAUT model in assessing the acceptance of open source technology and its relevant antecedents in the context of Malaysian university libraries.

CHAPTER 3: METHODOLOGY

Every theory is a self-fulfilling prophecy that orders experience into the framework it provides.
- Ruth Hubbard.

3.1 Chapter Overview

The research methodology for the librarians' acceptance of Koha open source library information system is presented in this chapter. The research methodology is divided into two main sections and several subsections. The two main sections are the research design and quantitative strand. The research design is illustrated using the specific research design descriptor- a diagram based illustration of the entire research flow. The specific research design descriptor is used as the guiding principle for this research. It introduces the theoretical research model, causal relationship type of investigation, quantitative analysis method, system librarians as the unit of analysis. Sample design uses the random sampling based on librarians' sampling framework which was given by the identified public and private libraries which have implemented and used the Koha open source library information system. The research issues were linked to the theoretical framework and being discussed. The OSIS-UTAUT theoretical framework applied in this study will explain the postulated relationships. The research hypothesis development is streamlined based on the influencing factors. The hypothesis formulation is to explain and investigate the determined variables of OSIS-UTAUT model and relationship in path modeling for the acceptance of open source library information system study. The quantitative strand introduces the measure, instrumentation and approach, data collection and data analysis technique for pre-test and the main study.

3.2 Research Design

The research design is described using the design descriptor. There are four main elements in research design descriptor which are the blueprint, plan, guide and framework (Haron et al., 2011, p.74). The blue print in the library is the activities and time-based plan related to the library system. The librarians' day to day activities, open source information system operations and services are clearly determined. The plan for this study is based on the formulated research questions for the librarians' acceptance of the open source library information system. The guide is the selection of sources and types of information. The sources and information which supports the entire study are gathered from the literature. The framework is indicating the relationship and variables in this study. The base framework for this study is the UTAUT model by Venkatesh et al. (2003). There are several value-added variables from the UAT adopted from information system studies and this formed a new model named as OSIS-UTAUT.

The research design descriptor is a complete strategy, technique, element, procedure, design, role, flow, process and sampling plan that integrate the components of this research in a logical and coherent way (Haron et al., 2011, p.73; Sekaran, 2003, p.102). The idea of research design descriptor is adapted from Cooper and Schindler (2008). This study has designed a specific research descriptor for effectively addressing the entire research. Hence, the research design descriptor will then guide this study in a systematic way. These research design descriptor will also fulfill the study's research objectives and answer the research questions. The descriptor shows the study flow of this research for the acceptance of an open source library information system. Figure 3.1 present the research design descriptor for this entire study. There are 7 layers in the research design descriptor with a top down approach.

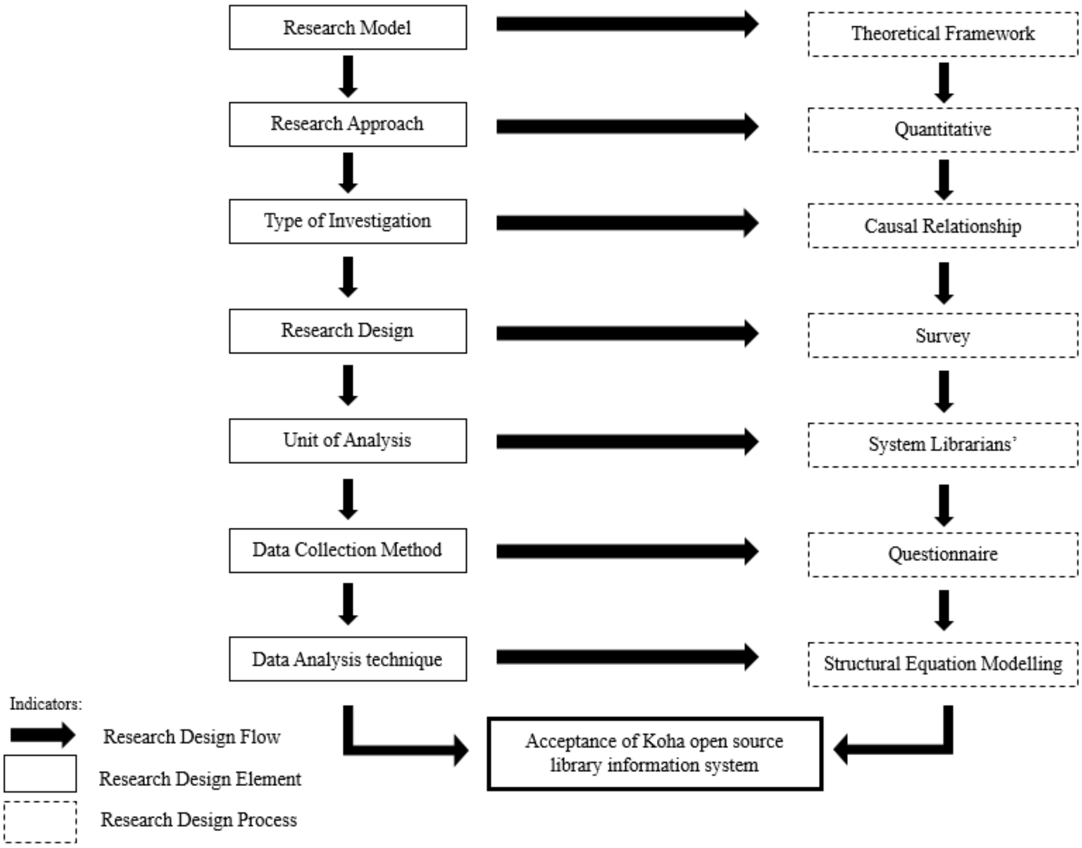


Figure 3.1: Research Design Descriptor

3.3 Research Framework

The structure that supports a theory in a research is a theoretical framework. A theoretical framework explains the understanding of theory, concept relevant to the research and research problem in a schematic diagram. A theoretical framework is strengthen by an explicit statement of theoretical assumption on hypothesis development and choice of research methods for a study. A theoretical framework specifies the variables that influence a phenomenon of interest, limit the scope of the relevant variables, understand the concept with the given definition and highlight the need to examine the variables under a circumstance (Research-Guides, 2015). The developed and investigated theoretical framework for this study is explain in Figure 3.2 and 3.3.

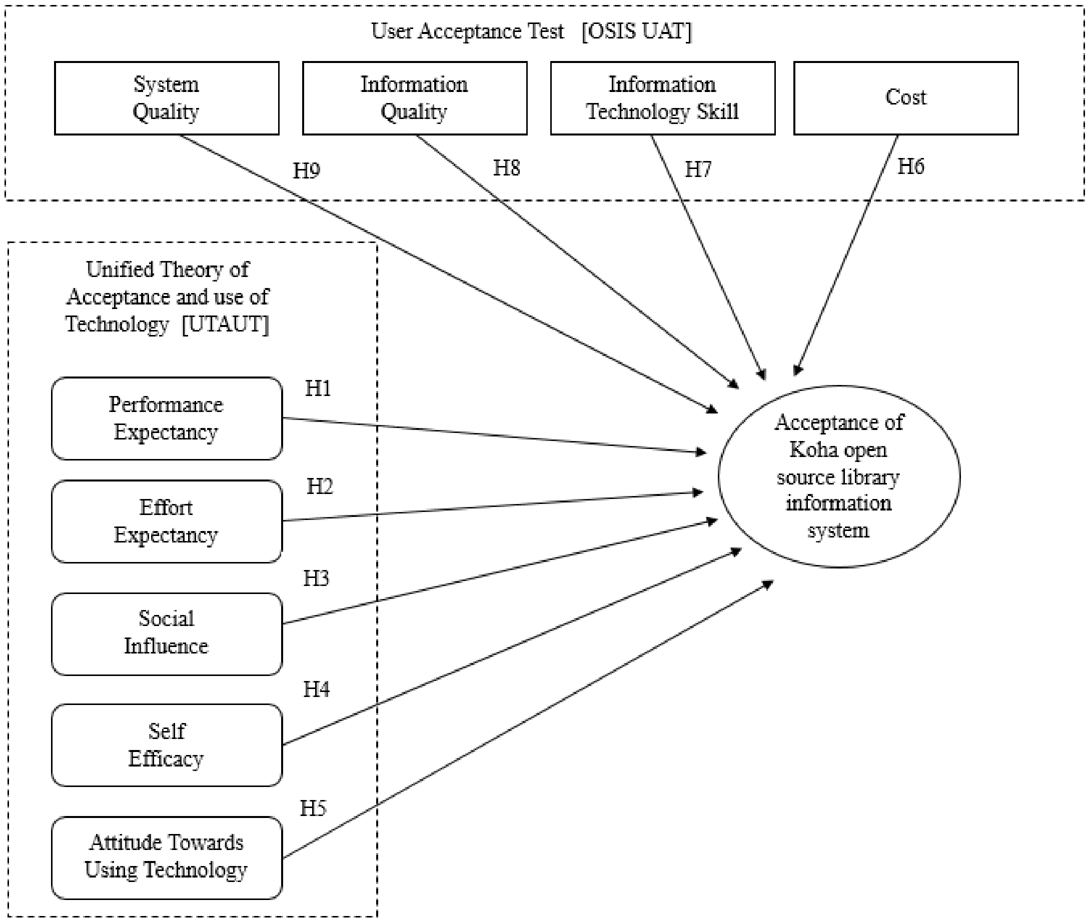


Figure 3.2: The OSIS-UTAUT Theoretical Framework

The theoretical framework illustrated in Figure 3.2 is the model used to examine the relationship of the influencing factors on the acceptance of Koha open source library information system. The outcome from the model shows the applicability of the OSIS-UTAUT model for library on the acceptance of an open source library information system. The model is developed based on the findings of the literature review and to fulfill the research problems identified in Chapter 1. The OSIS-UTAUT model in this study enhances the approach of a behavioral study of technology acceptance in the context of information system and enhances Venkatesh et al. (2003) model by investigating the influencing factors and the relationship particularly on the librarians' acceptance of Koha open source library information system.

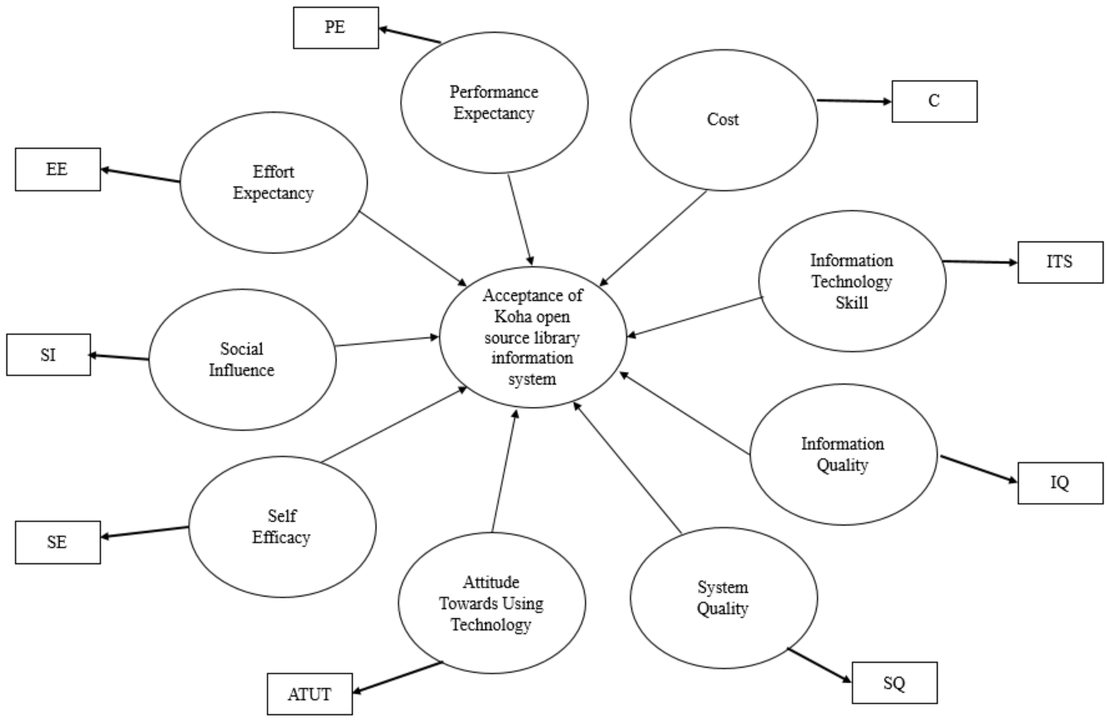


Figure 3.3: The Detailed of OSIS-UTAUT Theoretical Framework

The research model in Figure 3.3 is on *what* are the indicating or influencing factors for the acceptance of Koha open source library information system. The theoretical framework addresses causal explanatory relationship approaches of the OSIS-UTAUT model. The influencing factors are the performance expectancy, effort expectancy, social influence, self-efficacy, attitude towards using technology, cost, information technology skill, information quality and system quality. These factors are the independent variables (cause or exogenous) and the dependent variables (effect or endogenous) for the acceptance of an open source library information system. The investigated hypotheses are developed based on this model for each research question of this study.

The process of identifying *how* the open source technology influence librarians' acceptance is based on the instrumental approaches of OSIS-UTAUT model. The causal relationship in the model is based on the user acceptance of information technology towards an unified view (Venkatesh et al., 2003).

This OSIS-UTAUT model aims to explain the users' intention to use an information system and subsequent usage behaviour. The construct in the original UTAUT the performance expectancy, effort expectancy, social influence, self-efficacy, attitude towards using technology and facilitating condition.

The UTAUT2 is more to the environment intentions and focused to the facilitating condition, anxiety, hedonic motivation, price value and habit. This study adopted the first five constructs and dropped the UTAU2 constructs. The UTAUT2 constructs are tested under the intention category of environment. Therefore, these constructs are omitted. The UTAUT theory is the consolidation of 8 models that are used to explain information system usage behaviour. The 8 models in Appendix C highlight the theory of reason action (TRA), technology acceptance model (TAM), motivational model (MM), theory of planned behavioral (TPB), a combined theory of planned behaviour and technology acceptance model (C-TPB-TAM), model of personal computer use (MPCU), diffusion of innovations theory (IDT) and social cognitive theory (SCT).

The moderators are omitted because neither relevant nor mandatory fields in technology acceptance (Kripanont, 2007; Tibenderana & Ogao, 2008; Venkatesh et al., 2003). The added-value constructs which are the cost, attitude towards using technology, system quality, information quality and information technology skills are adopted form user acceptance test or system acceptance test (UAT/SAT) from the perspective of information studies on system acceptance test (O'brien & Marakas, 2007).

The answers to the issues are presented in a form of flow diagrams in Figure 3.1 that comprises the definition of research model, research type, type of investigation, analysis method, data collection method, unit of analysis and sample design.

The findings of the entire model, OSIS-UTAUT is to achieve research objectives and strengthen the main objective of this study: to examine the applicability of the proposed model for users of Koha open source library information system in academic libraries at public and private universities in Malaysia. The unified theory for technology acceptance is used to explain the relationship and link between librarians' acceptance of an open source library information system. The detailed framework in Figure 3.3 is explained in the hypotheses development stage.

3.3.1 Dependent and Independent Variables

Measures are item or determinants in a study. These items are questions which the participants respond. The items are directly related to the research questions. The measures in this study are the independent and dependent variables. These variables are also known as exogenous (cause) variables and endogenous (effect) variables. The independent variables are adopted from Venkatesh et al. (2003) and O'brien and Marakas (2007). The independent variables are performance expectancy, effort expectancy, social influence, self-efficacy, attitude towards using technology, cost, information technology skill, information quality and system quality. The dependent variable is the behavioral aspect focused to the librarians' acceptance of an open source library information system. In any quantitative approach, there are 2 stages of research methodology which includes the pre-test and main study.

The content analysis for Koha OSLIS is not applicable for this study due to several reasons. Most of the studies related to behavioral and information system are focused to the end-users of a system and focusing on technical aspects of the system software (Gallego et al., 2008). The phrase open source reflects the system developer compared to the system users. Hence, the open source studies are mostly focused to the system developers. Therefore, the measures are adopted and tested in the different scenario of users who are the direct users of an information system. The method used for measuring independent variables adopted from Venkatesh et al. (2003) UTAUT model which are the are performance expectancy, effort expectancy, social influence, self-efficacy and attitude towards using technology are mentioned in Chapter 2. The items for the questionnaire are adopted from (Sundaravej, 2010) for the performance expectancy, effort expectancy, social influence, self-efficacy and attitude towards using technology.

The value added independent constructs or the OSIS constructs are the information technology skill (Galandere-Zile & Vinogradova, 2005; O'brien & Marakas, 2007), system quality (O'brien & Marakas, 2007), information quality (Huang, Lee, & Wang, 1998) and cost (Adnanh & Lee, 2015). These constructs are adopted from various studies related to the information system and end-users behavioral as mentioned in Chapter 2.

The content analysis for information system constructs are also unavailable due to several reasons. This is due to the constructs of information system studies which is used to evaluate the functionalities and capabilities of a developed information system (O'brien & Marakas, 2007). These constructs are questionable by users who uses the information system for daily task. Therefore, this study adopted these constructs which are considered important for an information system acceptance by users. The information technology skill is used in decision makings (Galandere-Zile & Vinogradova, 2005). A system operates much faster than the human, therefore, the quality system in important for the human task. The information system benefits are to provide quality and better information. The organization and management of information will determine the quality of information stored in a system. The cost is the budget for the entire system adoption, implementation and training (Adnanh & Lee, 2015).

Dependent variable in this study is the librarians' acceptance of an open source library information system. The measure of the librarians' acceptance is done based on the 10 constructs. A pre-test study via direct approach to the respondent in the library is being performed to collect the data. Permission is granted from each library to distribute the survey to the system librarians. The direct approach is simpler as the sampling frame is given by the library management.

3.3.2 Research Hypotheses Development

There is a total of nine hypotheses to be tested for the librarians' acceptance of Koha open source library information system study:

According to Venkatesh et al. (2003), performance expectancy is the degree to which individuals' belief using a technology to perform different activities and will provide benefits to the user. There is a significant direct effect of performance expectancy on user behavioral to use a technology. Therefore, this research assume and adopt the performance expectancy construct from the UTAUT model to test the open source library information system acceptance. The assumption that the open source will be useful for librarians' job performance. Hence, the first hypothesis will be:

H1: Performance expectancy positively influence the user acceptance of Koha open source library information system

The effort expectancy is indicating the degree of ease associated with users' use of technology in daily task (Venkatesh et al., 2003). The effort expectancy is from the perspective of a system adopted in an organization. In this research, the librarians' feel easy to use the open source system and understand the interaction and system flow. The effort expectancy assumption is to evaluate the user and system interaction for an open source library information system. The second hypothesis will be:

H2: Effort expectancy positively influence the user acceptance of Koha open source library information system

The degree to which an individual perceives the importance that others believe on the use or need of a system (Venkatesh et al., 2003). Social influence is a specific cultural and interpersonal influences on an individual from the significant that others influence of as adoption of new technology. The social influence is the direct indication of a technology acceptance from the UTAUT model. The third hypothesis will be:

H3: Social influence positively influence the user acceptance of Koha open source library information system

Individual skill and ability to perform a task is known as self-efficacy (Venkatesh et al., 2003). The user' self-efficacy plays a vital role in building attitudes towards technology adoption. The librarians' confidence, ability and belief on open source library information system will eventually reflect the acceptance of open source technology. The fourth hypothesis will be:

H4: Self-efficacy positively influence the user acceptance of Koha open source library information system

Attitude is the individual positive or negative feeling about performing the target behavior in using a system (Venkatesh et al., 2003). Attitude is also an individual overall affective reaction to using a system. The librarians' attitude towards a technology acceptance is identified upon open source system usage and implementation. In UTAUT model, the attitude has the highest influences on technology adoption and implementation. The fifth hypothesis will be:

H5: Attitude toward using technology positively influence the user acceptance of Koha open source library information system

The amount of price or value added for money (Adnanh & Lee, 2015). The cost is an important construct in the technology acceptance study. The price for an open source library information system, training and maintenance are the value for the cost in an organization. The cost has positive influence in the technology adoption and implementation (Adnanh & Lee, 2015). The sixth hypothesis will be:

H6: Cost positively influence the user acceptance of Koha open source library information system

Skill gap which exists between the present information technology skill, knowledge and the required skill to fulfill the organization needs and objectives (Adnanh & Lee, 2015). In system adoption, the users' I.T. knowledge, technical skill and computer skill in handling an open source library information system in crucial. Therefore this information technology skill is identified as the main construct for any open source technology acceptance in an organization focused to library in this research. The seventh hypothesis will be:

H7: Information technology skill positively influence the user acceptance of Koha open source library information system

Information Quality is the process of maximizing the value of an organization information and assure the accuracy and real time information availability in the system (Lewis, 2002). The information resides in an open source library information system is evaluated based on data standard, information organization, meta-data and data accuracy. Therefore, the quality of information resides in a system can only be ascertain by the owner (librarians) of the data. The eighth hypothesis will be:

H8: Information quality positively influence the user acceptance of Koha open source library information system

System quality is the degree to which an individual believes that the system performs the task accordingly to the needs of the users' (Lewis, 2002). The interrelation and the connectivity between system components and dependability, flow of a data process, response time, system integration, reliability and portability are the concern of the open source system users'. A system quality has positive influence on the acceptance of technology (Lewis, 2002). Hence, the ninth hypothesis will be:

H9: System quality positively influence the user acceptance of Koha open source library information system

3.3.3 Causal Relationship Research Investigation

There is several type of research investigation (Haron et al., 2011, p. 220; Sekaran, 2003, p. 110). The causal investigation is used for this study. The casual investigation can be very complex and the researcher can never be completely certain that there aren't any other factors that may influence the causal relationship (Russo, 2011).

The causal research also produces quantitative data, determine variables (cause) that causing behaviour (effect). Causal research is needed in an organization to present the users behaviour. The causal research helps researchers to understand which variables are the cause, which variables are the effect and to determine the route of the relationship between variables and the effects to be forecasted.

In a causal research, 2 main questions have been raised. The questions are *what to determine* and *what outcome to expect*. These questions are the main concern for the causal type of research. This research has determine the influencing factors and the expectation is on the relevant influencing factors which influence the users acceptance of an open source technology and the applicability of the proposed model in the academic library.

Hence, in Chapter 1, the research objectives and research questions have clearly identified the determinant factors and testing relationship for this study. The determinants are adopted from the UTAUT model (Venkatesh et al., 2003) and information system UAT / SAT studies (DeLone & McLean, 1992; Gallego et al., 2008; O'brien & Marakas, 2007; Vimal Kumar & Jasimudeen, 2012; Zhussupova & Rahman, 2011).

In explanatory statistical, there are two main components which are the explanatory statistical model and evaluating the explanatory power of a model (Shmueli & Koppius, 2010). The key to a good solution of explanatory depends on the data (Shmueli & Koppius, 2010). The explanatory power is evaluated by the strength of fit measures. The random sample is used in the explanatory investigation. The explanatory power refers to the strength of association indicated by a statistical model whereas the predictive power refers to an empirical model's ability to predict new observational accurately.

Hence, this research strongly and clearly reflects the explanatory statistical method. To illustrate users' behaviour, a study on causal relationship using the OSIS-UTAUT model for the librarians' acceptance of Koha open source library information system is being conducted. Figure 3.4 explain the causal investigation flow for this study. The causal research is explanatory. The explanatory model is used for theoretical model testing and hypothesis testing (Shmueli & Koppius, 2010).

In an information system research, there is rare literature of empirical information system (Shmueli & Koppius, 2010). Causal explanatory has dominated the empirical modeling in the information system studies. The causal hypothesis and explanatory power evaluation are tested using statistical inference (Shmueli & Koppius, 2010) in this study. Hence, the causal explanatory is used for hypothesis testing.

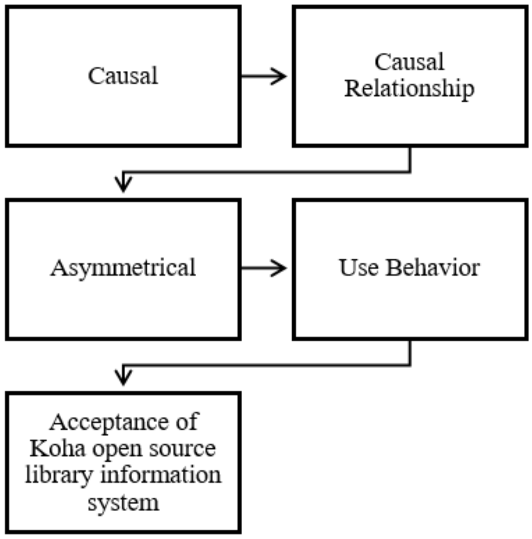


Figure 3.4: The Causal Relationship Investigation Flow

There are three types of causal relationship between variables. The symmetrical, reciprocal and asymmetrical. The asymmetrical relationship is the expecting relationship in a research by most researchers. The asymmetrical relationship postulates that changes in the independent variables (exogenous/cause) are responsible for the changes in dependent variable (endogenous/effect). This reflects the cause and effect relationship among the variables. The independent and dependent variables are obvious. In asymmetrical causal relationships, the behaviour relationship causes a specific behaviour and in this research, this indication is on the librarians' acceptance of an open source library information system. The causal relationship analysis is related to the variables and concerned with the relationship of cause and effect of one or more variables. Hence, there exist a causal-functional relationship between two or more variables. The causal relationship investigation comprises a set of mathematical structural equations with a graph explaining the hypothesized causal relationship structure (Russo, 2011). The causal relationship model is used to measure the average cause-effect and it differ from structural equation models which do aim at the relationship and modeling path.

In this research, structured equation modeling (SEM) is used for hypothesis testing on the relationship and path modeling. This study is not about the technical parts of the causal relationship model. The understanding and determination of the relationship between variables are clearly reflected with the structural equation modeling using the path modeling. This differs from correlation analysis. The correlation analysis examines the joint variation of two or more variables for determining the amount of correlation between two or more variables (Russo, 2011; Shmueli & Koppius, 2010).

In the causal relationship investigation, there are several statistical assumption for instance linearity, normality, non-measurement error and non-correlation of error terms. The important feature of causal relationship investigation is that the causal relations are statistically modeled and provide the link between the causes (exogenous) and effects (endogenous). The causal relationship model investigation modeled the relation between investigated variables. The causal relationship model is a tantamount model of explanation. The causal relationship model explains the strength of variables and relationship (Russo, 2011). The testing of relationships can have a hypothetico-deductive structure. This structure is used to determine whether the hypotheses are false or acceptable. The causal relationship model is one of the tantamount models of explanation and fits well with the case of quantitative social science.

In information system and the social sciences, the hypotheses are tested using the regression model or structural equation model (Shmueli & Koppius, 2010). The evaluation is done by indicating the strength of the relationships (Shmueli & Koppius, 2010). The R^2 of statistical test represent the explanatory power. A high R^2 indicates a strong relationship between the variables and data used to build the model. The statistical explanatory is used for the purpose of the hypothesis testing. In the information system, the empirical modeling has been dominated by causal explanatory statistical modeling.

The hypotheses and evaluation of explanatory power of the underlying formative model are tested using the statistical inference. There are a few evidence from the information system studies for explanatory oriented research. The evidence is an information system success model based on system quality and information quality (Iivari, 2005), the survey research methodology study in management information systems (Pinsonneault & Kraemer, 1993) and the implementation of an information system for workers - a structural equation modeling studying the causal relationship between workers, jobs and systems (Anderson, 1989). The finding of Pinsonneault and Kraemer (1993) study shows that explanatory studies are overall good quality compared to descriptive and exploratory are moderate to poor quality.

The causal relationship study in this research design includes a single, pre-test and in-depth study, OSIS-UTAUT formative model, and causal relationship and followed by the explanation from structural equation modeling. The unit of analysis in a causal relationship study can be an organization or individual (Haron et al., 2011, p. 222). In this research, the unit of analysis is the librarians. The librarians are known as system librarians for the purpose of this study. Causal relationship study in an organization can be strategic, internal business and organizational development (Haron et al., 2011, p. 222). The organizational development is one of the strength for this research. The public and private universities that have adopted and implemented the open source system for the library information system indicate the organizational development. The changes from proprietary system to a new technology based system is to overcome the imperfection of the existing state of the proprietary system on operational and services. The evolution from proprietary to open system is a major paradigm changed in the library operation and services.

In a library, the problem and issue are mainly focused on system and services (Mohideen & Kaur, 2015; Mohideen et al., 2012; Rahim, Zairah, & Alias, 2006). A preliminary open source software study and implementation in Malaysian public sector reported that there are many problems and barriers in the open source implementation (Adnanh & Lee, 2015). Reported main problems are related to lack of organizational support, lack of in-house expertise and manpower, lack of policy enforcement, improficiency of information technology skills and capabilities and librarians' perception of the risks of open source software. The reported problems are mainly on system acceptance, implementation and adoption. The migration and decision to open source deployment are related to the cost effectiveness.

The study findings for migration show the cost saving and technology perceive usefulness in the public sector. Jayawardena and Dias (2011) studied on the factors and impact on the open source software implementation. The factors are lack of in-house expertise, lack of support from external entities and demand for the use of proprietary software. Johnston et al. (2013) explored the open source software influencing factors and prohibiting factors which lead to an adoption decision at the Western Cape School in South Africa. The findings obtained show the effectiveness and benefits on cost, support for technology usage and advancement, users' attitudes, organizational support, open source policy, lack of open source expertise, resistance to change, comfort, trust on proprietary software and support. These problems and the findings of open source study at public sector show that there are demand and interest in the open source system. Most of the studies are focused on the system developers and the type of operating system used for the open source software. The terminology clearly reflects that the software developers are the testing entity. A system testing study in this research particularly is for system users who are the librarians. This study on the librarians' acceptance of an open source system and use of technology from the influencing intentional of organizational, technological and individual by adopting the key influencing factor from UTAUT model and UAT will benchmark the open source technology acceptance, gives impact to the organizational, technological and individual performance, reflect the applicability and usability of open source system and identify demands for an open source market and librarianship field of study. The causal relationship study using the causal investigation is studied on the acceptance of an open source technology for library information system. This study is conducted in the academic libraries at the public and private universities that have adopted the Koha open source library information system.

Social science goal is to understand the social phenomena (Russo, 2011). The social phenomena is to bring and exhibit the underlying mechanism. The social phenomena is the behaviour that influences or is influenced by others to respond to one another (Russo, 2011). In a library scenario, the users' behaviour phenomena are to understand the underlying mechanism. Hence, the underlying mechanism which supports the operational and services are beyond description. To exhibit the underlying mechanism, this study will require the causal relations between variables of interest in the library. The causal relation model in a quantitative research is used to provide the explanation of users' behaviour.

The formulated research questions indicate the causal study is needed to find an answer to the cause and effect relationship. The cause and effect relationship in OSIS-UTAUT model can be identified using path analysis (Sekaran, 2003, p.110). This solely depends on the type of research questions asked and how the problem is defined. The inference by the researcher with the normal flow of work in an organization has a direct bearing on the causal study (Sekaran, 2003, p.111). The causal relationship is also a process of variable manipulation to study the effect on the dependent variable (Sekaran, 2003, p.112).

There are examples of case study methods that are substantial in information systems related to the public sector. Case study issue for the open source is related to insufficient fund, service enhancement and system acceptance, adoption and implementation. (Cassell, 2008; Iivari, 2005; Jayawardena & Dias, 2011; Kaplan & Duchon, 1988; Pinsonneault & Kraemer, 1993). Case studies of implemented information system give a good understanding of the lack of users' involvement which will lead to either acceptance or rejection of a completed system (Gregor, 2006).

Kaplan and Duchon (1988) have reported on a case study on information system - A combination of quantitative and qualitative methods for a multidisciplinary study. This study also suggested on examining the acceptance of an information system and the effect of the information system on users and organization. The important conclusion is the urge for a variety of approaches to the information system study. Hence, the suggestion from this study strongly supports this research on information system research which uses a causal relationship type of investigation in the multidisciplinary field of study. A case study is also a problem-solving technique to issues undertaken in an organization (Sekaran, 2003, p.30) This study deals with problems similar to those experienced by an organization of a particular size and type of setting. A successful case study is by picking the right cases with clear understanding and considering critical for successful problem solving (Sekaran, 2003, p. 31). The application case study analysis which contributes to the successful installation of good information system in an organization is similar to the one that is planning to install it. The solution and practical application of the knowledge would be very functional. By nature, case studies are qualitative but the case study is useful in theory testing, empirical testing and a tool used for managerial decision making (Haron et al., 2011, p.220; Sekaran, 2003, p.109). Both the study strongly define the importance and use of case study for system implementation in an organization. This system is a tool for solving the organization operational and service issues.

3.3.4 Research Issues and Theoretical Framework

In information system research, it is important to understand and know the structural nature of theory beforehand. In information system forum, there is a limited discussion on theory and the contribution to the knowledge despite the recognition of the need for theory development. The structural nature of theory in the information system is important for a study related to information system (Gregor, 2006). The structure and questions related to the theory forming are neglected in comparison with questions related to epistemology. The epistemology is the theory of knowledge. This theory is regard to the method, validity, and scope. The epistemology also distinguishes the justified belief from opinion. The type of theory can influence epistemology approach for a research. The multidisciplinary studies that encompass all theory types are advocated.

There has been less or no recognition to date on the adopted research approach which could vary with different types of theory in the information system (Gregor, 2006). There are 5 types of theories in the information system. The Theory of analyzing, the theory of explaining, the theory of predicting, the theory for explaining and predicting and theory for design and action. The theory for explaining is used in this behavioral study.

There is little definitions and discussion of the theory and types of knowledge that can be expected to the result from different types of research approaches in the information system (Gregor, 2006). There are 4 classes of questions that arise for theories encompasses in a discipline. The domain questions, structural or ontological questions, epistemological questions and socio-political questions. The domain questions are related to the phenomena of interest in the discipline, core problems, the topic of interest and boundaries of the discipline. These classes of questions have received various researchers' attention and limited treatment in the extant literature. The researchers concern on technological artifacts approaches the theory.

The theoretical statement is of words or symbols that represent construct (Gregor, 2006). The statement types are the relationship, scope, explanation, prediction and prescription. The words or verbs are “belongs to”, “is a”, “led to”, “influences” and “constraints” which imply causality. This statement and word can be found in this research objectives in Chapter 1. A theory is distinguished based on the structural terms by considering the nature of the causal which is the technological and organizational, the variance or process theory and the level of analysis. The nature of causal defines the adoption of a particular theoretical framework for a research and this study has adopted the UTAUT model (Venkatesh et al., 2003). In this research, the nature of causal is on the organizational (library), technological (open source) and individual (librarians). The process is the temporal order based on a story or historic narrative and variance is seen as possessing laws of interaction or relationship.

A study related to user involvement is typically based on an assumption that the user involvement in the system design phase of information system development will eventually lead to increased system usage, the favorable perception of system quality and information satisfaction determinants (Baroudi, Olson, & Ives, 1986). These determinants are indirect indicators and usually unmeasurable. These determinants are used for decision makings and goal setting for system implementation in an organization. The traditional model of user involvement in a system testing includes system usage and information satisfaction. This model is hypothesized and user involvement leads to both the system usage and information satisfaction with an assumption that user involvement in the system designing phase in the information system life cycle will lead users to develop a better understanding of the system and tailored to specific needs. This model is silent on the causal relationship between system usage and user information satisfaction.

Three studies reported that there is no relationship in the user involvement and system usage (Lucas, 1976; Maish, 1979; Schewe, 1976). The argument on user involvement is viewed as participative decision making. User involvement argument may lead to system quality and information quality that increase user acceptance (Ives & Olson, 1984). A system which does not meet the users' requirements and satisfaction will be avoided. A theory regarding the relationship between constructs in the behavioral study will support the proposed model. A model for the behavioral study on information system will influence the intention of the use of a system and influence behaviour will lead to system usage (Fishbein & Ajzen, 1977). Behavioral studies eventually lead to attitudes and acceptance in an organization, the present users' attitude will reflect the implemented system users' behaviour (Baroudi et al., 1986). This behaviour will reflect the life cycle of an implemented system.

The theoretical framework is to improve the understanding of user acceptance process, provide theoretical insight of the successful design and implementation of information system (Davis Jr, 1986). The user acceptance model involved the demonstration of system prototypes, potential users and motivation to use and adopt the alternative system. The theoretical issue is on the target behaviour is focused on the causal relationship behaviour. Therefore, this study argues for the new technology based system and user acceptance to form judgments and applicability to job performance and services in the library.

The causality is the idea or the relation between cause and effect (Gregor, 2006). The causality is central to many conceptions of theory. When a theory is taken to invoke an explanation, then the theory is linked to ideas of causation. The concept of causality is extremely problematic but is of fundamental philosophical importance. In the 18th century, Scottish philosopher, David Hume has pointed out that humans are unable to see or prove that causal connection exist in the world. Hence, an empirically relevant theory in the behavioral study and social sciences is built upon an acceptance of the relationship notion rather than the idea of causality. Causal explanation in a theory would include the statement about causality with varying concepts of causality. This is when a theory is defined as a system interrelated statement and possibility of containing the abstract of theoretical terms that cannot be translated into empirical measures. Hence, it is important to for causal explanation to include causality which does not depend on statistical association alone. The primary goal of explanation to explain the relying and varying views of causal relationship and this explanation promote to greater understanding and insight into the phenomena of a study. The nature of a relationship depends on the purpose of a theory.

A theory is something that would not exist in the real world without human intervention, therefore, a theory is an artifact (Gregor, 2006). A theory that is describing a classification system and primarily analytic can have a causality. Therefore, a theoretical framework that classifies the important factors in information systems development, adoption, and implementation can imply that these factors are causally connected with successful system development, adoption and implementation. The judgment is to determine the primary goal of a theory and type of theory. The primary goal of a theory is eventually for analyzing, explaining, predicting or prescribing. Therefore, the unified theory of technology acceptance is used to explain the relative importance and applicable of the OSIS-UTAUT model.

Hence, the OSIS-UTAUT is used to explain the relative importance of the factors influencing acceptance of Koha open source library information system. The OSIS-UTAUT model is also used to explain the causal relationship and end of theory applied in a research which relates to the final objective of this research mentioned in Chapter 1:

to examine the applicability of the proposed model for users of Koha open source library information system in academic libraries at public and private universities in Malaysia.

This objective is a prime to the entire research for the library community on open source acceptance among librarians and the trust towards the information technology advancement.

3.4 Sampling Technique

This causal explanatory study is conducted using a quantitative analysis method. A set of the questionnaire is used to collect the data. The questionnaire comprises of 10 parts. The 5 - point Likert-type scale is used to measure the librarians' acceptance of Koha open source library information system. The items used for this study are validated instrument and extracted from the related literature in the research area and domain (Venkatesh et al., 2003).

How big is the study sample and how to represent the target population depends on the sample of people who complete the questionnaire? (Haron et al., 2011, p.147). A schematic diagram in Figure 3.5 is created as guidance and to illustrate the sampling process for this study.

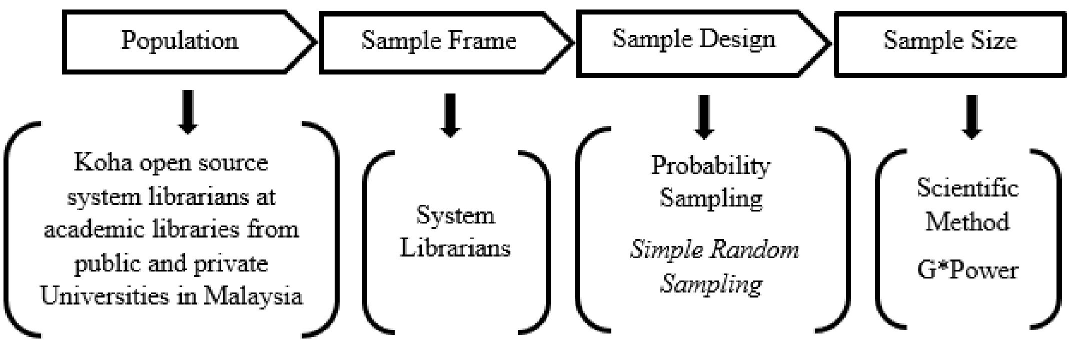


Figure 3.5: The Sampling Process

In Figure 3.5, the population of this study is the Koha open source system librarians at academic libraries in public and private universities from Malaysia and the sampling frame is the system librarians. The term system librarians are created for the purpose of this research to differentiate the normal librarians and the librarians who are hands on with Koha information system in the library.

In sampling method, there are 2 classifications (Haron et al., 2011, p.157; Sekaran, 2003, p.270). The probability sampling design or method is used for this research. In probability sampling design, the individual in the population is given equal chance of being selected and a non-zero probability of selection exist for each of the members of the population being selected.

The probability sampling design is referred to the simple random sampling and is used in this study. The advantage of the simple random sampling is high generalizability of findings and the disadvantage is that it is not as efficient as stratified sampling wherein stratified sampling all groups are adequately sampled and comparison among groups are possible (Sekaran, 2003, p.279). The sampling process is used to define the sufficient number of the right elements from the population to study the sample size and make it possible to generalize the properties to the population elements (Haron et al., 2011; Sekaran, 2003, p.266).

Simple random sampling is being performed from the sampling frame of systems librarians that have adopted the Koha open source library information system as mentioned in Chapter 2, Table 2.4. The purpose of the simple random sampling is to examine the comprehensibility of the items, least bias and offers the most generalizability (Sekaran, 2003, p.270) .

There are 5 main Koha users from academic libraries from public and private universities in Malaysia as mentioned in Chapter 2, Table 2.4. There is a total of 254 Koha users for this research. Therefore, the respondents are Koha system librarians from the library of University Science Malaysia, Al-Madinah University, Asia e-University, UNIKL and UNITEN. These Koha system librarians serve as the sampling frame for this study. In a causal explanatory study for a single organization with a small population (Sekaran, 2003, p.268), simple random sampling will be appropriate. The random sampling respondents in pre-test study are not being repeated in the main study (Sekaran, 2003, p. 270).

The sample size for the sampling process in a scientific way is reasonably sure that the sample statistic is fairly close to the population (Sekaran, 2003, p.268). Therefore, the sample size is based on the sample min (*X*), (Sekaran, 2003, p.265).

The total population is 325 users and there is 254 out of 325 librarians who are direct hands-on with Koha open source library information system and known as system librarians for this research. A sample is a subset of the population (Haron et al., 2011, p.148).

In this study, the scientific way (Sekaran, 2003, p.268) and G*Power (Faul, Erdfelder, Lang, & Buchner, 2007) software are used to determine the sample size. The rule of Thumb for sample size calculation is 10 times or more the number of variables used in the study (Sekaran, 2003, p.265). Hence, thus study has 9 independent variables and 1 dependent variable which make up to a total of 10 variables used for this study. Therefore the sample size is approximately 90 to 100 (10*9 = 90 or 10*10= 100). Both the method are equally reasonable and strongly supports the sample size chosen for this research.

The G*Power software version 3.1.9.2 in Figure 3.6 is also used to check on the required sample size for this study (Faul, Erdfelder, Lang, & Buchner, 2007). The G* Power is determined by sample size, alpha level and effect size (Faul, Erdfelder, Buchner, & Lang, 2009). This setting is a chance which will tolerate of making wrong conclusions. The setting in G*Power is based on the 1 tail statistical test, the effect size is 0.2 by the rule of thumb which means that the smaller the effect size the larger the sample size and the number of predictors are referred to the 9 independent variables. Therefore, the G* Power also indicated the appropriate sample size for this study to be 82. Hence, this study has more than actually needed sample size.

The effect size is what this study expect and wish to be presented in the sample. Effect size is a parameter and standard index that is independent of sample size and quantifies the magnitude of the population or relationship between explanatory and responsive variables (Olejnik & Algina, 2003). The effect size of 0.2 has a small effect, 0.5 has a medium effect and 0.8 has a large effect and the effect is on the sample size. The smaller the effect size, the larger the sample size and vice versa.

Alpha (α) is the probability of committing a type I error (level of statistical significance) and is set to 0.01 and power $1-\beta$ is set to 0.95 which is the probability of correctly rejecting the null hypothesis in the sample if the actual effect in the population is equal to or greater than the effect size (VanVoorhis & Morgan, 2007). The alpha and beta (α and β) decrease as the sample size increases.

The power is the probability of correctly rejecting a false null hypothesis. Attending power at the research designing phase protect the researcher and respondent. The researcher can manipulate power with sample size. The larger sample size increases the power and decrease estimation error. The power depends on sample size, significant level, effect size and directionality (1 tailed or 2 tailed) (Olejnik & Algina, 2003).

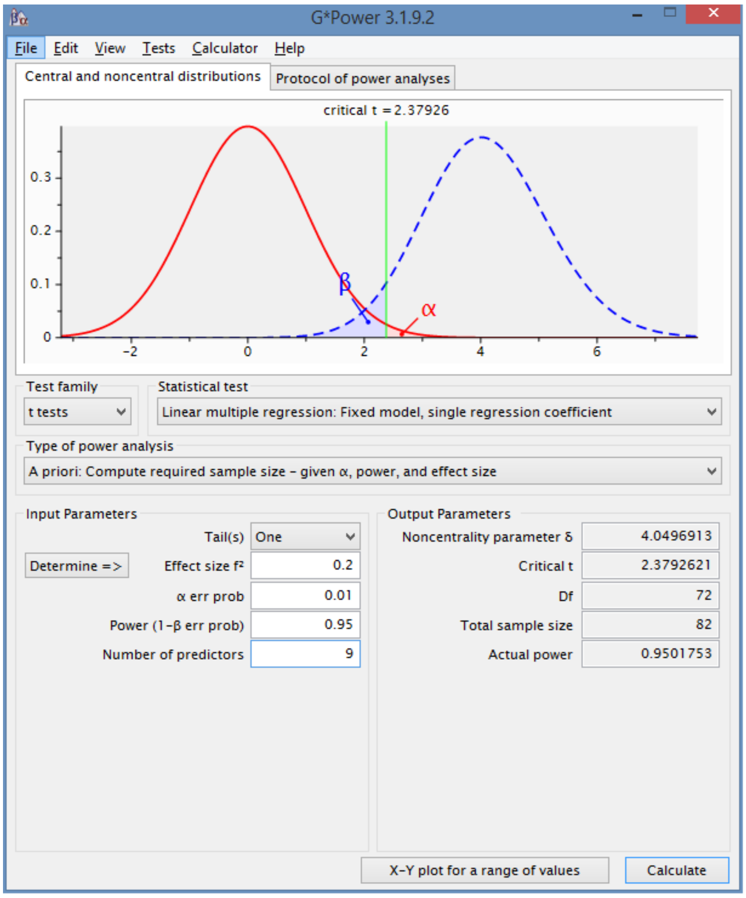


Figure 3.6: Minimum Required Sample Size Calculation

3.5 Administering the Survey

The initial step to the instrumentation and approach is to understand the definition of the constructs used in the previous study, develop and modified the constructs definition to suits this OSIS-UTAUT study. Appendix D shows the summary of the constructs used only by UTAUT studies (Venkatesh et al., 2003) and other studies and the new definition for this Koha OSLIS study. Appendix D also summarize the items used for the UTAUT in information system studies. The summary of the constructs and items are adopted for this Koha OSLIS research.

The first test is the face validity and content validity. The face validity and content validity is done thorough expert verification to validate the questionnaire. These tests include a permission letter to conduct a research, questions appropriateness, questions length and the indication used for the study. A total of 61 questions are created for the face validity. The face validity is performed on the month of April 2016 by the researcher's supervisors, followed by 2 more experts in the field of user behavioral study (Appendix E). There are several approaches to measuring the items in a study. The survey questions and interview are the most common approaches. The survey based approach is used in this research. The experts' validation feedback is to correct the grammar, sentence constructions, the layout of the survey, double-barreled questions, loaded questions, language of respondents' and analyze and check the knowledge related to the field of information system and behaviour study. The research instrumentation is based on the questionnaire. A set of the questionnaire is adopted from Sundaravej (2010) and some modification is done to suits this study (Appendix F). Table 3.1 and 3.2 interpret the instrument and item constructs. The items are measured using the 5-point Likert scale. The UTAUT model constructs, value added constructs, predictors and the sources are shown in Table 3.1 and items are shown in Table 3.2.

Table 3.1: Instrument Constructs

Latent Constructs (Predictors)	Constructs Sources
Performance Expectancy	(Venkatesh et al., 2003)
Effort Expectancy	(Venkatesh et al., 2003)
Social Influence	(Venkatesh et al., 2003)
Self-Efficacy	(Venkatesh et al., 2003)
Attitude towards using Technology	(Venkatesh et al., 2003)
Cost	(Adnanh & Lee, 2015; Galandere-Zile & Vinogradova, 2005; Gallego et al., 2008)
Information Technology Skill	(Adnanh & Lee, 2015; Galandere-Zile & Vinogradova, 2005; Gallego et al., 2008)

Table 3.1: continued

Information Quality	(Delone & McLean, 2003; O'brien & Marakas, 2007)
System Quality	(Delone & McLean, 2003; O'brien & Marakas, 2007)
Acceptance of system	(Venkatesh et al., 2003)

There are 5 items in performance expectancy (PE), item 6 to 11 are for effort expectancy (EE), item 12 to 17 on information technology skill (ITS), item 18 to 26 on system quality (SQ), item 27 to 33 is for information quality (IQ), cost is from item 34 to 39 (C), item 40 to 45 is on social influence (SI), item 46 to 49 on self-efficacy (SE), attitude towards using technology (ATUT) is from item 50 to 56 and acceptance of Koha open source library information system (Koha OSLIS) is from item 57 to 61. These item details are shown in the Appendix F.

Table 3.2: Item Constructs

Latent Constructs (Predictors)	Item	Item Sources
Performance Expectancy	PE 1 – 5	(Sundaravej, 2010)
Effort Expectancy	EE 6 – 11	(Sundaravej, 2010)
Information Technology Skill	ITS 12 – 17	(Lewis, 1995, 2002)
System Quality	SQ 18 – 26	(Lewis, 1995, 2002)
Information Quality	IQ 27 – 33	(Lewis, 1995, 2002)
Cost	C 34 – 39	(Lewis, 1995, 2002)
Social Influence	SI 40 – 45	(Sundaravej, 2010)
Self-Efficacy	SE 46 – 49	(Sundaravej, 2010)
Attitude towards using Technology	ATUT 50 – 56	(Sundaravej, 2010)
Acceptance of system	ATUKOSLIS 57 – 61	(Sundaravej, 2010)

3.5.1 Handling the Non-Response Bias

In every quantitative test, there is a probability of having non-response bias. In the pre-test of this research, the non-response bias does not exist. The sample in the pre-test is only 30 and all the respondent answered the survey in full scale. The 30 respondents are selected based on sampling frame provided by the library management. The respondents are given priority on voluntarily based to participate in this survey.

3.6 Pre-Test Study

The pre-test verified the validity, reliability and relevancy and clarity of the questionnaire. This feedback is considered important to proceed with the final design of the questionnaire. The pre-test also indicates that the university agreed for a research to be conducted on librarians' acceptance of Koha library information system, grant permission on the library users' data to identify the system librarians and non-system librarians and permit the librarians to participate in the study without any comprehension difficulty. In conclusion, the explanatory capability of the constructs are verified then the selected items are capable of explaining the associated constructs.

A pre-test includes the study from various research in the UTAUT methodology and information system as mentioned in Chapter 2. The UTAUT model is used to revise the constructs structure and explanatory capability. The pre-test includes a survey conducted on 30 participants who are from the USM library, as the pioneer Koha OSLIS adopter.

In any pre-test, there is no fixed rule for the number of samples and it is recommended that the sample for the pre-test study is a good representative of the target population. A pre-test study is considered as "dress rehearsal" for the instrument with a small sample and this sample adequately represent the research population (Lewis, Templeton, & Byrd, 2005, p.392). A sample of 10 to 30 have practical advantages as simplicity, easy calculation and able to test the hypothesis (Isaac & Michael, 1995, p. 101). A pre-test study sample is in the range of 10 to 40 samples (Hertzog, 2008; Julious, 2005) considered more than enough. A pre-test study sample for survey-based research is 10 to 30 participants (Hill, 1998). Roscoe rules of thumb for appropriate sample selection for behavioral study mentioned that samples less than 10 are not recommended, for experimental research 30 samples are recommended and the sample is about 10% of the population is recommended (Roscoe, 1975). A pre-test is conducted at the engineering campus library, IPPT campus library and medical campus library on the 19th of June, 2016. The respondents' are given about 7 days to reply the survey. On the 27th of June, 2016 the response of 30 survey are collected from these three campuses.

In the year 2009, USM is the first academic library from public university which adopted the Koha open source library information system and implemented at the USM-IPPT followed by engineering campus library in the year 2013. There is only 8 users in the USM-IPPT campus, 8 in main campus, 1 in medical campus and 13 users in the engineering campus library. These users are the pioneer users of Koha open source library information system. They are the system librarians in each campus. The pre-test study on the pioneer users of open source library information system represents the population of this research. Hence, there is a total of 30 users from these regional libraries who are the pioneer users of Koha open source library information system and these users are chosen for the pre-test test session on testing the questionnaire designed for this study. The population for the study are the librarians at the academic libraries at university in public and private universities. The total population of Koha users at academic libraries from public and private universities are 254. This pre-test study will only use 30 samples from USM main campus library, Medical campus library, Engineering campus library and IPPT campus library out of 254 Koha system users. Hence, the remaining 143 from USM main campus library and Medical campus library, 10 from Al-Madinah International University, 5 from Asia e-University Knowledge Centre Kuala Lumpur, 56 from

University Kuala Lumpur (UNIKL), 40 from University Tenaga Nasional (UNITEN) samples will be used for the main study. The pre-test study helps this research to check the content validity for the subject matter of the testing which is related to the users' behavioral study. The face validity indicating what is supposed to be measured and is obtained from the extant literature. Hence, the face validity and content validity from 30 system librarians confirmed the instrument. The pre-test study determine the dimensionality of the items and compute the internal reliability or the Cronbach's alpha.

3.6.1.1 Demographic Data

The demographic is quantifiable characteristics of the population. There are 5 variables used for the demographic data. Table 3.3 indicates the demographic data summary from the respondents.

Table 3.3: Pre-test Respondent Demographic Profile

Institutional Academic Libraries at Private and Public Universities	Frequency	Percentage
USM Main campus Library	8	26.7
USM Medical campus Library	1	3.3
USM Engineering campus Library	13	43.3
USM IPPT campus Library	8	26.7
Al-Madinah International University Library	0	0
Asia e-University Knowledge Centre Library	0	0
University Kuala Lumpur Library	0	0
University Tenaga Nasional Library	0	0
Total (N=30)	30	100

Table 3.3: continued

Gender	Frequency	Percentage
Male	17	56.7
Female	13	43.3
Total (N=30)	30	100
Age		
Less than 25 years old	0	0
25 to 35 years old	11	36.7
36 to 45 years old	11	36.7
More than 45 years old	8	26.7
Total (N=30)	30	100
Source to know about Koha		
Internet	2	6.7
Library Association	2	6.7
Librarians	21	70.0
Others	5	16.7
Total (N=30)	30	100
Koha OSLIS user		
Less than 1 year	1	3.3
1 to 5 years	22	73.3
More than 5 years	7	23.3
Total (N=30)	30	100

Table 3.3: continued

Koha OSLIS training hours		
1 to 5 hours	9	30.0
More than 5 hours	20	66.7
None	1	3.3
Total (N=30)	30	100

The first data from respondent is taken according to the USM campus libraries sampling frame which are either from main campus library, engineering library, IPPT library or medical library. There is a total of 8 respondents from USM main campus library, 8 from IPPT campus library, 1 from medical campus library and 13 respondent from engineering library. Therefore a total of 30 respondents are taken for pre-test study.

The second data from respondent is the gender. The gender is 18 male and 12 female from the total of 30 respondents. By means of practice, the male is greater than female in the library. The third data from respondent is the race. There are 4 categories in the race which are Malay, Chinese, Indian and others. There are 28 Malays and only 2 Indians among the respondents. The fourth data is age category. The age category is set to less than 25years old, 26 to 35 years old, 36 to 45 years old and more than 45 years old. There is 11 respondents aged from 26 to 35 years old, 10 respondents aged from 36 to 45 years old and 9 respondents are more than 45 years old. None of the respondent is below than 25 years old. The fifth data is on experience. The experience is set to less than 5, 6 to 19 years and more than 19 years. 23 respondents have 6 to 9 years of experience and 6 respondents are more than 19 years of experience. 1 of the respondent’s experience is less than 5 years.

The detailed histogram for the demographic profile for pre-test is shown in Appendix G. Table 3.3 summarize the respondents' demographic profile for pre-test.

3.6.1.2 Reliability and Validity of Research Instrument

There are 3 methods for assessing the reliability of measurement scale (Peter, 1979). The test-retest, internal consistency and alternative forms. This study will use the internal consistency method through Cronbach's alpha value for the reliability of measurement scale. The reliability of the scales in this study is obtained using the SPSS software. The outcome of Cronbach's alpha indicates how well a set of variables measure a single unidimensional (having one underlying construct) latent construct (Schwaninger, Vogel, Hofer, & Schiele, 2006, p. 350).

The Cronbach's alpha test is applied to the groups of items for the identified constructs of the UTAUT model. The Cronbach's alpha test is used to determine the internal consistency of instruments scales. The reliability is confirmed as all the constructs have high Cronbach's alpha coefficient is above 0.70 (Cronbach's alpha ≥ 0.70) (Nunnally, Bernstein, & Berge, 1967).

The relationship between items is analyzed by calculating the number of initial items, number of discarded items and impact on Cronbach's alpha value. The item with correlation of less than 0.20 and which reduces the Cronbach's alpha value is excluded (Nunnally et al., 1967) and the Cronbach's alpha value greater than or equal to 0.70 is considered acceptable. Therefore, in this study, all the constructs reached very satisfactory level and is above the recommended level of 0.7 (Nunnally et al., 1967). The total number of 61 items in the pre-test study questionnaire is maintained and will be used in the main study data collection. This circumstances proof that 61 items are capable to measure the 9 constructs of this Koha OSLIS study. Hence, studied by (Sundaravej, 2010) proven that the predictive capability on the UTAUT constructs are strongly supported in this research. Table 3.4 is the summary of the reliability of instruments.

The result of Cronbach's alpha for the pre-test as in Table 3.4 shows that the effort expectancy, social influence, attitude towards using technology and acceptance of Koha open source library information system is above the threshold 0.7 and the value indicate high reliability of these constructs for the instrument. Self-efficacy, information technology skill, system quality, information quality and cost also above the Cronbach's alpha threshold of 0.7. Therefore, this instrument and the constructs are reliable to be used for the main test study.

Table 3.4: Reliability Coefficient and Internal Consistency of Questionnaire

Latent Constructs (Predictors)	Cronbach's Alpha (≥0.70)	Number of Initial Items (61)	Number of Discarded Items (0)
Performance Expectancy	0.862	5	0
Effort Expectancy	0.916	6	0
Social Influence	0.904	6	0
Self-Efficacy	0.808	4	0
Information Technology Skill	0.887	6	0
Attitude towards using Technology	0.945	7	0
System Quality	0.889	9	0
Information Quality	0.869	7	0
Cost	0.869	6	0
Acceptance of Koha OSLIS	0.966	5	0

The mean and standard deviation is used to check the data distribution. The closer the value of standard deviation to the mean the higher the weightage for normal curve distribution. The standard deviation obtained for this study is positive and the difference from the mean is approximately to value 3.

The mean and standard deviation of the constructs as in Table 3.5 indicates that the average is nearest to 4.00. Therefore the constructs within the group is at average 3.0 except for the information technology skill construct that is below the average group. However, by rounding up the value of information technology skill is still to the average of value 3. This sample standard deviation is used as a base to estimate the population of the entire study. Therefore, these value are accepted for the Koha acceptance study.

Table 3.5: Mean and Standard Deviation of the Constructs

Latent Constructs (Predictors)	Mean	Standard Deviation	Difference
Performance Expectancy	4.0067	.49961	3.50709
Effort Expectancy	4.0556	.50918	3.54642
Social Influence	3.9500	.51258	3.43742
Self-Efficacy	3.6750	.55379	3.12121
Information Technology Skill	3.4167	.59169	2.82501
Attitude towards using Technology	3.9286	.64518	3.28342
System Quality	3.7740	.45625	3.31775
Information Quality	3.8286	.46314	3.36546
Cost	3.9167	.60291	3.31379
Acceptance of Koha OSLIS	4.1933	.61808	3.57522

The data normality test is performed using the skewness and kurtosis. This is due to small sample size. Sample size 30 is common for process of capability studies. However, skewness and kurtosis are very dependent on the sample size. Table 3.6 indicates negative skewness and kurtosis > 0. Negative skewness means that left-hand tail is longer than the right hand-tail. Kurtosis shows that the distribution has heavier tails. By rule of thumb, skewness between -1.0 and -0.5 or 0.5 and 1.0 indicates the data are moderately skewed in this Koha OSLIS study.

Table 3.6: Normality test using Skewness and Kurtosis

Mean	Mod	Median	Skewness	Kurtosis
4.1933	4.00	4.0000	- .455	.345

The Q-Q plot in Appendix H shows the validity of distributional assumption of the data collected. There is 95% confidence for the ATUKOSLIS with lower bound 3.9625 and upper bound 4.4241. The rationale for normal distribution is that mean ~ mod ~ median. Table 3.6 shows that mean is 4.1933 which is greater than median 4.0. Therefore there exist some extreme value below median.

In Table 3.7 shows that there are fewer value above median on one side and greater value below median on the other side. Hence, this condition moderately extreme the normality for this Koha OSLIS research.

The histogram with normal distribution is shown in Appendix H. The item correlation for PE, EE, ITS, SQ, IQ, C, SI, SE, ATUT and ATUKOSLIS satisfied the value < 1.00 and descriptive statistic of each items are shown in Appendix I. There is no outliers in the data set.

Table 3.7: Normality test Data using Median for Histogram

Median	Frequency	Percent	
2.60	1	3.3	ABOVE MEDIAN
3.00	1	3.3	
3.20	1	3.3	
3.80	2	6.7	
4.00	**14**	**46.7**	**MEDIAN**
4.40	1	3.3	BELOW MEDIAN
4.60	2	6.7	
4.80	1	3.3	
5.00	7	23.3	
Total	30	100	

3.7 Data Analysis Partial Least Square Path Modeling

Partial least square path modeling (PLS-PM) is used for complex cause and effect relationship model (Joe Hair et al., 2011; Williams et al., 2011). The PLS-PM is a variance based approach and differs from covariance based structural equation modeling. The PLS-PM approach is to maximize of variance explained and is more to a prediction model.

In the multiple regression analysis there is too much error in estimating the standardized beta coefficient or regression coefficient (Hair et al., 2011; Williams et al., 2011). SEM is used to minimize the measurement error and gives a better estimation to a data set. This is the reason for SEM selection compared to multiple regression analysis (MRA) in Koha OSLIS research (Joe Hair et al., 2011; Williams et al., 2011). SEM is a class of multivariate techniques that combines the aspects of factor analysis and regression which enable the researcher to simultaneously examine the relationship among measured variables and latent variables as well as between latent variables. The latent variables (constructs) are used to measure the concept that is abstract, complex and cannot be observed directly. The latent variables are represented in path models as blue circles and are measured by means of multiple items (survey questions). Indicators (manifest variables) are directly measured observation and known as the raw data set or items or manifest variables and represented in path models as yellow rectangle. The error terms is used to capture the unexplained variance in constructs and indicators when the path models are estimated.

There are two main terms used widely in PLS-PM which is the exogenous latent variables and endogenous latent variable. The exogenous latent variables are latent variables that serve only as independent variables in a structural model. The endogenous latent variables are latent variables that serve only as dependent variables or as both independent and dependent variables in a structural model. The predictive relationship in the path modeling is referred to causal links as the UTAUT model support the causal relationship (Min et al., 2008) used in Koha OSLIS research.

In a path model, the constructs used are relevant to Koha OSLIS research and is defined clearly in definition of terms, Chapter 1. The measurement for independent (exogenous) and dependent (endogenous) variables are clearly defined with expert validation (Appendix E) for the items and constructs used in Koha OSLIS research. The relationship is either positive or negative as well as the direction is hypothesized based on unified theory of technology acceptance and also based on literature discussed in Chapter 2. The unified theory of technology acceptance by (Venkatesh et al., 2003) explains the positive relationship to be exist in the Koha OSLIS research. An OSIS-UTAUT theoretical framework is used to explain the hypothesized relationship. A parsimonious approach to the theoretical specification is far more powerful than the broad application of a shotgun (Min et al., 2008).

There are two sub model in the PLS-SEM. The measurement model and structural model. The measurement model indicates the relationship between the observed data (item constructs or indicators) and latent variables in Koha OSLIS research. The structural model indicates the relationship between the Koha OSLIS latent variables. The latent variables in Koha OSLIS research are performance expectancy (PE), effort expectancy (EE), information technology skill (ITS), system quality (SQ), information quality (IQ), cost (C), social influence (SI), self-efficacy (SE), attitude towards using technology (ATUT) and acceptance of Koha open source library information system (ATUKOSLIS). Partial is used to explain the algorithm which solves the SEM (Joe Hair et al., 2011; Williams et al., 2011). In the measurement and structural model the partial algorithm is used to estimate the latent variables. The algorithm is repeated until a level where the convergence is obtained.

Partial least square path modeling is famous and widely used to test and analyze the well-established model such as UTAUT model by Venkatesh et al. (2003) and underlying theory such as unified theory of technology acceptance that combine 8 other theories in the technology acceptance model. The PLS-SEM is preferably used by researchers when the research data set is common factor based. The common factor for behavioral study is related to technology acceptance.

3.8 Summary

Chapter 3 is the structure for the overall research strategy that addresses the research problem in a theoretical framework. This chapter defines the study type, hypotheses, independent and dependent variables and data collection technique. This research reveals the direct cause and effect influencing factors for the technology acceptance for Koha

OSLIS using the OSIS-UTAUT model. The measure is explaining the variables used in this research. The difficulty to obtain the content analysis due to the model UTAUT which focused on users compared to the direct users of a particular system. The findings of UTAUT is bias to system developers (Gallego et al., 2008). The instrumentation validity is performed by experts in the behavioral aspects of study. There are 61 items in the survey instrument which are adopted and modified (Delone & McLean, 2003; Venkatesh et al., 2003). Pre-test is conducted with 30 respondents within the sampling frame with random sampling technique. Non- response bias does not exist for the pre-test. The data analysis technique will be using the partial least square path modelling (PLS-PM). Some terminologies and introduction to PLS-PM is explained. The instrument is considered reliable with the Cronbach's alpha's > 0.7 (Nunnally et al., 1967). 61 items are accepted to be used in main study. The respondent demographic is presented and attached in Appendix G.

CHAPTER 4: FINDINGS AND DISCUSSION

Experience tells you what to do;
confidence allows you to do it.
\- Stan Smith.

4.1 Introduction

Results of a research are reported by testing the theoretical framework with an application software. There are two types of output for the survey. The demographic data is examined using the SPSS statistical software. The structural equation modelling (SEM) is a statistical method chosen to test the theoretical model. The Partial Least Squares Path Modeling (PLS-PM) is the application used in the study. The SEM is a combination of statistical techniques for 2nd Generation (the 1990s until Present). The SEM is the extension of multiple regression and allows the variables to act as independent and dependent on path analysis. SEM is a class of multivariate techniques. The SEM combines the aspects of factor analysis and regression. The main purpose of SEM is to simultaneously examine the relationship among one or more latent variables, among measured variables as well as between latent variables. The latent variables are known as constructs. The latent variables cannot be observed directly. The latent variables need the indicators known as manifest variables. The manifest variables are measured directly. In the survey the manifest variables referred to the questions or items for respondents to answer. In the structural model, there are exogenous latent variables and endogenous latent variables. Exogenous latent variables serve as the only independent variable. The endogenous latent variables are the dependent variables or as both independent and dependent variable in the structural model. The results of path modeling is explained and hypothesis investigation is discussed. The findings are presented in measurement model and structural model.

4.2 Research Main Study Findings

The main study for this research is conducted upon approval of pre-test study and reporting of the Cronbach's alpha and questionnaire instrument reliability. A full report of pre-test studies are rare in the literature and the reporting only justify the research methods used for a pre-test (Lindquist, 1991). The main study indicates that the pre-test study has approved the crucial elements of a research design (Van Teijlingen & Hundley, 2002). The pre-test study increase the likelihood of a main study. Therefore, the data collection, data analysis technique and data preparation is being discussed to embark the in-depth research.

4.2.1 Data Collection

The data collection is targeted to librarians who have been using the library information system since the year 2009 until 2017. The simple random sampling from a confirmed sampling frame from the library management is obtained and is used for the data collection. This random sampling is to ensure this study exclude the non-librarians for the main study. In random sampling, each librarian of the population has an equal chance of being included in the research sample. In this technique, this research has acquired a complete list of members of the population. In the main study data collection excluded the pre-test study respondents from University Science Malaysia's main campus library, engineering campus library, IPPT campus library and medical campus library. The questionnaire for the main study is set to 61 items only. The remaining 224 respondents are from USM main campus and medical campus, Al-Madinah International University library, Asia e- University library, UNIKL and UNITEN. The pre-test study outcome is not used to test a hypothesis and neither included with the data for actual study in the reporting phase (Peat, Mellis, & Williams, 2002, p. 57).

The list of respondent for the main study is selected from the remaining sampling frame of system librarians from main campus library and medical library. The sampling frame for Asia e-university library, Al- Madinah International University, UNIKL and UNIKL are pre-defined by the library management. There is a total of 224 respondent for main study Koha OSLIS. A set of questionnaire (61 questions) will be distributed to a total of 224 respondents on the 24th of September, 2016. These questionnaires are posted to the identified libraries. The questionnaire is posted back latest by 10th of October, 2016. Two weeks' timeframe given to the respondents to answer the survey. However, the in-return for the hard copy questionnaire is only 215 out of 224 questionnaire distributed. 9 survey hardcopy is a non-response bias to this research. Hence, the 9 survey questionnaire will be excluded in the statistical computation. The late respondents are similar to who did not respond to the questionnaire (Berg, 2005) after two weeks in this research duration for questionnaire period of answering. The bias is the expected difference between an estimated characteristic of a population and that population's true characteristic. The non-response is the questionnaire response that falls outside the range of responses and the outcome is consider to be valid. The non-response bias is the mistake a researcher make in the estimation of population characteristic based on a sample data and due to non-response some or certain types of respondents are under-represented. The non-response bias is a special kind of selection problem of the type analyzed in the research. To overcome the non-response bias, this research has performed the random sampling (Fox & Tracy, 1986; Berg, 2005) and has the access to the respondents' sampling frame. The respondents of the questionnaire will be treated anonymously. The information from the questionnaire will only be applied for the purpose of academic research without revealing any of the respondents' details. There is no missing value in the data set obtained. In Table 4.1 illustrates the summary of respondent demographic profile of the main study. The demographic profile in bar graph is shown in Appendix J.

Table 4.1: Main Study Respondent Demographic Profile

Institutional Academic Libraries at Private and Public Universities	Frequency	Percentage
USM Main campus Library	82	38.1
USM Medical campus Library	25	11.6
USM Engineering campus Library	0	0
USM IPPT campus Library	0	0
Al-Madinah International University Library	10	4.7
Asia e-University Knowledge Centre Library	5	2.3
University Kuala Lumpur Library	56	26.0
University Tenaga Nasional Library	37	17.2
Total (N=215)	215	100
Gender		
Male	124	57.7
Female	91	42.3
Total (N=215)	215	100
Age		
Less than 25 years old	11	5.1
25 to 35 years old	94	43.7
36 to 45 years old	61	28.4
More than 45 years old	49	22.8
Total (N=215)	215	100

Table 4.1: continued

Source to know about Koha	Frequency	Percentage
Internet	18	8.4
Library Association	25	11.6
Librarians	153	71.2
Others	19	8.8
Total (N=215)	215	100
Koha OSLIS user		
Less than 1 year	58	27.0
1 to 5 years	143	66.5
More than 5 years	14	6.5
Total (N=215)	215	100
Koha OSLIS training hours		
1 to 5 hours	107	49.8
More than 5 hours	95	44.2
None	13	6.0
Total (N=215)	30	100

4.2.2 Data Analysis Technique

The collected data and research framework can be analyzed using either the first generation or second generation statistical techniques. The first generation is the also known as traditional method using the regression. The second generation is the structural equation modeling (SEM) technique.

The decision making of the data analysis technique solely depends on the some assumptions (Gefen, Straub, & Boudreau, 2000). The assumptions are based on the present research model and structure which is considered to be very straight forward and simple. All the latent variables are considered as observable and measure without error (Haenlein & Kaplan, 2004). The structure is using a hierarchical based model with inner and outer models (Gefen et al., 2000). The study model has multiple variables and the variables relationships are not well-defined and has various inner models. There might be random error which is caused by the order of items in a questionnaire or respondents' fatigue (Haenlein & Kaplan, 2004), systematic error such as method variance attributable to the measurement method rather than the construct of interest. The observed of the score of an item is therefore always the sum of three parts which are the score of variables, random error and systematic error, hence, the first generation technique are strictly applicable when there is neither a systematic nor random error component which indicates a rare situation in reality.

The first generation technique such as regression-based approaches will include the multiple regression analysis, discriminant analysis, logistic regression and analysis of variance with assumptions may not be appropriate to this study model evaluation (Gefen et al., 2000). The first generation regression model such as linear regression, LOGIT, ANOVA and MANOVA can analyze one layer of linkage between independent and dependent constructs at a time.

The second generation such as SEM enables researchers to answer a set of interrelated research questions in a systematic, single and comprehensive analysis by modeling the relationships among multiple independent and dependent constructs simultaneously (Gefen et al., 2000; Hair, Hult, Ringle, & Starstedt, 2017). The SEM is used to test the information system research meets for high quality statistical analysis.

Therefore, the analysis of this Koha open source technology acceptance study is performed using the SEM. The SEM runs the research model as the whole unit and account for possible errors. There are 2 types of SEM. The covariance-based (CB-SEM) and partial least squares (PLS-SEM). These 2 approaches have its own strengths, advantages and disadvantages. The CB-SEM purpose is for theory testing and confirmation whereas the PLS-SEM is for prediction (Chin & Newsted, 1999; Hair et al., 2011).

The PLS-SEM accommodate smaller sample size better than CB-SEM. There is a slight downward bias to the path coefficient estimation when using a small sample size in PLS-SEM in terms of generating the predictive accuracy compared to CB-SEM. The PLS-SEM is much better than CB-SEM for dealing with small sample size containing correlated exogenous variables (Qureshi & Compeau, 2009). PLS-SEM achieves high levels of statistical power with complex models. The CB-SEM acquire a set of assumption to be fulfilled, include multivariate normality of data and minimum sample size (Qureshi & Compeau, 2009).

The primary objective of applying the structural modeling is prediction and explanation of target constructs, therefore, PLS-SEM is an attractive alternative to CB-SEM. Furthermore, the PLS-SEM is a variance based statically compared to CB-SEM which is a covariance based statically.

The summary in Table 4.2 clearly reflects the method of variance based approach of PLS-SEM chosen for Koha OSLIS research and the comparison between PLS-SEM and CB-SEM (Hair et al., 2011; Venkatesh, Brown, Maruping & Bala, 2008). The PLS-SEM and CB-SEM comparatively explained in terms of statistical techniques and usage.

Table 4.2: Comparison PLS-SEM and CB-SEM

Statistical Technique	PLS-SEM	CB-SEM
Criterion	Variance Based Modelling	Covariance Based Modelling
Software	Smart PLS	AMOS, LISREL
Model Type	Prediction	Parameter
Distribution	Non-Parametric	Parametric
Sample Size	30 -100	100-800
Complexity	5 above	50 indicators
Bias	Potential bias	Stable
Constructs Indicator	1 - 2	3 - 4
Statistical Test	Bootstrapping	Assumption
Measurement Model	Formative and /or Reflective	Reflective only
Goodness of Fit	SRMR and NFI	Many

This research objective is to predict and explain the use behavioral through a number of influencing factors. This study applied a huge sample size. The factors are orthogonal by definition which mean the factors are not correlated to each other.

The selected factors are unrelated to each other and gives different perspective for the Koha open source library information system acceptance research. The model for this study comprises of 9 exogenous variables and 1 endogenous variable and the model is considered complex.

Therefore, this research will adopt the PLS-SEM and explain the model in depth. A simple illustration using the Smart PLS3.0 as in Figure 4.1 for Koha open source library information system acceptance (Koha OSLIS) is presented.

This model is being generated using the 30 days trial version of Smart PLS Professional software due to the expensive rate of purchasing the professional version of smart PLS. The constructs are red in colour as the items constructs have not been loaded. The center ATUKOSLIS is the endogenous variable and the surrounding circles are the exogenous variables. These are latent variables and cannot be measured directly and must have the item indicators.

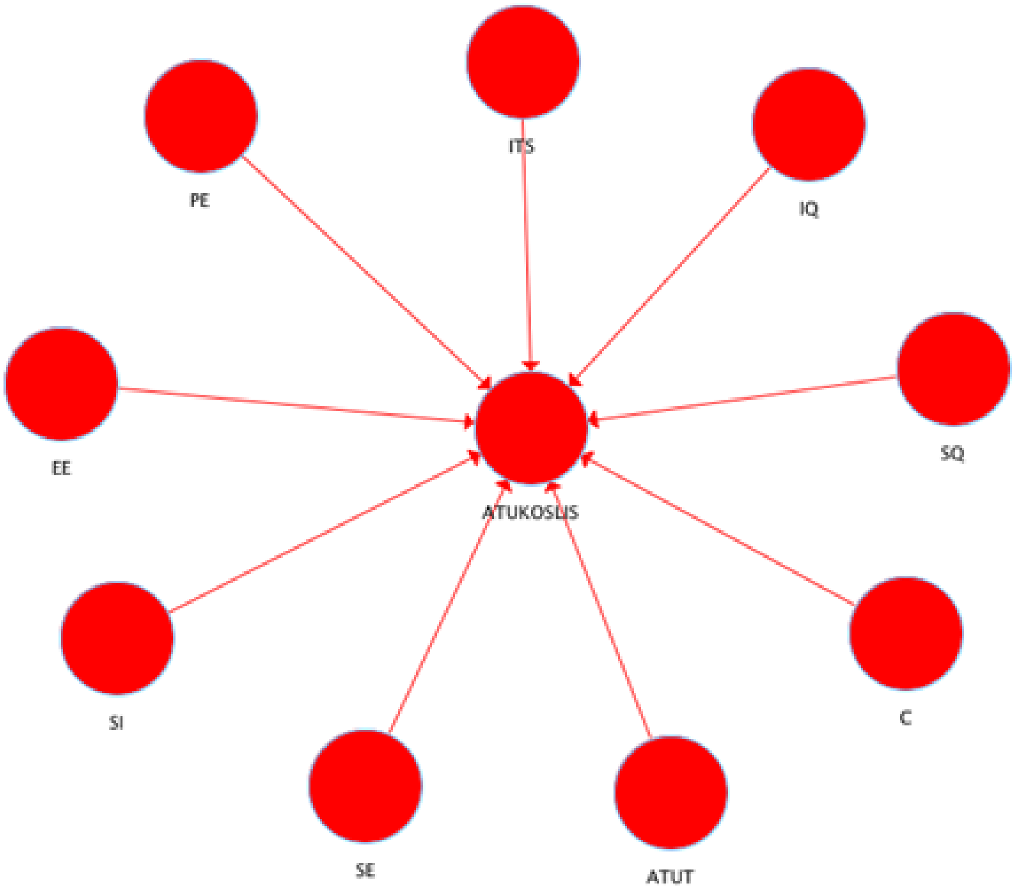


Figure 4.1: Initial Research Framework using the Smart PLS

4.2.3 Data Preparation

Data preparation is the process of data checking for accuracy, inputting process and integrates various measures. Logging data in research involve many methods. The methods can be via email or observational. Koha OSLIS study delivers the survey questions to system librarians within the sampling frame of academic libraries' at public and private universities in Malaysia.

There are several steps to be taken for data preparation. The initial step is to number the hardcopy surveys and input the demographic data followed by the Likert scale data which involves checking data accuracy, developing a database, inputting process and data transformation.

The data transformation is the process to transform the raw data into variables. The missing value, item reversal, scale, categories are being determined. There are 4 important terminologies in the data preparation which are the:

- Missing value

  The initial step is to check the missing value in the data collected and treat the missing value. Missing value is observed during the stage where the data is being inputted to the statistical software. Missing value occurs when the respondent omitted any of the items in the survey.

  In this Koha OSLIS research there is no missing value from the survey collected. Therefore, there is no imputation for the data collected. However, there are several method to handle the missing value in the data set. In any statistical data, there is a strategy to treat the missing value. In this Koha OSLIS research, some introduction to the 4 methods to capture the missing is introduced. The methods are pairwise deletion, list wise or case wise deletion, mean substitution and maximum likelihood estimation (Williams, Rana, Dwivedi, & Lal, 2011). The famous and most frequently used is the mean substitution method (Williams et al., 2011).

The term bias in statistics means the different captured from the population of an interest. The bias also indicate the statistical technique features of the results differ from the actual underlying quantitative solution.

Statistics is a powerful research tool, therefore there is several ways to handle the bias. In Koha OSLIS research, the bias discussion comprises of common method bias (CMB) and non-response bias (NRB).

- Common Method Bias (CMB)

  Common method bias has great influence on the item validities. Common method bias is known as threat to the validity of the conclusion regarding relationship between variables. There are several cause for common method bias occurring.

  There are 7 ways to capture the common method bias (Guadagnoli, 1988). The methods are common rater effect, consistency motif, social desirability, acquiescence bias, common scale format, item social desirability and scale length. The Harman's single factor test (Guadagnoli, 1988) is used in this Koha OSLIS research to observe the common method bias.

  In any behavioral study, the common method bias relates to the quality of the data collected. This is user response error in answering the survey questions. There is high tendency for common method bias to occur in any behavioral study. To reduce the common method bias to occurs, this Koha OSLIS research has clearly identified the answer choices 5-point Likert scale in fixed display at the top of the survey and also at the side of each item question.

The Harman's single factor test is the famous and mostly used in statistical to check the common method bias. By using the SPSS software all the factors are load into the exploratory factor analysis (EFA). This is to examine the un-rotated component matrix and determine the number of factors used in Koha OSLIS to capture the variance in the variables.

The EFA is conducted prior to CFA in Koha OSLIS research (Jöreskog, 1967; Wood, 2008) due to small sample size of 30 in the pre-test and the adequate sample size for EFA is 100. The EFA is used to explore the number of factors to represent model that fits with data (Wood, 2008).

There are 9 factors in this Koha OSLIS research. These 9 factors variance are generated. The idea of variance is to show the variables and the explained variance. The variance < 50 % indicates that the common method bias does not exist. The common method bias is present when all the factors load into a single factor (Guadagnoli, 1988). The common method bias for Koha OSLIS with 9 factors with Eigen value =1 or, indicates and un-rotated principal component matrix is shown in Table 4.3.

The most important factor to observe is the first factor (Guadagnoli, 1988). The first factor explains the overall factors in Harmon's single factor test. In this Koha OSLIS research, data set shows the maximum variance explained by a single factor is 46.005. Hence, approximately 46% of the variance is explained by a single factor. Table 4.3, shows the first factor is 46% and it explains the variance for Koha OSLIS research. This shows that 46% is lesser than the actual value of variance which is 50% for any common method bias to occur. Therefore the common method bias does not appear to be pervasive in Koha OSLIS research. Therefore, the data obtained for this Koha OSIS research is valid.

Table 4.3: Common Method Bias using Harmon Single Factor Test

Factors	Variance Explained (%)
1	**46.005**
2	4.438
3	4.142
4	3.467
5	2.774
6	2.508
7	2.412
8	2.169
9	2.035

- Non Response Bias (NRB)

Non-response bias is the bias reflecting the respondents (Berg, 2005). The respondents who are unwilling to response to the survey and are not voluntarily going to contribute for Koha OSLIS research.

In this Koha OSLIS research, the non-response bias exist for 9 respondents out of 224 respondent within the sampling frame. 6 are from University Science Malaysia's library and 3 from UNITEN. These respondents are neglect to answer and contribute to this research. Therefore, in this research there is no enforcement made to ensure the respondents respond are 100%.

Factor Analysis is used to identify the observed variables which has a common variance characteristics and also represent the constructs of latent variables (Wood, 2008). The factor analysis is a statistical technique which is used to determine the number and nature of latent variables. The items measured in a survey or questionnaire is also known as indicators. The word “factor” define the variables measured that accounts correlations among the observed variables.

- Confirmatory Assessment (CFA)

  Confirmatory factor analysis is used to confirm a certain numbers of factors to represent model fits with the data (Wood, 2008). CFA is also used to verify the structure of observed variables in Koha OSLIS. The confirmatory factor analysis is used to test the hypothesis and relationship between observed variables and the latent constructs used in Koha OSLIS. A component based Structural Equation Modelling (SEM), Smart Partial Least Square (PLS) 3.0 Professional version is used for Koha OSLIS research to validate both measurement and structural models. Koha OSLIS research has a sample of 224 data. According to Lewis, Templeton, and Byrd (2005) sample of 100 - 200 is a satisfactory data set for PLS and 211 is considered average sample size compared to CB-SEM requires 246 sample size. Therefore, PLS is more flexible than covariance based structural equation modelling (CB-SEM) in terms of distribution assumption and sample size (DeCoster, 1998; Lewis et al., 2005). G*Power software version 3.1.9.2 in Figure 3.6 is used to accurately measure the required sample size (Faul et al., 2007). The required sample size for this study is only 82 (Figure 3.6) and sample obtained for Koha open source library information system (Koha OSLIS) research is 224. Therefore, the number of factors used to analyze the data is adequate and fits the acceptance model of Koha open source library information research (Koha OSLIS).

4.2.4 Measurement Model

The measurement model in partial least square path modeling is used to measure and estimate the latent variables as weighted sum of the manifest variables (Hair et al., 2011; Williams et al., 2011). Koha OSLIS research will discuss the measurement model using the manual created in Appendix K using the smart PLS.

The initial step is to run the bootstrapping by setting the significance level at 0.10 and 500 sub samples. Suggestion from DeCoster (1998) bootstrapping samples of 500 to 1000 is sufficient to provide a reasonable standard estimation error. Therefore, bootstrapping is performed by removing the loading value which is lesser than 1.64. Hence, the bootstrapping value > 1.64 is accepted. Item ITS12 with loading factor 0.703 < 1.64 is removed. The convergent validity is checked with the outer loading values using the PLS algorithm. The outer loading values < 0.7 is removed in a sequence followed by bootstrapping and PLS algorithm. Items ATUT53 with loading value 0.588 < 0.7 is removed, ATUT54 with loading value 0.656 < 0.7, SQ26 with loading value 0.664 < 0.7 and PE4 with loading value 0.673 < 0.7 is removed.

Next is to check the Koha OSLIS constructs reliability. Table 4.4 illustrates the value obtained for construct reliability test. The composite reliability and average variance extracted. The Cronbach alpha > 0.7 is obtained for all the constructs. The composite reliability > 0.7 is also obtained for all the Koha OSLIS constructs. The composite reliability for all the constructs exceeded 0.8 and is beyond the threshold of 0.6 suggested by Jöreskog (1967). The average variance extracted, AVE > 0.5 is obtained for all the constructs.

Table 4.4: Constructs Reliability Test

	Cronbach's Alpha > 0.7	Composite Reliability (CR) > 0.7	Average Variance Extracted (AVE) > 0.5
ATUKOSLIS	0.958	0.968	0.857
ATUT	0.935	0.951	0.795
C	0.915	0.935	0.705
EE	0.912	0.932	0.694
IQ	0.896	0.918	0.616
ITS	0.865	0.902	0.649
PE	0.908	0.936	0.785
SE	0.878	0.916	0.733
SI	0.886	0.914	0.639
SQ	0.913	0.929	0.623

The discriminant validity of the Koha OSLIS constructs are obtained. Appendix K shows the discriminant validity (Gefen et al., 2000) in details. The final remaining items are > 0.7 with corresponding factors. It is clearly shown that there is no cross loading items which demonstrates the discriminant validity (Gefen et al., 2000).

The convergent validity, reliability and discriminant validity of Koha OSLIS research constructs are assessed. Table 4.5 describes the Koha OSLIS constructs reliability and discriminant validity with 215 data set (N= 215).

Table 4.5: Koha OSLIS Constructs Reliability and Discriminant Validity

	Composite Reliability (CR)	Average Variance Extracted (AVE)	ATUKOSLIS	ATUT	C	EE	IQ	ITS	PE	SE	SI	SQ
ATUKOSLIS	**0.97**	**0.86**	**0.93**									
ATUT	**0.95**	**0.80**	0.87	**0.89**								
C	**0.94**	**0.71**	0.58	0.59	**0.84**							
EE	**0.93**	**0.70**	0.71	0.72	0.53	**0.84**						
IQ	**0.92**	**0.62**	0.72	0.71	0.56	0.66	**0.79**					
ITS	**0.90**	**0.65**	0.53	0.54	0.43	0.62	0.60	**0.81**				
PE	**0.94**	**0.79**	0.73	0.74	0.53	0.75	0.67	0.56	**0.89**			
SE	**0.92**	**0.73**	0.67	0.68	0.56	0.64	0.67	0.54	0.60	**0.85**		
SI	**0.91**	**0.64**	0.72	0.72	0.58	0.72	0.67	0.55	0.66	0.63	**0.80**	
SQ	**0.93**	**0.62**	0.74	0.76	0.56	0.71	0.74	0.65	0.66	0.64	0.69	**0.79**

4.2.5 Structural Model

The structural model in partial least square path modeling is used to estimate the latent variables using the multiple regression technique. The estimation is between the latent variables which is measures in the measurement model. The unified theory of technology acceptance elements of the path modeling is represented in the structural model (Joseph Hair, 2014). The relationship between latent construct that is hypothesized in presented in the OSIS-UTAUT model. The structural model is test by estimating the path coefficient that indicates the strength of the relationship between latent constructs. The structural model also estimates the R^2 values which represent the amount of variance in the dependent variable of ATUKOSLIS explained by the independent variables. R^2 also indicates that 79% of ATUKOSLIS construct is used in the OSIS-UTAUT model for user acceptance of Koha OSLIS. Finally the blindfolding, using the Q^2 value is used the access the predictive relevancy of the path OSIS-UTAUT model. The initial structural model using the smart PLS is presented in Figure 4.2. A step by step manual of the smart PLS is included in Appendix K.

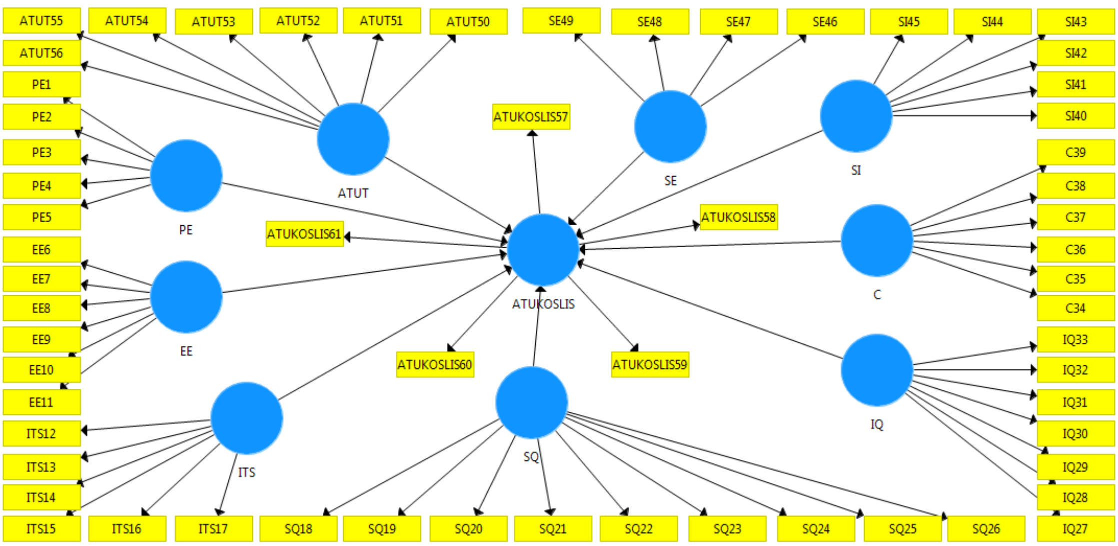


Figure 4.2: Initial Structural Model using Smart PLS

The bootstrapping is performed to determine the path coefficient in the structural model. The bootstrapping with sample 500 and actual case 215 for one-tailed t-test is performed corresponds are either negative or positive. The obtained one-tailed t-test value is positive. It reflects the positive influence in the Koha acceptance study.

The hypothesis is also examined by generating the t-values in the structural model. Table 4.6 shows the hypotheses of the research OSIS-UTAUT model. The detailed information with path coefficient diagram in in Appendix K. The positive path coefficient indicates the causal relation is positive.

Table 4.6: Path Coefficient Hypothesis Testing Result

Relationship	Path Coefficient	Original Sample (O)	Sample Mean (M)	Standard Mean (STDEV)	T Statistics (|O/STDEV|) t value	p value	Hypothesis
ATUT → ATUKOSLIS	**0.642**	0.547	0.550	0.068	**8.027 *** **	**0.000**	Supported
C → ATUKOSLIS	0.090	0.019	0.027	0.047	0.415	0.339	Not Supported
EE → ATUKOSLIS	0.135	0.046	0.041	0.074	0.619	0.268	Not Supported
IQ → ATUKOSLIS	**0.170**	0.091	0.088	0.070	**1.287 ***	**0.099**	Supported
ITS → ATUKOSLIS	0.025	-0.044	-0.041	0.051	0.877	0.190	Not Supported
PE → ATUKOSLIS	**0.193**	0.102	0.103	0.059	**1.713 ** **	**0.044**	Supported
SE → ATUKOSLIS	0.105	0.044	0.043	0.052	0.844	0.199	Not Supported
SI → ATUKOSLIS	**0.168**	0.084	0.085	0.064	**1.308 ***	**0.096**	Supported
SQ → ATUKOSLIS	**0.165**	0.097	0.092	0.056	**1.734 ** **	**0.042**	Supported

One tailed test with significant at level:

❖ 90% (*) $t > 1.28$; $p = 0.10$, 95% (**) $t > 1.645$; $p = 0.05$, 99% (***) $t > 2.33$, $p = 0.01$

❖ Path coefficient is between: $+1 < 0 < -1$

The path coefficient result has 5 hypotheses which are significantly supported and 4 hypotheses which are not supported significantly. There are 5 relationships which are significant at different level for the reflective OSIS-UTAUT model. The first relationship is the construct ATUT→ ATUKOSLIS is significant at level $p < 0.01$. This relationship is strongly supported with t-value > 2.33. There are 2 relationships with significant value at level $p < 0.05$ which are the PE→ATUKOSLIS and SQ→ATUKOSLIS. These relationships are supported with t-value > 1.645. There are also another 2 relationships with significant value at $p < 0.01$ which are the IQ→ATUKOSLIS and SI→ATUKOSLIS. These relationships are supported with t-value > 1.28.

The path coefficient value is between +1 to -1. The path coefficient indicates the sign positive and negative correlation and the absolute value. Correlation with value 0 indicates that there is no association between the independent and dependent variables. In Table 4.3, the path coefficient value for ATUT→ ATUKOSLIS is 0.642, IQ→ ATUKOSLIS is 0.170, PE→ATUKOSLIS is 0.193, SI→ ATUKOSLIS is 0.168 and SQ→ ATUKOSLIS is 0.165. Overall the path coefficient is greater than 0 and have positive value. Therefore the path coefficient supported the hypothesis generated for Koha OSLIS research. Path coefficient relation as in Table 4.7 shows the relationship obtained for Koha OSLIS research. There are 5 items for the acceptance of Koha OSLIS. The items are ATUKOSLIS57, ATUKOSLIS58, ATUKOSLIS59, ATUKOSLIS 60 and ATUKOSLIS61. The relationship is indicated by the constructs ATUT, IQ, PE, SI and SQ. Based on the path coefficient findings, several conclusion is made for the Koha OSLIS research. The acceptance of Koha OSLIS is indicated by the willingness to use the system, support the adoption and use of Koha OSLIS, recommendation of open source system to other users in Malaysian academic libraries in public and private universities, suggestion to the present library to continue to use the Koha open source technology based library information system and overall the librarians in Malaysians academic libraries in public and private universities accept the use of Koha open source library information system. In conclusion, the Koha OSLIS is applicable and well accepted in the Malaysian academic libraries at public and private universities. This research has proven that the open source technology based application is in demand (MAMPU, 2004) and strongly supported by librarians.

Table 4.7: Path Coefficient Relation

Relationship	Construct Item	Items
ATUT→ ATUKOSLIS PE → ATUKOSLIS SI → ATUKOSLIS SQ → ATUKOSLIS IQ → ATUKOSLIS	ATUKOSLIS57	I am willing to use Koha OSLIS.
	ATUKOSLIS58	I will support the use of Koha OSLIS.
	ATUKOSLIS59	I will recommend Koha OSLIS to other libraries.
	ATUKOSLIS60	I will suggest my library to continue to use Koha OSLIS.
	ATUKOSLIS61	I accept the use of Koha OSLIS in my library.

The amount of variance in the dependent latent variable is explained by the independent latent variables using the estimation of R^2 value. There are 3 types of R^2 values. R^2 value equal or above 0.75 is substantial, 0.50 is moderate and 0.25 is weak for the endogenous latent variable (Hair, 2014).

In Koha OSLIS research, the R^2 value represent the amount of variance in the dependent variable by ATUKOSLIS explained by the independent variables. Table 4.8 shows the R^2 value obtained for the Koha OSLIS research. The OSIS-UTAUT model explains 79% of variance for acceptance of Koha open source library information system (ATUKOSLIS) which is considered substantial and good. ATUKOSLIS is predicted directly by performance expectancy (PE), effort expectancy (EE), information technology skill (ITS), system quality (SQ), information quality (IQ), cost (C), social influence (SI), self-efficacy (SE) and attitude towards using technology (ATUT). The details on the steps for the resulting of R^2 is shown in the manual of smart PLS 3.0 version professional in Appendix K.

Table 4.8: R^2 and Adjusted R^2

	R Square	R Square Adjusted
ATUKOSLIS	0.798	0.789

Blindfolding is a function used to capture the predictive relevancy of path OSIS-UTAUT model and is assessed using the Q^2 value (DeCoster, 1998). The Q^2 value is a measure to see how well the observed values are reconstructed by the model and the parameter estimates (DeCoster, 1998). In order to obtain the Q^2 value, the blindfolding procedure is performed using the smart PLS. The Q^2 value > 0 indicates that a model has predictive relevance. The Q^2 value ~ 0 or Q^2 value < 0 indicate that a model is lack of predictive relevance.

In conclusion, Koha OSLIS research of Q^2 value is 0.6333 (Q^2 value > 0) as shown in Table 4.9. Therefore, the Q^2 value for Koha OSLIS research demonstrates that there exist predictive relevance in the OSIS-UTAUT model. The predictive relevance is demonstrated by ATUKOSLIS endogenous construct. The detail steps for obtaining the Q^2 value is shown in Appendix K.

Table 4.9: Blindfolding

	SSO	SSE	Q^2 (= 1- SSE/SSO)
ATUKOSLIS	1,075.0000	394.2095	0.6333

In Partial Least Square-Path Modelling, the model fit is determine by using the Standard Root Mean Square (SRMR) or Normed Fit Index (NFI) or Bentler and Bonett Index (Henseler, Hubona & Ray, 2016). Table 4.10 indicates the saturated model and estimated model for the user acceptance study. Saturated model is the correlation between all constructs and estimated model is the total effect and considered as the model structure. Both the SRMR and NFI are accepted and the acceptance study has acceptable value for model fit. The NFI between 0 and 1 are accepted. The SRMR value lower than 0.10 are accepted as Good Fit Model. Therefore, this study has fulfilled the third objective in Chapter 1: To examine the applicability of the proposed model for users' of Koha open source library information system in academic libraries at public and private universities in Malaysia.

Table 4.10: Model Fit

	Saturated Model	Estimated Model	Model Fit
SRMR	0.057	0.057	< 0.08 , YES
NFI	0.725	0.725	~1 , YES

The hypothesis in Table 4.8 are generated for Koha OSLIS research. There are 9 hypotheses whereby 5 are supported and 4 are not supported in Koha OSLIS research. The performance expectancy, social influence, attitude towards using technology, information quality and system quality are supported. Whereas the effort expectancy, self-efficacy, cost and information technology skill are not supported. The information system elements, the system quality and information quality are strongly supported (Delone & McLean, 2003) in Koha OSLIS research. In management field of study, the UTAUT model of performance expectancy, social influence and attitude towards using technology are strongly supported (Venkatesh et al., 2003) in this study.

Table 4.8: Hypothesis

HYPOTHESES		
H1	Performance expectancy positively influence the user acceptance of Koha open source library information system	Supported
H2	Effort expectancy positively influence the user acceptance of Koha open source library information system	Not Supported
H3	Social influence positively influence the user acceptance of Koha open source library information system	Supported
H4	Self- efficacy positively influence the user acceptance of Koha open source library information system	Not Supported
H5	Attitude towards using technology positively influence the acceptance of Koha open source library information system	Supported
H6	Cost positively influence the user acceptance of Koha open source library information system	Not Supported
H7	Information technology skill positively influence the user acceptance of Koha open source library information system	Not Supported
H8	Information quality positively influence the user acceptance of Koha open source library information system	Supported
H9	System quality positively influence the user acceptance of Koha open source library information system	Supported

In conclusion, the smart PLS generates the final model for Koha OSLIS research. This model reflects the final constructs that contributes to the Koha OSLIS acceptance among librarians. This model is the proof of technology acceptance using the OSIS-UTAUT model for Koha OSLIS research.

The final model path model for Koha OSLIS research is shown in Figure 4.2 with the constructs and relevant items. Performance expectancy (PE) has 4 items and 1 is removed, information technology skill (ITS) has 5 items and 1 has been removed, system quality (SQ) has 8 items and 1 has been removed and attitude towards using technology (ATUT) has 5 items and 2 were removed. The constructs effort expectancy, information quality, cost, social influence and self-efficacy have all the items maintained in Koha OSLIS research.

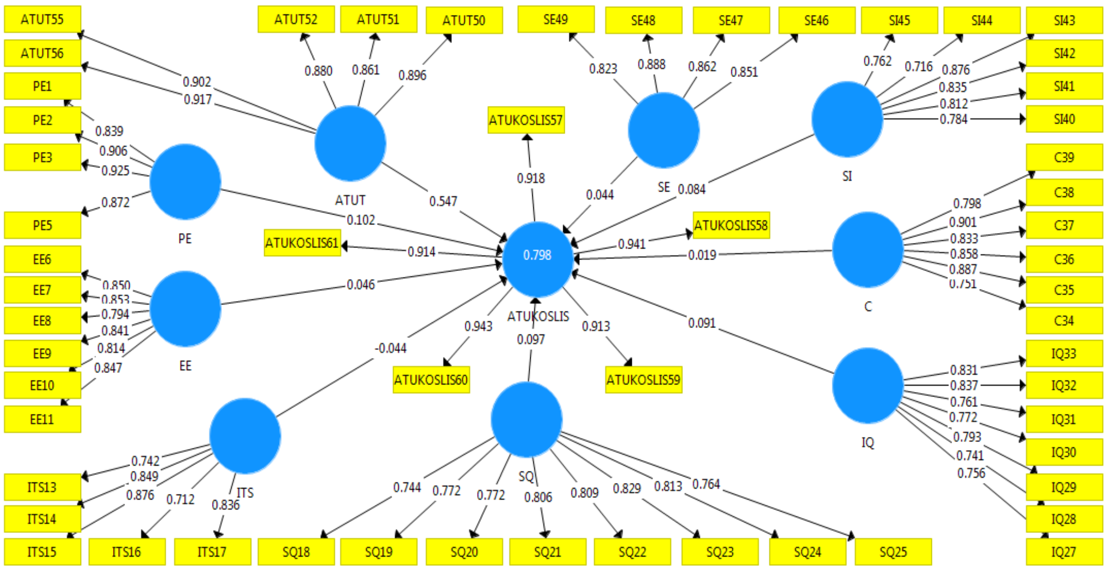


Figure 4.3: Final Path Modeling

Based on Figure 4.3, items PE4: Using Koha OSLIS increases my chance of getting a promotion, ATUT53: I need more practice on Koha OSLIS, ATUT54: I need more exposure in using Koha OSLIS, SQ26: Koha OSLIS is broken up into independent modules, ITS12: I have the technical skill to use Koha OSLIS have been removed during bootstrapping due to low loading values (Appendix K).

The omitted items reflect that Koha OSLIS adoption has no intention for job promotion. Koha OSLIS is easy to be used and users do not need a lot of practice to hands-on with Koha OSLIS. The Koha OSLIS is well-known to librarians, and less exposure need to well-versed in the system. Koha OSLIS is well integrated therefore the system is not broken up into independent modules. Technical skill is considered not important in Koha OSLIS and the librarians are capable to handle the system. Therefore, these items are considered not relevant to the Koha OSLIS acceptance studies. These items also give less impact to the applicability of OSIS-UTAUT model in the library and library professions.

The importance of Koha OSLIS findings is to highlights the omitted constructs which is the facilitating condition in the original UTAUT model. The facilitating condition construct in the original UTAUT has limitation in predicting the behavioral of an information system (Venkatesh, Brown, Maruping, & Bala, 2008). The facilitating construct is weak construct and unable to handle the findings for incomplete information in an information system. Therefore, this construct has been omitted and being replaced with information system constructs which are system quality, information quality and information technology skill that are important constructs for information system evaluation for the technology acceptance model (DeLone & McLean, 1992, 2003; Galandere-Zile & Vinogradova, 2005; Gallego et al., 2008). This Koha OSLIS research findings have filled the limitation in the original UTAUT with new constructs. The system quality and information quality are well accepted in the proposed OSIS-UTAUT model.

The users of Koha open source system have strengthen the findings and fill the UTAUT limitations by well accepting the Koha system behaviour based on information quality and system quality. These constructs are critical in the users' acceptance of an information system.

Overall, the Koha OSLIS research findings have introduced a new phase for the original UTAUT by Venkatesh et al. (2003) through adoption of the information system constructs from DeLone and McLean (1992) model and filled the limitation constructs of facilitating condition with system quality and information quality. Therefore, the OSIS-UTAUT model is accepted in any information system evaluation for user acceptance test in the perspective of adoption and implementation of a new information system. In conclusion, the final model reflects the acceptance of Koha OSLIS in

Malaysian academic libraries at public and private universities. The acceptance of the open source system reflects the acceptance of open source technology and the librarians cum system librarians are welcoming the new rapid growing open source system known as Koha in the library profession.

The free open source software are proven to be suitable for libraries with consideration of greater opportunities for system innovations, investment personnel and a library community participant are strongly supported in Koha OSLIS research. This is a good sign for library market and library profession in librarianship focusing to the system adoption and implementation. The open source awareness issue raised by Vimal Kumar and Jasimudeen (2012) is no longer a problem for library and librarians on the open source technology acceptance in the library as the ATUT54: I need more exposure in using Koha OSLIS is removed in the research. The technical skill issue raised by Vimal Kumar and Jasimudeen (2012) for using the open source technology in the library is also considered not important as the item ITS12: I have the technical skill to use Koha OSLIS is removed from the Koha OSLIS research. Finally the refined OSIS-UTAUT theoretical framework is presented in Figure 4.4.

The re-fined theoretical framework is shown in one tailed significance level with supported and not supported hypothesis, R^2, path coefficient value. The re-fined OSIS-UTAUT theoretical framework also indicates the combination of 2 main field of information system and management in Koha OSLIS research. The OSIS user acceptance test (UAT) from information system field of studies with 4 constructs and 2 constructs are supported and the UTAUT model from management field of studies with 5 constructs and 3 are supported.

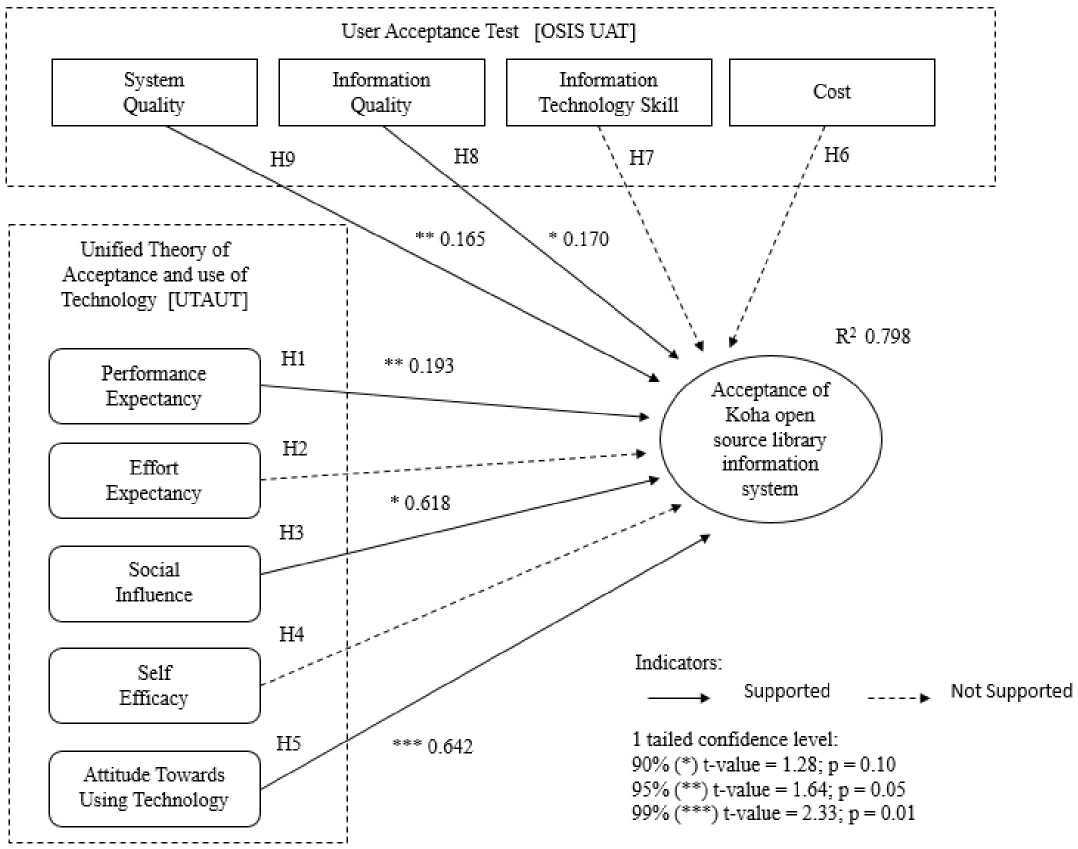


Figure 4.4: Re-Fined OSIS-UTAUT Theoretical Framework

The discussion for the re-fined OSIS-UTAUT model is based on the items which influence the Koha acceptance among librarians. The items are given in the Appendix F. There is a total of 61 items used in the survey and a re-fined OSIS-UTAUT findings shows that only 56 items are relevant and contribute to the Koha acceptance study.

There are 6 items in the attitude measurement and 2 of the items are not influencing the Koha acceptance. The supported hypothesis for attitude towards using technology (ATUT) discuss the librarians' attitude for the acceptance of Koha system is positive with items supported strongly on using Koha is a good idea, hands-on experience with Koha OSLIS is fun, librarians like working with Koha OSLIS, Koha OSLIS ease the library operations and services. Librarians' need more practice and more exposure in using the Koha OSLIS do not contribute to the acceptance of Koha OSLIS in this study.

The performance expectancy (PE) hypothesis is also strongly supported by librarians for the acceptance of Koha in the library. There is a total of 5 items and only 1 item that does not influence the Koha acceptance. The Koha OSLIS is proved to be useful in librarians' job, using the Koha allows the librarians to complete a task more quickly and also increase task productivity, the Koha OSLIS also enhance the librarians' effectiveness on the job performance. Koha OSLIS usage does not influence and support the librarians in terms of getting a promotion.

The system quality (SQ) construct's hypothesis is strongly supported by 8 items out of 9 items. The Koha OSLIS is a system which is broken up into independent modules is not influencing the system quality acceptance. The system quality for Koha OSLIS shows that the response time for the system is fast, the Koha system is compatible with SIP 2 and Z39.5 standards, the system can be used in other similar organizational environment without any major modification, the Koha system has all the functions that the librarians' need and expect, the Koha system also increases the librarians data processing rate, the Koha system is well integrated with various functions and the terminologies used throughout the system is similar and identical and Koha OSLIS can operates on different platform other than the presently used platform by the librarians.

There are 6 items in social influence (SI) constructs for the Koha acceptance. These 6 items are all well accepted and influence the librarians' acceptance to use Koha open source library information system. The decision to use Koha system is influenced by information technology personnel, the library association, top management in an organization and other people who are important at work also influence the librarians' behaviour and socially influence on the Koha acceptance by librarians.

The information quality (IQ) construct use 7 items and fully accepted in the Koha acceptance study. The information quality influenced is on the supports for various library data formats such as MARC21 and RSS, a prompt of an error message upon faulty inputs, information easily recovered upon mistakes, the terms used are familiar to users, the searching of information in Koha OSLIS is accurate, the data is clearly labeled and the data is easily matched with other modules of Koha OSLIS.

The cost, information technology skill, self- efficacy and effort expectancy construct and items do not contribute to the librarians' acceptance of Koha open source library information system. Initially these constructs with Cronbach alpha > 0.7 indicate that these constructs are reliable for the Koha acceptance study and the final findings reflects that these constructs are not dominant for the Koha acceptance study. The initial findings shows that the pioneer users of Koha need to determine the cost, adequate users with information technology skill, self- efficacy and effort efficacy for system adoption and implementation as the technology is new and there is no demand for it in the early stage of implementation. Therefore, in the main study stage the pioneer users are not in the sampling frame of respondents and the findings show these constructs are irrelevant for the acceptance of Koha OSLIS.

4.3 Summary

Chapter 4 explains the quantitative findings and discussion of Koha OSLIS research. Main test is conducted with 224 respondents and exclude the pre-test respondents. This is to avoid the bias in the final research findings. Only 215 respondents responded to the survey and 9 are non-response bias respondents. The data preparation is done from the collected surveys. The data preparation process include inputting, missing values, common method bias and confirmatory factor analysis. The data is checked for missing value and common method bias is performed to check the item validity. The EFA is performed prior to CFA using Harmon's single factor test to confirm the variance explained by the constructs used for this study. The PLS-SEM software is used to generate the 215 samples of data. The data set does not has common method bias issue and the data is accepted and further validation will be done for structural and measurement model using the Smart PLS-SEM 3.0 Professional version. Partial least square path modeling software version professional 3.0 is used to generate the research findings. The source of data set, sampling frame and techniques used to analyze the Koha OSLIS is explained in details with a manual to run the smart PLS (Appendix K). Koha OSLIS research provides a roadmap and explain the empirical test of the OSIS-UTAUT model. The partial least square path modeling has 2 main models to be reported. This model is the initial step to run the software. The measurement model and structural model are used to explain the research findings. The measurement model is used to explain the initial OSIS-UTAUT model used in Koha OSLIS research. The convergent validity, average variance explained (AVE), constructs reliability, Cronbach alpha and discriminant validity are being discussed.The structural model is used to explain the OSIS-UTAUT model used in Koha OSLIS research. The constructs relationship, path coefficient, R^2, blindfolding (Q^2) and hypothesis are being discussed. The final re-fined OSIS-UTAUT theoretical framework is drawn to show the Koha OSLIS acceptance by librarians. The findings reflect the acceptance of the Koha open source library information system by librarians at academic libraries in public and private universities in Malaysia, the importance of Koha OSLIS research in the library professions and the OSIS-UTAUT theoretical framework for information system and management field of studies.

CHAPTER 5: CONCLUSION

Enough research will tend
to support your conclusion.
- Arthur Bloch.

5.1 Chapter Overview

Discussion and conclusion on Koha OSLIS research will begin with recapitulating the research focusing on the research problem and research objectives. Followed by discussion on research implication, limitation, recommendation and contributions focusing on theoretical, practical and methodological. The findings and results obtained from this study draw conclusions in line with research objectives and the theoretical background. This research discussion and conclusion are applicable within the library professions and technology acceptance for Koha open source library information system among librarians. This study fills the methodological disparity in assessing the acceptance of open source library system between the librarians and system developers. Finally, some suggestions for future research are provided for researchers to enhance the findings of this study.

5.2 Recapitulation of the Study

Judgement and decisions are achieved by reasoning. The problem statement and objectives are summarized. A review of the literature provided an insight to the present situation of past and current research on open source and technology acceptance, while producing a wide range of knowledge on information systems, UAT, UTAUT and open source acceptance at university libraries in Malaysia. The OSIS-UTAUT model indicates a precise view of the entire Koha OSLIS acceptance study. The OSIS-UTAUT theoretical framework is tested and accepted for the information system acceptance study, especially for the open source library information system technology. The findings, strongly indicate the acceptance of Koha OSLIS in the library profession and library market. There is no missing value in the data set and the response on the survey is good. 254 survey questionnaires were distributed and 30 used for a pre-test. A 85% (215/254*100) response rate was obtained from main study. There are 9 non-response bias in this research. According to the G*Power software (Figure 3.6), Koha OSLIS research has more than the adequate sample size. The reliability of the instrument is achieved with a Cronbach alpha > 0.7. Hence, a total of 61 items are used for the main study. Five research hypotheses are supported and four hypotheses are not supported for the acceptance of Koha open source library information system. The proposed model, OSIS-UTAUT introduces some new constructs to the technology acceptance model for open source technology acceptance.

5.2.1 Restatement of Research Problem

Koha OSLIS research is on the basis of existence of a disparity between librarians who are the direct users' of library system, and open source library information system developers. The disparity is in the method used for information system adoption and implementation between developers and users' that impacts the information system success (Ashburner, 1990; Martinsons & Chong, 1999). The OSIS-UTAUT model has filled the gap by identifying the relevant influencing factors for the behavioral study of technology acceptance for Koha open source library information system. The study has attempted to bring together both aspects of the behavioral and system success for understanding an open source technology acceptance among librarians.

The research problem on the method used to identify the system acceptance by system developers is diversified to behavioral aspects of a system for a more practical solution based approach in the technology acceptance for a system adoption and implementation. There are 9 research questions generated in Chapter 1. These research questions will recapture the 9 constructs used to study the technology acceptance for Koha open source library information system. The findings of Koha OSLIS have fill the gap in the literature by answering the research questions:

1) Is there a relationship between **performance expectancy** and the user acceptance of Koha open source library information system?

   Yes. There is a positive relationship between performance expectancy and the user acceptance of Koha open source library information system. The performance expectancy construct also supported in technology acceptance studies (Venkatesh et al., 2003).

2) Is there a relationship between **effort expectancy** and the user acceptance of Koha open source library information system?

   No. There is no relationship between effort expectancy and the user acceptance of Koha open source library information system. In this study the effort expectancy construct is not supported and the users' degree of ease associated with the use of system is profound not friendly and difficult. Evaluating the user and system interaction for an open source library information system is less interesting.

3) Is there a relationship between **social influence** and the user acceptance of Koha open source library information system?

   Yes. There is a positive relationship between performance expectancy and the user acceptance of Koha open source library information system. The social influence construct also supported in technology acceptance studies (Venkatesh et al., 2003).

4) Is there a relationship between **self-efficacy** and the user acceptance of Koha open source library information system?

No. There is no relationship between self-efficacy and the user acceptance of Koha open source library information system. In this study the self-efficacy construct is not supported and the degree to which an individual believes, confidence or behavior on his or her capacity to produce specific performance while using the new system is less and the user's confidence level, ability and believe on an open source library information system is also lacking of interest.

5) Is there a relationship between **attitude towards using technology** and the user acceptance of Koha open source library information system?

   Yes. There is a positive relationship between attitude towards using technology and the user acceptance of Koha open source library information system. The attitude towards using technology construct also supported in technology acceptance studies (Venkatesh et al., 2003).

6) Is there a relationship between **cost** and the user acceptance of Koha open source library information system?

   No. There is no relationship between cost and the user acceptance of Koha open source library information system. In this study the cost construct is not supported and the amount of price or value for money is considered less important and price for an open source library information system, training and maintenance are fully considered to be with in-house capacity and capabilities which include less value for money.

7) Is there a relationship between **information technology skill** and the user acceptance of Koha open source library information system?

   No. There is no relationship between information technology skill and the user acceptance of Koha open source library information system. In this study the information technology skill construct is not supported and the skill gap which exist between the present information technology skill, knowledge and the required skill to fulfil the organization needs and objectives and adequate and users' I.T. Knowledge, technical skill and computer skill in handling an open source library information system is no longer an issue.

8) Is there a relationship between **information quality** and the user acceptance of Koha open source library information system?

   Yes. There is a positive relationship between information quality and the user acceptance of Koha open source library information system. The information quality construct also supported in technology acceptance studies (Delone & McLean, 2003; O'brien & Marakas, 2007).

9) Is there a relationship between **system quality** and the user acceptance of Koha open source library information system?

   Yes. There is a positive relationship between system quality and the user acceptance of Koha open source library information system. The system quality construct also supported in technology acceptance studies (Delone & McLean, 2003; O'brien & Marakas, 2007).

5.2.2 Restatement of Research Objective

Koha OSLIS research objectives are being discussed and re-stated in the discussion and conclusion:

1) To identify the factors on the user acceptance of Koha open source library information system.

   This study has successfully identified the factors on the acceptance of Koha open source library information system. The constructs are adopted from (Venkatesh et al., 2003) and (Delone & McLean, 2003) which are relevant to information system and behavioral aspects. The constructs from Venkatesh et al. (2003) are performance expectancy, effort expectancy, social influence, self-efficacy, attitude towards using technology from the management field of studies using the UTAUT model. The constructs from Delone and McLean (2003) are system quality and information quality for system acceptance testing (SAT). Adnanh and Lee (2015) also identified the information technology skill and cost constructs for the open source technology adoption and implementation.

2) To identify the relative importance of the factors influencing the user acceptance of Koha open source library information system.

This study tested selective constructs from UTAUT model and information system studies related to technology acceptance for the open source technology. Initially there are 9 factors in the Koha OSLIS research. Upon data analyses, there are only 5 factors that support the proposed model, whereas 4 constructs are not supported for this dataset. The identification of the relevancy is based on the path coefficient obtained from SEM-PLS as in Table 4.3. The attitude towards using technology (ATUT), social influence (SI), performance expectancy (PE), system quality (SQ) and information quality (IQ) are relevant in Koha OSLIS acceptance whereas the effort expectancy (EE), self-efficacy (SE), information technology skill (ITS) and cost (C) are irrelevant to Koha OSLIS acceptance study.

3) To examine the applicability of the proposed model for users of Koha open source library information system in academic libraries at public and private universities in Malaysia.

The proposed OSIS-UTAUT model is accepted to be applicable for the library and librarians' acceptance of Koha open source library information system in Malaysian university libraries. The R^2 at 79% indicates the level of ATUKOSLIS acceptance in the OSIS-UTAUT model. The Normed Fit Index (NFI) and Standard Root Mean Square (SRMS) as in Table 4.7 indicates the OSIS-UTAUT model fit for the Koha open source library information system in academic libraries at public and private universities in Malaysia are applicable for adoption and implementation. The correlation between all constructs are identified using saturated model and the model structure is identified using the total effect value as in Table 4.7. Item 57 to item 61 in the survey (Appendix F) reflects the acceptance of Koha OSLIS in the library environment. The items are well accepted and reflect the OSIS-UTAUT model acceptance among librarians'. These items show the willingness, support, recommendation, suggestions and accept the Koha OSLIS acceptance among librarians in the library. The OSIS-UTAUT model with strong indicators of behavioral study reflects the applicability of Koha OSLIS.

5.3 Limitations

This research is delimited in terms of time. A three years of time frame is allocated to complete the entire research. Time constraints may also influence the findings of this research. Delimitations of Koha OSLIS study is bound to the unified theory for technology acceptance and the UTAUT model by Venkatesh (2013).

The moderator are omitted in Koha OSLIS research as the moderators are less important for technology acceptance unless a technology is confirmed for implementation and adoption Venkatesh (2013). Koha OSLIS research is bound to a quantitative based approach. The information system constructs adopted are the main concern to the librarians' and indicates the distinction in the method used for a system adoption and decision upon open source technology acceptance (Adnanh & Lee, 2015).

Limitations in a research is beyond a researcher's control. Limitations are the incapability of a research. Limitations of this research is only to a specific boundary. The population of this research is librarians at academic libraries in public and private universities in Malaysia. This research is limited to and does not cover any other open source technology based library information system except Koha free open system.

This limitation is controlled to a scope to ensure the respondents are the system librarians. The respondents are treated confidentially and anonymously with random sampling technique upon the survey distribution even though the sampling frame is provided by the identified library management. The respondents are voluntarily participate in this research. There is no force used towards respondents to participate in this research as the results will be biased and cause violation from the actual ethic and principle of conducting a research.

This research also identifies weaknesses or constraints which are beyond the research scope. The Harmon's single factor test by Guadagnoli (1988) is used to manage the common method bias. The sample size is adequate for the scope of Koha open source library information system as there are only 5 universities in Malaysia which have adopted the system.

Koha OSLIS research also noted the quality of data which is observed through convergent validity, discriminant validity and reliability are crucial and the distribution of sample will warrant the generalizability of the research findings. The bootstrapping procedure by using a larger sample with random selection over a large number of trials and becomes robust (Hair et al., 2011).

The statistical method using the variance based structural equation modeling makes the process of analyzing a complex model with 9 constructs and 215 samples are supported on smart PLS professional version 30 days trial. This statistical method is not available on the students version Smart PLS which is free lifetime with a limited sample size of 100.

Koha OSLIS research is an interdisciplinary research of library science and information system. Therefore, the findings are usable and applicable within the disciplines only. The Koha OSLIS study limitations provide room for improvement for other scholars.

5.4 Recommendations

The Koha OSLIS study has shown the use of quantitative method approach in testing an empirically OSIS-UTAUT measurement and structural model for acceptance of Koha open source library information system. The study recommends that in any interdisciplinary field of study, the understanding of the key factors in identified field of studies are important. The initial understanding of the behavioral model in the management field is the key to determine the successful empirical model for a research.

Next is to identify the respondent for the particular research with the sampling type and identify the sampling frame if available. It is important to know and identify the experts in the particular field of research. This will help to gather the literature and streamline the research scope. Study the theoretical model and attain strong theoretical knowledge on the research phenomenon. This exercise will be helpful during the factor analysis stage. Data collection is performed within a timeframe. Data set is screened to capture missing value and outliers. The time allocation must be sufficient to avoid flawed assumptions.

5.5 Contributions and Implications

This is the first study with complete information system measures that has been tested in a single information system model known as the OSIS-UTAUT and is a success study. The Koha OSLIS research has huge implication for Malaysian university libraries, the library as an organization, the technological demands for open source, the profession of librarians' and the library market. These implications are based on the research findings which reflect the good acceptance and applicability of the proposed model for open source technology system in the library.

The Koha OSLIS research has 3 main contributions. The contributions are in terms of theoretical, practical and methodological. Each of the contribution is subject to body of knowledge related to information system field and management study related to user behavioral aspects and technology acceptance by direct users who are the system librarians and also known as Cybrarians in the digital library.

5.5.1 Theoretical Contribution

A better theoretical understanding of the influencing factors for the Koha open source library information system through practices in the academic libraries at public and private universities in Malaysia. The new constructs of the system encourage the librarians to give the actual expectation on a system acceptance decision.

The OSIS-UTAUT model is the extension model of the original UTAUT (Venkatesh et al., 2003). The extension model combines the user behavioral aspect for the system acceptance which capture the librarians' expectation upon system testing during the pilot test of an open source system. The theoretical contribution of the new constructs to unified theory of technology acceptance such as system quality and information quality are well accepted in this study. The information technology skill and cost are less important in the open source technology acceptance.

The OSIS-UTAUT model is used to facilitate the information system, information technology adoption and diffusion like the original UTAUT model. It is used to evaluate potential technology success of the open source technology adoption. OSIS-UTAUT model is also used to identify the relevant influencing factors for the open source technology adoption.

5.5.2 Practical Implication

The practical implication includes the financial and non-financial aspects upon an open source system adoption. The library as an organization which provides services, therefore, the library services must be available 24 by 7. Koha open source library information system has greater impact on the information quality and system quality. The Koha system supports the entire library expectation. The system response time is fast, has compatible library standards like SIP2 and Z39.5, has all the built in functions for library operations, increases data processing capacity, well integrated with various functions, simple and known terminologies applied throughout the system and operates on various platform of operating system. The system supports various library data format like MARC21 and RSS is easily recovered upon error, searching tool with accuracy, data is clearly labeled and is easily matched with other system modules.

The Koha OSLIS findings have built a base for open source technology for the library market. The positive relationship of the empirical data provides possible avenue for greater open source technology engagement in library. The positive impact of technology acceptance among librarians on open source welcome the business image, widen the community and encourage the library practice. This enables and encourage a change in the perception of library management towards the importance and benefits of open source technology for the library. In information system field, open source system creates the demands for open source system developers. In the field of library science, librarians demand and expectation in the library for open source system increases. Decision making process for library management for the implementation of Koha OSLIS in the library by considering organizational, technological and individual intention is enhanced.

There is also managerial impact on purchasing a system. The procedure of purchasing a system begins with a pilot test inspecting the system functionalities and capabilities by users. The outcome of the system functionalities and capabilities are used by developers to enhance and modify the system. Then by norm in public and private universities, a tender procedure is being used to evaluate the technical aspects of the system and final decision will be on the lowest bidding for the system. This is considered as appropriate decision for adoption and implementation. This practice need to be enhanced with a user acceptance test upon the pilot test with relevant construct such as performance expectancy (PE), social influence (SI), attitude towards using a technology (ATUT), system quality (SQ) and information quality (IQ) which have been supported as technology acceptance constructs for the Koha OSLIS research using the OSIS-UTAUT as the user behavioral aspects on user acceptance of the open source with non-technical aspects to validate the system.

The users acceptance test with a highly R^2 value indicates the system is acceptable for adoption and implementation. The research findings strengthen the decision making process upon a tender evaluation. This stage is important in the open source technology adoption as the users are the community of developers (MAMPU, 2004). Therefore, there is no more arguments on the UTAUT whether it is really used or just for the sake of information technology evaluation (Williams et al., 2011). The relationship reported in most UTAUT studies are significant and the UTAUT instrument reliability above threshold value 0.7 is consistent (Williams et al., 2011). The refined UTAUT model in this research, as OSIS-UTAUT model, contributes to the organization decision makings in the open source information technology adoption and reflects the open source information system is in demand for the library market.

5.5.3 Methodological Contribution

The majority of previous studied on unified theory of acceptance and use of technology (UTAUT) for the library is on open access, information literacy, digital library and electronic library services (Rahman et al., 2011; Tibenderana & Ogao, 2008) (Rafiq, 2009; Witten, 2003; Zhussupova & Rahman, 2011) using the SPSS for quantitative approach.

The users' acceptance of Koha open source library information system is the first study in the library with librarians as respondents and using the partial least square path modeling for quantitative approach. This method and approach provide an insight on the users' acceptance of Koha open source library information system for the field of library science. The OSIS-UTAUT model contributes to the information system/information technology, library science and management field of studies. Future researchers are encourage to adopt this method and approach in addressing the open system problems in the context library automation.

5.6 Future Research

The present Koha OSLIS research provides invaluable insight of open source technology in the context of Malaysian academic libraries at public and private universities and offer new knowledge for decision making and system adoption. This Koha OSLIS research results present a plausible findings for Malaysian scope of libraries and need in-depth research in the future to confirm the findings in other context of open source system acceptance.

Future scholars are suggested to delve this Koha OSLIS findings in a more precise manner and explore the quality of system librarians by examining the extent of librarians' influence which can guide library for a better services and practices.

The future work is recommended to be dispersed into two field of study. The information system and information science related to technology-organization-environment (TOE) model by DePietro et al. (1990) which is frequently used to look at technology adoption at organizational level. The TOE discuss the process of technological innovation and is suitable for open source technology.

The future work is related to the usage of different construct for the organizational, technological and individual from the perspective of information system. A UTAUT2 model constructs are also new approach for this study (Venkatesh et al., 2003).

A different enhancement approach to the technological, organizational and environmental (TOE) is yet to be used in the UTAUT or UTAUT2 model. The recommendation constructs from information system field are system reliability, system functionalities and system accuracy.

There is also a future work on digital library which is related to the institutional repository (IR) acceptance in the digital library. This is the next level approach for the library science field. The institutional repository is highly in demand for librarians and expectations of library patrons.

5.7 Conclusion

Koha OSLIS research explored the important determinants of technology acceptance at direct users' level who are the librarians. The determinants that give influence to Koha OSLIS acceptance are the attitude towards using technology (ATUT), system quality (SQ), performance expectancy (PE), information quality (IQ) and social influence (SI).

Findings of Koha OSLIS only supported and significantly influence 5 determinants and the most important determinant for the library technology acceptance is the librarians' attitude towards the technology acceptance. This findings highlights the important role of the librarians in encouraging behavior aspect in the context of technology acceptance in the library environment. Koha OSLIS is now well recognized at academic libraries in public and private universities in Malaysia. Therefore, the MAMPUS's master plan from phase I, year 2004 to phase III, year 2011 onwards, to focus on public sector, should be diversified and the 6th objective: increase growth of OSS user and developer community is achieved in this Koha OSLIS research. Koha OSLIS has the exact features, information and capabilities which support the library operations and services. Librarians' concern and disparity between system developers and system users on information quality (IQ) and system quality (QS) of open source system are justified in this study. As an interdisciplinary of research, this study has contribute to the applicability and acceptance of the OSIS-UTAUT model prior to open source system adoption in a library. The quantitative approach for the librarians' level is able to lead the findings to a reasonable solution for the acceptance and deployment of Koha OSLIS in the libraries at public and private universities in Malaysia. The librarians are the developers for the Koha OSLIS within a library environment, therefore this approach and OSIS-UTAUT model are the base for decision making for open source system adoption. Koha OSLIS implementation in reputed libraries have given publicity among library professionals.

REFERENCES

Abu-Sahab, E. a. P., M. (2009). Internet banking in jordan: An arabic instrument validation process. *International Arab Journal of Information Technology, 6*(3), 235-244.

Abu Bakar, A., Rahmad, F., & Mohd Amin, Z. (2015). Koha ils: The next level. *International Conference on Libraries: "Openness Paradigm: Emerging Knowledge Ecologies". 25th - 26th August, Vistana, Penang, Malaysia*.

Adnanh, & Lee, N. (2015). Preliminary study on open source software implementation in the malaysian public sector. *The 4th Asian Conference on Information System, ACIS 2015*.

Ahmed, A., & Alreyaee, S. (2014). Coping the budget pressure–possibility of adopting open source solutions in saudi libraries. *e-Library Science Research Journal, 2*(3).

Al-Gahtani, S. S., Hubona, G. S., & Wang, J. (2007). Information technology (IT) in saudi arabia: Culture and the acceptance and use of IT. *Information & Management, 44*(8), 681-691.

Al Hilali, A., Qutaifan, F., & Amer, N. T. (2012a). ITIL adoption model based on UTAUT. *Mediterranean-Middle Eastern Conference on Information MCIS2012*.

Al Hilali, A., Qutaifan, F., & Amer, N. T. (2012b). ITIL adoption model based on UTAUT. *European Mideterranean & Middle Eastern Conference on Information System, June 7-8, Munich, Germany*, 361-379.

ALA-TechSource. (2014). https://journals.ala.org/ltr/article/view/4618/5454#tbl1. *Retrieved on December, 2014*.

Alapetite, A. A., H.B, & Hertzum, M. (2009). Acceptance of speech recognition by physicians: A survey of expectations, experiences, and social influence. *International Journal of Human-Computer Studies, 67*(1), 36-49.

Albert, F. C., Jr. (1986). Information systems development: Principles of computer-aided software engineering, Prentice-Hall PTR, Boston, London.

Ali, A., & Sreenivasarao, V. (2013). A case study of acceptance and use of electronic library services in university based on SO-UTAUT model. *International Journal of Innovative Research in Computer and Communication Engineering, 1*(4), 903-911.

Alves, P., Reais, A., & Alves, E. (2012). Adopting an open source integrated library system in academic libraries: Experiences so far with koha and RFID at polytechnic institute of bragança. *18th Congress Of The European University Information Systems-EUNIS. Universidade de Trás-os-Montes e Alto Douro*.

American-Libraries. (2014). http://americanlibrariesmagazine.org/2014/04/15/library-systems-report-2014/. *Retrieved on December, 2014*.

Amoako-Gyampah, K., & Salam, A. F. (2004). An extension of the technology acceptance model in an ERP implementation environment. *Information & Management, 41*(6), 731-745.

Anderson, E. E. (1989). The implementation of information systems for workers: A structural equation model. *Information & Management, 16*(4), 171-186.

Anwar, N., Masrek, M. N., & Rambli, Y. R. (2012). *Visitor management system by applying the model of UTAUT.* Paper presented at the Business, Engineering and Industrial Applications (ISBEIS), 2012 IEEE Symposium

APEX-USM. (2015a). https://www.usm.my/index.php/en/infogateway/apex/apex-status-new. *Retrieved on January, 2015*.

APEX-USM. (2015b). https://www.usm.my/index.php/en/infogateway/apex/apex-transformation-agenda. *Retrieved on January, 2015*.

Arm, W. Y. (2000). Digital Libraries. *Digital libraries and electronic publishing.MIT Press, Cambridge, Massachusetts, London, England*, 2-9.

Ashburner, L. (1990). Impact of technological and organisational change. *Personnel Review, 19*(2), 16-20.

Bailey, P. (2011). How library management systems can demonstrate value for money from information and library services. *Business Information Review, 28*(2), 119-125.

Beizer, B. (2003). *Software testing techniques.: Amazon.Com*: Dreamtech Press Second Edition.

Berg, N. (2005). Non-response bias, MPRA-munich personal RePEc archive,paper no. 26373,posted 4th november 2010. University of Texas, Dallas. *https://mpra.ub.uni-muenchen.de/26373/.*

Bhatiasevi, V., & Krairit, D. (2013). Acceptance of open source software amongst Thai users: An integrated model approach. *Information Development, 29*(4), 349-366.

Biju, V., Jasimudeen, S., & Vimal Kumar, V. (2012). A study on managing koha open source library management system using live cd. *Mahatma Gandhi University, Kerala*.

Bødker, M., Nielsen, L., & Orngreen, R. N. (2007). *Enabling user centered design processes in open source communities*: *International Conference on Usability and Internationalization (*pp. 10-18): Springer. Berlin, Heidelberg.

Bonaccorsi, A., & Rossi, C. (2003). Why open source software can succeed. *Research Policy, 32*(7), 1243-1258.

Borgman, C. L. (1999). What are digital libraries? Competing visions. *Information Process Management, 35*(3), 227-243.

Braccini, A. M., Silvestri, C., & Za, S. (2009). Interactions with open source software: A pilot study on end users' perception *Information Systems: People, Organizations, Institutions, and Technologies* (pp. 549-556): Springer.

Breeding, M. (2009). The viability of open source ILS. *Bulletin of the American Society for Information Science and Technology, 35*(2), 20-25.

Brice, J. J., III. (2002). Open source @ Meadville Public Library: (814),336-1773 *American Library Association, at Atlanta*.

Brookshear, J. G. (2010). Computer science an overview.(11th ed.). Pearson (Addison-Wesley).ISBN:0805346325

Burton-Jones, A., & Straub, D. (2003). Reconceptualizing system usage. *Computer Information Systems Department Working Paper No. CIS 03-01, Georgia State University*.

Business-Dictionary. (2015a). http://www.businessdictionary.com/definition/cost.html. *Retrieved on January, 2015*.

Business-Dictionary. (2015b). http://www.businessdictionary.com/definition/garbage-in-garbage-out-GIGO.html. *Retrieved on January, 2015*.

Calisir, F., & Calisir, F. (2004). The relation of interface usability characteristics, perceived usefulness, and perceived ease of use to end-user satisfaction with enterprise resource planning (ERP) systems. *Computers in Human Behavior, 20*(4), 505-515.

Carlock, R. (2008). Open source integrated library systems. *Nebraska Library Association Quarterly, 39*(4), 5-11.

Cassell, M. (2008). Why governments innovate: Adoption and implementation of open source software by four european cities. *International Public Management Journal, 11*(2), 193-213.

Çetin, G., & Gokturk, M. (2008). *A measurement based framework for assessment of usability-centricness of open source software projects.* Paper presented at the

Signal Image Technology and Internet Based Systems, 2008. SITIS'08. IEEE International Conference

Chang, I.-C., Li, Y.-C., Hung, W.-F., & Hwang, H.-G. (2005). An empirical study on the impact of quality antecedents on tax payers' acceptance of internet tax-filing systems. *Government Information Quarterly, 22*(3), 389-410.

Chang, I. C., Hwang, H. G., Hung, W. F., & Li, Y. C. (2007). Physicians' acceptance of pharmacokinetics-based clinical decision support systems. *Expert Systems with Application, 3*(2), 296-303.

Chawner, B. (2004). *Free/open source software: New opportunities, new challenges.* Paper presented at the 12th VALA Biennial Conference Breaking boundaries: Integration & Interoperability, Available From. www. vala. org. au/vala2004/2004pdfs/33chawn. pdf.

Cheng, T. E., Lam, D. Y., & Yeung, A. C. (2006). Adoption of internet banking: An empirical study in Hong Kong. *Decision Support Systems, 42*(3), 1558-1572.

Chib, S. (2013). Free and open source software adoption framework for Swiss small and medium-sized tourist enterprises. ENTER 2010 Conference on Information and Communication Technologies in Tourism, Lugano, Switzerland. *Researchbank.rmit.edu.au*.

Chin, W. W., & Newsted, P. R. (1999). Structural equation modeling analysis with small samples using partial least squares. R. H. Hoyle (ed) statistical strategies for small sample size research. *Thousand OAks, CA : Sage Publications*, 307-341.

Chiu, C. M., Huang, H.Y. and Yen, C.H. (2010). Antecedents of trust in online auctions. *Electronic Commerce Research and Application, 9*(2), 148-159.

Chiu, C. M., & Wang, E. T. (2008). Understanding Web-based learning continuance intention: The role of subjective task value. *Information & Management*, *45*(3), 194-201.

Chudnov, D. (1999). Open source software: The future of library systems? *Library Journal, 124*, 40-43.

CompTIA. (2015). http://www.wired.com/wp-content/uploads/blogs/wiredenterprise/wp-content/uploads/2012/03/Report_-_CompTIA_IT_Skills_Gap_study_-_Full_Report.sflb_.pdf. *Retrieved on January, 2015.*

Cooper, Dempsey, P. R., Menon, V., & Millson-Martula, C. (1998). Remote library users: Needs and expectations. *Library Trends, 47*(1), 42-64.

Cooper, R. D., & Schindler, S. P. (2008). *Business Research Methods*: Singapore: McGraw Hill/Irwin.

Curtis, L., Edwards, C., Fraser, K.L., Gudelsky, S., Holmquist, J., Thornton, K. (2010). Adoption of social media for public relation by non-profit organizations. *Public Relations Review, 36*(1), 90-92.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 319-340.

Davis, F. D. (1993). User acceptance of information technology: system characteristics, user perceptions and behavioral impacts. *International Journal of Man-Machine Studies, 38*(3), 475-487.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: a comparison of two theoretical models. *Management Science, 35*(8), 982-1003.

DeCoster, J. (1998). Overview of factor analysis. http://www.stat-help.com/notes.html *Retrieved on 2016*.

Deek, F. P., & McHugh, J. A. (2007). *Open source: Technology and policy*: Cambridge University Press.

Deek, F. P., McHugh, J. A., & Tepper, M. . (2008). Open source: Technology and policy. Networker: The craft of network computing. *12*(1), 33.

DeLone, W. H., & McLean, E. R. (1992). Information systems success: The quest for the dependent variable. *Information Systems Research, 3*(1), 60-95.

DeLone, W. H., & McLean, E. R. (2002). *Information systems success revisited.* Paper presented at the System Sciences, 2002. HICSS. Proceedings of the 35th Annual Hawaii International Conference

Delone, W. H., & McLean, E. R. (2003). The DeLone and McLean model of information systems success: a ten-year update. *Journal of Management Information Systems, 19*(4), 9-30.

Dennison, L. (2011). Small and open source: Decisions and implementation of an open source integrated library system in a small private college. *Georgia Library Quarterly, 48*(2), 3.

Dhamdhere, S. N. (2011). ABCD, an open source software for modern libraries. *Chinese Librarianship: an International Electronic Journal, 32*, 1-17.

Dulle, F. W., & Minishi-Majanja, M. (2011). The suitability of the Unified Theory of Acceptance and Use of Technology (UTAUT) model in open access adoption studies. *Information Development, 27*(1), 32-45.

Duyck, P., Pynoo, B., Devolder, P.,Voet, T., Adang, L., Ovaere, D. (2010). Monitoring the PACS implementation process in a large university hospital-discrepancies between radiologists and physicians. *Journal of Digital Imaging, 23*(1), 73-80.

Dwivedi, Y. K., Rana, N. P., Chen, H., & Williams, M. D. (2011). *A Meta-analysis of the Unified Theory of Acceptance and Use of Technology (UTAUT).* Paper presented at the IFIP International Working Conference on Governance and Sustainability in Information Systems-Managing the Transfer and Diffusion of IT.

Eckhardt, A., Laumer, S., & Weitzel, T. (2009). Who influences whom? Analyzing workplace referents' social influence on IT adoption and non-adoption. *Journal of Information Technology, 24*(1), 11-24.

Egunjobi, R., & Awoyemi, R. (2012). Library automation with Koha. *Library Hi Tech News, 29*(3), 12-15.

Ennajeh, L., & Amami, M. (2014). *Open Source Software Adoption Model Ossam.* Paper presented at the 8th Mediterranean Conference on Information Systems (MCIS), pp.8.

Farrell-Vinay, P. (2008). Manage software testing. *Boca Raton, FLA: Auerbach Publication*.

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G* Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods, 41*(4), 1149-1160.

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G* Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39*(2), 175-191.

Ferdinand, A. E. (1993). System, software and quality engineering: Applying defect behavior theory to programming. Van Nostrand Reinhold, New York.

Feria Wirba, A. A. (2010). Applying UTAUT Model to understand Malaysian authors' readiness to self-archive in open access repositories: a study in progreee. *International Conference on Library Information Science (ICOLIS), LISU, FCSIT*, 359-371.

Fishbein, M., & Ajzen, I. (1977). Belief, attitude, intention, and behavior: An introduction to theory and research. Journal of Business Venturing, 5, 177-189.

Florence, M., & Alonzo, E. (1982). Software- how good is it? . *Computer Literacy Intelligent*. Computer Assisted Instruction (CAI) Proceesings.

Fox, & Marchionini, G. (1998). Toward a worldwide digital library. *Communications of the ACM, 41*(4), 29-32.

Fox, J. A., & Tracy, P. E. (1986). Randomized response: a method for sensitive surveys. *Springer-Verlag Berlin Heidelberg*. doi: 10.1007/978-3-642-36276-7_4

Fuggetta, A. (2003). Open source software-an evaluation. *Journal of Systems and Software, 66*(1), 77-90.

Gable, G., Sedera, D., & Chan, T. (2003). Enterprise systems success: a measurement model. *ICIS 2003 Proceedings 24th International Conference on Information Systems*, 48, 576-591.

Galandere-Zile, I., & Vinogradova, V. (2005). Where is the border between an information system and a knowledge management system? *Managing Global Transitions, 3*(2), 179-196.

Galim, D. (2004). Software quality assurance from theory to implementation. *Pearson, Addision Wesley*.

Gallego, M. D., Luna, P., & Bueno, S. (2008). User acceptance model of open source software. *Computers in Human Behavior, 24*(5), 2199-2216.

Ganesh, K., Mohapatra, S., Anbuudayasankar, S., & Sivakumar, P. (2014). User acceptance test *Enterprise Resource Planning* (pp. 123-127): Springer.

Gefen, D., Straub, D., & Boudreau, M.-C. (2000). Structural equation modeling and regression: Guidelines for research practice. *Communications of the Association for Information Systems, 4*(1), 7.

Ginzberg, M. J. (1993). Key recurrent issues in the MIS implementation process. *MIS Quaterly, 5*, 47-59.

Gonçalves, M. A., Moreira, B. L., Fox, E. A., & Watson, L. T. (2007). "What is a good digital library?"–a quality model for digital libraries. *Information Processing & Management, 43*(5), 1416-1437.

Goodhue, D., Lewis, W., & Thompson, R. (2006). *PLS, small sample size, and statistical power in MIS research.* Paper presented at the System Sciences, 2006. HICSS'06. Proceedings of the 39th Annual Hawaii International Conference on System Sciences.

Gordon Schulmeyer, G., & James, I. M. (1999). Handbook of software quality assurance *3rd ed.* Prentice Hall PTR, Boston, London.

Gorla, N., Somers, T. M., & Wong, B. (2010). Organizational impact of system quality, information quality, and service quality. *Journal of Strategic Information Systems, 19*(3), 207-228.

Guadagnoli, E., & Velicer, W. F. . (1988). Relation to sample size to the stability of component patterns. *Psychological Bulletin, 103*(2), 265-275. doi: 10.1037/0033-2909.103.2.265

Gupta, B., Dasgupta, S. and Gupta, A. (2008). Adoption of ICT in a government organization in a developing country: An empirical study. *Journal of Strategic Information System, 17*(2), 140-154.

Haenlein, M., & Kaplan, A. M. (2004). A beginner's guide to partial least squares analysis. *Understanding Statistics, 3*(4), 283-297.

Hair, J. F. (2014). A Primer on Partial Least Squares Structural Equation Modeling (LS-SEM). *Thousand Oaks, Calif: SAGE*.

Hair, J. F., Hult, G. T. M., Ringle, C. M., & Starstedt, M. (2017). A primer on Partial Least Squares Structural Equation Modeling. 2nd Edition. Sage Publications.

Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet. *Journal of Marketing Theory and Practice, 19*(2), 139-152.

Han, Y., & Rawan, A. (2013). Afghanistan digital library initiative: revitalizing an integrated library system. *Information Technology and Libraries, 26*(4), 44-46.

Haron, H., Khalid, S. N. A., & Ganesan, Y. (2011). *A Handbook for Business Research Methods*: Publisher: Pearson Malaysia, 321 pages, ISBN: 9789673491728.

Hashim, N., Rusuli, C., Saufi, M., & Rosmaini, T. (2012). The impact of digital library (DL) in academic library perspectives: A case study of University Tun Hussein Onn Malaysia (UTHM) Library.

Heeks, R. (2002). Information systems and developing countries: Failure, success, and local improvisations. *Information Society, 18*(2), 101-112.

Henseler, J., Hubona, G., & Ray, P. A. (2016). Using PLS path modeling in new technology research: updated guidelines. *Industrial Management & Data Systems*, *116*(1), 2-20.

Hsieh, S.-T., & Hsu, P.-Y. (2013). Mentoring effects in the successful adaptation of information systems. *Information Development*. doi: 0266666913511263

Hsu, H.-H. (2013). The acceptance of Moodle: An empirical study based on UTAUT. *Creative Education, 3*(08), 44.

Hung, Y. H., Wang, Y. S. and Chou, S. C. T. (2007). User Acceptance of E-Government Services Kaohsiung: National Sun Yat-Sen University. PACIS 2007 Proceedings Pacific Asia Conference on Information Systems, 97

Hurst, B. (1991). Facilitating change: The key to success with information technology. *Chief Information Officer Journal, Spring*, 39-46.

Iivari, J. (2005). An empirical test of the DeLone-McLean model of information system success. *ACM Sigmis Database, 36*(2), 8-27.

IPPT-USM. (2009). http://www.researchsea.com/html/article.php/aid/4699/cid/1/research/science/universiti_sains_malaysia/usm_wins_two_awards_at_mygosscon_2009.html. *Retrieved on January, 2015*.

IT-Skill. (2015). http://searchcio.techtarget.com/definition/IT-skills-gap-information-technology-skills-gap. *Retrieved on January, 2015*.

Jackson, C. M., Chow, S., & Leitch, R. A. (1997). Toward an understanding of the behavioral intention to use an information system. *Decision Sciences, 28*(2), 357-389.

Jaeger, T., & Metzger, A. (2002). *Open-source-Software*: Verlag C.H.Beck Munchen,http://tocs.ulb.tu-darmstadt.de/180488430.pdf.

Jaffe, L. D., & Careaga, G. (2007). Standing up for open source. *Library Philosophy and Practice, 9*(2), 21.

Jasimudeen, S. (2013). Adoption and user perceptions of Koha library management system in India. *Annals of Library and Information Studies (ALIS), 59*(4), 223-230.

Jayasingh, S., & Eze, U. C. (2010). The role of moderating factors in mobile coupon adoption: An extended TAM perspective. *Communications of the IBIMA*.

Jayawardena, S., & Dias, G. (2011). *Free and Open Source Software for Public Sector Enterprise Applications in Sri Lanka.* Paper presented at the ICIME 2011-Proceedings of the 2nd International Conference on Information Management and Evaluation: ICIME 2011 Ryerson University, Toronto, Canada, 27-28 April 2011.

Johnston, K., Begg, S., & Tanner, M. (2013). Exploring the factors influencing the adoption of Open Source Software in Western Cape schools. *International Journal of Education and Development using Information and Communication Technology, 9*(2), 64.

Jones, C. (1996). Patterns of Software System Failure and Success.Itp New Media. *International Thomson Computer Press, 28*(3), 86-87.

Jöreskog, K. G. (1967). A general approach to confirmatory maximum likelihood factor analysis. *ETS Research Report Series, 1967*(2), 183-202.

Jorgensen, P. C. (2013). *Software testing: a craftsman's approach, Third Edition-13:978-0-8493-7475-3, Department of Computer Science and Information System, Grand Valley State University*: Auerbach Publications, Taylor & Francis Group,6000 Broken Sound Parkway NW, Suite 300, Boca Raton, FL 33487-2742, CRC Press.

Jose, S. (2007). Adoption of open source digital library software packages: a survey 2007, Information and Knowledge Management in Networked World: 98-102. *ir.inflibnet.ac.in*.

Kamau, J. W., & Sanders, I. D. (2013). An Empirical Investigation into the Effect of Usability on Adoption of Desktop Open Source Software by University Students in Kenya. *Computer and Information Science, 6*(3), 108.

Kaplan, B., & Duchon, D. (1988). Combining qualitative and quantitative methods in information systems research: a case study. *MIS Quarterly*, 571-586.

Khan, M. E., & Khan, F. (2012). A comparative study of white box, black box and grey box testing techniques. *International Journal of Advanced Computer Science and Applications (IJACSA), 3*(6), 12-15.

Kijasanayotin, B., Pannarunothai, S. and Speedie, S.M. (2009). Factors influencing health information technology adoption in Thailand's community health centers: Applying the UTAUT model. *International Journal of Medical Informatics, 78*(6), 404-416.

Kijsanayotin, B., Pannarunothai, S., & Speedie, S. M. (2009). Factors influencing health information technology adoption in Thailand's community health centers: Applying the UTAUT model. *International Journal of Medical Informatics, 78*(6), 404-416.

Kim, W. C., & Mauborgne, R. (2005). Blue ocean strategy: from theory to practice. *California Management Review, 47*(3), 105-121.

Kinyondo, J., Van Biljon, J., & Gerber, A. (2012). The potential role of open source software in overcoming digital poverty. *IDIA2012 Conference proceedings, Beykent University, Istanbul, Turkey*.

Kiriyanant, P. (2012). *Survey of Open Source Integrated Library System in Thai University Libraries in Bangkok and Pathumthani*: Center for Southeast Asian Studies Library, Kyoto University.

KOHA-WordPress. (2015). https://mykoha.wordpress.com/2010/09/25/whoss-using-koha-in-malaysia/. *Retrieved on January, 2015*.

Komsky, S. H. (1991). A Profile of Users of Electronic Mail in a University Frequent Versus Occasional Users. *Management Communication Quarterly, 4*(3), 310-340.

Kripanont, N. (2007). Using technology acceptance model of internet usage by academics within Thai Business Schools. PhD Thesis, Victoria University. *Retrieved on January, 2014*.

Kulviwat, S., Bruner, I., Gordon, C., Kumar, A., Nasco, S. A., & Clark, T. (2007). Toward a unified theory of consumer acceptance technology. *Psychology & Marketing, 24*(12), 1059-1084.

Lankton, N. K., Wilson, E. V., & Mao, E. (2010). Antecedents and determinants of information technology habit. *Information & Management, 47*(5), 300-307.

Laumer, S., Eckhardt, A. and Trunk, N. (2010). Do as your parents say?- Analyzing IT adoption influencing factors for full and under age applicants. *Information System Frontiers, 12*(2), 169-183.

Lee, Y., Kozar, K. A., & Larsen, K. R. (2003). The technology acceptance model: Past, present, and future. *Communications of the Association for Information Systems, 12*(1), 50.

Lerner, J., & Triole, J. (2000). The simple economics of open source: *National Bureau of Economic Research Workinh Paper, 7600, 273-283.*

Lewis, B. R., Templeton, G. F., & Byrd, T. A. (2005). A methodology for construct development in MIS research. *European Journal of Information Systems, 14*(4), 388-400.

Lewis, J. R. (1995). IBM computer usability satisfaction questionnaires: psychometric evaluation and instructions for use. *International Journal of Human-Computer Interaction, 7*(1), 57-78.

Lewis, J. R. (2002). Psychometric evaluation of the PSSUQ using data from five years of usability studies. *International Journal of Human-Computer Interaction, 14*(3-4), 463-488.

Lewis, W. E. (2000). *Software Testing and Continuous Quality Improvement. ISBN: 13:978-1-4200-8073-5*.

Lewis, W. E. (2005). *Software Testing and Continuous Quality Improvement, 2nd ed. Boca Raton, Fla: Auerbach Publication*.

Li-ping, R. (2009). A Comparative Research on Open Source Software of Integrated Library System [J]. *Library Tribune, 1*, p.25.

Limaye, M. G. (2009). Software Testing: Principles, Techniques and Tools. New Delhi: Tata McGraw-Hill Education Private Limited.

Lin, J. C.-C., & Lu, H. (2000). Towards an understanding of the behavioural intention to use a web site. *International Journal of Information Management, 20*(3), 197-208.

Lindquist, R. (1991). Don't forget the pilot work! *Heart & lung: The Journal of Critical Care, 20*(1), 91-92.

Lu, J., Yu, C.-S., Liu, C., & Yao, J. E. (2003). Technology acceptance model for wireless Internet. *Internet Research, 13*(3), 206-222.

Luarn, P., & Lin, H.-H. (2005). Toward an understanding of the behavioral intention to use mobile banking. *Computers in Human Behavior, 21*(6), 873-891.

Lucas, H. C., & Spitler, V. (1999). Technology use and performance: A field study of broker workstations. *Decision Sciences, 30*, 291-312.

Macan, B., & Fernandez, G. V. (2010). ABCD vs. KOHA: open source library options, 36th IAMSLIC Anuual Conference: Netting Knowledge: Two Hemispheres-One World, 17-21 October, Mar del PAta, Argentina.

Malaysian-University-Guide. (2015). http://www.universitymalaysia.net/public-universities/. *Retrieved on January, 2015*.

MAMPU. (2004). Malaysian Public Sector Open Source Software (OSS) Initiatives: Open Source Software Technical Implementation Plan. *http://www.mampu.gov.my/documents/10228/92525/OSS+Implementation+Guideline.pdf/38ce9b16-07ff-48e8-9a12-c9309c3cab88*, *Retrieved on January, 2015*.

Marciniak, J. J., & Shumskas, A. (1994). *Acceptance Testing. Encyclopedia of Software Engineering*: Wiley Online Library.

Markus, M. L., & Bjørn-Andersen, N. (1987). Power over users: its exercise by system professionals. *Communications of the ACM, 30*(6), 498-504.

Martinsons, M. G., & Chong, P. K. (1999). The influence of human factors and specialist involvement on information systems success. *Human Relations, 52*(1), 123-152.

Mats Alvesson, H. W. (1992). Critical Management Studies. *Sage Publication Ltd, 6 Bonhill Street, London EC2A 4PU: ISBN 0-8039-8454-5*.

McGill, T., Hobbs, V., & Klobas, J. (2003). User developed applications and information systems success: A test of DeLone and McLean's model. *Information Resources Management Journal (IRMJ), 16*(1), 24-45.

Meissonier, R., & Houze, E. (2010). Attitude, involvement and parrticipation in business open source software projects: An empirical analysis of developers' behaviours. *ICIEMT-WASET conference, 26-28 May, 2010, Tokyo, Japan*.

Melone, N. P. (1990). A Theoretical Assessment of the User-Satisfaction Construct in Information System Research. *Management Science, 36*, 76-91.

Min, Q., Ji, S., & Qu, G. (2008). Mobile commerce user acceptance study in China: a revised UTAUT model. *Tsinghua Science & Technology, 13*(3), 257-264.

MIT-IQ. (2015). http://mitiq.mit.edu/. *Retrieved on January, 2015*.

Mockus, A., Fielding, R. T., & Herbsleb, J. D. (2002). Two case studies of open source software development: Apache and Mozilla. *ACM Transactions on Software Engineering and Methodology (TOSEM), 11*(3), 309-346.

Moghaddam, R. Z., Bongen, K., & Twidale, M. (2011). Open source interface politics: Identify, acceptance, trust and lobbying. *ACM Digital Library*, 1723-1728.

Mohamed, N., & Karim, N. S. A. (2012). Open Source E-learning Anxiety, Self-Efficacy and Acceptance–A Partial Least Square Approach. *International Journal of Mathematics and Computers in Simulation, 6*(4), 361-368.

Mohideen, Z. A., & Kaur, K. (2015). *Digital Library: Demands And Expectations.* Paper presented at the Emerging Trends and Technologies in Libraries and Information Services (ETTLIS), 2015, 4th International Symposium, SCOPUS.

Mohideen, Z. A., Muhamad, S., Ghadzali, M. P., Arshad, M., & Rafie, M. (2012). *A Practical Approach To Radio Frequency Identification Library Management System.* Paper presented at the RFID-Technologies and Applications (RFID-TA), 2012, IEEE International Conference.

Morgan, E. L. (2002). Possibilities for open source software in libraries. *Information Technology and Libraries, 21*(1), 12.

Munoz-Cornejo, G. (2007). *An empirical investigation into the adoption of open source software in hospitals*. Department of Inforamtion Systems, University of Marryland Baltimore County, MD, USA: ProQuest.

Nakakoji, K., Yamamoto, Y., Nishinaka, Y., Kishida, K., & Ye, Y. (2002). *Evolution patterns of open-source software systems and communities.* Paper presented at the Proceedings of the International Workshop on Principles of Software Evolution.

Nickerson, R. C. (1998). *Business and information systems*: Addison-Wesley Longman Publishing Co., Inc. ISBN: 03210041380.

Nunnally, J. C., Bernstein, I. H., & Berge, J. M. t. (1967). *Psychometric Theory* (Vol. 226): New York: McGraw Hill, 1967. JSTOR.

O'brien, J. A. (1993). *Management Information Systems, International: Managerial End User Perspective*: McGraw-Hill Professional.

O'brien, J. A., & Marakas, G. M. (2007). *Introduction to information systems* (Vol. 13): McGraw-Hill/Irwin New York City, USA.

Oberg, S. (2003). Open Source Software. *Serials Review, 29* (1), 36-39.

Olejnik, S., & Algina, J. (2003). Generalized eta and omega squared statistics: measures of effect size for some common research designs. *Psychological Methods, 8*(4), 434.

Online-Dictionary. (2014). http://dictionary.reference.com/browse/transdisciplinary. *Retrieved on December, 2014*.

OSCC. (2014). http://www.oscc.org.my/index.php/en/about-us/oscc-mampu. *Retrieved on December, 2014*.

OSS-Definition. (2005). The open source definition. *http://www. opensource. org/docs/definition_plain. php, Retrieved on December,2016*.

OSS-ORG. (2015). https://opensource.org/node/535. *Retrieved on January, 2015*.

Oz, E. (2008). *Management information systems*: Cource Technology, Division of Cengage Learning.

Pace, A. K. (2005). Helping You Buy: Integrated Library Systems. *Computers in Libraries, 25*(8), 25-33.

Patton, R. (2006). *Software Testing. ISBN:0672327988*: Pearson Education India.

Peat, J., Mellis, C., & Williams, K. (2002). *Health science research: a handbook of quantitative methods*: ISBN: 0 7619 7402 4. Sage Publication.

Peter, J. P. (1979). Reliability: A review of psychometric basics and recent marketing practices. *Journal of Marketing Research*, 6-17.

Petter, S., DeLone, W., & McLean, E. (2008). Measuring information systems success: models, dimensions, measures, and interrelationships. *European Journal of Information Systems, 17*(3), 236-263.

Pinsonneault, A., & Kraemer, K. (1993). Survey research methodology in management information systems: an assessment. *Journal of Management Information Systems, 10*(2), 75-105.

Prebor, G. (2010). Analysis of the interdisciplinary nature of library and information science. *Journal of Librarianship and Information Science*, 0961000610380820.

Qiang, X. (2011). The Research on Application of the Koha for Small and Medium-sized Library. *Library, 2*, 042.

Qureshi, I., & Compeau, D. (2009). Assessing between-group differences in information systems research: a comparison of covariance-and component-based SEM. *MIS Quarterly*, 197-214.

Rafiq, M. (2009). LIS community's perceptions towards open source software adoption in libraries. *International Information & Library Review, 41*(3), 137-145.

Rafiq, M., & Ameen, K. (2009). Issues and lessons learned in open source software adoption in Pakistani libraries. *The Electronic Library, 27*(4), 601-610.

Rahe, U. (2006). When Technology meets People. Göteborg : Chalmers University of Technology. ISBN:91-975079-4-6.

Rahim, A., Zairah, N., & Alias, R. A. (2006). Open Source Software Appropriation in Malaysian Public Sector.In Proceedings of the Postgraduate Annual Research Seminar, (p.334).

Rahim, N. Z. A., & Alias, R. A. (2006). Cross-case Analysis of Open Source Software Appropriation in Malaysian Public Sector. Proceedings of the Postgraduate Annual Research Seminar, (p.473).

Rahim, N. Z. A., & Zairah, N. (2009). *Multiple Perspectives Of Open Source Software Appropriation In Malaysian Public Sector.* Universiti Teknologi Malaysia, Faculty of Computer Science and Information System.

Rahman, A. L. A., Jamaludin, A., & Mahmud, Z. (2011). Intention to use digital library based on modified UTAUT model: Perspectives of Malaysian postgraduate students. *World Academy of Science, Engineering and Technology, 75*, 116-122.

Rai, A., Lang, S. S., & Welker, R. B. (2002). Assessing the validity of IS success models: An empirical test and theoretical analysis. *Information Systems Research, 13*(1), 50-69.

Raza, A., & Capretz, L. F. (2015). Do open source software developers listen to their users? *arXiv preprint arXiv:1507.06893*.

Reitz, J. M. (2016). Online Dictionary for Library and Information Science (ODLIS),Libary and Information Science, ABC-LIO Encyclopedia. http://www.abc-clio.com/ODLIS/odlis_i.aspx *Retrieved on January 2016*.

Research-Guides. (2015). http://libguides.usc.edu/writingguide/theoreticalframework. *Retrieved on January, 2015*.

Riewe, L. M. (2008). Survey of open source integrated library systems. Thesis Open access. San Jose State University, CA, Scholar Works. ProQuest LLC.

Roscoe, J.T. (1975) Fundamental Research Statistics for the Behavioural Sciences, 2nd edition. New York: Holt Rinehart & Winston.

Rowley, J. (1993). Information systems methodologies: a review and assessment of their applicability to the selection, design and implementation of library and information systems. *Journal of Information Science, 19*(4), 291-301.

Russo, F. (2011). Explaining causal modelling. Or, what a causal model ought to explain. *New Essays in Logic and Philosophy of Science, College Publications, London*.

Sabherwal, R., Jeyaraj, A., & Chowa, C. (2006). Information system success: Individual and organizational determinants. *Management Science, 52*(12), 1849-1864.

Saleh, A. M., Haris, A. B., & Ahmad, N. B. (2013). Towards a UTAUT-based Model for the Intention to use Solar Water Heaters by Libyan households. *International Journal of Energy Economics and Policy, 4*(1), 26-31.

Sapio, B., Turk, T., Cornacchia, M., Papa, F., Nicolo, e. and Livi, S. (2010). Building scenarios of digital television adoption : a pilot study. *Technology Analysis and Strategic Management, 22*(1), 43-63.

Saracevic, T. (1995). Interdisciplinary nature of information science. *Ciência da informação, 24*(1), 36-41.

Saracevic, T. (1999). Information Science *Journal of the American Society for Information Science, 50*(12), 1051.

Saracevic, T. (2000). Digital library evaluation: Toward evolution of concepts. *Library Trends, 49*(2), 350-369.

Sargent, K., Hyland, P., & Sawang, S. (2012). Factors influencing the adoption of information technology in a construction business. *Australasian Journal of Construction Economics and Building, 12*(2), 72.

Satyarajan, D., & Akre, V. (2011). Open Source Software Adoption: An Academic Perspective. *International Journal of Computer & Communication Technology, 2*(5), 38-42.

Schaupp, L. C., Carter, L. and McBride, m.E. (2010). E-file adoption: A study of US taxpayers' intentions. *Computer in Human Behavior, 26*(4), 636-644.

Schwaninger, A., Vogel, J., Hofer, F., & Schiele, B. (2006). A psychophysically plausible model for typicality ranking of natural scenes. *ACM Transactions on Applied Perception (TAP), 3*(4), 333-353.

Seddon, P., & Kiew, M.-Y. (1996). A partial test and development of DeLone and McLean's model of IS success. *Australasian Journal of Information Systems, 4*(1).

Seddon, P. B. (1997). A respecification and extension of the DeLone and McLean model of IS success. *Information Systems Research, 8*(3), 240-253.

Seddon, P. B., Staples, S., Patnayakuni, R., & Bowtell, M. (1999). Dimensions of information systems success. *Communications of the AIS, 2*(3es), 5.

Seilheimer, S. D. (1987). Importance of the human factor in the information system life cycle. *Journal of Systems Management, 38*(7), 24.

Sekaran, U. (2003). *Research Method for Business: A Skill Building Approach*: 4th edition, John Wiley & Sons Ltd.

Selim, H. M. (2003). An empirical investigation of student acceptance of course websites. *Computers & Education, 40*(4), 343-360.

Sheeja, N. (2009). Adoption of Koha Open Source Software in Libraries: A Web Based Study. Cochin University of Science and Technology. *dyuthi.cusat.ac.in*.

Shmueli, G., & Koppius, O. (2010). Predictive analytics in information systems research. *Robert H. Smith School Research Paper*, 06-138.

Siddike, A. K., Munshi, N., & Sayeed, A. (2011). The adoption of information and communication technology (ICT) in the university libraries of Bangladesh: An exploratory study.

Simon, J. C. (2000). Introduction to Information Systems .New York: Wiley.

Singh, M., & Sanaman, G. (2012). Open source integrated library management systems: Comparative analysis of Koha and NewGenLib. *Electronic Library, 30*(6), 809-832.

Singh, V. (2014). Expectations versus experiences: Librarians using open source integrated library systems. *The Electronic Library, 32*(5), 688-709.

Sisler, E. a. V. S. (2000). Building a library netwok from scratch: Eric and Veronica's excellent adventure. *Computer in Libraries, 20*(9), 44-48.

Six-Sigma. (2015). http://www.sixsigmacouncil.org/what-is-six-sigma/. *Retrieved on January, 2015*.

Slone, J. P. (2006). Information Quality Strategy: An Empirical Investigation Of The Relationship Between Infor-Mation Quality Improvements And Organizational Outcomes. *PhD dissertation, Capella University,Minneapolis, MN*.

Software-Quality. (2015). http://searchsoftwarequality.techtarget.com/definition/garbage-in-garbage-out. *Retrieved on January, 2015*.

Sommerville, I. (2001). Software Engineering. *Harlow: Addison-Wesley*.

Sommerville, I. (2007). Software Engineering. *8th. ed. Harlow: Addison-Wesley*.

Stallman, R. (2009). Viewpoint Why open source misses the point of free software. *Communications of the ACM, 52*(6), 31-33.

Stamelos, I., Angelis, L., Oikonomou, A., & Bleris, G. L. (2002). Code quality analysis in open source software development. *Information Systems Journal, 12*(1), 43-60.

Steier, L. P. (1989). When technology meets people. *Training & Development Journal, 43*(8), 27-30.

Sulayman, K. S., Ioannis, G. S., & Ioannis, M. S. (2008). *Emerging Free and Open Source Software Practices, IGI Publishing (an imprint of IGI Global)*.

Sundaravej, T. (2010). Empirical validation of unified theory of acceptance and use of technology model. *Journal of Global Information Technology Management, 13*(1), 5-27.

Swierczek, F. W. (1991). The management of technology: human resource and organizational issues. *International Journal of Technology Management, 6*(1-2), 1-14.

Talburt, J. (2011). Using Information Quality for Competitive Advantage. *International Symposium on Information Systems and Management, Xi'an, China (8th -11th December)*.

Tan, M., & Teo, T. S. (2000). Factors influencing the adoption of Internet banking. *Journal of the Association for Information Systems, 1*(1es), 5.

Tech-Terms. (2015). http://techterms.com/definition/gigo. *Retrieved on January, 2015*.

Thompson, R. L., Higgins, C. A., & Howell, J. M. (1991). Personal computing: Toward a conceptual model of utilization. *MIS quarterly*, 125-143.

Tibenderana, P., & Ogao, P. (2008). Information technologies acceptance and use among universities in Uganda: a model for hybrid library services end-users. *International Journal of Computing and ICT research*, 60-75.

Tosi, D., Lavazza, L., Morasca, S., & Chiappa, M. (2015). Surveying the Adoption of FLOSS by Public Administration Local Organizations *Open Source Systems: Adoption and Impact* (pp. 114-123): Springer.

Van Teijlingen, E., & Hundley, V. (2002). The importance of pilot studies. *Nursing Standard, 16*(40), 33-36.

VanVoorhis, C. R. W., & Morgan, B. L. (2007). Understanding power and rules of thumb for determining sample sizes. *Tutorials in Quantitative Methods for Psychology, 3*(2), 43-50.

Vasupongayya, S., Keawneam, K., Sengloilaun, K., & Emmawat, P. (2011). Open source library management system software: A review. *World Academy of Science, Engineering and Technology, 77*, 973-978.

Venkatesh, V., Brown, S. A., Maruping, L. M., & Bala, H. . (2008). Predicting different conceptualizations of system use: The competing roles of behavioral intention, facilitating conditions and behavioral expectation. *MIS Quarterly, 32*(3), 483-502.

Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science, 46*(2), 186-204.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 425-478.

Venkatesh, V., Thong, J. Y., & Xu, X. (2012). Consumer acceptance and use of information technology: Extending the unified theory of acceptance and use of technology. *MIS Quarterly, 36*(1), 157-178.

Vimal Kumar, V., & Jasimudeen, S. (2012). Adoption and user perceptions of KOHA library management system in India. *Annals of Library and Information Studies, 59*(4), 223-230.

Vliet, H. V. (2008). Software Engineering: Principles and Practice. *3rd ed.: John Wiley & Sons*. ISBN:0470031468

Von Krogh, G. (2003). Open-source software development. *MIT Sloan Management Review, 44*(3), 14-18.

Walleigh, R. (1990). Manufacturing: the rich get richer. *Information Strategy, 7*(1), 34-36.

Walton, R. E., & Vittori, W. (1983). New information technology: Organizational problem or opportunity? *Office Technology and People, 1*(4), 249-273.

Wang, Y. S. a. S., Y. W. (2009). Why do people use information kiosks? A validation of the Unified Theory of Acceptanceand Use of Technology. *Government Information Quarterly, 26*(1), 158-165.

Wayne Gould, R. (2012). Open innovation and stakeholder engagement. *Journal of Technology Management & Innovation, 7*(3), 1-11.

Williams, M. D., Rana, N. P., Dwivedi, Y. K., & Lal, B. (2011). *Is UTAUT really used or just cited for the sake of it? a systematic review of citations of UTAUT's originating article.* Paper presented at the ECIS.

Wilson, B. (2001). Soft systems methodology: conceptual model building and its contribution.

Witten, I. H. (2003). *Browsing around a digital library.* Paper presented at the SODA, (3), p.99.

Wood, P. (2008). Confirmatory factor analysis for applied research. *The American Statistician, 62, p.91-92.* Taylor & Francis.

Worldwide-KOHA-Users. (2015). http://librarypolice.com/wiki.koha.org/kohausers.html. *Retrieved on December, 2014*.

Young, M. (2008). *Software testing and analysis: process, principles, and techniques*: John Wiley & Sons, New York.

Youngok, C., & Rasmussen, E. (2006). What Is Needed to Educate Future Digital Librarians: A Study of Current Practice and Staffing Patterns in Academic and Research Libraries. *D-Lib Magazine, 12*(9), 3.

Zhou, T., Lu, Y.B. and Wang, B. (2010). Integrating TTF and UTAUT to explain mobile bangking user adoption. *Computer in Human Behavior, 26*(4), 760-767.

Zhu, H., Madnick, S. E., Lee, Y. W., & Wang, R. Y. (2014). Data and Information Quality Research: Its Evolution and Future, Computing Handbook: Information Systems and Information Technology, 3rd Edition, Editors: Heikki Topi, Allen Tucker. Chapman & Hall / CRC,. *MIT-CDO-WP-01*, 161-162.

Zhussupova, A., & Rahman, A. A. (2011). *Open source software adoption in public organizations of Kazakhstan.* Paper presented at the Open Systems (ICOS), 2011 IEEE Conference, 417-422.

Zilouchian Moghaddam, R., Twidale, M., & Bongen, K. (2011). *Open source interface politics: identity, acceptance, trust, and lobbying.* Paper presented at the CHI'11 Extended Abstracts on Human Factors in Computing Systems.

LIST OF PUBLICATIONS AND PAPERS PRESENTED

Publications:

Mohideen, Z. A., Muhamad, S., Ghadzali, M. P., Arshad, M., & Rafie, M. (2012, November). A Practical Approach to Radio Frequency Identification Library Management System. In *RFID-Technologies and Applications (RFID-TA), IEEE International Conference, Nice, France.* IEEE (pp. 323-329). USM-RCMO Research Fund RM 3000

Mohideen, Z. A., & Kaur, K. (2015, January). Digital Library: Demands and expectations. *4th International Symposium on Emerging Trends and Technologies in Libraries and Information Services (ETTLIS), Delhi, India.* SCOPUS (pp. 17-21). UM-PRA-RM 2000

Mohideen, Z. A., & Kaur, K. (2016, October). An Experienced-Based Library Cybernation: A Schematically Approach for Information System management at Academic Libraries. Journal of Information Systems Research. ISI JOURNAL (under review)

Mohideen, Z. A., & Kaur, K. (2016, October). Digital Library Road Map and Best Practice in Malaysian Academic Library. Journal of Information Technology and Libraries. ISI JOURNAL (under review)

Mohideen, Z. A., Kaur, K., NHA Karim. & Muhamad, S. (2017, January). UTAUT's Performance Consistency: Empirical Evidence from a Library Management System. ISI JOURNAL. MJLIS University of Malaya (under review)

Mohideen, Z. A., & Kaur, K. (2017, January). IoT: QoS in the Digital Library. Digital Library Journal. ISI JOURNAL. ICIET Conference @Tokyo-Japan Conference. ACM Digital Library Journal. UM-PRA-RM 2000

Z. A. Mohideen, K. Kaur, S. Muhamad, N. A. W. Jan and A. B. Ahamadhu (2017, April), "ITIL: Implementation and service management best practices in Malaysian academic libraries," International Journal of Technology and Engineering Studies, vol. 3, no. 2, pp. 65-73, 2017

International Conferences:

Mohideen, Z. A., Muhamad, S., Ghadzali, M. P., Arshad, M., & Rafie, M. (8^{th} -10^{th} of October, 2012). Information System Management in Library Automation. *Conference on GenNext Libraries, Brunei, Conference Proceeding.* USM Library Conference Fund RM 3500

Mohideen, Z. A., Muhamad, S. (31st March –1st April, 2013*).* ITIL: Best Practices in Malaysian Academic Library. *1st BCS, International IT Conference, Abu Dhabi, Conference Proceeding.* USM Library Conference Fund RM 3500

Mohideen, Z. A., Muhamad, S. (26th – 27th of January, 2016). A Practical Approach and Implementation of Digital Library towards Best Practice in Malaysian Academic Library. *ICDL 2016: 18th International Conference on Digital Libraries, Jeddah, Saudi Arabia World of Science, Engineering and Technology, International Journal of Educational and Pedagogical Sciences Vol: 3, No:1, 2016 Waste.org\abstracts\31709 (ABSTRACT ONLY)*

Mohideen, Z.A., Kaur, K. Muhamad, S. (5th – 6th of October, 2016). ITIL: Implementation and Service Management Best Practices in Malaysian Academic Libraries. *RCMI 2016: 2nd International Conference on Regional Challenges to Multidisciplinary Innovation (RCMI 2016), Dubai, UAE, Conference Proceeding.*UM-PRA-RM2000

Symposium:

Mohideen, Z.A. (26th – 27th of October, 2015). Librarians' Acceptance of Open Source Library Information System Using the OSIS-UTAUT Model. *PhD Project. Proceeding of the 7th Asia Library and Information Research Group (ALIRG 2015 Workshop).Rizal Library, Ateneo de Manila University, Manila.* Proposal Presentation. UM-Research Grant Prof. Abrizah Abdullah RM2000.

Certification:

ITIL ®2011 Certified, Foundation Examination, 18 July 2012, ITIL/MY738015, Certificate Number: 12351-736397, APMG-Group-International Ltd, England.

Competition:

UM3MT Thesis Defense. 10th of March 2016, Faculty Science Computer and Information Technology [FCSIT], University Malaya.

Grant:

Postgraduate Research Grant (PPP)-Research (2015B), Ref No: 4824, December 2016 to December 2018, RM 3000. Title: Librarians' Acceptance of Koha Open Source Library Information System using OSIS-UTAUT Model. Supervisor: Assoc. Prof. Dr. Kiran Kaur Gurmit Singh.

Postgraduate Research Allocation (PRA):

Year 2015, Fund: RM 2000. Paper Presenter.
Conference: 4th International Symposium on Emerging Trends and Technologies in Libraries and Information Services,6^{th} – 8^{th} of January, Jaypee Institute, Uttar Pradesh, Noida, India

Year 2016, Fund: RM 2000. Paper Presenter.
Conference: Conference: The 2^{nd} International Conference on Regional Challenges to Multidisciplinary (RCMI 2016), 5^{th} – 6^{th} of October 2016, Dubai, United Arab Emirates (UAE)

Year 2017, Fund: RM 2000. ACM Journal Publication.
Conference: Conference: The 5^{th} International Conference on Information and Education Technology (ICIET 2017), 10^{th} – 12^{th} of January 2016, Tokyo, Japan

Thesis:

Shape Preserving Using Rational Splines (Positivity and Monotonicity). University Science Malaysia (2008). Computer Aided Geometrical Design (CAGD). Master in Science (Mathematics). School of Mathematics.

Ajab Mohideen, Zainab. Pembelian Barangan Runcit Melalui Kedai Maya Berasaskan Pelanggan Pelayan. Thesis, Universiti Teknologi Malaysia (2001). Ijazah Sarjana Muda Sains Komputer, Information System and Networking. http://ir.fsksm.utm.my/view/creators/AJAB_MOHIDEEN=3AZAINAB=3A=3A.default.html

Ajab Mohideen, Zainab. Sistem Harta Pusaka dalam Islam. Kolej Agama Sultan Zainal Abidin (KUSZA). Pusat Pengajian Teknologi Maklumat. Diploma Teknologi Maklumat. Kuala Terengganu (1998).

APPENDIX

Appendix A

Summary of Information System Acceptance Studies

Author	Paper	Purpose	Findings
(Martinsons & Chong, 1999)	The influence of Human Factors and Specialist Involvement on Information Systems Success 60 organization across East and Southeast Asia	A study on human factors and human resources management issues associated with IT assimilation. Constructs: -System Quality -Information Quality -Use -Individual Impact	-IT computer based system short fall of performance expectations -The information system failures are due to non-technical factors -relationship between human resource specialist and information system
(Bailey, 2011)	How Library Management Systems can demonstrate value for money from information and library services	Integration of various modules in integrated library management software	-Improve handling process -Team efficiency increased -24 by 7 services -Information Quality -Cost Efficiency

(Rowley, 1993)	Information systems methodologies: a review and assessment of their applicability to the selection, design and implementation of library and information systems	A brief study and approach to hard methodologies and soft methodologies	-Appropriate for software and hardware configuration -IS success determine the effectiveness, management, planning and users involvement
(Jackson et al., 1997)	Toward an understanding of the Behavioral Intention to Use an Information System TAM Model SEM-PLS	Examine several constructs used for behavioural intention to use an information system	-Developers is urged to pursue with a process that will lead to system adoption -Ease of Use -Attitude -Behavioral Intention -Perceived Usefulness
(Gable, Sedera, & Chan, 2003)	Enterprise systems success: a measurement model 27 items	Validate measurement model of information system for assessing system success	-state the rationale for system selection -model validation from management, users' and technical aspect -information quality -system quality -individual impact -organizational impact

(Prebor, 2010)	Analysis of the interdisciplinary nature of library and information science	Examine the papers conducted in non-LIS department	-LIS affected by evolution technology -LIS focus on information user
(Rai, Lang, & Welker, 2002)	Assessing the Validity of IS Success Models: An Empirical Test and Theoretical Models: An Empirical Test and Theoretical Analysis DeLone and McLean Model Quantitative Respondents: 908 university users Survey: 274 SEM approach	Empirically and theoretically assess the DeLone (DeLone & McLean, 1992) model and Seddon model (Seddon, 1997) for information system success in quasi-voluntary IS use.	-System Quality -Information Quality -IS use -User Satisfaction -Individual Impact -The survey omitted and did not measure the information system used -Suggestion on system quality and information quality are the main determinants for information system
(Seddon & Kiew, 1996)	A Partial Test and Development of DeLone and McLean Model of IS Success Causal Model for relationship study Respondents: 94 out of 159 Survey: 35 questions SEM-AMOS	Study the relationship between 6 IS success constructs	-System Quality -Information Quality -Use -User Satisfaction -Individual Impact -Organizational Impact IQ and SQ supports the individual of user of information system $R^2 = 78\%$ SQ => significant at $p < 0.001$ IQ => significant at $p < 0.01$

(McGill et al., 2003)	User-Developed Applications and Information System Success: A Test of DeLone and McLean's Model -Model applicability to measure IS success factors SEM-AMOS	First empirical test of adaptation of DeLone and McLean model in the user developed application domain -System Quality -Information Quality -Use -User Satisfaction -Individual Impact -Organizational Impact	-9 hypotheses, 4 significant and 5 not significant -Strongly support perceived system quality and user satisfaction, perceived information quality and user satisfaction, user satisfaction and intended to use and user satisfaction and perceived individual impact -System quality: economy, portability, reliability, understand ability, user-friendliness
(Seddon, 1997)	A Respecification and Extension of the DeLone and McLean Model of IS Success	Justifies a specified and extension to DeLone and McLean Model -USE: benefits from a system usage	-Focused on system bugs -System Quality -Information Quality -User involvement -Usefulness -User Satisfcation
(DeLone & McLean, 2002)	Information System Success Revisited	Review and analyse 150 articles for past 8 years in the measuring of IS success	-Service Quality -System Quality -Information Quality -Individual Impact -Organizational Impact -Intention to use -User satisfaction

(Seddon et al., 1999)	Dimensions of information system success	To present an alternative to DeLone and McLean model of IS success	DeLone and McLean is the main model for IS success -The model does not recognize the users' factors about determining an information system -System Quality -Information Quality -Use -User Satisfaction -Individual Impact -Organizational Impact
(Burton-Jones & Straub, 2003)	Reconceptualising system usage: An approach and empirical Test	To study the relationship between system usage and short run task performance in cognitively engaged tasks	-System Characteristics
(Sabherwal, Jeyaraj, & Chowa, 2006)	Information System Success: Individual and Organizational Determinants LISREL Meta data analysis and SEM	To study the interrelationship among IS success determinants	-Users participation in pilot test indicate the greater chances for adoption based on system characteristics -system quality -system use -perceived usefulness -user satisfaction

Appendix B

Summary of Technology Acceptance Studies

Trends of studies: 1970s System Use 1990s End-Users 2000 User Behavior			
Author	Paper	Purpose	Findings
(Gallego et al., 2008)	User acceptance model of open source software **Quantitative (31 items)** **TAM** **Linux Operating System**	To identify the variables and factors that have a direct effect on individual attitude towards Open Source Software adoption	Open source software is viable solution information management for organization **Variables:** **Software Quality** **System Capability** **Social Influence** **Software Flexibility**
(Zhussupova & Rahman, 2011)	Open Source Software Adoption in Public Organization of Kazakhstan **Case Study** : Ministry of Oil and Gas of Republic of Kazakhstan	To determine the factors that hold process of Open Source Software adoption using Multiple Perspective of OSS Appropriation (MPOSSA) model	Enough knowledge about OSS Lack of specialists of OSS Personal resistance **Future:** To consider 4 areas: technical, organizational, managerial, personal

(Sundaravej, 2010)	Empirical validation of unified theory of acceptance and use of technology (UTAUT) model Quantitative UTAUT	To validates the UTAUT model in subject of user acceptance towards an educational technology : acceptance of Blackboard an educational Web-Based software system	-The UTAUT (Venkatesh, Morris, Davis, & Davis, 2003) appears to have been acceptably robust across studies and user groups -To further explore the specific influence of factors that may alter the behavior to use an information system -The UTAUT is an adequately valid and reliable instrument to measure the usage behavior on information technology and further investigation is needed.
(Rafiq & Ameen, 2009)	Issue and lesson learned in open source software adoption in Pakistani libraries **Case Study**	To identify and discuss key issues on open source software adoption	-Only a few organization made 1st move -cultural disparity -conceptual confusion -digital divide -lack of technological -lack of financial -lack of human development
(Rafiq, 2009)	LIS community's perceptions towards open source software adoption in libraries **Quantitative (20 items)**	To investigate LIS Community's perceptions towards Open Source Software (OSS) adoption in libraries.	Attention was given to three variables: organization type (public/private sector), library type (academic/public/special), Country type (developed/developing).

(Vimal Kumar & Jasimudeen, 2012)	Adoption and user perception of Koha library management system in India **Questionnaire**	To evaluate satisfaction level of Indian library professionals with Koha	Indian libraries have recognized the capabilities of Koha features and its suitability to implement in any type of libraries. -key functional Koha Modules
(Alves et al., 2012)	Adopting an open source Integrated Library Systems in academic Libraries: Experiences so far with Koha and RFID at Polytechnic Institute of Braganca	There are several barriers that libraries are facing when considering the adoption of open source- highlights the advantages of adopting an Open Source Library Management System	-reduce costs -license costs saving -improve efficiency in circulation and inventory -contribute to the development of Open source product
(Dulle & Minishi-Majanja, 2011)	The suitability of the Unified Theory of Acceptance and Use of Technology (UTAUT) model in open access adoption studies **Survey: 30 questions** **UTAUT** **Respondent: 544** **Sampling: Random sampling** **Population: 1088 at 6 public universities**	Analyze the acceptance and use of open access within public universities in Tanzania -Response rate: 73% achieved -Analysis using SPSS	UTAUT has been supported in studying the adoption of open access -attitude -awareness **-effort expectancy** **-performance expectancy** **Significant:** -age -awareness -facilitating condition -social influence -behavioral intention

(Anwar et al., 2012)	Visitor Management System by Applying the Model of UTAUT **Sampling: Random sampling** **Survey: 80 questions** **Respondents: 57 students**	Aim to adopt and adapt the use of technology model (UTAUT) to determine the user acceptance of visitor application system among viewers of the visitor management system (VMS) -Analysis using SPSS	Using the system development life cycle (SDLC) from computer science field. Accepted: -Performance expectancy -Effort expectancy -Perceived enjoyment -User acceptance of VMS software
(Ali & Sreenivasarao, 2013)	A Case Study of Acceptance and Use of Electronic Library Services in Universities Based on SO-UTAUT Model **Case Study** **Survey by (Davis, 1993)** **Hypotheses:7**	Empirically investigate the determinants of e-library end users acceptance and use in academic libraries -Partial Least Square Path Modelling	To determine factors that affect the acceptance and use of e-library service end users using the SO-UTAUT Model Path coefficient are positive and indicate positive inclination of end-users acceptance Accepted: -Performance expectancy -Effort expectancy -Social Influence -Facilitating Condition -Age, Gender, Experience, Voluntariness of use -Behavior Intention, Use Behavior, Expected Benefits

(Al Hilali, Qutaifan, & Amer, 2012b)	ITIL Adoption Model Based on UTAUT Case Study on a failed ITIL project Qualitative based research	To use the technology adoption model UTAUT as an adoption of IT governance framework, specifically on ITIL Constructs: -Performance expectancy -Effort Expectancy -Social Influence -Facilitating Condition -Age, gender, experience, voluntariness of use -behavioral intention, behavioural use	Determine critical success factor for ITIL adoption using the UTAUT model A successful roadmap for ITL implementation is proposed using the UTAUT model Success factors: -management support -ITIL awareness and training -Interdepartmental Collaboration -Process Priority -Tool Selection -Change Management
(Feria Wirba, 2010)	Applying UTAUT Model to understand Malaysian authors' readiness to self-archive in Open Access repositories: a study in progress	Aimed at determining university lecturers and academicians' readiness to self-archive in digital/ institutional repositories via the green route to open access	Pilot test: Awareness exist among researchers of institutional repository and some do not know the existence of it Constructs: -Performance expectancy -Effort expectancy -Social Influence -Facilitating Condition -Age, Gender, Experience, Voluntariness of use -Behavior Intention, -Use Behavior

(Williams et al., 2011)	Is UTAUT really used or just cited for the sake of IT? A Systematic Review of Citations of UTAUT's Originating Article	Results of 450 citations of originating article in an attempt to better understand the reason for citation, use and adaptations of the theory	Only 43 actually utilised the theory -used constructs in empirical reasoning for examining the information system or information technology related issues -basis supporting for an argument -critics the theory -potential tools for adoption of new technology -helps to identify factors for influence and adoption of technology -contribute to information system or information technology adoption an diffusion
(Dwivedi, Rana, Chen, & Williams, 2011)	A Meta-analysis of the Unified Theory of Acceptance and use of Technology (UTAUT)	To undertake a statistical meta-analysis of findings reported in 43 published studies that have actually utilized UTAUT or its constructs in empirical research	-Significance relationship -Facilitating condition and behavioural intention need further attention and there is disparity with (Venkatesh et al., 2003) Constructs: -Performance expectancy -Effort expectancy -Social Influence -Facilitating Condition -Age, Gender, Experience, Voluntariness of use -Behavior Intention, -Use Behavior

Appendix C

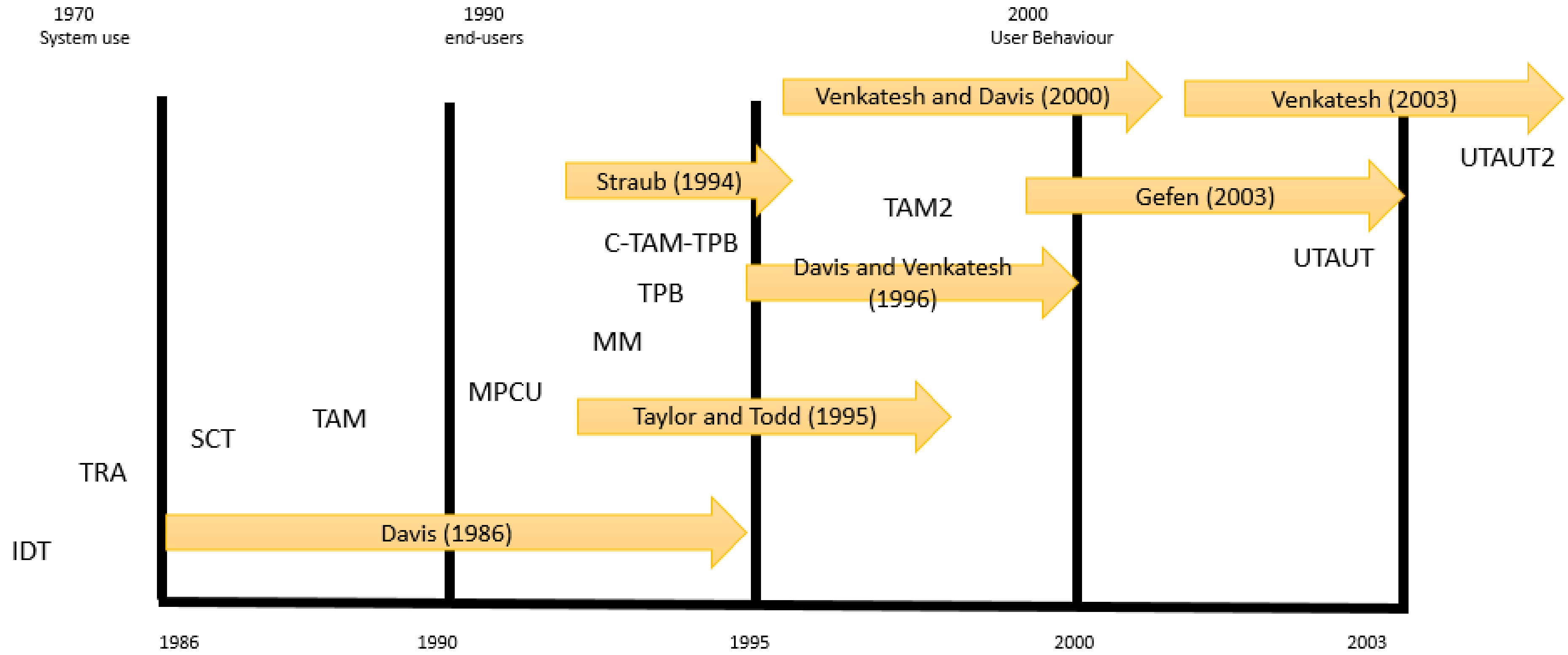
Summary of Acceptance Model and Theories

Models and Theories of User Acceptance			
Theory	Model	Constructs	Originally By
[1] Theory of Reason Action	TRA	Attitude Subjective norm	Fishbein and Ajzen (1975) derives from psychology to measure behavioral intention performance
[2] Theory of Technology Acceptance Model	TAM	Perceived Usefulness Perceived Ease of Use *Subjective Norm *Experience *Voluntariness	Davis (1989) develops new scale with 2 specific variables to determine user acceptance of technology
	TAM2	*Image *Job Relevance *Output Quality *Result Demonstrability	Venkatesh and Davis (2000) is adapted from TAM and includes more variables *TAM2 constructs only
[3] Motivational theory	Motivational Model	Extrinsic Motivation Intrinsic Motivation	Davis et al (1992) applies this model to technology adoption and use

[4] Theory of Planned Behavior	TPB	Attitude Subjective norm Perceived Behavioral Control	Ajzen (1991) extends TRA by including one or more variable to determine intention and behavior
[5] Combined TAM and TPB	C-TAM-TPB	Perceived Usefulness Perceived Ease of Use Attitude Subjective norm Perceived Behavioral Control	Taylor and Todd (1995)
[6] Model of PC Utilization Theory	MPCU	Social Factors Affect Perceived Consequences Facilitating Condition Habits	Thompson et al. (1991) is adjusted from theory of attitudes and behavior by Triandis (1980) to predict PC usage behavior
[7] Innovation Diffusion Theory	IDT	*Relative Advantage *Compatibility *Complexity *Observability *Trialability Image Voluntariness of Use	Rogers (1962) is adapted to information systems innovations by Moore and Benbasat (1991) *5 constructs from Rogers 2 additional identified

[8] Social Cognitive Theory	SCT	Encouragement by Others Others' Use Support Self-Efficacy Performance Outcome Expectations Personal Outcome Expectations Affect Anxiety	Bandura (1986) is applied to information system by Compeau and Higgins (1995) to determine the system usage
[9] Unified Theory of Acceptance and Use of Technology	UTAUT	Performance Expectancy Effort Expectancy *Social Influence* *Self-Efficacy* *Attitude towards using technology* *Facilitating Condition *Anxiety *Hedonic Motivation *Price Value *Habit	Venkatesh et al. (2003) integrates 8 theories and models to measure user intention, use behavior and usage on technology UTAUT : Organizational, *Individual* *UTAUT2 : Environment Added-Value: Koha OSLIS research Technological : SQ, IQ, C Organizational : ITS

Model Evolution



IDT : Innovation Diffusion Theory SCT : Social Cognitive Theory C-TAM-TPB : Combination of TAM-Theory of Planned Behaviour
TRA : Theory of Reasoned Action TAM : Technology Acceptance Model MM: Motivational Model MPCU : Model of PC Utilization

Appendix D

Summary of UTAUT and Information System’s Constructs and Items

Construct	UTAUT (2003)		Other studies	My Study using OSIS-UTAUT Model	
	Definition	Items Used		My Definition	My Item Used
Performance Expectancy	The degree to which an individual believes that using the system will help him or her to attain gains in job performance	• I find MyGateway useful in my study • Using MyGateway enables me to accomplish tasks more quickly • Using MyGateway increases my productivity • Using MyGateway increases my chance of getting a good grade	• Empirical Validation of Unified Theory of Acceptance and Use of Technology Model (Sundaravej, 2010) • The suitability of the Unified Theory of Acceptance and Use of Technology (UTAUT) model in open access adoption studies (Dulle & Minishi-Majanja, 2011) • Perceived usefulness, perceived ease of use, and user acceptance of information technology (Davis, 1989) • User acceptance of information technology: Toward a unified view (Venkatesh et al., 2003) • Visitor Management System by Applying the Model of UTAUT (Anwar et al., 2012) • A Case of Acceptance and Use of Electronic Library Service in Universities Based on SO-UTAUT Model (Ali & Sreenivasarao, 2013)	User’s job performance in using an open source library information system.	• Koha OSLIS is useful in my job • Using Koha OSLIS enables me to accomplish tasks more quickly • Using Koha OSLIS increases my tasks productivity • Using Koha OSLIS increases my chance of getting a promotion • Using Koha OSLIS enhance my effectiveness on the job

Construct	UTAUT (2003)		Other studies	My Study using OSIS-UTAUT Model	
	Definition	Items Used		My Definition	My Item Used
Effort Expectancy	The degree of ease associated with the use of the system	• My interaction with my MyGateway is clear and understandable • It is easy for me to become skilful at using MyGateway • I find MyGateway easy to use • Learning to operate MyGateway is easy for me • Is SIS user friendly? • Is SIS easy to use?	• Empirical Validation of Unified Theory of Acceptance and Use of Technology Model (Sundaravej, 2010) • The suitability of the Unified Theory of Acceptance and Use of Technology (UTAUT) model in open access adoption studies (Dulle & Minishi-Majanja, 2011) • Perceived usefulness, perceived ease of use, and user acceptance of information technology (Davis, 1989) • User acceptance of information technology: Toward a unified view (Venkatesh et al., 2003) • Visitor Management System by Applying the Model of UTAUT (Anwar et al., 2012) • A Case of Acceptance and Use of Electronic Library Service in Universities Based on SO-UTAUT Model (Ali & Sreenivasarao, 2013) • A Case of Acceptance and Use of Electronic Library Service in Universities Based on SO-UTAUT Model (Ali & Sreenivasarao, 2013) • Assessing the Validity of IS Success Models: An Empirical Test and Theoretical Analysis (Rai et al., 2002)	Evaluating the user and system interaction for an open source library information system	• I find Koha OSLIS is easy to use • My interaction with Koha OSLIS is clear and • I understand the flow of Koha OSLIS • The commands in Koha OSLIS is user-friendly • Koha OSLIS gives me greater control over my work • Koha OSLIS is easy to learn by new users’

Construct	(Adnanh & Lee, 2015; Galandere-Zile & Vinogradova, 2005)		Other studies	My Study using OSIS-UTAUT Model	
	Definition	Items Used		My Definition	My Item Used
Information Technology Skill	Skill gap which exist between the present information technology skill, knowledge and the required skill to fulfil the organization needs and objectives	• Qualitative study	• Preliminary Study on Open Source Software Implementation in the Malaysian Public Sector (Adnanh & Lee, 2015) • The influence of human factors and specialist involvement on information systems success (Martinsons & Chong, 1999) • Information systems methodologies: a review and assessment of their applicability to the selection, design and implementation of library and information systems (Rowley, 1993) • Emerging Free and Open Source Software Practices, IGI Publishing (an imprint of IGI Global) (Sulayman et al., 2008) • Where is the border between an information system and a knowledge management system? (Galandere-Zile & Vinogradova, 2005) • Computer Technology Industry Association (CompTIA) : (CompTIA, 2015)	Users' I.T. Knowledge, technical skill and computer skill in handling an open source library information system	• I have the technical skills and knowledge to use Koha OSLIS • I have the information technology knowledge to use Koha OSLIS • Koha OSLIS is easy to develop • Koha OSLIS maintenance is easy • I have the programming proficiency for developing Koha OSLIS • I have the competency in Koha OSLIS

Construct	(Lewis, 1995, 2002)		Other studies	My Study using OSIS-UTAUT Model	
	Definition	Items Used		My Definition	My Item Used
System Quality	The degree to which an individual believes that the system performs his or her job tasks well	• Compared to other computer software, DAS is easy to learn • Using DAS is often frustrating • It is easy for me to become skillful at using DAS • Using DAS require a lot of mental effort • I believe that DAS is cumbersome to use • The system increased my data processing capacity • The system can be run on computers other than the one presently used • The system could be used in other similar organizational environments, without any major modifications • Unauthorized access is controlled in several parts of the system • The data entry sections provide the capability to easily make corrections to data • Corrections to error in the system are easy to make • The same terminology is used throughout the system	• User acceptance model of open source software (Gallego et al., 2008) • Enterprise Systems Success: A Measurement Model (Gable et al., 2003) • A Partial Test and Development of DeLone and McLean's Model of IS Success (Seddon & Kiew, 1996) • User-Developed Applications and Information Systems Success: A Test of DeLone and McLean's Model (McGill et al., 2003) • A respecification and extension of the DeLone and McLean model of IS success (Seddon, 1997)	The interrelation or connectivity between system components and dependability, flow of an open source library information system in terms of response time, integration, reliability and portability	• Koha OSLIS response time is fast • The Koha OSLIS has compatible library standard like SIP2 and Z39.5 • Koha OSLIS can be used in other similar organizational environment, without any major modification • Koha OSLIS has all the functions that I expect it to have • Koha OSLIS increases my data processing capacity • I find the Koha OSLIS is well integrated with various functions • The terminologies used throughout Koha OSLIS are similar and identical • Koha OSLIS can operates on different platform other than the one presently used • Koha OSLIS is broken up into independent modules

Construct	(Lewis, 1995, 2002)		Other studies	My Study using OSIS-UTAUT Model	
	Definition	Items Used		My Definition	My Item Used
Information Quality	The process of maximizing the value of an organization information assets and assuring the information system created by the organization to meet the users' expectation	• Does SIS provide the precise information you need? • Does SIS provide output that exactly what you need? • Does SIS provide sufficient information to enable you to do your tasks? • Does SIS have error in the program that you must work around? • Are the output options (print types, page size, etc) sufficient for your use? • Is the information provided helpful regarding your questions or problems? • Do you think the output is presented in a useful format? • Is the information clear? • Is the system accurate? • Does the system provide sufficient information? • Does the system provide up-to-date information? • Do you get the information you need in time? • Does the system provide reports that seem to be just about exactly what you need? • Does the information content meet your needs? • Is the information provided by your system understandable?	• Enterprise Systems Success: A Measurement Model (Gable et al., 2003) • Assessing the Validity of IS Success Models: An Empirical Test and Theoretical Analysis (Rai et al., 2002) • A Partial Test and Development of DeLone and McLean's Model of IS Success (Seddon & Kiew, 1996) • User-Developed Applications and Information Systems Success: A Test of DeLone and McLean's Model (McGill et al., 2003) • A respecification and extension of the DeLone and McLean model of IS success (Seddon, 1997) • Using Information Quality for Competitive Advantage. (Talburt, 2011)	The information that resides in an open source library information system is evaluated based on data standard, information organization, data accuracy	• Koha OSLIS supports various library data formats like MARC21 and RSS • Koha OSLIS prompt error message upon fault input • Whenever I made a mistake, the information on Koha OSLIS is easily recovered • The terms used in the data entry operations are familiar to most librarians • The searching of information in Koha OSLIS is accurate • Data is clearly labeled in Koha OSLIS • Data is easily matched with other modules of the Koha OSLIS

Construct	(Adnanh & Lee, 2015; Galandere-Zile & Vinogradova, 2005)		Other studies	My Study using OSIS-UTAUT Model	
	Definition	Items Used		My Definition	My Item Used
Cost	The amount of price or value added for money	• Qualitative Study	• How library Management systems can demonstrate value for money from information and library services (Bailey, 2011) • Mobile Commerce User Acceptance Study in China: A Revised UTAUT Model (Min et al., 2008) • ABCD vs Koha Open Source Library Options (Macan & Fernandez, 2010) • The Role of Moderating Factors in Mobile Coupon Adoption: An Extended TAM Perspective (Jayasingh & Eze, 2010) • The influence of Human Factors and Specialist Involvement on Information System Success (Martinsons & Chong, 1999) • How Library Management Systems can demonstrate value for money from information and library services (Bailey, 2011)	Price for an open source library information system, training and maintenance	• Koha OSLIS is zero based budget • Koha OSLIS is able to save library budget • Koha OSLIS ownership cost is cheap compared to other proprietary library system • Koha OSLIS training cost is cheap • Koha OSLIS maintenance cost is cheap • The market value of library systems affect the adoption of Koha OSLIS

Construct	UTAUT (2003)		Other studies	My Study using OSIS-UTAUT Model	
	Definition	Items Used		My Definition	My Item Used
Social Influence	The degree to which an individual perceives the importance that others believe he or she should use the new system	• People who influence my behavior think that I should use MyGateway • People who are important to me think that I should use MyGateway • Professors in my classes have been helpful in the use of MyGateway • In general, the university has supported the use of MyGateway	• Empirical Validation of Unified Theory of Acceptance and Use of Technology Model (Sundaravej, 2010) • The suitability of the Unified Theory of Acceptance and Use of Technology (UTAUT) model in open access adoption studies (Dulle & Minishi-Majanja, 2011) • User acceptance model of open source software (Gallego et al., 2008)	The influence by individual characteristic and others for the use of an open source library information system	• The Information Technology personnel influence my behavior on the deployment of Koha OSLIS • The library association think that the library professionals should use Koha OSLIS • People who influence my behavior at work think that I should use Koha OSLIS • People who are important to me at work think that I should use Koha OSLIS • The top management supports the adoption of Koha OSLIS

Construct	UTAUT (2003)		Other studies	My Study using OSIS-UTAUT Model	
	Definition	Items Used		My Definition	My Item Used
Self-Efficacy	The degree to which an individual believes, confidence or behavior on his or her capacity to produce specific performance while using the new system	• I can complete a job or task using MyGateway, if there is no one around to tell me what to do as I go • I can complete a job or task using MyGateway, if I can call someone for help if I get stuck • I can complete a job or task using MyGateway, if I have a lot of time to complete the job for which the software is provided • I can complete a job or task using MyGateway, if I have just the built-in help facility for assistance	• Empirical Validation of Unified Theory of Acceptance and Use of Technology Model (Sundaravej, 2010) • The suitability of the Unified Theory of Acceptance and Use of Technology (UTAUT) model in open access adoption studies (Dulle & Minishi-Majanja, 2011)	The user's confidence level, ability and believe on an open source library information system	• I can complete a job or task using Koha OSLIS even when there is no one around to tell me what to do as I go • I can complete a job or task using Koha OSLIS, despite problems arising • I can complete a job or task using Koha OSLIS, regardless of the amount of time that I have • I can complete a job or task using Koha OSLIS, if the system has built-in help facility for assistance

Construct	UTAUT (2003)		Other studies	My Study using OSIS-UTAUT Model	
	Definition	Items Used		My Definition	My Item Used
Attitude Towards Using system	Individual positive or negative feeling about performing the target behavior in using a system. Individual overall affective reaction to using system	• Using MyGateway is a good idea • MyGateway makes study more interesting • Studying with MyGateway in fun • I like studying with MyGateway	• Empirical Validation of Unified Theory of Acceptance and Use of Technology Model (Sundaravej, 2010) • User acceptance of information technology: Toward a unified view (Venkatesh et al., 2003) • Belief, attitude, intention, and behavior: An introduction to theory and research (Fishbein & Ajzen, 1977) • Personal computing: toward a conceptual model utilization (Thompson, Higgins, & Howell, 1991) • Toward an Understanding of the Behavioral Intention to Use an Information System (Jackson et al., 1997)	The user's favor or disfavor, way of thinking, norm characteristics and habits to use an open source library information system	• Using Koha OSLIS is a good idea • Hands-on experience with Koha OSLIS is fun • I like working with Koha OSLIS • I need more practice on Koha OSLIS • I need more exposure in using Koha OSLIS • I find Koha OSLIS ease the library operations • I find Koha OSLIS ease the library services

Construct	UTAUT (2003)		Other studies	My Study using OSIS-UTAUT Model	
	Definition	Items Used		My Definition	My Item Used
Acceptance of System	Acceptance is the use Behavioral study on users' behavior towards an implemented system	• I am dependent on SIS • I am willing to use SIS • Overall, I feel comfortable using the SIS	• User Acceptance of Information Technology: system characteristics, user perceptions and behavioural impacts (Davis, 1993) • The suitability of the Unified Theory of Acceptance and Use of Technology (UTAUT) model in open access adoption studies (Dulle & Minishi-Majanja, 2011) • Visitor Management System by Applying the Model of UTAUT (Anwar et al., 2012) • User acceptance model of open source software (Gallego et al., 2008) • Toward an Understanding of the Behavioral Intention to Use an Information System (Jackson et al., 1997) • Assessing the Validity of IS Success Models: An Empirical Test and Theoretical Analysis (Rai et al., 2002) • A Partial Test and Development of DeLone and McLean's Model of IS Success (Seddon & Kiew, 1996) • User-Developed Applications and Information Systems Success: A Test of DeLone and McLean's Model (McGill et al., 2003) • A respecification and extension of the DeLone and McLean model of IS success (Seddon, 1997) • Conceptualizing system Usage: An Approach and Empirical Test (Burton-Jones & Straub, 2003)	User's behavior of effort put into, willingness to use, recommend and value the system which gives impact to organizational decision making for an open source library information system adoption and implementation, technological acceptance and individual job commitments.	• I am willing to use Koha OSLIS • I will support the use of Koha OSLIS • I will recommend Koha OSLIS to other libraries • I will suggest my library to continue to use Koha OSLIS • I accept the use of Koha OSLIS in my library

Appendix E

LETTER OF INSTRUMENT VALIDATION – 1

Professor Dr. Azlan Amran

Dekan

Pusat Pengajian Siswazah Perniagaan

Universiti Sains Malaysia

Dated: 1st of May 2016

LETTER OF INSTRUMENT VALIDATION - 2

Dr. Mehran Nejati

Pensyarah Kanan

Pusat Pengajian Siswazah Perniagaan

Universiti Sains Malaysia

Dated: 1st of May 2016

Appendix F

A SURVEY ON LIBRARIANS' ACCEPTANCE OF KOHA OPEN SOURCE LIBRARY INFORMATION SYSTEM

Dear respondent,

Thank you for your participation. The aim of this study is to investigate librarians' acceptance of Koha Open Source Library Information System (**Koha OSLIS**). This survey is being carried out as partial fulfillment of my PhD work.

There are 2 main sections in this questionnaire which comprises:

Section A: Demographics of the respondent

Section B: Acceptance of Koha OSLIS

Your participation in this research is voluntary. Your anonymity is assured. The use of all data will be limited to this research and resulting publications, as authorized by University of Malaya. Your valuable input to this study can greatly enhance our understanding on the acceptance of Koha among Malaysian librarians.

Sincerely,

ZAINAB AJAB MOHIDEEN

Phd Candidate
Department of Library & Information Science
Faculty of Computer Science & Information Technology
University of Malaya

Information Technology Officer
Institutional Repository Division
Hamzah Sendut Library
University Science Malaysia
Tel: 0125277150
Email: zainab@usm.my

Section A: Respondents demographics

[*Please mark X against the corresponding answer*]

1. Institutional Library you currently work at:

- [ ] USM Main campus
- [ ] USM Medical campus
- [ ] USM Engineering campus
- [ ] USM IPPT campus
- [ ] Al-Madinah International University
- [ ] Asia e-University Knowledge Centre
- [ ] University Kuala Lumpur
- [ ] University Tenaga Nasional

2. Gender

- [ ] Male
- [ ] Female

3. Age

- [ ] Less than 25 years old
- [ ] 25 to 35 years old
- [ ] 36 to 45 years old
- [ ] More than 45 years old

4. How do you know about Koha OSLIS?

- [ ] Internet
- [ ] Library Association
- [ ] Librarians
- [ ] Others

5. How long have you been a Koha OSLIS user?

- [ ] Less than 1 year
- [ ] 1 to 5 years
- [ ] More than 5 years

6. On an average, how many hours of training did you received prior to using Koha OSLIS?

- [ ] 1 to 5 hours
- [ ] More than 5 hours
- [ ] None

Section B: Librarians' Acceptance of Koha Open Source Library Information System

Please read the following statements carefully and rate your familiarity and agreement level with Koha OSLIS using the following scale:

1	Strongly Disagree
2	Disagree
3	Neutral (Neither disagree nor agree)
4	Agree
5	Strongly Agree

Acceptance of Koha open source library information system **(Koha OSLIS)**		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Performance Expectancy						
1.	Koha OSLIS is useful in my job.	1	2	3	4	5
2.	Using Koha OSLIS enables me to accomplish tasks more quickly.	1	2	3	4	5
3.	Using Koha OSLIS increases productivity of my tasks.	1	2	3	4	5
4.	Using Koha OSLIS increases my chance of getting a promotion.	1	2	3	4	5
5.	Using Koha OSLIS enhances my effectiveness on the job.	1	2	3	4	5
Effort Expectancy						
6.	I find Koha OSLIS easy to use.	1	2	3	4	5
7.	My interaction with Koha OSLIS is clear.	1	2	3	4	5
8.	I understand the flow of Koha OSLIS.	1	2	3	4	5
9.	The commands in Koha OSLIS is user-friendly.	1	2	3	4	5
10.	Koha OSLIS gives me greater control over my work.	1	2	3	4	5
11.	Koha OSLIS is easy to learn by new users'.	1	2	3	4	5
Information Technology Skill						
12.	I have the technical skill to use Koha OSLIS.	1	2	3	4	5
13.	I have the information technology knowledge to use Koha OSLIS.	1	2	3	4	5
14.	Koha OSLIS is easy to develop.	1	2	3	4	5
15.	Koha OSLIS maintenance is easy.	1	2	3	4	5

16.	I have the programming proficiency for developing Koha OSLIS.	1	2	3	4	5
17.	I have the competency in Koha OSLIS.	1	2	3	4	5
System Quality						
18.	Koha OSLIS response time is fast.	1	2	3	4	5
19.	Koha OSLIS has compatible library system standard like SIP2 and Z39.5.	1	2	3	4	5
20.	Koha OSLIS can be used in other similar organizational environments, without any major modification.	1	2	3	4	5
21.	Koha OSLIS has all the functions that I expect it to have.	1	2	3	4	5
22.	Koha OSLIS increases my data processing capacity.	1	2	3	4	5
23.	I find the Koha OSLIS is well integrated with various functions.	1	2	3	4	5
24.	The terminologies used throughout Koha OSLIS are similar and identical.	1	2	3	4	5
25.	Koha OSLIS can operates on different platform other than the one presently used.	1	2	3	4	5
26.	Koha OSLIS is broken up into independent modules.	1	2	3	4	5
Information Quality						
27.	Koha OSLIS supports various library data formats like MARC21 and RSS.	1	2	3	4	5
28.	Koha OSLIS prompts error message upon faulty input.	1	2	3	4	5
29.	Whenever I make a mistake, the information on Koha OSLIS is easily recovered.	1	2	3	4	5
30.	The terms used in the data entry operations are familiar to most librarians'.	1	2	3	4	5
31.	The searching of information in Koha OSLIS is accurate.	1	2	3	4	5
32.	Data is clearly labeled in Koha OSLIS.	1	2	3	4	5
33.	Data is easily matched with other modules of the Koha OSLIS.	1	2	3	4	5
Cost						
34.	Koha OSLIS is a zero based budget.	1	2	3	4	5
35.	Koha OSLIS is able to save library budget.	1	2	3	4	5
36.	Koha OSLIS ownership cost is cheap compared to other proprietary library systems.	1	2	3	4	5
37.	Koha OSLIS training cost is cheap.	1	2	3	4	5
38.	Koha OSLIS maintenance cost is cheap.	1	2	3	4	5
39.	The market value of library systems affect the adoption of Koha OSLIS.	1	2	3	4	5

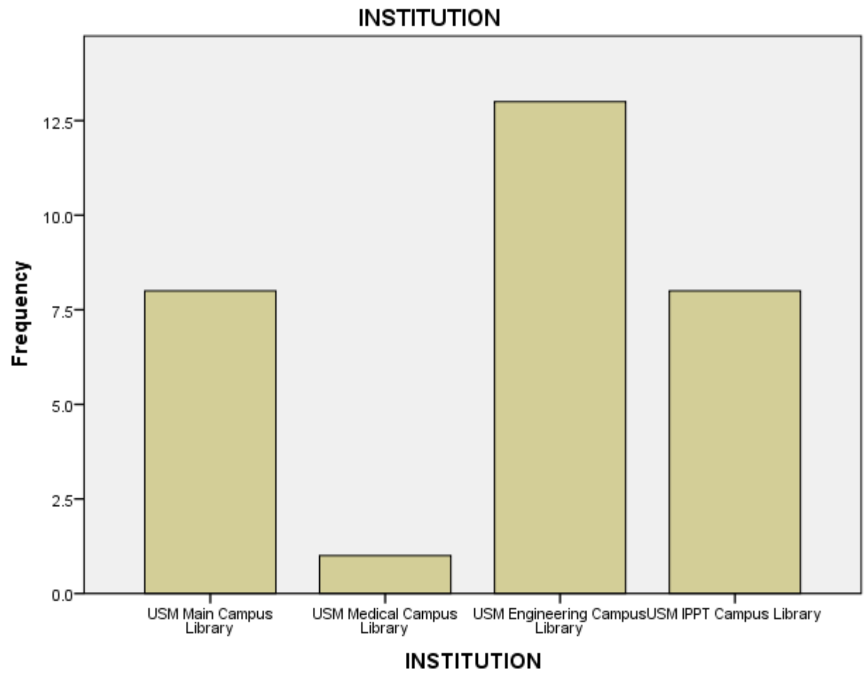
Social Influence						
40.	The Information Technology personnel influence my behavior on the deployment of Koha OSLIS.	1	2	3	4	5
41.	The library association think that the library professionals should use Koha OSLIS.	1	2	3	4	5
42.	People who influence my behavior at work think that I should use Koha OSLIS.	1	2	3	4	5
43.	People who are important to me at work think that I should use Koha OSLIS.	1	2	3	4	5
44.	The top management supports the adoption of Koha OSLIS.	1	2	3	4	5
45.	Overall, the library professionals have supported the use of Koha OSLIS.	1	2	3	4	5
Self-Efficacy						
46.	I can complete a job or task using Koha OSLIS, even when there is no one around to tell me what to do.	1	2	3	4	5
47.	I can complete a job or task using Koha OSLIS, despite problems arising.	1	2	3	4	5
48.	I can complete a job or task using Koha OSLIS, regardless of the amount of time that I have.	1	2	3	4	5
49.	I can complete a job or task using Koha OSLIS, if the system has built-in help facility for assistance.	1	2	3	4	5
Attitude towards using system						
50.	Using Koha OSLIS is a good idea.	1	2	3	4	5
51.	Hands-on experience with Koha OSLIS is fun.	1	2	3	4	5
52.	I like working with Koha OSLIS.	1	2	3	4	5
53.	I need more practice on Koha OSLIS.	1	2	3	4	5
54.	I need more exposure in using Koha OSLIS.	1	2	3	4	5
55.	I find Koha OSLIS ease the library operations.	1	2	3	4	5
56.	I find Koha OSLIS ease the library services.	1	2	3	4	5
Acceptance of Koha Open Source Library Information System						
57.	I am willing to use Koha OSLIS.	1	2	3	4	5
58.	I will support the use of Koha OSLIS.	1	2	3	4	5
59.	I will recommend Koha OSLIS to other libraries.	1	2	3	4	5
60.	I will suggest my library to continue to use Koha OSLIS.	1	2	3	4	5
61.	I accept the use of Koha OSLIS in my library.	1	2	3	4	5

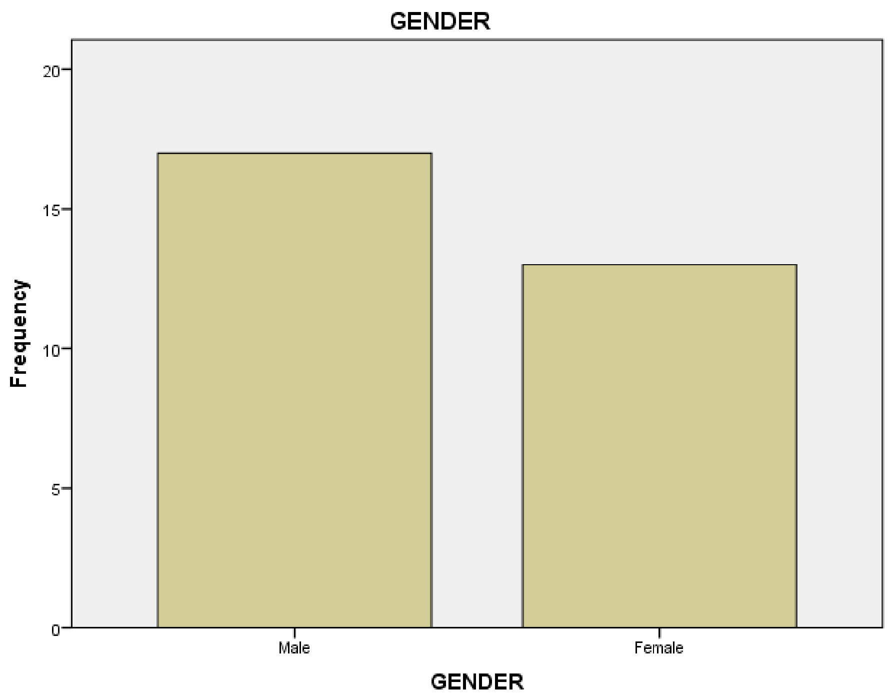
THANK YOU!

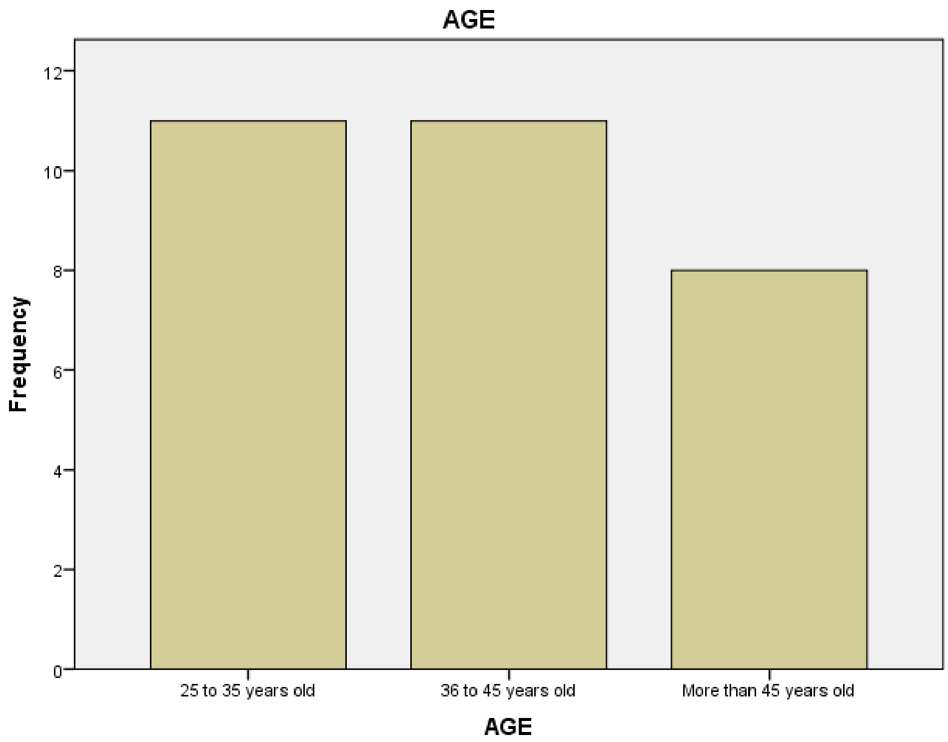
A GIVEN . . . Standardized tasks and processes are the foundation for continuous improvement and employee empowerment! – *Albert Einstein,*

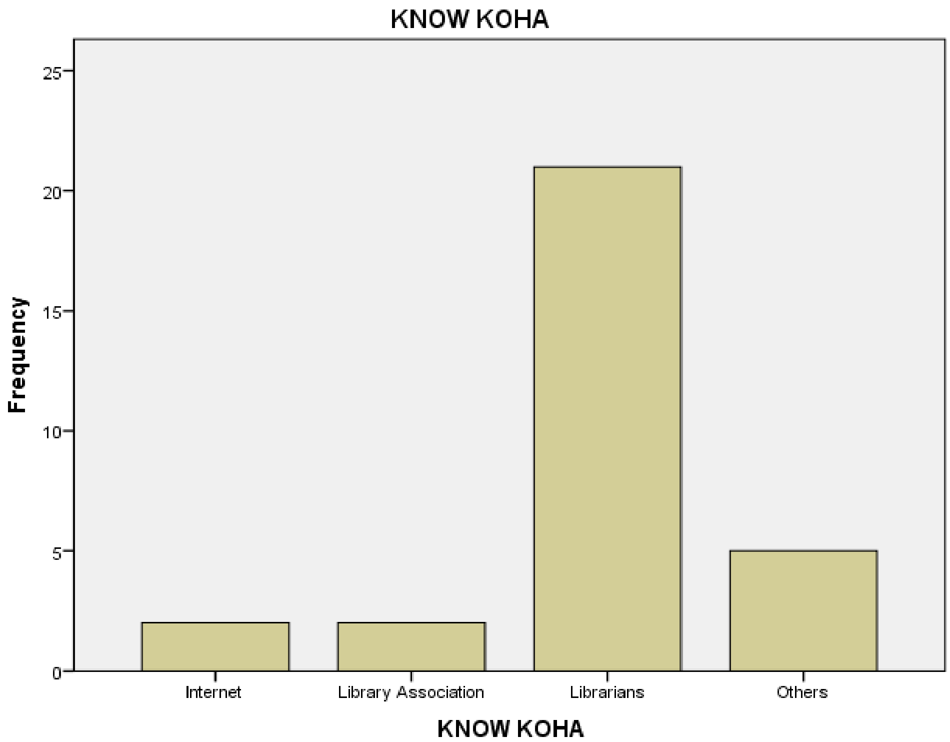
Appendix G

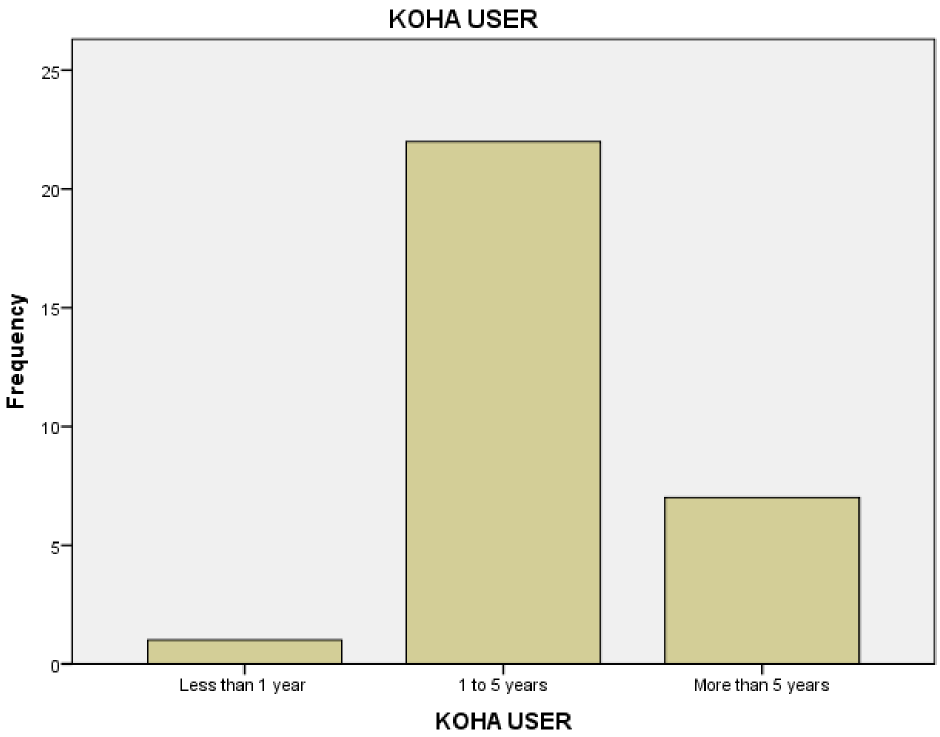
Pre-Test: Demographic Respondents

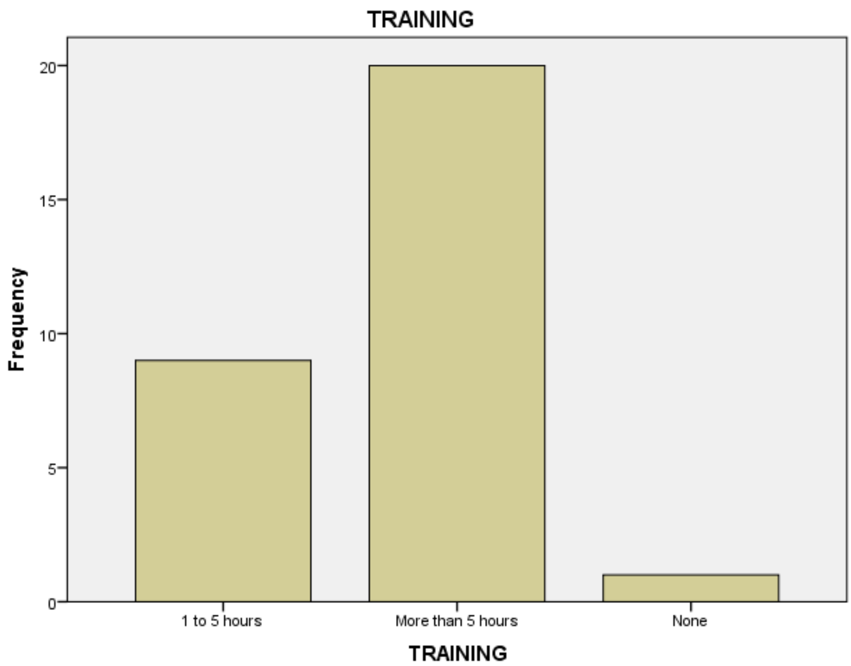





AGE
Frequency
0
2
4
6
8
10
12
25 to 35 years old
36 to 45 years old
More than 45 years old
AGE

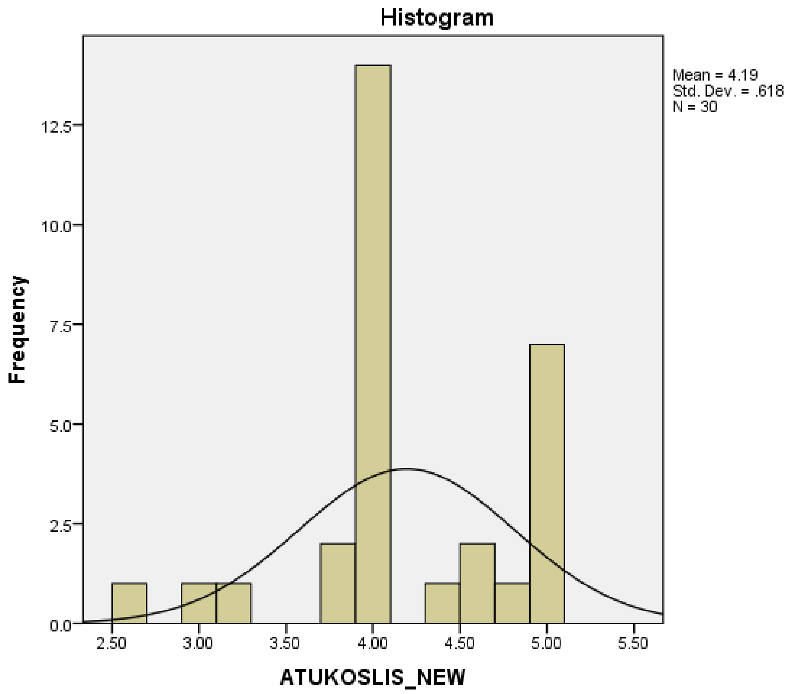

KNOW KOHA
Frequency
0
5
10
15
20
25
Internet
Library Association
Librarians
Others
KNOW KOHA


KOHA USER
Frequency
25
20
15
10
5
0
Less than 1 year
1 to 5 years
More than 5 years
KOHA USER


TRAINING
Frequency
20
15
10
5
0
1 to 5 hours
More than 5 hours
None
TRAINING

Appendix H

Pre Test: Normality Test of Data



Skewness:
-To measure symmetry or lack of symmetry
-Negative Skewness: Left-hand tail will be longer than the right-hand tail

Rule of thumb:
-Skewness between -1.0 and -0.5 or 0.5 and 1.0 the data are moderately skewed
-Therefore, in my research the Skewness = - .455 is considered as moderately skewed.

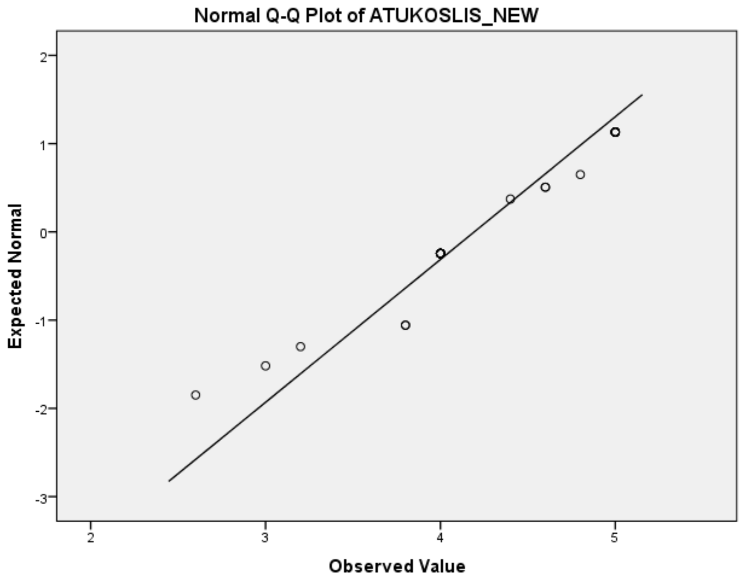
Kurtosis :
-Kurtosis > 0 then the distribution has heavier tails and is called aleptokurtic distribution → [Kurtosis = .345]
-Therefore, in my research the Kurtosis = .345 is considered as aleptokurtic distribution

Pre-Test Descriptive Statistics

Statistics		
ATUKOSLIS_NEW		
N	Valid	30
	Missing	0
Mean		4.1933
Median		4.0000
Mode		4.00
Skewness		-.455
Std. Error of Skewness		.427
Kurtosis		.345
Std. Error of Kurtosis		.833

ATUKOSLIS_NEW					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2.60	1	3.3	3.3	3.3
	3.00	1	3.3	3.3	6.7
	3.20	1	3.3	3.3	10.0
	3.80	2	6.7	6.7	16.7
	4.00	14	46.7	46.7	63.3
	4.40	1	3.3	3.3	66.7
	4.60	2	6.7	6.7	73.3
	4.80	1	3.3	3.3	76.7
	5.00	7	23.3	23.3	100.0
	Total	30	100.0	100.0	

Q-Q Plot of ATUKOSLIS



95% Confidence ATUKOSLIS

Descriptive				
			Statistic	Std. Error
ATUKOSLIS_NEW	Mean		4.1933	.11285
	95% Confidence Interval for Mean	Lower Bound	3.9625	
		Upper Bound	4.4241	
	5% Trimmed Mean		4.2296	
	Median		4.0000	
	Variance		.382	
	Std. Deviation		.61808	
	Minimum		2.60	
	Maximum		5.00	
	Range		2.40	
	Interquartile Range		.85	
	Skewness		-.455	.427
	Kurtosis		.345	.833

Descriptive Statistics

	N	Skewness		Kurtosis	
	Statistic	Statistic	Std. Error	Statistic	Std. Error
PERFORMANCE EXPECTANCY-1	30	-.404	.427	-.567	.833
PERFORMANCE EXPECTANCY-2	30	.081	.427	.589	.833
PERFORMANCE EXPECTANCY-3	30	.000	.427	1.122	.833
PERFORMANCE EXPECTANCY-4	30	.119	.427	-.232	.833
PERFORMANCE EXPECTANCY-5	30	-.969	.427	3.705	.833
EFFORT EXPECTANCY-6	30	-.086	.427	-.357	.833
EFFORT EXPECTANCY-7	30	-.040	.427	-.082	.833
EFFORT EXPECTANCY-8	30	.000	.427	-.364	.833
EFFORT EXPECTANCY-9	30	.022	.427	.623	.833
EFFORT EXPECTANCY-10	30	-.409	.427	.591	.833
EFFORT EXPECTANCY-11	30	.022	.427	.623	.833
INFORMATION TECHNOLOGY SKILL-12	30	-.867	.427	.630	.833
INFORMATION TECHNOLOGY SKILL-13	30	-.465	.427	-.026	.833
INFORMATION TECHNOLOGY SKILL-14	30	-.074	.427	-.796	.833
INFORMATION TECHNOLOGY SKILL-15	30	-.097	.427	-.083	.833
INFORMATION TECHNOLOGY SKILL-16	30	-.159	.427	.327	.833
INFORMATION TECHNOLOGY SKILL-17	30	-.222	.427	-.085	.833
SYSTEM QUALITY-18	30	.323	.427	-.722	.833
SYSTEM QUALITY-19	30	.087	.427	-.770	.833
SYSTEM QUALITY-20	30	-.141	.427	.056	.833
SYSTEM QUALITY-21	30	-.003	.427	.229	.833
SYSTEM QUALITY-22	30	-.417	.427	.523	.833
SYSTEM QUALITY-23	30	-.192	.427	.459	.833
SYSTEM QUALITY-24	30	.086	.427	-.357	.833
SYSTEM QUALITY-25	30	-1.031	.427	1.695	.833
SYSTEM QUALITY-26	30	-.549	.427	.382	.833
INFORMATION QUALITY-27	30	.109	.427	1.089	.833
INFORMATION QUALITY-28	30	-.781	.427	.893	.833
INFORMATION QUALITY-29	30	-.106	.427	.097	.833
INFORMATION QUALITY-30	30	-.022	.427	.623	.833
INFORMATION QUALITY-31	30	-.731	.427	.353	.833
INFORMATION QUALITY-32	30	.117	.427	-.298	.833
INFORMATION QUALITY-33	30	.040	.427	-.082	.833

COST-34	30	-.292	.427	-.260	.833
COST-35	30	-1.489	.427	4.157	.833
COST-36	30	-1.032	.427	2.793	.833
COST-37	30	-1.649	.427	5.533	.833
COST-38	30	-.969	.427	3.705	.833
COST-39	30	-.778	.427	2.127	.833
SOCIAL INFLUENCE-40	30	-.658	.427	1.567	.833
SOCIAL INFLUENCE-41	30	-.028	.427	.208	.833
SOCIAL INFLUENCE-42	30	-1.163	.427	1.409	.833
SOCIAL INFLUENCE-43	30	-1.231	.427	2.747	.833
SOCIAL INFLUENCE-44	30	.106	.427	.097	.833
SOCIAL INFLUENCE-45	30	.266	.427	.945	.833
SELF-EFFICACY-46	30	-.484	.427	.332	.833
SELF-EFFICACY-47	30	.385	.427	-.609	.833
SELF-EFFICACY-48	30	.385	.427	-.609	.833
SELF-EFFICACY-49	30	.210	.427	-.234	.833
ATTITUDE TOWARDS USING TECHNOLOGY-50	30	-.541	.427	.565	.833
ATTITUDE TOWARDS USING TECHNOLOGY-51	30	-.467	.427	.673	.833
ATTITUDE TOWARDS USING TECHNOLOGY-52	30	-.335	.427	.041	.833
ATTITUDE TOWARDS USING TECHNOLOGY-53	30	-.144	.427	-.629	.833
ATTITUDE TOWARDS USING TECHNOLOGY-54	30	-.686	.427	.286	.833
ATTITUDE TOWARDS USING TECHNOLOGY-55	30	-.833	.427	2.608	.833
ATTITUDE TOWARDS USING TECHNOLOGY-56	30	-.778	.427	2.127	.833
ACCEPTANCE OF KOHA OSLIS-57	30	-.871	.427	2.275	.833
ACCEPTANCE OF KOHA OSLIS-58	30	-.040	.427	-.082	.833
ACCEPTANCE OF KOHA OSLIS-59	30	-.819	.427	1.089	.833
ACCEPTANCE OF KOHA OSLIS-60	30	-.242	.427	-.634	.833
ACCEPTANCE OF KOHA OSLIS-61	30	-.189	.427	-.482	.833
Valid N (listwise)	30				

Descriptive Statistics		
Construct	Skewness	Kurtosis
Based on the Skewness and Kurtosis table, the Skewness and Kurtosis for SYSTEM QUALITY Do Not appear to be significant problem in the data set. By using the benchmark ±1, item SQ-25 exhibited significant skewness and demonstrated the kurtosis.		
SYSTEM QUALITY-18	.323	-.722
SYSTEM QUALITY-19	.087	-.770
SYSTEM QUALITY-20	-.141	.056
SYSTEM QUALITY-21	-.003	.229
SYSTEM QUALITY-22	-.417	.523
SYSTEM QUALITY-23	-.192	.459
SYSTEM QUALITY-24	.086	-.357
SYSTEM QUALITY-25	**-1.031**	**1.695**
SYSTEM QUALITY-26	-.549	.382
Based on the Skewness and Kurtosis table, the Skewness and Kurtosis for INFORMATION QUALITY Do Not appear to be significant problem in the data set. By using the benchmark ±1, no item exhibited significant skewness and only item IQ-27 demonstrated the kurtosis.		
INFORMATION QUALITY-27	.109	**1.089**
INFORMATION QUALITY-28	-.781	.893
INFORMATION QUALITY-29	-.106	.097
INFORMATION QUALITY-30	-.022	.623
INFORMATION QUALITY-31	-.731	.353
INFORMATION QUALITY-32	.117	-.298
INFORMATION QUALITY-33	.040	-.082
Based on the Skewness and Kurtosis table, the Skewness and Kurtosis for COST Do Not appear to be significant problem in the data set. By using the benchmark ±5, items C-35, C36 and C-37 exhibited significant skewness and items C-35, C-36, C-37, C-38 and C-39 demonstrated the kurtosis.		
COST-34	-.292	-.260
COST-35	**-1.489**	**4.157**
COST-36	**-1.032**	**2.793**
COST-37	**-1.649**	**5.533**
COST-38	-.969	**3.705**
COST-39	-.778	**2.127**

Descriptive Statistics		
Construct	Skewness	Kurtosis
Based on the Skewness and Kurtosis table, the Skewness and Kurtosis for SOCIAL INFLUENCE Do Not appear to be significant problem in the data set. By using the benchmark ±2, item SI-42 and SI-43 exhibited significant skewness and also demonstrates kurtosis including item SI-40 which also demonstrated the kurtosis.		
SOCIAL INFLUENCE-40	-.658	**1.567**
SOCIAL INFLUENCE-41	-.028	.208
SOCIAL INFLUENCE-42	**-1.163**	**1.409**
SOCIAL INFLUENCE-43	**-1.231**	**2.747**
SOCIAL INFLUENCE-44	.106	.097
SOCIAL INFLUENCE-45	.266	.945
Based on the Skewness and Kurtosis table, the Skewness and Kurtosis for SELF-EFFICACY Do Not appear to be significant problem in the data set. By using the benchmark ±1, No items exhibited significant skewness and kurtosis is between the platykurtic and aleptokurtic distribution.		
SELF-EFFICACY-46	-.484	.332
SELF-EFFICACY-47	.385	-.609
SELF-EFFICACY-48	.385	-.609
SELF-EFFICACY-49	.210	-.234
Based on the Skewness and Kurtosis table, the Skewness and Kurtosis for ATTITUDE TOWARDS USING TECHNOLOGY Do Not appear to be significant problem in the data set. By using the benchmark ±1, No items exhibited significant skewness and items ATUT-55 and ATUT-56 demonstrated the kurtosis.		
ATTITUDE TOWARDS USING TECHNOLOG-50	-.541	.565
ATTITUDE TOWARDS USING TECHNOLOG-51	-.467	.673
ATTITUDE TOWARDS USING TECHNOLOG-52	-.335	.041
ATTITUDE TOWARDS USING TECHNOLOG-53	-.144	-.629
ATTITUDE TOWARDS USING TECHNOLOG-54	-.686	.286
ATTITUDE TOWARDS USINGTECHNOLOGY-55	-.833	**2.608**
ATTITUDE TOWARDS USING TECHNOLOGY-56	-.778	**2.127**
Based on the Skewness and Kurtosis table, the Skewness and Kurtosis for ACCEPTANCE OF KOHA OSLIS Do Not appear to be significant problem in the data set. By using the benchmark ±2, No items exhibited significant skewness and items ATUKOSLIS-57 and ATUKOSLIS-59 demonstrated the kurtosis.		
ACCEPTANCE OF KOHA OSLIS-57	-.871	**2.275**
ACCEPTANCE OF KOHA OSLIS-58	-.040	-.082
ACCEPTANCE OF KOHA OSLIS-59	-.819	**1.089**
ACCEPTANCE OF KOHA OSLIS-60	-.242	-.634
ACCEPTANCE OF KOHA OSLIS-61	-.189	-.482

Constructs	Skewness	Kurtosis
PE_NEW	-.055	1.842
EE_NEW	.322	.024
ITS_NEW	.062	.055
SQ_NEW	-.058	.969
IQ_NEW	-.081	1.521
C_NEW	-2.201	8.409
SI_NEW	-.969	.2474
SE_NEW	.693	.511
ATUT_NEW	-.462	.977
ATUKOSLIS_NEW	-.455	.345

Therefore, this **research justified rationale for the normality** of the variables concerned using the skewness and kurtosis. In conclusion the data are considered to be **Normal Distribution.**

Appendix I

Pre-Test Item Correlation

Item Correlation: The below value must be < than 1.000

Inter-Item Correlation Matrix For Performance Expectancy

	PERFORMANCE EXPECTANCY-1	PERFORMANCE EXPECTANCY-2	PERFORMANCE EXPECTANCY-3	PERFORMANCE EXPECTANCY-4	PERFORMANCE EXPECTANCY-5
PERFORMANCE EXPECTANCY-1	1.000	-	-	-	-
PERFORMANCE EXPECTANCY-2	.502	1.000	-	-	-
PERFORMANCE EXPECTANCY-3	.534	.599	1.000	-	-
PERFORMANCE EXPECTANCY-4	.443	.357	.592	1.000	-
PERFORMANCE EXPECTANCY-5	.605	.706	.854	.612	1.000

Inter-Item Correlation Matrix For Effort Expectancy

	EFFORT EXPECTANCY-6	EFFORT EXPECTANCY-7	EFFORT EXPECTANCY-8	EFFORT EXPECTANCY-9	EFFORT EXPECTANCY-10	EFFORT EXPECTANCY-11
EFFORT EXPECTANCY-6	1.000	-	-	-	-	-
EFFORT EXPECTANCY-7	.765	1.000	-	-	-	-
EFFORT EXPECTANCY-8	.643	.815	1.000	-	-	-
EFFORT EXPECTANCY-9	.716	.611	.578	1.000	-	-
EFFORT EXPECTANCY-10	.620	.569	.614	.725	1.000	-
EFFORT EXPECTANCY-11	.610	.611	.482	.777	.636	1.000

Inter-Item Correlation Matrix For Information Technology Skill

	INFORMATION TECHNOLOGY SKILL-12	INFORMATION TECHNOLOGY SKILL-13	INFORMATION TECHNOLOGY SKILL-14	INFORMATION TECHNOLOGY SKILL-15	INFORMATION TECHNOLOGY SKILL-16	INFORMATION TECHNOLOGY SKILL-17
INFORMATION TECHNOLOGY SKILL-12	1.000	-	-	-	-	-
INFORMATION TECHNOLOGY SKILL-13	.862	1.000	-	-	-	-
INFORMATION TECHNOLOGY SKILL-14	.464	.386	1.000	-	-	-
INFORMATION TECHNOLOGY SKILL-15	.558	.488	.661	1.000	-	-
INFORMATION TECHNOLOGY SKILL-16	.568	.436	.597	.608	1.000	-
INFORMATION TECHNOLOGY SKILL-17	.578	.634	.625	.666	.610	1.000

Inter-Item Correlation Matrix For System Quality

	SYSTEM QUALITY-18	SYSTEM QUALITY-19	SYSTEM QUALITY-20	SYSTEM QUALITY-21	SYSTEM QUALITY-22	SYSTEM QUALITY-23	SYSTEM QUALITY-24	SYSTEM QUALITY-25	SYSTEM QUALITY-26
SYSTEM QUALITY-18	1.000	-	-	-	-	-	-	-	-
SYSTEM QUALITY-19	.553	1.000	-	-	-	-	-	-	-
SYSTEM QUALITY-20	.499	.454	1.000	-	-	-	-	-	-
SYSTEM QUALITY-21	.569	.673	.455	1.000	-	-	-	-	-
SYSTEM QUALITY-22	.538	.413	.475	.490	1.000	-	-	-	-
SYSTEM QUALITY-23	.654	.532	.416	.520	.848	1.000	-	-	-
SYSTEM QUALITY-24	.534	.382	.471	.655	.418	.520	1.000	-	-
SYSTEM QUALITY-25	.534	.553	.640	.655	.690	.631	.595	1.000	-
SYSTEM QUALITY-26	.201	.184	.295	.218	.146	.123	.391	.295	1.000

Inter-Item Correlation Matrix For Information Quality

	INFORMATION QUALITY-27	INFORMATION QUALITY-28	INFORMATION QUALITY-29	INFORMATION QUALITY-30	INFORMATION QUALITY-31	INFORMATION QUALITY-32	INFORMATION QUALITY-33
INFORMATION QUALITY-27	1.000	-	-	-	-	-	-
INFORMATION QUALITY-28	.339	1.000	-	-	-	-	-
INFORMATION QUALITY-29	.529	.374	1.000	-	-	-	-
INFORMATION QUALITY-30	.603	.415	.653	1.000	-	-	-
INFORMATION QUALITY-31	.496	.430	.475	.538	1.000	-	-
INFORMATION QUALITY-32	.477	.177	.492	.691	.650	1.000	-
INFORMATION QUALITY-33	.596	.290	.423	.611	.546	.763	1.000

Inter-Item Correlation Matrix For Cost

	COST-34	COST-35	COST-36	COST-37	COST-38	COST-39
COST-34	1.000	-	-	-	-	-
COST-35	.413	1.000	-	-	-	-
COST-36	.341	.675	1.000	-	-	-
COST-37	.501	.595	.694	1.000	-	-
COST-38	.320	.577	.807	.678	1.000	-
COST-39	.294	.531	.818	.556	.752	1.000

Inter-Item Correlation Matrix For Social Influence

	SOCIAL INFLUENCE-40	SOCIAL INFLUENCE-41	SOCIAL INFLUENCE-42	SOCIAL INFLUENCE-43	SOCIAL INFLUENCE-44	SOCIAL INFLUENCE-45
SOCIAL INFLUENCE-40	1.000	-	-	-	-	-
SOCIAL INFLUENCE-41	.602	1.000	-	-	-	-
SOCIAL INFLUENCE-42	.578	.729	1.000	-	-	-
SOCIAL INFLUENCE-43	.734	.661	.816	1.000	-	-
SOCIAL INFLUENCE-44	.530	.307	.559	.625	1.000	-
SOCIAL INFLUENCE-45	.555	.301	.649	.652	.888	1.000

Inter-Item Correlation Matrix For Self-Efficacy

	SELF-EFFICACY-46	SELF-EFFICACY-47	SELF-EFFICACY-48	SELF-EFFICACY-49
SELF-EFFICACY-46	1.000	-	-	-
SELF-EFFICACY-47	.657	1.000	-	-
SELF-EFFICACY-48	.586	.919	1.000	-
SELF-EFFICACY-49	.216	.395	.395	1.000

Inter-Item Correlation Matrix For Attitude Towards Using Technology

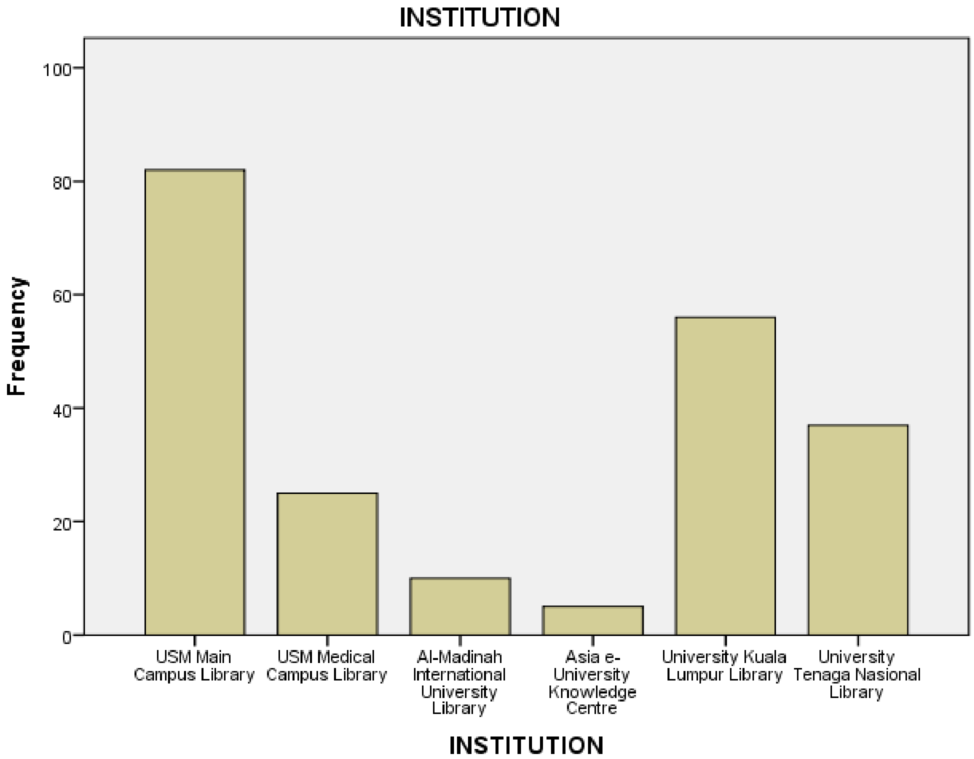
	ATTITUDE TOWARDS USING TECHNOLOGY-50	ATTITUDE TOWARDS USING TECHNOLOGY-51	ATTITUDE TOWARDS USING TECHNOLOGY-52	ATTITUDE TOWARDS USING TECHNOLOGY-53	ATTITUDE TOWARDS USING TECHNOLOGY-54	ATTITUDE TOWARDS USING TECHNOLOGY-55	ATTITUDE TOWARDS USING TECHNOLOGY-56
ATTITUDE TOWARDS USING TECHNOLOGY-50	1.000	-	-	-	-	-	-
ATTITUDE TOWARDS USING TECHNOLOGY-51	.717	1.000	-	-	-	-	-
ATTITUDE TOWARDS USING TECHNOLOGY-52	.856	.811	1.000	-	-	-	-
ATTITUDE TOWARDS USING TECHNOLOGY-53	.510	.627	.699	1.000	-	-	-
ATTITUDE TOWARDS USING TECHNOLOGY-54	.439	.652	.612	.855	1.000	-	-
ATTITUDE TOWARDS USING TECHNOLOGY-55	.794	.828	.848	.589	.633	1.000	-
ATTITUDE TOWARDS USING TECHNOLOGY-56	.764	.876	.822	.638	.682	.962	1.000

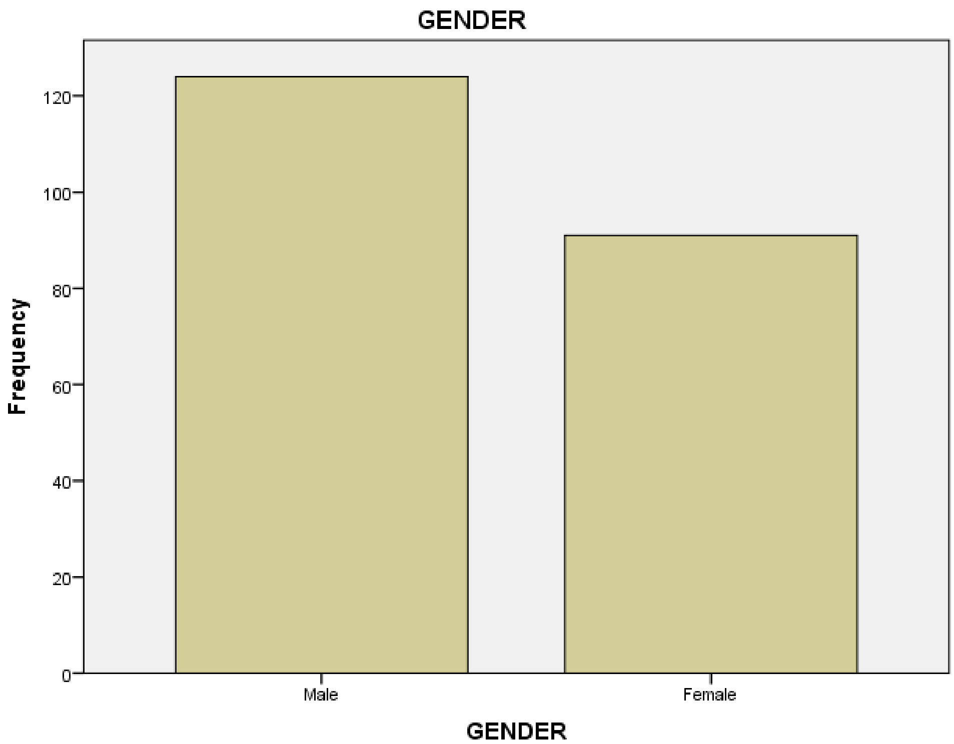
Inter-Item Correlation Matrix For Acceptance Of Koha OSLIS

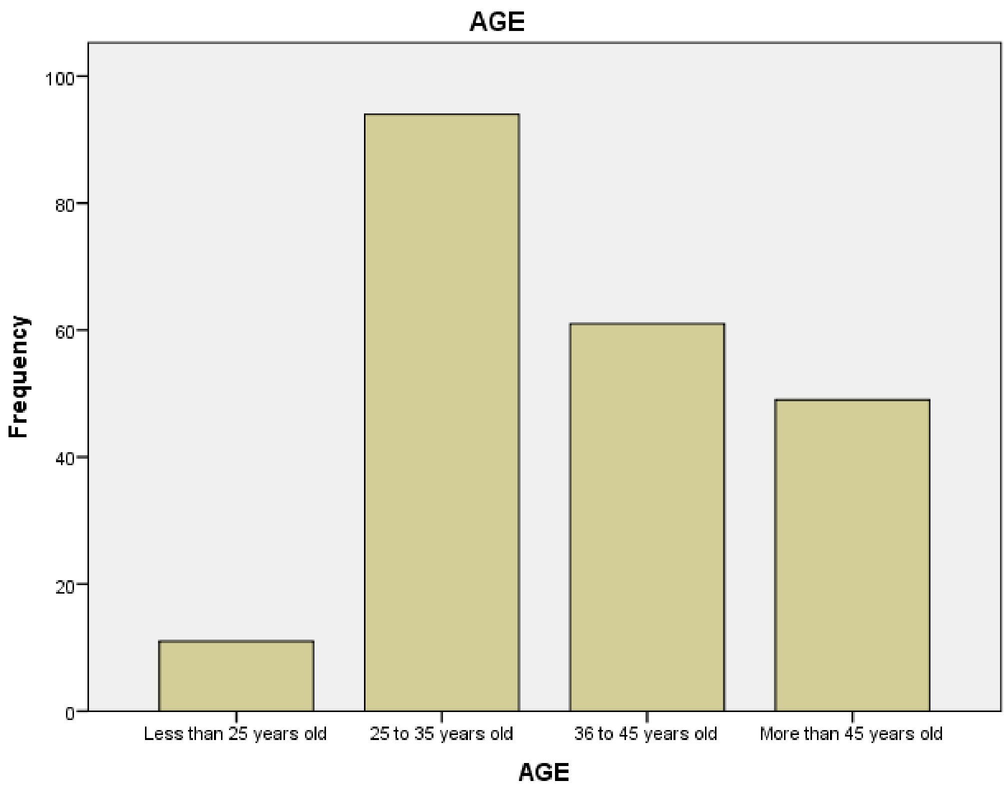
	ACCEPTANCE OF KOHA OSLIS-57	ACCEPTANCE OF KOHA OSLIS-58	ACCEPTANCE OF KOHA OSLIS-59	ACCEPTANCE OF KOHA OSLIS-60	ACCEPTANCE OF KOHA OSLIS-61
ACCEPTANCE OF KOHA OSLIS-57	1.000	-	-	-	-
ACCEPTANCE OF KOHA OSLIS 58	.969	1.000	-	-	-
ACCEPTANCE OF KOHA OSLIS-59	.904	.871	1.000	-	-
ACCEPTANCE OF KOHA OSLIS-60	.777	.789	.834	1.000	-
ACCEPTANCE OF KOHA OSLIS-61	.832	.831	.891	.888	1.000

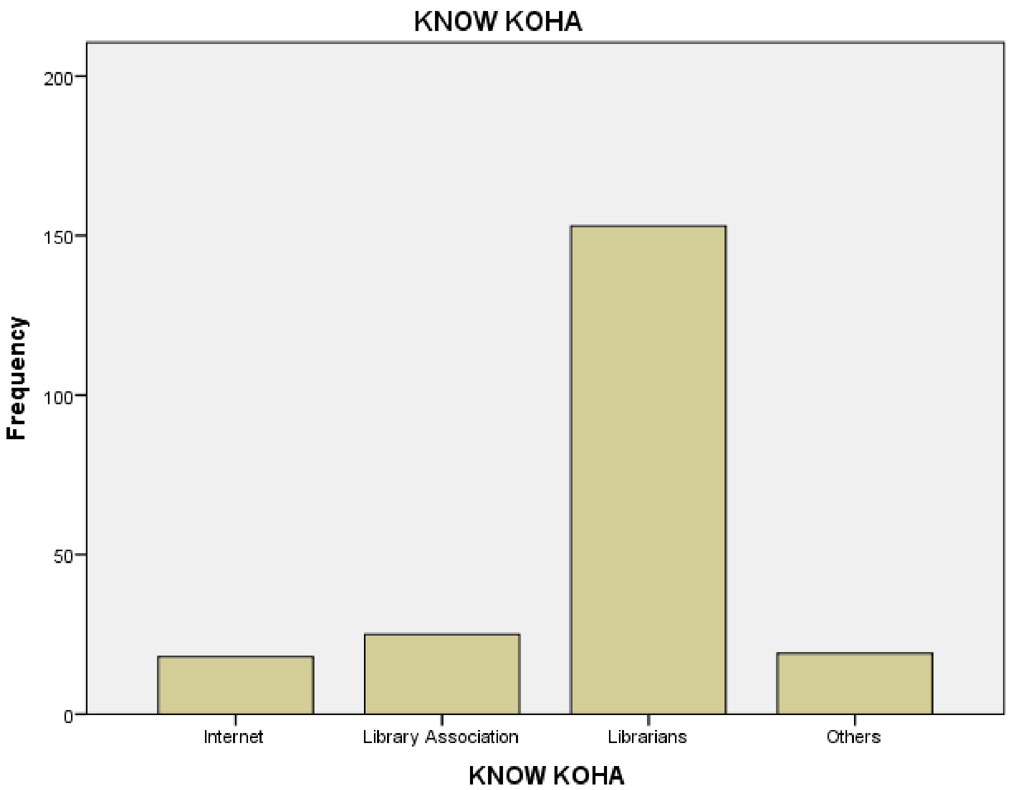
Appendix J

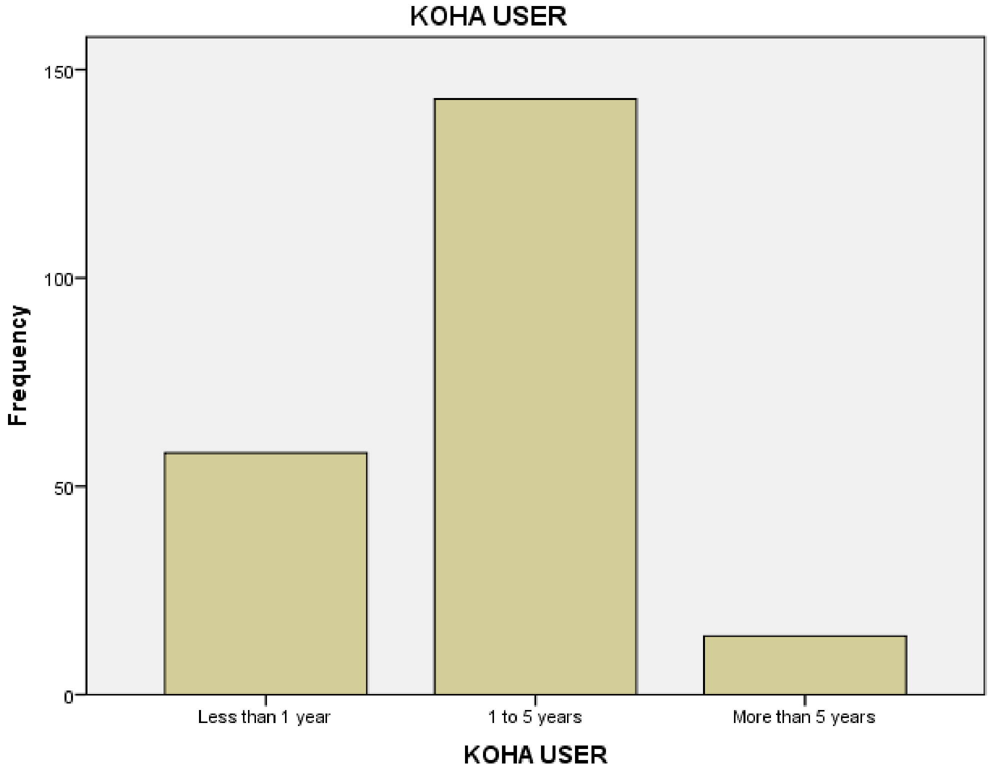
Main Test- Demographic Respondents

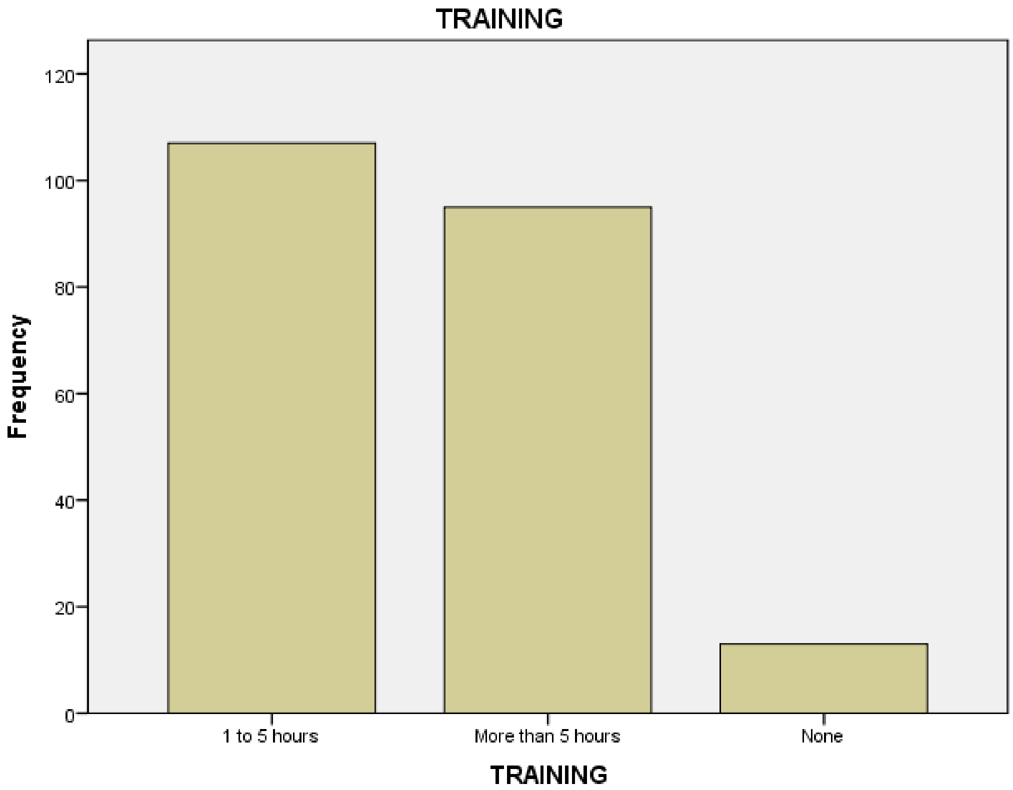





AGE
Frequency
100
80
60
40
20
0
Less than 25 years old
25 to 35 years old
36 to 45 years old
More than 45 years old
AGE


KNOW KOHA
Frequency
200
150
100
50
0
Internet
Library Association
Librarians
Others
KNOW KOHA

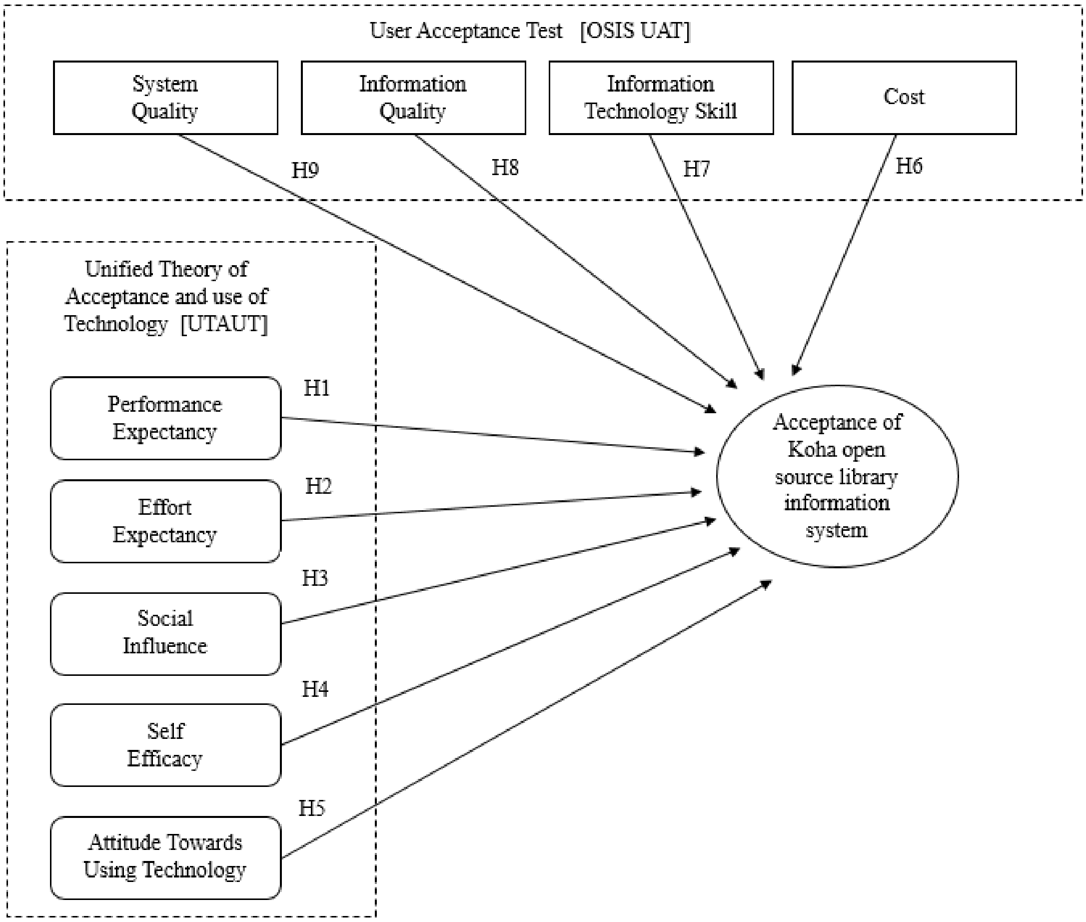

KOHA USER
150
100
50
0
Frequency
Less than 1 year
1 to 5 years
More than 5 years
KOHA USER


TRAINING
120
100
80
60
40
20
0
Frequency
1 to 5 hours
More than 5 hours
None
TRAINING

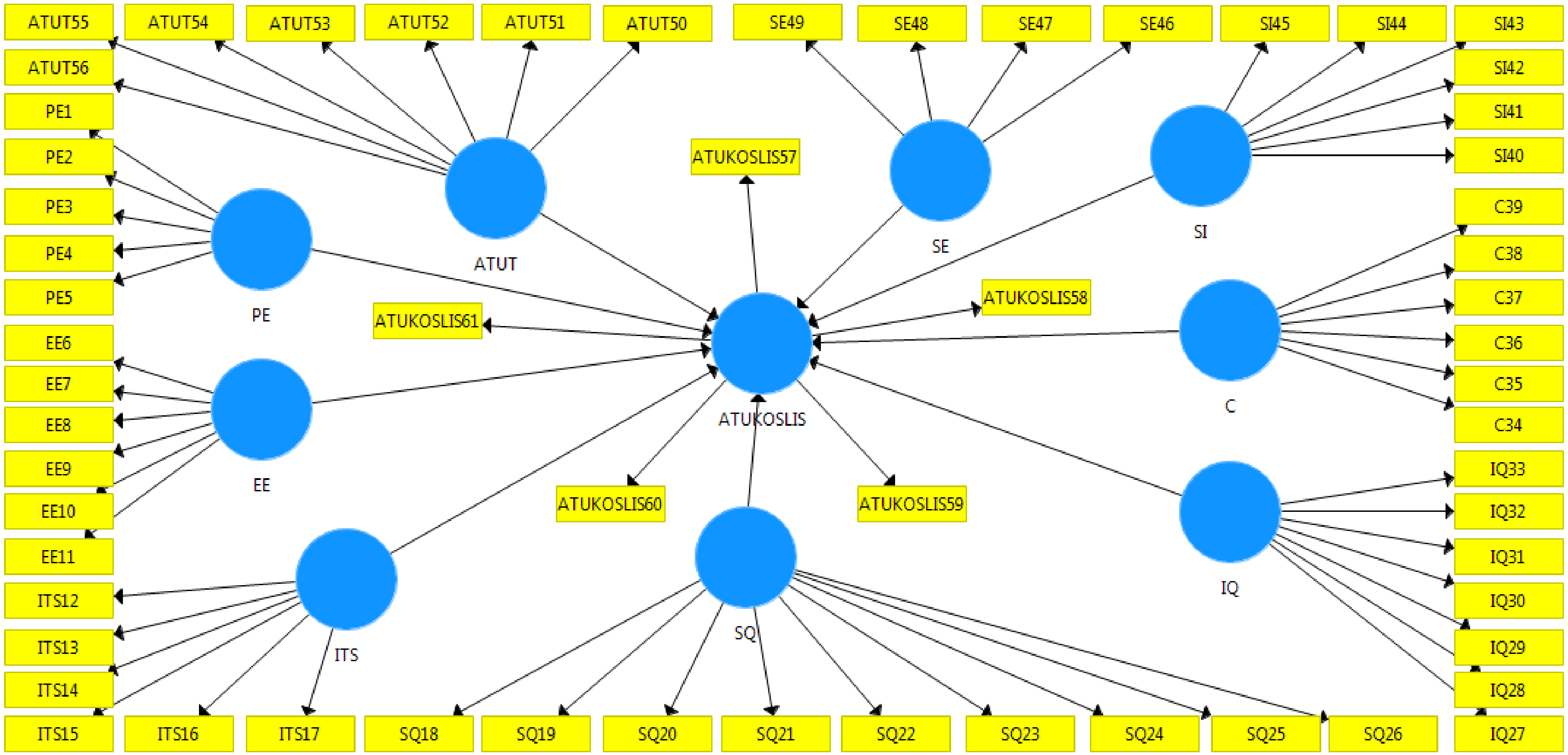
Appendix K

Manual to run PLS 3.0 Professional version (30 days trial)

Initial OSIS-UTAUT Theoretical Framework

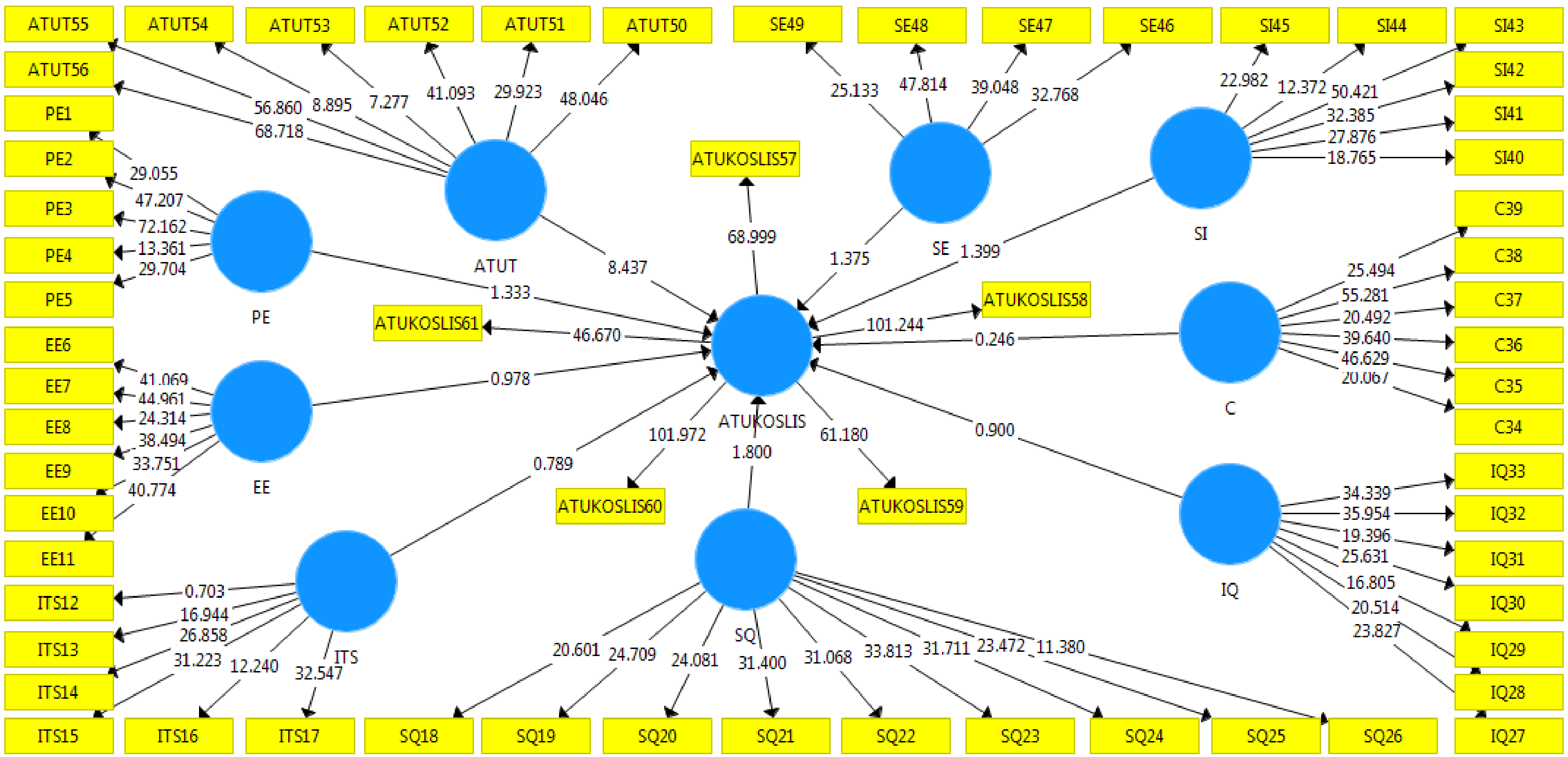


STEP 1: INITIAL MODEL

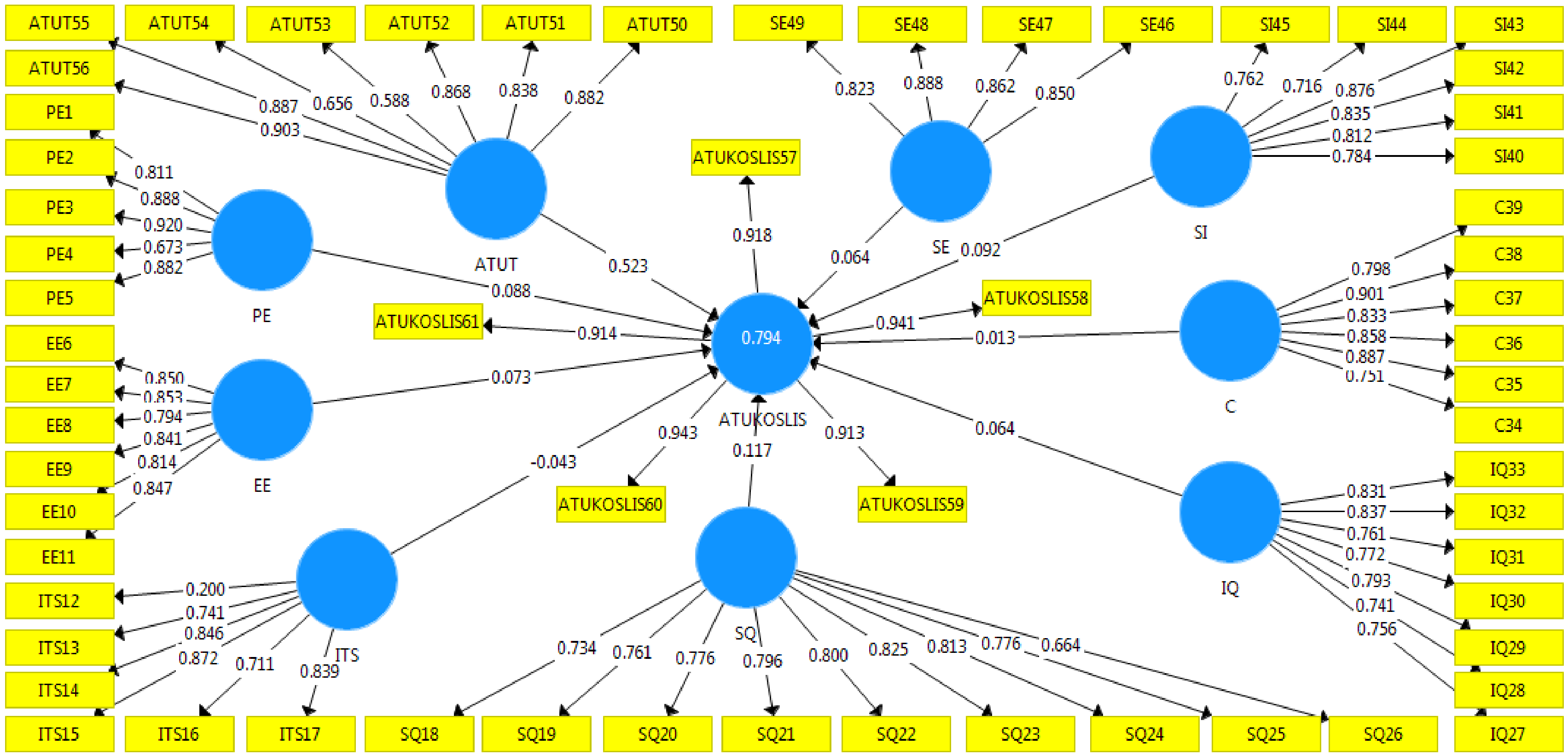


STEP 2: RUN BOOTSTRAPPING, factor loading > 1.64, p = 0.10, 1 tailed Confidence level

Factor loading smaller than 1.64 is removed

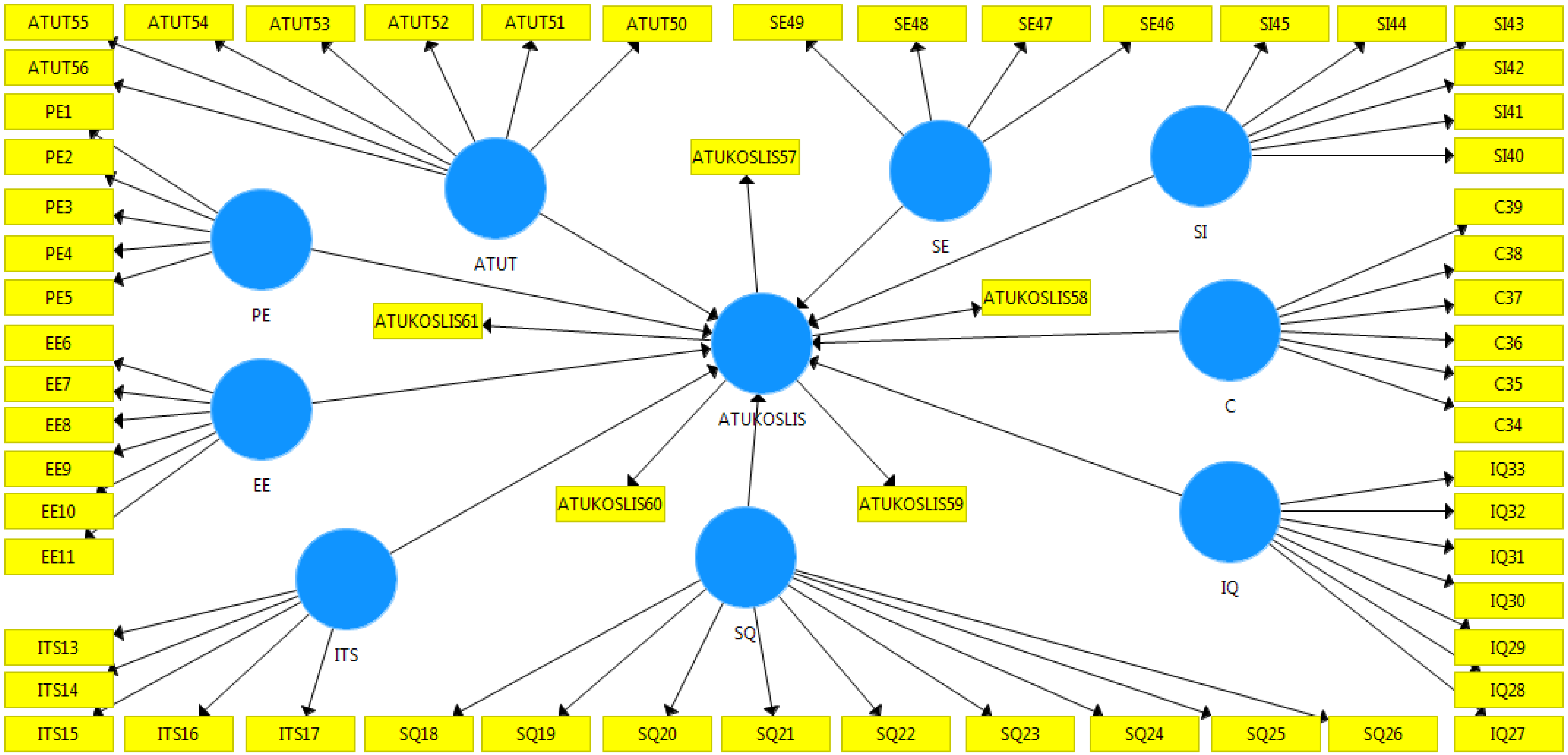


STEP 3: RUN PLS ALGORITHM

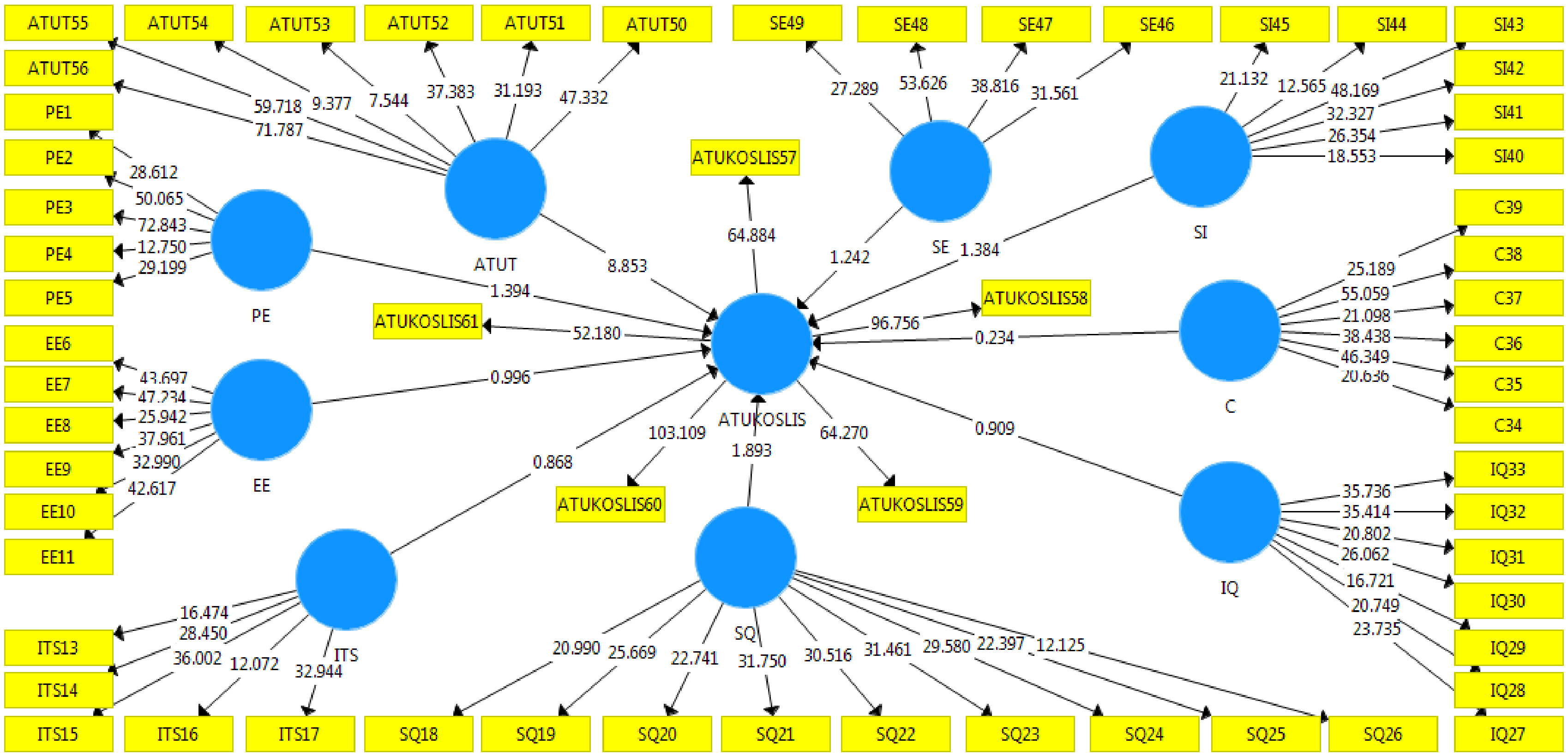


255

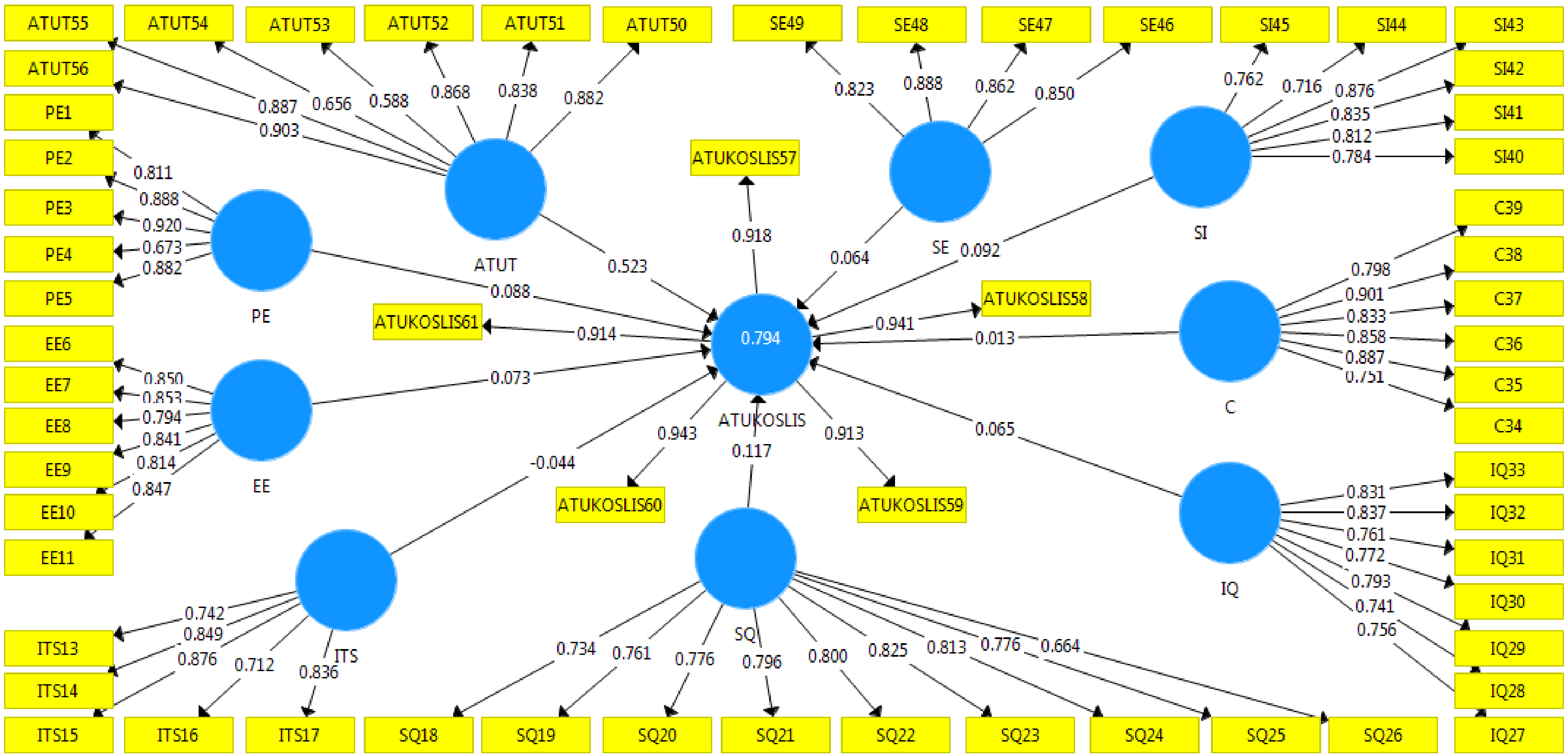
STEP 4: REMOVED ITS 12 < 1.64 loading factor



STEP 5: RE – RUN BOOTSTRAPPING



STEP 6: RE – RUN PLS ALGORITHM



STEP 7: **CONVERGENT VALIDITY**: Cross Loading > 0.7 loading value

Removed the lowest: ATUT53 remove it and re-run bootstrap and PLS Algorithm

Next look for 2nd lowest: ATUT54 remove it and re-run bootstrap and PLS Algorithm

Then look for 3rd lowest: SQ26 remove it and re-run bootstrap and PLS Algorithm

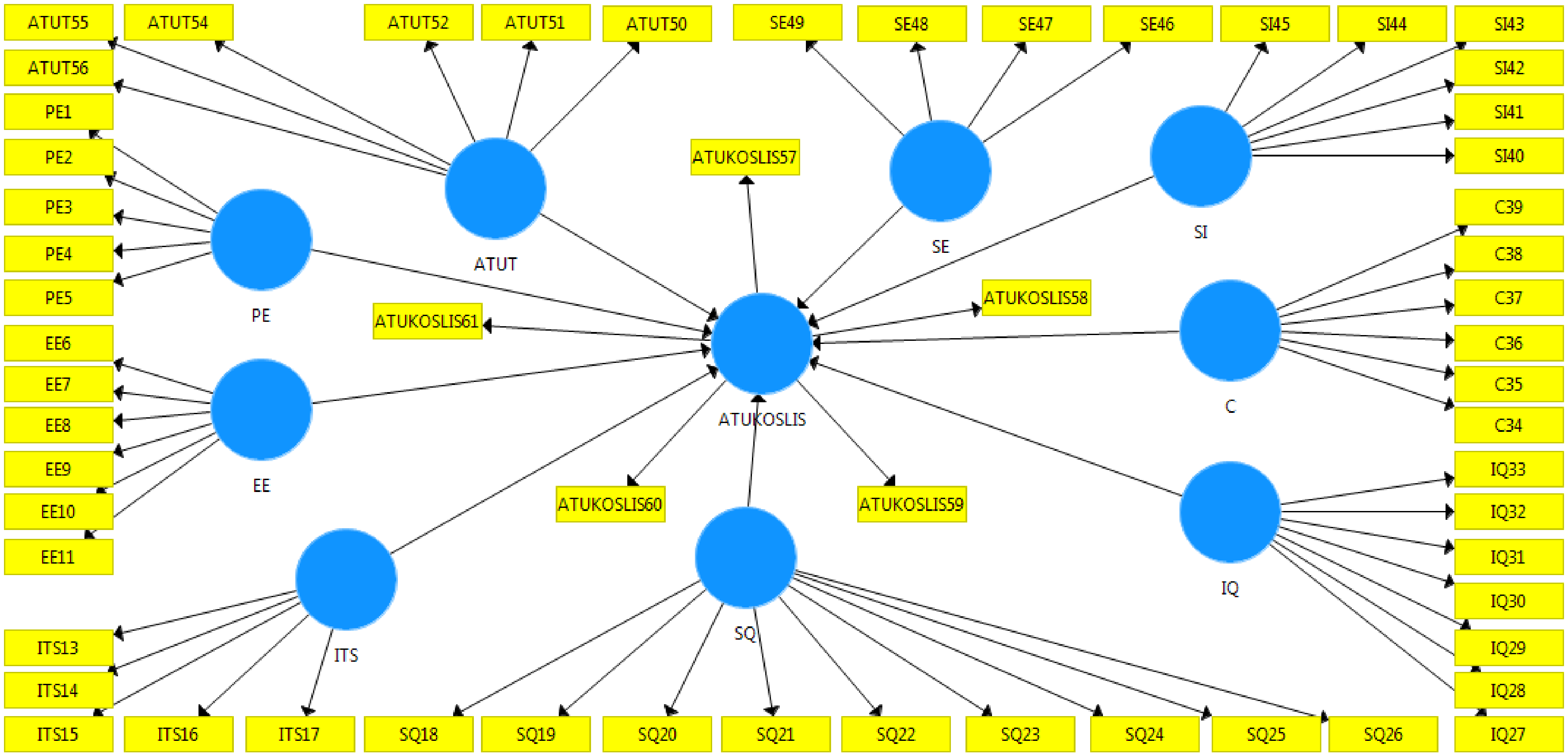
Finally look for the 4th lowest: PE4 remove it and re-run bootstrap and PLS Algorithm

	ATUKOSLIS	ATUT	C	EE	IQ	ITS	PE	SE	SI	SQ
ATUKOSLIS57	0.918									
ATUKOSLIS58	0.941									
ATUKOSLIS59	0.913									
ATUKOSLIS60	0.943									
ATUKOSLIS61	0.914									
ATUT50		0.882								
ATUT51		0.838								
ATUT52		0.868								
ATUT53		0.588	1ST removed							
ATUT54		0.656	2nd removed							
ATUT55		0.887								
ATUT56		0.903								
C34			0.751							
C35			0.887							
C36			0.858							
C37			0.833							

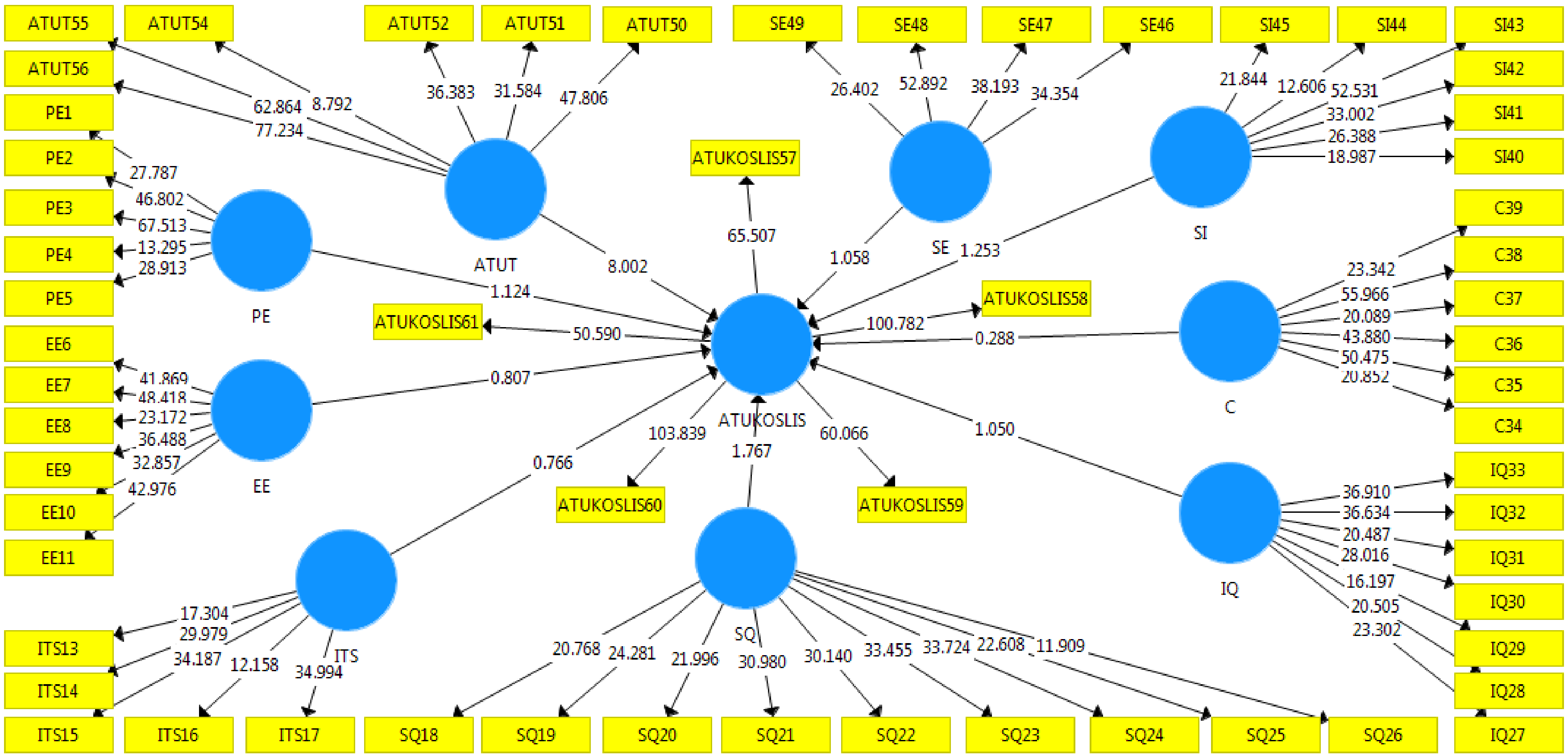
C38			0.901							
C39			0.798							
EE10				0.814						
EE11				0.847						
EE6				0.850						
EE7				0.853						
EE8				0.794						
EE9				0.841						
IQ27					0.756					
IQ28					0.741					
IQ29					0.793					
IQ30					0.772					
IQ31					0.761					
IQ32					0.837					
IQ33					0.831					
ITS13						0.742				
ITS14						0.849				
ITS15						0.876				
ITS16						0.712				
ITS17						0.836				
PE1							0.811			
PE2							0.888			
PE3							0.920			
PE4							0.673	4th removed		
PE5							0.882			
SE46								0.850		

SE47								0.862		
SE48								0.888		
SE49								0.823		
SI40									0.784	
SI41									0.812	
SI42									0.835	
SI43									0.876	
SI44									0.716	
SI45									0.762	
SQ18										0.734
SQ19										0.761
SQ20										0.776
SQ21										0.796
SQ22										0.800
SQ23										0.825
SQ24										0.813
SQ25										0.776
SQ26									3rd removed	0.664

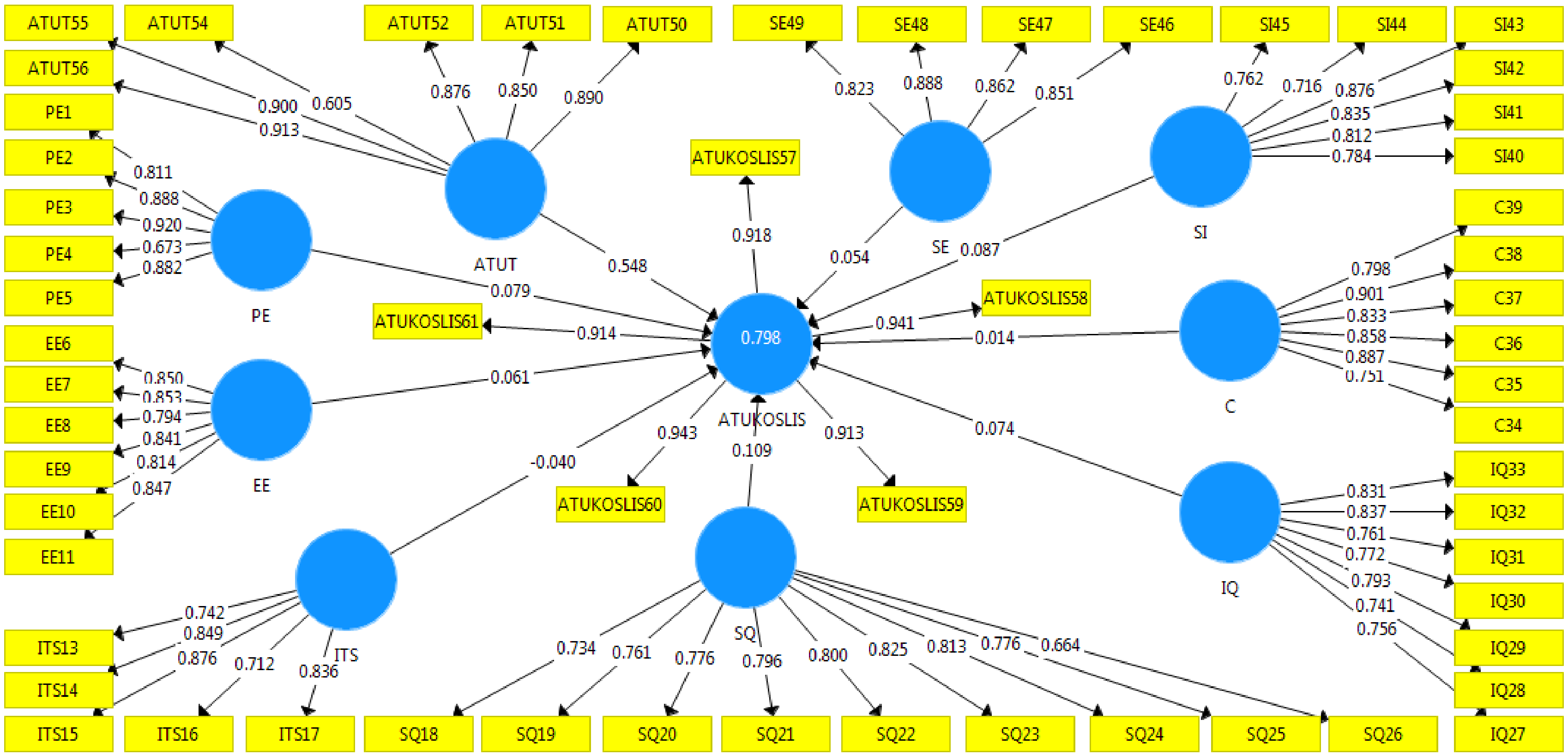
STEP 8: REMOVED ATUT53



STEP 9: RE – RUN BOOTSTRAPPING



STEP 10: RE – RUN PLS ALGORITHM



STEP 11: Check the Convergent Validity Table for next lowest

Cross Loading Factor > 0.7

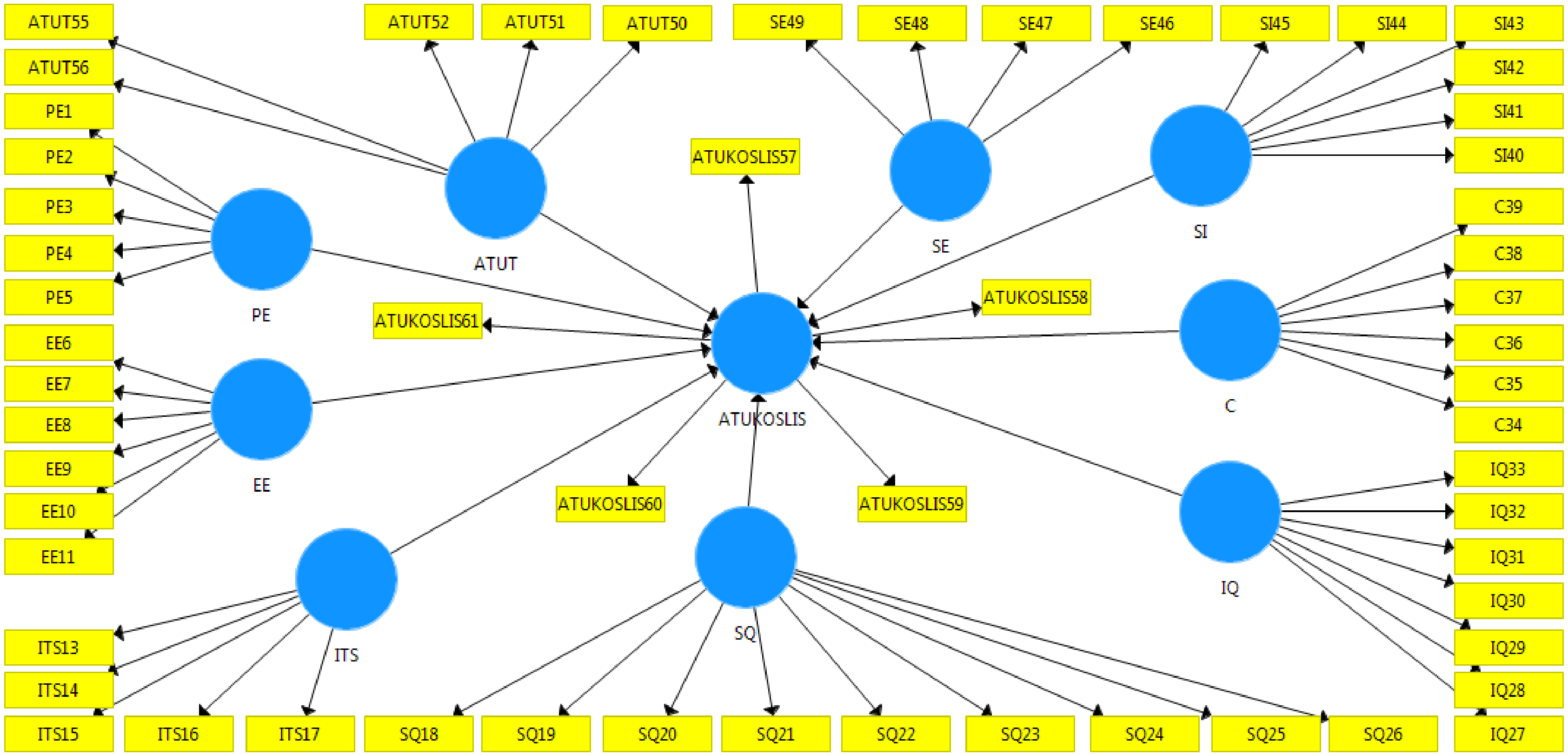
REMOVED ATUT54 < 0.7

	ATUKOSLIS	ATUT	C	EE	IQ	ITS	PE	SE	SI	SQ
ATUKOSLIS57	0.918									
ATUKOSLIS58	0.941									
ATUKOSLIS59	0.913									
ATUKOSLIS60	0.943									
ATUKOSLIS61	0.914									
ATUT50		0.882								
ATUT51		0.838								
ATUT52		0.868								
ATUT53		0.588	1ST removed							
ATUT54		0.656	2nd removed							
ATUT55		0.887								
ATUT56		0.903								
C34			0.751							
C35			0.887							
C36			0.858							
C37			0.833							
C38			0.901							
C39			0.798							
EE10				0.814						

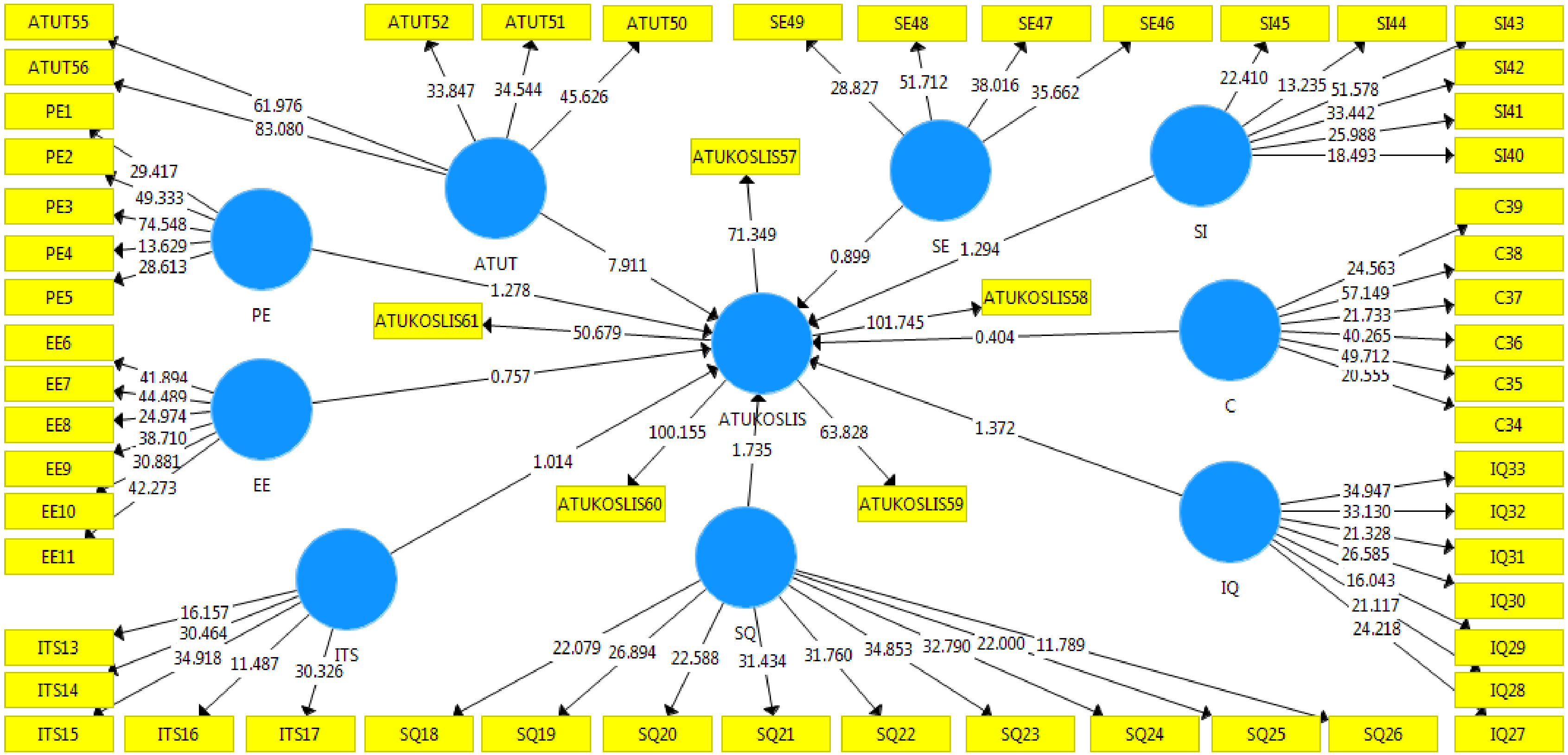
EE11				0.847						
EE6				0.850						
EE7				0.853						
EE8				0.794						
EE9				0.841						
IQ27					0.756					
IQ28					0.741					
IQ29					0.793					
IQ30					0.772					
IQ31					0.761					
IQ32					0.837					
IQ33					0.831					
ITS13						0.742				
ITS14						0.849				
ITS15						0.876				
ITS16						0.712				
ITS17						0.836				
PE1							0.811			
PE2							0.888			
PE3							0.920			
PE4							0.673	4th removed		
PE5							0.882			
SE46								0.850		
SE47								0.862		
SE48								0.888		
SE49								0.823		

SI40									0.784	
SI41									0.812	
SI42									0.835	
SI43									0.876	
SI44									0.716	
SI45									0.762	
SQ18										0.734
SQ19										0.761
SQ20										0.776
SQ21										0.796
SQ22										0.800
SQ23										0.825
SQ24										0.813
SQ25										0.776
SQ26									3rd removed	0.664

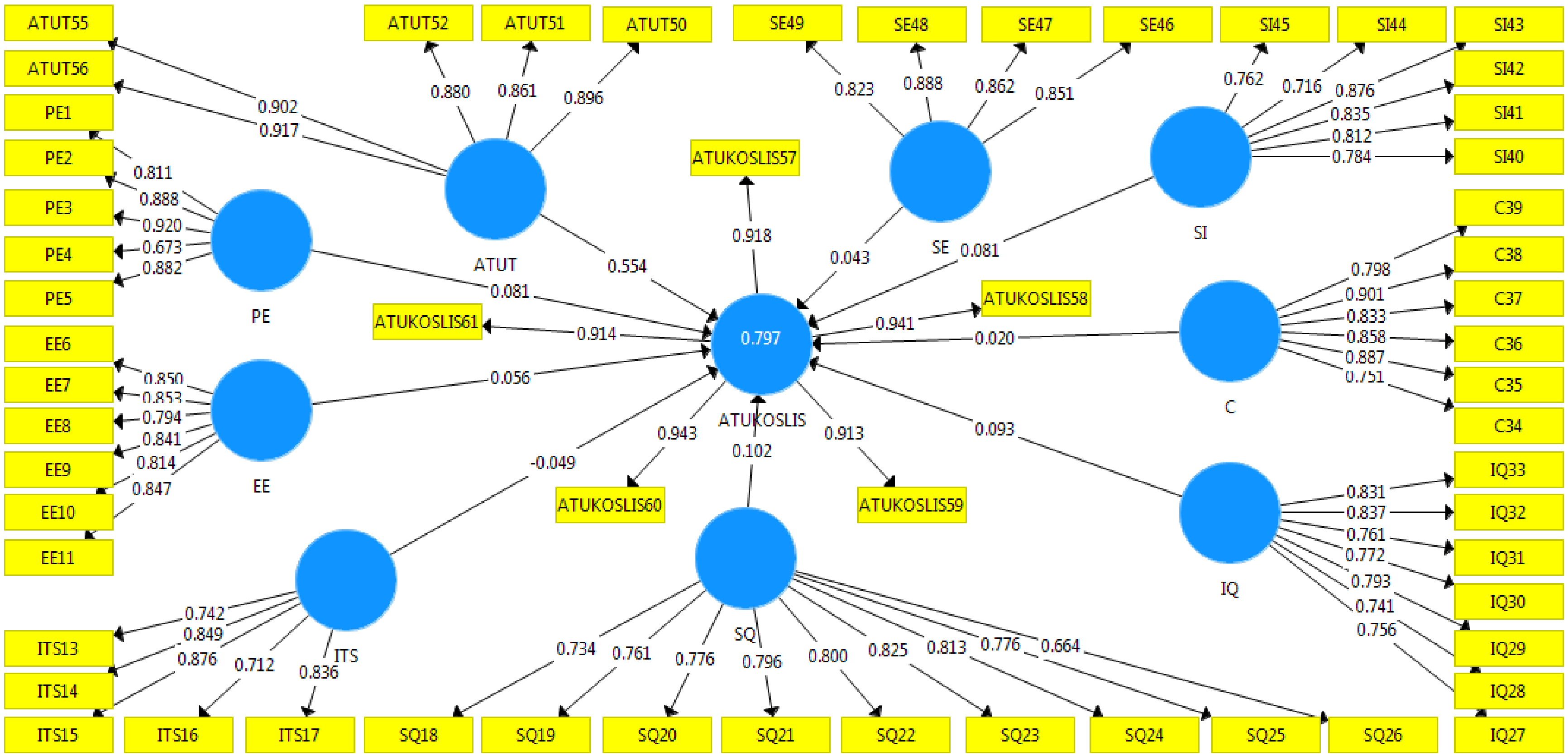
STEP 12: REMOVED ATUT54



STEP 13: RE – RUN BOOTSTRAPPING



STEP 14: RE – RUN PLS ALGORITHM



STEP 15: Check the Convergent Validity Table for next lowest

Cross Loading Factor > 0.7

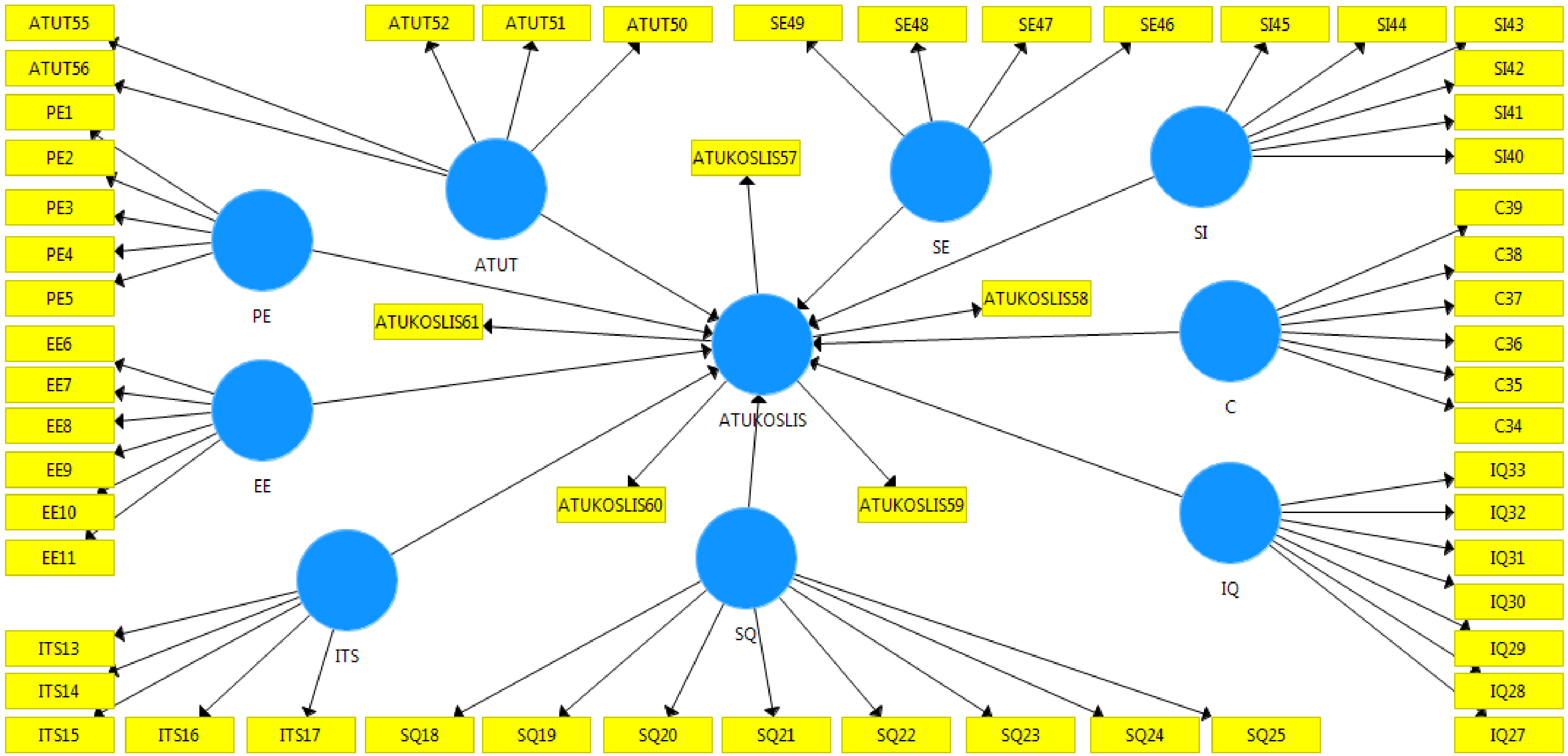
REMOVED SQ26 < 0.7

	ATUKOSLIS	ATUT	C	EE	IQ	ITS	PE	SE	SI	SQ
ATUKOSLIS57	0.918									
ATUKOSLIS58	0.941									
ATUKOSLIS59	0.913									
ATUKOSLIS60	0.943									
ATUKOSLIS61	0.914									
ATUT50		0.882								
ATUT51		0.838								
ATUT52		0.868								
ATUT53		0.588	1ST removed							
ATUT54		0.656	2nd removed							
ATUT55		0.887								
ATUT56		0.903								
C34			0.751							
C35			0.887							
C36			0.858							
C37			0.833							
C38			0.901							
C39			0.798							
EE10				0.814						

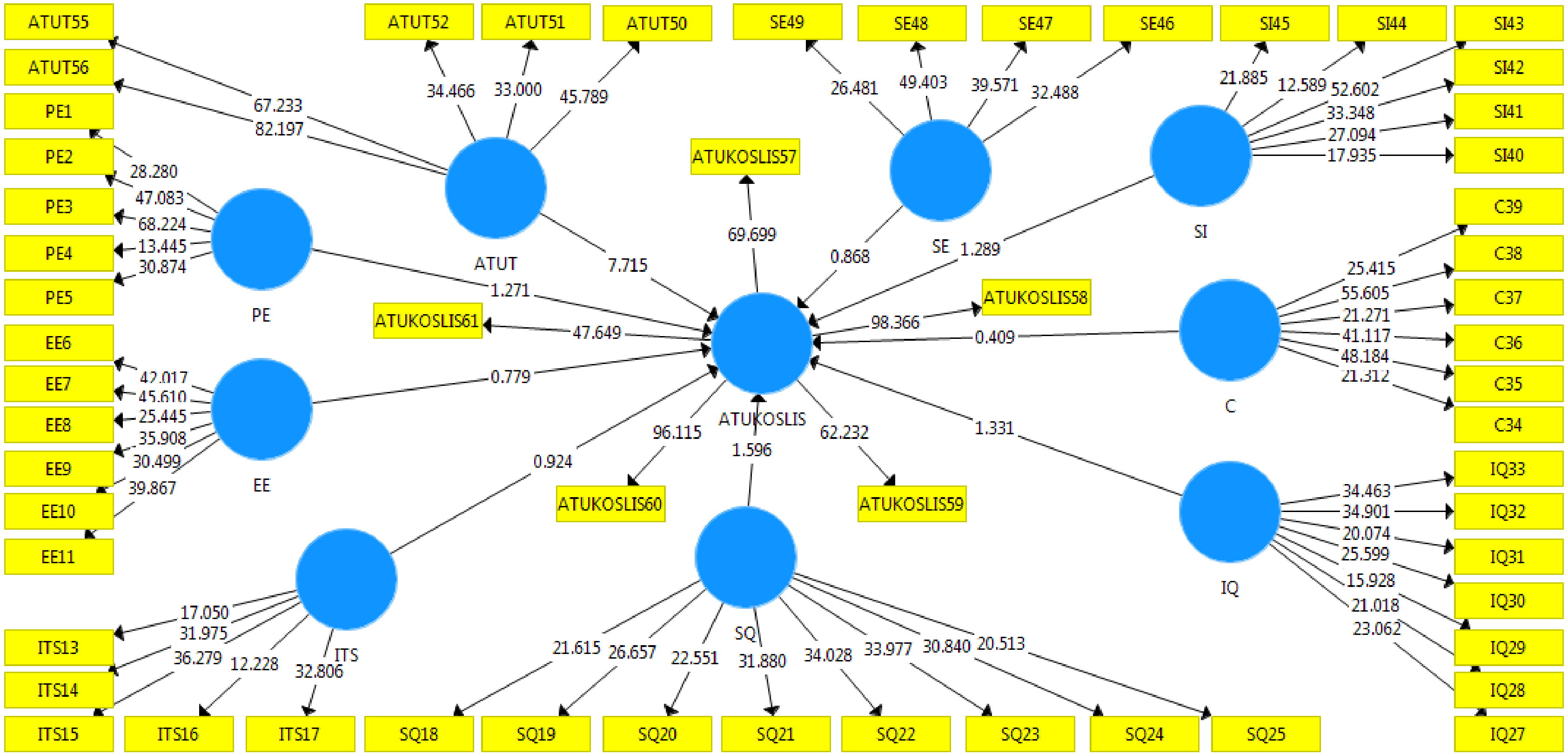
EE11				0.847						
EE6				0.850						
EE7				0.853						
EE8				0.794						
EE9				0.841						
IQ27					0.756					
IQ28					0.741					
IQ29					0.793					
IQ30					0.772					
IQ31					0.761					
IQ32					0.837					
IQ33					0.831					
ITS13						0.742				
ITS14						0.849				
ITS15						0.876				
ITS16						0.712				
ITS17						0.836				
PE1							0.811			
PE2							0.888			
PE3							0.920			
PE4							0.673	4th removed		
PE5							0.882			
SE46								0.850		
SE47								0.862		
SE48								0.888		
SE49								0.823		

SI40									0.784	
SI41									0.812	
SI42									0.835	
SI43									0.876	
SI44									0.716	
SI45									0.762	
SQ18										0.734
SQ19										0.761
SQ20										0.776
SQ21										0.796
SQ22										0.800
SQ23										0.825
SQ24										0.813
SQ25										0.776
SQ26									3rd removed	0.664

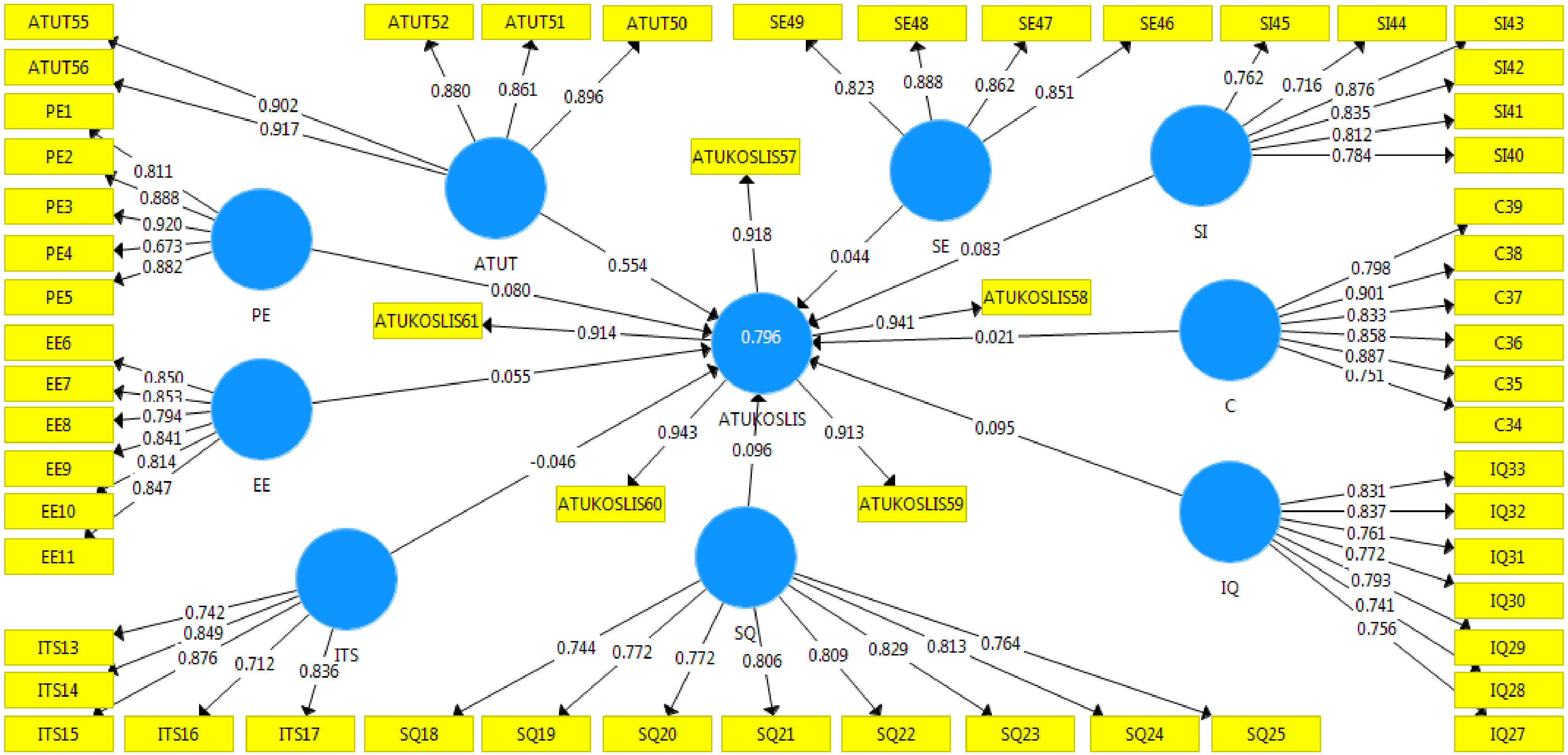
STEP 16: REMOVED SQ26



STEP 17: RE – RUN BOOTSTRAPPING



STEP 18: RE – RUN PLS ALGORITHM



STEP 19: Check the Convergent Validity Table for next lowest

Cross Loading Factor > 0.7

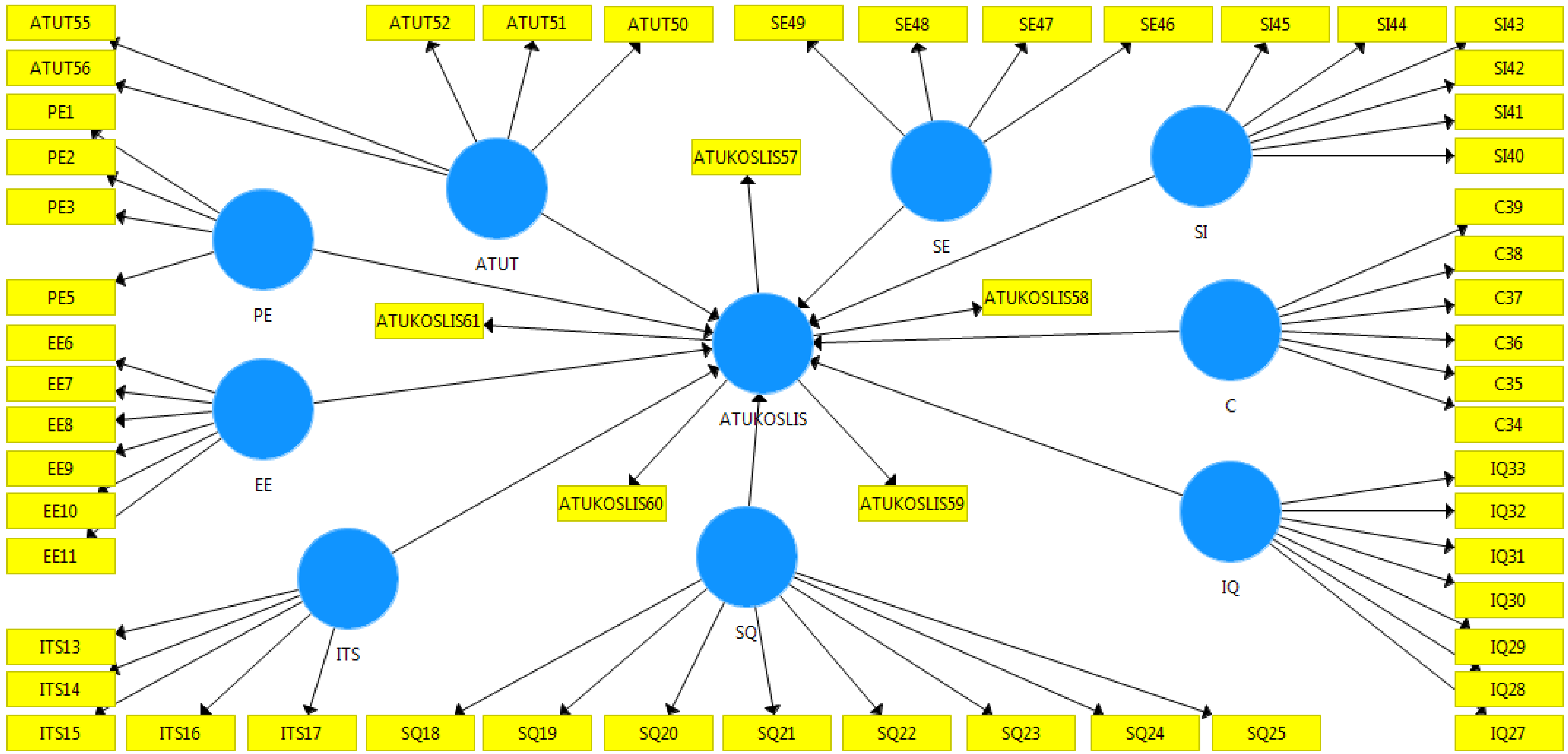
REMOVED PE4 < 0.7

	ATUKOSLIS	ATUT	C	EE	IQ	ITS	PE	SE	SI	SQ
ATUKOSLIS57	0.918									
ATUKOSLIS58	0.941									
ATUKOSLIS59	0.913									
ATUKOSLIS60	0.943									
ATUKOSLIS61	0.914									
ATUT50		0.882								
ATUT51		0.838								
ATUT52		0.868								
ATUT53		0.588	1^{ST} removed							
ATUT54		0.656	2^{nd} removed							
ATUT55		0.887								
ATUT56		0.903								
C34			0.751							
C35			0.887							
C36			0.858							
C37			0.833							
C38			0.901							
C39			0.798							
EE10				0.814						

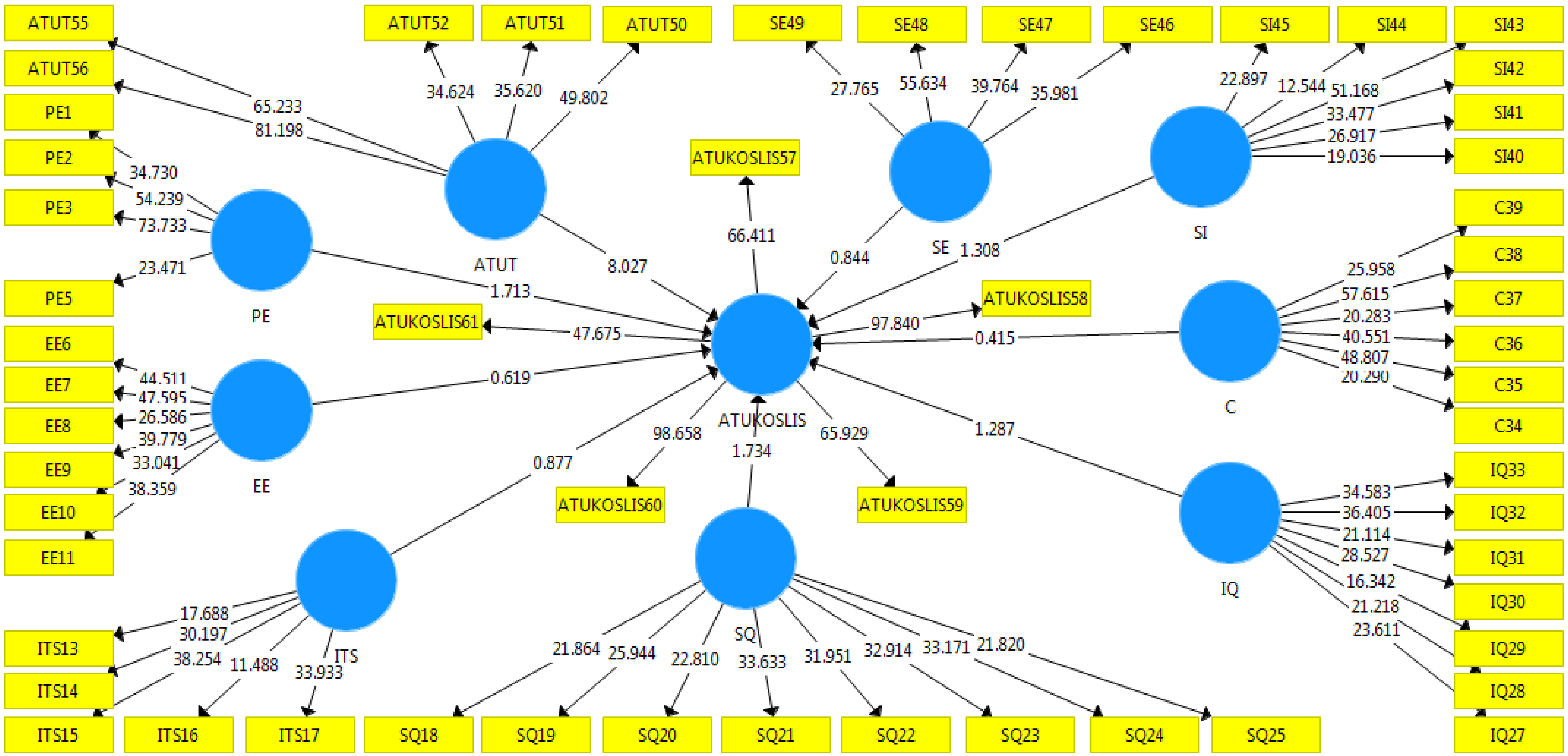
EE11				0.847						
EE6				0.850						
EE7				0.853						
EE8				0.794						
EE9				0.841						
IQ27					0.756					
IQ28					0.741					
IQ29					0.793					
IQ30					0.772					
IQ31					0.761					
IQ32					0.837					
IQ33					0.831					
ITS13						0.742				
ITS14						0.849				
ITS15						0.876				
ITS16						0.712				
ITS17						0.836				
PE1							0.811			
PE2							0.888			
PE3							0.920			
PE4							0.673	4th removed		
PE5							0.882			
SE46								0.850		
SE47								0.862		
SE48								0.888		
SE49								0.823		

SI40									0.784	
SI41									0.812	
SI42									0.835	
SI43									0.876	
SI44									0.716	
SI45									0.762	
SQ18										0.734
SQ19										0.761
SQ20										0.776
SQ21										0.796
SQ22										0.800
SQ23										0.825
SQ24										0.813
SQ25										0.776
SQ26									3rd removed	0.664

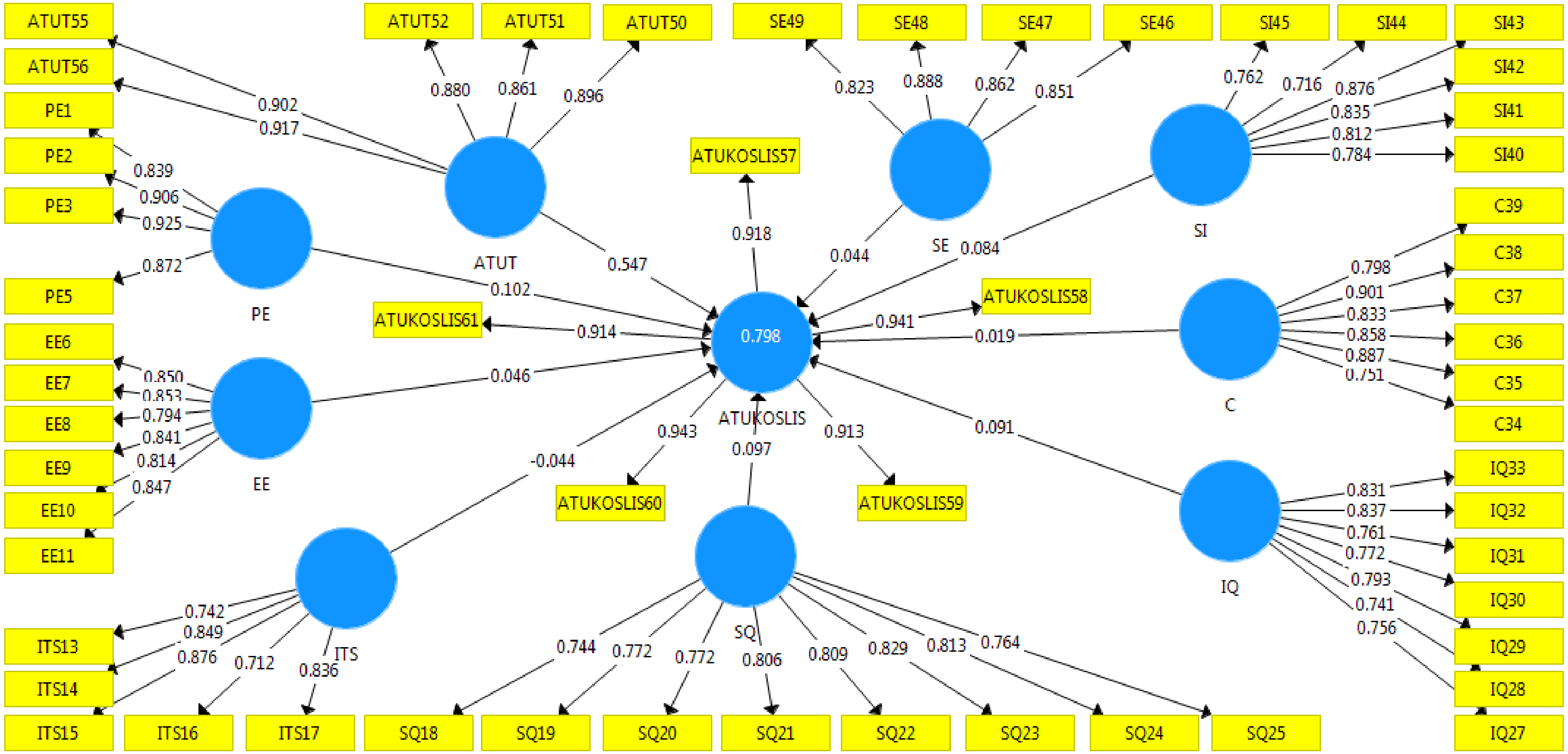
STEP 20: REMOVED PE4



STEP 21: RE – RUN BOOTSTRAPPING



STEP 22: RE – RUN PLS ALGORITHM



STEP 23: Final Convergent Validity all value > 0.7

	ATUKOSLIS	ATUT	C	EE	IQ	ITS	PE	SE	SI	SQ
ATUKOSLIS57	0.918									
ATUKOSLIS58	0.941									
ATUKOSLIS59	0.913									
ATUKOSLIS60	0.943									
ATUKOSLIS61	0.914									
ATUT50		0.896								
ATUT51		0.861								
ATUT52		0.880								
ATUT55		0.902								
ATUT56		0.917								
C34			0.751							
C35			0.887							
C36			0.858							
C37			0.833							
C38			0.901							
C39			0.798							
EE10				0.814						
EE11				0.847						
EE6				0.850						
EE7				0.853						
EE8				0.794						
EE9				0.841						
IQ27					0.756					
IQ28					0.741					

IQ29					0.793					
IQ30					0.772					
IQ31					0.761					
IQ32					0.837					
IQ33					0.831					
ITS13						0.742				
ITS14						0.849				
ITS15						0.876				
ITS16						0.712				
ITS17						0.836				
PE1							0.839			
PE2							0.906			
PE3							0.925			
PE5							0.872			
SE46								0.851		
SE47								0.862		
SE48								0.888		
SE49								0.823		
SI40									0.784	
SI41									0.812	
SI42									0.835	
SI43									0.876	
SI44									0.716	
SI45									0.762	
SQ18										0.744
SQ19										0.772
SQ20										0.772

SQ21										0.806
SQ22										0.809
SQ23										0.829
SQ24										0.813
SQ25										0.764

STEP 24: Cronbach Alpha, Composite Reliability and AVE

	Cronbach's Alpha > 0.7	Composite Reliability (CR) > 0.7	Average Variance Extracted (AVE) > 0.5
ATUKOSLIS	0.958	0.968	0.857
ATUT	0.935	0.951	0.795
C	0.915	0.935	0.705
EE	0.912	0.932	0.694
IQ	0.896	0.918	0.616
ITS	0.865	0.902	0.649
PE	0.908	0.936	0.785
SE	0.878	0.916	0.733
SI	0.886	0.914	0.639
SQ	0.913	0.929	0.623

STEP 25: Latent Variable Correlation

	ATUKOSLIS	ATUT	C	EE	IQ	ITS	PE	SE	SI	SQ
ATUKOSLIS	**1.000**									
ATUT	0.870	**1.000**								
C	0.575	0.582	**1.000**							
EE	0.714	0.718	0.529	**1.000**						
IQ	0.719	0.710	0.559	0.655	**1.000**					
ITS	0.532	0.542	0.433	0.619	0.592	**1.000**				
PE	0.731	0.736	0.533	0.746	0.671	0.555	**1.000**			
SE	0.668	0.678	0.564	0.639	0.669	0.540	0.600	**1.000**		
SI	0.721	0.722	0.575	0.717	0.669	0.546	0.662	0.627	**1.000**	
SQ	0.744	0.755	0.563	0.707	0.742	0.652	0.661	0.644	0.684	**1.000**

STEP 26: Latent Variable, Composite Reliability and AVE

Focused on AVE and Diagonal Construct Value = 1.000

	Composite Reliability (CR)	Average Variance Extracted (AVE)	ATUKOSLIS	ATUT	C	EE	IQ	ITS	PE	SE	SI	SQ
ATUKOSLIS	0.968	**0.857**	**1.000**									
ATUT	0.951	**0.795**	0.870	**1.000**								
C	0.935	**0.705**	0.575	0.582	**1.000**							
EE	0.932	**0.694**	0.714	0.718	0.529	**1.000**						
IQ	0.918	**0.616**	0.719	0.710	0.559	0.655	**1.000**					
ITS	0.902	**0.649**	0.532	0.542	0.433	0.619	0.592	**1.000**				
PE	0.936	**0.785**	0.731	0.736	0.533	0.746	0.671	0.555	**1.000**			
SE	0.916	**0.733**	0.668	0.678	0.564	0.639	0.669	0.540	0.600	**1.000**		
SI	0.914	**0.639**	0.721	0.722	0.575	0.717	0.669	0.546	0.662	0.627	**1.000**	
SQ	0.929	**0.623**	0.744	0.755	0.563	0.707	0.742	0.652	0.661	0.644	0.684	**1.000**

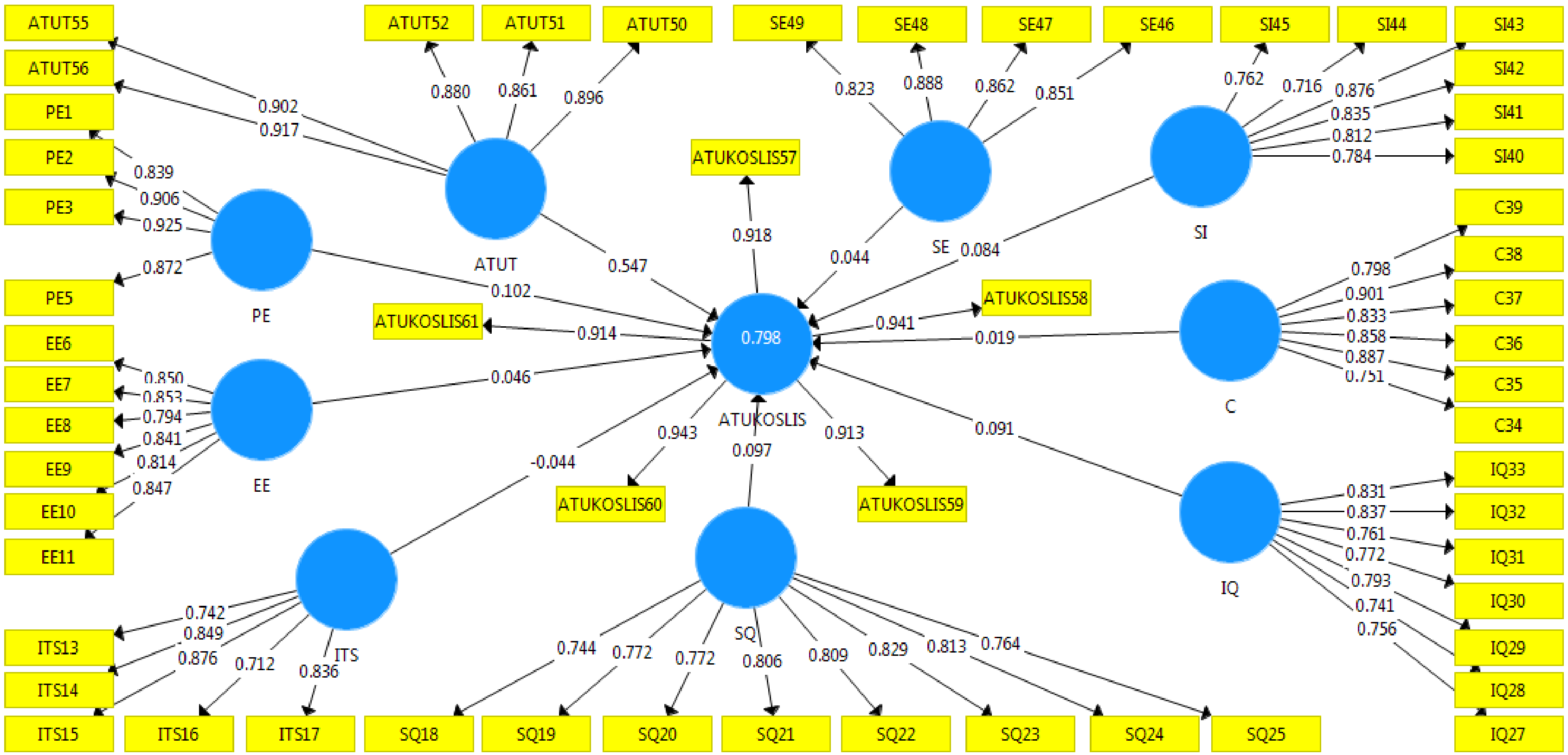
STEP 27: The Latent Variable Correlation is set to 2 decimal place and √ **AVE** and replace the 1.000 with √ **AVE** Value

	Composite Reliability (CR)	Average Variance Extracted (AVE)	ATUKOSLIS	ATUT	C	EE	IQ	ITS	PE	SE	SI	SQ
ATUKOSLIS	**0.97**	**0.86**	**0.93**									
ATUT	**0.95**	**0.80**	0.87	**0.89**								
C	**0.94**	**0.71**	0.58	0.59	**0.84**							
EE	**0.93**	**0.70**	0.71	0.72	0.53	**0.84**						
IQ	**0.92**	**0.62**	0.72	0.71	0.56	0.66	**0.79**					
ITS	**0.90**	**0.65**	0.53	0.54	0.43	0.62	0.60	**0.81**				
PE	**0.94**	**0.79**	0.73	0.74	0.53	0.75	0.67	0.56	**0.89**			
SE	**0.92**	**0.73**	0.67	0.68	0.56	0.64	0.67	0.54	0.60	**0.85**		
SI	**0.91**	**0.64**	0.72	0.72	0.58	0.72	0.67	0.55	0.66	0.63	**0.80**	
SQ	**0.93**	**0.62**	0.74	0.76	0.56	0.71	0.74	0.65	0.66	0.64	0.69	**0.79**

STEP 28: R Square and Adjusted R Square

	R Square	R Square Adjusted
ATUKOSLIS	0.798	0.789

STEP 29: Final Path Modelling with PLS ALGORITHM Value



STEP 30: Path Coefficient – Hypothesis

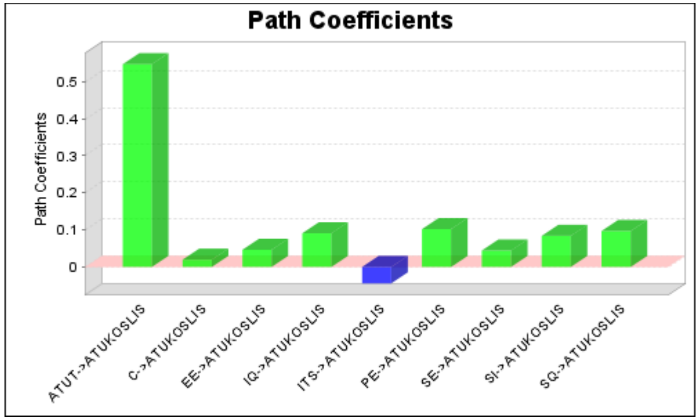
Confidence level: 90% (*) $t > 1.28$, $p = 0.10$ 95% (**) $t > 1.645$, $p = 0.05$ 99% (***) $t > 2.33$, $p = 0.01$

<table>
<tr><th>Relationship</th><th>Path Coefficient</th><th>Original Sample
(O)</th><th>Sample Mean
(M)</th><th>Standard Mean
(STDEV)</th><th>T Statistics (|O/STDEV|)
t value</th><th>p value</th><th colspan="2">Hypothesis</th></tr>
<tr><td>ATUT → ATUKOSLIS</td><td>0.642</td><td>0.547</td><td>0.550</td><td>0.068</td><td>8.027 ***</td><td>0.000</td><td>Supported</td><td>H5</td></tr>
<tr><td>C → ATUKOSLIS</td><td>0.090</td><td>0.019</td><td>0.027</td><td>0.047</td><td>0.415</td><td>0.339</td><td>Not Supported</td><td>H6</td></tr>
<tr><td>EE → ATUKOSLIS</td><td>0.135</td><td>0.046</td><td>0.041</td><td>0.074</td><td>0.619</td><td>0.268</td><td>Not Supported</td><td>H2</td></tr>
<tr><td>IQ → ATUKOSLIS</td><td>0.170</td><td>0.091</td><td>0.088</td><td>0.070</td><td>1.287 *</td><td>0.099</td><td>Supported</td><td>H8</td></tr>
<tr><td>ITS → ATUKOSLIS</td><td>0.025</td><td>-0.044</td><td>-0.041</td><td>0.051</td><td>0.877</td><td>0.190</td><td>Not Supported</td><td>H7</td></tr>
<tr><td>PE → ATUKOSLIS</td><td>0.193</td><td>0.102</td><td>0.103</td><td>0.059</td><td>1.713 **</td><td>0.044</td><td>Supported</td><td>H1</td></tr>
<tr><td>SE → ATUKOSLIS</td><td>0.105</td><td>0.044</td><td>0.043</td><td>0.052</td><td>0.844</td><td>0.199</td><td>Not Supported</td><td>H4</td></tr>
<tr><td>SI → ATUKOSLIS</td><td>0.168</td><td>0.084</td><td>0.085</td><td>0.064</td><td>1.308 *</td><td>0.096</td><td>Supported</td><td>H3</td></tr>
<tr><td>SQ → ATUKOSLIS</td><td>0.165</td><td>0.097</td><td>0.092</td><td>0.056</td><td>1.734 **</td><td>0.042</td><td>Supported</td><td>H9</td></tr>
</table>

STEP 31: Predictive Relevance – Q^2

	SSO	SSE	Q^2 (= 1- SSE/SSO)
ATUKOSLIS	1,075.0000	394.2095	0.6333

STEP 32: Path Coefficient



STEP 33: Path Coefficient Relation

Relationship	Construct Item	Items
ATUT→ ATUKOSLIS	ATUKOSLIS57	I am willing to use Koha OSLIS.
PE → ATUKOSLIS	ATUKOSLIS58	I will support the use of Koha OSLIS.
SI → ATUKOSLIS	ATUKOSLIS59	I will recommend Koha OSLIS to other libraries.
SQ → ATUKOSLIS	ATUKOSLIS60	I will suggest my library to continue to use Koha OSLIS.
IQ → ATUKOSLIS	ATUKOSLIS61	I accept the use of Koha OSLIS in my library.

STEP 34: Model Fit

	Saturated Model	Estimated Model	Model Fit
SRMR	0.057	0.057	< 0.08 , YES
NFI	0.725	0.725	~1 , YES

SRMR: Standardized Root Mean Square Residual .

SRMR < 0.10 or SRMR < 0.08 are accepted as Good Fit Model (Henseler et al., 2016)

SRMR is a Goodness of fit measure for PLS-SEM which is used to avoid model misspecification (Henseler et al., 2016)

NFI: Normed Fit Index or Bentler and Bonett Index. The value of NFI which is between 0 and 1.

The closer NFI value to 1 indicates the better the model fit.

NFI above 0.9 indicates acceptable model fit.

Saturated Model: Correlation between all constructs.

Estimated Model: Total effect and consider the model structure

STEP 35: HYPOTHESIS

HYPOTHESES		
H1	Performance expectancy positively influence the user acceptance of Koha open source library information system	Supported
H2	Effort expectancy positively influence the user acceptance of Koha open source library information System	Not Supported
H3	Social influence positively influence the user acceptance of Koha open source library information System	Supported
H4	Self- efficacy positively influence the user acceptance of Koha open source library information System	Not Supported
H5	Attitude towards using technology positively influence the user acceptance of Koha open source library information system	Supported
H6	Cost positively influence the user acceptance of Koha open source library information system	Not Supported
H7	Information technology skill positively influence the user acceptance of Koha open source library information system	Not Supported
H8	Information quality positively influence the user acceptance of Koha open source library Information system	Supported
H9	System quality positively influence the user acceptance of Koha open source library information System	Supported

STEP 36: Re-fined OSIS-UTAUT Theoretical Framework with Path Coefficient Value