Service Level Agreements Framework for Digital Library
Quality of Service Management

By

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Submitted in fulfilment of the requirements for the degree of Doctor of Philosophy

Deakin University
November, 2015
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DEDICATION

My humble effort I dedicate to my sweet and loving,

Husband,
Mohd Nor Ismail.
Whose affection, love, encouragement, prays day and night have sustained me to complete this work

My father and mother,
Mr. Ahmad and Madam. Rosseeda,
Thank you for all your prayers that accompany my struggle, although we are far apart.

My late Father and Mother in Laws
Mr. Ismail and Madam Sawiah
May Allah bless both of you

My brothers and My sister in-laws
Masrom, Masri, Masrul Affandi, Nazrul Afandi, Siti Jaudah, Norli, Shida, Normah and Aisyah
For their external love.

My lovely nephew,
Muhammad Zharif Ilham, Muhammad Zikri Ilman
Whose love and confidence is a constant source of inspiration and encouragement

And

Along with my hard working and respected supervisor
Prof. Jemal H. Abawajy
Who has been a constant source of knowledge, kindness, patience, motivation and inspiration.
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Alhamdulillah for everything, For the Good.. For the Bad And everything in between..

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Abstract

Advances in information and communication technology have changed the way libraries deliver services to their patrons. The horizon of modern libraries has been extended to encompass areas such as e-government services as well as digital outreach beyond the physical library walls. Today, libraries offer their services mostly in digital and electronic form such as digital reference services, e-journals, e-books, online document delivery, web-based service, networked desktop computers and so forth. Almost all these new services are produced and managed externally by digital service providers, while the libraries purchase the right for their customers to access the digital services. These forms of libraries with externally procured digital contents and networked desktop computers are known as digital libraries. In addition to saving physical space and solving the problem of inadequate printed materials in the conventional libraries, digital libraries provide access to digital services in a coherent and economical manner to geographically distributed library patrons. Furthermore, digital libraries have the potential to store much more information than the conventional libraries with little physical space. Measuring quality of services (QoS) is an important component and a major issue for digital libraries. The extension of the library horizon beyond the traditional spheres coupled with the utility-oriented service procurement has introduced a number of challenges. Especially, as the digital libraries with externally procured digital contents become more prevalent, issues regarding how to assess the quality of service level offered by digital libraries have gained critical importance. The conventional library service quality assessment techniques cannot be applied to the digital library with utility-oriented service procurement in which the libraries subscribe
for a fee to various services from digital service providers in order to service the needs of their patrons with some value-added aspects. No framework that provides a practical approach for the assessment of quality of service level offered by digital libraries exists. This thesis aims to address this gap. The thesis develops a service level agreements (SLAs) based mechanisms for the digital libraries to measure and assess the quality of service they deliver to their customers. The SLAs is a formal contract between the digital content providers and the digital library consumers. The level of customer satisfaction is crucial, thus SLAs are significantly important in digital libraries with utility-oriented service procurement. The proposed approach incorporates library consumer's service quality expectations into the SLAs with the aim to guarantee that consumer's service quality expectation can be achieved. The utility and effectiveness of the proposed framework have been evaluated using SmartpPLS and Delphi method.
Publications

Journals


Conference paper


Book Chapter
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<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AVE</td>
<td>Average Variance Extracted</td>
</tr>
<tr>
<td>DARPA</td>
<td>Defence Advanced Research Projects Agency</td>
</tr>
<tr>
<td>IT</td>
<td>Information Technology</td>
</tr>
<tr>
<td>LV</td>
<td>Latent Variables</td>
</tr>
<tr>
<td>NASA</td>
<td>National Aeronautics and Space Administration</td>
</tr>
<tr>
<td>NSF</td>
<td>National Science Foundation</td>
</tr>
<tr>
<td>PLS-SEM</td>
<td>Partial Least Square Structural Equation Modelling</td>
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<td>SLAs</td>
<td>Service Level Agreements</td>
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<td>QoS</td>
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Chapter 1

Introduction

Advances in information and communication technologies have profoundly changed the way library services are procured and provisioned to library patrons. In particular, the increasing availability of information in digital format has led to the emergence of the digital library concept, which has changed the way information is managed and provisioned (e.g., gathering, organizing, storing, retrieving and disseminating) to the library patrons. Also, various new services are now available such as managing system infrastructure, access to electronic or digital collections (online databases, electronic journal, e-books and digitized collections), electronic publishing, developing web-portals, online reference, and online document deliver, and preserving metadata and digital archival objects.

Digital services have become more prevalent in the library and information science fields. A digital library is composed of digital collections of information accessible over a network, using a web-portal, new services (e.g., electronic publishing), external sources digital services (e.g., online database, electronic journal, e-books and hardware and software systems) and infrastructure to support the needs of all its patrons.
There are many advantages and challenges of digital library services. For example, digital libraries have the potential to store much more information than the conventional libraries whilst using the limited physical space. Digital libraries provide access to digital services in a coherent and economical manner to geographically distributed library patrons. It also solves the problem of inadequate printed materials available in conventional libraries.

The major challenges and the focus of this thesis is how to ensure the quality of external procured services. The satisfaction of library patrons is a function of the quality of services received. Thus, as externally sourced digital services are becoming prevalent within the library environment, and issues regarding their quality assessment are gaining critical importance. In particular, we are concerned with how to measure quality of service (QoS) provided by the digital service providers.

1.1. Motivations and Scope

In many service industries, companies have created programs which incorporate a study that elicits customers' assessments of service quality, plus a feedback loop through which service changes are implemented and then evaluated with subsequent survey data. However, the determinants and measurements of service quality in the library have become unique compared to other service sectors. Thus, libraries face an increased pressure to provide high quality services to patrons. The challenge facing libraries is how to effectively measure the quality of service for the services offered. This challenge is mainly brought about by the advances in information and communication technology that have changed the way libraries deliver their services.
Today, libraries mostly offer their services in digital and electronic form such as digital reference services, e-journals, e-books, online document delivery, web-based service and so forth. Almost all these new services are produced and managed externally by digital service providers, while the libraries purchase the right for their customers to access the digital services. Such innovation has introduced utility-oriented service provisioning environments in which the libraries subscribe for a fee to various services from digital service providers, in order to service the needs of their patrons with some value-added aspects.

Since the libraries do not produce and manage the new services, this requires the libraries to negotiate service level agreements (SLAs) with the digital service providers. This new environment has introduced another layer of service provisioning in so far as a modern library is concerned. As a result, the conventional QoS delivery and assessment mechanism by the libraries is ineffective. These necessitate a new SLAs-driven approach for the libraries to measure and assess the quality of service they deliver. To this end, this thesis aims to:

1. Analyse existing methodologies in quantifying the quality of service in the context of external digital service providers.
2. Develop a framework that allows a library management to negotiate SLAs with service providers.
3. Develop an efficient metric to measure the success of the negotiated SLAs between the library management and the service providers.
4. Analyse the effectiveness of the framework and the metrics in capturing the QoS.
1.2. Research Significance

Measuring Quality of Services (QoS) is an important factor and is a major issue for digital library services [1]. Libraries are facing stiff competition from agencies such as their parent institutions and accrediting bodies regarding the quality and impact of the service they provide to the community of service users. For example, the main objective of Malaysian electronic government (e-government) initiative is to transform the way services and information are delivered to the public services, as well as the way they interact with citizens and businesses. In essence, the initiative is an effort to streamline public service internal processes to improve Quality of Services (QoS), reduce costs and increase productivity [2]. The libraries in Malaysia are government-funded and provide to the public and businesses, both traditional and electronic access to information and resources, including government information. Therefore, libraries in Malaysia as e-government service providers are clearly significant players in the implementation of the Malaysian e-government initiatives.

Although the problem of service quality has been discussed in the literature, there has been no work focusing on service level agreement for the digital library. As the digital library brought with it a new service procurement from external service providers on different models such as pay per use (e.g., e-books) and an annual fee (e.g., on-line databases), service level agreements have become an important element of setting expectations and measuring the service quality. Therefore, this thesis makes original contributions to the field of digital library services.
1.3. Research Problem

This thesis will focus on mechanisms based on SLAs for the libraries to measure and assess the quality of service they deliver to their customers. In particular, the thesis focuses on the library management and digital service provider dimension since impacts on this layer will have a significant impact on the library and customer dimension. The specific questions addressed in this thesis are:

Although libraries are dynamic organizations providing dynamic services to their patrons, technological advances have created a serious competition for libraries from many information services provisioning agents. This leads us to investigate:

- What are the issues relevant to digital service quality assessment for effective reporting of library values and performances?

Various models and frameworks have been proposed to evaluate the Quality of Service in Digital Library. Unfortunately, most of the present models and frameworks are mostly limited only to the human perspective and lack analysis of the technological perspective.

Another problem is that features that contribute towards the Digital Library service quality have not been factored into the design of most existing quality of the service design models in digital libraries. Therefore, the key features that contribute to the Digital Library service quality need to be identified in order to make sure the model is more efficient. In order to achieve this goal, we need to answer the following question:

- What are the key features that contribute to the digital library services?

The digital services are commonly sourced from third-party service providers for a fee. As externally sourced digital services become more prevalent, issues regarding their quality assessment are gaining critical importance. Unfortunately, sourcing digital
services from external providers has brought with it stringent QoS demands for the library service users. Currently, there is no way for evaluating QoS between the digital service providers and the library management.

- How to evaluate QoS of externally provided digital services?

Digital technology has been adopted by many library services that need to gather, organize, store, retrieve and disseminate information to their end user. The third-party sourced services is one of the main instruments involved in digital technology services and this involvement has brought with it stringent Quality of Service (QoS) demands from the library patrons. It is a great challenge to measure the quality of services in the Digital Library. At this time, different library uses different models to measure their QoS [3]. Traditional measures of library services, such as counting interlibrary loans, circulation statistics or percentages of reference questions answered correctly have become obsolete [4]. The major issues with current methods is that performance indicators only show the raw materials or potential input but not the results or output. In many service industries, companies have created programs which incorporate a survey that elicits customers' assessments of service quality, plus a feedback loop through which service changes are implemented and then evaluated with subsequent survey data. However, the determinants and measurements of service quality in the library have become unique compared to other service sectors. This is because QoS in libraries can have many aspects including (1) user-orientation of services, (2) accuracy and reliability of the services, (3) speed and currency of the services, (4) accessibility, (5) competence of staff; and (6) effectiveness and efficiency [5].
1.4. Research Contributions

This thesis studied a significant problem within the digital library sphere and will emphasise on service level agreements with a number of contributions. The obvious contributions include:

1. *Multi-stage service quality assessment Model.* The thesis presents a service quality architectural model for digital services. The architecture describes the required components, interaction sequences, and related procedures for enabling digital services and various aspects that need to be highlighted by the library, during the measurements of the QoS.

2. *Service Quality Model for Digital Libraries.* The thesis presents a model for evaluating the quality of service for digital libraries. It illustrates new features that determine the efficiency of right third-party sourced services and a number of factors for digital libraries to use when evaluating service quality.

3. *SLA framework.* This thesis has developed a framework for managing service level agreements for digital services. The framework describes the interrelated modules and the essential mechanisms for measuring the QoS and an SLAs negotiation strategy.

In summary, these contributions collectively enhance the quality of service that provide. Consequently the satisfaction of the library customers is fulfilled.
1.5. Thesis Organization

The remainder of the thesis is organized as the following:

1. **Chapter 2: Literature review.** This chapter provides an in-depth analysis and overview of existing IT and Digital services systems in Library, presented within a comprehensive literature review.

2. **Chapter 3: Methodology.** This chapter presents architectures to enable the Library System to be consumed as services. It describes the key components to realize libraries.

3. **Chapter 4: Multi-stage service quality assessment Model.** This chapter presents an indicator for evaluating the quality of IT and Digital services in relation to libraries.

4. **Chapter 5: Digital Library Services Quality Assessment Model.** This chapter presents a model to assess the quality of IT and Digital services in relation to libraries.

5. **Chapter 6: Service Level Agreement.** This chapter presents a framework for managing service level agreements and QoS negotiation approach in relation to service-oriented content adaptation.

6. **Chapter 7: Conclusion and Future Directions.** The concluding chapter provides a summary of contributions and future research challenges.
Chapter 2

Literature Review

This literature review chapter is divided into two main parts. The first part provides an overview of the Digital library that focuses on the general background to this study, which includes the understanding of the terminology of Digital Library, Digital Service and Information Services (IT). This introduction is followed by the discussion of the history of digital library, advantages of the Digital Library, and the development of digital library’s to expand understanding of the related research. In order to investigate the implementation of the present method and model in evaluating the Digital Services quality in the Digital library it is essential to sketch out the historical perspective of the Digital Library system. The second part focuses on issues in the service quality of Digital Library services. This review is based on the digital library environment. The chapter also offers a review of randomized control trials in relation to surveys and their length.
2.1 Introduction

Libraries have changed the way they provide services. Today’s libraries, mostly offer their services in electronic and web-based form. These services include online databases, electronic serial and digital documents [6]. For example, in November 2009 the most recent European Commission study in the context of e-Europe Benchmarking framework was published. It shows that 83% of the basic services in the library are available on-line [7]. Therefore, the quality of service (QoS) is one of the most important factors and is a major issue on the research agenda for electronic services [2]. Commercial information service providers are now competing in the information marketplace. Thus, libraries are facing stiff competition from many information provider agencies. Also, libraries are being held accountable from agencies such as their parent institutions and accrediting bodies regarding the quality and the impact of the service they provide to their community of service users.

Many innovations have been implemented in libraries in recent years. Here is a redefining of the library as place; developing libraries that provide the best of print and electronic resources; the development of alternative acquisition methods such as patron driven acquisitions (PDA); improvements in information literacy and instruction, and data management. There are also new positions such as literacy and instruction, data management, and the emerging technology librarian. These are just some of the many responses Electronic resources development has brought to the local library, each posing a fundamental challenge to libraries. The libraries need to continually fulfil their various stakeholders’ needs.
Stakeholders are those people inside and outside the library who have a vested interest in the library. In the current information age, libraries seeking to meet the information needs of their clients are increasingly looking to modern electronic technologies (including computing devices, mobile phones; and the Internet). The goal of the library is not to make a profit, but to satisfy customers’ need for information. Libraries compete with other departments for financial resources. Due to that, financial support of the library would depend on the user satisfaction with its services. Unfortunately, there has been no consistent way for assessing the quality of services the libraries provide to end-users.

2.2 Understanding the Terminology

2.2.1 Digital Library

The Digital library was first referred to in the early 1990s, when universities and institutions began to develop their digital collections. There are many definitions that have been discussed by previous works in a variety of situations [4,8]. The term “Digital Library” can be defined in two different senses, which are from the view of the researchers and the librarians [4]. The digital library can be defined within two contexts; the first from the technical aspect, and the second from the perspective of the collection, organization and services that involve librarians and information professionals [4].

Digital libraries can be accessed virtually and the digital library resources provided to the users in digital form [4]. Besides that, the digital library can be accessed via the library’s homepage because of the digital library collections, including items which are electronic journals and online databases, making it easier to the users to access and get the information needed [6]. Based on the collection, organization and
services perspective, a digital library contain collections of digital objects which are images, text, audio and video as well as advice on how to access and retrieve and select and share the collections with others [6].

One definition of digital library includes all types of the digital collections where users of a digital library can search as well as access the resources via the library website, with the purposes of viewing, downloading, printing and loaning [9]. Others define a digital library as a combination of an organization, a system and a Digital Library Management System [10]. The organizational aspect is seen as a virtual organization that comprehensively collects, manages and preserves rich digital content for the long term. Such an organization will offer the content to its user community with specialized functionality of that content, in a measurable quality and according to codified policies. The generic software system that provides the appropriate software infrastructure is described as a digital library management system. It involves both producing and administering a Digital Library System incorporating the suite of functionality. Moreover, a digital library management system also offers more refined on integrated additional software, specialized or advanced functionality.

Based on the definition of the digital library given, it can be defined that the digital library in the present study is a digital library that provides access. For example, when a user uses the digital library to search for a book through Online Public Access Catalogue (OPAC) provided in the library, it also can be considered that such users are using the digital library. The digital library contains digital materials that can be accessed by the users at anytime and anywhere because the digital library collections are always available.
2.2.2 Digital Services

Digital services include Online collections search (e.g. Online catalogue search number; electronic periodical search; online periodical table of contents search; CD-ROM database search, and transfer of electronic documents), and Online library services (e.g. Online reservation number; online overdue notice number; online applications for cooperative library service number; online information, recommendations; E-mail assistance services; search library www information services and online reference consultation). Finally, for user services the services include database (e.g. number of online abstract databases; amount of online full text data), and OPAC (e.g. number of electronic periodicals; number of electronic books; number of electronic reference materials).

In the conventional library setup, the library users must be physically present in the libraries if they need to make use of the library services such as reference services, interlibrary loan and bibliographic search services. As a result of advances in information and web technologies, many of the traditional library services have been digitized resulting in the Digital Library. Therefore, libraries have changed their information management (e.g., gathering, organizing, storing, retrieving and disseminating) activities into digital format. Also, various new services such as access to electronic or digital collections (online databases, electronic journal, e-books and digitized collections), electronic publishing, web-portals, online reference, and online document deliveries, help desk and online library instructions have been introduced into service delivery by the libraries.
2.2.3 Quality of Services

Digital libraries can be used for many reasons, but the most central set of use cases focuses around information access. In the Digital library services context, evaluation means an appraisal of the performance or functioning of a system, or finding certain part types of content, retrieving specific information, locating known items, accessing material the client does not know enough about. There are many content-based, more or less goal-directed motivations that will lead a user to the access terminal of a digital collection of information.

The evolution of library services, along with the development of social media, has had an impact on the evaluation and measurement of DL services. Researchers exploring the evaluation of DLs have focused on services, technology, users, usability, accessibility, efficiency, interactivity, learn ability, and effectiveness [40, 45, 47]. However, few have considered the factors influencing user perceptions of DL services from the perspective of specific services.

2.2.4 Service Quality in Library Services

Service quality can be defined as the degree to which a provided activity promotes customer satisfaction. For example, quality of services (QoS) technologies used in the electronic or telephone networking business typically assists in optimizing network traffic management in order to improve the experience of network users.

QoS (Quality of Service) is the idea that transmission rates, error rates, and other characteristics can be measured, improved, and, to some extent, guaranteed in advance. A general term describing various technologies, Quality of Service (QoS) involves the measuring, improving, and prioritizing of data transmission. In general,
service quality is an evaluation of how well a library provides a service, resource, or program. Service quality approaches include evaluation of the library, an area that directly involves user perspectives. Traditionally, the quality of an academic library has been described in terms of its collection and measured by the size of the library’s holding and various counts of its use [11]. For years, researchers in library and information science (LIS) have examined information needs, user wants and user perceptions about the value of library services. They have also looked at an elusive concept, “quality”, in terms of collections and the effectiveness (extent to which goals and objectives are set and met) of library services [7]. However, in recent years, LIS researchers have drawn on marketing and other literatures to focus their attention on “expectations”, an alternative view of quality, one representing the user’s or customer’s perspective on the services used. In 1988, [35] developed a definition of service quality as being “the overall evaluation of a specific service firm that results from comparing the firm’s performance with the customer’s generally expectations of how firms in that industry should perform.

### 2.2.5 Service Level Agreements (SLAs)

Service level agreements (SLAs) are a contract between a service provider (either internal or external) and the end user that defines the level of service expected from the service provider [12] and describes the minimum performance criteria a provider promises to meet while delivering a service [13]. SLAs is simply a document describing the level of service expected by a customer from a supplier, laying out the metrics by which that service is measured, and the remedies or penalties, if any, should the agreed-upon levels not be achieved [14]. Usually, SLAs are agreements among
companies and external suppliers, but they may also be between two departments within a company. SLAs are output-based in that their purpose is specifically to define what the customer will receive. SLAs do not define how the service itself is provided or delivered. It typically also sets out the remedial action and any penalties that will take effect if performance falls below the promised standard. It is an essential component of the legal contract between a service consumer and the provider.

2.3 Development of Digital Library

The National Science Foundation (NSF), Defences’ Advanced Research Projects Agency (DARPA), and National Aeronautics and Space Administration (NASA) funded six digital library projects in the $30 million Phase 1 of the Digital Libraries Initiative [15] between 1994 and 1999. In 1999, National Science Foundation (NSF), Defences’ Advanced Research Projects Agency (DARPA), the National Library of Medicine, the Library of Congress, National Aeronautics and Space Administration (NASA) and the National Endowment for the Humanities, with participation from the National Archives and the Smithsonian Institution, provided $55 million for Phase 2 (DLI-2). DLI-2 funded 36 projects to extend and develop innovative digital library technologies and applications.

NSF continues to support digital library research programs through several directorates. DLI-2 and an International Digital Libraries Collaborative Research program are administered within the directorate for Computer and Information Science and Engineering (CISE). NSF's Information Technology Research program also supports several digital library research projects. NSF's Directorate for Education and Human Resources (EHR) administers the National Science Digital Library (NSDL), which builds on earlier DLI-2 projects and aims to establish a network of learning
environments and resources for science, technology, engineering and mathematics education.

Phase 3 of eLib was the resulting £4.1M three year program which sought to achieve this by concentrating the program on the following four areas [16]:

• Hybrid libraries
• Large scale resource discovery (or ‘Clumps’)
• Digital preservation
• Developing services for Phase 1 and 2 projects

eLib Phase 3 was managed by the JISC Committee for Electronic Information (CEI), later to become the JCEI.

2.4 Background and Overview of Digital Library

The digital library is crucial services to assist users locate and access information resources at a time when we live, work and play in the information society. Therefore, many researches on digital libraries have been carried out by the ICT research communities [11]. Other than that, the example of services is the success rate of information search and level of difficulty of search interface. For Digital services, it includes Online collections search (e.g. Online catalogue search number; electronic periodical search; online periodical table of contents search; CD-ROM database search, and transfer of electronic documents), and Online library services (e.g. Online reservation number; online overdue notice number; online applications for cooperative library servicesumber; online information, recommendations; E-mail assistance services; search library www information services and online reference consultation). Finally, for user services the services include database (e.g. Number of online abstract
databases; amount of online full text data), OPAC (e.g. Number of electronic periodicals; number of electronic books; number of electronic reference materials).

The first emerging sign of digital library development from the research was that 36% of the libraries have declared to become a hybrid type, having some components of their collection digitized whilst providing some form of online services. The remaining 55% was print based and only 1.3% declared to be digital. Perhaps the phrase from MALMARC (1978) to PERDANA (1999) might be able to give us a glimpse of the degree of digital library development that has taken place in Malaysia. The force behind the endeavour has been the National Library of Malaysia (PNM), earlier working strategically with the Multimedia Development Corporation, state/public libraries, and selected academic and special libraries. In a recent development, PNM has been working on the U-Library project, operational July 2010, with a new anchor partner – the Malaysian Communications and Multimedia Commission (MCMC) in an attempt to bring PERDANA project to a higher level [17].

2.4.1 National Digital Library System (PERDANA)

Libraries with their vast store of information and ability to organize, manage and disseminate information and knowledge can contribute towards Vision 2020's aim of achieving a knowledge-rich society in Malaysia [17]. In line with the aspirations, the National Digital Library System (System PERDANA or Perpustakaan Digital Nasional) is being rolled out nationwide through the existing libraries to bring digital library services to the general public. This is a project which is jointly initiated by all libraries in Malaysia and the private sector that is The National Library, academic libraries, special libraries, public libraries, research institution libraries, supported by the Multimedia Development Corporation (MDC), and Telekom Malaysia Berhad. A pilot
website Mylib was developed as a gateway to knowledge resources such as the online commercial databases, theses, library catalogues, abstracts, indexes and other resources. Mylib was launched on the 27 June 2000, by Y.A.B. Dato' Seri Abdullah Ahmad Badawi, the Deputy Prime Minister of Malaysia. The portal can be accessed at the URL http://www.mylib.com.my [18].

2.4.2 Islamic Digital Library Network (PERDIM)

This project aims to develop a web portal that collects all information on Islam. Nine institutions are involved in brainstorming sessions for this project, namely The National Library, the Multimedia Development Corporation (MDC), Jabatan Kemajuan Islam Malaysia (JAKIM), Institute of Islamic Understanding (IKIM), International Islamic University (UIA), University of Malaya, National University of Malaysia (UKM), National Archives of Malaysia and International Institute of Islamic Civilization and Thought (ISTAC) [18]. A conceptual framework has been developed for this project and this will be used as a basis for funding applications.

2.5 Advantages of Digital Library

Digital library brings many benefits to their users. Some of the benefits that have been listed by [19] as follows:

1. **No physical boundary**: users can gain information at their fingertips by using the digital library.

2. **Round the clock availability**: Digital libraries can be accessed at any time, 24 hours a day and 365 days of the year
3. **Multiple accesses**: The same resources can be used at the same time by a number of users.

4. **Structured approach**: The digital library provides access to much richer content in a more structured manner, i.e. we can easily move from the catalogue for the particular book than to a particular chapter and so on.

5. **Information retrieval**: The user is able to use any search term belonging to the word or phrase of the entire collection. The digital library will provide very user friendly interfaces, giving clickable access to its resources.

6. **Preservation and conservation**: An exact copy of the original can be made any number of times without any degradation in quality.

7. **Space**: Whereas traditional libraries are limited by storage space, digital libraries have the potential to store much more information, simply because digital information requires very little physical space to contain them. When the library had no space for extension digitization is the only solution.

8. **Networking**: A particular digital library can provide the link to any other resources of other digital library very easily, thus a seamlessly integrated resource sharing can be achieved.

9. **Cost** - The cost of maintaining a digital library is much lower than that of a traditional library. A traditional library must spend large sums of money paying for staff, to maintain books, rent, and purchasing new resources. Digital libraries do away with many of the maintenance costs.
2.6 Issues in Digital Library

Digital library services provide many benefits, such as allowing individual institutions to share expertise and resources, expanding hours of service, and providing access to a larger collection of knowledge resulting from digital reference service (e.g., question-answer archives). However, sharing the workload and resources with other institutions can also present challenges, such as ensuring the quality and consistency of responses, reaching consensus on developing procedures and policies, and configuring technology that can be best accessed and used by each participating group.

With the growth of digital services and collaborative networks, there is a clear need for defining standards in order to ensure service quality and interoperable technology. In providing and supporting digital services, more work needs to be done. However, as more libraries and organizations provide digital service and face issues regarding technology, procedure, and partnerships, these and other standards efforts will lead digital services into the future. The emerging field of digital libraries brings together participants from many existing areas of research. Currently, the field lacks a clear agenda independent of these other areas. It is tempting for researchers to think that the field of digital libraries is a natural outgrowth of an already known field [26, 49]. From a database or the information retrieval perspective, digital libraries may be seen as a form of federated databases. From a hypertext perspective the field of digital libraries could seem like a particular application of hypertext technology.

In the electronic and digital perspective, the owners of information are resorting to punitive measures regarding the use and contents in digital form. Some of the constraints faced by our libraries to engage in serious digital initiatives are three fold - that of money, manpower and contents. Most digital libraries, particularly in the higher
education and research institutes depend solely on the information providers and publishers in the developed world to satisfy their urge for vital contents that inspire indigenous research. Since contents are a major ingredient in digital library development, the pragmatic and viable way out for libraries is to judiciously judge them as available in electronic forms in optical media or on the Web, and to procure at least some of them for hosting locally. In these disciplines, where considerable progress has been made on the digital access provision, most of the publishers, authors, and information providers are based in the developing world.

A variety of distributed repositories may offer digital collections, including the content and metadata, to various libraries, and may themselves offer complementary or competitive library services. There is considerable experimentation underway regarding the technical, economic, and organizational supports necessary for such distributed arrangements in organizing, providing access to, and preserving knowledge that is born digital, in digital libraries providing access to information that is needed to extend the reach of the scholarly enterprise to new audiences [4]. Almost every type of information can be represented in digital form, including text, pictures, musical works, computer programs, databases, models and designs, video programs, and compound works combining many types of information [6]. In the digital library, what you store is not what you get. The digital contents available in the world are organized in many different ways and have to be accessed through a variety of mechanisms [17].

Basically, in the DL evaluation criteria, usability is the one that has been most investigated. Usability was also extended to performance measures, such as efficiency of interactions, avoidance of user errors, and the ability of users to achieve their goals, affective aspects, and the search context [19]. In other words, although libraries have
many unique qualities, they face challenges similar to other organizations when faced with change. A library dealing with the shift from print books to electronic books will face many of the same challenges with regard to its organization and personnel as a retailer that must shift its focus from a bricks-and-mortar model for online sales. Therefore, though there is some written on change management in digital services within libraries, it is useful to look at the more general literature on the subject.

2.7 Service Quality Evaluation Models and Theories

The proposed model derives from a previous model that has been investigated before [20, 21, 22]. Their models are based on service quality. Below are the justifications of the measurement models.

<table>
<thead>
<tr>
<th>Perspective</th>
<th>Topic</th>
</tr>
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<tbody>
<tr>
<td>Internal (Library)</td>
<td>Library System</td>
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<td></td>
<td>Procedures</td>
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<td></td>
<td>Standards</td>
</tr>
<tr>
<td>External (User)</td>
<td>Aboutness</td>
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<tr>
<td></td>
<td>Usability</td>
</tr>
</tbody>
</table>

Figure 2.1 Measurement matrix, quadrant

The purpose of this matrix is to aid library evaluators choose targets for measurement that will help in the understanding of the library system from a more holistic view. There are four parts of the complete matrix:

1. The internal view of the library system (what does the library system consist of?), which does not involve users but compares components of the library system to some type of standard;
(2) The external view of the library system (how effective is the library system?), where the user presents a query to the library and examines the usability of the system and the robustness of the results presented by the library;

(3) The external view of use (how useful is the library system?), where the user presents the overall usefulness of information gained through the library, either through elicitation by an evaluator or by citing/linking to library works;

(4) The internal view of use (how is the library system manipulated?), where the data-based behavioural artifacts of interactions between users and a system are analysed to understand how a system is manipulated.

![Quality of Electronic Services Model](image)

Figure 2.2 Quality of Electronic Services Model

In this model, three independent variables are involved - the environment quality, delivery quality and outcome quality. The dependent variable is the quality of electronic services. According to the framework, three dimensions of service quality have to be considered: service environment, service delivery, and service product.

*Environment quality* is related to the appearance of the user interface, which includes graphic quality and clarity of layout.
Delivery quality pertains to the customer and focuses on Web-site interaction during service usage, that is, it includes aspects that are relevant to the customers when they are looking for information, selecting from available options or carrying out transactions. It contains four sub-dimensions which are concerned with the attractiveness of selection, information quality, ease of use and technical quality. Outcome quality is viewed as what the customer is left with after service delivery. It is represented by three sub-dimensions which refer to reliability, functional benefit and emotional benefit.

2.8 Service Quality in Digital Library

According to [23], service quality has been explored widely and defined differently in many research studies. Defined service quality as a perceived quality, relates to the consumer judgment of the product [24]. Key factors for an organization's sustainability and the driving forces for an organization achievement are Services quality [25]. Even though the acceptance of the service quality concept derives from the marketing literature, the indicators for quality of library services are still not well defined [26]. Service quality also has received a lot of attention in the information system literature [27]. However, a number of surveys [28, 29, 30] have shown that standardized scales are not applicable in different service conditions. Therefore, for different organizations, the service needs adaptations of different factors to ensure quality is maintained in their organization [3].

For a library, service quality involves the cooperating relationship between the library and the patron that they supposed to aid. Therefore, to evaluate a Digital Library capability, Service Quality is an essential element that must be considered. This
statement has been supported by research [31]. This work highlighted that the role of service quality in information system success, and it is considered service quality to be the most important Critical Success Factor (CSF). The recognition of service quality determined elements has surfaced in the literature yet without sufficient details at this time of writing. Most of the research that has been done, does not directly connect to a non-profit library service environment. The various service quality evaluation tools available today are merely transferred from traditional services to the self-service electronic environment. It does not necessarily mean that traditional service measures will adequately capture the quality of electronic service quality [26]. Thus, it is necessary for Digital Library to monitor and evaluate their third-party sourced services, in order to better understand the expectations that the digital library should attempt to meet during revising and refining their quality of service [21].

Digital libraries are new and pioneering information systems, under constant development and change. Ensuring patron satisfaction and providing the highest quality of services are recognized as the main factors that lead to success for Digital Libraries. Consequently, quality becomes essential to determine the patron's expectations and satisfaction in the way that digital library delivers their services [32]. The Digital Library could report a high volume of services offered, but abandon its long-term value due to eroding service quality [33]. The basis of using services in Digital Library is to satisfy the needs of their patrons. Therefore, the evaluation of service quality in Digital Library is important. The evaluations are to ensure not only progress, but also to meet the expectations of their patrons and all stakeholders. The objective of service quality digital library evaluation is to examine the main features that need to be better
understood to meet with digital library objectives. In addition, this evaluation can offer suggestions for improvement [27].

The existing literature on the aspect of quality service in Digital Library shows that most studies have been focusing on the content services provided by the library [8]. Mainly research studies on Digital Library adopt service quality tools from the business and marketing field [26] such as SERVQUAL(Service Quality Model), SERVPERF, and e-SERVQUAL. In measuring the quality of service of Digital Library, different origin theories have been established and reform [34].

Among the famous theories that have used in library service assessment is SERVQUAL that have been introduced by [36]. The well-known dimensions that most of the researchers highlight include concern factors of Reliability, Responsiveness, Assurance, Empathy and Tangibility. Usually, researchers within the library and information science have measured gap reduction through the use of SERVQUAL [34] using a standard test method. However, it has been on counts and frequency of responses. It lacks accuracy due to nonlinearity in measurement [26]. Moreover, libraries act differently from business entities. Adaptation of traditional services to electronic services goes further than the application of innovative technology [26] to deliver services.

The validity and reliability SERVQUAL in the library situation has been tested by [28] and he found that the SERVQUAL model did not match the data. The SERVQUAL model did not match the data because the data collection was based on a convenience nonprobability sample. The researcher realised that the inclusion of 104 statements in section A of the questionnaire makes data collection, labour intensive,
with the likely result that some students or faculty might opt out of participation in the study and that others might not complete the whole questionnaire. Furthermore, approving an off-the-shelf measurement tool runs the risk of compliant inaccurate data, given each service industry might have its unique dimensions [36]. Digital library service quality assessment has many features depending on the characteristic and the prospect of the evaluating instrument.

[37] proposed a model that addressed applications of service quality to assess library e-service quality. The idea was based on relevant dimensions from SERVQUAL and E-S-QUAL. This study did not report a convincing empirically tested e-service quality assessment tool. However, it was suggested that researchers should examine the various dimensions reported in the study and seek conceptualization of the e-service construct [22]. On top of that, Service quality can be categorized into three (3) components (a) environment quality, (b) Delivery quality and (c) outcome quality. Hence, building in the lead of the work [9], the proposed model in this paper will appoint three methods of service quality for digital library specifically environment quality, delivery quality and outcome quality. This model is supported by [26], methods that describe the service quality of the digital library is serviced environment quality, service delivery quality and service outcome quality.

The emergence of digital libraries calls for the need for the evaluation of digital libraries. Evaluation is a research activity, and it has both theoretical and practical impacts [39]. An evaluation is a judgment of worth. The objective of DL evaluation is to assess to what extent a digital library meets its objectives and offer suggestions for improvements [40]. Even though there are no standard evaluation criteria and evaluation
techniques for DL evaluation, DL evaluation research has been conducted on different aspects. While more research is on specific issues of DL evaluation, there is less research on general DL evaluation criteria. Moreover, these criteria are derived from evaluation criteria for traditional libraries, human-computer interaction, IR system performance and digital technologies. Digital libraries are extensions and augmentations of physical libraries.

[41] suggested applying existing techniques and metrics for evaluating digital libraries, such as circulation, collection size and growth rate, patron visits, reference questions answered, patron satisfaction, and financial stability. Reviewing evaluation criteria for libraries by [42] and library and information services by others [43,44] and [45] offered more detailed evaluation variables related to traditional library criteria on collection consisting of purpose, scope, authority, coverage, currency, audience, cost, format, treatment, and preservation; as well as on information including accuracy, appropriateness, links, representation, uniqueness, comparability, presentation and on use comprising of accessibility, availability, search ability, and usability and standards. Digital library evaluation framework focuses on different dimensions and levels. For example, DELOS Network of Excellence has conducted a series of research concerning the evaluation of DLs. [46] developed a DL evaluation framework based on a large-scale survey of DL evaluation activities. This framework is derived from conceptual models for EL evaluation.

Work by [47] proposed a scheme for digital library evaluation, which contains four dimensions: data/collection, system/technology, users, and usage. Data/collection assessment mainly focuses on content, description, quality/reliability attributes, and management and accessibility attributes. System/technology assessment is related to
using technology, information access, system structure, and document technology. Users and their uses are represented by the types of users, what domain areas users are interested in, how they seek information, and the purpose of seeking information.

[48] further examined the interactions of DL components. The analysis of the relationships between user-system, user-content, and content-system led to the following evaluation foci: usability, usefulness, and system performance, respectively. [46] integrated [45] four dimensions of evaluation activities (construct, context, criteria, and methodology) and essential questions regarding DL evaluation (why evaluate, what to evaluate, and how to evaluate?) together. The why question, focuses on making strategic decisions related to the constructs, the relationships, and the evaluation. The question, what concerns the major construct of digital libraries and their relationships. The how question offers guidance regarding procedures to perform the evaluation. The major contribution of DELOS Network’s work is that researchers not only illustrate but also justify why they evaluate, what they evaluate, and how they evaluate. [49] also identified some specific issues related to general DL evaluation. For usability, he discussed the issue of accessibility for users with special needs. For retrieval evaluation, he emphasized the guidance for users to retrieve too little or too much. For collection, he conferred the problems of item quality.

[50] reviewed DL evaluation criteria for libraries, IR systems and user interface. These researchers further stressed the need to assess the overall impact of digital libraries on users and society. [27] created a conceptual framework for the artifact-based evaluation in digital libraries to have an in-depth understanding of digital library services and users. However, there is a gap between evaluation theorists and evaluation practitioners [44] since these DL criteria are not always applied.
### 2.9 Reviews of Theories and Models in Digital Libraries

#### Table 2.1: Previous model of digital library

<table>
<thead>
<tr>
<th>Author (Year)</th>
<th>Title</th>
<th>Method</th>
<th>Sample</th>
<th>Framework/ variables</th>
<th>Findings</th>
</tr>
</thead>
</table>
• Personal administered questionnaire  
• Likert-scale  
• Analyzed using SPSS and AMOS (for SEM) | Digital library users at University of Tehran | ![Diagram](attachment:image.png) | All hypotheses are supported  
Info_Qual → DLib_Use  
Sys_Qual → DLib_Use  
Serv_Qual → DLib_Use  
User_Sat → DLib_Use  
Personal_sense → DLib_Use |

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<tr>
<th>Author (Year)</th>
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<th>Method</th>
<th>Sample</th>
<th>Framework/ variables</th>
<th>Findings</th>
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</thead>
</table>
| Shafiq Ur Rehman, Martha Kyrillidou & Imran Hameed (2014) | Reliability and validity of a modified LibQUAL+® survey in Pakistan: An Urdu language experience | Cross sectional design self-reporting questionnaire | Data was collected using two separate studies conducted by graduate and undergraduate students and faculty members of 29 universities in Pakistan.  
A total of 514 and 1,473 survey questionnaires was | ![Diagram](attachment:image.png) | All hypotheses are supported |
collected respectively from these two studies.

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<th>Author (Year)</th>
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<th>Method</th>
<th>Sample</th>
<th>Framework/ variables</th>
<th>Findings</th>
</tr>
</thead>
</table>
| Ismail Samadi; Mohamad Noorman Masrek & Saiful Farik bin Mat Yatin (2014) | The effect on individual characteristics and digital library characteristics on digital library effectiveness: a survey at University of Tehran | Simple random sampling, Personal administered questionnaire, IBM SPSS and AMOS | 425 Digital library users       | ![Diagram](image) | All hypotheses are supported

- Info_Qual → DLib_Use
- Sys_Qual → DLib_Use
- Serv_Qual → DLib_Use
- Internet_efficiency → DLib_Use
- Personal_IT_Innovativeness → DLib_Use
- DLib_Use → Individual Impact
<table>
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<tr>
<th>Author (Year)</th>
<th>Title</th>
<th>Method</th>
<th>Sample</th>
<th>Framework/ variables</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jody Condit Fagan (2014)</td>
<td>The dimension of library service quality: a confirmatory factor analysis of the LibQUAL + instrument</td>
<td>Web survey</td>
<td>James Madison University’s administration of the LibQUAL + instrument Undergraduate students</td>
<td>Affect of service Information control Library as place</td>
<td>Three factor model was supported Measurement of the information control constructs seem to be problematic - causes by personal control and information access Reliabilities for three subscale scores were very good (Affect of service = 0.918; information control = 0.879; Library as Place = 0.848)</td>
</tr>
<tr>
<td>Author (Year)</td>
<td>Title</td>
<td>Method</td>
<td>Sample</td>
<td>Framework/ variables</td>
<td>Findings</td>
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</tbody>
</table>
| Siti Khairiyah Nordin, Norliya Ahmad Kassim & Kasmarini Baharuddin | Evaluating digital reference services in university libraries         | Qualitative  | • Librarians in Malaysian and International University Libraries  
• SME in Malaysia | • Responsiveness  
• Style and scope of answer  
• Communication process  
• Quality of the answer  
• Service evaluation | • University libraries provide faster and prompt response               |
| Omer Dalkiran et al. (2014) | Usability testing of digital libraries: the experience of EPrints        | Mixed method | 5 volunteers randomly picked         | Questions:  
• Full access an article  
• System sign-up  
• Listing articles  
• Listing author  
• Finding a source  
• Utilization and learning  
• Adequacy of assistance/guidance in searches  
• Visual features  
• Menu arrangement  
• Language  
• Speed  
• Access features  
• System errors | • Negative opinion about the system listed: 1) Inadequacy of search features 2) Inapprehensible terminology 3) Defining activation mail  
• The rate of answering of questions and fulfilling of duties were high, excluding a question about signing up to the system  
• Users had spent less time for finding an article  
• System interface and menus were reviewed as being average by the users |
<table>
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<tr>
<th>Author (Year)</th>
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<th>Method</th>
<th>Sample</th>
<th>Framework/ variables</th>
<th>Findings</th>
</tr>
</thead>
</table>
| Chang-Ping Hu, Yuan Hu & Wei-Wei Yan (2014) | An empirical study of factors influencing user perception of university digital libraries in China | • Survey questionnaire  
• Analysis by using structural equation modeling (SEM) | Undergraduate and postgraduate students and faculties of 78 universities in mainland China | ![Diagram](image.png) | • Information provider service and information retrieval service found to be more important.  
All the hypotheses are supported except for the:  
• Interaction service → user perception  
• Information organizing service → user perception |
2.10 Present Studies on Service Quality in Digital Libraries

There have been many approaches to measuring QoS in libraries such as SERVQUAL [1], LibQual [2], ISO standard [60]. Among these approaches, the standard and most popular approach for measuring QoS in libraries are based on SERVQUAL [1, 23, 52, 53, 54, 55, 56]. [5], focuses on the perception of university library services and their level of satisfaction is studied. The results show that although the academic staffs are using the library services, their perception of the quality of library services is average [5]. [1] study reveals that user expectation was high when compared to their perceptions. The study shows that libraries pay attention to printed resources, easy access to online resources, modern equipment, and facilities. Other studies [53] found that library service quality factors (quality of library service provided, quality of information and library environment, reliability, quality of the online catalogue system and confidences) positively affected students’ satisfaction and were crucial to an excellent library system. These studies are all in agreement that SERVQUAL only measure QoS based on certain services in libraries. The newest services where a third-party is responsible for the provisioned the library services, is especially relevant to this study. Thus, the library management needs to change the way QoS is measured and build a climate of continuous improvement in all areas of library service.

[52] uses SERVQUAL as a tool to measure QoS in libraries (responsiveness, empathy, assurance, tangible; and reliability). The study focuses on user perception of university library services and their level of satisfaction with library services. The analysis is done twofold – first the data are tabulated for all responses across all eight libraries and the second tabulation is done for only the main library responses as a majority of the users are from this library. Data analysis is done using descriptive statistics. The mean value (m) of perception in quality
as rated by academics staff based on the five dimensions is shown in the results as a responsiveness ($m = 3.39$), followed by empathy ($m = 3.36$), assurance ($m = 3.31$), tangible ($m = 3.13$) and reliability ($m = 2.47$). Due to that, [5] suggests that although the academic staff is using the library services, their perception of the quality of library services is “average”.

[3] on the other hand, considered only five attributes (tangibles, reliability, responsiveness, assurance and empathy) in SERVQUAL in their study. This study reveals that user expectation was high compared to their perceptions. Users had an overall positive view of library service quality. Service quality was found to be good when it was related to library staff polite behaviour and their ability to perform quickly. However, in terms of modern equipment, visually appealing facilities and knowledgeable staff service quality were found to be lacking [1].

SERVQUAL is the most popular and standard tool to measure the quality of library services [55]. For instance, using explorations method researchers [55] investigated the overall service quality of a library system. A modified version of the SERVQUAL questionnaire for data collection was used. Differential gaps between perceived and desired services were calculated and ranked to indicate services meet, those that were exceeded or fell short of the user expectations. From this study [55], it was revealed that all the attributes (assurance, collection and access, empathy, library as a place, reliability, responsiveness and tangibles) desired service higher than perceived service. It concluded that the institution pays attention to printed resources, easy access to online resources, modern equipment, and facilities.

Based on [54], study the prioritizing academic library service quality indicators used a fuzzy approach. Once again in this study, the SERVQUAL model was used. [54] criticized the measurement of the dimension and component of SERVQUAL in a number of respects: (a) The method disregard the vagueness of the individual judgments and their value changes
when converted to a number; and (b) The evaluators’ subjectivity, judgment, selection and priority would have a big impact on the results of the methods.

[23] also suggests that different measuring instruments will need to be used because libraries are now providing electronic services to their clients. The survey was conducted among faculty, graduate, and students found that libraries are now using a modified version of SERVQUAL developed by [56]. Four factors found through this exploratory analysis were; (1) Affect of service (organization), (2) Collections and access, (3) Library as a place; and (4) Affect of service (personal).

[53] studied the service quality of university libraries at two university libraries. Using a questionnaire to measure this service quality with a total of 400 students interviewed. This study used a modified version of SERVQUAL as a tool to assess service quality and user satisfaction. It was found [53] that library service quality factors (quality of library service provided, quality of information and library environment, reliability, quality of the online catalog system and confidences) positively affected students’ satisfaction and was crucial to an excellent library system.

As a conclusion, based on the related work done by previous researchers [1, 23, 52, 53, 54, 55, 56] we can conclude that SERVQUAL only measures QoS based on selected services in libraries.

2.11 SLAs Background

Service-level agreements (SLAs) are a contract between a service provider and its internal or external customers that documents what services the provider will furnish. This SLAs document is not meant to be static, but a working document that will reflect the continuous change in services delivered by the organization [57]. SLAs are a negotiated agreement designed to create a common understanding about services, priorities and
responsibilities. SLAs originated with network service providers, but are now widely used by telecommunication service providers and cloud computing service providers. Corporate IT organizations, particularly those that have embraced IT service management (ITSM), enter SLAs with their in-house customers (users in other departments within the enterprise). And IT department creates SLAs so that its services can be measured, justified and perhaps compared with those of outsourcing vendors. SLAs measure the service provider’s performance and quality in a number of ways.

Many organizations introduce service level agreements as part of a quality initiative to improve customer focus, service delivery and organizational performance. SLAs can help to provide a clear framework for service delivery; monitor performance and service quality; and support continuous improvement. It requires a commitment from both parties to support and adhere to the agreement in order for the SLAs to work effectively. A service-level agreement is normally a two-way written agreement which defines the services your team provides to your customers, whether these are students and academics or other support teams. It also describes what you need from your customers in order to deliver the service stated.

It defines the level of service or quality standards provided in terms of specific deliverables. Agreements should include details of how the service will be monitored, evaluated, measured and managed. Agreements should also set out how conflicts may be resolved and how feedback and learning points will be acted upon. Fees and costings may also be included where appropriate.

2.12 SLAs Characteristics

SLAs have been used for many years in IT organizations and departments to identify the support requirements for internal and external customers of services. In this context, SLAs set the expectations of library service consumers and providers. It is common for service
providers to deliver services at different levels of quality based on the cost paid for a service. SLAs is valuable for helping all parties understand the tradeoffs inherent between cost, schedule, and quality because their relationship is stated explicitly [57]. As with any type of contract, the existence of SLAs cannot guarantee that all promises will be kept, but it does define what will happen if those promises are not kept. “SLAs cannot guarantee that you will get the service it describes, any more than a warranty can guarantee that your car will never break down. In particular, SLAs cannot make a good service out of a bad one. SLAs can mitigate the risk of choosing a bad service [58]. A “good” service is one that meets the needs of the service customer in terms of both quality and suitability.

Properly specified SLAs describe each service offered and addresses

- How delivery of the service at the specified level of quality will become realized
- Which metrics will be collected
- Who will collect the metrics and how
- Actions to be taken when the service is not delivered at the specified level of quality and who is responsible for doing them
- Penalties for failure to deliver the service at the specified level of quality
- How and whether the SLAs will evolve as technology changes (e.g., multi-core processors improve the provider’s ability to reduce end-to-end latency).

### 2.13 Gap in the Literature

The traditional quantitative measurement of library collections is no longer an appropriate means of the quality of service assessment. Currently, libraries use different models to measure QoS [3]. Traditional measures of library services such as counting interlibrary loans, circulation statistics or percentages of reference questions have become obsolete [4]. The major issue with the current performance indicators is that they only show
the raw materials or potential input but not the results or output. These studies are all in agreement that SERVQUAL only measure QoS based on certain services in libraries. This study is especially interested where a third party is responsible for the provision of the library services. Thus, the library management needs to change the way QoS is measured and build a climate of continuous improvement in all areas of library service.

This development has improved access to appropriate, current and pertinent information at incredible speed. An important and significant change in the library system is the introduction of the third-party source services such as computers, search engines and scholarly databases. This change has brought with it stringent Quality of Service (QoS) requirements of the library patrons. Digital Library introduces an interactive information flow between end-user and the third-party service (service provider) using online access tools [26]. Thus, the library must now include online usage and electronic resources in the overall evaluation of the Digital Library [59]. For that reason, every effort to measure digital library service quality must be established upon a strong understanding of the phenomenon of service quality and what indicates the service quality of the user perspective [60]. Therefore, QoS requirements of library service users coupled with the changes in the library service provision have mandated the need for a new approach to evaluating the quality of library service provisioning.

However, there is no work that takes into account the influence of the quality of the third-party source services in digital library when evaluating library service quality. Second, while researchers and professionals have actively engaged in DL evaluations, users are mainly the passive subjects of these studies. Their feedback is mostly limited to what researchers or professionals define for them. There is a lack of user involvement in determining DL evaluation criteria and associated variables. In order to gain a complete picture of users’
assessment of DL, we need to engage users in every aspect of DL evaluation from defining DL evaluation criteria, their uses, and their assessment.

2.14 Chapter Summary

In this chapter, reviewed for the progress in the quality of service assessment in the provisioning of library services have been made. Comprehensive approach that encompasses various aspects of the library services to be lacking. What can we draw from previous research on DL evaluation? Previous research offers guidance for researchers and professionals to conduct evaluation studies. At the same time, researchers and professionals have conducted a variety of evaluation studies for the assessment of prototypes or actual digital libraries. These studies have largely focused on the perception which is related to the consumer judgment of the product aspects of digital library services. In these studies the criteria or variables applied in the evaluation are determined by researchers or professionals themselves depending on their purpose of evaluation.
Chapter 3

Methodology

This chapter discusses the aspects of research methodology used in the study and is divided into five main sections. The first section provides a discussion of the paradigm that guides the study. The second section introduces details of the research design and methods used, including a background to qualitative methodology within an interpretive philosophy. The selection of research sites, participants and key informants is dealt with in the third section. In the fourth section the data analysis approach is discussed. The chapter concludes with a consideration of the ethical issues arising from such a study.

3.1. Paradigm

The conducting of this study is led by the interpretive paradigm. A paradigm is the basic belief system that guides the investigation [61]. In this study, the interpretive paradigm had been chosen, because it lends itself to the particular investigation of Digital Services Quality in the Digital Library. The social world is not “specified” [62]. The social world is shaped and supported by humans through their “subjective and inter subjective” perceptions and interactions. Therefore, in this study the actions and interactions among the individual
implementers (participants of this study) at library management and key informants at service provider levels had been explored in order to show how these shape and support (or do not support) the implementation of Quality of Digital Services. In order to understand the reality of the setting, the researcher has to go inside the world which is generating it. The meanings and practices of social reality are formed and informed by the language use, and cultural norms shared by the humans in the setting. This study, examines the implementation of a program concerned with measuring the quality of Digital Library Services in selected libraries. Thus, the focus of this study is on the understanding of the participants’ views, especially related with their social world and their role within a Digital Library. This study seeks to better understand how the practices and meanings shared by these participants work towards measuring the quality of their Digital Services in libraries.

3.2 Method

3.2.1 Qualitative Approach

This study adopted a qualitative approach to investigate the current understanding that there is no substantial way to measure the quality of digital services in libraries. This is essentially a qualitative approach because the problem investigated is the lack of clarity about what factors facilitate or hinder the implementation of the quality of digital services in the libraries. Qualitative research can be defined as an inquiry process seeking to understand a human problem, based on building a complex holistic picture, formed with words, reporting detailed views of informants and conducted in natural settings using data comprising words rather than numbers [63]. The use of this approach allows researchers to gather rich description of how people experience a phenomenon of interest or research issue, and access the human side of the issue. In essence, such an approach helps the researcher to identify
social reality in the cultural and contextual setting. The purpose of this research is to identify
the method that had been used by the library management to measure the quality of the digital
library services. Therefore, by adopting the qualitative approach, the study’s participants can
be more easily approached to share their experiences. Several data gathering methods had
been used to ensure that the collection is “information rich”. This study fits into the
qualitative research genre because it focuses on individual live experiences illustrated by
mainly phenomenological approaches.

3.2.2 Case Study Research

These studies are using the case study as the strategy of inquiry. The following
discussion provides the justification for using case study in the research.

a) Reasons For Selecting Case Study

Case study research is a strategy of inquiry that allows an investigation of the
phenomenon within its real life context, especially when the boundaries between phenomenon
and context are not clearly evident and where multiple sources of evidence are used [64].
Case study research is the most common qualitative method used in information system [65].
Therefore, case study is an appropriate strategy of inquiry as the form of the research question
focuses on a contemporary event, where the types of ‘how’ or ‘why’ questions are being
posed in the research, and where the researcher has little control over events [64]. It is
exploratory because only so little information currently exists about a way to measure the
quality of digital library services. According to [64], an exploratory case study can be used to
ask the ‘what’ question. For example: What are the issues relevant to digital service quality
assessment for effective reporting of library values and performances? The second research
question is the “how” question. For example: How to evaluate QoS of externally provided
digital services? This enables the researcher to explain how the factors may influence each other. According to [64], this type of question leads to the use of ‘case studies’ as a preferred method of inquiry. Thirdly, case study research is usually employed in examining a contemporary phenomenon. In this case it helps examine the innovation concerned with measuring the quality of digital library services. The focus of this study concerns identifying the key factors that contribute towards the digital library services.

b) Case Study Design: Multiple-Case Holistic [64] categorizes case study design into four types: single-case (holistic) designs, single-case (embedded) designs, multiple-case (holistic) designs, and multiple-case (embedded) designs. Among these types, multiple-case designs are seen to be more appropriate than single-case designs, because of the possibility of ‘replication’, and thus, tend to be more robust. The holistic design is used rather than the embedded design because the aim is to study the global nature of the phenomenon. In this study, a multiple-case holistic design has been used. Due to the replication logic, when using a multiple-case design, each case ‘must be carefully selected’ so that it could either reveal similar results or contrasting results for predictable reasons.

In this study, a preliminary model was developed to guide the research design. As stated by [64], an important step in the replication process is ‘the development of a rich, theoretical framework’. That means the theoretical framework must identify clearly the conditions related to the phenomenon of study, and also act as a vehicle for generalizing to new cases, where modifications must be made, if cases do not work as predicted. The advantage of a multiple-case design is the conclusions of each case can be considered to be information needing replication by other cases, and they could contribute to the conclusions of the whole study.

c) Unit of Analysis [64] explains that the unit of analysis for case study research can be an individual, an event, an entity or a process as the actual source of information. It
relates to the basic problem of the study. Thus, the unit of analysis of the research was
the process of measuring the Quality of Services (QoS) in digital library services. The
unit of analysis for this study is an organization, (i.e. the library). The case study
participants are selected from: the public library, academic library, special library,
National library and Digital service department. In obtaining insights and gaining a
clear idea of the problem, at the early stage an exploratory technique is employed by
semi-structured interviews and secondary data analysis. Thus, it includes interviews
with the head of the Digital Services department in the selected library.

3.3 Method In this study

This study follows a qualitative interpretive approach with an exploratory case study
method. The study adopts case study methods in achieving the research objectives because
case study methods allow a researcher to acquire a fuller understanding of the case. The
interpretive paradigm is considered to be the most appropriate approach to the current
exploratory study. It provides support for the examination of social aspects underlying the
technology implementation, assimilation and institutionalization, thus allowing a deeper
understanding of the phenomenon at a theoretical level. Multiple methods of data collection to
triangulate evidence had been used in this study. It is also used to ensure the rich data
gathering. This study used Yin’s strategy for a case study which involves five elements: the
study questions, propositions, unit of analysis, and logic of linking data to the propositions
and the criteria for interpreting the finding [64].

Gathering the data involved visits to the research site (library, with digital services) to
conduct one to one interviews, observation and data analysis. The participants included the
Chief Librarian, management in library and Information Technology Officer in Library,
including the key informants such as the Digital Services administrators. Documentary analysis was then undertaken to look for any evidence of issues and factors related to the measurement of QoS in digital libraries.

3.3.1 Data Collection Approach

Data were collected using the three methods: face-to-face interview, direct observation and document analysis. All interview sessions were conducted in English, considering that the participants were educated in English for their respective library and IT Degrees. The next section, how the collection of data obtained was explained in more detail.

3.3.1.1 Documentary Evidence

Document review as a study methodology offers a powerful impact on the quality of the result because it allows researchers to obtain insights about the case under investigation. This is achieved through access to and detailed analysis of the actual content in the document relevant to the study. Documents for this study were chosen in order to provide a significant account of the issues relevant to digital service quality assessment for reporting of library values and performance. They were related to QoS implementation, and produced by the chief librarian and IT officer who work in the Digital Library. The analysis and review of documents related to practices in digital library and provided a rich source of information with which to complement and supplement data collected through interviews.

3.3.1.2 Semi-structured Interviews

In this study, the interview was the primary data collection method because it allowed the researcher to capture the participants’ viewpoints and experiences of measuring the QoS in Digital Library Services. The interview questions were in a semi-structured
format. The questions were available as guidelines to address the research questions; therefore the participants were free to elaborate their experiences by using their own words. In addition, the participants’ answers to each of the main questions affected the following questions. This allowed a certain degree of flexibility for me to probe and prompt. Compared to the structured interview, the semi-structured interview provides “some latitude to ask further questions in response to what is seen as significant replies [66]. Furthermore, conducting in-depth interview allows participants to freely elaborate and express their experiences, as well as allowing unexpected information to emerge. Information gathered from these methods portrays a rich and thick description of the Digital Library officers' experiences in dealing with management issues of Digital Services when performing their duties in the Digital Library.

In this study, the interviews were intended to last approximately one hour to two hours per session. This was because the participants, particularly at library management, had to observe a tight and designated schedule. The interview was conducted, followed by the advice of [67]. Accordance to three stages, that is, the introduction, the main part of the topics for investigation and the summary of the participant’s responses. The interview was conducted with one participant at a time. Selection of the participants was made using two sample frameworks. First, the research sites were specified, and then the sample population was determined. All interviews were digitally recorded and where necessary notes were taken during the interviews. The recording was then transcribed verbatim after the interviewing.

### 3.3.1.3 Direct Observations

Observational evidence is useful in providing additional information and understanding of the situation. In this study, data collected through observation served as a complement to data collected through interviews in order to enhance the credibility of
research findings, and also an effort to reduce bias. This additional data is helpful for the researcher to uncover the overall view on technology implementation, assimilation and institutionalization in the Digital Library.

3.4 Procedures for Data Gathering and Analysis

This part outlines the procedures and techniques that were used for data collection and analysis, and concludes by addressing the ethical issues, validity and reliability issues.

3.4.1 Selection of Research Sites and Participants

The study is focused on quality of digital services in digital library, therefore ten sample sites were chosen which are funded and administered by the Malaysian and Australia governments. The criteria for selecting a particular library are discussed below. In addition, key informants were identified in the interview session based on recommendations of the Chief of librarians. The reason for selecting the key informants from these two divisions is they are the ones who provide the digital services for the digital library. The following section explains how the research sites and selection of the participant was conducted.

3.4.1.1 Research Sites

A purposive sampling procedure is used to select the research sites. This type of sampling is a usual method used in a case study methodology [68]. This approach is based on the assumption that it is important to selectively choose a sample from a site where the researcher can learn the most [69]. The sample population of the digital library was situated in the Klang valley Malaysia area and Geelong, Australia. The Geelong sites were chosen because the district encompasses the public library, academic library, special library and
national library. Therefore, for this study, the researcher identified that Klang valley Malaysia area and Geelong, Australia, as the most appropriate places given the aims of the study.

3.4.1.2 Selection of Participants

The participants were recruited once the authorities had given their consent to conduct the study in the organization (library and department of Information Technology). The interview participants in this study were collected from senior management and middle administrators involved with the digital services. The ‘attributes of interest’ [68] were recognized to identify the participants that suited the criteria. The criteria were ‘information-rich’ [69]. The interviewees were those who are able to provide rich and abundant descriptions of their experiences and thus, allow in-depth information about their experiences. The criteria for interview participant selection included: a) a top Digital Library administrator, who set the policy and who knows the issues, regardless of quality and b) upper and middle management who has dealt with the Digital Library Services from the beginning. These criteria were important to ensure the generation of the most accurate of rich information as possible and to minimize misunderstandings.

3.4.2 Schedule

The gathering of data for this study required approximately 12 weeks, averaging two weeks per school. Two weeks were allocated to each case study Digital Library to conduct interviews, and two further days in each participating organization undertake observations and data analysis. Each interview lasted from 30 minutes to two hours. The Head of Digital Library Services department and Digital Services Librarian were asked for the required documents. We also spent one to two days in each research site (case study digital library and
key informants’ organisations) to select, read and review for Digital Services related documents or other relevant documents.

### 3.4.3 Data Analysis

The qualitative data collected from case study interviews was verified and rigorously analysed to obtain an in-depth description of this typical contemporary phenomenon within a real life context [62]. In a qualitative study, data analysis is an analytic process which involves several stages. The data analysis in this study adapted and used the [70] interactive model (1994) as a guide. It has been widely used in qualitative research. In this study, the inductive technique of analysis to make sense of multiple participants’ views and sources was used. Data were analysed in the three iterative processes: data reduction, data display, and conclusions.

#### 3.4.3.1 Data Reduction

At the beginning, the research questions and the preliminary model had been reviewed to create a list of relevant and possible codes related to the study. The initial list included the three stages of Digital Services implementation in the Digital Library, that is, use, early use, and non-use, as well as the suggested factors affecting the implementation of Digital Services. The three stages of Digital Services implementation and suggested factors are the dimensions and vary in the preliminary model of the study (refer to Figure 4.1). The next stage was pursued after the completion of the data collection and interview transcription.

The researcher then began to attach descriptive codes to the highlighted terms and phrases in the texts that represent the concepts. After the coding, the data were ready to be categorized. The codes developed were analysed in order to assign them into higher level categories. The data were then compared against the preliminary model or prior theories.
which had been used, also known as within-unit analysis [71]. Microsoft Excel was used to manage and analyse the data. The preparation for data analysis began with inputting initial codes in the Excel sheet which derived from the dimensions and factors of my preliminary model of Digital Services implementation in the Digital Library. After the process of familiarization and identification of important terms or phrases, the terms or phrases had been separated into two columns. One column was dedicated to terms or phrases in Malay language identified in the transcripts, and another column was the English translation of the terms or phrases. Next, after separating the terms and phrases into columns, two sheets named as initial coding – Digital Library administrator and initial coding - key informants had been created. These two sheets consist of all important terms and phrases identified in the transcripts which derived from the Digital Library participant and key informants at the third party service provider (Digital Services).

3.4.3.2 Data Displays

The findings are presented in the next two chapters. They are presented in themes that are derived from the analysis of data. Chapter five (5) addresses the first and second sub-questions about the research. It presents the findings related to the management of Digital Services in Digital Library. It also presents the findings about current approaches that had been used by the management of a Digital Library in measuring the quality of their services. Chapter 6 presents the discussion and analysis of data gathered from all sources such as interview data, observation and document analysis. The method of data analysis was very instrumental in the development of a Digital Services Quality implementation model or framework to answer the research questions. In this study, the data was analysed manually and also used Microsoft Excel. Microsoft Excel was chosen because it effectively and efficiently created the coding, linking and searching. The findings arising from the data are
presented as a number of factors that were linked together and that collectively analysed the research problem. Then, the current study was situated within the prior research, and was compared and contrasted with issues that were raised in the literature. Based on the analysis and synthesis process, several conclusions are drawn, along with implications and various theoretical, practical and research-related recommendations.

3.5 Issues Related To the Research

3.5.1 Ethical Considerations

This study involved no voluntary participants, who were initially informed about the purpose of the study, how they could contribute and the advantages or disadvantages that might be part of the outcome of their participation. Due to that and prior to conducting this study, the researcher applied for ethics approval from the university, the country in which the study conducted, as well as the library involved. The ethics approval application in itself was a rigorous process. To meet specific specifications in order to undertake this research, ethics approval before commencing this research had been done. Details of the steps taken to ensure such approval are discussed here.

3.5.2 Trustworthiness

To ensure the trustworthiness of this research, the issues of validity and reliability had been addressed. [64], states that reliability is the degree of consistency that an instrument or data collection procedure demonstrates, while validity is the quality of data collection procedure that enables it to measure what it is intended to measure. This is to ensure that the data collection was organized and presented in a clear and systematic way so that the analysis resulted in valid and accurate conclusions. In such research the issues of
validity and reliability in qualitative research need to correspond to the criteria of truthfulness – credibility to internal validity, transferability to external.

3.6. Chapter Summary

In conclusion, this chapter has identified the paradigm to be used as the interpretive paradigm. The research was conducted using qualitative methods within a case study research approach. The data were collected using semi-structured individual interviews, observation and documentation analysis. Finally, considerations relating to data analysis have been identified along with the ethical issues related to qualitative research.
Chapter 4

Service Quality Model for Digital Library

In this chapter, a new evaluation model suitable for Digital Libraries is proposed. With the new method in information delivery for libraries the quality of service and Digital Library issues become of paramount importance. Various models and framework have been proposed to evaluate the Quality of Service in Digital Library. Unfortunately, features that contribute towards the Digital Library service quality have not been factored into the design of most existing quality of service models in the Digital Library. To this end, a new model suitable for Digital Libraries is proposed.

4.1 Introduction

In the conventional library setup, the library users must be physically present in the libraries if they wish to use of the library services such as reference services, interlibrary loan and bibliographic search services. As a result of advances in information and web technologies, many of the traditional library services have been digitized resulting in the
Digital Library. As a result, libraries have changed their information management (e.g., gathering, organizing, storing, retrieving and disseminating) activities into digital format. Various new services such as access to electronic or digital collections (online databases, electronic journal, e-books and digitized collections), electronic publishing, web-portals, online reference, and online document delivery and help desk and online library instructions have been introduced into service delivery by the libraries. This development has improved access to appropriate, current and pertinent information at incredible speed.

An important and significant change in the library system is the introduction of the third-party source services such as computers, search engines and scholarly databases. This change has brought with it stringent Quality of service (QoS) requirements of the library patrons. Digital Library introduces an interactive information flow between end-user and the third-party service (service provider) using online access tools [26]. Thus, the library must now include online usage and electronic resources in the overall evaluation of the Digital Library [71]. For that reason, every effort to measure digital library service quality must be established upon a strong understanding of the phenomenon of service quality and what indicates service quality from the user perspective [60]. Therefore, QoS requirements of library service users coupled with the changes in the library service provision have mandated the need for a new approach to evaluating the quality of library service provisioning.

The relationship between Digital Library and third-party sourced services is different from normal customer/service provider relations [72]. It is crucial for libraries to face up to the challenge of their patrons’ demand, especially in relation to the increasing sensitivity to soft service components, value and the quality of service offered in the current networked environment [73]. However, there is no research that takes into account the influence of the quality of the third-party source services in digital library when evaluating library service quality.
The aim of this chapter is to close this gap in the literature. This chapter also attempts to discuss at a conceptual level on the service quality of the digital library. We make two main contributions; first we introduce new features that determine the right third-party sourced services efficiently. The second contribution is to provide a number of factors for digital libraries to use it as an evaluation method to determine the library service quality. The rest of the chapter organized as follows. The section 4.2 focuses on describing the proposed model. It is then followed by method to assess the research model that was discussed in Section 4.3. The following section 4.4, 4.5, 4.6, 4.7, 4.8, 4.9 and 4.10 presents the results of the analyses for the proposed model. The results are accompanied by detailed explanations, especially the outcome of the hypothesis testing. A summary of the chapter is provided in section 4.11.

4.2 A Proposed Model

A model is conceptualized based on the previous work of others [27, 36, 74]. As shown in Figure 4.1, the proposed model for considering the impact of third-party sourced services on Digital Library Services Quality. Based on a review of previous work, we added three features in the model. The first features consist of (1) Service quality features (i.e. environment quality, delivery, quality and outcome quality) as a dependent variable. The second features independent variables are (2) internal-focus (Digital Library) perspective, and third features are (3) external-focus (end-user) perspective. The components of internal perspectives are procedures and standard. While the components for external perspectives are aboutness and usability. The sufficient variables in the relationship between service quality and Digital Library will be (4) third-Party Sourced service features, which include utilization, capability access quality and indicator. All of these features, components and variables are chosen because of their strong support in previous studies. Their applicability and suitability
in the context of service quality in Digital Library is justified by the outcome of the interview with the randomly selected experts’ who’s working with the digital library environment.

Figure 4.1: The proposed model

4.2.1 Service Quality

- **Environment quality**: Environment Quality covers the extent to the presence of the user interface in digital services. Hence, how the library understands and interacts with their patron will affect the quality and nature of the services concentrated [75]. Graphic quality captures how well the various elements of the user interface. The design structure of the user interface helps patrons to clarify the layout of the extended. This includes text, icons, digital images, or backgrounds that are visually represented [76].

- **Delivery Quality**: Using electronic media as a method for delivering services is a crucial challenge encountered by any of the organization including the Digital Library. Among these challenges concerns an inability of the organization to identify the patron needs and
desired what they want [77]. The approaches used electronic medium in the business and management service delivery fields has been addressed by many researchers [7]. Service delivery quality as it relates to library involves two components; service quality and customer satisfaction [26]. This interaction includes features that are applicable to the patrons. For example, when the patron accesses the information from the Digital Library services, the patron needs to select from the existing collections of resources which are stored in digital formats (electronic, database, microform) or relevant to the digital services that have been given by the libraries. To meet the needs of patron’s service delivery quality is requiring robust and reliable technology [78]. Therefore, the Digital library must make sure that it already has in place pertinent aspects that are related to the patrons when they are observing for information.

- **Service outcome quality**: Service outcome is a view as any independent measure of digital library services, digital service delivery or usage. Unclear what is meant. It may contain digital collections and services that facilitate access, retrieval, and analysis of the collections in the library. In this model, outcome quality is viewed as what the patrons are missing after accessing service delivery. The outcome includes the extent to which the digital library keeps its serviceability. It is important that the service is delivered with the accuracy and timeliness which the essential service promises. [36]. Hence, to make it features of outcome quality this service outcome quality can only be judged after service deliver. Explicit discussion of outcome quality as a component is slight in the available research; however there is wide consensus in the literature on the importance of reliability within the scope of Quality of Electronic Services [25]. In essence, the hypothesize that:

\[ H1: \text{Services quality is significantly related to an internal perspective factor (Digital Library).} \]
4.2.2 External-Factor

The second factor that influences the evaluation of quality service for digital library environments is the external-factor. In this study this occurs when the patrons present the overall usefulness of information gained through the library, either through elicitation by an evaluator or by citing/linking to library services. It is essential to assess what users need and desire for services [79]. Particular external factors (patrons) are concurrently growing their expectations of the quality of service delivery [38]. Therefore, the service provider (digital library) will ignore such expectations at their risk. Aboutness and usability are components that need to be considered in this factor.

- **Aboutness:** External factors need the aboutness in their measurement according to some research theories [27]. There are two categories in this component: measurement, based on the patron’s view of services, and measurement based on the patron’s view of the user experience. The user experience of patrons may extend beyond with the time spent interacting with that library. It may involve working with the patron before they start their interactions with the library and following up with users well after their library interactions. These post-transactional measurements are crucial to understanding the larger picture of how the library services are being used. Understanding these differences allows libraries to offer and personalize services to meet the needs of more communities.

- **Usability:** Usability is a multidimensional concept that can be examined from various perspectives [80]. In this chapter, the usability is defined as ease of use or user-friendliness, from the interface effectiveness point of view. This view has a theoretical base on human-computer interaction [80]. Several aspects such as interface design, functional design, data, metadata, and computer systems and networks relate to the concept
of usability [4]. This entire component needs to work together to create an effective and convenient digital library service. Hence, we posited that:

\[ H2: \text{Services quality is significantly related to an external perspective factor.} \]

### 4.2.3 Internal-Factor

Digital library as a mutual customer for third-party service provider, therefore third-party service provider must be active with the Digital Library need. So that it would not create any contradiction in standard and procedures related to the Digital Library. Due to that, procedures and standards need among the factors to be considered in this model.

- **Procedures:** In the world of digital libraries, a procedure is typically described as a condition, term or regulation governing the operation of a digital library or some aspect thereof. Individuals (such as digital library staff members, managers, and stakeholders) make procedures for digital libraries. Sometimes, this procedure can be expressed as rules. The rules provide mechanisms to express complex policies in ways that digital services can interpret and apply them. At an internal level, digital library access procedures must be enforced. Therefore, users often need to be informed of the procedure and educated as to what constitutes a reasonable behaviour [81] normally through the usage procedure. Finally, the procedure could be affected by quality parameters. This could require a quality assurance (QA) which would ensure documented procedures on the standards. Other than that, the best practices need to be implemented with a systematic policy for measuring compliance with this procedure [81].

- **Standards:** A standard provides a powerful means of guiding library performance measurement [21]. A standard is a collection processes intended to accommodate the minimum levels of anticipation held by their external clients. In other words, is to
make sure that they do not reduce underneath. Over the year, libraries have developed standards as a basis for services. A digital library service standard can be considered as a specific case of digital service standard. This is defined as any law, regulation, rule, or practice that affects the creation, acquisition, disposition, organization, dissemination, use, or evaluation of digital services [81]. In principle, we hypothesize that:

\[ H3: \text{An external perspective factor is significantly related to internal perspectives factor} \]

### 4.2.4 Third-Party Sources Services

There are a number of studies about the evaluation quality of digital service factors, mainly to do with the patron’s satisfaction and expectations. Any delaying on developing standards and procedures may impact negatively on information technology (IT) in the organization. Therefore, this study highlights the role of third-party sourced services in providing sufficient variability in the relationship between service quality and the Digital Library. Providers of IT service can no longer afford to focus only on technology and their internal organization. They also have to consider the quality of the services that they provide and focus on the relationship with customers [22]. To develop a strong third-party source services that offer Digital Library with the accessibility and quality of services, third-party must first understand the factors that influence Digital library implementation of this innovation. Among the factors that have been proposed in this chapter that need to be considered are utilization, capability, access quality and indicator.

- **Utilization**: The literatures on Digital library suggest that when library services are being utilized strategically for gaining competitive improvement, then such a library
can be seen to be offering what are called strategic library services. Utilization can be seen in the outputs of standards that deal with the use and delivery of digital reference services, specifically to determine whether a digital reference service is succeeding [22]. The third-party source needs utilize their services to maximize the quality of digital services. These can include a mix of qualitative and quantitative metrics as well as more abstract statements of best practice or objectives for the service [82]. The crucial question is how well digital library management' needs are satisfied. The primary utility of a performance measure is for internal self-diagnosis of library services, sourced and activities [41]. Source usage can be monitored, controlled, and reported, providing transparency for both the third-party source services and a library of the utilized service.

- **Capability:** The capability provided for third-party sourced services to the digital library is related to provision processing, storage, networks, and other fundamental computing resources. The digital library does not manage or control the underlying digital infrastructure but has control over operating systems; storage, deployed applications, and possibly limited control of select networking components (e.g., host firewalls).

- **Access quality:** Access is the first step in digital library services and it's obtaining of the services that contain information. Therefore, it is important to have an access quality of the digital library services environment. Digitizing services for the Digital library should be easily reachable and navigable by any patron, regardless of equipment sophistication, physical disability or language barrier [83]. Access quality and suitability of library resources should also meet patron’s needs [25]. This expectation is related to the perception that Digital library services have an impact on the patron's work. Therefore, there is indeed potential for third-party source
services to improve their services and make sure that they can fulfill the requirements of the digital library.

- **Indicator**: Definitions for IT service indicators are different in each organization. Among the indicators are availability, throughput, downtime and response time. Most of the organizations had been focusing on the infrastructure to define their service availability, and others will be concerned about accessing the service application [6]. From the perspective of information technology resources (ITR), the handling of appropriate IT software, hardware, Network, storage and the help desk are some of the indicators used to measure quality of third-party sourced services.

Two hypotheses formulated:

- **H4**: The third-party service provider has direct effects on the level of service quality that digital libraries provide.

- **H5**: The third-party service provider is significantly related to the external perspective factor.

### 4.3 Method to Assess the Proposed Model

This study adopts PLS-SEM [85] as the statistical method to assess the research model based on the following reasons:

1. The focus of the analysis in this study does not involve the measuring of model invariance. The focus of this study is on service quality. Hence, the use of latent variable (LVs) scores is important to examine the underlying relationship between the LVs.

2. This study uses a large number of LVs and complex modelling of a research model. According to [84], PLS is suitable for large, complex models with many latent variables.
According to [85], large, complex model refers to a research model that has 100 constructs and 1,000 indicators.

3. The focus of this study is to test the relationships, according to prior theoretical knowledge. The ability of PLS-SEM to estimate the correlations between the residuals and assess their impacts on the model makes this technique the appropriate approach.

### 4.3.1 Partial Least Square (PLS)

PLS was originated by an econometrician named Herman Wold in the ‘60s and ‘70s [86]. PLS is a family of alternating least squares algorithms, which extend principal component and canonical correlation analysis [84]. Its path models are usually defined using two sets of linear equations known as the measurement model and structural model [84]. The measurement model specifies the relationships between unobserved or latent variables (LV) whereas the outer model specifies the relationships between a LV and its manifest variables. The inner and outer models are sometimes also known as the structural and measurement model. The PLS algorithm is essentially a sequence of regressions in terms of weight vectors [84]. The basic PLS algorithm involves the following stages:

Stage 1: Iterative estimation of LV scores consisting of a four-step iterative procedure that is repeated until convergence is obtained:

a. Outer approximation of the LV scores,

b. Estimation of inner weights,

c. Inner approximation of the LV scores, and

d. Estimation of the outer weights.

Stage 2: Estimation of outer weights/loading and path coefficients.

Stage 3: Estimation of location parameters.
4.3.2 Reflective and Formative Constructs

Based on SEM literature, LV can be modelled using either formative or reflective indicators. [87], argues that reflective constructs are viewed as a construct that is affected by the same underlying construct, which uses parallel measures that co-vary and it is measuring the same underlying construct. For a reflective construct, the direction of causality is from the construct (i.e., LV) to the indicators, and changes in the underlying construct are hypothesized to cause changes in the indicators [87]. In reflective construct, the arrow direction points from LV to reflective indicators. Furthermore, indicators for a reflective construct should be consistent internally because all of the measures are assumed to be equally valid indicators of the underlying LV [88].

Meanwhile, formative construct refers to constructs that have formative indicators, which are combined to give rise to the meaning of the LV [72]. In contrast to a reflective construct, a formative construct assumes that the measures (indicators) have an impact on the underlying construct [87]. In a reflective construct, the group of indicators jointly determines the conceptual and empirical meaning of the constructs. The direction of causality flows from indicators to LV [87].

Figure 4.2 shows the diagram of reflective and formative constructs. When defining a reflective construct, one view items or indicators as dependent on a latent variable [88] where Y1 is the λ11 indicator, η1 is the latent variable that affects it and λ11, λ12, λ13 is the coefficient giving the expected effect of η1. Indicators that depend on the latent variable are effect indicators. Figure 4.2 is a path diagram that represents three effect indicators (Y1, Y2 and Y3) influenced by η1.

Thus, when defining a formative construct, one conceives the indicators as causing the latent variable where η1 are deviation scores, the deviation scores do not co vary with the
latent variable’s disturbance term ($\zeta_1$), and the disturbance represents all of the variance in the latent variable not accounted for by its indicators [88]. Equation 2 differs from Equation 1 in that the indicators determine the latent variable rather than the reverse and $y_{11}, y_{12}, y_{13}$ is the coefficient giving the expected effect of $\eta_1$. The indicators in Equation 2 are referred to as cause, causal, composite, or formative indicators. We use the term formative indicators simply for consistency. Figure 4.2 depicts three indicators (X1, X2 and X3) that influence the latent variable, $\eta_1$.

According to [72], internal consistency is important for a reflective construct. Thus, the uses of internal reliability measures are required to ensure the measures are reliable. In addition to that, a reflective construct should be uni-dimensional and if any measures are removed, it would not affect the content validity [72]. On the other hand, formative indicators need not be correlated nor have high internal consistency and any changes in the formative measures will cause changes in the underlying construct [87]. A formative construct causes the latent construct representing different dimensions of it [89]. These observed variables are not assumed to be correlated with each other or to represent the same underlying dimension [90].

![Figure 4.2: The Diagrams of Reflective and Formative Constructs](image-url)
For constructs using reflective measures, it is appropriate to examine the loadings as they represent the correlation between the indicators and component scores [89]. While for those constructs with formative measures, the interpretation of formative indicators should be based on weight, as it provides information regarding the importance of each indicator in the formation of the component [90].

In this study, all LVs are modelled as reflective measures. The causality flows of each LV are based on prior knowledge gathered during the literature review phase. Using prior knowledge to determine the causality flow is very important to avoid measurement model misspecification [91].

4.4 Evaluating Measurement and Structural Models Using Partial Least Square

For this study, the research model is assessed using a two-step process: 1) the assessment of the measurement model and 2) the assessment of the structural model. In general, the purpose of model validation is to determine whether both measurement and structural model fulfil the quality criteria for empirical work [90]. The following subsections discuss the guidelines used in this study to assess both the measurement and structural model of this study.

4.4.1 Measurement Model

Based on previous studies, the validation of a reflective measurement model can be established by testing its internal consistency, indicator reliability, convergent validity and discriminant validity [92, 93].
4.4.1.1 Internal Consistency

Traditionally, a measurement item’s internal consistency is evaluated using Cronbach’s alpha (CA). Constructs with high CA values mean that the items within the construct have the same range and meaning [94]. Using CA provides an estimate of the reliability based on indicator inter-correlations. However, within PLS, internal consistency is measured using composite reliability (CR) [86]. This is because even though both CA and CR measure the same thing (internal consistency), CR takes into account that indicators have different loadings. CA provides a severe underestimation of the internal consistency reliability where it does not assume that equivalent among the measures and assuming all indicators are equally weighted [94]. Despite which particular reliability coefficient is used, an internal consistency reliability is considered satisfactory when the value is at least 0.7 in the early stage and values above 0.8 or 0.9 in more advanced stages of research, whereas value below 0.6 indicate a lack of reliability [95].

4.4.2.1 Indicator Reliability

When assessing indicators’ reliability, the researcher is evaluating the extent to which a variable or a set of variables is consistent with what it intends to measure [90]. The reliability, construct is independent of and calculated separately from other constructs. According to [86], indicator loadings should be significant, at least at the 0.05 level and the loading must be greater than 0.7. This is because with the loading value at 0.707, an LV is said to be able to explain at least 50 percent of its indicator’s variance. The significance of the indicator loadings can be tested using a resembling method such as bootstrapping or jack-knifing. According to [91], taking into consideration PLS characteristics of consistency at large, one should be careful when deciding to eliminate an indicator. It makes sense to
eliminate an indicator only when the indicator’s reliability is low and the elimination of that indicator goes along with a substantial increase of CR.

4.4.3.1 Convergent Validity

Convergent validity involves the degree to which individual items reflect a construct converging in comparison to items measuring different constructs [90]. Using PLS, convergent validity can be evaluated using the value of the average variance extracted (AVE). According to [96], sufficient convergent validity is achieved when the AVE value of a construct is at least 0.5.

4.4.4.1 Discriminant Validity

Discriminant validity is used to differentiate measures of a construct from one another. In contrast with convergent validity, discriminant validity tests whether the items do not unintentionally measure something else [90]. In PLS, two measures of discriminant validity are commonly used is cross loading [86] and Fornell-Larcker’s criterion [96]. According to [90], cross-loading is obtained by correlating each LV’s component scores with all of the other items. If each indicator’s loading is higher for its designated construct compared to any other constructs, then it can be inferred that the different constructs’ indicators are not interchangeable. Using Fornell-Larcker’s criterion requires an LV to share more variance with its assigned indicators than with any other LV. Thus, the AVE of each LV should be greater than the LV’s highest squares correlation with any other LV.

4.4.2 Structural Model

Validating the structural model can help the researcher to evaluate systematically whether the hypotheses expressed by the structural model are supported by the data [90]. The
structural model can only be analysed after the measurement model has been validated successfully. In PLS, a structural model can be evaluated using coefficient of determination ($R^2$), and path coefficients.

The first important criterion for assessing the PLS structural model is to evaluate each endogenous LV’s coefficient of determination ($R^2$). $R^2$ measures the relationship of an LV’s explained variance to its total variance. According to [90], a value of $R^2$ around 0.67 is considered substantial; values around 0.333 are average and values of 0.19 and lower are considered weak.

While by examining the path coefficient value, a researcher is able to know the strength of the relationship between two LVs. To examine the relationship between two LVs, the researcher should check the path coefficients, algebraic sign, magnitude and significance. According to [97], the path coefficients should exceed 0.100 to account for a certain impact within the model and be significant at least at the 0.05 level of significance.

### 4.5 Items Selection

The wording of each item is modified to fit the context of service quality four constructs are measured using multiple items (See Table 4.1). Three constructs (i.e., internal, external and service quality) have six items and one construct (third party) have eight items. All items are measured using a five-point Likert scales ranging from “strongly disagree” (1) to “strongly agree” (5).

Measures for internal and external factors are adopted from [98] and [99]. Meanwhile, third party sources services measurement scales are adapted from [100]. Finally, the measurements for service quality are adapted from other research [98] and [101].
<table>
<thead>
<tr>
<th>Construct</th>
<th>Items</th>
<th>Coding</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal factors</td>
<td>The digital library has functional infrastructures ease learning</td>
<td>A1</td>
<td>[98]; [99]</td>
</tr>
<tr>
<td></td>
<td>The digital library has access tools that allow users to find things on their own</td>
<td>A2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Users have the resources necessary to use digital library.</td>
<td>A3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Users have the knowledge necessary to use digital library.</td>
<td>A4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Digital library is compatible with other technologies that user use.</td>
<td>A5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Users can get help from others when they have difficulties using digital library</td>
<td>A6</td>
<td></td>
</tr>
<tr>
<td>External factors</td>
<td>The digital library has functional facilities that inspires study and learning</td>
<td>B1</td>
<td>[98]; [99]</td>
</tr>
<tr>
<td></td>
<td>Learning how to use digital library is easy for users.</td>
<td>B2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>User’s interaction with digital library is clear and understandable.</td>
<td>B3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Users find digital library easy to use.</td>
<td>B4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>It is easy for users to become skillful at using digital library.</td>
<td>B5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Users can get help from librarian when they have difficulties using digital library</td>
<td>B6</td>
<td></td>
</tr>
<tr>
<td>Third Party</td>
<td>Third party provide on time and reliable deliveries</td>
<td>C1</td>
<td>[100]</td>
</tr>
<tr>
<td></td>
<td>Third party perform promised service with dependability and accurately</td>
<td>C2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Librarian discuss regularly with third party provider on the methods of ensuring that performance goals are being met</td>
<td>C3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Third party bring service issues to a complete and satisfactory close</td>
<td>C4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Third party help digital library improve operations efficiency</td>
<td>C5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Third party provide automation and advance information technology service</td>
<td>C6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Third party maintain up-to-date technical data of library products / services</td>
<td>C7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Third party understands the service needs of the digital library</td>
<td>C8</td>
<td></td>
</tr>
<tr>
<td>Service Quality</td>
<td>The library has modern and functional equipment that allows easy access to information</td>
<td>D1</td>
<td>[98]; [101]</td>
</tr>
<tr>
<td></td>
<td>Librarian has the dependability in handling user's service problems</td>
<td>D2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The digital library service to obtain digital resources never break down</td>
<td>D3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Digital library provides the service at the time.</td>
<td>D4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Library gives prompt service to customers.</td>
<td>D5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Users have the convenient access to library collections</td>
<td>D6</td>
<td></td>
</tr>
</tbody>
</table>

Table 4.1 Measurement Constructs
4.6 Descriptive Statistic of Respondents

These statistics give insight into the demographic profiles of respondents who participated in the survey. Among these respondents, 16% were males and 48% were females. The analysis also shows more than half (70%) of the respondents were 31 to 40 years old. 14% age between 41 to 50 years old, 10% age between 20 to 30 years old and 6% age above 50 years old. The majority of the respondents (92%) is a Malay while 8% are other races. Among the type of library, 44% respondents are from the academic library, 42% are from special library, 6% of public library, school library and other library are 6% respectively. 58% of the respondents have at least eleven to fifteen years of working in the digital library. 20% of the respondents were working between zeros to five years, 14% of the respondents are working in the digital library between six to ten years and 8% with more than fifteen years of working in the digital library.

<table>
<thead>
<tr>
<th>Demographic</th>
<th>Frequency (n=200)</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>32</td>
<td>16 %</td>
</tr>
<tr>
<td>Female</td>
<td>168</td>
<td>84 %</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-30 years old</td>
<td>20</td>
<td>10 %</td>
</tr>
<tr>
<td>31-40 years old</td>
<td>140</td>
<td>70 %</td>
</tr>
<tr>
<td>41-50 years old</td>
<td>28</td>
<td>14 %</td>
</tr>
<tr>
<td>Above 50 years old</td>
<td>12</td>
<td>6 %</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malay</td>
<td>184</td>
<td>92 %</td>
</tr>
<tr>
<td>Others</td>
<td>16</td>
<td>8 %</td>
</tr>
<tr>
<td>Type of Library</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Academic</td>
<td>88</td>
<td>44 %</td>
</tr>
<tr>
<td>Special</td>
<td>84</td>
<td>42 %</td>
</tr>
<tr>
<td>Public</td>
<td>12</td>
<td>6 %</td>
</tr>
<tr>
<td>School</td>
<td>8</td>
<td>4 %</td>
</tr>
<tr>
<td>Others</td>
<td>8</td>
<td>4 %</td>
</tr>
<tr>
<td>Years working in the library</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-5 years</td>
<td>40</td>
<td>20 %</td>
</tr>
<tr>
<td>6-10 years</td>
<td>28</td>
<td>14 %</td>
</tr>
<tr>
<td>11-15 years</td>
<td>116</td>
<td>58 %</td>
</tr>
<tr>
<td>More than 15 years</td>
<td>16</td>
<td>8 %</td>
</tr>
</tbody>
</table>

Table 4.2: Respondents’ Demographic Information
4.7 Descriptive Statistics of Instrument

Using the statistical software SPSS version 20.0, the mean, standard deviation, variance, minimum value and maximum value of each indicator were examined. Table 4.3 outlines the descriptive statistics for all indicators.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Indicator</th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal</td>
<td>A1</td>
<td>200</td>
<td>1</td>
<td>5</td>
<td>3.51</td>
<td>0.977</td>
</tr>
<tr>
<td></td>
<td>A2</td>
<td>200</td>
<td>1</td>
<td>5</td>
<td>4.12</td>
<td>0.911</td>
</tr>
<tr>
<td></td>
<td>A3</td>
<td>200</td>
<td>3</td>
<td>5</td>
<td>4.18</td>
<td>0.656</td>
</tr>
<tr>
<td></td>
<td>A4</td>
<td>200</td>
<td>1</td>
<td>5</td>
<td>3.82</td>
<td>1.055</td>
</tr>
<tr>
<td></td>
<td>A5</td>
<td>200</td>
<td>2</td>
<td>5</td>
<td>4.10</td>
<td>0.857</td>
</tr>
<tr>
<td></td>
<td>A6</td>
<td>200</td>
<td>1</td>
<td>5</td>
<td>4.44</td>
<td>0.900</td>
</tr>
<tr>
<td>External</td>
<td>B1</td>
<td>200</td>
<td>2</td>
<td>5</td>
<td>4.48</td>
<td>0.730</td>
</tr>
<tr>
<td></td>
<td>B2</td>
<td>200</td>
<td>1</td>
<td>5</td>
<td>3.90</td>
<td>0.833</td>
</tr>
<tr>
<td></td>
<td>B3</td>
<td>200</td>
<td>1</td>
<td>5</td>
<td>3.70</td>
<td>0.902</td>
</tr>
<tr>
<td></td>
<td>B4</td>
<td>200</td>
<td>1</td>
<td>5</td>
<td>4.00</td>
<td>0.874</td>
</tr>
<tr>
<td></td>
<td>B5</td>
<td>200</td>
<td>1</td>
<td>5</td>
<td>3.86</td>
<td>0.897</td>
</tr>
<tr>
<td></td>
<td>B6</td>
<td>200</td>
<td>1</td>
<td>5</td>
<td>4.16</td>
<td>0.948</td>
</tr>
<tr>
<td>Third party</td>
<td>C1</td>
<td>200</td>
<td>2</td>
<td>5</td>
<td>3.78</td>
<td>0.857</td>
</tr>
<tr>
<td></td>
<td>C2</td>
<td>200</td>
<td>2</td>
<td>5</td>
<td>3.98</td>
<td>0.885</td>
</tr>
<tr>
<td></td>
<td>C3</td>
<td>200</td>
<td>1</td>
<td>5</td>
<td>4.08</td>
<td>0.870</td>
</tr>
<tr>
<td></td>
<td>C4</td>
<td>200</td>
<td>1</td>
<td>5</td>
<td>3.76</td>
<td>0.909</td>
</tr>
<tr>
<td></td>
<td>C5</td>
<td>200</td>
<td>1</td>
<td>5</td>
<td>3.88</td>
<td>0.842</td>
</tr>
<tr>
<td></td>
<td>C6</td>
<td>200</td>
<td>1</td>
<td>5</td>
<td>3.86</td>
<td>0.897</td>
</tr>
<tr>
<td></td>
<td>C7</td>
<td>200</td>
<td>1</td>
<td>5</td>
<td>3.88</td>
<td>0.938</td>
</tr>
<tr>
<td></td>
<td>C8</td>
<td>200</td>
<td>1</td>
<td>5</td>
<td>3.86</td>
<td>0.962</td>
</tr>
<tr>
<td>Service</td>
<td>D1</td>
<td>200</td>
<td>1</td>
<td>5</td>
<td>4.34</td>
<td>0.910</td>
</tr>
<tr>
<td>quality</td>
<td>D2</td>
<td>200</td>
<td>1</td>
<td>5</td>
<td>3.88</td>
<td>1.110</td>
</tr>
<tr>
<td></td>
<td>D3</td>
<td>200</td>
<td>1</td>
<td>5</td>
<td>3.50</td>
<td>1.207</td>
</tr>
<tr>
<td></td>
<td>D4</td>
<td>200</td>
<td>1</td>
<td>5</td>
<td>4.18</td>
<td>0.993</td>
</tr>
<tr>
<td></td>
<td>D5</td>
<td>200</td>
<td>1</td>
<td>5</td>
<td>4.00</td>
<td>0.940</td>
</tr>
<tr>
<td></td>
<td>D6</td>
<td>200</td>
<td>1</td>
<td>5</td>
<td>4.34</td>
<td>0.932</td>
</tr>
</tbody>
</table>

Table 4.3: Descriptive Statistics for All Indicators

4.8 Measurement Model Assessment

The research model for this study is tested using partial least squares (PLS). Smart PLS 2.0 M3 [102] is used to assess the measurement and structural model for this study. This statistical program assesses the psychometric properties of the measurement model and estimates the parameters of the structural model. The validity and reliability of the
measurement model for this study are evaluated using the following analyses: internal consistency reliability, indicator reliability, convergent validity and discriminant validity. The following subsections present the findings for each of the analyses used to evaluate the validity of the measurement model for this study.

4.8.1 Internal Consistency Reliability

<table>
<thead>
<tr>
<th>Construct</th>
<th>Item</th>
<th>Mean</th>
<th>Std Dev.</th>
<th>Loadings</th>
<th>t-statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal</td>
<td>A1</td>
<td>0.040</td>
<td>0.018</td>
<td>0.755</td>
<td>2.213</td>
</tr>
<tr>
<td></td>
<td>A2</td>
<td>0.221</td>
<td>0.007</td>
<td>0.843</td>
<td>31.679</td>
</tr>
<tr>
<td></td>
<td>A3</td>
<td>0.208</td>
<td>0.010</td>
<td>0.832</td>
<td>21.068</td>
</tr>
<tr>
<td></td>
<td>A4</td>
<td>0.231</td>
<td>0.006</td>
<td>0.881</td>
<td>39.039</td>
</tr>
<tr>
<td></td>
<td>A5</td>
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<td>0.839</td>
<td>23.532</td>
</tr>
<tr>
<td></td>
<td>A6</td>
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<td>0.009</td>
<td>0.874</td>
<td>30.305</td>
</tr>
<tr>
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<td>0.842</td>
<td>23.890</td>
</tr>
<tr>
<td></td>
<td>B2</td>
<td>0.190</td>
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<td>0.914</td>
<td>31.678</td>
</tr>
<tr>
<td></td>
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<td>0.871</td>
<td>41.482</td>
</tr>
<tr>
<td></td>
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<td>0.007</td>
<td>0.910</td>
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</tr>
<tr>
<td></td>
<td>B5</td>
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<td>0.006</td>
<td>0.898</td>
<td>33.406</td>
</tr>
<tr>
<td></td>
<td>B6</td>
<td>0.196</td>
<td>0.008</td>
<td>0.872</td>
<td>25.945</td>
</tr>
<tr>
<td>Third Party</td>
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<td>0.004</td>
<td>0.839</td>
<td>28.262</td>
</tr>
<tr>
<td></td>
<td>C2</td>
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<td>0.004</td>
<td>0.809</td>
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</tr>
<tr>
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</tr>
<tr>
<td></td>
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<td>0.004</td>
<td>0.879</td>
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</tr>
<tr>
<td></td>
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<td>0.002</td>
<td>0.917</td>
<td>58.451</td>
</tr>
<tr>
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<td>C6</td>
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<td>0.939</td>
<td>39.952</td>
</tr>
<tr>
<td></td>
<td>C7</td>
<td>0.143</td>
<td>0.004</td>
<td>0.898</td>
<td>38.635</td>
</tr>
<tr>
<td></td>
<td>C8</td>
<td>0.153</td>
<td>0.005</td>
<td>0.930</td>
<td>29.233</td>
</tr>
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<td>0.008</td>
<td>0.885</td>
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<tr>
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<td>D2</td>
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<td>0.005</td>
<td>0.859</td>
<td>34.434</td>
</tr>
<tr>
<td></td>
<td>D3</td>
<td>0.139</td>
<td>0.007</td>
<td>0.790</td>
<td>19.241</td>
</tr>
<tr>
<td></td>
<td>D4</td>
<td>0.210</td>
<td>0.008</td>
<td>0.953</td>
<td>25.905</td>
</tr>
<tr>
<td></td>
<td>D5</td>
<td>0.195</td>
<td>0.005</td>
<td>0.949</td>
<td>35.883</td>
</tr>
<tr>
<td></td>
<td>D6</td>
<td>0.203</td>
<td>0.006</td>
<td>0.862</td>
<td>32.564</td>
</tr>
</tbody>
</table>

Table 4.4: Descriptive and Reliability Statistics

A measurement model has satisfactory internal consistency reliability when the composite reliability (CR) of each construct exceeds the threshold value of 0.7. Table 4.4
shows that the CR of each construct for this study ranges from 0.755 to 0.953 and this is above the recommended threshold value of 0.7. Thus, the results indicate that the items used to represent the constructs have satisfactory internal consistency reliability.

### 4.8.2 Convergent Validity

The degree to which multiple items to measure the same concepts are in agreement, which is Convergent validity. As suggested by [103] factor loadings, composite reliability and the average variance extracted are used to assess convergent validity.

In this study, the measurement model’s convergent validity is assessed by examining its average variance extracted (AVE) value. Convergent validity is adequate when constructs have an average variance extracted (AVE) value of at least 0.5 or more. Table 4.5 shows that all constructs have AVE ranging from 0.612 to 0.783, which exceeded the recommended threshold value of 0.5. This result shows that the study’s measurement model has demonstrated an adequate convergent validity.

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Average Extracted Variance (AVE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal</td>
<td>0.612</td>
</tr>
<tr>
<td>External</td>
<td>0.783</td>
</tr>
<tr>
<td>Third Party</td>
<td>0.783</td>
</tr>
<tr>
<td>Service Quality</td>
<td>0.783</td>
</tr>
</tbody>
</table>

Table 4.5: AVE Value

### 4.8.3 Discriminant Validity

Discriminant validity is the degree to which items differentiate among constructs or measure distinct concepts by examining the correlations between the measures of potentially
overlapping constructs. Items should load more strongly on their own constructs in the model, and the average variance shared between each construct and its measures should be greater than the variance shared between the construct and other constructs [96].

In this study, the measurement model’s discriminant validity is assessed by using two measures: 1) [96] criterion and 2) cross loading. A measurement model has discriminant validity when 1) the square root of the AVE exceeds the correlations between the measure and all other measures, and 2) the indicators’ loadings are higher against their respective construct compared to other constructs.

Thus, to determine the first assessment of measurement model’s discriminant validity, the AVE value of each construct is generated using the smartPLS algorithm function. Then the square roots of AVE are calculated manually. Based on the results, all square roots of AVE exceeded the off-diagonal elements in their corresponding row and column. The bolded elements in Table represent the square roots of the AVE and non-bolded values represent the intercorrelation value between constructs. Based on Table 4.6, all off-diagonal elements are lower than square roots of AVE (bolded on the diagonal). Hence, the result confirmed that the Fornell and Larker’s criterion is met.

<table>
<thead>
<tr>
<th></th>
<th>External</th>
<th>Internal</th>
<th>Serv_Qual</th>
<th>Third_Party</th>
</tr>
</thead>
<tbody>
<tr>
<td>External</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internal</td>
<td>0.726</td>
<td></td>
<td>0.782</td>
<td></td>
</tr>
<tr>
<td>Serv_Qual</td>
<td>0.819</td>
<td>0.736</td>
<td></td>
<td>0.885</td>
</tr>
<tr>
<td>Third_Party</td>
<td>0.882</td>
<td>0.738</td>
<td>0.880</td>
<td>0.885</td>
</tr>
</tbody>
</table>

Table 4.6: Inter-correlation Matrix

* Square root of the AVE of the diagonal (bold)
The second assessment of discriminant validity is to examine the indicators’ loadings with respect to all construct correlations. The output of cross loadings is produced by the SmartPLS algorithm function. Table 4.7 shows the output of cross loading between constructs and indicators. Table 4.7 also shows that all measurement items loaded higher against their respective intended latent variable compared to other variables. The table also demonstrated that the loading of each block is higher than any other block in the same rows and columns. The loading clearly separates each latent variable as theorized in the conceptual model. Thus, the cross loading output confirmed that the second assessments of the measurement model’s discriminant validity are satisfied. This study, therefore, concludes that the measurement model has established its discriminant validity.

<table>
<thead>
<tr>
<th></th>
<th>Internal</th>
<th>External</th>
<th>Third Party</th>
<th>Service Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>0.755</td>
<td>0.618</td>
<td>0.743</td>
<td>0.611</td>
</tr>
<tr>
<td>A2</td>
<td>0.843</td>
<td>0.775</td>
<td>0.687</td>
<td>0.650</td>
</tr>
<tr>
<td>A3</td>
<td>0.832</td>
<td>0.707</td>
<td>0.584</td>
<td>0.663</td>
</tr>
<tr>
<td>A4</td>
<td>0.881</td>
<td>0.810</td>
<td>0.724</td>
<td>0.650</td>
</tr>
<tr>
<td>A5</td>
<td>0.839</td>
<td>0.799</td>
<td>0.784</td>
<td>0.719</td>
</tr>
<tr>
<td>A6</td>
<td>0.874</td>
<td>0.853</td>
<td>0.773</td>
<td>0.864</td>
</tr>
<tr>
<td>B1</td>
<td>0.886</td>
<td>0.842</td>
<td>0.790</td>
<td>0.832</td>
</tr>
<tr>
<td>B2</td>
<td>0.809</td>
<td>0.914</td>
<td>0.792</td>
<td>0.787</td>
</tr>
<tr>
<td>B3</td>
<td>0.736</td>
<td>0.871</td>
<td>0.717</td>
<td>0.591</td>
</tr>
<tr>
<td>B4</td>
<td>0.778</td>
<td>0.910</td>
<td>0.862</td>
<td>0.791</td>
</tr>
<tr>
<td>B5</td>
<td>0.840</td>
<td>0.898</td>
<td>0.717</td>
<td>0.619</td>
</tr>
<tr>
<td>B6</td>
<td>0.856</td>
<td>0.872</td>
<td>0.791</td>
<td>0.703</td>
</tr>
<tr>
<td>C1</td>
<td>0.731</td>
<td>0.699</td>
<td>0.839</td>
<td>0.656</td>
</tr>
<tr>
<td>C2</td>
<td>0.699</td>
<td>0.630</td>
<td>0.809</td>
<td>0.740</td>
</tr>
<tr>
<td>C3</td>
<td>0.711</td>
<td>0.817</td>
<td>0.859</td>
<td>0.836</td>
</tr>
<tr>
<td>C4</td>
<td>0.762</td>
<td>0.839</td>
<td>0.879</td>
<td>0.754</td>
</tr>
<tr>
<td>C5</td>
<td>0.653</td>
<td>0.762</td>
<td>0.917</td>
<td>0.798</td>
</tr>
<tr>
<td>C6</td>
<td>0.786</td>
<td>0.811</td>
<td>0.939</td>
<td>0.831</td>
</tr>
<tr>
<td>C7</td>
<td>0.786</td>
<td>0.811</td>
<td>0.898</td>
<td>0.756</td>
</tr>
<tr>
<td>C8</td>
<td>0.798</td>
<td>0.846</td>
<td>0.930</td>
<td>0.836</td>
</tr>
<tr>
<td>D1</td>
<td>0.873</td>
<td>0.868</td>
<td>0.837</td>
<td>0.885</td>
</tr>
<tr>
<td>D2</td>
<td>0.599</td>
<td>0.567</td>
<td>0.720</td>
<td>0.859</td>
</tr>
<tr>
<td>D3</td>
<td>0.488</td>
<td>0.446</td>
<td>0.592</td>
<td>0.709</td>
</tr>
<tr>
<td>D4</td>
<td>0.770</td>
<td>0.753</td>
<td>0.883</td>
<td>0.953</td>
</tr>
<tr>
<td>D5</td>
<td>0.778</td>
<td>0.747</td>
<td>0.784</td>
<td>0.949</td>
</tr>
<tr>
<td>D6</td>
<td>0.839</td>
<td>0.862</td>
<td>0.801</td>
<td>0.862</td>
</tr>
</tbody>
</table>

Table 4.7: The Cross Loading Output Using Smart PLS
Overall, the reliability and validity tests conducted on the measurement model are satisfactory. All reliability and validity tests are confirmed and this is an indicator that the measurement model for this study is valid and fit to be used to estimate the parameters in the structural model.

4.8.4 Indicator Reliability

Indicator reliability of the measurement model is measured by examining the item loadings. A measurement model is said to have satisfactory indicator reliability when each item’s loading is at least 0.7 and is significant at least at the level of 0.05. Based on the analysis, all items in the measurement model exhibited loadings exceeding 0.700; ranging from a lower bound of 0.755 to an upper bound of 0.953. Table 4.8 shows the loading for each item and its T-statistic values on their respective constructs. Based on the results, all items used for this study have demonstrated satisfactory indicator reliability.

<table>
<thead>
<tr>
<th></th>
<th>Internal</th>
<th>External</th>
<th>Third Party</th>
<th>Service Quality</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
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<td>A2</td>
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<tr>
<td>A3</td>
<td>0.832</td>
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<td>0.584</td>
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<tr>
<td>A4</td>
<td>0.881</td>
<td>0.810</td>
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</tr>
<tr>
<td>A5</td>
<td>0.839</td>
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<td>0.784</td>
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</tr>
<tr>
<td>A6</td>
<td>0.874</td>
<td>0.853</td>
<td>0.773</td>
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</tr>
<tr>
<td>B1</td>
<td>0.886</td>
<td>0.842</td>
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</tr>
<tr>
<td>B2</td>
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<td>0.914</td>
<td>0.792</td>
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<tr>
<td>B3</td>
<td>0.736</td>
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<td>0.717</td>
<td>0.591</td>
</tr>
<tr>
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<td>0.791</td>
</tr>
<tr>
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<td>0.831</td>
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<tr>
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</tr>
<tr>
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</tr>
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<td><strong>0.930</strong></td>
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</tr>
<tr>
<td>D1</td>
<td>0.873</td>
<td>0.868</td>
<td>0.837</td>
<td><strong>0.885</strong></td>
</tr>
<tr>
<td>D2</td>
<td>0.599</td>
<td>0.567</td>
<td>0.720</td>
<td><strong>0.859</strong></td>
</tr>
<tr>
<td>D3</td>
<td>0.488</td>
<td>0.446</td>
<td>0.592</td>
<td><strong>0.790</strong></td>
</tr>
<tr>
<td>D4</td>
<td>0.770</td>
<td>0.753</td>
<td>0.883</td>
<td><strong>0.953</strong></td>
</tr>
<tr>
<td>D5</td>
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<td>0.747</td>
<td>0.784</td>
<td><strong>0.949</strong></td>
</tr>
<tr>
<td>D6</td>
<td>0.839</td>
<td>0.862</td>
<td>0.801</td>
<td><strong>0.862</strong></td>
</tr>
</tbody>
</table>

Table 4.8: The Cross Loading Output Using Smart PLS

### 4.9 Structural Model

The following subsections discuss the tests used to assess the validity of the structural model for this study. The validity of the structural model is assessed using the coefficient of determination ($R^2$) and path coefficients. In addition, this study also assesses the mediation, relationships that are being proposed in the research model. The mediation, relationships is tested using the guidelines proposed by [104].

#### 4.9.1 Coefficient of Determination ($R^2$)

The $R^2$ value indicates the amount of variance independent variables that is explained by the independent variables. Thus, a larger $R^2$ value increases the predictive ability of the structural model. In this study, SmartPLS algorithm function is used to obtain the $R^2$ value, while the SmartPLS bootstrapping function is used to generate the t-statistics values. For this study, the bootstrapping generated 5000 samples from 200 cases. The result of the structural model is presented in Figure 4.3.
Referring to Figure 4.3, external and internal are able to explain 85.8% of the variance in service quality. Meanwhile, third party explains 78.1% of variance and 80.7% of variance in service quality.

**4.9.2 Path Coefficients**

Within the structural model, each path connecting two latent variables represented a hypothesis. Based on the analysis conducted on the structural model, it allows the researcher to confirm or disconfirm each hypothesis as well as understand the strength of the relationship between dependent and independent variables.

Using the SmartPLS algorithm output, the relationships between independent and dependent variables were examined. However, in SmartPLS in order to test the significant level, t-statistics for all paths are generated using the SmartPLS bootstrapping function. Based on the t-statistics output, the significant level of each relationship is determined. Table 4.9
lists down the path coefficients, observed t-statistics, and significance level for all hypothesized path. Using the results from the path assessment, the acceptance or rejection of the proposed hypotheses is determined. The testing of the proposed hypotheses is discussed in the next section.

<table>
<thead>
<tr>
<th>Dependent constructs</th>
<th>Independent constructs</th>
<th>Path coefficients (β)</th>
<th>t-value</th>
<th>Significance Level</th>
</tr>
</thead>
<tbody>
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<td>External</td>
<td>0.926</td>
<td>61.832</td>
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</tr>
<tr>
<td>External</td>
<td>Internal</td>
<td>0.148</td>
<td>1.812</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>External</td>
<td>0.745</td>
<td>9.850</td>
<td>0.01</td>
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<tr>
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<td>5.124</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>Third Party</td>
<td>0.602</td>
<td>9.666</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Table 4.9: Path Coefficients, Observed T- Statistics, Significant Level for All Hypothesized Paths

4.10 Hypotheses Testing

To validate the proposed hypotheses and the structural model, the path coefficient between two latent variables is assessed. Based on previous studies, the path coefficient value needs to be at least 0.1 to account for a certain impact within the model [103]; [105]. Assessment of the path coefficient shows that all proposed hypotheses are supported. From the analysis, supported hypotheses are significant at least at the level of 0.05, have expected sign directions (i.e., positive) and consist of a path coefficient value (β) ranging from 0.148 to 0.926.
<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Relationship</th>
<th>Std Beta</th>
<th>Std Error</th>
<th>t-value</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
<td>INTERNAL -&gt; SERV_QUAL</td>
<td>0.331</td>
<td>0.065</td>
<td>5.124**</td>
<td>Supported</td>
</tr>
<tr>
<td>H2</td>
<td>EXTERNAL -&gt; INTERNAL</td>
<td>0.926</td>
<td>0.015</td>
<td>61.832**</td>
<td>Supported</td>
</tr>
<tr>
<td>H3</td>
<td>THIRD_PARTY -&gt; SERV_QUAL</td>
<td>0.602</td>
<td>0.062</td>
<td>9.666**</td>
<td>Supported</td>
</tr>
<tr>
<td>H4</td>
<td>EXTERNAL -&gt; THIRD_PARTY</td>
<td>0.745</td>
<td>0.076</td>
<td>9.850**</td>
<td>Supported</td>
</tr>
<tr>
<td>H5</td>
<td>INTERNAL -&gt; THIRD_PARTY</td>
<td>0.148</td>
<td>0.082</td>
<td>1.812*</td>
<td>Supported</td>
</tr>
</tbody>
</table>

Table 4.10: Hypothesis

**p< 0.01, *p< 0.05

Based on the analysis, it shows that Service Quality is influenced directly by internal ($\beta =0.331$, $t=5.124$, $p<0.01$). As a result, hypothesis H1 is supported.

From the analysis, internal factor is influenced directly by external factors ($\beta =0.926$, $t=61.832$, $p<0.01$). As a result, hypothesis H2 is supported.

Further, from the analysis, service quality is influenced directly by third parties ($\beta =0.602$, $t=9.666$, $p<0.01$). As a result, hypothesis H3 is supported.

Meanwhile, the third party is influenced directly by external factors ($\beta =0.745$, $t=9.850$, $p<0.01$) As a result, hypothesis H4 is supported. On the other hand, third party is directly influenced by internal factor ($\beta =0.148$, $t=1.812$, $p<0.05$). As a result, hypothesis H5 is supported.

4.10.1 Mediating Analysis

According to [91], assessing the direct and indirect relationships between exogenous and endogenous latent variable is another important evaluation of a structural model. This direct and indirect relationship can be examined by conducting mediating or moderating analysis. In this section, it only assessed the significance of the mediating relationships.
Figure 4.4 shows the result of the post-hoc analysis conducted to examine the mediating effect third party on service quality. The post-hoc analysis is started by examining the influence of internal factor on internal factor. From the analysis internal factor is influence positively by external factor ($\beta = 0.926$, $t = 61.832$) (please refer to Figure 4.4 A). To test the mediating effect of internal factor, the mediating variable is introduced into the relationship between external and service quality. In this study, the important of the mediating is third party sourced services. The internal and external factors are mediated by third party sourced services on service quality.

Then the post-hoc analysis is continued to examine the mediating effect of third party on the relationship between internal and service quality (please refer to Figure 4.4 B). From the analysis, third party is identified to service quality positively ($\beta = 0.602$, $t = 9.666$) and has been influenced positively by internal factor ($\beta = 0.148$, $t = 1.812$).

![Figure 4.4: The Results of Post-hoc Analysis](image)
4.11 Chapter Summary

SmartPLS is used to investigate the determinants of the service quality. A number of observations can be made from the analysis conducted on the measurement and structural model. First, the structural model demonstrated satisfactory reliability and validity measures. In terms of internal consistency, all constructs have composite reliability values more than 0.7. All item loadings are greater than 0.7 and are significant at the level of 0.001, demonstrating indicator reliability. The measurement model also demonstrated satisfactory convergent and discriminant validity by having AVE value greater than 0.50, all manifest variables loaded on their respective latent variable and the square roots of AVE for each construct are greater than its inter-correlation.

Second, the validation of the structural model demonstrated satisfactory results. The R2 were substantial with a value of 80.7%. This demonstrates strong explanatory power. Moreover, the structural model is supported. Based on the path coefficient assessment, five proposed relationships have β value greater than 0.1 and are significant at least at the level of 0.05. Finally, the structural model exhibited two significant mediating relationships. Based on the analysis made, proves that the third party indispensable element in the measurement of quality in digital services.
Service Quality Assessment in Provision of Library Services

In this chapter, the aim is to understand the issues relevant to service quality assessment processes in libraries. Subsequently, conceptual models of aligning library quality of service assessment for effective reporting of library value and performance have been developing. The model concerned with stakeholders with a focus on service quality and factors that exert significant relationship in regards to the QoS in libraries. Then the integration of Service Level Agreements (SLAs) in the evaluation of library systems is proposed. The key elements that need to be evaluated are the third-party service provider as one of its. It is proposed that what is required is a three-pronged approach to the assessment of digital service quality within a library domain. At the service provider and library interface level, service level agreements (SLAs) are used to establish the required level of digital service quality. At the user-library interface level, the library management collects user experiences and perceptions through the various existing instruments. At the user-service interface level, the digital service
usage data are collected and used in conjunction with the data collected. As a consequence, the user-library interface will enhance user experiences as well as gauge changes to the level of QoS required. The purpose of this chapter is to consider the issues relevant to service quality assessment in libraries and subsequently develop a conceptual model of aligning library quality of service assessment for effective reporting of library value and performance to stakeholders. Currently, there is no way to adequately ensure QoS between the digital service providers and the library management. On the bases of the hypothesis that emerged in chapter 4 it is possible develop new models that will do just this. This chapter also reports on the case study undertaken within the proposed approach, using a networked desktop system provided to the library from a third-party service provider. Service level agreements (SLAs) are proposed to capture the QoS requirements of the digital service users and the commitments, as well as the adherence of the digital service providers.

5.1 Introduction

Libraries have changed the way they provide services. Today’s libraries, mostly offer their services in electronic and web-based form. These services include online databases, electronic serial and digital documents [2]. Digital libraries have become more prevalent in the library and information science fields. They provide access to digital services in a coherent and economical manner to geographically distributed library patrons. An advantage of the digital libraries over the conventional libraries is that the former has the potential to store much more information with extremely little or no physical space. Increased accessibility as well as availability of non traditional constituencies of a library such as geographic location or organizational affiliation is another important advantage of the digital libraries over the traditional libraries.
Therefore, the quality of service (QoS) is one of the most important factors and is a major issue on the research agenda for electronic services [52, 1]. Commercial information service providers are now competing in the information marketplace. Thus, libraries are facing stiff competition from many information provider agencies. Also, libraries are being held accountable from agencies such as their parent institutions and accrediting bodies regarding the quality and the impact of the service they provide to their community of service users. Moreover, digital library users can access some of the digital services from anywhere at any time, thus saving their time [2, 26].

The digital library has changed the business model from buy-and-use to a rent-and-use business model. The advantage of this change is that the libraries will be able to tailor their services to the needs of their current and future users. This, in turn, will enable the libraries to be strongly linked to their communities and rapidly adjust to the changing world around them. As externally sourced digital services are becoming prevalent, issues regarding their quality assessment are gaining critical importance. Furthermore, sourcing digital services from external providers has brought with it stringent quality of service (QoS) demand from the library service users. Currently, there is no way of ensuring QoS between the digital service providers and the library management. This issue has recently become an area of considerable interest. Moreover, libraries are dedicating increasingly large components of their budget to electronic resources [106]. The main problem to address in this chapter is how to evaluate these qualities of the service.

Unfortunately, the traditional quantitative measurement of library collections is no longer appropriate, nor applicable, as a means of quality of service assessment. Currently, different library uses different models to measure their QoS [20]. Traditional measures of library services, such as counting interlibrary loans, circulation statistics or percentages of
reference questions answered correctly have become obsolete [5]. The major issues with current methods are that performance indicators only show the raw materials or potential input, not the results or output. In many service industries, companies have created programs which incorporate a survey that elicits customers' assessments of service quality, plus a feedback loop through which service changes are implemented and then evaluated with subsequent survey data. However, the determinants and measurements of service quality in library become unique compared to other service sectors. QoS in libraries, consist of many facets including (a) user-orientation of services, (b) accuracy and reliability of the services, (c) speed and currency of the services, (d) accessibility, (e) competence of staff, and (f) effectiveness and efficiency [32].

Thus, this is the age of information-rich era and cost-effective information providing agents competing with the libraries. Library management needs to change the way it measures QoS and builds a climate of continuous improvement in all areas of library service. It especially needs to work directly with customers to deliver such service on a continuous basis. Customer satisfaction was seeded as the libraries highest priority. Due to that, the libraries will achieve success only if customers are satisfied.

The library should centre on service provision and improvement on building a good relationship between stakeholders with their services. However, digital services provided by digital libraries often include services that exist outside the physical and administrative bounds of the library. These digital services are often contracted from third-party digital service providers for a fee. Therefore, the quality of service assessment for digital services requires the inclusion of the third-party service provider. This chapter is the first to address the integration of Service Level Agreements (SLAs) in the evaluation of library systems.
This study differs from the previous work on tools to assess service quality within library domains. The rest of the chapter is structured as follows: first the layered architecture of the library system. Next, a proposal for a conceptual framework for assessing QoS in provisioning library services is considered. The introducing of a three-pronged approach to the assessment of digital service quality within a library domain has been done after that. At the service provider and library interface level, service level agreements (SLAs) are used to establish the required level of digital service quality. At the user-library interface level, the library management collects user experiences and perception through various existing instrumentation. Digital service usage data are collected and used in conjunction with the data that had been collected on the user-library interface.

The goal is to enhance user experiences as well as gauge changes to the level of QoS required. The first two levels assessments are also used to validate SLAs. The proposed approach is generic and can be applied to all types of libraries that have standalone digital services or provide integrated traditional and digital library services. The proposed approach provides valuable performance information to digital libraries’ decision-makers, and can assess digital service quality offered by digital libraries to their stakeholders.

5.2 Overview of the Problem

The objectives of e-government are to offer efficient, high quality administrative online services to citizens and businesses. They also include an effort to streamline government’s internal processes to improve Quality of Services (QoS), reduce costs and increase productivity [75]. In other words, the primary objectives are to bring dramatic improvements in the quality of government’s interactions with it. Due to that, all organizations that involve with the services include libraries must deliver benefits services to
their customers. Libraries have to engage their users continually to continue using and value library resources, services and facilities. With the dramatic increase of available materials and user expectations, libraries are forced to exploit new technologies to fulfil their missions with relatively limited resources [107].

Libraries are dynamic organizations that can provide highly significant services to their patrons. However, advances in IT and networking have created a serious level of competition for libraries from many information services provisioning agents. Therefore, it is imperative for libraries seek ways to ensure that their services meet and preferably exceed stakeholders’ expectations. Libraries are adopting service-oriented provisioning. The evaluation of the performance in the library is one of the major concerns and an integral part of the library management, if they are to attract the new user to use their services.

Libraries organizational structures have changed considerably in just a few years. Long vertical hierarchies are disappearing and in their place are many structures that recognize the new technological realities. Furthermore, sets of performance measures and indicators (example, ISO 11620 1998, PROLIB-PI and IFLA Handbook), only include measures mainly developed for traditional library services [108]. Due to that, it is important for libraries to develop new performance indicators that cover electronic services in libraries. A good relationship between a library and users will encourage users to come and use library resources. Repeated review of service goals and objective in relation to user expectation is the fundamental need in service quality in libraries. In addition, improvements in library technology can help libraries to appeal to the younger generations by assisting new users to gather and utilise information in and via libraries. Based on this statement, a library as service organization needs to have a motivated staff that could give excellent service and directly work with the stakeholders both old and new.
Stakeholders are those people inside and outside the library who have a vested interest in the library. In the current information age, libraries seeking to meet the information needs of their clients are increasingly looking to modern electronic technologies (including computing devices, mobile phones; and the Internet). The goal of the library is not to make a profit, but to satisfy readers' needs for information. Libraries compete with other departments for financial resources. Due to that, financial support of the library would depend on the user satisfaction with its services. Unfortunately, there has been no consistent way for assessing the quality of services the libraries provide to end-users.

The purpose of this chapter is to propose a conceptual framework for library institutions to better assess the quality of their services. The focus is on service quality and factors affecting it. Figure 5.2 also shows a multi-stage service quality assessment model that is proposed in this chapter. Information Technology (IT) is a service that libraries get from another department, for example IT department that related to the IT facilities. Among those services includes a photocopy machine, connection speed, level of difficulty in operating computer interface, collection type, record of the collection, renewal and timeliness.

Other than that, the examples of services are success rate of information search and level of difficulty of search interface. For Digital services, it includes Online collections search (e.g. Online catalogue search number; electronic periodical search; online periodical table of contents search; CD-ROM database search, and transfer of electronic documents), and Online library services (e.g. Online reservation number; online overdue notice number; online applications for cooperative library services number; online information, recommendations; E-mail assistance services; search library www information services and online reference consultation). Finally, for user services the services include database (e.g. Number of online abstract databases; amount of online full text data), OPAC (e.g. number of
electronic periodicals; number of electronic books and the number of electronic reference materials).

Thus, an approach that guarantees the expected quality of digital services prior to their deployment as well as after they deploy is necessary. In the digital library settings, service level agreements (SLAs) are enormously beneficial if libraries are to achieve their stated mission of serving their patrons. However, there exists no research that addresses SLAs as a tool to create a level of digital service quality in Library. Therefore, the study of such a method is suitable and relevant to be considered because it is increasing in the Digital environments.

The final complete framework will enable the libraries to identify any gaps in their service management and provision so that these requirements can be built into their business and service quality improvement planning; offering clarity of direction for service managers and transparency of development to meet business and client. The rest of the chapter is organized as follows. A high level conceptual framework is presented in Section 5.3. Various components of the framework are also described in Section 5.4. In Section 5.5, the proposed SLAs framework for third-party sourced services are explained. Finally, the chapter summary directions are presented in Section 5.6.

### 5.3 Reference Library System Model

Libraries provide a variety of different services to a variety of different user groups. The provision of service, not profit, in which intangible benefits are provided to individuals, is the main objective of the libraries.
There are two categories for library user services. These include library public user services such as circulation, bibliographic instructions, distance learning, government documentation, reference, special collections and so on. The others are library technical services (focus on procedures and operations of maintaining, developing and supporting library collections behind the scene such as acquisition, cataloguing and classification, interlibrary loan and document delivery, serials, and systems) [5]. Normally internal services involve a service provider (SP) that supplies the materials and products to the library. So each time when a product is delivered the staff inside this department undertake a process that includes i) Acquisition, ii) Cataloguing, iii) Archiving and iv) Retrieving. After the process has been completed, the user can utilize the services that are referred to as an external service.

The library services can be classified as technology-driven services (i.e., an Internet-accessible collection of services) and non-technology based services. An example of the later is the information product (i.e., the content and quality of the information) and the service components which include the facilities and the computerized and human assistance that deliver the information product to its users) [35]. The trends in library service provisioning indicate that more and more library processes and workflows will take the form of automated systems built by combining a variety of services.

Library patrons are parts of other systems (researchers, disciplines, families, occupational groups). The library usage behaviour of the library patrons can be expected to range over numerous other systems. In addition to the library service (e.g., colleagues, newspapers, bookshops, other libraries, meetings, etc.). A given library service will be only one part of any given user's range of information. Also, the expectations of the library patrons and the parenting agencies are quite different. The parent agency, for example, requires the libraries to provide services in line with their mission and goals [109].
Figure 5.1: Library service, their users, and the interactions between them.

Given the multiple nature of the services provided the various stakeholders may have a different perception of the quality of the services provided to them. For example, some of them may not care for the efficiency of the local process, but be more particular on delivery of service effectiveness. Parent institutions that provide funding are stakeholders who have a particular point of view regarding the libraries under their control and are they are more interested in a benefit that the library can give to them and in the library’s cost effectiveness. The libraries need to prove their value and contribution to the parent agency and prove they are worthy of their share of the agency budget. From the parent agency perspective, libraries are expected to provide more efficient ways of delivering services to achieve greater returns on investments. Thus, librarians should fully understand and be aware of the supporting agency goals and strategic directions since library operations sometimes seen as peripheral to
an agency’s core competency. They must align themselves with agency goals, and make sure the values of the library’s contributions are known throughout the organization.

Libraries not only have their own internal systems and procedures (e.g., collection service, delivery, service and discovery services), but also participate in wider sorts of systems (e.g., networked electronic resources refer to a database of Internet network service), with other libraries (i.e., libraries depend significantly on other libraries for interlibrary loans and, more recently, on the collective use of computerized bibliographical utilities).

In Figure 5.1, it can be seen that library service is a bundle of services. Thus, within the realm of library, services are comprised of multiple components and each component may have its unique result arising from an outcome assessment. Most library services are bundles of core, facilitating and supporting services. Moreover, these services are multi-dimensional. For example, airline service includes a core service, transportation, plus check-in service, in-flight meal service and so forth. Thus, assessment of a service can be decomposed into a series of interrelated stages: assessments of performance, service quality and value.

Digital revolution also has made library collection more visible, accessible and usable. The amount of digital information used in the library is largely network-based, as a result of advances in IT and networking. The prevalent format, the speed of information creation, delivery and dissemination and user needs and expectations have changed. IT has also been used to computerize their technical processes, develop networks and build databases, range of administrative and using intelligent information services [32].

5.4 Multi-Stage Model of Service Quality

Although libraries have the tools (e.g. Accreditation; Benchmarking; Total Quality management(TQM); International Standard (ISO11620); Services quality (SERVQUAL) and
Library service quality (LibQUAL) to assist them in decision making on the basis of tangible indicators such as the size and quality of their collections, there have been few instruments for monitoring and measuring service quality. Research in the library system has so far focused on the quality of the library in terms of its collection, the size of its holding as well as various counts of its use [5]. There has also been research on the performance of libraries in terms of its performance as viewed from the library patrons prospective. This chapter argues that these approaches mainly measure library customer satisfaction and not service quality. The SERVQUAL is the most popular and standard tool to measure quality among the customer [1, 23, 52, 53, 54, 55, 56]. However, elements in this SERVQUAL could not be used to measure the QoS which specific to e-services in the libraries. Unfortunately, they do not describe the performance or indicate whether service quality is good, indifferent or bad. They need to understand what library customers expect in terms of service quality is now necessary for good management.

The provision of library services depends on the provisions of other services such as IT resources and online databases. Therefore, the QoS in the library context should be looked at as a multidimensional factor encompassing customer services as well as outsourced delivery of service effectiveness. The nature and the need of library patrons vary from one sort of context to another. Different sorts of services will involve with different sorts of inquiries call for services. Therefore, an approach that takes these factors should develop in order to assess the quality of service provisioning in library environments with a sense of coherence—a sense of fitting together to form a whole. Also, libraries have been traditionally classified into academic, school, public, and special (i.e., specialized and usually in support of industry or public administration). The traditional types of library services are noticeably different from each other, although each library may vary from one country to another.
Therefore, coming-up with a general framework for QoS assessment in library service provisioning is a complex undertaking.

The model presented in Figure 5.2 is an original representation of how the author believes service quality assessment stage appears within a Libraries Services environment. The key characteristics of this model are Stakeholders' view (referred to Beneficial Outcome); Service delivery view (Utilization, Capability and Access Quality Indicator) and Resource view (IT Services, Digital Services and User Services). Figure 5.2 shows various library services and their multiple constituencies with differing interests (e.g., patrons, sponsors, funding agency, etc.) as well as the interactions between them as a system.

![Figure 5.2: Multi-stage service quality assessment model](image-url)

Figure 5.2 also shows a multi-stage service quality assessment model that is proposed in this chapter. Information Technology (IT) is a service that libraries get from another department, for example IT department that related to the IT facilities. Among those services includes photocopy machine, connection speed, level of difficulty in operating computer
interface, collection type, record of collection, renewal and timeliness, the success rate of information search and level of difficulty of search interface. Digital services, includes Online collections search (e.g. Online catalogue search number; electronic periodical search; online periodical table of contents search; CD-ROM database search and transfer of electronic documents). Online library services (e.g. Online reservation number; online overdue notice number; online applications for cooperative library servicesumber; online information, recommendations; E-mail assistance services; search library www information services and online reference consultation). Finally, for user services it’s included database (e.g. Number of online abstract databases; amount of online full text data), OPAC (e.g. number of electronic periodicals; number of electronic books; number of electronic reference materials).

Service delivery includes such factors as longer hours of service and better assistance, as well as resources selected for their quality, authority, accessibility, currency and subject relevance. The type of capability being provided needs to be related to the sort of demand to serve. Immediate availability and related measures of document delivery are evidently measures of a library's capability. The utilization of the services is another major factor to take into the determination of library service quality provisions. The beneficial outcome is a multi-dimensional output. Its first dimension is technical quality, meaning the outcome of service performance. Its second dimension is functional quality, meaning subjective perceptions of how the service is delivered. Functional quality reflects consumers’ perceptions of their interactions with service providers. The third is program quality: the range of activity programs, operating time, and secondary services. The fourth is interaction quality, or outcome quality.

The intention of this study is to investigate and devolve a conceptual framework for quality of service assessment in the provision of library services. Currently, the services provided by libraries consist of an inherently disjointed set of reference models. There must
be a way to create useful relationships across the various services. The proposed conceptual framework aims to rectify this through the accumulation of reference models that provide a consistent view of library activities and a shared means of expressing them. The framework would assist libraries in strategic planning. It would provide a tool to help them establish priorities, guide, investment, and anticipate future needs in uncertain environments. Moreover, the framework will help develop standardization in quality of service assessment in libraries service provisioning. These standardized processes would facilitate consistent performance measures and benchmarks.

5.5 Service Level Agreements

SLAs have become a valuable tool to help manage service expectations and monitor quality of service (QoS) attributes of services. In a digital library, the specification and management of QoS are necessary to enhance user experiences. QoS represents the parameters that can be used to characterize and assess the functional and non-functional aspects of digital services. Some of these parameters are objective in nature and can be automatically measured, whereas others are subjective in nature and can only be measured through user evaluations (e.g., focus groups). [76] discussing the scope and contents as well as the role of service agreements in Australian health libraries. [110] focused on establishing and monitoring SLAs for complex service based systems. The author uses business, software and infrastructure services as SLAs hierarchy spanning through multiple domain and layers of a service economy. However, the proposed SLAs framework is specifically on the service provider side only. Therefore, the approach is not suitable for digital library QoS measuring where QoS in the library is also expressed by parameters that focus on the interactive relationship between the libraries with the people whom it is supposed to serve [111]. [112] proposed an approach for SLA framework in cloud computing.
The author uses non-functional requirements of services such as availability, scalability and response time to define the SLA parameters for each type of cloud service (Infrastructure as a Service, Platform as a Service, Software as a Service and Storage as a Service). However, the above work is not directly related with the context of SLAs in Digital Library. Moreover, the services in this framework are focusing only on cloud computing environments. Apart from the nominal work of [76], creating and implementing service level agreements in libraries does not exist in the published literature. Thus, an approach that guarantees the expected quality of digital services prior to their deployment as well as after they deploy is necessary. In the digital library settings, service level agreements (SLAs) are enormously beneficial if libraries are to achieve their stated mission of serving their patrons. However, there are no works that address SLAs as a tool to create a level of digital service quality in Library. Therefore, the study of such a method is suitable and relevant to be considered because it is increasing in the Digital environments.

5.6 SLAs Framework

The digital library provides $S = \{S_1, S_2, ..., S_n\}$ different services (e.g., desktops, e-journals, storage and electronic books) to $U = \{U_1, U_2, ..., U_z\}$ libraries service user (LSU). The digital services can be dedicated (e.g., hardware such as desktops) or shared (e.g. databases). Also, each service will have a set of attributes such as service availability that can be quantifiable measures. The library service provider (LSP) contracts the $S$ services from $P = \{P_1, P_2, ..., P_m\}$ digital service providers (DSP) for charging. LSP also provides value-added services such as searching and presentation of information of interest to the LSU. In addition, the LSU is responsible for the planning and provisioning of the digital services within the Library. They ensure that content selection, purchasing licenses and access
arrangements are in place and understood by the user community. In addition, the LSP will develop a set of KPI to fulfil its clients’ need.

![Conceptual Framework](image)

**Figure 5.3: Conceptual Framework**

Service Level Agreements (SLAs) are the core of the relationship between the digital library service delivery functions and the end-users of the digital services. They capture the mutual understanding and commitment of the DSP and LSP regarding the service quality requirements and expectations. DSP and LSP will use SLAs Negotiation Interface to negotiate and establish mutually acceptable agreement on the delivery of the service. SLAs 1, SLAs 2 and SLAs 3 contain the terms of the service level agreements as understood by both the DSP and LSP. It covers items such as the responsibilities of each party (including acceptable performance parameters with applicable metrics), a statement of the expected duration of the agreement, a description of the applications and services covered by the agreement, procedures for monitoring the service levels, a schedule for remediation of outages and associated penalties, and problem-resolution procedures. Measuring and reporting SLAs compliance are the core components of any SLA-based system. SLA
reporting is vital for both LSP and DSP as it is one of the stages in SLAs process that indicates the level of compliance. KPIs and SLA metrics are used to measure and assess the digital service performance under SLAs reporting. The report serves as the basis of intervention, validation, justification and direction for agreed SLAs. Hence, SLM reporting is vital for both customer and service provider.

5.6.1 SLA-based digital library quality evaluation

Service Service Level Agreements (SLAs) have become a valuable tool to help manage service expectations and monitor quality of service (QoS) attributes of services in various domains. QoS may contain many metrics that define the deliverable acceptance criteria or serve as standalone measurements of a single aspect of the delivered service. The aims of SLAs are to implement a framework that adapts to changing business priorities and service levels, define clear objectives to shape the service offered by the provider. Effective SLAs not only ensure the delivery of negotiated service quality, but also serves as an efficient service planning and prediction or adjustment processes. Therefore, properly establishing SLAs is crucial to its successful outcome or otherwise.

In a digital library, the specification and management of QoS are necessary to enhance user experiences. QoS represents the parameters that can be used to characterize and assess the functional and non-functional aspects of digital services. Some of these parameters are objective in nature and can be automatically measured, whereas others are subjective in nature and can only be measured through user evaluations (e.g., focus groups). The proposed SLA-based approach is designed to move away from subjective measures based on opinions. [76] discussed the scope and contents as well as the role of service agreements in Australian health libraries. [110] focused on establishing and monitoring SLAs for complex service based systems. The authors use business, software and infrastructure services as a SLAs hierarchy
spanning through multiple domain and layers of a service economy. The authors applying the framework to industrial use cases.

![Digital Service Quality Evaluation Framework]

Figure 5.4: SLA-based digital service quality evaluation framework

However, the proposed SLAs frameworks are specifically on the service provider side only. Therefore, the approach is not suitable for digital library QoS measuring where QoS in the library is also expressed by parameters that focus on the interactive relationship between the libraries with the people whom it is supposed to serve [110].

Figure 5.4 shows the digital services quality evaluation framework. The purpose of the framework is to achieve expected level of digital service quality, through a periodic cycle of negotiation, agreeing, monitoring and reporting upon delivering digital service. The library benefits from a clearer picture of the library users expectations; the ability to balance and adjust their resources to meet those expectations, as well as explicitly detail the costs associated with any given level of service. To achieve these aims, the library management develops a set of KPI’s that dictate what is important to the library clients and the librarians using historical performance data and expert knowledge. The main idea here is to convert both subjective and objective data collected by the librarians using the conventional methods.
into KPI’s. These KPIs define the expectation of the level of service which the library patrons can expect to receive and specified in terms of an achievable service level. KPI’s are specific, measurable characteristics of the digital services such as throughput, availability, response time, or quality of support. KPIs for the service must accurately reflect the expectations and perceptions of both the service user and service provider. It should also be directly linked to a value which can be consistently monitored.

The next step is to develop SLAs in collaboration with the service provider. A consensus between the digital service provider and library service provider in the service delivery is critical for a service agreement to be successful [76]. Basically, SLAs are intended to ensure that the service provider understands the expected service quality level they are supposed to deliver; the customer knows what to expect, and both can see what is actually being delivered. Therefore, the library service providers will need to communicate the quality requirements, how it is monitored and measured with the service providers quite succinctly. To this end, the library management will select and start negotiations with service providers based on its KPI’s with the aim to reach a service level agreement (SLAs) that ensures high quality and timely delivery of digital services to support the library business. SLAs must capture the mutual understanding and commitment of the digital service provider and the library management regarding the service quality requirements and expectations. Commitments are responsibilities that digital service providers must meet to fulfil service level agreements for an agreed amount of remunerations from the library.

In order to avoid misunderstandings, SLAs guarantee terms need to be explicitly related to reasonable, attainable performance levels and measurable metrics. Also, SLAs should formally state the exact settings under which the digital services should be delivered. SLAs should ensure that the level of digital service delivery is objectively measured based on KPIs and should also be in compliance with relevant best practice and standards. The SLA
should include a provision in which the service provider agrees to assure the library for any breaches of its agreement. Furthermore, SLAs should be clear and simple to ensure that it is possible to determine compliance.

With the SLAs in place, the library patrons are given access to the services. The library management will collect and analyze information related to its client satisfaction level with the service provided through the conventional mechanisms such as surveys. Even though some of the information collected is subjective, they can serve as a check on the validity of the SLAs. On the other hand, the digital service provider will monitor the quality of the service delivered and generate reports. The service provider will also make SLAs report available to help the library management to authenticate and oversee the quality of services delivered through scheduled and on-exception reports. The library management can use the internally collected library client’s level of satisfaction with the perceived level of service provided and the reports from the service provider to check how that the commitment as specified in the SLAs is faring, whether service levels have been maintained and whether you are owed any rebates for service outages or to renegotiate the terms of the SLAs if need be. Making the SLAs two-sided and by measuring the end users satisfaction on mutually dependent metrics is a good way to concentrate on the intended outcomes.

5.7 Case Study

The proposed approach using a networked desktop system provided to the library from a third-party service provider has been illustrated. The motivation for using this example is that people increasingly depend on the local library’s public access computers, Internet access, and reference support to search for jobs, take classes, complete homework assignments, obtain medical information, and receive government information and services
The various QoS properties such as availability, accessibility, performance, reliability, and security should be addressed in the creation of SLAs.

The library management identifies IT services and service requirements and define, build and negotiate Service Level Agreements (SLAs).

- **KPI1**: Percentage increase in customer perception and satisfaction of SLAs achievements, via service reviews and customer satisfaction survey responses.
- **KPI2**: The system (i.e., hardware, software, and network) must be functioning and available 99% of the time during business hours.
- **KPI3**: Customer support for service maintenance requests must not exceed 12 hours at most.

KPI1 is for the sole purpose of use by the library that the libraries are the end users of library services. KPI2 dictates system availability guarantees over a period of time. KPI3 includes the typical help desk problem reporting and problem resolution guarantees based on severity level. Severity level and response and resolution times are assigned according to their impact on customers. The acceptable response time and resolution time are negotiated between the IT Service Provider and the Customer.

For the second and third KPIs, the library management will negotiate and develop SLAs with the service provider. The developed SLAs will specify that if the system fails to meet the negotiated 99% uptime, the library is entitled to reduce its bill by an agreed-on percentage. For instance, if the system is unavailable for an hour, the library is entitled to a 10% rebate of its monthly service fees; in the case of a service outage for two hours, the library is entitled to a 20% rebate of its monthly service fees” and so on. The SLAs also describes the procedures for reporting any problems with the service to the service provider; notifying library management about all scheduled maintenance as well as generating SLAs reports and on-exception reports. It will also include scope for renegotiation and meeting
response and resolution times associated with service related incidents. For example, for KPI3, average speed of answer (e.g., 15 seconds), target service level of 95\(^{\%}\) calls answered in 15 seconds, and average talk time of less than 3.5 minutes per call can be stated.

The library management will collect satisfaction data through its own instrumentation to measure the level of KPI1 achievement. This is essential for the library to see if the digital service provided the capacity is below or above that needed to meet the clients’ needs and adjust the service accordingly. This will require renegotiation of the SLAs.

## 5.8 Chapter Summary

QoS is a crucial issue for each organization that is involved with services. In order to fulfil the satisfaction and the need of their user, organizations have to improve their services. Therefore, using IT in an organization is one of the important ways that can be formally recognized by the user to fulfil their needs. Providing reliable QoS is one of the important requirements in Cloud computing environment. It is important to set out clearly the relationships between the Service Provider (SP) and the user.

Libraries are very important institutions that have services that can be given to their patron. Emerging phenomena like e-information services [17], e-library services which are related to E-Facilities, E-collection, and E-Service are now available at most of the libraries. Unfortunately, there is a lack of authoritative guidelines or criteria to help a library define how QoS of a library's performance should be provided, especially in regard to the proper of use measurement leading to improvements that better serve the end. Both sides need a benchmark-against that tests the efficiency and effectiveness of the services. The lack of understanding on both sides means the objectives and goals was not defined. As a result, the user is dissatisfied with the services. Libraries need to work directly with customers to deliver such service on a continuous basis. They also had a profound impact on the way
library services operate. QoS has become one of the most important factors and major issues on the research plan for electronic services in the digital age.

A number of indicators have been developed and tested in libraries. However, elements in this indicator could not be used to fulfill the measure the QoS, which are specific to services in the libraries. Libraries must be able to show whether they are developing in the right direction, and if their services have been accepted by users and whether their services have been offered in a cost-effective way [18]. The literature reveals that evaluating QoS in libraries should be considered to a greater extent. The assessment of digital services is a key element in the delivery of digital library services to meet the needs of the library users. Due to that, more evaluation studies on the basis validated methods was needed.

In this chapter, the reviewed for the progress of the quality of service assessment in the provisioning of library services have been made. It was found that comprehensive approach that encompasses various aspects of the library services as whole is lacking. This chapter proposed a conceptual model applicable to all types of libraries to effectively assess the quality of their service and increase the alignment of assessment and the library's ability to report value and impact. The model has been developed and discussed. A conceptual model was developed based on theories relevant to the library needs. One research direction is to extend further and then test and confirm the proposed conceptual framework.

In this chapter, we argued that SLAs is principally valuable for correlating library patron experience metrics with the underlying infrastructure components that support the associated business service. It was proposed a three-pronged approach of the assessment of digital service quality within a library domain. At the service provider and library interface level, service level agreements (SLAs) are used to establish the required level of digital service quality. At the user-library interface level, the library management collects user experiences and perception through the various existing instrument. At the user-service
interface level, the digital service usage data are collected and used in conjunction with the data collected.

Due to that, the user-library interface is to enhance user experiences as well as gauge changes to the level of QoS required. The first two levels assessments are also used to validate SLAs. The proposed approach is generic and can be applied to all types of libraries that have standalone digital services or provide integrated traditional and digital library services.
Chapter 6

Validation on the SLAs Framework using Delphi Technique

In this chapter, a SLAs framework for Digital Library Services based on the model that has been elaborated in chapter 5 has been validated. This chapter aims to present the analysis of the findings detailed using the Delphi technique in validating the model. In discussing the processes of the Model validation via Delphi technique, this chapter is divided into three parts which is Introductory Round, First Round and Second Round. The discussion begins with an introductory round of the expert involved in this analysis. It is then followed by first round section, which comprises the response from the selected expert. Two rounds of Delphi technique were employed in validating the Model. Basically findings reported in this chapter answered the fourth research question concerning the analysis of the effectiveness of the framework and the metrics in capturing the QoS.
6.1 Introduction

Digital libraries offer a massive set of digital services to geographically distributed library patrons. The digital services are commonly sourced from third-party service providers for a fee. As externally sourced digital services are becoming prevalent, issues regarding their quality assessment are gaining critical importance. Unfortunately, sourcing digital services from external providers has brought with it stringent quality of service (QoS) demand from the library service users. Therefore, to make sure the library aligns with this stringent, a new method to look into this matter is required. This method needs to be verified by those experts in the library services or those who are working with the environment or nature. Therefore, the validation of the model that had been suggested in this research using the Delphi method is really necessary. The detail of how this method is implemented, will explain further in the next section.

6.2 Introductory Round

The introductory round the potential experts to be part of the Delphi technique in validating the SLAs Model were invited to participate. Initially, 15 SSEs were invited to take part using the Delphi technique. The invitation letters consisted of two documents, i.e. the invitation letter and the e-Expert Profile Form. As discussed in Chapter Four, the development of the Conceptual Model was based on the previous model in the library. The detail can be found in the chapters 4 and 5. The conceptual Model is shown below:
6.3 First Round

6.3.1 The Subject Specialization Experts (SSEs)

Ten experts, who were each involved directly with digital library services were involved in First Round of the Model validation. Two Malaysian and two International participants from the Head of Digital Services department in Library services participated in the First Round. They are referred to as Mr. Red, Mr. Green, Mrs. Yellow, Mr. Blue and Mrs. Pink; three managers in department of IT services are referred to Mr. Grey and Mrs. Orange; Mr. Brown,. Also included were two ICT specialists in the library who have vast experiences dealing with digital services, known as Mr. White and Mrs. Black. Table 6.1 below shows the summary of First Round of the Delphi participants.
### Table 6.1: The First Round of the Delphi participants

<table>
<thead>
<tr>
<th>Subject Specialization</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head of Digital Services department in Library</td>
<td>Mr. Red, Mr Green, Mrs. Yellow, Mr. Blue and Mrs. Pink</td>
</tr>
<tr>
<td>Manager of IT services in Library</td>
<td>Mr. Grey, Mrs. Orange and Mr. Brown</td>
</tr>
<tr>
<td>ICT specialist in Library</td>
<td>Mr. White and Mrs. Black</td>
</tr>
</tbody>
</table>

#### 6.3.2 Procedures

In First Round of the Model validation, a research kit which includes the following items was sent via postal mail to all Subject Specialization Experts (SSEs),

1) Consent form for the experts on their willingness to participate in the research. The nature of the Delphi technique with an explanation of the objectives of the Delphi technique were also included.

2) The Delphi Technique schedule proposed of the current study.

3) A set of the SLAs Model of Digital Library Services which comprised the Overall Model and its features, namely SLAs related to SLAs negotiation and SLAs reporting (i.e Usage Metering, Compliance Management) and KPI which involved Historical Data, Satisfaction Analysis and Satisfaction Collection.

4) Five open-ended questions for validation were as follows:

   i) Could you comprehend the SLAs Model in general? Please clarify your answers.

   ii) Do you think the features contribute to the comprehensiveness of the model?
iii) By looking at the Model, how would you amend or modify the Model? Please give further explanation.

iv) Which feature (s) do you recommend receives the most focus to support the Quality of Digital Library Services?

v) Do you think the Model is feasible for implementation in Digital Library Services? Please explain further.

All the SSEs were given two weeks to return their answers through emails. Upon getting the emails of round one, interview sessions were also conducted. The SSEs feedbacks were recorded and transcribed verbatim and were classified according to the five questions asked.

i) Could you comprehend the SLAs framework in general? Please clarify your answers.

The responses received were divided into two sections such as the comprehensibility of the Model and the improvisation of the Model.

a) The comprehensibility of the Model

Ten of the SSEs agreed that the Model is understandable and some of their responses are as described below:

Ms. Green: Yes, I could comprehend the model easily. It's quite detailed and the segregation of the categorization of the components is easily understandable and appropriate to my knowledge that suits and will cater to the library need.

Mrs Pink : The model is quite comprehensible and covers all or maybe almost all aspects in measuring the quality of digital library services.
Mr. Blue: Yes, I can. It’s quite comprehensive. It’s quite comprehensive in terms of the model of measuring the quality of Digital Services in the library.

Mr. Red: In general the model is easily comprehended and easily understood…and then with the step by step from one to one component. To me, it's clear.

Mr. Grey: As for me, the segregation of the model makes easier to understand. We can see each of the features that involves in this model. And the model divisions are also good. We could comprehend one by one. It covers the three main processes of library delivering their services in order to provide quality on it. The flow of the model is very nice.

b) Improvisation of the model

Although the majority of the SSEs could comprehend and understand the model, two of them provided some inputs on the weaknesses and offered suggestions to improve the model as stated below:

Mrs. Black: ….it seems complicated when there is no arrow represented to show how this model is linked with other each of the features.

Mr Brown:…..do the management in this section know how to do with this model? What are their functions in relation to the need of customer satisfaction?

ii) Do you think the features contribute to the comprehensiveness of the model?

All the SSEs with the exception of Mr. Pink agreed that all the features named in the framewok related to SLA negotiation and SLA reporting (i.e Usage Metering, Compliance Management) and KPI which involve with Historical Data, Satisfaction Analysis and
Satisfaction Collection, contribute to the comprehensiveness of the Model. Excerpts are given below:

1) Mr. Blue: When it talks about digital services or IT services for example, it identifies the mechanism and technology that support to increase their quality of services. The features also elaborate on the relation in library management system, quality of service provisioning in library environments with a sense of coherence a sense of fitting together to form a whole the model looks at the more friendly timetable and interval. This model also incorporates the need to have a special officer who is knowledgeable of IT language and the SLAs document when the customers need assistance.

2) Mrs. Orange: It is a comprehensive model. With the addition of policy in this framework, we could implement this framework by including the requirement by the Information Federation of Library Association (IFLA) for development of digital libraries.

iii) By looking at the Model, how would you amend or modify the Model? Please give further explanation.

Two SSEs i.e. Ms. Blue and Mr. Grey say “I don’t think the model needs further amendment or further modification. As has been mentioned, it is very comprehensive and been taught in detail and covers all areas or departments in the library. Mr. red stated, “I agreed with the Model without further modification”.

The recommendations and suggestions from the SSEs on the enhancement and improvement of the Model were presented according to the individual expert as follows:

1) Ms Black: I suggest that a feedback loop be created in each of the features, and arrow need to be put in the model. The arrow may facilitate the understanding of this model.
2) Mrs Orange: The people who are involved with the policy on digital services in the library need to give input to the authorities what their needs are. As is, it is assumed the relevant sections seem to know all about the end user and this create the prescriptive image of this mode.

3) Mr. Brown: In order for this model can be accessible for all the libraries, you should involve the policy maker as a reference and part of people who involve in developing this model.

iv) Which features (s) do you recommend to receive the most focus to support the Quality of Digital Library Services?

In responding to the above question, seven SSEs emphasized that all features in the model are important to support the Quality of Digital Library Services. Their responses are as follows:

1) Mrs. Pink: In the library, there is not doing capacity management it will affect long term digital library service. There are three problems held in the library which are capacity management, maintenance culture and process, not holistic.... So, I will say that all of the features in this model are really necessary.

2) Mr. Blue:.... previously, we do not have any proper measurement mechanism when it comes to look into the quality of the digital services, we only have feedback from the user. But actually we know the importance of features such as this usage metering, SLAs reporting, so I can say that all the features in this model in important.

3) Mr. Brown: I would say all of them are significant. All the features must work together. Everything is much interrelated.
v) Do you think the Model is feasible to be implemented in Digital Library Services? Please explain further.

6.4 Second Round

6.4.1 Subject Specialization Experts (SSEs) Responses

The Model was modified and improvised according to the suggestions made by the SSEs in Round One of Delphi. Then, Round Two began by sending the revised Model to the experts.

A questionnaire consisting of 14 questions with four Likert-scale responses, including ‘Strongly Agree’, ‘Agree’, ‘Disagree’ and ‘Strongly Disagree’ was prepared. In addition, an additional space after each Likert-scale answer was provided for the experts to explain, add or share their expertise. And again, the last question, requested that the experts to respond whether they agreed or not with the Model. In the second round of the Delphi study, the instrument (Appendix ) was developed based on the previous literature. The items identified in the literature for each research question were developed into a close-ended Likert-type scale survey for SSEs requiring respondents to agree or disagree with each statement. SSEs were asked to rate each survey item within the their role domains.

The response rate was 100% for the second round instrument. All the answers were keyed-in into SPSS version 19.0. SPSS version 19.0’s data analysis tool calculated the frequencies, the standard deviation and weighted mean score for each question of the Likert-type survey. The panel was considered to have reached consensus when at least 80% of the panel responded to each item in the two highest values on the scale. All SSEs rated 14 items.
A response was provided via email, and the SSEs responded to the items in two significant ways: email and fax.

6.5 Chapter Summary

The main purpose of Chapter six was to validate the SLAs Framework for Library. The Delphi technique was utilized among 10 Subject Specialization Experts (SSEs) in validating the Model. In discussing the Model validation process, this chapter was divided into three main divisions, namely Introductory Round, First Round and Second Round. The Delphi technique was stopped at the Second Round as all the SSEs agreed with the Framework with very minimal amendments, particularly in the technical parts of the Framework. Therefore, based on the final framework which has been approved by the SSEs, all the features that had been outlined in the framework appeared to fulfilling the needs of libraries and especially in using this framework to verify the QoS in digital service in the library environment.
Chapter 7

Conclusion and Future Directions

This thesis analysed existing methodologies in order to quantify the quality of service provided by external digital service providers. In this final chapter, the conclusions drawn from the findings related to the quality of service in the digital library and the perspectives of SSEs at the level of expertise in the library are presented. Also reviewed are the contributions and findings of the thesis. The conclusion of this thesis will also focus discussion on future directions and other potential research problems in the quality of service in digital services for libraries.

7.1 Conclusion

Digital Library services give high priority to how they provide the quality of service to their patrons. This study shows that there are some aspects such as new methods of information-seeking, source preferences, forms of competition as well as changing services into electronic information environments that need to be considered seriously by a Digital Library services library [36]. Moreover, these aspects cannot progress without ongoing and focused support. Components that need to be highlighted in digital services include the
provision of quality delivery, outcomes, standards, and Digital library procedures. In order to provide high quality services, it is important to make sure those elements noted by [60] are fulfilled. Digital Library services need to be maintained by three features, Service Quality, Internal Factors and External Factors [52].

Chapter two provided a thorough investigation of existing methodologies in order to quantify the quality of service in the context of external digital service providers, proposed by other authors. The study also listed the advantages and disadvantages of each methodology. It was argued that a comprehensive approach that encompasses various aspects of the library services as a whole was not well-defined. This research contributed to the body of existing knowledge relating to digital services for the library by presenting an in-depth discussion of the conceptual and operational issues in quality of external digital service providers, focusing on digital services in the library.

As a result, this thesis contributes to academic knowledge and practice in digital services for libraries. This research used an exploratory case study method, given there was no previous evidence of research into the digital services. However, there has been substantial research on other related areas such as health [76] Thus, this thesis applies those principles based on that literature to the library environment paradigm to generate a modified model for the digital services in a library situation. The need to develop a modified model arose because the library holds a different value from any other business information. This thesis makes two primary contributions. The contribution from the perspective of theory is the first contribution and second, a contribution from the perspective of practice. In the following section we will address each contribution.
7.2 Thesis Contribution

7.2.1 Contribution 1: New Model for Digital Library

In this thesis, a new model suitable for Digital Libraries is provided. The studies suggest a new method in information delivery for the digital library, especially related to the QoS. Various models and framework have been proposed to evaluate the QoS in Digital Library. Unfortunately, features that contribute towards the Digital Library service quality have not been factored into the design of most existing QoS models in the Digital Library. Therefore, this thesis draws from these approaches and discusses the related issues. A new model suitable for Digital Libraries is then proposed. Currently, there is no way for ensuring QoS between the digital service providers and the library management.

A model is proposed in this research because it is useful to represent the third party element in an empirical phenomenon. It explains the component and the relationship between these components of the phenomena. In this model, the hypothesis had been tested and the result shows that the third party element is very important in evaluating the QoS on digital services in the library context. This study offered an opportunity to further investigate the service quality, and effectiveness in the digital library. Its conforming backgrounds through a variety of research designs and settings by examination the hypotheses presented in this study. Survey research designs employing thirds-thirds party sources' services as a sample in the model would best match the requirements for validating the proposed framework.

The proposed model should be of interest to both library practitioners and the academic community. For library practitioners, the model will enhance their understanding of the features that contribute towards QoS in the digital library. The proposed model also offers
research opportunities for both the academic and the library community side to support or disprove the proposed propositions.

### 7.2.2 Contribution 2: Case Studies on SLAs Framework for Library and SLAs Framework

The detail about the case studies has been detailed in chapter 5. These case studies revealed the key concepts in SLAs proposed approach using a networked desktop system provided to the library from a third-party service provider. Discussions of the case studies concentrate on the principle requirement of using SLAs for the library needs and the KP1 compliance as the foundation to ensure the QoS in the library are achieved. In the current business with information services, library is not a static organization. Libraries are dynamic organizations providing dynamic services to their patrons. Despite the great plethora of studies on service quality assessment for library and information science, only a limited number of academic literatures address digital service quality evaluations. The most common thread among the existing tools and approaches is that they are all designed to evaluate the performance of the services after they have been deployed. However, digital services provided by digital libraries often include services that exist outside the physical and administrative bounds of the library. These digital services are often contracted from third-party digital service providers for a fee. Therefore, it is recognized in this study that the quality of service assessment for digital services needs to include the third-party service provider.

This thesis also provided a framework on how to evaluate the quality of service (QoS) in library related to the digital services using SLAs. This research is perhaps the first to address the integration of Service Level Agreements (SLAs) in the evaluation of library systems. SLAs have become a valuable tool to help manage service expectations and monitor
QoS attributes of services. In a digital library, the specification and management of QoS are necessary to enhance user experiences. QoS represents the parameters that can be used to characterize and assess the functional and nonfunctional aspects of digital services. Some of these parameters are objective in nature and can be automatically measured, whereas others are subjective in nature and can only be measured through user evaluations. Furthermore, this framework has already been validated by experts in library fields and technologically composed.

### 7.2.3 Contribution 3: Reference Library System Model

This thesis provided a reference library system model for libraries. This model provides a platform for future IT and digital services maturity studies in library plans. QoS is a crucial issue for each organization involved with services. In order to fulfill the expectations and the needs of their user, many organizations have to significantly improve their services. Generally, the main objective of a library is to provide service, not profit, where intangible benefits are provided to individuals. In the context of this thesis the term “library” is used to indicate the full range of library services (Digital services – electronic services) and information services (Information technology). Furthermore, it is acknowledged that each kind of information organization has a different way of implementing and institutionalizing technology. Thus, the thesis proposes this model according to the nature, needs and environment of libraries.

### 7.2.4 Contribution 4: Multi-Stage Model of Service Quality

A multi-stage model of service quality is also proposed in this thesis. This model is proposed because it is useful to represent the important features involved in an empirical phenomenon in service quality. It explains the features of the phenomenon under study and
the relationship between these important features. In this thesis, the model reveals the relationship between these important features such as utilization, capability, access quality indicator, and service delivery in the model. Looking at the overall view of the model enables one to get an inclusive understanding of the relationship between these features studied.

7.2.5 Contribution 5: Contribution to Library Service Quality Theory

Based on chapter two referring to section 2.13, this thesis also found a gap in the normal environment of service quality in libraries, especially in relation to digital and IT services. This is due to the different nature and needs of libraries. The natures of libraries is not static, but exist as dynamic environments, therefore it is important to have a different way of viewing the life cycle in the libraries. Thus, this new multi-stage model is expected to fill the gap in presenting the nature of libraries in comparison to other providers recognised in the literature review.

7.2.6 Contribution 6: Issues and Problem in Service Quality with Library.

This thesis stresses the importance of a third-party element in a measure the QoS due to the use of IT and digital services in the libraries. However, implementing this element should be aligned with the features which need to be understood by the library management. This study argues for a proper digital service and IT department within each library. It also requires sufficient and trained IT staff to tackle related issues, who are knowledgeable of IT language and the SLAs document when the customers need assistance. Fully depending on a third-party without monitoring their capability will only cause a lot of other issues, such as security risks.
7.3 Future Direction

Since the exposure of this study is limited to its digital and IT services, future research could fruitfully extend into other technology services used in the library environment. Since some of the framework and model proposed in this study is still at a conceptual level, further research on its application in the selected libraries is warranted. As a further addition to this research, the generic framework of SLAs for library development in this study could be used as a reference for all libraries. This framework could be tested in other information environments and other IT departments. To ensure that this framework can be upgraded to the satisfaction of users of libraries and the QoS in the libraries, there needs to be opportunities to improve the proposed solutions and to explore other related issues. The framework also needs to be flexible because of the nature and needs of libraries as distinct from other type of information organizations.
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1. Recommended text is in plain type.

2. Instructions for preparation of the document are in bold, italic type. You should delete these comments from the final document.

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Plain Language Statement

Date:

Full Project Title: Service Level Agreements Framework for Libraries

Principal Researcher: A/Professor Jemal Abawajy

Student Researcher: Masitah Ahmad

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1. Your Consent

You are invited to take part in this research project.

This Plain Language Statement contains detailed information about the research project. Its purpose is to explain to you as openly and clearly as possible all the procedures involved in this project so that you can make a fully informed decision whether you are going to participate.

Please read this Plain Language Statement carefully. Feel free to ask questions about any information in the document. You may also wish to discuss the project with a relative or friend or your local health worker. Feel free to do this.

Once you understand what the project is about and if you agree to take part in it, you will be asked to sign the Consent Form. By signing the Consent Form, you indicate that you understand the information and that you give your consent to participate in the research project.

You will be given a copy of the Plain Language Statement and Consent Form to keep as a record.

2. Purpose and Background

The purpose of this project is seeks to explore the management of SLAs in Malaysian Library, especially on the implementation of SLAs in IT services inside the Malaysian Libraries, in order to synthesizing library administration issues and the study of SLAs in IT services for Malaysian Libraries. This study is being conducted by a post graduate student to fulfil the requirements in obtaining a PhD in Information System Management in The School of Information Technology.
A total of 5 groups of Library will participate in this project.

The use of Service Level Agreements (SLAs) is rapidly growing, and is becoming important in recent years. In library, SLAs play an important component of IT service management and most libraries would benefit from developing SLAs between their IT (information technology) service provider and the various departments that rely on that service. There appears to be very little research, or study investigating the areas synthesizing library administration issues and the study of SLAs in IT services for Malaysian Libraries. To date of those issues, this research seeks to explore the management of SLAs in Malaysian Library, especially on the implementation of SLAs in IT services inside the Malaysian Libraries.

You are invited to participate in this research project because you are:

1) A major resource for the research as you responsible for planning, develop, implementing and evaluate SLAs in libraries at Malaysia. The participants a major resource for this research as you have the experience at every stage during the process on develop the SLAs in their library. Based on your responsibilities meets the research requirements this concentrates on your tasks and roles of your job accountabilities.

The results of this research may be used to help researcher Masitah Ahmad to obtain a PhD in Information System Management degree.

3. Funding

This research is totally funded by Government of Malaysia (Ministry of Higher Education) and Deakin University.

The researchers have the following financial or other interests in the funding organisation:

<table>
<thead>
<tr>
<th>Researcher</th>
<th>Funding organisation</th>
<th>Interests</th>
</tr>
</thead>
<tbody>
<tr>
<td>A/Professor Jemal Abawajy</td>
<td>Deakin University</td>
<td>Responsible as Principal Supervisor and Associate Supervisor</td>
</tr>
<tr>
<td>Masitah Ahmad</td>
<td>Ministry of Higher Education, Government of Malaysia</td>
<td>Complete study within 3 years</td>
</tr>
</tbody>
</table>

4. Procedures

The contact details and the positions responsibilities of the participants will be among Librarian Manager how engage directly with the development of SLAs in the Malaysian Libraries. Participants in this project will be involved in an interview which will be recorded. The interview will take about two hour. The time and location of the interview will be determined by the participants and will be conducted privately and confidentially between the researcher and participants. Names will be disclosed for transcriptions, storage at Deakin University, School of Information Technology.

Researcher will be contacting the participants and make appointment depending with their time availability. Before participants make their decision, the researcher will be available to answer any question that they have about the research project. They can ask any questions and seek further information regarding this research. And their only will sign the Consent
Form after they have had a chance to ask their questions and have received satisfactory answers.

If participants decide to withdraw from this research, they can notify the researcher or complete and return the Revocation of Consent Form attached. The notice will allow the research team to inform them if there are any special requirements linked to withdrawing.

To monitor this research, the researchers will conduct meetings on regular basis to discuss the progress of the research project. The expertise of the participants is particularly relevant to the knowledge and outcomes of this project. Participants will be informed of this and asked to give their full consent.

5. Possible Benefits

The findings of this study are expected to benefits all IS practitioners in Libraries also to the stakeholder and could be a catalyst for a better improvement and development of human capital in evaluating of SLAs in IT services inside the Libraries. The study also will provide conceptual framework to stakeholders (Library Management, Decision Maker) in helping them to have better understanding on SLAs. It also able to contribute to the University that provides Information Management Program which can help them in development of curriculum integrated.

6. Possible Risks

There are no possible risks or discomfort from participation in the research. The interview will be held within participants’ own time and on selected venue. The interview will be conducted privately and confidentially between researcher and participants. The researcher will use pseudonyms for all participants in all publication and the organization will be cited as organization ABC and XYZ. Results will be scrutinised accordance to the literature review in order to factors which will be used to design the framework.

7. Privacy, Confidentiality and Disclosure of Information

This research uses electronic and paper copies to keep all the information from participants. Information in electric material type will be stored on DVDs. All papers and DVDs copies will be stored in locked filing cabinet in a locked postgraduate research room in Deakin University, Waurn Ponds Campus. At completion, the information will be stored for a period of six years in accordance to Deakin University’s requirements. After six years, the information in papers will be shredded while DVD’s will be incinerated.

Any information obtained in connection with this project and that can identify you will only be disclosed with your permission, subject to legal requirements. If you give us your permission by signing the Consent Form, we plan to share, discuss or publish the results with Deakin University.

The information will be collected directly from participants who involved directly with the development of SLAs inside the Library. A face to face interview with the Librarian who involve with the SLAS will conducted as an instrument for data collection, and there for indentifies who are potentially identifiable. This is due to the need of the research to obtain a clear picture about the use of SLAs in the Library. The interviewees are all experts in their field.

The interview information from participants will be kept confidential where the access for this information will be controlled by the researcher. Responses from participants will be kept on the researcher personal computer for analysis until transferred into writing. This is a longitudinal study within 3 years; the researchers may need to recontact participants. For this, all participants’ personal data will be kept and used for further data requirements.
8. **New Information Arising During the Project**

During the research project, new information about the risks and benefits of the project may become known to the researchers.

9. **Results of Project**

The participants will be informed of the results of the research when the research project is completed and acknowledged your input as necessary for any publication anticipated from the research.

10. **Participation is Voluntary**

Participation in any research project is voluntary. **If you do not wish to take part you are not obliged to.** If you decide to take part and later change your mind, you are free to withdraw from the project at any stage. Any information obtained from you to date will not be used and will be destroyed.

Your decision whether to take part or not to take part, or to take part and then withdraw, will not affect your relationship with Deakin University.

Before you make your decision, a member of the research team will be available to answer any questions you have about the research project. You can ask for any information you want. Sign the Consent Form only after you have had a chance to ask your questions and have received satisfactory answers.

If you decide to withdraw from this project, please notify a member of the research team or complete and return the Revocation of Consent Form attached. This notice will allow the research team to inform you if there are any health risks or special requirements linked to withdrawing.

11. **Ethical Guidelines**

This project will be carried out according to the *National Statement on Ethical Conduct in Human Research (2007)* produced by the National Health and Medical Research Council of Australia. This statement has been developed to protect the interests of people who agree to participate in human research studies.

The ethics aspects of this research project have been approved by the Human Research Ethics Committee of Deakin University.

12. **Complaints**

If you have any complaints about any aspect of the project, the way it is being conducted or any questions about your rights as a research participant, then you may contact:

The Manager, Office of Research Integrity, Deakin University, 221 Burwood Highway, Burwood Victoria 3125, Telephone: 9251 7129, Facsimile: 9244 6581; research-ethics@deakin.edu.au.
Please quote project number EC 00213 -2009.

13. **Reimbursement for your costs**

You will not be paid for your participation in this project.

14. **Further Information, Queries or Any Problems**

If you require further information, wish to withdraw your participation or if you have any problems concerning this project, you can contact the principal researcher.

Name: A/Professor Jemal Abawajy  
Address: School of Information Technology  
Deakin University  
Waurn Ponds Campus  
Pigdons Road,  
Geelong VIC 3217  
Australia  
Organisation: Deakin University  
Area: School of Information Technology  
Position: A/Professor  
Contact (Bus) +61 3 52271376  
Email: jemal.abawajy@deakin.edu.au

The researchers responsible for this project are:

Name: Mrs Masitah Ahmad  
Address: School of Information Technology  
Deakin University  
Waurn Ponds Campus  
Pigdons Road,  
Geelong VIC 3217  
Australia  
Organisation: Deakin University  
Area: School of Information Technology  
Position: Ph.D Student  
Contact (Bus) +61 0430928244  
(Mob) +61 0430928244 (Fax) +610352272411  
Email: mahma@deakin.edu.au
TO:  Participants

Consent Form

Date:

Full Project Title:

Service Level Agreements Framework for Libraries

I have read, or have had read to me in my first language, and I understand the attached Plain Language Statement.

I freely agree to participate in this project according to the conditions in the Plain Language Statement.

I have been given a copy of the Plain Language Statement and Consent Form to keep.

The researcher has agreed not to reveal my identity and personal details, including where information about this project is published, or presented in any public form.

Participant’s Name (printed) ……………………………………………………………………

Signature ………………………………………………………          Date ………………………

Researcher:

Mrs Masitah Ahmad
School of Information Technology
Deakin University, Waurn Ponds Campus
Pigdons Road, Geelong VIC 3217
Australia
(Bus) +61 0430928244
(Mob) +61 0430928244
(Fax) +610352272411
Email: mahma@deakin.edu.au
Third Party Consent Form

(To be used by parents/guardians of minor children, or carers/guardians consenting on behalf of adult participants who do not have the capacity to give informed consent)

Date:

Full Project Title:

I have read, or have had read to me in my first language [only include this phrase if the documents will be translated into other languages], and I understand the attached Plain Language Statement.

I give my permission for ...........................................................(name of participant) to participate in this project according to the conditions in the Plain Language Statement.

I have been given a copy of Plain Language Statement and Consent Form to keep.

The researcher has agreed not to reveal my identity and personal details, including where information about this project is published, or presented in any public form.

Participant’s Name (printed) ...........................................................

Name of Person giving Consent (printed) ............................................

Relationship to Participant: ............................................................

Signature ................................................................. Date .........................

Researcher:
Mrs Masitah Ahmad
School of Information Technology
Deakin University, Waurn Ponds Campus
Pigdons Road, Geelong VIC 3217
Australia
(Bus) +61 0430928244
(Mob) +61 0430928244
(Fax) +610352272411
Email: mahma@deakin.edu.au
DEAKIN UNIVERSITY
PLAIN LANGUAGE STATEMENT AND CONSENT FORM

TO: Deakin University, Head of Facilities Management

Organisational Consent Form

(To be used by organisational Heads providing consent for staff/members/patrons to be involved in research)

Date:

Full Project Title:

Service Level Agreements Framework for Libraries

I have read, or have had read to me in my first language and I understand the attached Plain Language Statement.

I give my permission for staff/members/patrons of Deakin University to participate in this project according to the conditions in the Plain Language Statement.

I have been given a copy of Plain Language Statement and Consent Form to keep.

The researcher has agreed not to reveal the participants’ identities and personal details if information about this project is published or presented in any public form.
I agree that

1. The institution/organisation MAY / MAY NOT be named in research publications or other publicity without prior agreement.

2. I / We DO / DO NOT require an opportunity to check the factual accuracy of the research findings related to the institution/organisation.

3. I / We EXPECT / DO NOT EXPECT to receive a copy of the research findings or publications.

Name of person giving consent (printed) ………………………………………………………………

Signature ……………………………………………………… Date ……………………………

Researcher:
Mrs Masitah Ahmad
School of Information Technology
Deakin University, Waurn Ponds Campus
Pigdons Road, Geelong VIC 3217
Australia
(Bus) +61 0430928244
(Mob) +61 0430928244
(Fax) +610352272411
Email: mahma@deakin.edu.au
Revocation of Consent Form

(To be used for participants who wish to withdraw from the project)

Date;

Full Project Title:

Service Level Agreements Framework for Libraries

I hereby wish to WITHDRAW my consent to participate in the above research project and understand that such withdrawal WILL NOT jeopardise my relationship with Deakin University

Participant’s Name (printed) …………………………………………………….

Signature ……………………………………………………………….

Date

……………………

Please mail or fax this form to:

Researcher:
Mrs Masitah Ahmad
School of Information Technology
Deakin University, Waurn Ponds Campus,
Pigdons Road, Geelong VIC 3217
Australia
(Bus) +61 0430928244
(Mob) +61 0430928244
(Fax) +61352272411
Email: mahma@deakin.edu.au
Dear experts,

Kindly please answer the questionnaire below by referring to the modified SLAs Model of Digital Library Services

**Questionnaire Round 2**

Name of expert: 
Date: 

**Please tick (✓) the appropriate box in each case:**

1) In overall, this model is easy to understand

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

Additional comment (if any):

2) The processes and steps in this model and its features are clear

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

Additional comment (if any):

3) The process of identification of the SLAs is clearly explained

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

Additional comment (if any):

4) The six features in this model, i.e. Usage Metering, Compliance Management, Satisfaction Collection, Satisfaction Analysis, Service Level Negotiation Interface as well as SLAs Reporting is contributing to the comprehensiveness of the overall model

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

Additional comment (if any):

5) The utilization of service delivery in the Digital Library service is clearly presented

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

Additional comment (if any):

6) The library service provider provides value-added services such as searching and presentation of information of interest to the Library Service User.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>
Additional comment (if any):

7) The digital service must have a set of attributes such as service availability that can be quantifiable measures is clearly presented

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

Additional comment (if any):

8) The Library Service User is responsible for the planning and provisioning of the digital services within the Library is clearly presented

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

Additional comment

9) SLAs Negotiation Interface to negotiate and establish mutually acceptable agreement on the delivery of the service is very important in this model

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

Additional comment (if any):

10) Service Level Agreements (SLAs) are the core of the relationship between the digital library service delivery functions and the end-users of the digital services

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

Additional comment (if any):

11) All the proposed features in this model will support and help the Digital Libraries Quality of Service Management

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

Additional comment (if any):

12) Universal Design for measuring the QoS is supported in this model

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

Additional comment (if any):
13) This model is feasible to be implemented in Digital Library

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

Additional comment (if any):

14) I agree with this model

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

Additional comment (if any):

Dear Expert,

Enclosed here is a set of the modified Model of SLAs. Kindly please answer the questionnaire provided pertaining to the Model.
Memorandum

To: A/Prof Jemal Abawajy
   School of Information Technology

   cc: Mrs Masitah Ahmad

From: Deakin University Human Research Ethics Committee (DUHREC)

Date: 20 October, 2010

Subject: 2010-169
   Service Level Agreements framework for Libraries

Please quote this project number in all future communications

The application for this project was considered at the DU-HREC meeting held on 30/06/2010.

Approval has been given for Mrs Masitah Ahmad, under the supervision of A/Prof Jemal Abawajy, School of Information Technology, to undertake this project from 20/10/2010 to 20/10/2014.

The approval given by the Deakin University Human Research Ethics Committee is given only for the project and for the period as stated in the approval. It is your responsibility to contact the Human Research Ethics Unit immediately should any of the following occur:

- Serious or unexpected adverse effects on the participants
- Any proposed changes in the protocol, including extensions of time.
- Any events which might affect the continuing ethical acceptability of the project.
- The project is discontinued before the expected date of completion.
- Modifications are requested by other HRECs.

In addition you will be required to report on the progress of your project at least once every year and at the conclusion of the project. Failure to report as required will result in suspension of your approval to proceed with the project.

DUHREC may need to audit this project as part of the requirements for monitoring set out in the National Statement on Ethical Conduct in Human Research (2007).

Human Research Ethics Unit
research-ethics@deakin.edu.au
Telephone: 03 9251 7123

Human Ethics Research
Office of Research Integrity
Research Services Division
70 Elgar Road Burwood Victoria
Postal: 221 Burwood Highway
Burwood Victoria 3125 Australia
Telephone 03 9251 7123 Facsimile 03 9244 6581
research-ethics@deakin.edu.au
13 October 2010

To Whom It May Concern

Ms. Masitah Ahmad (a PhD candidate) and A/Professor Jemal Abawajy from the School of Information Technology, Deakin University, Australia are working together on a research that investigates the requirements for a service level agreement framework for libraries in Malaysia.

The research constitutes part of Masitah’s PhD thesis. The resulting framework will help the library managers in understanding service provider and service consumer differences and similarities, finding problems and reducing the gap between service providers and service consumers’ perception and expectation. Additional benefits of the new framework include that it enables the library managers in Malaysian to measure service quality and what customers values as important in a standardised way.

In order to come out with the said framework, it is necessary for the researcher to collect some specific data via interview, survey, document review and observation in your Library. We also have prepared a questionnaire which we would be grateful if you could spend some time for completing it. I am sure you appreciate the importance of this research and understand that it will have significant impact on Malaysian Librarians management. I will be most grateful if you could support Ms. Masitah’s research through participation in the case study that she is proposing to carry out in your organisation.

If you have any question or require further information, please feel free to contact me.

Yours Sincerely,

[Signature Redacted by Library]

A/ Professor Jemal Husseim Abawajy,
Associate Head of School Research

Dr. Jemal H. Abiawajy
School of Engineering & IT Tech
Deakin University Australia