CHAPTER ONE

INTRODUCTION

1.1   Background of Study

The continuing development of systems and applications through a combination of technologies of Information Systems (IS) and Information and Communication Technology (ICT) has transformed a large part of our environment into a digitized and online-based world. The far-reaching impact of digitisation and online-based systems have made such digital infrastructure and repositories widely applicable to support the activities of the educational, workplace and scientific communities. The deployment and adoption of different types of Information Systems within or across organisations and academic institutions is growing exponentially, which includes the decision support systems (DSS), e-commerce, knowledge management systems, online analytical processing (OLAP), as well as the online resource systems in academia. Libraries in general and academic libraries in particular, had taken several steps to make the necessary change and transform from mere physical libraries to digital libraries in light of the manner information is organized, retrieved and discovered today.

The result of increasingly developed systems and applications had brought about enhancements on Information Systems which have now become ubiquitous. Organizations (as well as individuals) are able to gain enormous benefits from the use of these systems and applications when compared to the traditional ways. The field of Information Systems may have become one of their main supporters, to keep pace with

technology and to fit into very competitive business or academic challenges. Nevertheless, questions like how successful the Information System is to the community served and how well the Information System fits into an individual task and organisational environment, remain to be answered. In consequence, the performance of Information Systems is a paramount issue that has been discussed in the Information Systems literature since 1970s, and is still receiving vast attention among Information System researchers (Fishbein and Ajzen, 1975; Davis, 1986, 1989; Goodhue and Thompson, 1995; DeLone and McLean, 1992, 2003, 2004; Wijesinghe, Sedera and Tan, 2009). The perseverance among these Information System researchers has yielded various models and theories, as well as constructive feedback on evaluating the success of Information Systems have been received.

Some general categories of Information Systems include the decision support systems, digital libraries, knowledge management systems and e-commerce. An Information System acts as a mediator (or supporter) between human activities and information technology. Westmark (2004) noted that Information Systems are network systems with the integration of varying quality meant to provide services to end users. In the Information Systems literature, the formal definition of Information System can be derived from two perspectives that relate to its function (see Goldkuhl and Lyytinen, 1982) and structure (see Davis and Olson, 1984). In the perspective related to its function, the information system is defined as a technologically-implemented medium used for recording, storing and disseminating linguistic expression as well as supporting inference making. In the structural perspective, information system consists of a collection of people, processes, data, models, technology and partly formalised language, forming a cohesive structure which serves some organisational purposes or functions.

The last three decades have witnessed numerous Information System researchers attempting to define the variables that measure and evaluate Information Systems. Many of the researchers focused on identifying the determinants and dimensions that might have had an influence on the success of Information Systems. Thus so far, there has been no firm consensus on the best model or dimensions or measures to use (Gable, Sedera and Chan, 2008) for this purpose. It may be due to different authors conceptualising different constructs in assessing the success of a system. Moreover, different Information Systems are developed for different purposes to serve different types of information communities. Hence the measures chosen vary depending on such criteria.

Many researchers relate the success of the Information Systems model with Information System usage, such as Davis (1986, 1989) for Technology Acceptance Model (TAM), Goodhue and Thompson (1995) for Task Technology Fit (TTF) and DeLone and McLean (1992, 2003, 2004) for IS Success model. With the emergence of different models in evaluating the Information System successes, Gable, Sedera and Chan (2008) admitted that evaluation studies have been varied, resulting in the lack of consensus on the appropriate measures of the Information System successes. In addition, some Information Systems success models are difficult to apply in practice. Legris, Ingham and Collerette (2003) in De Toni and Zanutto (2006) agreed that although the models are theoretically precise, to apply them in the real world would be difficult due to the linkage to users' psychological and sociological theories. Seddon et al. (1998), cited in Wijesinghe, Sedera and Tan (2009), claimed that although many reasons exist in the gap between research and practice, evaluating Information Systems successes may require differing measures and dimensions depending on the stakeholders and systems used. Theories formulated to measure the performance of Information Systems are seemingly unending.

DeLone and McLean (1992) introduced the most widely cited models to measure the success of Information Systems (Palmius, 2007; Petter, DeLone and McLean, 2008; Al-adaileh, 2009) called the D&M IS Success model. Since then, their model has been used, tested and extended by a number of Information Systems researchers which yielded hundreds of articles related to measuring Information Systems successes. The model was later updated in year 2003 and 2004. Since the D&M IS Success model was developed, Information Systems researchers have embarked further on Information Systems research by studying the dimensions proposed, and this has led to the call for more consistent success metrics, urging for modifications of the model and by taking further research into consideration, DeLone and McLean (1992) eventually updated it about a decade after. Goodhue and Thompson (1995), for instance, believed that user attitudes and technology fit theory have a close linkage to IS successes. Their new model called Task-Technology Fit (TTF) is found to be consistent with DeLone and McLean's (1992) theory.

The most recent and rigorous (Elias and Cao, 2009; Rabaa'i, 2009) IS Success model that received growing attention is the IS-Impact model developed by Gable, Sedera and Chan in 2008. Ifinedo (2008), Wijesinghe, Sedera and Tan (2009), Elias and Cao (2009) regarded this model as the most comprehensive IS Success model to date. IS-Impact model is derived from D&M IS Success model and has some basis in Benbasat and Zmud's (2003) Information Systems nomological net (IS-Net). In validating the salient measures for evaluating Information Systems, they conducted three rounds of the survey using enterprise systems as a unit of analysis. Their study incorporates three key surveys, each with its respective purpose: identification survey (garnering IS Success dimensions and measures), specification survey (specifying the IS Success dimensions and measures derived from identification survey and validated by rigorous statistical tests) and confirmation survey (further validation process on the IS

Success dimensions and measures by using new data). The derivation of the IS-Impact model is based on the stream of *net benefits* (one of the dimensions introduced by DeLone and McLean (2003, 2004)). As cited by Gable, Sedera and Chan (2008:386), the IS-Impact model of an Information System is regarded as "*a measure at a point in time, of the stream of net benefits from the Information System, to date and anticipated, as perceived by all key-user-groups*".

The D&M IS Success model (updated) by DeLone and McLean (2004) comprises six dimensions that are said to be consistent with the requirements to measure IS Success. It has again been used widely in studies by Information System researchers aimed at measuring IS successes. The D&M IS Success model (2003, 2004) dimensions are *system quality, information quality, service quality, use (system), user satisfaction* and *net benefits.* The net benefits of the IS-Impact mode is separated into individual and organisational impacts.

In contrast to the D&M IS Success model, TTF model goes beyond that. It takes into consideration the role of technology itself. Goodhue and Thompson (1995) argued that individuals must utilise technology and technology must very well fit the individual tasks that it supports. From here, the positive impact gained in individual performances reflects the IS success. They posited *task characteristics, technology characteristics, task-technology fit, utilisation* and *performance impact* as the five dimensions of the model.

Gable, Sedera and Chan (2008) investigated the issue from a different angle, but based on DeLone and McLean's model (2003, 2004), which took into consideration the net benefits. They envisaged the measurement model as a holistic measure for evaluating the success of Information System by considering two key dimensions of impact; *backward* (impacts) and *forward* (quality). Backward is the *impact to date* which measures the individual impact and organisational impact, while *forward* is

quality measuring the *impacts anticipated* for system quality and information quality. Hence the IS-Impact model is a holistic index representing the stream of net benefits; the 'impact' half measures net benefits to date, while the 'quality' half forms their "best" proxy measure of probable future impacts, with 'impacts' being the common denominator (Gable, Sedera and Chan, 2008). The model developed is applied to measure the impact of the contemporary Information System (Enterprise System) and is said to be the most comprehensive and validated model so far (Elias and Cao, 2009; Ifinedo, 2006).

It is learned from the Information Systems literature that in the previous three decades, studies on evaluating IS Success yielded various measures defined by different authors that related to their respective IS Success models. Despite the complexity of implementing the model in the real world setting, some models are successful. Measures are indicators used to measure the success of an Information System, and with regards to this, some of them may comply with organisational requirements and others may not. Different models and theories lead to differences (but not all) or additional measures. Some uses similar dimensions but with additional or different measures. In general, measures selected are likely to depend on the type of Information System used and the end users. Among the most popular measures used in evaluating the IS Success is ease of use, ease of learning, efficiency, information accuracy and usability. Gable, Sedera and Chan's (2008) model for example, used a-priori of 37 measures to be tested in their models, which left only 27 in the final model.

Academic libraries serve to support the processes of learning, teaching and researching, while academic digital libraries offer unique ways of collecting, recording, preserving accessing and propagating culture in multimedia forms. According to Wan Ab. Kadir (2008), in Huling (2002: 533), academic libraries are those that serve the information needs of students and faculties of colleges and universities. While Rosna

(2002) indicated that academic libraries contribute to the development of scholarship through the strength of collection, services, technology and staffs. Academic digital libraries provide academic resources through online and networked environments that are capable of fulfilling users' academic information needs.

The term "digital library" may pose a wide interpretation of meaning to many and the technology is said yet to be prominent in Malaysia. Vassilou and Rowley (2008) also earlier stressed the difference in the definitions used between an "electronic journal" and an "electronic book". Different definitions of e-book is also discovered. Shelburne (2009) once noted that Levine-Clark (2006) raised the concern on the different definitions of "e-book" by librarians, publishers and industry. However, by taking into consideration the concept of the digital library as an Information System, but still holding on to the definition of digital library, this study refers the "digital library" as *online library resources*. Online library resources consist of all library materials that can be accessed through online and networked facilities which include digital materials such as e-journals, e-books and e-thesis, as well as online past examination papers. The term as given is based on the personal view of the Coordinator of Royal Melbourne Information and Technology University's (RMIT) Digital Repositories, Marion Slawson. She commented on the appropriateness of referring the academic digital libraries to the term "online library resources*."* However, the study adheres to the term "digital libraries*"* as through the pilot study, it was discovered that respondents understood the meaning of the digital library. It is mainly due to the broad use of the term, and moreover, most of the respondents acknowledged the existence of their universities' digital libraries especially through the social network, Facebook.

With increasing importance in the use of digital libraries especially for academic purposes, the discussion on how well academic digital libraries successfully accommodate users' needs may not be clearly addressed by many digital library

providers (the universities). The term "academic libraries" represents the traditional or physical libraries of universities in Malaysia. Due to the advancement of the information and communication technology, these libraries adopted the technology to migrate from the physical libraries to digital libraries. According to Butdisuwan (2005), the transition has made the academic libraries to become inevitably digital, and his study revealed that the Thailand academic libraries started preparing for the in-house digital collections like thesis, archives and research papers to serve this purpose. In addition, the digital library concept has introduced digital resources such as e-journals, e-books and online databases. Academic libraries in Malaysia are also heading in the same direction. In recent years, besides maintaining the physical libraries, the academic libraries are also equipped with such digital resources. It is worth noting that the implementation of digital libraries is inevitable at higher institutions in Malaysia as well. Apart from the varsities' in-house digital collections and resources, the digital repositories are also included as part of the digital library. Maintaining digital repositories (for academic libraries) is analogous to maintaining physical library materials and is often a necessary aspect of building local digital libraries (Campbell, 2006). He also emphasized that "even before the Web was introduced, academic libraries had started to create digital libraries of trustworthy information". Owing to the Internet and Web technologies that has brought a myriad of advances to academic libraries, Campbell (2006) once said; "The reason that the (physical academic) library is losing its supremacy in carrying out this fundamental role is due, of course, to the impact of digital technology". Using his premises, as quoted, the term *online library resources* are interchangeably used with the term (*academic*) *digital libraries* in this thesis to represent the digital libraries at higher institutions in Malaysia. In addition to this, evaluating the performance of a digital library should take into account the measuring of the success of the Information Systems. The interrelationship between

digital library technology and Information Systems technology should be regarded as a complete way in evaluating the performance of a digital library. The following section discusses the problem statement of this study.

1.2   Problem Statement

In the mainstream of human-computer interaction (HCI), problems or issues in coalescing Information System requirements and users' needs are expected to exist, particularly when information retrieval and information provisioning are the main goals. To date, there is still a lack of evidence from previous research findings of performance analysis of how useful digital libraries are to specific users using the formative measurement model. It is essential to understand users' needs and criteria because digital library systems depend on people (users) and the benefits from its use cannot be experienced if people or organisations cannot adapt to them. With the many advantages that an academic digital library can offer, the challenge in making full use of this system lies not only on the Information System technology, but also in dealing with users' satisfaction and needs. As mentioned earlier, understanding digital library user needs and criteria in evaluating digital library performance is both very important in sustaining its implementation in the academic environment. These can be understood by investigating its performance indicators from users' point of views as users are the key players in the life cycle of digital libraries. If a digital library cannot perform as expected by its users, this may imply that the system does not have an impact towards users' academic requirements in relation to the information seeking / accessing / retrieving processes.

To the best knowledge of the researcher, Information Systems researchers extensively delved into the dimensions and measures of IS Success uses reflective models. Among 43 articles in high ranking journals (MIS Quarterly (MISQ), Information Systems Research (ISR), Management Science (MS), Journal of MIS

(JMIS), Journal of the AIS (JAIS), Decision Sciences (DS), Information & Management (I&M) and European Journal of Information Systems (EJIS)), as well as the International Conference on Information Systems (ICIS) from 1985 to 2007, Gable and Sedera (2009) raised their concerns on the tests of IS Success measures that had been validated as reflective. Further, none of the articles (some had employed the structural equation modeling, SEM) reported on studies that had performed the appropriate formative tests. Diamantopoulos, Riefler and Roth (2008), however, identified recent areas of research including marketing literature (Bruhn, Georgi and Hadwich, 2008; Brewer, 2007), management literature (Helm, 2005; Venaik, Midgley and Devinney, 2005) and information technology literature (Pavlou and Gefen, 2005; Yi and Davis, 2003) that are beginning to employ formative construct validation. However, to date, there is yet a research focusing on measuring the success factors of an academic digital library by employing a formative mode for establishing the success measures. In bridging this gap, this study proposes employing the formative measurement model, from the theoretical foundation of Gable, Sedera and Chan (2008) and Ambrose, Rai and Ramaprasad (2006), in measuring the success of academic digital libraries. Hence, the main problem investigated in this study is to uncover the use of DLs for information seeking and provisioning through Information Systems (usage) perspectives in the academic community. This includes discovering the actual users' criteria to appreciate the digital libraries' capability in providing them with information or data that they need for their academic purposes.

1.3   Objectives of Study

The main objective of the study is to test the model of digital library success by adopting the IS-Impact model (Gable, Sedera and Chan, 2008), in the context of academic knowledge acquisition among university students and academicians/researchers. This will require the analysis of digital library performance

incorporating four main dimensions of information systems – *system quality, information quality, individual impact and institutional (organizational) impact*, as recommended in the IS-Impact model (Gable, Sedera and Chan, 2008). Moreover, the dimensions are reconciled with the usage of DLs as information provisioning properties (Ambrose, Rai and Ramaprasad, 2006; Segars, 1997; Sethi and King, 1991; Churchill, 1979). The impact or net benefits of digital libraries to users are measured based on IS Success dimensions where IS Success is one of the four paradigms used in scholarly studies in the Information Systems literature. The paradigms relate to Information System usage where the commonly employed "*usage*" refers to IS for Decision-making, IS Implementation, IS Acceptance and IS Success. Elaborating on the other three paradigms is beyond the scope of this study; however, in the context of digital libraries, *IS Success* is the most applicable paradigm for Information System usage, as studied in this research. As defined by DeLone and McLean (1992, 2003, 2004), Information Systems Usage is a process of using Information Systems that leads to the net benefits (success) to individuals and organisations. The research is accomplished by using a user-centered approach (field work) where the units of analysis (students and academicians) engaged with *online library resources*. Therefore, the research was conducted with the objectives of:

1. To determine the suitability of Digital Library Usage for the Information Provisioning (DLUIP) model in measuring individual usage impact (IUI).

Determining the suitability of dimensions and indicators in influencing the usage of digital libraries for information provisioning impact was set as the first objective of the study. DLUIP properties consist of three dimensions postulated and validated by Ambrose, Rai and Ramaprasad (2006) as formative: content breadth, content depth and interaction

dynamism. By all formative measures and constructs, partial least squares (PLS) path modeling was used in assessing the DLUIP properties with the formative validation test.

2. To identify the effects of users' awareness in moderating the relationships between DLUIP indicators and individual usage.

This second objective focused on the awareness of end users towards the online library resources used throughout their academic routines or activities. Research on awareness in digital libraries is still understudied (Farooq et al., 2008) as compared to human and computer interaction domains (Dourish and Belloti, 1992). Awareness factor is seen as an essential factor in the individual use of an information system, for a longer term to fulfil users' information needs. The awareness level of digital libraries between academic users is varied in past research where circumstances have led to different perceptions and usage of digital libraries (Tammaro, 2008; Asemi and Rihaniya, 2007; Atilgan and Bayran, 2006; University of Rhode Island, 2006). Past findings motivated this study to investigate the awareness of digital libraries among academic users and to incorporate the factors as moderators in investigating their effects on the strength of the relationships in the individual usage dimension. The awareness is proposed to conceptualise three main categories described by Hansen and Javelin (2005) i.e., awareness of objects (accessing different types of resources), awareness of activities (having the same need for information like search activities) and awareness of people (knowing about colleagues or study groups). As indicated earlier, awareness indicators are not directly posited in estimating the IS success but rather to investigate the level of awareness of digital libraries by the academic community. The factors are addressed at postulating the success indicators as moderating the effects on the individual usage impact. The impact of the relationships can be determined via the predictive strength of the sub-model for the individual usage dimension.

3. To investigate the most influential DLUIP dimension on individual usage.

The third objective investigated the key property of DLUIP in predicting the IUI. The result of the impact was based on the highest magnitude of the path coefficient produced by the path model.

4. To investigate the suitability of information systems success indicators in measuring the success of digital libraries.

Using the PLS path model, the full model, the DL-Success model was performed and assessed with formative validation tests, as well as to determine its predictive strength in explaining the model variance. The dimensions and indicators of the success of digital libraries were evaluated using the formative IS-Impact measurement model developed by Gable, Sedera and Chan (2008). The full model was performed after the reconciliation of the DLUIP properties with the IUI.

5. To determine the impact of the four success dimensions on DL-Success.

The last objective was to determine the impact of the four success dimensions on the success of digital libraries. The aim included investigating the degree of the predictive strength of the model and identifying significance and non-significance of the weights and path coefficients, as well as the algebraic signs and magnitude of all the postulated indicators. The model was used to measure the overall performance of academic digital libraries, namely the online library resources.

From the objectives outlined above, five research questions were generated and explained in detail in the next section.

1.4   Research Questions

It is absolutely essential to develop research questions to identify the phenomenon to be studied and also as a focus of this research. In regard to this study, five research questions were formulated so that they match with each of the study objectives as presented earlier.

Thus, the research questions developed are as follows:

1. Is the usage for information provisioning model acceptable when applied in the context of digital libraries?

The first research question addressed the task of examining DLUIP indicators in predicting the individual impact, by identifying whether the model is acceptable or otherwise.

2. Do the relationships between digital library usage for information provisioning (DLUIP) measures and individual usage depend on the users' awareness factors?

This research question sought to extract the level of awareness of digital libraries and the extent the awareness factors influence individual usage of the libraries. The researcher's conjecture for the former would suggest that the concept of awareness of digital libraries as an interactive term between the three dimensions of DLUIP in the *Individual Usage Impact* (IUI) dimension's relationships.

3. What is the DLUIP dimension that has the greatest influence on individual usage?

This research question determined which of the DLUIP properties has the highest influence on the IUI. It is hypothesised that all of the three dimensions of DLUIP, i.e., content breadth, content depth and interaction dynamism were positively associated

with the IUI measures (where the dependent variables are learning, recall, decision effectiveness and individual productivity).

4. Is the DL-Success model valid in measuring the success of academic digital libraries?

The fourth research question examined the validity of the DL-Success model using formative validation tests provided in the literature.

5. What is the degree of the impact of the four success dimensions on the DL success?

The last research question examined the impact or influence of the four success dimensions on DL success (as the full predictive model). It is hypothesised that the four dimensions of individual usage impact, institutional impact, information quality and system quality are four dimensions (or constructs) that can predict the success measures (positive impact on the individual and the institution, satisfaction of information and system).

The performance indicators from information provisioning and Information Systems Success of digital libraries identified will guide the academic libraries in providing information services of digital libraries that are tailored to their users' needs, and also to better serve the specific needs of digital libraries and other information systems such as hypertext/hypermedia for academic digital libraries.

Information systems play a significant role in the development, deployment and implementation of digital libraries. Therefore, the answers to the research questions of the study can be used to help digital library developers in producing digital library systems based on user needs. Thus, it is expected in improving the usability, effectiveness and efficiency of digital library services for academic purposes.

The following section justifies the significance of this research which complies with the objectives discussed in Section 1.5.

1.5   Significance of Study

This research is aimed at exploring the overall performance of academic digital libraries as a successful information system through a user-centered design approach via formative success measures. Subjects for this study were students, academicians/researchers as well as librarians because they form the community involved in digital libraries. The main reason for choosing these particular users is that they work closely with information gathering and information seeking activities in their study and research. Digital libraries can be considered an alternative information channel to gather the required information and data. Hence, it is expected that online resources and digitised sources that can be accessed anywhere anytime are the best resources for them to use in their information-seeking activities.

Therefore, the importance of this study is, firstly, it could be a benchmark for information services of digital libraries which could lead to the evaluation of the performance of digital libraries performance. This can be done by establishing the relative strengths and weaknesses of academic digital libraries. Based on users' perceptions, the strengths and weaknesses of digital libraries' online information services can be investigated. Long (2002) stressed that this is because the common reason for evaluation is to identify users and their information needs. This includes knowing the kind of resource users want most, the type of data format mostly useful and other kinds of user needs. It is expected that the relative strengths and weaknesses of digital libraries investigated would be useful and have an important role in the evaluation of the digital libraries' performance in particular for students, academicians/researchers and librarians.

Secondly, the need to contribute towards improving service quality of digital libraries as online library resources and service providers that is expected by users in this study, suggested (based on the identified success indicators) the kind of actions that should be subsequently performed to develop or improve current digital libraries (if necessary) which will fulfil the targeted users' needs. The significant success indicators were useful for academic digital library providers, as well as developers, in setting priorities to meet the required level of performance of digital libraries based on user criteria. The indicators should be treated as a guide in planning for future academic digital libraries which are currently developing rapidly with a huge volume of digital contents added periodically. The success of the academic digital library relies upon how successful it is in serving to, and being accepted by, its community. Apart from that, the success of an Information System has the tendency to fit well with its users' work environment. In practice, the application of the measures identified in this study will generate further discussions and actions for institutions to meet their users' information needs.

Thirdly, this study observed the aspects of usage of digital libraries where the usage measures covered: (1) digital libraries as providers of information to users with the information of interest and (2) digital libraries as successful information systems used for academic purposes. Each has its own dimensions and measures: for the former, the study investigated the questions of *what* and *why* digital libraries are used. For the latter, usage of digital libraries may point to a process leading to the impact on the users' academic use. Both groups of constructs (DLUIP and DL Success) were seen as two main factors in sustaining the utilisation and success of digital libraries. This research is not meant to focus on technological aspects but rather emphasise how well digital libraries serve the target communities. Therefore, this study suggests the

usefulness of the digital libraries in supporting the information services of academic libraries and users' information needs.

Fourthly, the proposed dimensions and indicators obtained from the outcomes of this study can be treated in future as measures in assessing academic digital libraries as a successful Information System in the academic domain. Specifically, the significance of this research is that a similar research (on performance analysis of digital information systems) could hardly be located and the study's proposed model, DL Success, is therefore applicable for further research using the same applications but with different data sets.

In light of the discussed rationale, it is vital to understand the scope and limitation of this study so that the study's objectives can be met. This is discussed in the following section.

1.6 Scope of the Study

At this time, it would be unwise to admit that academic digital libraries are already established in Malaysia. However, this does not hinder the research process. In the context of this study, the focus was on selected academic online library resources (established hybrid libraries), that covered users of four Research Universities (RU) in Malaysia, namely Universiti Malaya (UM), Universiti Kebangsaan Malaysia (UKM), Universiti Putra Malaysia (UPM) and Universiti Sains Malaysia (USM). The URLs for these online library resources are UM (http://www.umlib.um.edu.my/), UKM (http://www.ukm.my/library/), USM (http://www.lib.usm.my/equip-usm/custom/home.jsp) and UPM (http://www.psasir.upm.edu.my/).

Referring to the formal definition of "digital library", each of the URL address given above is treated as an "academic digital library" due to these reasons:

1. Each of the URLs provides academic online materials such as e-journals, e-books and e-media to the end users with a controlled access (username and password).

2. All the online library resources are digitally available as they are maintained and managed by specialised staff (in this case, the librarians as well as the IT officers).

3. Online library resources are information systems where many institutions have developed academic repositories to date. The term *academic (institutional) repositories* are actually part of online library resources, where it also refers to digital libraries (Wikipedia, 2010).

In addition, the units of analysis for the study are selected from these four universities due to these reasons (Wan Ab. Kadir, 2008):

1. These universities are among the most established i.e., each is more than 40 years old.

2. Their online library services are well established.

3. The number of student enrollments and total number of lecturers are comparatively higher than other universities.

With long years of establishment, well-equipped online services and high numbers of students as compared to other higher learning institutions, these research universities which provide access to their online academic library resources to the campus population, are believed to have established digital repositories of these materials, that can largely be used by their students and academicians/researchers. The terminology of academic digital library used in the study is limited to online library resources that have been developed, managed and provided by the specialised teams

(librarian and information technology people) in each university. UM, for example, has MyManuskrip (manuscripts), DSpace@UM (for thesis and dissertations), MyAIS (Malaysiana articles), Eprints (UM's publications), UM in the news (newspaper cuttings), UM Memory (photographs), etc. With a variety of features, end users may have more choices in meeting their information needs. Hence, this offers opportunities for them to experience the use of digital libraries at their own institutions. This will be in line with the aim of the study, that is to conduct an assessment of the performance of the digital libraries based on the IS Success model, from the users' perspective.

The respondents chosen for this study involved only students, academicians/researchers, and librarians from the four selected institutions. This is a user-centered mixed study based on a survey and interviews; explorations of in-depth technical aspects or issues related to information systems and digital libraries' system are beyond the scope of this study.

This study is also limited to only on-site users at the selected universities and thus does not consider students or staff who are distance loggers. To comply with the study objectives, the respondents participating in this study were only students, academicians and librarians due to the nature of their work, and thus possessed the requisite experience necessary for the conduct of the study. The experience indicator was that the subjects must have at least one semester of experience using the digital libraries.

1.7   Limitations of the Study

Overall, there are several limitations to this study. Firstly, the study was a survey of only four research universities in Malaysia. Conclusive understanding towards the research may not be achieved for the whole population of students and academicians from public and private universities. Secondly, this study examined the phenomenon under study by defining *online library resources* as digital libraries. In Malaysia, the

technology of digital libraries has yet to fully emerge; however, online library resources can be thought of as digital libraries since the provision of online and digital resources to end-users (students and academicians) require specifically-built information systems. Therefore, the true virtues of the actual technology may not have been portrayed in this study. However, this limitation did not hinder the researcher's attempt to test the IS-Impact model (Gable, Sedera and Chan, 2008) empirically. As stated in Wikipedia (2010), institutional repositories are also referred to as digital libraries. Thirdly, the study drew upon a formative measurement model based on previous research, in the context of enterprise systems (IS-Impact theory) and clinical decision-makers (IUIP theory), where the list of measures may not be exhaustive in the context of academic digital libraries. Fourthly, the study proposed a statistical approach via structural equation modeling namely partial least squares (PLS) path model. Since the aim was to predict the success of academic digital libraries based on the theoretical foundation given in the literature, only one type of formative model is proposed; one first-order formative, four second-order formative and one third-order formative. The model was selected based on the evidence of the relationships between the constructs that had been defined in formative mode (refer to Gable, Sedera and Chan, 2008; Ambrose, Rai and Ramaprasad, 2006). Thus, all the outcomes are based on the results from the proposed multidimensional formative measurement model.

In the following section, definitions of the basic terminologies used in this thesis are outlined.

1.8   Definitions of Concepts

In discussing this study with further details, it is very important to understand the terms used in the thesis. The terms and concepts are as follows:

Academic community

Academic community is formed by scholars (students and academicians/researchers at the universities) who have (or study) similar disciplines, research interests and topics. As far as the university is concerned, the study takes the "academic community" term as fairly literal to define a community of students or academicians/researchers formed according to similar information needs.

Academic information

Academic courses and curriculum designed at higher institutions formed within a diversity of disciplines (knowledge) and interdisciplinary, with a combination of theory and practice. The formation leads to the organisation of an academic community which require (or share) similar information, knowledge, interest and research topics. Academic information is therefore information which fulfils the academic community's information needs supported by the resources provided by the academic digital libraries.

Awareness

Awareness refers to three definitions: awareness of people, awareness of objects and awareness of activities. It is a concept of awareness towards academic digital libraries where appreciation or familiarity of using their services and functionalities (awareness of objects) and implication of using such systems to self and colleagues/groups (awareness of people), and digital libraries for fulfilling academic needs (awareness of activities) are expected to be beneficial academically.

Digital libraries

A digital library is a library where collections are stored in digital formats (as opposed to print, microform, or other media) and accessible by computers (Greenstein and Thorin, 2002). Thus digital library for this study refers to online

library resources ranging from e-journals, e-thesis, e-books to e-media to academic users at the higher institutions (Butdisuwan, 2005).

Digital Library services and functionalities

Services and functionalities will be associated with information systems facet like storage, in terms of accessing/receiving/distributing data and also features of the user interface.

Digital Library usage

The usage of digital library systems is conceptualised as *how* and *for what* the system is used. This relates to how digital libraries are capable of providing information tailored to users' information needs (Ambrose, Rai and Ramaprasad, 2006).

Information Systems

Information systems such as academic digital library systems (online library resources) are a type of applications designed and developed for information retrieval, updating and maintaining metadata, databases and archives of academic publications, and for use by academic users. It is a managed collection of information with associated services where the information is stored in digital format and accessible over a network (Arms, 2001).

Performance

The success of digital libraries is evaluated using information systems success measures (Gable, Sedera and Chan, 2008) of individual and institutional impacts, and information and system quality.

Success

Success, as used in the thesis, is the benefit received or perceived by end users, as far as information needs are concerned. Success reflects in two main paradigms: for provision of information and for an information system success. Reconciling

these two paradigms, the net impacts (success) to end users of digital libraries will be predictable (Gable, Sedera and Chan, 2008; Ambrose, Rai and Ramaprasad , 2006).

Success Indicators

The definition of a DL success factor of this study refers to the usage of online library resources for individual benefits in academia. The success measures proposed are grounded by the works of Gable, Sedera and Chan. (2008) and Ambrose, Rai and Ramaprasad (2006). All of the indicators used in the study are conceptually justified in both research and are selected based on formative measures and constructs.

1.9   Organisation of Thesis

This thesis is divided into five chapters. Chapter 1 covers the background of the study, brief discussion on information systems research, digital library research, problem statement, study objectives, research questions, significance of study, scope, limitation and key definitions of concepts.

Chapter 2 encompasses discussions of the literature of information systems which includes widely about the models, dimensions and measures used in evaluating IS Success in Information Systems. The discussion extends to information systems and digital libraries, issues pertaining to digital libraries and information systems' evaluation studies, roles and relationships of information systems and digital libraries, users' of digital libraries, evaluation of digital libraries with respect to issues related to performance indicators, usage and also impact on users.

Chapter 3 describes about the design of the study and methodology which comprises the following: stages of research followed by the proposed study framework and model, research design, population and sample, instrument, data collection, definition of formative measurements for both individual usages and success model, and

performed analyses. The partial least squares (PLS) path model is also explained in brief, alongside the introduction to the concept and formal models of formative and reflective measurements.

Chapter 4 presents and discusses further about the findings of the study with regard to the data collected. Preliminary and descriptive analyses are presented in describing and summarizing the data. The results of the model estimation are also elaborated in detail, illustrated in tables, figures and charts.

Chapter 5 concludes the thesis by highlighting the research findings, recommendations, implications for research and practice, as well as considerations for future work.