UNIVERSITY OF SOUTHERN QUEENSLAND

Measuring E-Learning Systems Success

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ABSTRACT

The education sector has been radically affected by developments in information technology. In the education arena, substantial funds have been invested in the systematic development of technology infrastructure. E-learning is believed to be the main platform for adopting and using new and more advanced IT in the education sector. However, measuring the success of e-learning systems is one of the key issues facing universities and educational institutions. Although considerable attention has been paid to the information systems success issue, there remain arguments about which factors are the most telling in measuring information system success. The issue of evaluation of the success of information systems generally, and e-learning systems in particular, has become more complicated due to the differing interests and needs of stakeholders. Different groups of stakeholders deal with e-learning systems in different ways - for instance, students, academic staff, ICT staff, management, and software developers. These stakeholders have substantially different objectives and often there are conflicts between their aims. This study proposes an evaluation methodology model to assess e-learning systems success.

The model proposed is one which includes eight constructs: IT infrastructure services; system quality; information quality; service delivery quality; perceived usefulness; user satisfaction; customer value; and organisational value. A range of stakeholders such as students, academic staff, and ICT staff are considered in this model. Three instruments were designed to measure the perceptions of three different stakeholders towards e-learning system success. A quantitative study was conducted at University of Southern Queensland (USQ), with survey responses from 720 students who use the e-learning system, 110 academic staff members, and 22 ICT staff. The results confirm that the study model is valid and reliable to measure the success of e-learning systems from different points of view. Some of the relationships among the constructs in the study model were supported and some were not. The study contributed to the body of knowledge by providing a valid and reliable model to measure the success of e-learning systems. Moreover, this study contributes to the practitioners, recommending universities and educational institutions that develop and support e-learning systems.

Publications

- **Book Chapters**

Alsabawy, Ahmed Younis, Cater-Steel, Aileen and Soar, Jeffrey (2012) *A model to measure e-learning systems success.* In: Belkhamza, Zakariya and Wafa, Syed Azizi, (eds.) Measuring organisational information systems success: new technologies and practices. Business Science Reference (IGI Global), Hershey, PA, USA, pp. 293-317.

Alsabawy, Ahmed Younis and Cater-Steel, Aileen and Soar, Jeffrey (2013) *E-learning service delivery quality: a determinant of user satisfaction*. In: Kats, Yefim (ed.) Learning Management Systems and Instructional Design: Metrics, Standards, and Applications. (IGI Global), USA.

- **Conference Proceedings - Refereed**

Alsabawy, Ahmed Younis, Cater-Steel, Aileen and Soar, Jeffrey (2011) *Measuring e-learning system success (Research in progress).* In: PACIS 2011: Quality Research in Pacific Asia, 7-11 Jul 2011, Brisbane, Australia.

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Alsabawy, Ahmed Younis, Cater-Steel, Aileen and Soar, Jeffrey (2012) *IT infrastructure and its role in the success of e-learning systems: measurement and causal models*. In: EUNIS'12 A 360^{o} perceptive on IT/IS in Higher Education, 20, 21 and 22 of June 2012, University of Trás-os-Montes e Alto Douro, Vila Real, Portugal.

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- **Report**

Alsabawy, Ahmed Younis, and Cater-Steel, Aileen "Measuring E-Learning System Success", Report to the Senior Management of University of Southern Queensland.

The researcher compiled a report with the results and recommendations of the thesis for the Faculty Deans at USQ, Deputy Vice-Chancellor (Academic Services) and Chief Information Officer, Executive Director of Australian Digital Futures Institute, and Executive Director, ICT Services. The results and recommendations of this report were adopted by the "Integrated StudyDesk" team which is updating the USQ StudyDesk to improve students' experience, and also to improve some inefficiencies for academic staff.

CERTIFICATION OF DISSERTATION

I certify that the ideas, results, analyses and conclusions reported in this dissertation are entirely my own effort, except where otherwise acknowledged. I also certify that the work is original and has not been previously submitted for any other award, except where otherwise acknowledged.

Candidate signature

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LIST OF ABBREVIATIONS

AGFI	Adjusted Goodness-of-Fit Index
AHP	Analytic hierarchy process
AST	Adaptive Structuration Theory
AVA*	**Availability**
AVE	Average variance extracted
BELS	Blended E-Learning Systems
C.R.	Critical Ratio
CAS	Computerized Accounting System
CEO	Chief executive officer
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
χ^2	Chi-square
CIO	Chief information officer
CIS	Customer Information Satisfaction
CONT*	**Contact**
CPQ	Consumer Products Questionnaire
CSE	Computer Self-Efficacy
CSF	Critical Success Factors
CUSV*	**Customer value**
DDLM	Demand-Driven Learning Model
DP	Data Processing
DSS	Decision Support Systems
EASE	Electronic Assignment Submission Environment
ECM	Expectation-Confirmation Model
EDMS	Electronic document management system
EDT	Expectancy Disconfirmation Theory
EFFI*	**Efficiency**
eLSE	e-Learning Systematic Evaluation
ERP	Enterprise resource planning
e-SELFQUAL	Online self-service quality
e-SQ	electronic Service Quality
ESS	Enterprise System Success
eTailQ	eTail Quality
ETM	Educational Technology Model
eTransQual	Electronic transaction quality
FULF*	**Fulfilment**
GFI	Chi-Square, Goodness-of-Fit Index
GoF	Goodness-of-Fit
H^2	Cross-validated communality
HELAM	Hexagonal E-learning Assessment Model
ICE	Integrated Content Environment
ICT	Information and communication technology
IIT	Image Interactivity Technology
IQ*	**Information Quality**
IS	Information system
ISSDOs	Information System Service Delivery Organisations
IT	Information technology
ITIS	**Information technology infrastructure services**
KMS	Knowledge Management System
LMSs	Learning management systems
ML	Maximum likelihood
MOOC	Massive Open Online Course
NFI	Normed Fit Index
NNFI	Non-normed Fit Index
OER	Open Education Resource (OER)
OLS	Online Learning System

OMIS	Organisational memory information system
ORGV*	**Organisational value**
PCLOSE	P of Close Fit
PeSQ	Perceived e-service quality
PGFI	Parsimony Goodness of Fit Index
PIQ	Perceived Information Quality
PIRQ	Perceived Internet Retailing Quality
PLS	Partial Least Squares
PLS-SEM	Partial Least Squares Structural Equation Modeling
PNFI	Parsimony Normed Fit Index
PRATAM	The Perceived Resources and Technology Acceptance Model
PRIV*	**Privacy**
PSP/IQ	Product and Service Performance Model for Information Quality
PWQ	Perceived web quality
Q^2	predictive relevance
QES	Quality of Electronic Service
QMS	Quality Management System
QUIS	Questionnaire for User Interface Satisfaction
R&D	Research and development
R^2	Coefficient of determination
RESP*	**Responsiveness**
RFID	Radio Frequency Identification
RMR	Root Mean-square Residual
RMSEA	Root Mean Square Error of Approximation
S.R.W. *	**Standardized Regression Weight**
SATF*	**User satisfaction**
SCT	Social Cognitive Theory
SDQ	Service delivery quality
SEM	Structural Equation Modelling
SMC	Squared Multiple Correlation
SOLE	Soft Library Evolution
SQ*	**System Quality**
SQM	Software Quality Metrics
SQMAT	Software Quality Measurement and Assurance Technology
SRMR	Standardise Root Mean-square Residual
TAM	Technology Acceptance Model
TLI	Tucker-Lewis Index
TPB	Theory of Planned Behaviour
TQM	Total Quality Management
TRA	Theory of Reasoned Action
TRA	Theory of Reasoned Action
TTF	Task-Technology Fit
UDA	User Development computer Applications
UIS	User information satisfaction
USEF*	**Perceived usefulness**
UTAUT	Unified Theory of Acceptance and Use of Technology
VET	Vocational Education and Training
VLE	Virtual Learning Environments
WBL	Web-Based Learning
WEBCT	Web Course Tools
WebCT CCMS	WebCT course content management system
WebQual	Web site quality
WWW	World Wide Web
ZOT	Zone of Tolerance
(χ^2/df)	Normed Chi-square

***This abbreviations created by the researchers to use in the statistical analysis**

CHAPTER ONE

This chapter provides the introduction to explain this study. The study background describes the main issues in the e-learning systems area and the issues to be resolved in this study. The second part of the chapter provides the motivation for conducting this study. The study problems are then outlined in the third part of this chapter. The objectives of the study are presented in section four while section five describes the significance of the study. Finally, the final section of this chapter provides a framework for the entire study.

CHAPTER ONE: INTRODUCTION

1.1. Chapter introduction

Research should be conducted based on issues and problems that need to be resolved. The identification of the research problem, objectives and motivation to conduct the research are considered to be essential steps in this process. Accordingly, the first stage of this study is to overview the issues related to the success of e-learning systems that will be addressed in this research. In recent years, many universities and educational institutions have made considerable investments in e-learning systems. These systems deliver educational services via electronic channels. However, these universities and educational institutions still face problems in relation to evaluating the success of these systems. The issues and problems associated with evaluating the success of e-learning systems, the research motivation, and the objectives of this study are provided in this chapter.

1.2. Background to the study

Information technology (IT) has become an essential contributor to organisational success due to the critical role of IT in enabling the achievement of individual and organisational goals. The introduction of IT is no longer limited to back-office business functions, but has grown to include core processes in health, education, transport, banking, and other fields. The advantages generated by using technologies such as the Internet, hardware and software have pushed organisations to employ IT to facilitate more and more of their activities. Shannak (1999) argues that organisational performance is considered impracticable without Information Technology. The impact of using IT is extended to include the macro economy of different countries. Doig (2002) states that 'The information revolution is sweeping through our economy. No company can escape its effects' (p. 1).

The education sector is considered to be one of the sectors that has been radically affected by developments in Information Technology. In the education arena, substantial funds have been invested in the systematic development of technology infrastructure (Georgina & Olson, 2008). Ahmed et al. (2007) consider technology to be the main aspect of the college today and it is believed to be the major influence behind students' and communities' success. Rogers (2000) argues that the role of technology in generating rapid change in higher education cannot be ignored. The education sector has received substantial benefits from using IT in its domain. The introduction of IT has supported communication between teachers and students, and communication between universities worldwide. Also, IT has enabled easier access to library resources in this sector. The introduction of IT in higher education is deemed to be the main key to quality improvements (Turoff, 1999).

E-learning is the main outcome of adopting and using the new and more advanced IT innovations in the education sector. These e-learning systems have also been adopted by non-educational organisations (Wang & Wang, 2009). Daneshgar and Toorn (2009) suggest that 'In order to sustain competitive advantages in today's economy, characterised by rapid change, knowledge-intensive and technological-orientation, organisations are adopting e-learning to facilitate the achievement of lifelong learning, and to retain employees' (p.16). The introduction of e-learning systems enables non-educational organisations to receive valuable benefits. For example, IBM saved USD200 million in 1999, providing five times the learning at one-third the cost of their previous methods; and Rockwell Collins reduced training expenditure by 40 percent with only a 25 percent conversion rate to web-based training (Strother, 2002). According to Giga Information Group, use of an e-learning system to train employees rose from 21 percent in 2002 to 75 percent in 2005 (Wang & Wang, 2009).

In higher education, the adoption of e-learning systems is deemed to be one of the most crucial developments in this arena in the last decade (McGill & Klobas, 2009). In the context of knowledge management, e-learning has become a key driver in establishing virtual communities (Hardaker & Smith, 2002). Because of the Internet revolution, exchanging and disseminating information and knowledge provides a direct link between members of virtual communities without considering the hierarchical channels (Koh & Kim, 2004). Therefore, e-learning systems can be viewed as knowledge management systems because all the processes of knowledge pass through them. Knowledge management tools such collaboration and community, social software, search engine and taxonomy tools, peer-to-peer, and personalised knowledge management support the learners to acquire knowledge (Lau & Tsui, 2009). Institutions of higher education are considered to be the main source in creating, transferring, exchanging and saving knowledge. Therefore, these institutions attempt to find effective approaches to enhance the process of knowledge transfer and to achieve their objectives. E-learning has been an effective way to achieve these two purposes.

In the USA, 90 percent of 2-year and 89 percent of 4-year public education institutions offered distance education courses in 2000-2001 with enrolments of 1,472,000 and 945,000 respectively out of total enrolment of 3,077,000 (Holsapple & Lee-Post, 2006). Updated statistics about the adoption of e-learning systems shows that in the USA, 44 percent of students took online courses in 2009 and this is expected to rise to over 80 percent in 2014 (Daniel, 2012a). Most universities in the United Kingdom are supporting their educational services and students via Virtual Learning Environments (VLE) (Ogba, Saul, & Coates, 2012).

Learning Management Systems (LMSs) have been adopted by 95 percent of all higher education institutions in the United Kingdom (McGill & Klobas, 2009). It is worth mentioning that transnational courses are delivered by most Australian universities via educational software (Shurville, O'Grady, & Mayall, 2008). According to the Australian Flexible Learning Framework (2009), a survey of registered training organisations (RTOs) indicated that 39 percent of all Vocational Education and Training (VET) activities were based on e-learning systems.

The adoption and development of distance education is not limited to single universities—rather, universities are starting to work together to adopt and develop distance education. The best example of this is the Open Education Resource (OER). In this regard, Daniel (2012) states that ‘One development that could inject new life into the dual-mode model is the Open Education Resource (OER) University that is being explored by a group of public universities from several countries’ (2012a, p. 92). Some evidence of this collaboration is provided by Daniel (2012a) who alludes to the positive impression toward OER: OERs delivered by Massachusetts Institute of Technology (MIT), the UK Open University and others are used by millions of informal learners and students; The Virtual University for Small States of the Commonwealth is a network established by the 32 small states of the Commonwealth to develop, adapt and use OERs. This example provides a clear picture about the intention to adopt the shared enterprise model between universities and educational institutions around the world via web-based networks. Many institutions in European countries executed initiatives to adopt OER, including Joint

Information System Committee (JISC) and Higher Education Academy (HEA) (England), and National Digital Learning Resources (NDLR) (Ireland) (Pantò & Comas-Quinn, 2013).

Some issues are still being encountered in e-learning. One of these issues is the high incompletion rates by students in courses (Crawford & Persaud, 2013). For example, in 2012 the MIT released its first MOOC (Massive Open Online Course) and the number of students enrolled was 155,000; however, the number of students who passed a course as a whole was only 7,000: a dropout rate of more than 95 percent (Daniel & Uvalić-Trumbić, 2013). This high rate of drop out was justified by Programme's Head, MIT, 'If you look at the number of passes in absolute terms, it's as many students as might take the course in 40 years at MIT' (as cited in Daniel & Uvalić-Trumbić, 2013, p. 2). Pisutova (2012) offered another reason for this issue and states that 'For face-to-face as well as traditional online courses, the drop-out rates are significant in quality assessment. MOOCs with their less that 10% completion rate would not score very high in this sense' (2012, p. 299). Bates (2011) also agrees about the role of quality issue in failure of e-learning systems because some educational institutions still fail to meet best quality standards for e-learning. From these indicators it can be seen that the issue of high rate of drop-out may be related to the issues of courses, services, and education quality. The issues of e-learning systems mentioned above are interlinked and are related to, and can be classed as, part of e-learning systems success. It is illogical to consider these issues in isolation.

Accordingly, measuring e-learning system success is one of the key issues facing universities and other educational institutions. Although considerable attention has been paid to the information systems success issue, disagreement persists about the factors which are most effective in measuring information system success (Rai, Lang, & Welker, 2002). Because e-learning systems are considered to be a special kind of information system (Wang, Wang, & Shee, 2007) the issue of measuring information system success has an impact on evaluating e-learning system success. In the context of e-learning systems, this issue is considered more complicated because the 'e-learning' term is not used consistently. Cohen and Nycz (2006) state that 'E-learning can be difficult to understand because different authors use the term differently' (p.23). Lack of evaluation of e-learning systems success is considered to be a central concern for the researchers and stakeholders of these systems. For example, MacDonald and Thompson (2005) state that ‘Educators and researchers have voiced concern over the lack of rigorous evaluation studies of e-learning programs’ (p. 1). According to Ardito et al. (2006) an effective methodology to evaluate e-learning system success is still unavailable. The issue of lack of an effective methodology to evaluate e-learning system success is no longer restricted to the higher education field, but now extends to non-educational organisations. Wang et al. state that ‘Little research has been conducted to assess the success and/or effectiveness of e-learning systems in an organisational context’ (2007, p. 1792).

The issue of evaluating the success of information systems generally and e-learning systems in particular has become more complicated due to the differing viewpoints of stakeholders. Different groups of stakeholders deal with e-learning systems, for instance, students, academic staff, ICT staff, top management and developers. However, these stakeholders exhibit substantial differences in their objectives and often conflicting viewpoints exist (Ozkan & Koseler, 2009; Sedera, Tan, & Dey, 2007). This issue is still a key concern in the information systems field: ‘The concern is that different employment cohorts have differing experiences of the system. Yet, IS studies have, in the main, attempted to quantify the impacts of IS by analysing data collected from only a single employment cohort’ (Gable, Sedera, & Chan, 2008, p. 8).

Another issue is that the selection of factors to measure the success of e-learning systems often focuses on a single factor, especially user satisfaction, and ignores the success of e-learning systems: ‘over three-quarters of all evaluations conducted are targeting users’ satisfaction and not learning success, transfer, or return of investment of an educational process’ (Ehlers & Hilera, 2012, p. 1).

Evaluating the success of e-learning systems is a key issue in this field. The variety of stakeholders and their objectives and the selection of factors could impact the success of e-learning systems–which makes this issue more complicated.

1.3. Motivation for the study

The first motivation for this study is related to the rapid growth in the use of e-learning systems. As mentioned in the study background section, the rate of adoption of online education is rapidly increasing. In addition, developments in software and platforms used to provide users with online services have also received substantial attention. Australia is one of the leading countries in distance and online education. In Australia, the first department of Correspondence Studies was created by the University of Queensland in 1911 (Daniel, 2012a). Currently, most Australian universities have adopted e-learning systems to provide students around the world with educational services (Shurville et al., 2008). The growth in the adoption of e-learning systems reflects it significance in the field of education, thus, it needs more research to understand the issues and recommend solutions. This study deals with success of e-learning systems and will be useful in enhancing the understanding of factors affecting the success of these types of systems.

The second motivation for this study is the gap in the literature. E-learning systems are considered to be multidisciplinary so the evaluation of these systems depends on different points of view (Ozkan & Koseler, 2009). Before 1990, the evaluation of e-learning systems success received little attention from researchers. According to McGorry (2003), the main direction of research was on the differences between traditional and distance education. After 1990, the direction of research in this field started to focus on the issue of the quality of e-learning (MacDonald & Thompson, 2005; McGorry, 2003). This direction was supported after attention was paid to this issue by some educational institutions such as the Western Interstate Commission for Higher Education (WICHE) and the Institute for Higher Education Policy (Frydenberg, 2002). Quality is considered to be an essential factor in assessing e-learning system success, however, there are other factors that should be considered in the evaluation process.

Stakeholders are an essential component in organisations' activities. In the information systems field, stakeholders are believed to be a significant element in evaluating information systems success due to the relationship between these stakeholders and the systems (Shee & Wang, 2008). In the context of e-learning systems, studies continue to ignore the issue of multiple stakeholders because most of the research has focused on single stakeholders, in particular, students. This direction of research led to scant attention to establishing a comprehensive measurement that can evaluate e-learning systems success and ensure the stakeholders achieve their goals. This study aims to fill this void by proposing an evaluation methodology model to assess e-learning systems success. A range of stakeholders such as academic staff, students and ICT staff are considered in this model. Three instruments are designed to measure e-learning system success, but with different users. The diversity of stakeholders who evaluate e-learning systems will provide a holistic picture about these systems and their outputs.

Another gap in the literature is the role of IT infrastructure services in the success of e-learning system success. There are few studies dealing with issues in the e-learning system arena. This issue is confirmed by Xu et al. (2010) who state that 'Despite the abundance of research on IT infrastructure capabilities, the questions of how organisations can leverage IT infrastructure capabilities to achieve IT project success remains unanswered' (2010, p. 124).

The third motivation is related to the advantages that can be obtained from this study and provided to practitioners. This study is conducted empirically and includes three types of stakeholders: students, academic staff and ICT staff. Obtaining results from these stakeholders can be useful in identifying the issues in e-learning systems and the factors influencing the success of these systems. Obtaining results can be useful to generate recommendations to senior managers of universities, educational institutions and practitioners to solve the problems and enhance the performance of e-learning systems.

1.4. Study problem

A critical issue facing IT projects is their high rate of failure. The major concern of organisations' senior management is the lack of success of new information systems and their failure in achieving expected goals (Saleh, 2002). The successful completion of information technology and information systems projects is a key challenge due to the uncertainties related to technological complexities (Xu et al., 2010). Statistics published by *Computer Wee*kly in 1994 show that in the previous 12 years $5 billion of public money was lost from failed information system projects (Whyte 1994). Furthermore, Saleh (2002) states that 'In 1995 in the United States alone, 31.1% of projects are cancelled before they finish, with a cost of $81 billion. Only 52.75% of projects are completed with 189% of their original estimated cost, out of those, only 42% of the originally proposed features and functions are fulfilled' (p.1). Regarding ERP systems, implementation of these types of system confronted the issue of high rate of failure. Garg and Garg (2013) concluded that 90 percent of

ERP systems were behind schedule or over budget and the success rate is around 33 percent.

Electronic applications such as e-commerce, e-learning, e-health and e-banking have become commonplace throughout the last decade. However, these applications are still facing the challenge of failure. For instance, the initiatives of e-commerce still encounter problems. Pather (2006) states that 'There is little understanding of the crucial importance of managing the technology through which the Internet and Web delivers e-Commerce opportunities' (p. iii).

E-learning systems also encounter the problem of failure. Despite the considerable resources invested in e-learning systems, some organisations continue to fail to meet the targeted advantages (Strother 2002). According to Rovai and Downey (2009), the British Government spent $113 million in 2000 to establish an e-learning project called The United Kingdom e-University (UKeU). In February 2004, the British Government announced that UKeU had failed because it did not meet recruiting targets. In another example, New York University online (NYU) closed due to economic conditions. The challenge of failure is not limited to e-learning systems projects that are in the establishment stage, but includes those already in place. In this regard, Bates (2011) identified three main issues from 11 case studies and a literature review: increased cost of online education due to the high investment in information technology and supporting staff without replacing activities; there is no evidence about improvements in learning outcomes; and some educational institutions still fail to meet best quality standards for e-learning.

The lack of evaluation is believed to be a significant reason for failure in e-learning systems. According to McGorry (2003), many educational institutions have not considered this important issue (i.e. evaluating e-learning systems). As Ozkan and Koseler (2009) state: 'the development, management, and continuous improvement of e-learning systems are quite challenging both for the educational institutions and for industry. In that, assessment has become an essential requirement of a feedback loop for continuous improvement (p. 1286). Therefore, these systems need to be assessed continuously to ensure that the outputs meet users' needs. However, there are some dilemmas in measuring the success of e-learning systems and in determining the most effective technique to undertake this process (Ardito et al., 2006; McGorry, 2003; Y. S. Wang et al., 2007). Consequently, the key research questions are:

- What are the key factors considered to be important in measuring e-learning system success?
- Is the model to measure e-learning system success proposed in this study valid and reliable to evaluate e-learning systems from different points of view (with different users)?

1.5. Study objectives

This study deals with the issue of e-learning systems success. Different factors are considered to evaluate their success. Furthermore, the variety of stakeholders is taken into account in this study to evaluate the success of e-learning systems. Accordingly, measuring e-learning system success is the main objective of this study. To achieve this objective, a model has been proposed. More specifically, the objectives of this study are:

1. To determine what factors affect e-learning systems success and place them in a holistic model.

The focus of this objective is to select factors from the literature that impact the success of e-learning systems. Then, the selected factors are placed in a model to measure the success of e-learning systems. The relationships among the factors in the proposed model are established based on the theoretical justifications from information systems and e-learning systems literature.

2. To test the validity and reliability of the proposed model and confirm that the model is suitable to measure the success of e-learning systems from different points of view.

This objective seeks to examine the ability of the model to measure the success of e-learning systems from the viewpoint of three stakeholder groups: students, academic staff and ICT staff. The data to test this model is collected from these stakeholders groups. Testing the validity and reliability is not limited to the whole model, but includes the constructs of model and the items used to measure each construct.

3. To determine the type and power (significance) of relationships between those factors in the context of the proposed model, and to measure the direct and indirect effects between constructs of the study model.

Two types of relationships are investigated in the study model: direct and mediation. This objective is stated to identify the type of relationships between the constructs of study model, positive or negative, and the significance of these relationships. In addition, service delivery quality is selected to be a mediation construct in the study model. Accordingly, the role of service delivery quality is examined in this study.

4. To identify the role of IT infrastructure services in the success of e-learning systems.

One of the issues presented in this study is the role of IT infrastructure services in the success of e-learning systems. IT infrastructure services is included in the study model as a foundation construct to achieve the success of e-learning systems. Accordingly, this objective is formulated to investigate IT infrastructure services as a construct to measure e-learning systems success.

1.6. Significance of study

E-learning systems have become essential in universities and substantial funds are invested annually on these systems (Georgina & Olson, 2008). Hence, assessing e-learning systems success is a crucial issue. The process of evaluating e-learning systems success is significant because it assists in managing, maintaining and developing these systems; and in diagnosing the problems that need to be solved. The main purpose of the evaluation process is to ensure that the objectives of implementing the systems are achieved. The differences in goals of stakeholders create a difficulty in assessing the success of e-learning systems. Most of the previous research that has dealt with the e-learning systems success issue was limited to one type of stakeholder (i.e. students) and ignored the other categories of stakeholders. The significance of this study is in identifying the factors impacting on the success of e-learning systems and placing these factors in a proposed model. Four views have been considered in designing the study model:

1. Technical view: the model includes factors to measure the technical performance of e-learning systems and to identify the efficiency and quality of these systems.

2. Attitude view: this view includes the factors that deal with user behaviour in using e-learning systems and the satisfaction gained from the use of these systems.
3. Marketing view: includes the factors relating to the product of e-learning systems (e-learning service). These factors relate to service delivery quality and IT infrastructure service.
4. Organisational view: this view relates to net benefits generated from using e-learning systems. The net benefits constructs have been prepared based on organisational effectiveness literature, especially through the contributions of Cameron (1978, 1981, 1986).

Another contribution of the study will be through the constructs of e-learning systems value. Perez-Mira (2010) states that ‘Individual impact *per se* is the most ambiguous to define … Organisational impact does not have a clear and defined measurement variable’ (p. 25). Different views of value will be employed to measure the net benefits of e-learning systems dealing with customer value and organisational value. These two types of value will provide a comprehensive picture about the value generated by e-learning systems. IT infrastructure services has been used as a construct in this model. To the author’s knowledge, this factor has rarely been used as a construct to measure information systems and e-learning system success. Thus, the validity and reliability of this construct in measuring e-learning success will be tested in the context of this model.

This study will provide universities with a model and instruments for the evaluation of e-learning system success. This study will also assist them to identify the problems and shortfalls in the success of e-learning systems. Based on the findings, some recommendations will be proposed to enhance the performance of e-learning systems and to solve the problems and shortfalls in these systems.

1.7. Dissertation outline

This dissertation comprises nine chapters to achieve the study objectives outlined in Section 1.5. Chapter 1 overviews the background, motivations, problems and the significance of the study. The main issues to be investigated in this study are presented in this chapter.

Chapter 2 is allocated to reviewing the literature related to this study. The emphasis of this chapter is an overview of the studies dealing with success of information systems and e-learning systems. In addition, the review includes literature related to the constructs of the study model.

The proposed model to measure the success of e-learning systems in this study is presented in Chapter 3. This chapter comprises the proposed model, studies that support establishing this model, and selection of the constructs of the model, research philosophy and approach, and formulation of the hypotheses based on the relationships among the model constructs.

In Chapter 4, the research methodology is outlined. It includes the study method and the justification for its adoption, study sample, study instrument, data collection method, data analysis, and the ethical considerations in this study.

The next three chapters provide an overview of the analysis of the data: Chapter 5 presents the data analysis of the student sample; Chapter 6 is allocated to analysis of data of the academic staff sample; and Chapter 7 presents results for the ICT staff sample.

The study results obtained from Chapters 5, 6 and 7 are discussed in detail in Chapter 8. Finally, Chapter 9 provides a conclusion to the study and focuses on an overview of the achievement of the study objectives, contributions, recommendations, and suggestions for future research.

1.8. Chapter summary

This chapter presented an overview of the research study. The background to the study focused on e-learning systems success and the issues related to evaluating these types of systems. Then, the motivations for conducting this study were provided, followed by a description of the research problems to be investigated, the objectives of the research and its contribution to current knowledge in evaluating the success of e-learning systems.

CHAPTER TWO

This chapter reviews the literature related to the study. This chapter includes three main parts. The first part focuses on the studies related to the constructs of the study model. The issues, measures, and conceptual framework of each construct are presented first. The second and third parts are allocated to the approaches of success of information systems and e-learning systems.

CHAPTER TWO: LITERATURE REVIEW

2.1. Chapter introduction

The previous chapter provided an introduction to this study. The main objective of this study is to propose a model to measure the success of e-learning systems success from different points of view. The constructs included in the study model are obtained from the literature on information systems and e-learning systems. However, there is a wide range of studies dealing with evaluation of information systems and e-learning systems and that requires an effective technique to review these studies. Thus, the literature review begins with the suggested constructs of the study model: information technology infrastructure services; system quality; information quality; service delivery quality; perceived usefulness; user satisfaction; customer value; and organisational value. Then, the literature related to evaluation and success of information and e-learning systems is reviewed via specific approaches suggested to classify studies that have dealt with this subject.

A systemic literature review was undertaken of relevant contributions in the information systems and e-learning systems fields. Search parameters included all the constructs of the study model, information system success, and e-learning system success. To include most of the relevant literature in this study, different key words were employed as shown in Table 2.1.

Table 2.1 Terms used to search the relevant literature

Topics	Terms used in the search
IT Infrastructure Services	IT infrastructure /IT Infrastructure services/IT infrastructure capabilities
System Quality	System quality/Information system quality/E-learning system quality
Information Quality	Information Quality/Data quality
Service Delivery Quality	Service Delivery/Service Delivery Quality/Service Quality /Electronic service quality
Perceived Usefulness	Perceived usefulness/System use/Mandatory system/Voluntary system
User Satisfaction	User satisfaction/Students satisfaction/Instructor satisfaction /User dissatisfaction
Customer Value	Customer value/User value/Net benefits/Individual benefits /E-learning benefits
Organisational Value	Organisational value/Net benefits /Organisational benefits/E-learning benefits
Information system success and e-learning systems success	Information system success/E-learning system success/McLean and DeLone model/Technology Acceptance Model/User involvement/E-learning systems Quality/E-learning platforms
System failure	Information system failure/e-learning system failure

Google Scholar was used as it provides instant access to all database that were linked to University of Southern Queensland (USQ) for instance EBSCO, Sciences Direct, Emerald Management eJournals, and SAGE Management and Organisation Studies. The search was not limited to a single term but included more than one term during the search process to obtain as much relevant literature as possible related to these terms. For instance, the term IT infrastructure services was searched along with terms such as information system success and e-learning systems. This strategy was conducted with all the other terms used to search the relevant literature. Search parameters and publications reviewed were within the period from the 1970s to 2013.

2.2. Information technology infrastructure services

Significant attention has been paid to information technology infrastructure services (King & Flor, 2008; Sobol & Klein, 2009). This attention is considered to be as a result of the crucial role of IT infrastructure services on organisational outcomes and growth. Substantial proportions of the budgets of companies are allocated to investment in IT infrastructure services. According to Byrd and Turner (2000), 58 percent of an organisation's IT budget is spent on IT infrastructure services. The added value of IT infrastructure services is extended to include fast response, organisational learning, fact-based decision making, productivity improvement, inter-organisational coordination and organisational flexibility (Davenport & Linder 1994). IT infrastructure services are vitally significant to organisations working in dynamic environments and aiming to re-engineer their business processes (Duncan 1995). However, there are still some issues confronting organisations in regard to IT infrastructure services. Decision making on investment in IT infrastructure services flexibility and the role of IT infrastructure services in the success of information systems is believed to be the main recent issue concerning this domain. Most of the research carried out in this arena attempts to address these issues.

2.2.1. Issue of investment in IT infrastructure and its impact on ensuring organisational performance

Davenport and Linder (1994) are believed to be among the earliest researchers investigating the role of long-term investment in IT infrastructure in gaining competitive advantage. The findings of their study concluded that five components are indispensable aspects of IT infrastructure to boost organisational efforts in achieving competitive advantage: core technologies; technical functionality; business applications; business information and business process support.

In the context of information systems professionals, Lee, Trauth, & Farwell (1995) studied the skills and knowledge requirements of information systems professionals as an essential infrastructure aspect of IT. Their study concluded that 'the requirements from IS professionals are becoming more demanding in multiple dimensions, particularly in the areas of business functional knowledge and interpersonal/ management skills' (Lee et al., 1995, p. 313). Four skills and knowledge requirements of IS professionals were agreed as critical for IT infrastructure were: technical specialties knowledge; knowledge of technology management; business functional knowledge; and interpersonal and management skills.

Broadbent and Weill (1997); Broadbent et al. (1999), Weill and Vitale (2002); and Weill et al. (2002) have added important contributions in addressing the issue of investment in IT infrastructure services. Broadbent and Weill (1997) proposed a new approach to assist managers in identifying significant IT capabilities to achieve organisational goals. According to the above authors, there are three elements of IT infrastructure necessary to enhance business processes: human IT infrastructure; shared IT services; and IT for business process.

The suggested framework aims to enable managers to make effective decisions concerning investment in IT infrastructure services. The framework depends on initially considering three key issues: strategic context of company, synergies among business units, and the extent to which a company wants to exploit those synergies.

The strategic context and identification of the firm's future direction are considered key determinants of strategic statement or business maxims. Based on business maxims, IT maxims will be identified by business and IT managers together. The significance of business and IT maxims is that they 'identify the firm's predominant view of infrastructure, which gives a context for decision making about findings for specific infrastructure services' (Broadbent & Weill, 1997, p. 79). In regard to IT infrastructure, the results of their study showed that there are 23 infrastructure services that may contribute to achieving business goals. The services have been classified into two categories: five core IT infrastructure services and 18 additional IT infrastructure services.

In 1999, Broadbent et al. (1999) continued to develop a framework of IT infrastructure. This effort is considered to be an expansion of their 1997 study. In this contribution, the four dimensions of a firm's context have been recognised as critical aspects in evaluating patterns of IT infrastructure capability: industry differences; marketplace volatility; business unit's synergies; and strategy formation processes. Another construct of this framework is IT infrastructure capability. IT infrastructure capability is believed to be the result of combining two elements, functionality and connectivity. To define these elements, Broadbent et al. (1999) state that 'functionality is defined by the infrastructure services offered firm-wide. Connectivity is identified by the infrastructure reach and range' (p. 162). In this empirical study, 23 services were identified and categorised into eight groups based on the nature of the services. These groups were application management, communication management, data management, IT R&D, services management, security management, standards management, and IT management.

With respect to e-business, Weill and Vitale (2002) developed a new initiative that dealt with IT infrastructure for e-business. In the e-business field, the main purpose of using IT infrastructure is to link the organisation with stakeholders such as suppliers, consumers and allies. According to these authors, four types of changes will happen in the IT infrastructure of organisations as a result of adopting e-business: expanded capability; stronger gravity; greater externality; and increased cooperation within industries. The research has been conducted on 50 e-business initiatives in a diverse range of Asia Pacific subsidiaries of global firms, Australian-based global firms, and government agencies. The first stage of the empirical study involved using the previous list of 23 IT infrastructure services, which were the results from the Broadbent and Weill (1997) study. Then the list of IT infrastructure services was expanded based on discussions with several companies. The second stage of the study collected data using questionnaires and interviews. The results identified 70 IT infrastructure services for e-business. These services, clustered into nine groups, are: Application management (13 services), Communication management (7), Data management (6), IT management (9), Security (4), Architecture and standards (20), Channel management (7), IT R&D (2) and Education (2). The main contributions of this study were firstly increasing the number of IT services identified in large organisations from 23 in 1997 to 70 in 2001; and, secondly, an increase in spending on these services compared to previous years.

King and Flor (2008) conducted a study on IT infrastructure in the global domain. The purpose of that study was to investigate the role of global strategic orientation in global IT infrastructure capabilities, employing global integration as a mediator. Various elements of IT infrastructure have been used to measure this factor such as: hardware platform; operating system; network and telecommunication technologies; and databases. Shared support services have also been employed to measure IT infrastructure, which contains the management of communication networks, data management, and the identification and testing of new technologies. The range and reach of IT infrastructure capabilities has also been explored in this measurement. The main result of this research is the findings that human resources significantly affected the reach, range, support services and planning of the global IT infrastructure.

The effects of the CIO's background and IT infrastructure on economic performance were studied by Sobol and Klein (2009). Technical services, application services, management services, hardware and data services were used to measure IT infrastructure. IT orientation (utilitarian, strategic) has been employed in this study. Size, performance, market and knowledge were used to measure economic performance. In regard to IT infrastructure, results confirmed that IT infrastructure services significantly affected financial performance. Also, the findings pointed to some IT infrastructure components becoming more important due to growth in organisations and market size. A study by Chen and Tsou (2012) adopted IT infrastructure (as a measure of IT capability) as a determinant of firm performance. The findings of the study concluded that the impact of IT capability on organisational performance is mediated by service process.

Based on a study by Weill et al. (2002), Fink and Neumann (2009) proposed a model to investigate the relationship between IT personal capabilities and IT infrastructure capabilities and how IT infrastructure was associated with IT-dependent organisational agility. IT infrastructure was used as a mediating factor between IT personal capabilities and IT-dependent organisational agility. Ten subscales were used to assess the range of IT infrastructure services. The findings of the study confirm that IT infrastructure positively affected IT-dependent information agility. Also, the technical and behavioural capabilities of IT personnel positively influenced IT infrastructure services.

The impact of IT assets (IT infrastructure and enterprise information systems) on organisational capabilities was investigated by Luo, Fan, and Zhang (2012) who state that ‘Our empirical study results show that IT can lead to higher level of organisational capabilities’ (p. 186).

The studies above clearly demonstrate the decision of investment in IT infrastructure services is still viewed as a key issue in this field. Furthermore, there are issues which to date have not yet been investigated, for example, the issue of IT infrastructure integration. In this regard, Bradley, Pratt, Thrasher, Byrd, and Thomas (2012) state that ‘After extensive research we found no studies that investigated a likely antecedent to IT infrastructure integration—IT capability intentions’ (p. 2971). Accordingly, the impact of IT infrastructure services on organisational activities still needs further investigation by researchers.

2.2.2. Issue of IT infrastructure flexibility

Some of the research dealing with IT infrastructure issues adopted another direction: the flexibility of IT infrastructure. The flexibility aspect is considered to be valuable for organisations because this factor supports the ability to use infrastructure technology competitively (Duncan, 1995). However, there is a shortfall in the measurement of IT infrastructure flexibility. To fill this gap, Duncan (1995) conducted a study to explore characteristics of flexibility. The first stage in this study used the Delphi method to investigate this critical issue from a practitioner's point of view. The next step comprised of extensive semi-structured interviews conducted with information systems planning executives from three major insurance firms in Texas and a major investment bank in New York. One of the most important results of this study is the identification of infrastructure flexibility dimensions: platform; network/telecom; data and applications.

A similar study by Byrd and Turner (2000) aimed to develop a valid and reliable instrument to measure IT infrastructure flexibility. Eight dimensions were selected to measure this factor. The complete questionnaire consists of 74 items to measure eight aspects of flexibility: IT connectivity; application functionality; IT compatibility; data transparency; technology management; business knowledge; management knowledge; and technical knowledge. Analysis of results indicated that the instrument is valid and reliable.

Attempts to investigate the role of flexibility in enhancing business value are continuing. Fink and Neumann (2009) designed a model to study the impact of human IT infrastructure and technical IT infrastructure on business value—strategic alignment and IT-based competitive advantage. Organisational size and reporting level of the top IT executive were considered as organisational moderators of business value. A total of 293 IT managers participated as a sample for this study. The results concluded that human IT infrastructure and technical IT infrastructure enabled flexibility.

Organisational responsiveness and competitive advantage are deemed to be strategic objectives in organisations. Bhatt et al. (2010) studied the effect of IT flexibility on organisational responsiveness and its subsequent impact on competitive advantage. The empirical study confirmed that IT infrastructure significantly affected information generation and dissemination. Also, IT infrastructure flexibility was a critical factor in enhancing organisational responsiveness. The same findings were generated from a study by Prasad, Heales, and Green (2010) that confirmed the vital role of flexible IT infrastructure in enhancing internal process performance, which in turn significantly influenced customer service process performance and firm-level performance.

IT infrastructure flexibility also impacted organisational agility. A study by Chen and Siau (2012) confirmed the significant role of IT infrastructure flexibility as an antecedent of organisational agility.

In spite of this attention paid to exploring the flexibility of IT infrastructure on different organisational sides, there are still some issues that need to be investigated. Bush, Tiwana, and Rai (2010) claim that 'The role of IT infrastructure capability, its complementary interactions with product design, and the intervening mechanisms through which this complementarity enhances focal firm performance has not received direct attention in previous research' (p. 240). Therefore, many issues related to the impact and role of IT infrastructure flexibility still need to be explored and investigated.

2.2.3. Issue of IT infrastructure impact on information systems success

The impact of IT infrastructure services on information systems success is still under investigation by researchers. However, there is not sufficient evidence about the role of IT infrastructure in enhancing the success of information system projects. In this regard, (Xu et al., 2010) state that 'Despite the abundance of research on the IT infrastructure capabilities, the question of how organisations can leverage IT infrastructure capabilities to achieve IT project success remains unanswered' (p. 124).

To investigate the role of IT infrastructure in the success of information systems, some studies adopt this factor as an essential factor affecting system success. Finlay and Forghani (1998) studied the factors affecting the success of Decision Support Systems (DSS). The result confirmed that learning and support IT infrastructure surrounding the DSS development is deemed to be a significant factor impacting on the success of these systems. The empirical study of Shaw (2002) support the view that the technological changes in IT infrastructure impact user acceptance of information technology. Shang and Seddon (2002) explored IT infrastructure as a fundamental source to generate the benefits of ERP and attain success. The benefits of IT infrastructure in the context of ERP were building business flexibility for current and future changes to reduce IT costs and to increase IT infrastructure capability.

As has been mentioned above, IT flexibility is considered to be a critical issue. In the context of this direction, Palanisamy (2005) investigated the role of information system flexibility in achieving organisational flexibility and IS success. The empirical study concluded that information system flexibility is a contributor to improving information system success at two levels: strategic and operational. Sabherwal et al. (2006) designed a model to evaluate information system success based on two determinants: individual and organisational. Facilitating conditions for information systems has been elevated in the model as a critical construct in creating the success of information systems. Finney and Corbett (2007) reviewed some studies to identify the Critical Success Factors (CSFs) of ERP. They concluded that IT infrastructure was a vital factor in the success of ERP.

IT infrastructure became a fundamental pillar in the success of web-based systems. Zhu (2004) applied this principle in a study about e-commerce capability. The main conclusion was that IT infrastructure has an essential role in enhancing e-commerce capability. In the context of e-government, Hussein et al. (2007) examined the relationship between technological factors and e-government success. The result confirmed that information system facilities (IT infrastructure) had the highest effect on the success of e-government systems. The same result for the role of IT infrastructure in the success of e-government has been found in a study by Verdegem and Verleye (2009). Many studies have been conducted in this regard, for instance, Wilson et al. (2002); Zhu and Kraemer (2003); Jennex et al. (2004); Hung et al. (2005); Eikebrokk and Olsen (2007); Lin et al. (2010); and Jehangir (2011).

In the context of e-learning systems, little attention has been paid to IT infrastructure services. Studies dealing with this construct adopted a narrow approach and limited measures to investigate the role of this factor in the system's success. Soong et al. (2001) studied the critical factors in the online courses field. IT infrastructure was an important factor in the success of online courses. The measures of IT infrastructure focused on the software used in implementing the online courses. The measure is limited and insufficient because different aspects should be considered in measuring this construct such as IT education, IT security and risk management, channel management, data management, and application management. Pahl (2003) suggested an approach to manage evolution and change in the electronic technology and learning environment. IT infrastructure was a key dimension in the suggested approach. The key elements of IT infrastructure were hardware technology, system and language technology and learning devices. The main limitation of this approach is that no empirical examination has been conducted to measure the validity and reliability of this approach and to investigate the role of IT infrastructure in the success of web-based learning. Selim (2007) studied critical success factors affecting acceptance of e-learning systems. The results concluded that IT infrastructure was a significant factor affecting e-learning system acceptance. However, the study used a narrow range of measures to gauge this construct: computer access and computer network reliability. A similar study was conducted by Ahmed (2010) who found that

IT infrastructure also significantly affected acceptance of hybrid e-learning courses by learners. The measure of IT infrastructure used in the study was limited to computer access. From the literature above, the main conclusion that can be offered is that the measures used in the previous studies included one or two aspects of IT infrastructure and ignored other aspects.

Reviewing the literature supports the conclusion that IT infrastructure services play a critical role in organisational performance, organisational value, competitive advantage, decision making, achieving organisational goals, and the success of an information system. The efforts of researchers into IT infrastructure focused on three main issues, namely: IT investment decision and the impact of IT infrastructure, flexibility of IT infrastructure, and the impact of IT infrastructure on the success of information systems. The e-learning system is believed to be the most commonly used system in higher education institutions. However, there is scant attention paid to IT infrastructure services in the e-learning field, especially the role of this factor in contributing to the success of an e-learning system.

2.3. Information system quality

Information system quality is believed to be an important component in achieving the target objectives of stakeholders such as individual users and organisations. Considerable work has been done to measure and improve the quality of information systems. Some studies have presented evidence about the critical role of information system quality in organisational performance, for example Salmela (1997). At the individual level, the quality of information systems impacts users' needs and perceptions. Based on this view, quality is defined as 'contingent and resides in the user's perception of the product' (Von Hellens, 1997, p. 801).

The term *system quality* is used by different stakeholders and that leads to different measures and criteria to assess this construct. Dahlberg and Jarvinen (1997) raised two critical questions about the quality of information systems:

1. Why is there not a comprehensive and adequate model and methodology to evaluate information systems quality?
2. What are the main barriers facing practitioners in using existing models and standards?

To answer those two issues, Dahlberg and Jarvinen suggested three reasons behind those problems:

- Quality focus does not solve the problems.
- A QMS (Quality Management System) is not a guarantee for information systems quality for the procurer/buyer.
- A QMS disintegrates and is not visible to information systems users (1997, p. 813).

Stylianou and Kumar (2000) claimed that there are essential differences between organisations in regard to information systems quality. These differences emerge due to variations in definitions and organisational perspective of information systems quality. Thus, the dimensions of information systems quality and the criteria that are used to evaluate this type of quality will be different from one organisation to another. Kanungo and Bhatnagar (2002) pointed to four issues that need to be considered and addressed in the context of information systems quality: multiplicity of perspective; the notion of subjectivity; importance of hierarchy; and competence.

Research on information systems quality has not focused on only one issue or dimension. The focus is distributed in three directions: software quality; information system quality; and web-based system. Previous research on each of these is now presented.

2.3.1. Software quality

Software quality is considered to be a major concern for information systems stakeholders including individual users, software developers and organisations. In this regard, Von Hellens (1997) identified three viewpoints of information system quality and software quality: managerial viewpoint, organisational viewpoint and engineering viewpoint.

The main concern of the managerial viewpoint is that of enhancing the contribution of information technology in achieving business goals and increasing profitability. Information systems and software with high quality can contribute to reaching the outlined objectives.

The organisational view focuses on the use of information technology and its impact on work practices and competition through achieving organisational activities efficiently and enhancing organisational effectiveness. The main concern in software engineering is that software quality is an approach to produce information systems according to standards of quality. Therefore, software engineers are targeted to enhance the quality of software because of the impacts of this quality on the system quality as a whole.

Due to this importance of software quality, considerable attention has been paid to this issue. The main emphasis of these efforts is to establish models, measures and attributes to gauge software quality from different viewpoints. Since the 1970s, efforts commenced to deal with the matter of software quality. The model by Boehm et al. (1976) is believed to be the fundamental contribution in the development of software quality. Three levels have been identified in the model.

The highest level, general utility is related to the actual uses to which evaluation of software quality would be put. The general utility need three characteristics (intermediate-level): AS-IS utility, maintainability, and portability. AS-IS Utility requires a program to be reliable, accurate, and Human-Engineered. However, AS-IS Utility does not needs the user to test the program, understand its internal workings, modify it, or try to use it elsewhere. Maintainability focuses on the ability of user to understand, modify, and test the program, and is aided by good human engineering. The portability characteristic means the extent to which it can be operated easily on computer configurations other than its current one.

Regarding the lower level (Boehm et al., 1976) state that 'The lower level structure of the characteristics tree provides a set of primitive characteristics which are also strongly differentiated with respect to each other, and which combine into sets of necessary conditions for the intermediate-level characteristics' (p. 596).

McCall et al. (1977) proposed a model to evaluate the quality of software. This model includes attributes classified into three approaches based on the product activity, namely: product operation; product revision; and product transition. Table 2.2 depicts these attributes and the definition of each one.

Table 2.2 Definitions of software quality factors

Product Activity	Attributes	Definition
Product operation	Correctness	Ability of program to perform the function to achieve objective of user
	Reliability	Ability of program to perform the function with required precision
	Efficiency	Computing requirements by software to achieve a function
	Integrity	Ability of software to prevent access to unauthorised users
	Usability	Learning, operating, preparing input and interpreting output of software easily
Product revision	Maintainability	Locating and fixing an error in the software easily
	Testability	Ability to test that program performs its intend function
	Flexibility	Ability to modify the software
Product transition	Portability	Ability to transfer the software from one hardware to another
	Reusability	Ability to use the software in different applications
	Interoperability	Ability to integrate with other software

(Source: McCall et al. (1977))

Sunazuka et al. (1985) conducted a study to evaluate two measurements of software quality: Software Quality Metrics (SQM) and Software Quality Measurement and Assurance Technology (SQMAT). The results determined that SQM has the ability to indicate the quality quantitatively which he refers to as visual management. In respect to SQMAT, the findings concluded that SQMAT is an economical measurement and can be used to assess every scale of software.

The International Organisation for Standardizations (ISO) and International Electrotechnical Commission (IEC) played a key role in developing standards for evaluating software quality. The first contribution of the ISO in regard to software quality was in 1991 through the release of ISO/IEC 9126 (ISO/IEC, 1991). In 2001, ISO released the revised standards, ISO/IEC 9126-1(ISO/IEC, 2001). According to ISO/IEC 9126-1, there are six factors that can be used to assess software quality. Each factor can be measured by sub-characteristics, which are classified into two categories: internal and external. Figure 2.1 shows the software quality criteria according to ISO/IEC 9126-1.

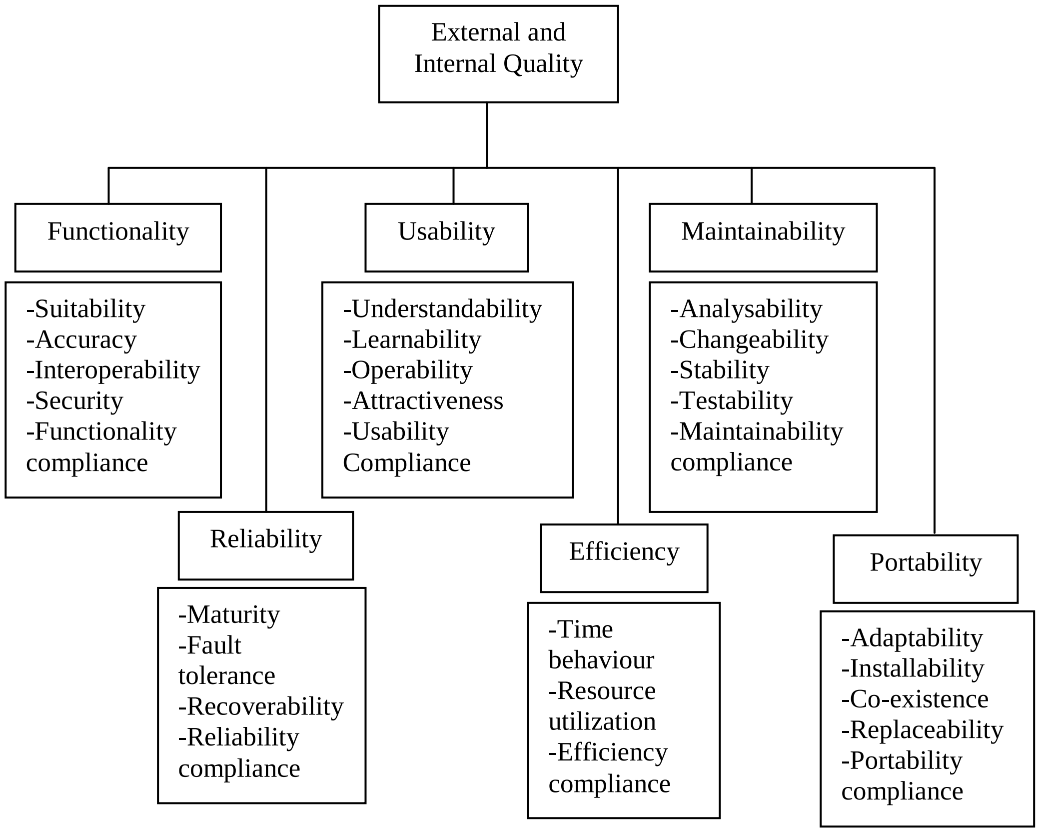


Figure 2.1 ISO/IEC 9126-1 External and Internal Quality Attributes

(Source: ISO/IEC (2001))

Parzinger and Nath (2000) studied the role of Total Quality Management (TQM) in enhancing software quality. Five measures were adopted to gauge software quality: user satisfaction; the Capability Maturity Model; ISO 9000-3; cost of quality; and overall success. The empirical test showed that there is a positive relationship between TQM and software quality.

In regard to the customer viewpoint, Issac et al. (2003) focused on the customer's perspective to evaluate determinates of software quality. The main contribution of the study is in preparing a conceptual framework for software quality based on the customer perspective. According to the suggested framework, determinants of software quality are product quality characteristics, client focus, infrastructure and facilities, operational effectiveness, process quality, and employee competence.

Gorla and Lin (2010) investigated determinants of software quality from the project managers' perspective. The study included 112 CIOs in different projects. The major finding of the study is that there are six determinates which affect software quality, clustered in three groups. The first group are organisational factors and include attitude of management, stability of organisation and responsiveness of the information system department. The second group, namely technological factors, consists of the suitability of the technology and the capability of the information system department. The third group, individual factors, include capabilities of users.

The contributions of research in software quality have established the essential basis of information systems quality. The standards of Boehm et al. (1976) are still used to evaluate software quality and these criteria have undergone some updates for evaluating different systems and applications.

2.3.2. Information system quality

Due to the significant role of information systems quality, many studies have been conducted to identify the criteria and to suggest models to measure this construct. Bailey and Pearson (1983) employed four indicators to measure information system quality: convenience of access, flexibility of systems, integration of systems and response time. Belardo et al. (1982) measured DSS quality by using four indicators: reliability, response time, ease of use and ease of learning. DeLone and McLean (1992) employed system quality as a key construct in the information systems success model. Eriksson and Törn (1991) adopted a different approach to measure information system quality through developing a hierarchal model called Soft Library Evolution (SOLE). Eriksson and Törn (1991) identified three main groups of stakeholders who deal with information system quality: management, users, and information systems personnel. These groups of stakeholders have been considered in designing SOLE and in selecting quality factors.

Boloix (1997) suggested a framework to evaluate software systems. The proposed framework includes three dimensions: project, system and environment. Information system quality was measured with 27 criteria. Another model was presented by Salmela (1997). The main purpose of this model is to evaluate the business value of information systems quality. Salmela defined business quality as 'The net value of an information system for the user organisation' (1997, p. 819).

Accordingly, business quality affects two groups of factors:

1. Cost of planning, developing, maintaining and using the system; and

2. The benefits achieved through systems use.

The model was prepared based on four constructs: information system quality, information system user quality, business integration and business quality. The suggested model can be used into two directions. The first direction focuses on saving costs and reducing the resources needed in information processing. The second direction of Salmela's (1997) model includes the relationship between information systems work quality, user quality and information systems benefits. The model provides an explanation about the role of information systems quality in generating organisational benefits.

Jennex et al. (1998) extended DeLone and McLean's model to evaluate organisational memory information system (OMIS) success. The system quality construct was measured by three sub-constructs: technical resource, level of OMIS and form of OMIS.

Nelson et al. (2005) tested the quality of data warehousing systems. The dimensions of system quality were classified into two categories. The first category, system-related, includes accessibility and reliability. The second category, task-related, includes response time, flexibility and integration. These five dimensions of systems quality explained 75 percent of systems quality.

Wang and Chen (2006) studied the factors impacting ERP system quality. The conceptual framework assumed that input (top management, user support and consultant quality) affects the consulting process (communication effectiveness and conflict resolution) and this in turn impacts ERP system quality. The main finding of this study is that top management support indirectly affected ERP system quality via the communication effectiveness construct.

Many studies have investigated the measurement and factors affecting system quality, for instance, Jang et al. (2006), Stockdale and Standing (2006), Quintero and Peláez (2008), Vance et al. (2008), Al-Adaileh (2009), and Rodríguez and Casanovas (2010).

The studies above showed that information systems quality has an impact on different groups of stakeholders, including individual users, organisational, developers, and other groups. The research dealing with this construct has focused on establishing models and indicators to measure it. Some studies have investigated the value of information systems quality and its impact on organisations and the strategies that can be used to increase the value of information systems quality.

2.3.3. Web-based system quality

The electronic applications of information technology have played a significant role in modern economies and communities. Significant attention has been paid to these systems by researchers, organisations, government and customers. However, some problems still exist with web-based systems and using IT effectively. Systems quality of electronic systems is deemed to be the key concern encountered by stakeholders. In this regard, Zhang claims that ‘this might cause the “web-based information systems crisis” like the “software crisis” forty years ago’ (2005, p. 33).

Thus, significant efforts were exerted to overcome this issue. Most of the studies are focused on measuring the quality of electronic systems and its role in user satisfaction, organisational performance and information systems success.

Dabholkar (1996) proposed a model to study expected service quality of the technology-based self-service option. Five indicators were used to measure this construct: expected speed of delivery, expected ease of use, expected reliability, expected enjoyment and expected control. Chen and Wells (1999) investigated customers’ attitude toward the web site. The main contribution of this study is in preparing a reliable and valid scale to measure customer attitude toward the websites. The scale includes three factors and each factor consists of some sub-factors to evaluate attitudes: entertainment (fun, exciting, cool, imaginative, entertaining, and flashy); informativeness (informative, intelligent, knowledgeable, resourceful, useful, and helpful); and organisation (messy, cumbersome, confusing, and irritating).

Loiacono et al. (2002) employed Theory of Reasoned Action (TRA) and Technology Acceptance Model (TAM) to develop measures of website quality. The result concluded the 12 core indicators for measuring website quality were ease of understanding, intuitive operations, informational fit-to-task, tailored communication, trust, response time, visual appeal, innovativeness, emotional appeal, on-line completeness, relative advantage and consistent image. McKinney et al. (2002) proposed and tested an instrument to evaluate web-customer satisfaction. System quality was selected as an essential construct to assess quality of the website.

The result of the empirical test showed that access, usability and navigation were the main indicators of web system quality. Table 2.3 presents some studies that dealt with website quality.

Table 2.3 Selected research on website quality

Author/s	Dimensions
Dabholkar (1996)	Expected speed of delivery, expected ease of use, expected reliability, expected enjoyment, and expected control
Chen and Wells (1999)	Entertainment (fun, exciting, cool, imaginative, entertaining, and flashy); informativeness (informative, intelligent, knowledgeable, resourceful, useful, and helpful); and organisation (messy, cumbersome, confusing, and irritating)
Loiacono et al. (2002)	Ease of understanding, intuitive operations, informational fit-to-task, tailored communication, trust, response time, visual appeal, innovativeness, emotional appeal, on-line completeness, relative advantage, and consistent image
Negash et al. (2003)	Interactivity and access
Kim and Stoel (2004)	Information fit-to- task, tailored communication, online completeness, relative advantage, visual appeal, consistent image, ease of understanding, intuitive operations, response time, and trust.
Sinnappan and Carlson (2005)	Usefulness, ease of use, entertainment, and complementary relationship
Yang et al. (2005)	Usefulness of content, adequacy of information, usability, accessibility, privacy/security, and interaction
Cao et al. (2005)	Search facility, responsiveness, and multimedia capability
Lewiecki et al. (2006)	Content, credibility, navigability, currency, and readability
Lin and Lee (2006)	Reliability, accessibility, ease of use, and flexibility
Lee and Kozar (2006)	Navigability, response time, personalisation, telepresence, and security
Lee et al. (2008)	Dependability, response time, downtime, and missing links
Lee and Chung (2009)	Security, access, and ease of use
McCoy et al. (2009)	Adopted 12 dimensions in the study of Loiacono et al. (2002)
Wells et al. (2011)	Security, download delay, navigability, and visual appeal
Kincl and Štrach (2012)	Content, presentation, and overall impression

In the e-learning system field, system quality is considered to be a key issue. Therefore, researchers are still seeking suitable measures that can be used to assess the quality of e-learning systems. Volery and Lord (2000) investigated critical success factors in online education. The empirical study concluded that system quality was a key factor in measuring online education. System quality of online education has been measured by two indicators: ease of access in navigation and interface. Holsapple and Lee-Post (2006) measured e-learning system quality via six indicators: ease of use, user friendliness, stability, security, speed, and responsiveness. Lanzilotti et al. (2006) proposed a new framework of e-learning system quality called TICS (Technology, Interaction, Content and Service).

A new methodology was derived by Lanzilotti et al. (2006) called eLSE (e-Learning Systematic Evaluation). It was established based on combining an inspection technique called Abstract Tasks (ATs) inspection with user testing. The empirical study proved the reliability of the ATs technique in evaluating e-learning system quality.

Many studies have investigated quality of e-learning systems and searched for the appropriate indicators to gauge this construct effectively. Table 2.4 list some studies that dealt with this construct and the measures adopted to evaluate it.

Table 2.4 Summary of studies dealing with e-learning system quality

Author/s	Measures
Volery and Lord (2000)	Ease of access in navigation and interface
Brown (2002)	Ease of finding, and ease of understanding
Chua & Dyson (2004)	Adopted the standards of ISO/IEC 9126: functionality, reliability, usability, and efficiency
Holsapple and Lee-Post (2006)	Ease of use, user friendliness, stability, security, speed, and responsiveness
Lanzilotti et al. (2006)	Technology, interaction, content, and service
Chiu et al. (2007)	Design, speed, navigate, functionality, and response time
Chang & Tung (2008)	Friendly website, navigate, functionality, completeness, and information easy to comprehend
Shee & Wang (2008)	Ease of use, user-friendliness, ease of understanding, operational stability
Liaw (2008a)	Function, speed, content, and interaction
Ozkan & Koseler (2009)	Ease of use, reliability, maintenance, well organised, personalization, help option available, security, usability, user-Friendly, availability, and interactivity
Chen et al. (2009)	Ease of use, learner interface, learning community, and hyperlink connotation
Wang & Wang (2009)	Control, flexibility, functionality, compatibility, accessibility, and well-designed
Kassim et al.(2010)	Easy to use, user friendly, and easy to learn
Freeze et al. (2010)	Availability, user-friendly, interaction, attractive, and high-speed
Wu et al. (2010)	System functionality, content feature, and interaction
Wang & Chiu (2011)	Easy to use, humanised interface, and friendly
Islam (2011)	Integration, reliability, ease of use, and access
Tella (2011)	Availability, easy to use, user-friendly, interaction, accessibility, attractive features, and presentation
Lin and Wang (2012)	Ease of use, friendliness, stability, acceptability, navigability

To summarise, system quality received substantial attention from researchers and organisations due to the importance of this construct in the success of achieving organisational activities and success of information systems. Researchers focused on three directions to treat the issues related to system quality: software quality; information system quality; and quality of web-based information systems. The measurements and models to assess the quality of e-learning systems still depend on the traditional contribution in the information system field and do not demonstrate any substantial contribution in the e-learning system arena.

2.4. Information quality

Information is believed to be a central pillar in achieving different organisational activities. Information quality is an important factor that needs to be considered in effectively performing organisational functions. Effectiveness of organisational decisions and actions is dependent on information quality (Stvilia, Gasser, Twidale, & Smith, 2007). Wang and Strong (1996) claim that there are serious economic and social problems occurring due to poor quality of information. The most important issue related to information quality is establishing an efficient measurement of information quality. The review of the literature relevant to information quality proceeds in two directions: information quality of traditional information systems; and information quality of web-based systems and e-learning systems.

2.4.1. Information quality of traditional information systems

The earliest efforts to measure information quality focused on the reports generated by information systems researchers such as Zmud (1978) and Olson and Lucas (1982). Some researchers focused on information value as a measurement to assess information quality, for example, Gallagher (1974) and King and Epstein (1982). In the context of user satisfaction, Iivari (1987) and Bailey and Pearson (1983) considered information quality as the primary measure in evaluating user satisfaction. Table 2.5 shows some empirical studies from the 1980s that measured information quality as summarised by DeLone and McLean.

Table 2.5 Research measuring information quality

Author/s	Measures of information quality
Bailey and Pearson (1983)	Convenience of access, flexibility of system, integration of system, and response time.
Belardo et al. (1982)	Reliability, response time, ease of use, and ease of learning.
Conklin, Gotterer, and Rickman, (1982)	Response time.
Franz and Robey (1986)	Perceived usefulness of I/S.
Goslar (1986)	Usefulness of DSS features.
Hiltz and Turoff (1981)	Usefulness of specific functions.
Lehman (1985)	I/S sophistication (use of new technology).
Mahmood (1987)	Flexibility of system.
Morey (1982)	Response time, system reliability, system accessibility.
Barki and Huff (1985)	Realisation of user expectations.

Source: DeLone & McLean (1992)

Efforts to measure information quality continued. Wang and Strong (1996) developed a framework based on the four aspects of data quality: intrinsic, contextual, representational, and accessible. Two stages of surveys were conducted to establish the framework. The first stage survey clarified a list of data quality attributes, including consumers' perspectives of data quality. In the second stage, data was collected based on the importance of each attribute. Then, exploratory factor analysis was carried out to identify the dimensions of data quality. From an analysis of the results, it was concluded four categories of data quality: (1) Intrinsic: accuracy, objectivity, believability, and reputation; (2) Contextual: value added, relevance, timeliness, completeness, and appropriate amount of data; (3) Representational: interpretability, ease of understanding, representational consistency, and concise representation; and (4) Accessibility: Accessibility, ease of operations, security.

Gardyn (1997) developed a model to measure the quality of data in a data warehouse. This model made a link between data warehouse components (data acquisition, data storage, and information catalogues) and data quality (correctness, completeness, currency, consistency, and accessibility) via the quality properties of the data. The main finding of this study was that the criteria used to assess the quality of data are different and depend on the intended use of the data.

Kahn et al. (1997) proposed the Information Quality Product-Service Model. The main purpose of this model is to enhance the quality of information delivered to information consumers. Their model has been designed to find more coordination among information producers, maintainers, and consumers. This coordination issue is considered vital for the quality of information delivery. Conformity to specification and meeting or exceeding customer expectations were used as dimensions in this model. Product quality and service quality were used as rows. Four quadrants resulted from the intersecting columns and rows: sound information, useful information, usable information, and effective information. Table 2.6 shows the Information Quality Product-Service Model.

Table 2.6 Information Quality Product-Service Model

	Conforms to Specifications	**Meets or Exceeds Customer Expectations**
Product Quality	Sound Information Free-of-Error Believability Completeness Consistent Representation Timeliness	Useful information Objectivity Reputation Relevancy Interpretability Understandability
Service Quality	Usable Information Timeliness Consistent Representation Concise Representation Accessibility Ease of Operations Security	Effective Information Value-Added Appropriate Amount

Source: Kahn et al. (1997)

Based on this model, Kahn (2002) suggested a new model called Product and Service Performance Model for Information Quality (PSP/IQ). The dimensions of information quality used in the Kahn's 1997 work have been used in this model. The main aim of this model is to determine which dimensions of information quality belong to which quadrant of the model. Two stages were used to achieve this goal.

The first stage was a survey conducted on 45 professionals. The second stage involved calculating the responses based on the specific criterion. The criterion used to categorise the responses was that when a majority (over 50 percent) of respondents selected this assignment, the dimension was assigned to a quadrant. The efficacy of the PSP/IQ model has been tested in three large healthcare organisations. The findings concluded that delivering useful and usable information is not only the responsibility of the information technology department but it is also the responsibility of consumers, producers, and custodians. This model is useful because it provides companies with a baseline for evaluating information quality improvements.

The Assessment Information Management Quality (AIMQ) methodology has been proposed by Lee, Strong, Kahn, and Wang (2002) to assess and benchmark information quality. This method depended on three components. The first one is the PSP/IQ model. The second component is a questionnaire called IQA. The main use of IQA is to assess the information quality dimensions, then assign them to each quadrant of the PSP/IQ model. The third component is the information quality gap analysis techniques. To achieve gap analysis, there are two techniques. The first technique depends on carrying out a comparison between organisation information quality and the organisation that has best practices in this respect. The second technique measures the differences in the stakeholders' opinions about the information. The reliability of the questionnaire used in the AIMQ has been tested. The AIMQ has been conducted at five organisations for gap analysis. The focus of the analysis was on the size of the gap, location of the gap, and direction of the gap (positive versus negative).

To measure the Enterprise System Success (ESS) Sedera and Gable (2004) conducted an important study. Four distinct dimensions were identified to assess ESS according to confirmatory factor analysis: individual impact; organisational impact; system quality; and information quality. The instrument in this study included 27 validated survey items: nine for system quality; six for information quality; four for individual impact; and eight for organisational impact. In regard to information quality, the six valid dimensions identified to measure this construct were availability, utility, understandability, relevance, format and conciseness. According to Petter, DeLone, and McLean (2008) the instrument designed in Sedera and Gable study is believed to make an important contribution because it has strong construct validity in measuring information system success.

In regard to Perceived Information Quality (PIQ), Nikolaou and McKnight (2006) developed a model to test the role of information quality in successful initial phase inter-organisational (I-Q) data exchange. The research considered PIQ as an aspect of data exchange. The dimensions of quality data employed were: currency, relevance, completeness, and reliability. Two main findings resulted from this study. The first one is that PIQ has an indirect effect on the intention to use the exchange through perceived risk and trusting beliefs. The second finding is that user perceptions of information quality depend on control transparency. In other words, when the control transparency is high the user perceptions of information quality will be high also.

Source of information quality, related activities, and taxonomy of information quality dimensions have been used as the basis of the model proposed by Stvilia et al. (2007). The sources of information quality problems were identified as four types: mapping, context change, change to information entity and change to underlying entity. The taxonomy of information quality dimensions included intrinsic, relational or contextual, and reputational aspects. Types of activities have been identified as: representation dependent, de-contextualising, stability dependent and provenance dependent. Two large classes of information objects, Simple Dublin Core records and online encyclopaedia articles, have been selected as case studies to test the study model. The results confirmed that the model is valid and can be used to develop measures to assess information quality in a different setting.

Gustavsson and Jonsson (2008) adopted Lee et al.'s (2002) measurement to assess the level and consequence of the deficiencies of information quality in two fields: customer orders and forecasts. The focus of the study was information received by suppliers from their main customers. The empirical side of this research has shown that information quality deficiencies were higher in the forecasts than the customers' orders and the consequences were high in both. The variables that obtained the highest level of deficiency in forecasts and customer orders were conciseness, reliability, timeliness and credibility. These variables have shown the highest perceived consequences in the forecasts. The highest perceived consequences in customer orders were credibility, completeness, reliability and validity.

Fehrenbacher and Helfert (2012) highlighted that an important issue in dealing with information quality is trade-offs between the criteria used to measure this construct. The empirical study conducted to address this issue found that the perceptions of respondents about information quality was impacted upon by information and communication technology, available resources, the user role, the department, and the type of information systems.

From reviewing the literature above it can be observed that most of the studies focused on investigating different aspects of information quality. In this respect, the initiative of Wang and Strong (1996) provided a comprehensive framework to measure information quality. Most of the current studies adopt the aspects included in the framework of Wang and Strong (1996). However, maintaining information quality is still a challenge for organisations and researchers (Fehrenbacher, 2012).

2.4.2. Information quality of web-based applications and e-learning systems

The concern with information quality has extended to include those involved in web-based applications in the information system field as well. Information quality is deemed to be an essential construct in measuring e-commerce system success (Molla

& Licker, 2001). McKinney et al. (2002) found information quality is a significant factor influencing web-customer satisfaction. Six essential aspects figured in the information quality construct: relevance, understandability, reliability, adequacy, scope and usefulness.

Lee and Kozar (2006) employed an analytic hierarchy process (AHP) to investigate the effect of web site quality on e-business success. The subscales of information quality used in this study were: relevance, currency and understandability. The findings support the view that information quality is considered an important construct in creating e-business success.

In the environment of mobile commerce, Wang and Liao (2007) applied their study to explore factors affecting m-commerce user satisfaction. The Confirmatory Factor Analysis (CFA) generated four constructs that affect m-commerce. Content quality (information quality) was the most important factor. DeLone and McLean's model has been used by Lee and Chung (2009) to identify factors impacting trust and satisfaction with mobile banking. The main result of their empirical study was that information quality affected customers' trust and satisfaction.

Awareness of information quality is no longer limited to e-commerce, but has extended to cover e-health systems as well. Jen and Chao (2008) applied DeLone and McLean's model to measure mobile patient safety information system success. The results of their analysis confirmed that information quality impacted significantly on two dependent factors, i.e. the use and user satisfaction of mobile patient safety information systems.

In the online communities area, Lin and Lee (2006) conducted a study to identify factors affecting online communities success. Different categories of online communities such as arts, computers, friend groups, games, health and news participated in this study. The main finding was that information quality influenced member loyalty significantly, via two constructs: user satisfaction and behavioural intention to use the online communities.

In the e-learning systems field, information quality has received substantial attention. Many studies are agreed on information quality as a critical construct in measuring e-learning system success. Roca et al. (2006) implemented TAM to recognise factors affecting e-learning continuing intention. Information quality has been appended to this model. The results illustrated that information quality had significant effects on user satisfaction, which affected directly the user's continuing intention to use the e-learning system.

In the framework of e-learning system design, Holsapple and Lee-Post (2006) argued that information quality is considered a fundamental factor in system design. The subscales used to measure information quality were supposed to be the characteristics of the course content such as whether it was well organised, effectively presented, of the right length, clearly written, useful and up-to-date. Two instruments have been employed: satisfaction survey and evaluation survey. The results found that information quality is a vital construct in evaluating e-learning system success and in measuring user satisfaction.

Information quality has been used as a necessary factor by Wang et al. (2007) to evaluate enterprise e-learning system success. The results demonstrated that information quality is a valid and reliable construct in measuring success in the context of enterprise e-learning systems.

Wang and Wang (2009) evaluated the success of e-learning systems from the point of view of instructor. The main result of this study was that information quality dimensions are considered important in enhancing teaching performance and efficiency of instructor.

Ozkan and Koseler (2009) considered information quality (content quality) as an essential technical issue in measuring e-learning system success. Eleven subscales were employed to measure this construct: curriculum management, course flexibility, interactive content, learning model, tutorial quality, clarity, sufficient content learner assessment material, maintenance, accuracy and well organised. Analytical results confirmed that the information quality of e-learning management systems had a significant effect on the learners' overall perceived satisfaction.

Based on students' perceptions, Freeze et al. (2010) performed a study to investigate factors affecting e-learning system success. The findings concluded that information quality had a significant positive effect on user satisfaction and e-learning system use.

Alkhattabi et al. (2010) implemented Wang and Strong's (1996) model to evaluate information quality of e-learning systems. The four quality dimensions comprising this model were: accessibility data quality; representational data quality; contextual data quality; and intrinsic data quality. The study sample was 315 e-learning system users from 24 different countries. Resulting analysis showed that the aspects of information quality are three (not four): contextual representation, accessibility, and intrinsic data quality. The main justification to merge contextual and representational factors into one factor is that ‘contextual and representational quality factors are measuring the same aspects from the e-learning system user's perspective’ (Alkhattabi et al., 2010, p. 353).

The studies reviewed above agree on information quality as a fundamental construct in evaluating the success of information systems. This factor is also commonly used in evaluating the success of web-based applications such as e-commerce, e-banking, e-learning and e-health. Most of the studies that dealt with e-learning system success considered information quality as an important construct in measuring success. However, there are some difficulties in measuring information quality in the context of e-learning. The most important of these difficulties is that information quality is believed to be complex and multidimensional. Also, this construct is used by different groups of stakeholders, and each stakeholder has a different point of view in assessing this factor. This difficulty is confirmed by Fehrenbacher and Helfert who state that ‘Despite the subjective character of quality, foremost frameworks and assessment methodologies do not often consider the context in which the assessment is performed’ (2012, p. 111).

2.5. Service delivery quality

Service quality has received substantial attention not just in the marketing field, but also in the information systems literature. In the last four decades, enormous efforts have been exerted in selecting comprehensive measurements to assess information systems service quality.

Rockart (1982) is believed to be one of the earliest researchers who examined the role of service quality in information system success. According to Rockart (1982), service quality was deemed to be the most important Critical Success Factor (CSF) to information system executives. This construct is critical for organisation customers because this term is related to three kinds of customers: ‘external customers who have experienced the firm’s services; competitors’ customers whom the firm would like to make its own, and internal customers (employees) who depend on internal services to provide their own services' (Berry & Parasuraman, 1997, p. 65).

The research on service delivery quality can be classified into three directions: Service delivery quality and traditional information systems; online service delivery quality; and service delivery quality in e-learning systems.

2.5.1. Service delivery quality and traditional information systems

Service quality of information systems was largely absent in information systems literature until the mid-1990s. Pitt et al. highlighted this and stated that 'service rarely appears in the vocabulary of the traditional system development life cycle' (1995, p. 173). Since 1995, a new trend in information systems has emerged. This trend focuses on using service quality as a measurement of information system success. Pitt et al. (1995) noted that service quality should be used as a criterion in evaluating information system effectiveness. This contribution is the earliest empirical study that adopted service quality as a measurement to assess information systems success.

Pitt et al. (1995) adopted the SERVQUAL measurement prepared by Zeithaml et al. (1990). This measure was established based on the central notion that quality of service can be measured by calculating the gap between customer expectations and perceptions of performance level. The dimensions of this measurement are tangibles, reliability, responsiveness, assurance, and empathy. Two essential reasons were behind the acceptance of SERVQUAL by researchers (Kettinger & Choong, 1997). Firstly, SERVQUAL is a benchmarking tool which can be used to make comparisons between companies in the same industry. Secondly, this measurement can be employed as a diagnostic or prescriptive tool because SERVQUAL can locate and diagnose problems in the service process. Watson et al. (1998) adopted SERVQUAL to measure information service quality. The measurements have been conducted three times (in 1993, 1994, and 1995). The result of this research is that delivering information system service quality depends on action at three levels: strategic, tactical and operational. So information system service quality is considered to be more than an operational issue. As a result of these contributions, and based on recommendations by some studies, especially Pitt et al. (1995), Kettinger et al. (1994), Li (1997), and Wilkin and Hewitt (1999), service quality was added by DeLone and McLean (2003) to their model as a construct to measure information system success. Another contribution in this field came from Kettinger and Lee (2005) who applied an empirical study to address criticisms that had been directed at SERVQUAL. The criticism related to the conceptual and empirical foundations of SERVQUAL. According to this study, two levels of service expectations can be used by information customers to evaluate these services: desired service and adequate service. A Zone of Tolerance (ZOT) has been employed to define the two levels of service. The empirical study confirmed that information system ZOT SERVQUAL includes four dimensions that can be used to measure desired, adequate and perceived service quality levels. The four dimensions were tangibles, rapport, reliability and responsiveness.

2.5.2. Online service delivery quality

At the start of the 21st century the focus moved more towards online service quality. This was associated with the growth in electronic retailing (Ding, Hu, & Sheng, 2011). E-service quality was seen as a critical determinate of the success or failure of electronic commerce (Santos, 2003). The benefits of e-service quality extend to include strategic benefits, operational efficiency and profitability (L. Berry & Parasuraman, 1997). According to Santos (2003), in 2001 the world lost £8 billion due to inadequate e-services. The first initiative to address this issue in electronic applications was taken by Zeithaml et al. (2000). The key contribution of this study is a scale called E-SERVQUAL. Eleven dimensions were identified as criteria to evaluate features of web sites: reliability, responsiveness, access, flexibility, ease of navigation, efficiency, assurance/trust, security/privacy, price knowledge, site aesthetics and customisation/personalisation. In 2002, Zeithaml et al. (2002b) proposed a new scale to measure quality in e-tailing called E-SERVQUAL. This measurement has two parts. The first part is used to measure the core services and includes four dimensions: efficiency, reliability, fulfillment and privacy. The second part is related to recovery services and consists of three dimensions: responsiveness, compensation and contact. In 2005, the authors performed a second examination of the structure and properties of the scale. This empirical examination of E-S-QUAL and E-RecS-QUAL aimed to reconfirm the reliability and validity of the scale. The main finding of this study is that ‘both scales (core service and recovery scale service) demonstrate good psychometric properties based on findings from a variety of reliability and validity tests' (Parasuraman et al., 2005, p. 1). There are some measurements that have been devised to evaluate e-service quality. These scales have various titles, for example, WebQual, SITE-QUAL, eTailQ, PIRQUAL, and e-SELFQUAL. Table 2.7 lists those scales and some details about each study.

Table 2.7 Summary list of studies related to online quality service

Contributions	Author/s	Sample	Dimensions
Online retailing service quality	Zeithaml et al. (2000)	Six focus group interviews	Reliability, responsiveness, access, flexibility, ease of navigation, efficiency, assurance/trust, security/privacy, price knowledge, site aesthetics, and customisation/ personalisation
Web site success	Liu and Arnett (2000)	122 Response From Webmaster of Forunter1000 Companies	Information and service quality, system use, playfulness, and system design.
Service Quality and E-commerce	Cox and Dale (2001)	Theoretical study	Accessibility, communication, credibility, understanding, appearance, and availability.
Online library service quality	O'Neill, Wright, and Fitz (2001)	269 students from a prominent a public sector university in Western Australia	Contact, responsiveness, reliability, and tangibles.
E-satisfaction	Szymanski and Hise (2000)	1007 online shoppers	Convenience, site design, and financial security.
SITEQUAL	Yoo and Donthu (2001)	69 college students evaluated three sites	Ease of use, aesthetic design, processing speed, and security.
PIRQ Perceived Internet Retailing Quality	Francis and White (2002)	152 Australian Internet shoppers	Web site, transaction system, delivery, customer service, and security.
WebQual^{TM}	Loiacono et al. (2002)	Two samples: 510, 336 Web Users	Information fit-to-task, tailored communication, trust, response time, ease of understanding, intuitive operation, visual appeal, innovativeness, emotional appeal, consistent image, on-line completeness, and relative advantage.
PWQ Perceived web quality	Aladwani and Palvia (2002)	101 college students	Specific content, content quality, appearance, and technical adequacy.
E-SERVQUAL	Zeithaml, Parasuraman, and Malhotra (2002a)	Exploratory focus groups	Efficiency, system availability, fulfilment, privacy, responsiveness, compensation, and contact.
WebQual in e-commerce	Stuart and Richard (2002)	376 Shoppers from three online Bookshop	Usability, design, information, trust, and empathy.
e-SQ electronic Service Quality	Yang and Jun (2002)	271 Internet Service Providers (ISP)	Internet purchasers: Reliability, access, ease of use, personalisation, security, and credibility.

Contributions	Author/s	Sample	Dimensions
			Internet Non-purchasers: Security, responsiveness, ease of use, reliability, availability, personalisation, and access.
eTailQ	Wolfinbarger and Gilly (2003)	1013 Customers	Website design, Fulfilment/reliability, privacy/security, and customer service.
E-Service Quality	Santos (2003)	30 focus groups	Incubative dimensions: Ease of use, appearance, linkage, structure, and layout. Active dimensions: Reliability, efficiency, support, communication, security, and incentives.
Internet retail service quality	Trocchia and Janda (2003)	In-depth interview with 58 online shoppers	Performance, access, security, sensation, and information.
Retail service quality on the Internet	Long and McMellon (2004)	447 customers using retail Internet sites	Tangibility, assurance, reliability, purchasing, process, and responsiveness.
Service quality of Internet retailing	Yang, Peterson, and Cai (2003)	1078 customers using two sites	Responsiveness, credibility, ease of use, reliability, convenience, communication, access, competence, courtesy, personalisation, continuous improvement, collaboration, security/privacy, and aesthetics.
Online service quality satisfaction and dissatisfaction	Yang & Fang (2004)	Analysis content of 740 customer's review of brokerage Services	Dimensions leading to satisfaction: Responsiveness, competence, ease of use, service reliability, courtesy, service portfolio, continuous improvement. Dimensions leading to Dissatisfaction: System reliability, content, credibility, and system flexibility.
E-S-QUAL Re-E-S-QUAL	Parasuraman et al. (2005)	Two samples: 205 Walmart.com customers, 653 amazon.com customers	E-S-QUAL: Efficiency, system availability, fulfilment, privacy. Re-E-S-QUAL: Responsiveness, compensation, contact.
QES Quality of Electronic Service	Fassnacht and Koese (2006)	349 Homepage service 345 sport coverage service 305 online shoppers	Environment Quality: Graphic quality, clarity of layout Delivery Quality: Attractiveness of selection, information quality, ease of use, technical quality. Outcome Quality: Reliability, functional benefit, emotional benefit.
eTransQual Electronic transaction quality	Bauer., Falk., and Hammerschmidt (2006)	348 Online shoppers in Germany	Functionality/design, enjoyment, process, reliability, and responsiveness.

Contributions	Author/s	Sample	Dimensions
Success factors for Destination marketing websites	Park & Gretzel (2007)	Qualitative research 53 papers in tourism field 100 papers in tourism field	Information quality, ease of use, security/privacy, visual appearance, personalization, responsiveness, interactivity, trust, and fulfilment.
NetQual	Bressolles, Durrieu, and Giraud (2007)	85 customers of two commercial Web sites (Travel and electronic goods)	Information, ease of use, reliability, fulfilment, site design, security/privacy, interactivity/personalisation.
e-trust	Hwang & Kim (2007)	325 undergradu-ate business stu-dents in U.S.	Integrity, benevolence, and ability.
E-S-Qual	Boshoff (2007)	1409 Online shoppers	Efficiency, delivery, privacy, speed, system availability, and reliability.
PeSQ Perceived e-service quality	Cristobal, Flavian, and Guinaliu (2007)	267 buyers. 194 information searchers in Spain.	Web design, customer service, assurance, and order management.
e-SELFQUAL Online self-service quality	Ding et al. (2011)	302 students familiar with e-retailing and online purchase.	Perceived control, service convenience, customer service, and service fulfilment.
E-service quality of Internet banking	Ho & Lin (2010)	130 e-bank user	Customer service, web design, assurance, preferential treatment, and information provision.

All the studies mentioned above focused on the critical issue of service delivery quality. Delivering services through electronic media is deemed to be an essential challenge encountered by organisations. As Zeithaml states: 'Too many companies are performing poorly in delivering service on the web, and a large part of this problem is the lack of complete understanding of what customers want in the medium' (2002, p. 135). Establishing key performance indicators for service delivery and establishing quality and service delivery standards are believed to be the main pillars in Information System Service Delivery Organisations (ISSDOs) (McManus, 2009).

2.5.3. Service delivery quality in e-learning systems

Service delivery quality in e-learning systems can be vital in assisting educational institutions to obtain the potential competitive advantage that e-learning offers (Roffe, 2002; Udo, Bagchi, & Kirs, 2011). Learner services and support are considered to be an essential standard in the design, delivery and development of e-learning programs (Frydenberg, 2002). Therefore, service delivery quality has received noteworthy attention in the context of e-learning systems. Most research dealing with e-learning system success issues has considered service quality as a critical element in creating success. The different indicators used to gauge service delivery quality in the e-learning systems area are as follows:

- Holsapple and Lee-Post (2006) considered service quality, alongside system quality and information quality, as a critical factor in designing e-learning systems successfully. Five indicators were used to measure service quality: promptness, responsiveness, fairness, knowledgeability and availability.
- Roca et al. (2006) extended the Technology Acceptance Model (TAM) to study e-learning continuance intention. A measure of service quality has been prepared based on the studies of Kettinger and Lee (1994), Pitt et al. (1995) and Parasuraman, Zeithaml, and Berry (1985, 1988). The aspects used to measure service were not identified.
- Lin (2007) adopted DeLone and McLean's model (2003) to assess online learning system success. The indicators employed to measure service quality in this research were visual appeal, availability of help and responsiveness of the online learning system.
- Wang et al. (2007) adopted service quality, besides five other constructs, to gauge the success of an e-learning system in an organisational context. The items used to measure the service quality construct focused on online assistance and explanation, developer interaction with users, staff availability, consideration of user suggestions, and satisfactory support.
- Ozkan and Koseler (2009) proposed a model to evaluate e-learning system success in the higher education context, namely the Hexagonal E-learning Assessment Model (HELAM). Service quality was chosen as a key construct in this model. Four subscales were employed to measure this construct: student tracking, course/instruction authorisation, course management and knowledgeability.
- Wang and Wang (2009) combined TAM with three dimensions of quality to investigate adoption of e-learning systems by instructors: system quality,

information quality, and service quality. Five indicators were used to evaluate service quality: training, professional knowledge of staff, contact, responsiveness, and support.

- Adeyinka and Mutula (2010) suggested a model to evaluate WebCT (WEB course tool) course content management system success. Service quality has been specified as an important construct. The focus of service quality concerned evaluating the support delivered by the course content management team to students. Teaching and learning quality and the quality of tutors' interaction with students were the main concerns of this variable.
- Hassanzadeh et al. (2012) employed five indicators to measure service quality: provide guidance services; responsiveness; reflecting user views in system design and development; course management; and speed of provided service.
- Cheng (2012a) focused on the support service from the help desk and the support service from the administrators of e-learning systems to assess the support service quality.

Service delivery quality is considered to be a central challenge encountered by organisations. Shortfalls in this construct will lead to undesired results with respect to organisational activities, performance and customer satisfaction. The importance of this issue has increased after growth in use of e-commerce and electronic systems. Many studies have been conducted to address this issue and to explore factors affecting service delivery quality. In the context of an e-learning system, these factors are deemed to be critical to the success of these systems. However, most of the efforts directed at resolving these issues focused on specific stakeholders such as students (external stakeholders) and ignored other groups of stakeholders. Instructors (academic staff) and ICT staff are believed to be vital stakeholders because these two groups have regular contact with this system. Those two groups of stakeholders depend on e-learning system service to deliver their own service to external customers (students or trainers). Therefore, the opinions of different groups of stakeholders (both external and internal users) should be considered in evaluating service delivery quality to compose a comprehensive picture of these services.

2.6. Perceived usefulness

Since the 1970s researchers have applied considerable effort to investigate the role of perceived usefulness in generating system utilisation (Burton-Jones & Straub, 2006; Davis, Bagozzi, & Warshaw, 1989). This construct has been used by Christie (1974); Lucas (1975); Robey (1979); Larcker and Lessig (1980); Balachandra (1980); Franz (1986); and Chenhall (1986) to measure the use of the information system.

In spite of the attention paid to perceived usefulness, arguments persist about employing it in measuring the success of information systems. McLean and DeLone highlighted this issue and state that ‘usage, either actual or perceived, is only pertinent when such use is voluntary’ (1992, p. 68) On the other hand, Venkatesh and Davis (2000) and Venkatesh et al. (2003) established that ‘perceived usefulness’ is a valid and reliable construct in assessing information systems in both types of use: mandatory and voluntary.

To address this issue, firstly an explanation about the concepts of use and perceived usefulness will be offered.

2.6.1. System use

The concept of use has been employed in the information system literature since the 1980s. Different measures have been suggested to gauge this construct. Straub et al. (1995) reviewed some studies that employed the system usage concept and found two types of measures used to assess system usage: Objective (reports requested, records updated, number of queries, and connect time); and Subjective (frequency of use, value in decisions, extent of use, frequency of report, intention to use, number of packages, and number of messages).

More measures have been introduced to measure system use, for instance, faithfulness of the use and attitude during use (DeSanctis & Poole, 1994); number of times used, time spent and number of tasks used (Taylor & Todd, 1995); number of packages used, number of supported tasks, duration and frequency (Igbaria & Tan, 1997); duration of use per day (Venkatesh & Davis, 2000), duration of use of hardware, software and IT in general (over a week) (Vlahos, Ferratt, & Knoepfle, 2004), direct and indirect use (Tong, Teo, & Tan, 2008), duration, frequency and intensity (Venkatesh & Bala, 2008), and frequency of usage (He, Fang, & Wei, 2009).

In spite of the considerable research that dealt with system use, there are critical issues confronting this construct. In this regard, Straub et al. (1995) state that 'Despite the number of studies targeted at explaining system usage, there are crucial differences in the way the variable has been conceptualized and operationalised' (Straub et al., p. 1328). Burton-Jones and Straub (2006) are in agreement about this issue and argue that 'Despite its centrality in IS research, the system usage construct has received scant theoretical treatment to date … We are unaware of in-depth, theoretical assessment of the construct' (2006, p. 228). Moreover, there are two other issues faced by system use: the lack of a holistic definition of usage and the measures of usage (Sedera & Tan, 2007).

Some efforts have been made to address the aforementioned issues. Burton-Jones and Straub (2006) suggested an approach to develop clear and valid measures of system usage. Based on this approach, conceptualisation of system usage can be formulated in terms of its structure and function.

User, system, and task are considered the tripartite of structure of system usage. According to the structure of usage the researchers should be able to identify and justify which elements of usage are relevant to their study. In the context of function, 'Researchers should choose measures for each element (i.e. user, system and/or task) that tie closely to the other constructs in the researcher's monological network' (Burton-Jones & Straub, 2006, p. 228). This suggested approach has been supported by empirical investigation. The study proposed new direction for research to investigate system usage in the context of the nature of system usage and its consequences.

Sedera and Chian (2007) employed the Adaptive Structuration Theory (AST) to conceptualise usage in the context of contemporary information system success. In their study, the construct of IS usage in AST has been replaced by 'appropriation'. The main justification for replacing usage by appropriation is that 'Appropriation goes beyond the traditional interaction between the user and the system or the manner in which the user is using the system' (Sedera & Tan, 2007, p. 1352). Appropriation is determined by four dimensions: faithfulness of appropriation, instrumental uses, attitudes towards appropriation and consensus of appropriation.

In regard to system use conceptualisation, Venkatesh et al. (2008) focused on the predictors that lead to different conceptualisations of system use. Also, an important question has been asked: 'Are the drivers of frequency of system use different from the drivers of duration of system use?' (Venkatesh, Brown, Maruping, & Bala, 2008, p. 484). The behavioural expectations construct has been used as a predictor that overcomes critical limitations and produces a better understanding of system use. Use of the system has been tested in the context of three essential conceptualisations: duration, frequency and intensity. The empirical investigation concluded that behavioural intention strongly impacted duration of use and behavioural expectation strongly affected frequency and intensity of use.

The identification of factors predicting system use in terms of social networks was the main objective of Sykes et al.'s (2009) study. Network density, value network density, network centrality and value network centrality have been employed as the key predictors of system use. Regarding these four constructs, Sykes et al. (2009) state that "We incorporate network density (reflecting "get-help" ties for an employee) and network centrality (reflecting "give-help" ties for an employee), drawn from prior social network research, as key predictors of system use. Further, we conceptualize valued network density and valued network centrality, both of which take into account ties to those with relevant system-related information, knowledge, and resources, and employ them as additional predictors" (p. 371). The participants in Sykes et al. (2009) study were users of a new system and use of the system was voluntary. The result confirmed that social network is believed to be a main predictor of system use and provides a better explanation of this construct.

2.6.2. Perceived usefulness

Perceived usefulness is considered to be the main construct in the original version of TAM and in the modified models of TAM. This construct has been employed to predict different factors, for instance, word processing and spreadsheet system acceptance, predicting user intentions, Tele-community technology, measuring web and wireless site usability and continual system use (Alrafi, 2007). Davis defined perceived usefulness as 'The degree to which a person believes that using a particular system would enhance his or her job performance'(1989, p. 320).

The reliability and validity of perceived usefulness as a predictor of intention to use information technology has been tested by Davis et al. (1989). The empirical test showed that the reliability of perceived usefulness was extremely high (Cronbach's alpha .97) and it was a key determinant of usage behaviour.

The main limitation of TAM is that behaviour is considered to be voluntary (Kowalczyk, 2008). In other words, TAM has been designed to measure technology acceptance in the context of a voluntary environment. To overcome this limitation, Venketesh and Davis (2000) extended TAM and produced a new model called TAM2. Four different systems at four organisations were selected as a study sample. The usage of two systems was voluntary and the two others were mandatory. The study found that social influence processes and cognitive instrumental processes were the critical determinants of perceived usefulness in both systems. For the same purpose, Venkatesh et al. (2003) proposed and tested a new model called Unified Theory of Acceptance and Use of Technology (UTAUT). The two types of usage, voluntary and mandatory, have been considered in this model. Perceived usefulness has been employed in UTAUT and used with other variables to measure the performance expectancy. As proposed by Venkatesh and Bala (2008), perceived usefulness is also included as a main construct in TAM3.

Based on the theory of human needs, Yeh and Teng (2011) suggested a new framework to re-conceptualise the perceived usefulness construct. The main purpose of this study is to expand the perceived usefulness beyond job performance. Two constructs have been used to extend the traditional construct of perceived usefulness: perceived extended usefulness and perceived needs fulfilment. The empirical investigation confirmed that self-development needs fulfilment and is considered a significant construct in measuring perceived usefulness. However, the relatedness fulfilment was a non-significant predictor of perceived usefulness.

In the e-learning system arena, perceived usefulness has been commonly used by researchers in this field. Arbaugh (2000b) argued that perceived usefulness of the electronic medium to deliver courses will enhance the attitude of students toward their course experience and will encourage them to adopt courses via the Internet in the future. The empirical study supported the argument and confirmed that perceived usefulness affected positively on student satisfaction. The findings of the aforementioned study have been supported by Drennan et al.'s (2005) study. Drennan et al. (2005) found that perceived usefulness had the strongest effect on student satisfaction among the factors that predicted this construct. The same results on the impact of perceived usefulness on students' satisfaction were obtained in the studies of Joo et al. (2011), and Hsieh & Cho (2011).

Sela and Sivan (2009) conducted an investigation to identify the success factors for enterprise e-learning. Two clusters of factors have been identified: 'Must–Have' factors and 'Nice-to-Have' factors. Perceived usefulness was the first factor in the first group, 'Must-Have'. Teo (2011) conducted a study to explore the determinants of perceived usefulness in the terms of e-learning systems. The empirical study found that course delivery, tutor attributes and facilitating conditions were the main determinants of perceived usefulness. In respect to TAM, perceived usefulness is believed to be a main pillar affecting usage behaviour. Thus, studies have dealt with this construct in the context of e-learning systems, and aimed to identify determinants of the perceived usefulness construct. Table 2.8 list details of some studies that targeted identifying perceived usefulness determinants.

Table 2.8 Perceived usefulness determinants

Author/s	Sample	Perceived usefulness determinates
McFarland (2001)	676 high school students and industry professionals	Age, computer efficacy, IT perceived ease of use
Stoel & Lee (2003)	618 university students	Prior experience, perceived ease of use
Martins & Kellermanns (2004)	243 university students	Change motivators, change enablers, perceived ease of use the system
Gong & Yu (2004)	146 full-time teachers	Computer efficacy, perceived ease of use
Saadé & Bahli (2005)	102 university students	Cognitive Absorption (Temporal dissociation, Focused Immersion, and Heightened Enjoyment), perceived ease of use
Roca et al. (2006)	127 persons who had taken e-learning course provided by the United Nations System staff college or by the international centre of the IOL	Confirmation, cognitive absorption
Pituch & Lee (2006)	259 college students	System functionality, system interactivity, system response, Self-efficacy, Internet experience.
Ong & Lai (2006)	67 female, and 89 male from six international companies in Taiwan.	Gender, computer self-efficacy
Toral et al. (2007)	142 students	Curiosity, ease of use.
Ngai et al.(2007)	836 university students	Technical support, perceived ease of use.
Martinez-Torres et al. (2008)	220 students	Interactivity and control, ease of use.

Author/s	Sample	Perceived usefulness determinates
Raaij & Schepers (2008)	45 Chinese managers enrolled in an Executive MBA program.	Personal innovativeness in the domain of IT, social norms, perceived ease of use.
Liaw (2008a)	424 university students	Learners' characteristics, environmental factors.
Abbad et al. (2009)	486 undergraduate students from Arab Open University	Subjective norms, Internet experience, system interactivity, self-efficacy, technical support.
Sørebø & Eikebrokk (2008)	124 university teachers	Perceived autonomy, perceived competence, perceived relatedness, confirmation.
Wang & Wang (2009)	268 full-time instructors at universities in southern Taiwan	Information quality, system quality, perceived ease of use, subjective norm.
Cho et al. (2009)	445 user e-learning tools from seven universities in Hong Kong.	Perceived functionality, perceived user-interface design, perceived ease of use.
Lee et al. (2009)	214 undergraduate students.	Instructor characteristics, teaching materials, perceived ease of use.
Sanchez & Hueros (2010)	226 students of Business Administration and Management (LADE) in the University of Huelva.	Technical support, computer self-efficacy, perceived ease of use.
Teo (2011)	189 pre-service teachers	Learning environment, course delivery, tutor attributes, facilitating conditions.
Hsieha & Cho (2011)	445 users of self-paced modules. 293 Instructor-students Interactive model	Ease of use, information quality.
Hunga et al. (2011)	144 teachers used wisdom master (WM)	Dis(Confirmation), Causal Attributions.
Liaw, and Huang (2013)	196 university students	Perceived self-efficacy, perceived anxiety, interactive learning environments.

The debate about using the usage construct versus the perceived usefulness construct in measuring information system success is still ongoing. This issue is related to the nature of systems: voluntary or mandatory. Most of the studies dealt with information system success; specifically, studies following the DeLone and McLean model replaced the use construct with usefulness construct due to the ambiguity of the indicators when usage is mandatory and when it is not (Molla & Licker, 2001).

The main criticism directed by Seddon and Kiew (1994) to the model of DeLone and McLean (1992) is related to measuring of information system use. According to Seddon, there are three possible meanings of use concept. They are:

- Information systems used as a variable that proxy the benefits from use.

- Information systems used as the dependent variable in a variance model of future IS use.
- Information systems used as an event in a process leading to individual or organisational impact. (1997, p. 243).

The shortfall in the theoretical treatment, and the lack of comprehensive definition of use and difficulty related to measuring the use construct are believed to be challenging issues encountered by this construct (Burton-Jones & Straub, (2006); Sedera & Tan, (2007); Venkatesh et al., (2008)).

Seddon and Kiew (1994) partially tested DeLone and McLean's (1992) model. The use construct was replaced by usefulness because the researchers believed that if users use a system that means it must be useful. Seddon and Kiew state that 'Reflecting on the relevance of use as an indicator of system success in some situation and its irrelevance in others, we conjectured that the underlying success construct that researchers have been trying to tap is usefulness, not use' (1994, p. 93).

Iivari provided an explanation about this issue and argued that 'DeLone and McLean (1992) do not explicitly restrict their model to voluntary systems' (2005, p. 9). This opinion is believed to be reasonable and corresponds with DeLone and McLean's opinion about this issue, that is, 'No system is totally mandatory'(2003, p. 16).

In respect to TAM, perceived usefulness is considered to be a central competent in this model. As has been mentioned previously, the main criticism directed at TAM is that using TAM is limited to the voluntary usage environment. This limitation has been solved by Venkatesh and Davis (2000) through TAM2, and Venkatesh et al. (2003) through UTAUT. These studies prove that perceived usefulness is a valid and reliable construct to predict intention to use information systems in both types of usage: voluntary and mandatory.

In terms of e-learning systems, Lee (2006) tested TAM with consideration of the usage nature of e-learning systems: mandatory or voluntary. The empirical study found that perceived usefulness was the key component in measuring acceptance in both voluntary and mandatory usage.

Koh et al. (2010) studied the mandatory use of software. Three models have been proposed and tested in their study. The statistical results showed that the R^2 value of use construct was 1 percent in the three models. To justify this result, Koh et al. state that ‘This may suggest that in mandatory environments, use is indeed irrelevant’ (2010, p. 192)

The review of the above literature is related to the argument about employing the usage or perceived usefulness construct to measure e-learning system success.

In the proposed model of this study, perceived usefulness is employed as a main construct in measuring e-learning system success. The justifications for adopting this construct are:

- ‘Perceived usefulness’ does not appear to have the problems related to the theoretical grounding as encountered by the ‘system use’ construct (Burton-Jones & Straub, 2006).
- In the context of mandatory systems, the reliability and validity of ‘perceived usefulness’ as a predictor construct have been tested (Venkatesh & Davis (2000) Venkatesh et al. (2003); Lee (2006)).
- E-learning systems cannot be considered totally mandatory systems (DeLone & McLean, 2003). Jackson et al. (1997) argue that in spite of the use of specific systems being considered mandatory, sometimes the outcomes of these systems contain irrelevant information for users. Furthermore, different stakeholders are dealing with e-learning systems, and each group has different goals—and the information they need is different as well. Therefore, specific features of e-learning systems may be considered mandatory for specific users and voluntary for other users.
- In the e-learning system field prior studies adopted ‘perceived usefulness’ as a central determinate of student satisfaction. In this regard, studies of Hussein et al. (2007); Johnson et al. (2008); Lee and Lee (2008); Limayem and Cheung (2008); Joo et al. (2011); and Hsieh & Cho (2011) proved that ‘perceived usefulness’ significantly affected student satisfaction. Based on this empirical evidence, recent studies adopted perceived usefulness as a key construct in creating user satisfaction and the success of e-learning systems.

Considerable efforts have been exerted to introduce a valid and reliable instrument to measure IS usage. However, the measures of information systems usage face a major criticism because the ways used to conceptualise and operationalise IS usage are different (Straub et al., 1995). In other words, there is no agreement on a common instrument that can be used to measure this construct. In the context of perceived usefulness, the instrument prepared by Davis (1989) is considered to be a valid and reliable instrument to gauge perceived usefulness. Many studies have tested this measurement and proved its validity and reliability, for instance, Davis (1989); Adams et al. (1992); Hendrickson et al. (1993); Chin and Todd (1995); Doll et al. (1998); Venkatesh and Davis (2000); and Venkatesh and Bala (2008).

In summary, evaluating e-learning system success remains an essential challenge confronting organisations. This issue became increasingly more complex due to the difficulty in determining the most suitable measure, ‘system use’ or ‘perceived usefulness’, to achieve this goal. The evidence and arguments presented about this issue support the view that perceived usefulness is considered to be more reliable and valid to measure e-learning system success.

2.7. User satisfaction

Since 1970, considerable attention has been paid to user satisfaction in the information systems field. Technology, the user and the organisation are believed to be the main elements in evaluating information system success (Oriyo, 2010). The most notable aspect of user satisfaction is its role in evaluating the success of information systems.

2.7.1. User satisfaction approaches

Many studies adopted user satisfaction as a single construct to assess information system success, for example, Bailey and Pearson (1983); Ilias et al. (2009); Gudigantala et al. (2010); and Pike et al. (2010).

User satisfaction has also been used as a fundamental construct in measuring the acceptance of technology. One example can be found in the study by Wixom and Todd (2005). Their results highlighted that the perspectives of user satisfaction and technology acceptance can be integrated. User satisfaction is believed to be valuable to management as a measure of information system success. Herald (1996) states that 'a structured and meaningful methodology for determining user satisfaction that results in a management plan of action should be regularly applied by the IS organisation with its users' (1996, p. 5).

User satisfaction is considered to be a commonly-used single construct for measuring information system success. In this regard, Bokhari states that 'The basis for considering user satisfaction as a success measure concerns that information systems fulfil user needs and objectives and may reinforce satisfaction' (2001, p. 83). DeLone and McLean (1992) presented three reasons for adopting user satisfaction as a significant measure in gauging information system success: it has a high degree of face validity, the availability of a reliable measurement, and the poor quality of the other measures.

Four approaches have been used to study user satisfaction. The first two approaches, micro and macro, focus on the level of user satisfaction. The other two approaches emphasise user satisfaction as a measure of information systems success: user satisfaction as the comprehensive single factor; and user satisfaction as one of many factors.

The micro and macro level approaches are commonly used to review studies dealing with user satisfaction. Olson and Ives initially developed these approaches and stated that 'The micro level focuses on satisfaction with a particular information system … A macro level measure of information satisfaction assesses user managers' overall satisfaction with all computer-based information use in their jobs' (1981, p. 186)

In the context of micro studies, Chin et al. (1988) offered an instrument to measure user satisfaction called Questionnaire for User Interface Satisfaction (QUIS). They conducted a comparison of two pairs of software categories. The first pair was named 'like vs. dislike' and the second was the standard Command Line System and a Menu Driven Application. Four factors emerged from the analysis: learning, terminology and information flow, system output, and system characteristics. Also, the reliability of the questionnaire was rated highly.

Somers et al. (2003) researched end–user computing satisfaction with ERP systems. The instrument developed by Doll and Torkzadeh (1988) was adopted in the study to confirm the structure, dimensionality, reliability and validity of the instrument. The findings concluded that the psychometric stability of the instrument has been proven in the context of an ERP system.

Longinidis and Gotzamani (2009) examined the factors affecting ERP system success. As a result, three factors were identified as main components impacting satisfaction of ERP users: interaction with the IT department, pre-implementation processes, and ERP product and adaptability. Many other studies have been performed to investigate user satisfaction in the context of an ERP system, for example, Bin et al. (2010) and Venugopal et al. (2010).

The efforts to study user satisfaction with a specific system (micro) continued, and included many types of systems such as Decision Support Systems (DSS) by Jarupathirun and Zahedi (2007), Hung et al. (2007) and Gudigantala et al. (2010); Computerized Accounting System (CAS) by Ilia et al. (2009); data warehousing by Shin (2003); and knowledge management systems by Wu and Wang (2006), Kulkarni et al. (2007) and Liaw et al. (2008).

With regard to the macro view, a study by Bailey and Pearson (1983) is believed to be the most important contribution in regard to measuring user satisfaction. The main contribution of this study was producing a valid and reliable questionnaire to gauge user satisfaction. The questionnaire had 39 distinct factors and is 'based on the semantic differential of four adjective pairs which describe the factor' (Bailey & Pearson, 1983, p. 538). Ives et al. claimed that, 'Although Pearson's study represents an important first step toward the development of a valid UIS [*User Information Satisfaction*] measure, further investigation is required to assess the validity and reliability of Pearson's measure and to refine it for use in research and practice' (1983, p. 788). Based on this claim, Ives et al. (1983) carried out a study to achieve four purposes. The most important one was to develop a 'short form' of the instrument to measure user satisfaction. The procedures undertaken to establish the short form instrument and the statistical analysis conducted in this regard demonstrate that 'the short questionnaire is a sound general measure of Pearson's original UIS concept' (Ives et al., 1983, p. 791). The short form instrument has been used in many studies, for instance, Wu and Wang (2007) and Miller (2010).

Regarding the third approach to study user satisfaction, Doll and Torkzadeh (1988) considered user satisfaction as a comprehensive measure in assessing information system success. Five subscales shaping end-user computing satisfaction in this study were content, accuracy, format, ease of use and timelines. Rivard and Huff's (1988) study investigated the factors affecting the success of User Development computer Applications (UDA). The results concluded that the factors that affected overall user satisfaction were independence from Data Processing (DP), user satisfaction with the environmental set up, perception of the user friendliness of software tools, user attitude toward UDA, the degree of DP push and, lastly, user satisfaction with support from DP. Many other studies followed this direction, including Ong and Lai (2007); Leclercq (2007); Pike et al. (2010); and Al Maskari and Sanderson (2010).

According to the fourth approach, some studies adopted user satisfaction as one of many factors to assess the success of the information system. Raymond (1990) considered user satisfaction as a measure of information system success, alongside offline usage and online usage. DeLone and McLean (2003; 1992) also adopted user satisfaction as an essential factor in the success of an information system in conjunction with five other factors. Studies by Wixom and Todd (2005), Sabherwal et al. (2006), Larsen (2009), Kang and Lee (2010), and Hsieh (2012) were supportive of this approach. Those two approaches have shared aspects with micro and macro approaches. Some studies have adopted user satisfaction as a comprehensive measure to assess a specific system (micro) or the overall information systems (macro). User satisfaction has also been adopted as one factor in a group of factors to evaluate specific system (micro) or overall information systems. Table 2.9 shows some studies based on the shared aspects among the approaches described.

Table 2.9 Selected studies with shared aspects among the user satisfaction approaches

User Satisfaction Approaches	Micro level	Macro level
Comprehensive	Chin et al. (1988); Somers et al. (2003); Longinidis and Gotzamani (2009); Larsen (2009); Bin et al. (2010); Venugopal et al. (2010); Ilia et al. (2009); Rainer and Watson (1995); Ong and Lai (2007); Pike et al. (2010); Almaskari and Sanderson (2010).	Bailey and Pearson (1983); Ives et al. (1983); Joshi et al. (1986); Rivard and Huff (1988); Doll and Torkzadah (1988); Palvia (1996); Etezadi-Amoli and Farhoomand (1996); Doll et al. (2004); Leclercq (2007).
As one of many factors	Shin (2003); Wu and Wang (2006); Hung et al. (2007); Jarupalhirun and Zahedi (2007); Kulkarni et al. (2007); Liaw et al. (2008a); Chung et al. (2009); Larsen et al. (2009); Kang and Lee (2010); Hsieh (2012), Tona (2012) .	Raymond (1990); McLean and DeLone (2003; 1992); Seddon (1997); Landrum and Prybutok (2004); Wixom and Todd (2005); Sabherwal et al. (2006); Kettinger et al. (2009); Landrum et al. (2010).

2.7.2. User satisfaction with e-learning systems

Web-based systems facilitate delivery of products and services via the internet. (Kiang, Raghu, & Shang, 2000). Wang et al. state that ‘Measures of user information satisfaction developed for the conventional data processing environment or end-user computing environment may no longer be appropriate for the digital marketing context, where the role of an individual customer is in some ways different to that of an organisational end user’ (2001, p. 90).

To study factors affecting user satisfaction with web-based systems, some research has been conducted. Wang et al. (2001) identified seven factors that shaped Customer Information Satisfaction (CIS): customer support, security, ease of use, digital products/services, transaction and payment, information content and innovation. Lai (2006) identified three factors of user satisfaction associated with e-business, namely: content, dependability and ease of use. In the same context, Cristobal et al. (2007) established that consumer satisfaction with e-service affected web site loyalty. Liao et al. (2007) employed the Theory of Planned Behaviour (TPB) and customer satisfaction to identify factors affecting the continued use of e-service. The results of that study concluded that customer satisfaction is a main determinant of the customer's behavioural intentions toward e-service continuance. Study findings of Udo et al. (2010) were supportive of the result of Liao et al. (2007) concerning the role of user satisfaction on behavioural intention in the context of e-service. Verdegem and Verleye (2009) found that nine factors were considered fundamental in creating user satisfaction in the context of e-government: infrastructure, cost, awareness, security/privacy, content, usability, technical aspects, customer friendliness and availability. Finally, McNamara and Kirakowski (2011) proposed and examined the validity and reliability of the Consumer Products Questionnaire (CPQ). This instrument was prepared to measure user satisfaction with electronic consumer products. Three factors were identified as significant dimensions of CPQ: efficiency, helpfulness, and transparency.

Learners’ dissatisfaction with e-learning experience remains a critical issue (S. S. Liaw, 2008a). Most of the studies that dealt with user satisfaction, in the context of e-learning systems, have targeted investigation of the role of this construct in creating the success of e-learning systems. Some studies employed user satisfaction as a dependent variable and aimed to determine factors affecting it. Based on this direction, Arbaugh conducted a study to answer the crucial question: 'What factors must be present to produce effective Internet-based courses?' (2000a, p. 33). The answer produced from the empirical study illustrated that the flexibility of the medium, the ability to develop an interactive course environment, and the ease or frequency with which the medium can be used were the main factors affecting and determining student satisfaction. Lee and Hwang (2007) conducted a study to explore factors affecting e-learners' satisfaction. The results confirmed that perceived usefulness, perceived ease of use, service quality on interaction, self-regulation, learning strategy, and computer self-efficacy affected e-learners' satisfaction. Wu et al. (2010) produced a model to measure student satisfaction in a Blended E-Learning Systems (BELS). Social cognitive theory was employed in the model's design. Analysis of results confirmed that interaction among cognitive factors, technological environmental factors, and social environmental factors had an impact on learning satisfaction. Lin and Chen (2012) combined the Technology Acceptance Model (TAM) and McLean and DeLone's model to identify the factors affecting user satisfaction and continuous use of e-learning systems. The results confirmed that system quality, platform information, and course information were the main determinates of user satisfaction and continuous use of e-learning systems. Table 2.10 shows some studies that adopted the above approach.

Table 2.10 Selected studies conducted to identify factors affecting user satisfaction

Author	Factors
Eom et al. (2006)	Course structure, instructor feedback, self-motivation, learning style, interaction and instruction facilitation.
Sun et al. (2008)	Learner computer anxiety, instructor attitude toward e-learning course flexibility, e-learning course quality, perceived usefulness, perceived ease of use, and diversity in assessment.
Shee & Wang (2008)	Learner interfaces including: ease of use, user friendliness, ease of understanding, and operational stability.
Ho & Dzeng (2010)	Platform function (network quality, platform operation, user interface, testing after the course); content design (animation design, case teaching simulation test, and materials capacity).
Ramayaha & Lee (2012)	Service quality, information quality, and system quality.
Sawang (2013)	Gender, age, education, position, authenticity, complexity, technology efficacy, openness to change, and organisational support.

Another framework was applied by some researchers to measure user satisfaction in the context of e-learning systems. Within this framework, user satisfaction has been considered an important factor affecting e-learning system continuance intention.

Most of these studies have, in fact, considered user satisfaction as an essential factor in determining users' continuance intentions and at the same time other factors 'take their turn' as determinants of user satisfaction. Chiu et al. (2005) employed Expectancy Disconfirmation Theory (EDT) to measure factors that affect e-learning continuance intention and their outcomes confirmed that satisfaction determines users' continuance intention and that user satisfaction was determined by perceived usability, perceived quality, perceived value and usability disconfirmation. The result of a study conducted by Liaw (2008a) identified two groups of factors as the determinates of perceived satisfaction: learner's characteristics, and environmental factors. The studies by Hayashi et al. (2004); Limayem and Cheung (2008); Larsen et al. (2009); Cho et al. (2009); Park (2012 and Chang (2013) have adopted this approach in dealing with user satisfaction in the context of e-learning systems.

In summary, since 1970, the term 'user satisfaction' has appeared in the information systems literature and received considerable attention from researchers. Four approaches have applied user satisfaction to measure the success of information systems: micro; macro; user satisfaction as the comprehensive single factor; and user satisfaction as one of many factors. The third and fourth approaches were adopted to employ user satisfaction to measure information system success. Considerable efforts have been made to address the issue of user satisfaction in the e-learning systems field. These efforts were in two directions. The first direction focuses on identifying determinants of user satisfaction and the second direction emphasises the role of user satisfaction as a construct influencing the success of e-learning systems. User satisfaction has become a critical issue, especially after the rise of web-based applications. Today, the term 'user satisfaction' is no longer limited to internal users but has been extended to include external customers as well.

2.8. Value of e-learning systems

Achieving individual and organisational tasks effectively and obtaining competitive advantage are believed to be the main purposes of investment in information technology. Information technology is deemed to be a core source in generating organisational value (Tzeng, Chen, & Pai, 2008). The impacts of information technology are not restricted to individual and organisational facets, but are expanded to include the productivity of the economy as a whole (Gammelgård &

Ekstedt, 2006). Therefore, vast efforts have been exerted to generate a convenient instrument to evaluate information technology value. This issue has been considered the fifth most important information systems issue in the 1980s (and the ninth top issue in 1987) in the information system field according to studies by Dickson et al. (1984) and Brancheau et al. (1987). It is worth mentioning that researchers are using terms dealing with information technology value such as information technology benefits and information technology impact. These terms are used interchangeably in the research (Gammelgård & Ekstedt, 2006). The term 'value' is used in this study interchangeably with the terms 'benefits' and 'impacts' relating to information systems and e-learning systems.

DeLone and McLean (1992) focused on two types of IT impacts: individual and organisational. Seddon (1997) is considered the earliest researcher who used the term 'Net Benefits' and associated it with stakeholders. Seddon states 'Net benefits is an idealized comprehensive measure of the sum of all past and expected future benefits, less all past and expected future cost, attributed to the use of an information technology application ... To measure Net Benefits, one has to adopt some stakeholder's point of view about what is valuable and what is not'(1997, pp. 227, 246) To reduce the complication in the information systems success model, DeLone and McLean (2003) decided to merge all the impacts of information systems and put them into a single construct called 'Net Benefits'. Much research has been conducted to identify benefits generated by using information technology and information systems in organisations. Based on what has been mentioned above, value can be classified into four categories: customer value (internal customer); customer value (external customer); organisational value; and social (societal) value. These four classifications are discussed in the next sections.

2.8.1. Customer Value (Internal Customers)

Users are believed to be the main evaluators of information systems' outcomes because they have continued contact with these systems and their outputs. Since 1980, much research has been conducted to identify benefits received through using information technology–from the users' point of view. DeLone (2003) reviewed 39 previous studies conducted to identify the individual impacts of information systems. The main measures used to assess individual benefits in these studies were information understanding, learning, accurate interoperation, information awareness, information recall, problem identification, decision effectiveness, decision quality, improved decision analysis, correctness of decisions, time to make decisions, confidence in decisions, decision making participation, improved individual productivity, change in decision behaviour, task performance, quality planning, individual power or influence, personal evaluation of information systems, and willingness to pay for information. Staples et al. (2002) categorised the benefits of information systems into five groups: ease of learning, personal benefits, sense of personal accomplishment, attitudes concerning system use and perceived net benefit. Gable et al. (2003) tested the validity of measures gauging the individual impacts of information systems. The results of their analysis identified four valid indicators that could be used to measure the individual impact. They were learning, awareness/recall, decision effectiveness and individual productivity. Almutairi and Subramnian (2005) employed four subscales to gauge the individual impacts. They were task productivity, task innovation, customer satisfaction and management control. Regarding DSS, Hung (2007) used three indicators for DDS success: decision performance, user satisfaction and user regret. Many other studies have measured individual impact with respect to different systems, for instance, Iivari (2005); Wu and Wang (2006); Chien and Tsaur (2007); Chung et al. (2009); Kaiser (2010); and Fitterer et al. (2011). In the context of e-health, Jen and Chao (2008) assessed the individual impact of the Health Risk Reminder and Surveillance. Three items have been used to gauge this construct: focus on work practice, experience and job satisfaction. Ho and Dzeng (2010) conducted a study concerning safety training through e-learning. Three indicators have been used to evaluate learning effectiveness: satisfaction degree, increasing operations safely and, lastly, reduction of time and cost.

Most of these measures mentioned previously focused on the role of information systems in improving decision-making and individual performance. Also, the focus of these studies was on internal customers (managers and employees) and how they improved their performance by using the information system's output. The main reason researchers ignored the external customer at the end of the last century was that the introduction of electronic applications, especially e-commerce, was very narrow. However, that does not mean the investigation of individual benefits has stopped. Contemporary studies continue to pay substantial attention to this issue.

2.8.2. Customer Value (External Customers)

The roots of the term 'customer value' belong to marketing literature. Zeithaml (1988) is believed to be the first researcher who used this term. In 1997, Woodruff considered customer value as a source of competitive advantage. The idea of customer value has gained considerable attention since the appearance of electronic transaction systems and e-commerce. The measurements of value in the information system literature focus on perceived value generated from use of new and advanced technology. Han and Han (2001) proposed a framework to analyse and evaluate customer value in the context of Internet business. The framework was established based on two components: value components and value improvement directions Figure 2.2 shows this framework.

	Value Component	
Value Improvement	**Content**	**Context**
Quality Enhancement	(1) Content Quality: Enhancing benefits from the content.	(2) Context Quality: Increasing the benefits de-rived in the process of the transaction.
Cost Reduction	(3) Content Cost: Reducing sacrifices directly required to obtaining the content.	(4) Context Cost: Cost from the process of transaction.
Customisation	(5) Content Customisation: Differentiating the content of the transaction	(6) Context Customisation: Providing personalised transaction environment.

Figure 2.2 The customer value framework

(Source: Han & Han, 2001)

Fiore et al. (2005) investigated the impact of Image Interactivity Technology (IIT) of a web site, tele-presence, and customer value on consumer responses toward the online retailer. Two kinds of value have been used to measure customer value: instrumental value and experiential value. Based on the literature of marketing and information systems, Shun and Yunjie (2006) suggested and tested a three-component customer value model. The model was established in the context of e-commerce. The components of customer value in the model were process value, enjoyment and outcome value. Yang and Jolly (2009) depended on marketing discipline literature to measure consumer-perceived value in the context of mobile data service. Four kinds of customer value were employed in this study: functional, social, monetary and emotional. In another study, Chang et al. (2009) considered perceived value as a moderating factor between customer satisfaction and loyalty. The most important result was that the relationship between satisfaction and loyalty is stronger when the perceived value is high; and tends to be less when the perceived value is low. In the context of ubiquitous business value, Kim et al. (2009) employed three items to gauge customer value, namely, customer satisfaction, customer loyalty and customer repurchasing. Sørum (2012) measured user benefits using five indicators: improved information and services; effective communication; 24 hour accessibility; cost saving; and time saving.

The issue of measuring and enhancing customer value is no longer limited to the marketing field, but has extended to include the information systems arena. Therefore, efforts tend to deal with this issue in order to achieve a core purpose, namely, creating, enhancing and delivering products with a high rate of value to customers via electronic channels.

2.8.3. Organisational Value

Extensive attention has been paid to organisational value by researchers in the organisation theory and information systems field. Many studies have been applied to find suitable measurements to evaluate the value of IS in organisations. Sedera and Tan (2005) presented measurements generated by previous contributions to identify organisational impacts of IT: application portfolio-range and scope of application, the number of critical applications, organisational costs, staff requirements, overall productivity, increased work volume, improved outcomes/outputs (quality of products), business process change, increased market share, increased profits, return on investment, return on assets, the ratio of net income to operating expenses, cost/benefit ratio, stock price, product quality and contributions to achieving goals. Most of the measurements mentioned above were focused on financial criteria and aimed to measure the effects on organisational performance of using IT. Le Roux (2001) presented a concise explanation about information technology benefits based classification of Money, Twite, and Remenyi

(1995). According to this classification, IT benefits can be categorised into five clusters as shown in Table 2.11.

Table 2.11 Categories of IT benefits

Benefit Category	Examples
IT benefits: Regulatory compliance	The objective of information technology is to comply with legal and policy requirements of organisations.
Financial benefits from IT	Improved productivity, reductions in the costs of failure, improved cash flow and reduced bad debts, reduced computer costs, and reduced overhead costs.
Quality of service benefits from IT	Improved response times, improved interface with clients, and improved resource utilisation.
Internal management benefits from IT	Decision making, and improving management productivity.
Benefits from IT infrastructure	Flexibility of IT infrastructure.

Source: (Le Roux, 2001)

Mirani and Lederer (1998) established and tested an instrument to gauge the benefits of information system projects. The study concluded that information systems benefits could be categorised into three clusters: strategic benefits (competitive advantage, alignment and customer relations); information benefits (information access, information quality, information flexibility); and transactional benefits (communication efficiency, system development efficiency, business efficiency). Efforts to assess information technology's impact on organisations continue and these efforts tend to identify the effects of information technology and information systems on business value. Tallon et al. (2000) measured information technology value by adopting a process-oriented approach. The model of the study established that information technology goals can be achieved and that information technology value can be realized via activities within the value chain. Four kinds of information technology goals were adopted in this research: unfocused, operations-focus, market focus, and dual focus. Information technology business value is measured by: customer relations, supplier relations, sales and marketing, production/operations, product/service enhancement, process planning and support. The main finding was that there is a direct relationship between the level of perceived payoffs from information technology and the corporate goals for information technology. Shang and Seddon (2002) conducted an investigation concerning benefits generated by investment in enterprise systems (ES). The analysis was carried out on data from 233 enterprise system vendor-reported stories published on the web, in addition to interviews with 34 managers of organisations that use ES. The benefits of ES were classified into five groups: operational, managerial, strategic, IT infrastructure and organisational. Love and Irani (2004) classified the benefits created by using information technology in construction companies in Australia into three groups: strategic, operational and tactical. Subsequently, a cost-benefit approach was employed to assess information technology investment in organisations. The main result of this study is that ‘while organisations experienced no significant differences in the tactical and operational benefits incurred after the adoption of information technology, differences were found with respect to the strategic benefits’ (2004, p. 224).

Gregor et al. (2007) focused on the transformational benefit but did not ignore the other types of benefits: informational, strategic and transactional. The main result of the research was that transformation is considered a source of business benefit. Furthermore, it is believed to be a crucial component of overall IT business value and closely associated with other types of benefits. Bernroider (2008) assessed ERP value in small-to-medium and large enterprises in Austria. Two separate groups of benefits from using ERP were identified. The first group included enhanced decision making, reduced cycle times, system cost, business process improvement, degree of enabling of desired business processes, increased organisational flexibility and improved innovation capabilities. The second group included financial benefits: revenue impact and profit impact. Benefits of using IT in the health sector has been described by Tzeng et al. (2008) who conducted an applied study about the value produced by employing RFID (Radio Frequency Identification) technology in five hospitals in Taiwan. Value created by using this technology has been divided into two groups. The first group is *refinement* and included effective communication, increased asset utilization and enhanced patient care. The second group is *extension*, which included active patient management, virtual integration of the supply chain, new service strategies and new business opportunities. Kim et al. (2009) measured ubiquitous business value (U-business) by using three subscales: customer value, business value and process value.

Gorla et al. (2010) adopted a new measurement to assess organisational impact. The validity and reliability of this measurement have been tested. The measurement includes five indicators to measure organisational impact: supplier switch/search cost, product/service enhancements, market information support, product cost control and internal organisational efficiency. A study by Thao (2012) confirmed the significant role of ERP systems on organisational agility.

The effect of information technology and information systems on the organisational value has been confirmed by previous studies. The influence of information technology on organisational value is not limited to the tactical or operational levels but also includes the strategic level of organisations. Accordingly, organisations invest substantial funds in the information technology to obtain the benefits of these technologies.

2.8.4. Social (Societal) Benefits

Top management in organisations face crucial concerns in their decision making related to IT investment. The problem is how companies consider the social subsystem when making IT investment decisions (Ryan, Harrison, & Schkade, 2002). Most of the studies conducted to measure IT benefits focused on organisational value, especially on growth, profit and customer value, and ignored the societal benefits. Seddon highlighted this issue and, in focussing on the stakeholders, states that ‘net benefits as perceived by these different types of stakeholders ... organisations include both groups and management. Thus, the four principle types of stakeholders (in whose interests IS effectiveness will be evaluated) are individuals, groups of individuals, management of organisations and society. In general, measures important to one type of stakeholders are less likely to be important to the others’(1997, p. 246). In spite of the importance to society in evaluating the benefits of information technology, there is still a lack of research dealing with this group of stakeholders.

Through careful consideration of studies conducted to identify information technology benefits it will be noticed that measures are focused on a specific group of stakeholders. For instance, Mirani and Lederer (1998) studied users inside organisations, Shang and Seddon (2002) studied business managers’ perspectives; Jiang et al. (2002) studied IS staff and IS users; Ryan et al. (2002) studied decision-makers in organisations and Kettinger et al. (2009) studied MBA students who were registered users of the college's computing services. According to what is mentioned above, there is a shortfall in measures that evaluate information systems benefits through views of multiple stakeholders.

In order to obtain a comprehensive measure to evaluate the benefits of e-learning system success, reviews have been conducted on previous contributions dealing with performance evaluation and effectiveness issues in higher education institutions. Cameron has been conducting research about this issue in higher education since 1978. The main contribution of Cameron is a measure to assess organisational effectiveness in higher education institutions (1978;1981;1986). This measure includes nine dimensions, which fall into three domains. Table 2.12 shows these dimensions.

Table 2.12 Dimensions of organisational effectiveness in higher education institutions

Domain	Dimensions
Morale Domain	Student educational satisfaction/Faculty and administrator employment satisfaction /Organisational health
Academic Domain	Student academic development/Professional development and quality of the faculty /Student personal development
External Adaptation	Student career development/System openness and community interaction/Ability to acquire resources

Source: (Cameron, 1981)

This measure is believed to be a comprehensive and valid instrument. Most stakeholders have been taken into account in the measurement such as students, top management, faculty staff, and community.

Some prior studies have investigated the benefits of e-learning systems. Holsapple and Lee-Post (2006) divided e-learning system’s outcomes into two groups: positive aspects (enhanced learning, empowerment, time savings and academic success); and negative aspects (lack of contact, isolation, quality concerns and technology dependence). Wang et al. (2007) employed Mirani and Lederer’s (1998) scale to measure the benefits of an e-learning system in an organisational context. Analytical results of the empirical study confirmed that their scale is valid and reliable in assessing success of e-learning systems. Lin (2007) adopted DeLone and McLean’s (2003) model to measure online systems success. The net benefit construct has been replaced by actual online learning system use. Three items have been employed to measure actual use: focus on a sense of accomplishment, status among peers and chances to obtain rewards. Academic performance has been used by Lee and Lee (2008) to measure the benefits of e-learning systems. Liaw (2008a) used three indicators to evaluate e-learning effectiveness: learning efficiency; learning performance; and learning motivation. Three types of value have been used by Chiu and Wang (2008) to measure the benefits of web-based learning: attainment value, utility value and intrinsic value (playfulness). Johnson et al. (2008) employed three indicators to assess e-learning effectiveness: course instrumentality, course performance and course satisfaction. Yu et al. (2010) examined the impacts of online social networking on learning outcomes. Self-esteem, satisfaction with university life, and performance proficiency were used to measure learning outcomes. Some studies focused on the impact of e-learning systems on non-educational organisations that adopted this type of system. For instance, Liu (2012) found that implementing e-learning systems could improve organisational benefits via enhancing customer trust, organisational reputation, customer services, and market valuation. Chen (2012 established that e-learning system can enhance the individual benefits of employees via supporting task performance.

In the context of e-learning systems, the measurement of value remains limited to a specific group of stakeholders. Most of the studies dealing with this issue have focused on e-learning system value from a student's point of view. However, the opinions of other stakeholders concerning e-learning system value, such as academic staff and ICT staff, are considered to be the main pillars in evaluating the success of these systems (Ozkan & Koseler, 2009).

In summary, measuring the value of information technology and information systems encompasses a large body of research in this arena. Enormous efforts have been exerted in investigating convenient measures to assess the value of information technology. The outcomes of these efforts can be classified into four categories: customer value (internal), customer value (external), organisational value and societal value. Also, in the e-learning field measures have emerged through contributions of researchers in this arena. However, most of these measures focus on a single group of stakeholders and ignore the points of view of others.

2.9. Information systems success approaches

Success of information systems is believed to be the central issue in the information systems field. Because of considerable investment and effort on information technology and information systems projects, the evaluation of their success has become a critical issue. Therefore, substantial research has been performed and considerable attention paid to this issue. A large number of studies have been conducted to investigate the factors that lead to the success of information systems.

The diversity in approaches of researchers has led to the development of different methodologies and models to measure information system success. The contributions to measuring information system success can be classified in four approaches: Technology Acceptance Model (TAM); user satisfaction approach; user involvement approach; and DeLone and McLean approach. Each of these approaches is now discussed.

2.9.1. Technology Acceptance Model (TAM) approach

The Technology Acceptance Model (TAM) is considered to be one of the most important contributions in the information systems arena. 'TAM continues to be the most widely applied theoretical model in the IS field' (Lee, Kozar, & Larsen, 2003, p. 752). Davis (1986) introduced TAM, which was established based on the Theory of Reasoned Action (TRA) developed by Ajzen and Fishbein (1969).

Figure 2.3 depicts the TRA.

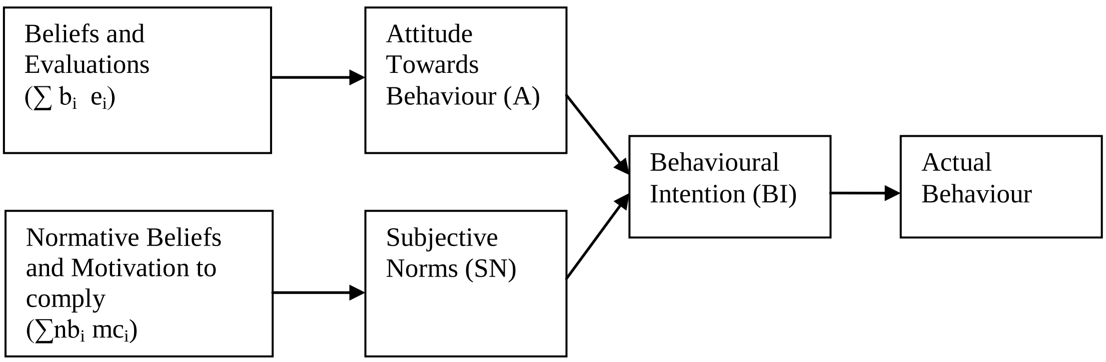


Figure 2.3 Theory of Reasoned Action

(Source: Davis (1986))

The focus of TRA is to identify the determinants of consciously intended behaviour (Davis et al., 1989). According to TRA, actual behaviour is believed to be the outcome of the effects of two categories of significant beliefs: behavioural and normative (Sagar, 2006). Based on TRA, Davis (1986) introduced the TAM. The goal of TAM is to explain the determinants of computer acceptance incorporating user behaviour across a broad range of technologies and populations, while at the same time being both 'parsimonious and theoretically justified' (Davis et al., 1989, p. 985). The main use of TAM is to measure success of information systems through uptake and acceptance of these systems (Smart, 2009). TAM can be categorised under the theories of Social Psychology (El-Kordy, 2000). Figure 2.4 depicts TAM.

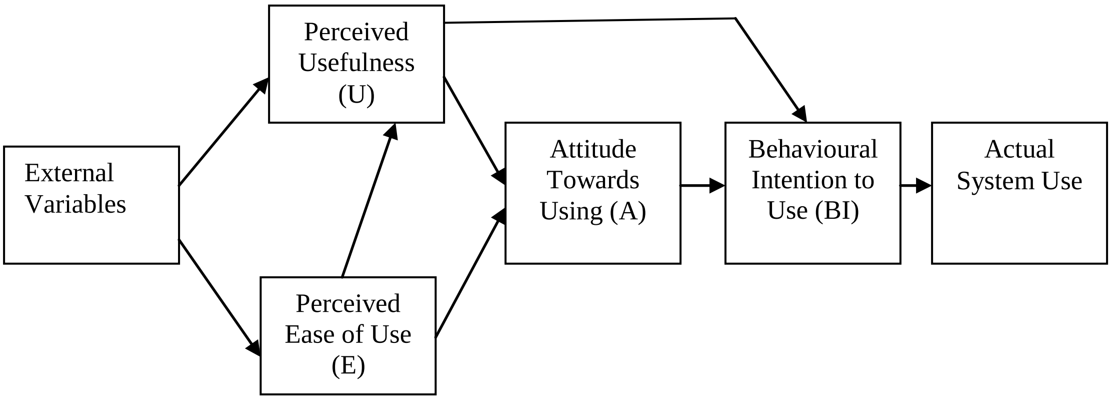


Figure 2.4 Technology Acceptance Model (TAM)

(Source: Davis (1989))

Many studies have been conducted to investigate the reliability and validity of TAM. Davis (1989) tested the validity of perceived usefulness and ease of use. The empirical test concluded that the reliability of usefulness and ease of use items were extremely high (Cronbach's alpha .98 and .94 respectively). Both constructs significantly correlated with usage behaviour. Davis et al. (1989) conducted another study to compare TAM and TRA. The main purpose of this comparison was to study the ability of each model in predicting and explaining the use of a specific system (Word-processing application). Data was collected at two points in time: after one hour of using the system and after a 14-week period. In regard to TAM, the empirical study of the first period showed that perceived usefulness and ease of use affected behavioural intention. The effect of perceived usefulness was the strongest. Data analysis of the second period concluded that perceived usefulness was the main determinant of behavioural intention. However, ease of use had an indirect effect on intention through usefulness and the direct effect was non-significant.

Adams et al. (1992) replicated previous studies conducted by Davis (1989) and Davis et al. (1989) with a focus on three constructs of TAM: perceived usefulness, ease of use and information technology usage. Two empirical studies were conducted by Adams et al. (1992), the first of which dealt with voice and electronic mail and the second one included WordPerfect, Lotus 1-2-3, and Harvard Graphics. The results from the first study confirmed the convergent validity and discriminate validity of both scales (perceived usefulness and ease of use). The results of the second study highlighted that perceived usefulness is a fundamental determinant of system usage. The analysis confirmed that usefulness and ease of use were central indicators of system usage.

Hendrickson et al. (1993) directed a criticism at the study of Adams et al. (1992). The criticism is that 'The test-retest reliability of the scales was not reported'(Hendrickson et al., 1993, p. 228). Thus, test-retest reliability was conducted based on the data collected from two samples of 51 students using a spreadsheet package and of 72 students using a database management package. This study found that Davis's (1989) scales have a high level of test-retest reliability.

The data of Adams et al.'s (1992) study was reused and tested using the Confirmatory Factor Analysis (CFA) approach by Segars and Grover (1993). The result of CFA showed that the model with two factors is not sufficient to explain the relationship between 'job performance and effectiveness'. Accordingly, a new factor, 'effectiveness' has been added to the model. Two indicators were eliminated due to low reliability: work more quickly, and clarity and understandability. Based on the results above, the study suggested the Three-factor model that includes usefulness (make job easier, useful and increase productivity); effectiveness (effectiveness and job performance); and ease of use (easy to use, easy to learn and easy to become skillful).

These results have been criticized by Chin and Todd (1995). These criticisms focused on two issues. The first issue is related to exploratory procedures in the conduct of the study. The second issue is that the substantive reasoning to generate effectiveness as a new construct from usefulness is absent. Adams et al.'s (1992) data were used in this study, as well as data collected from a single organisation using voice mail. The empirical study found that the instrument of usefulness has reasonable psychometric aspects. In addition, there is no empirical evidence to support the separation of perceived usefulness into two factors.

Taylor and Todd (1995) pointed out two important issues related to empirical tests of TAM. The first issue is related to the ability of TAM to predict the behaviour of inexperienced users. The second and important issue is 'Whether the determinants of IT usage are the same for experienced and inexperienced users of a system' (Taylor

& Todd, 1995, p. 561). An empirical investigation has been conducted to address the two issues aforementioned. The samples were 430 experienced and 356 inexperienced users of a student computing information resources center. Two constructs added to TAM in this study were social influence and behavioural control. The empirical study found that the extended TAM is an adequate model to predict information technology usage for both types of users: experienced and inexperienced.

Szajna (1996) employed self-report usage as an objective indicator of technology acceptance. An empirical longitudinal study was conducted on users of an electronic mail system in two periods: pre-implementation (intention to use the system) and post-implementation (usage of a system 15 weeks later). The study confirmed that TAM is a worthy tool to explain the behavioural intention to use information systems. Another finding is that self-reporting may not be a suitable indicator for actual system use. Ongoing testing and developing of TAM by researchers in the information system field has continued. Taylor and Todd (1995) tested three models to identify the best model to understand information technology usage: TAM, Theory of Planned Behaviour (TPB) and a third model generated by decomposing the belief structure in the TPB. The findings of empirical examination confirmed that the ability of three models in explaining behaviour were roughly alike. Dishaw and Strong (1999) extended TAM through adding Task-Technology Fit (TTF) model. The empirical test was conducted on three models: TAM, TTF and the integrated model. This study found that the explanation provided by the integrated model is superior to the explanation offered by other two models (TAM, TTF).

Many studies tested the validity and reliability of TAM with a wide range of systems and extended it through adding various constructs from different theories. An important contribution to extend TAM was introduced by Venkatesh and Davis (2000) and called TAM2.

TAM2 incorporated additional theoretical constructs: social influence processes (subjective norm, voluntariness and image) and cognitive instrumental processes (job relevance, output quality, result demonstrability and perceived ease of use). Figure 2.5 depicts TAM2.

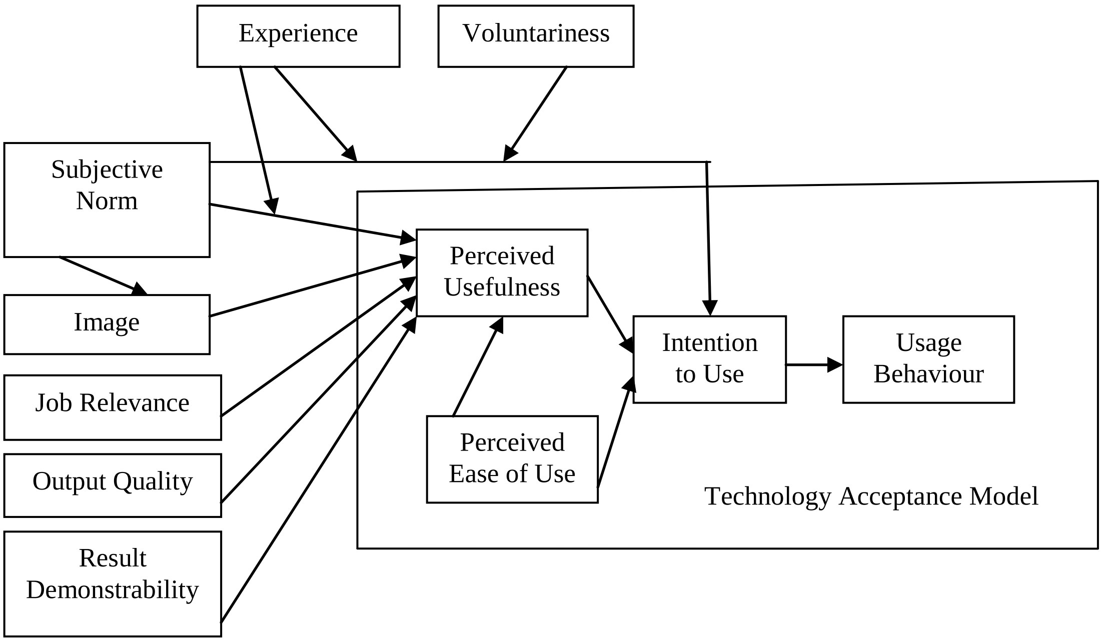


Figure 2.5 Technology Acceptance Model (TAM2)

(Source: Venkatesh & Davis (2000))

To test this model, data was collected from four organisations using four different systems. The usage of two systems was voluntary and the other two mandatory. TAM2 has been tested three times: pre-implementation, one month post-implementation and three months post implementation. The empirical tests showed that the two new constructs significantly affected user acceptance. Overall, TAM2 received considerable support through four studies and three points of measurement.

Venkatesh et al. (2003) proposed and tested a unified model to explain and understand use behaviour. This unified model was based on a review of eight prominent models: the theory of reasoned action, TAM, the motivational model, the theory of planned behaviour, a model combining the technology acceptance model and the theory of planned behaviour, the model of PC utilisation, the innovation diffusion theory and the social cognitive theory. Figure 2.6 shows the Unified Theory of Acceptance and Use of Technology (UTAUT).

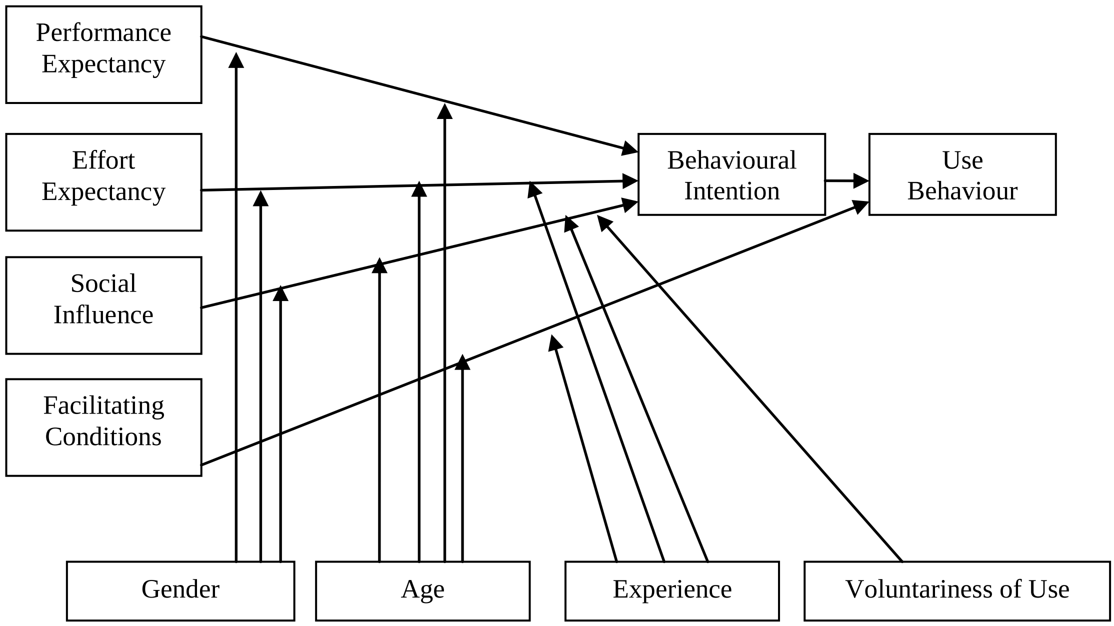


Figure 2.6 Unified Theory of Acceptance and Use of Technology (UTAUT)

(Source: Venkatesh et al. (2003))

Four organisations using four dissimilar systems were selected as a sample to run the study model. The authors considered the nature of system usage. Two of those systems were mandatory and the other two systems were voluntary. The first stage of the empirical study involved the preparation of a questionnaire including items to measure the eight models. Then, surveys were conducted at three different points in time: post-training, one month after the implementation and three months after implementation. The percentage of explanation of the eight models was between 17 percent and 53 percent of the variance in behaviour intention to use information technology. The same data has been used to test the UTAUT, with new data collected from two additional organisations. The results supported UTAUT strongly and 70 percent of the variance in usage intention was explained by UTAUT.

Based on the literature of user satisfaction and technology, Wixom and Todd (2005) suggested and tested a new model. The main purpose of this study was to build a model linking user satisfaction and technology acceptance literature. The key elements of the model are object-based beliefs, object-based attitudes, behavioural beliefs and attitude. Figure 2.7 shows the model.

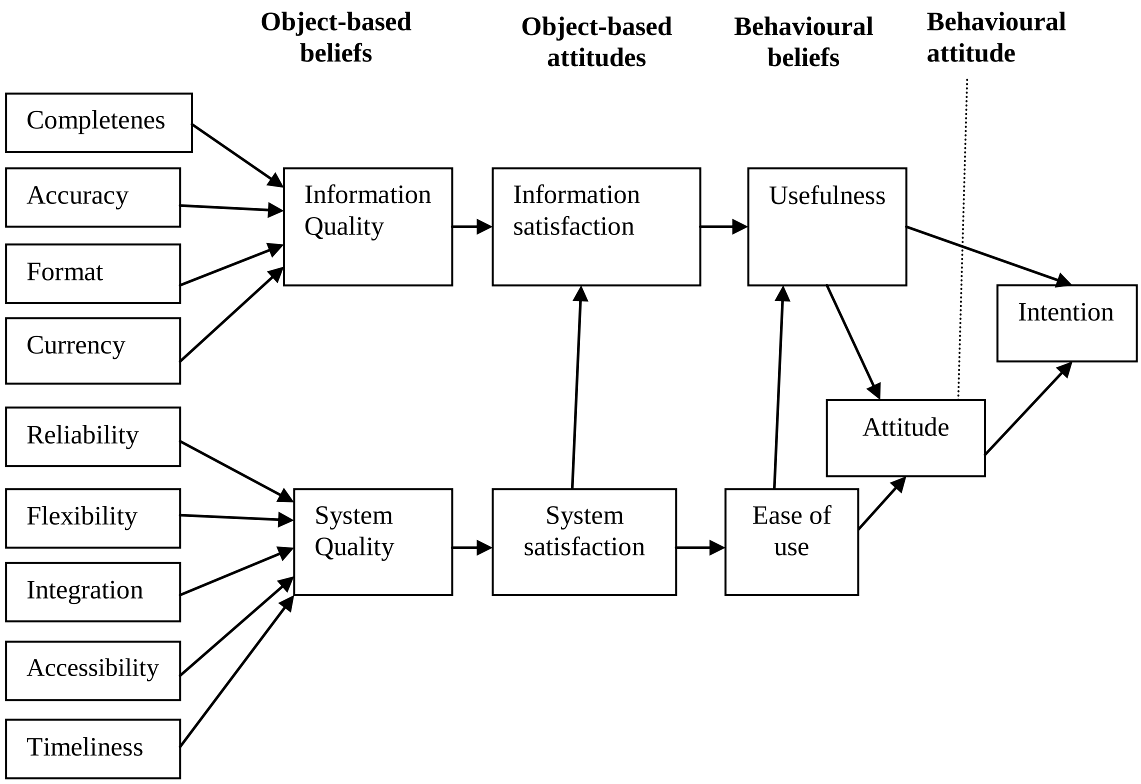


Figure 2.7 Integrated model of user satisfaction and technology acceptance

(Source: Wixom & Todd (2005))

The study was conducted on seven organisations that were using a data warehouse. The findings strongly supported the model and provided empirical evidence about the integration between the user satisfaction and technology acceptance perspectives.

Extensions on the TAM continued. Venkatesh and Bala argued an essential issue relates to ‘how managers make informed decisions about interventions that can lead to greater acceptance and effective utilization of IT’ (2008, p. 273). To address this issue, an integrated model was proposed, namely TAM3. The model, established based on the literature of TAM, especially deals with determinates of perceived usefulness and ease of use. Figure 2. 8 depicts the TAM3.

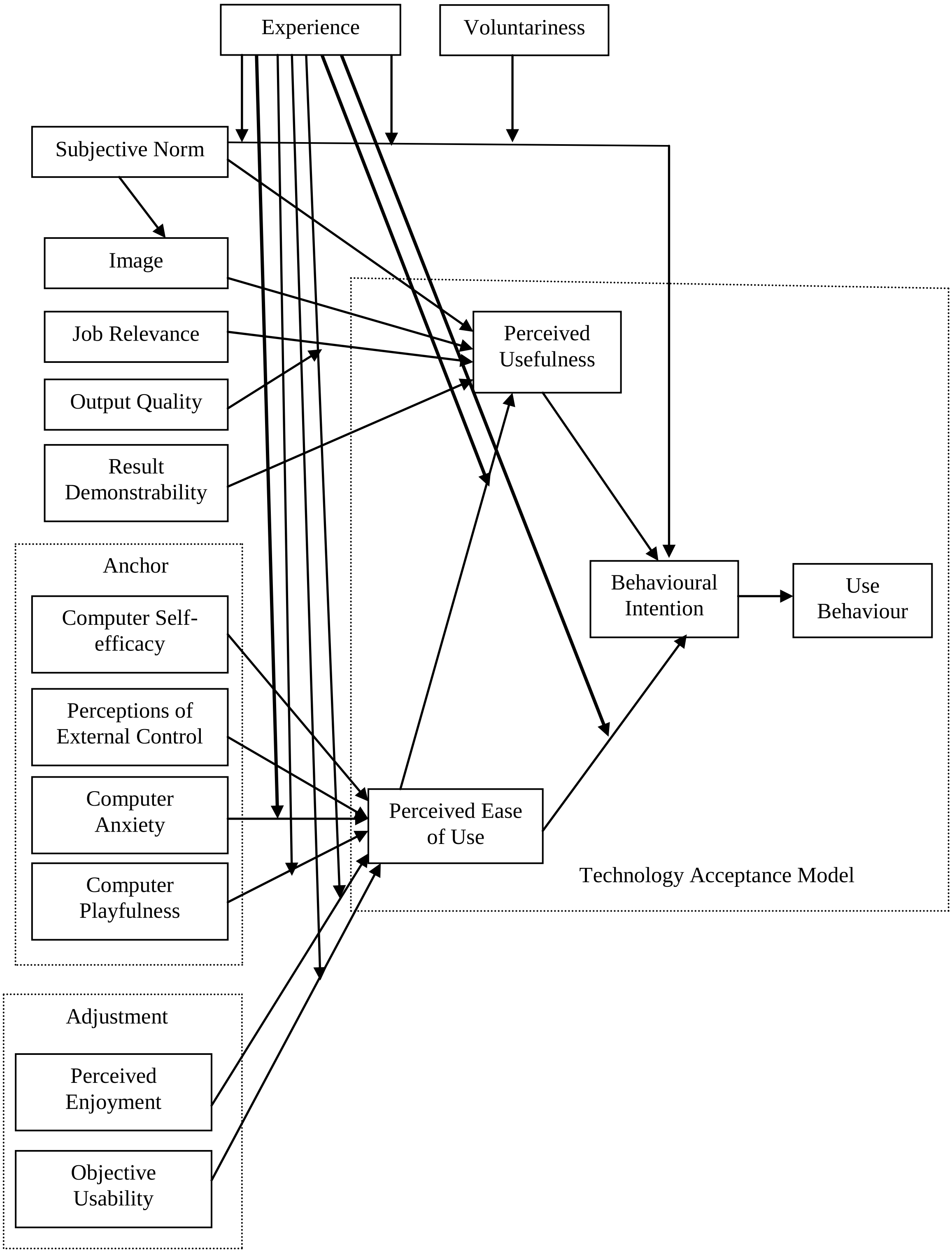


Figure 2. 8 Technology Acceptance Model 3 (TAM3)

(Source: Venkatesh & Bala (2008))

Adopting and using information technology at the individual level is the major objective of this contribution. The study was conducted on four organisations implementing new information technologies. Data was collected through four time periods of measurement within five months. The results highlighted that four constructs were considered the main predictors of perceived usefulness: perceived ease of use, subjective norm, image and result demonstrability.

Overall, TAM3 can assist managers to make the decisions about implementation of information technology in their organisations and support adoption and use of information technology by employees.

The updated contribution to understand factors affecting the user behaviour of information technology was presented by Venkatesh et al. (2012) and named UTAUT 2. This model is the extended version of UTAUT. Figure 2.9 depicts UTAUT 2.

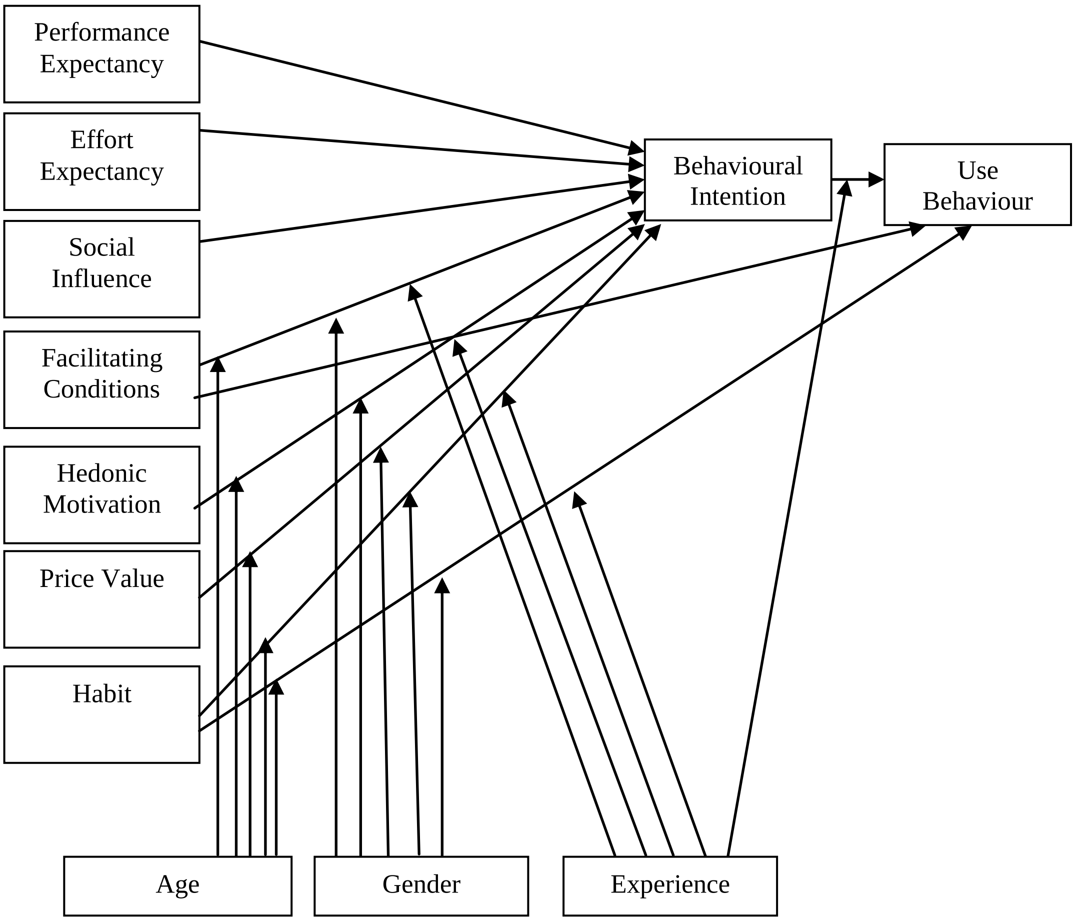


Figure 2.9 Unified Theory of Acceptance and Use of Technology (UTAUT 2)

(Source: Venkatesh et al. (2012))

Three new constructs were added to create the UTAUT 2: hedonic motivation; price value; and habit. This model was empirically examined with mobile Internet consumers. The results show that the suggested extensions in UTAUT 2 produced considerable improvement in attempts to explain behavioural intention compared to UTAUT.

The TAM received substantial attention in terms of electronic applications. Most of the studies focused on the core issue of understanding and explaining the intention to use the electronic channels by customers.

Lederer et al. (2000) studied the TAM in the context of the World Wide Web (WWW). One of the most important purposes of the study was to identify the factors of antecedent ease of use and antecedent usefulness. The factor analysis results concluded that the factors of antecedent ease of use were ease of understanding, ease of finding, and information focus. The factors that determined antecedent usefulness were information for support activities, information quality, information for primary activities, information for management, and information for research and development. Furthermore, the study found that acceptance and use of the web sites by users depend on the constructs of usefulness and ease of use of the sites.

Significant efforts have been made to investigate the electronic application in the context of TAM, for instance, E-collaboration technology (Dasgupta, Granger, & McGarry, 2002); enticing online consumers (Chen, Gillenson, & Sherrell, 2002); (Olivera & Joia, 2005); Internet banking (Lai & Li, 2005); Internet usage (Porter & Donthu, 2006); online retailing of financial services (McKechnie, Winklhofer, & Ennew, 2006); taxpayer intentions (Fu, Farn, & Chao, 2006); online apparel shopping (Kim & Forsythe, 2008); Internet banking behaviour (Yousafzai, Foxall, & Pallister, 2010); e-government (Lin, Fofanah, & Liang, 2011); Jaradat, 2013); electronic transactions (Al-Gahtani, 2011); e-payments (Ifinedo, 2012; Tella, 2012); and social networking (Shittu, 2013).

Considerable attention has been paid to TAM. The validity and reliability of this contribution has been tested and many studies conclude that TAM is valid and reliable to measure the acceptance of technology. The development of TAM is ongoing. The main contribution in developing TAM came from Venkatesh and Davis (2000) through the introduction of TAM2. Another important contribution by

Venkatesh and Bala (2008) was establishing TAM3. TAM has been used widely to identify factors affecting acceptance of new systems and technologies such as e-commerce, e-government, e-health, e-learning and e-banking.

2.9.2. User satisfaction approach

User satisfaction is considered one of the most important factors in assessing success of information systems (Sedera & Tan, 2005). Since the 1980s, user satisfaction has received considerable attention as a measure of information system success. Bailey and Pearson (1983) are believed to be the earliest researchers who used user satisfaction to measure information systems success. Bailey and Pearson state that 'If a formal information system exists, its success at meeting those needs either reinforces or frustrates the user's sense of satisfaction with that source' (1983, p. 530). Ives et al. (1983) also adopted user information satisfaction (UIS) to evaluate information systems success. UIS is considered an essential measure to evaluate the success of information systems. Ives et al. state that 'UIS is a perceptual or subjective measure of system success; it serves as a substitute for objective determinants of information system effectiveness which are frequently not available' (1983, p. 785).

The contribution to the body of knowledge of user satisfaction still continues. It is used as an essential construct in the models that deal with the issue of information system success. This approach has received considerable support for measurement of information success by researchers in the information system discipline such as Doll and Torkzadeh (1988), Melone (1990), Gelderman (1998) and Wang and Liao (2007). This approach was covered in section 2.7.

2.9.3. User involvement approach

User involvement is deemed to be an important factor in the information systems literature. Thus, considerable efforts have been exerted to investigate the impacts of this factor. The importance of this factor appears in the organisational and users' activities. In this regard, Robey and Farrow state that 'expected benefits include:

- More accurate assessment of user information requirements
- Prevention of costly system features that are unacceptable to user
- Greater user acceptance and support of the system
- Improve user understanding of the system, and

- Granting of democratic rights of organisation members' (1982, p. 73).

User involvement may improve the quality of decision making, develop the skills of end-users, improve the abilities of users to identify the required information and increase user acceptance of the systems and users' commitment to the resultant application (Doll & Torkzadeh, 1989).

Most studies have focused on the main issue of the role of user involvement in the success of information systems. Considerable attention has been paid to this issue and the research can be classified into three directions: user involvement in information systems success; user involvement in information systems development; and user involvement in the electronic applications of information systems.

2.9.3.1. User involvement in the information systems success

This direction has been adopted commonly in the information systems literature. The success of information systems is believed to be an essential issue faced by organisations. Therefore, many studies focused on determining the factors affecting the success of information systems. Since the 1980s, user involvement has been adopted as a critical factor impacting the success of information systems. However, many studies have pointed to issues of employing user involvement in measuring the success of information systems. In this context, Ives and Olson state that 'determining when and how much, or even if, user involvement is appropriate are questions that have received inadequate research attention' (1984, p. 586).

Based on this claim, Ives and Olson (1984) reviewed 22 studies which dealt with user involvement and information systems success. These studies considered three types of information systems: multiple systems across organisations, single systems and experimental systems. In addition, four measures were adopted in these studies to assess the success of information systems: system quality, system usage, user behaviour/attitude and information satisfaction. The outcome of reviewing these studies regarding the relationship between user involvement and information system success concluded that seven studies showed positive relationships, seven studies showed mixed relationships and the final seven presented negative or non-significant relationships. Based on these results, Ives and Olson conclude that 'The benefits of user involvement have not been strongly demonstrated ... No significant results may often be a result of poor instruments or lack of control over the research setting' (1984, p. 600).

Baronas and Louis (1988) investigated the role of user involvement in system acceptance. The focus of this study was on restoring perceived control during system implementation. The study suggested that user involvement would enhance the user's sense of control and that would increase the satisfaction of users with new systems. The empirical study found that the satisfaction of the treatment group with the new system was significantly higher than satisfaction of control group members. In addition, users' perceptions of the interaction with implementers of the system were positive.

Doll and Torkzadeh (1989) proposed a model of end-user involvement. The model was established based on the discrepancy concept of participation presented by Alutto and Belasco (1972). Three main constructs were considered in the model: perceived involvement, design involvement and user satisfaction. The contingency approach has been adopted to formulate the relationships between the constructs. The model has been tested empirically and the results provided support for the contingency model. Doll and Torkzadeh suggested that 'The discrepancy model might have implications for user involvement in the broader system development life cycle context' (1989, p. 1169).

Saarinen & Sääksjärvi (1990) argue that the participation of system analysts should be considered in evaluating the success of information systems. Another argument that has been offered is that the quality of participation, not the quantity, is of critical importance. To investigate these assumptions, Saarinen and Sääksjärvi (1990) conducted an empirical study. The study found that the skills of systems analysts, involvement and adequacy of participation are important factors in the success of information systems. Furthermore, the quality of participation impacted the success of information systems and the quantity had no significant effect on the systems success. Many studies have been conducted to identify the role of this construct in the success of information systems. Table 2.13 lists some of these studies.

Table 2.13 Studies investigating the role of user involvement in the success of information systems

Author/s	The main issue of study	User involvement dimensions	Information system success measures	Main findings
Kappelman & McLean (1991)	Redefine the participation concept and investigate the role of participation and user involvement in the success of information systems implementation.	1. User participation: Questionnaire with 13 items. 2. User involvement: Questionnaire with 14 items.	User satisfaction	1. User involvement is distinct from user participation. 2. To understand information system success, user involvement can be more important than user participation.
Guimaraes & Igbaria (1997)	The effect of the human aspects on the success of client/server system.	Nine activities of user involvement have been adopted to measure this construct.	End-user satisfaction, the system usage, and the impacts on the end-users' jobs.	End-user involvement is an important factor in the success of client/server system success.
Blili et al. (1998)	The effect of end-user involvement on the success end-user computing.	Importance of end-user computing, perceived risk, degree of pleasure and sign value.	User satisfaction and the impacts of end-user computing.	The perceived importance of user attitude to end-user computing had significantly affected the success of end-user computing.
Palanisamy (2001b)	The relationship between user involvement in the information systems planning and the strategic success of information systems.	1. User involvement in strategic planning of information system. 2. User involvement in information requirements analysis and architecture.	1. Information enablement for organisational change. 2. Information enablement for competitive advantages. 3. Information enablement for organisational learning.	The results showed that user involvement significantly affected information enablement for organisational change and for learning. However, the relationship between user involvement and Information enablement for competitive advantages was non-significant.
Palanisamy (2001a)	The relationships between user involvement, information waste, and management information system success.	1. User involvement in management information system prioritization 2. User involvement in management information system design	User satisfaction	User satisfaction associated positively with user involvement.

McGill & Klobas (2008)	The effects of user involvement on user developed application success.	3. The perceived importance 4. Personal relevance of a system	1. User satisfaction 2. Individual impact 3. Perceived individual impact The study hypothesised that user involvement positively affects user satisfaction and perceived system quality.	1. The model has been tested with two groups: participation in development, and non-participation in development. The results showed that: 2. Involvement affected positively user satisfaction in the non-participation group. However, same relationship was non-significant in the participation group. 3. Involvement influenced positively perceived system quality in both groups.
Gefen and Reychav (2010)	The role of user involvement in motivate the users to continue using the information systems voluntarily	Perceived user benefits from learning the knowledge management system	Users continued using Knowledge management system	User involvement through learning is an important mediator factor between trust and continued use of knowledge management system.
Kale et al. (2010)	Evaluation ERP performance	Single item	1. Tangible benefits of ERP 2. Intangible benefits of ERP	The study found that top management support, and user involvement and participation were the main factors affect the success of ERP system.
Ghobakhloo et al. (2011)	Information technology implementation success	CEO involvement Employees' involvement	Organisational impacts which are mediated by user satisfaction and IT usage.	The main finding of study is that organisational impacts affected indirectly by CEO involvement and employees' involvement via user satisfaction and IT usage.

Many other studies have been conducted to examine the role of user involvement in information systems success, for instance, Choe (1996), Hunton (1996), Foster and Franz (1999), Santhanam et al. (2000), Lynch and Gregor (2004), Pries-Heje (2008), Jamshidian (2012) and Shiau (2012).

The main focus of the studies above is the investigation of user involvement influence on information systems success. Most of the studies in this regard found that user involvement plays an essential role in the success of information systems through the impacts of these systems in enhancing user satisfaction, IT usage, employees' performance and organisational performance.

2.9.3.2. User involvement in information systems development

Significant attention has been paid to the processes of information systems development. The main focus of researchers in the information systems and management field is to identify the factors that affect successful systems development. Furthermore, efforts of researchers have taken another direction that is to investigate the factors that lead to failure of information systems. In this regard, Robey et al. (1989) claimed that 'Expensive system failures have been attributed to behavioural and organisational factors; prescriptions for user involvement in system development have been offered' (p. 1172). Many studies have been conducted to identify the factors that impact the success of the information systems development process. User involvement has been studied as an important factor in the development process. Therefore, considerable efforts have been exerted to identify the role of the user involvement construct and its effect in developing information systems. Foster and Franz (1999) argued that user involvement affects users' attitudes toward information systems applications through increased user satisfaction and perceived usefulness. Foster and Franz (1999) pointed to the importance of user involvement in systems development, especially in the development stages.

Robey and Farrow (1982) proposed a model for explaining the role of user involvement in information systems development. The model includes four constructs: participation, influence, conflict and conflict resolution. Three stages of system development were adopted in the study: initiation, design and implementation. The main finding of this study is that user participation determined the influence, and the latter leads to conflict and conflict resolution. This result has been concluded based on the total effects among the factors in the model. Another essential result came from the indirect effect between the model constructs. In this regard, Robey and Farrow state that 'participation without influence, however, does not lead to successful conflict resolution in any of three development stages' (1982, p. 73).

Robey et al. (1989) tested the conflict model for user involvement by focusing on assessing the group process during the development of information systems. The study concluded that participation positively impacted influence and the latter positively affected conflict and conflict resolution in the five periods of study.

Robey et al. (1993) extended the model to include a new construct, namely, project success. An empirical study was conducted in 17 system development projects in three organisations. The result supported the model and the relationships between the constructs. The relationship between conflict resolution and project success was positive and strong. The participation construct modestly affected project success.

Kujala (2008) focused on an early user-involvement process and its role in analysing user needs and identifying the input to product development. The empirical investigation of seven case studies showed that the process of early user involvement supported the analysis of user needs. In addition, the role of user involvement is not limited to identifying user needs, but also can be employed to increase the understanding of user value.

The role of user involvement is no longer limited to enhancing the success and development of information systems, but has been extended to solve the problems that are confronting information technology users. Based on this direction, Tarafdar et al. (2010) studied the negative impacts of techno stress on users' performance at work, and mechanisms that can be used to reduce the effect of techno stress. The study model focuses on the role of user involvement in ICT development and support mechanisms for innovation in reducing techno stress. The main finding of the empirical study is that user involvement plays a critical role in reducing techno stress.

The review above presents some evidence about the role of user involvement in achieving successful information system development. This construct has been tested as a supportive factor in solving the problems generated from using information technology.

2.9.3.3. User involvement in the web-based systems

The revolution of the Internet has led to the appearance of new applications of information systems. These applications depend on electronic channels to provide customers with services. Thus, most organisations adopt these applications to receive the expected advantages from using electronic channels. E-commerce is considered to be the most commonly-used electronic application. The main benefits of e-commerce are that customers can collect information about products and services easily, it enables customers to negotiate with suppliers, and it provides communication links to order products and online post-sale services (Archer & Yuan, 2000). Furthermore, electronic applications enable organisations to reduce operation costs, raise market share and increase the organisation's ability to form business relationships with well-known and larger organisations (Terry & Standing, 2001). Therefore, considerable attention has been paid to the investigation of the user involvement impacts in the electronic applications in different sectors, including e-health, e-learning, e-commerce and e-banking.

Grange & Scott (2010) investigated the influence of poor end user involvement on electronic document management system (EDMS) implementation. The empirical study concluded that there is a relationship between success of EDMS and user involvement during the implementation stage of EDMS.

Table 2.14 details some studies that dealt with user involvement and electronic applications.

Table 2.14 Studies that investigated the role of user involvement in electronic systems

Author/s	Field	Sample	Main finding
Terry & Standing (2001)	E-commerce	Five case studies	Organisations are still paying little attention to engage users in the development activities of e-commerce site.
Terry & Standing (2004)	E-commerce	Three case studies	Organisations focused on the internal users more than external customers in the systems design.
Yue (2008)	E-commerce	Case study	The role of user involvement is varied during the e-commerce application life cycle.
Terry (2008)	E-commerce	44 project leaders	Customers are participating in the activities of development; however, the influence on the site design is weak.
Sarkar (2009)	E-commerce	Four case studies	User involvement is a crucial factor in implementing successfully the e-commerce system and reducing user resistance to changes.
Liao Cheung (2002)	E-banking	323 e-banking users	User involvement affected willingness to use e-banking. In addition, an expectation of user involvement was one of the most important quality attributes in the perceived usefulness of e-banking.
Floh & Treiblmaier (2006)	E-banking	2075 customers of an Austrian online bank	The role of user involvement as a moderating factor leads to higher perceptions of web site quality and service quality. People with low involvement are less loyal to the online bank than highly involved people.

Merisalo-Rantanen et al. (2009)	E-banking	Case study	User involvement and user satisfaction affected by the feedback and initiative management process.
Klobas & McGill (2010)	E-learning	244Austrialian students	User involvement is a critical factor in the success of learning management system.
Oosteveen and Besselaar (2004)	E-government	Two e-government projects	Traditional methods for user involvement are not valid to use in procedures to develop the large-scale e-government.
Følstad et al. (2004)	E-government	16 project leaders	Leaders of e-government project are paying attention to user involvement. However, the procedures of user involvement depend on the participation practice of industrial democracy rather than the methods advocated in the deployment of Human Computer interaction (HCI)
Holgersson et al. (2010)	E-government	Theory	There are four challenges confronting user to involve in developing e-government: identify the segment target of user, the difficulty to identify the individual user within each segment, getting user for participating, and shortfalls in adequate skills.
Doong (2011)	E-government	56 mangers of departments in government	The involvement managers positively correlated with their intention to purchase e-government software more than the innovativeness managers.

In summary, the review of the literature above was based on three main directions. The first direction dealt with studies aimed at investigating the role of user involvement in the success of information systems. Most of these studies support the positive role of user involvement in the success of information systems. The second direction focused on the role of user involvement in the processes of information systems development. Studies in this direction provided evidence of the importance of user involvement in developing information systems successfully and in reducing the negative impacts of using information technology. The third direction is believed to be the newest one. This direction appeared as a result of the Internet revolution and the new electronic applications of information systems. The influence of user involvement on electronic applications has been studied in different sectors including e-commerce, e-learning, e-health, e-banking and digital library.

2.9.4. DeLone and McLean approach

There have been many attempts to measure information systems success. The DeLone and McLean model (2003; 1992) is believed to be the most commonly used one. This model was based on a review of 180 articles. After analysing the variables in these articles the outcomes were classified within six dimensions of information system success. The model describes the relationships among the constructs and how each is related to each other (Pérez-Mira, 2010). These constructs and the relationships among them are shown in Figure 2.10.

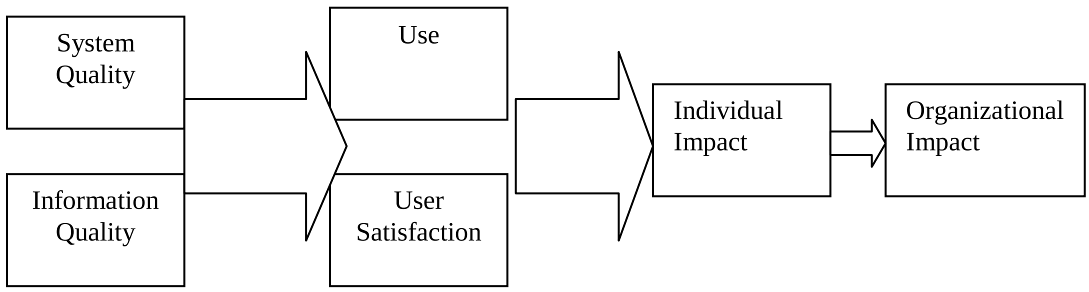


Figure 2.10 DeLone and McLean model of information system success
(Source: DeLone & McLean (1992))

This model is deemed to be a comprehensive model because it does not depend on a single construct; also it is an attempt to create an integrated framework to measure information systems success. Many studies have been conducted to test the validity of this model. Seddon and Kiew (1994) examined the relationships among the four constructs of DeLone and McLean's model: system quality, information quality, usefulness and user satisfaction. The model tested by Seddon and Kiew has three differences:

1. The use construct in DeLone and McLean's model has been replaced by usefulness.
2. A new variable, user involvement, has been added to the DeLone and McLean model to help explain variations in user perceptions of usefulness and user satisfaction.
3. The simultaneous causality between Use and User satisfaction in DeLone and McLean's model has been replaced by one-way causality (1994, p. 99).

The empirical test provided considerable support for the DeLone and McLean model. Information quality, system quality and usefulness explained 72 percent of the variance in user satisfaction. 54 percent of the variance in usefulness was explained by the three constructs above and user involvement as well. However, the role of user involvement as a predictor factor of user satisfaction was non-significant. In 1997, Seddon introduced another contribution related to DeLone and McLean's model. Seddon (1997) directed some criticisms at DeLone and McLean's model. The first criticism is the combination of variance and process models in one model. In this regard Seddon states that 'It is not possible to adopt a variance model interpretation of one part of a box-and-arrow diagram and a process model interpretation of another part' (1997, p. 242).

The second criticism was about the different meanings of the 'IS Use' construct. The final criticism related to the category meanings of this model. Seddon (1997) argues that the DeLone and McLean model is a combination of three different models: a variance model of information system success, a variance model of information system use as a behaviour, and a process model of information system success. To address the aforementioned problems, Seddon (1997) reformulated DeLone and McLean's model. In this contribution, process interpretation has been eliminated from DeLone and McLean's model and the model split into two variance models. To clarify the meaning of information system use, four new constructs have been added to the model: expectations, consequences, perceived usefulness and net benefits.

Rai et al. (2002) examined the validity of DeLone and McLean's model to measure information systems success. The empirical study found that DeLone and McLean's model is a valid model to explain the success of information system. In this regard, Rai et al. state that 'Our results support DeLone and McLean's model focus on integrated IS success models and their observation that IS success models need to be carefully specified in a given context' (2002, p. 50).

Another empirical test of DeLone and McLean's model was conducted by McGill et al. (2003). The study aimed to employ the DeLone and McLean model to measure the success of user developed applications. Perceived information quality has been added to the model and the 'Use' construct has been replaced by 'intended use'. The empirical test found that four relationships among the constructs were significant and five were non-significant. Based on the results above, McGill et al. argue that 'Further research is required to understand the relationship between user perceptions of IS success and objective measures of success and to provide a model of IS success appropriate to end user development' (2003, p. 24).

Iivari (2005) tested DeLone and McLean's model in the context of mandatory information systems. In this study, the construct of use has been replaced by actual use and the organisational impact has been eliminated from the model. The results show that perceived system quality and perceived information quality were the main determinants of user satisfaction. The effect of perceived system quality on actual use was significant. User satisfaction significantly affected individual impact. However, two relationships among the constructs were non-significant: the relationship between perceived information quality and actual use; and the relationship between actual use and individual impact.

In terms of Knowledge Management System (KMS) success, Wu and Wang (2006) employed DeLone and McLean's model to measure the success of this kind of system. Five constructs were used to assess KMS success and to test interrelationships among those constructs: quality, knowledge or information quality, perceived KMS benefits, user satisfaction and system use. The empirical test supported DeLone and McLean's model to evaluate the success of KMS success. It is worthy of mention that 69 percent of the variance in user satisfaction is explained by system quality, knowledge/information quality and perceived KMS benefits. Perceived KMS benefits and user satisfaction explained 60 percent of the variance in system use.

In 2003, DeLone and McLean published the updated model of information system success. The updated model was based on suggestions offered by other researchers, criticisms directed to the original model and the empirical studies that have adopted this model. Service quality and intention to use have been added to the updated model and the net benefits have been used instead of individual and organisational impacts. Figure 2.11 shows the updated DeLone and McLean model.

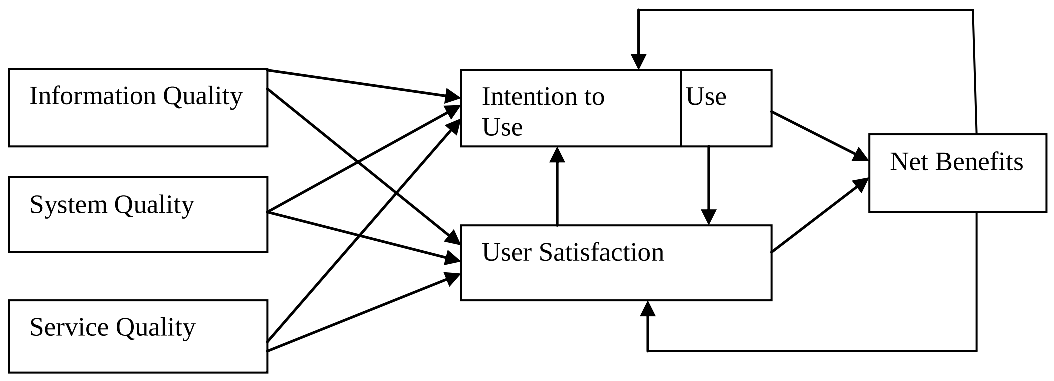


Figure 2.11 Updated DeLone & McLean's model of information system success

(Source: DeLone & McLean (2003))

Many efforts have been exerted to test the validity of this model totally and partially. The validity and relationships among four constructs of this model were tested by Bernroider (2008). Those constructs were information quality, system quality, service quality and net benefits. Statistic results confirmed the validity of those four constructs in measuring the success of ERP system.

Gorla et al. (2010) introduced an essential research question: 'Whether system quality, information quality and service quality impact organisational performance measures' (p. 13). The empirical investigation showed that 29 percent of the variance in organisational impact is explained by information quality and service quality.

Since the Internet revolution the use of electronic applications has grown and become commonly used in different sectors, for instance, commerce, health, education and banking. The main challenge faced by organisations that have adopted these applications is identifying suitable measures to evaluate the success of these applications. DeLone and McLean's model has been commonly employed in evaluating the success of electronic applications. In the context of e-commerce, substantial amounts of money are invested by companies to adopt this application. However, the main challenge that companies are confronting is the difficulty in evaluating the success of e-commerce systems (DeLone & McLean, 2004). To address this challenge, efforts have been exerted to find appropriate measurements to assess e-commerce success. DeLone and McLean (2004) used their updated model to evaluate the success of e-commerce. Two case studies were conducted in that particular study. DeLone and McLean (2004) focused on new and suitable measures to assess each dimension of their model in the context of e-commerce systems. The study confirmed that ‘These two examples demonstrate the flexibility and relevance of the updated DeLone & McLean’s model as a framework for measuring e-commerce success’ (DeLone & McLean, 2004, p. 43).

The model was also tested in the context of e-government by Wang and Liao (2008) and the results supported the relationships among six constructs of model, except the relationship between system quality and use which was non-significant .

Chen and Cheng (2009) conducted an investigation to understand customer intention in online shopping. DeLone and McLean’s model was adapted by separating ‘use’ into two constructs: intention to use and actual use. The study found that 60 percent of the shopping website’s success was predicted by the model.

DeLone and McLean’s model has been also used by Lee and Chung (2009) to evaluate mobile banking. In this study trust and interface design quality constructs were added to the model while service quality and net benefits were eliminated from the model. The empirical investigation found that system quality and information quality significantly affected customer trust and satisfaction. However, interface design was a non-significant construct in predicting the success of mobile banking.

The success of digital object identifier systems has been measured by using DeLone and McLean’s model, through a study by Park (2011). In this study, the ‘use’ construct has been replaced by perceived usefulness. In addition, measuring the benefits was limited to organisational benefits. The empirical results concluded that all the relationships among the constructs were significant and supported the DeLone and McLean model.

The DeLone and McLean model is deemed to be an essential contribution in the information systems field. This model has been adopted in different industries, systems, stakeholders and levels. Employing this model is no longer restricted to traditional systems but extended to include electronic applications such as e-commerce, e-banking, e-learning, and e-health. Studies that adopted this model aimed to test the validity and reliability of this model to measure the success of these systems. Some studies considered DeLone and McLean’s model as the main basis to establish new models and to add additional constructs for assessing information system success.

2.10. E-learning system success: definition, platforms, and approaches

E-learning systems are considered to be the main outcome of adopting and using IT in educational and non-educational organisations. This concept is applied differently by different users, and therefore, the definition of this concept has not gained uniform consensus (Byoung-Chan et al., 2009). Most definitions of e-learning have focused on the delivery of a learning service through electronic media. This study agrees with this direction. Engelbrecht defines e-learning as ‘the use of electronic media (the Internet, DVD, CD-Rom, videotapes, television, cell phone, etc.) for teaching and learning at a distance’ (2005, p. 218). In the context of active learning, Lee et al. define e-learning as ‘Web based learning which utilise web-based communication, collaboration, multimedia, knowledge transfer and training to support learners’ active learning without the time and space barriers’ (2009, p. 1321).

E-learning systems are believed to be an essential and new mode of learning which assists higher education institutions in gaining a competitive edge (Sánchez & Hueros, 2010). Many institutions of higher education have already started preparing the necessary infrastructure to run online programs (Ngai et al., 2007). Software is considered the main requirement to adopt e-learning systems; hence, e-learning platforms have appeared in this field. Martín-Blas & Serrano-Fernández define the e-learning platform as ‘a software system designed to support teaching and learning’ (2009, p. 35). E-learning platforms can be classified into two kinds: commercial virtual platforms and the open-source platforms (Sánchez & Hueros, 2010). WebCT and Blackboard, as commercial systems, are considered to be the most widely-used. At the present time, Moodle—as a free platform—is considered the most commonly-used in the e-learning field.

In 2003, WebCT was believed to be the most applied platform in higher education to deliver courses through the web (Burgess, 2003). Up until 2005, nearly 70 countries used this platform. In 2006, Blackboard Inc. purchased this platform and renamed it the Blackboard Learning System (Cheung, Lam, & Yau, 2009). This system is also used by non-educational organisations. In this context, Adeyinka and Mutula state that ‘It is a system developed to support and enhance the organisational processes of content creation, storage, relatively, transfer, delivery and application’ (2010, p. 1795).

Blackboard Inc. is deemed to be the largest provider of the e-learning platform, especially after it purchased WebCT (Cheung et al., 2009). Blackboard Inc. is a commercial software provider and has two product lines: the Blackboard commercial suite and the Blackboard academic suite. As of June 2006, the number of Blackboard users was 12 million in over 60 countries (Bradford, Porciello, Balkon, & Backus, 2007).

The Moodle (Modular Object-Oriented Dynamic Learning Environment) platform is a commonly used open-source application of Learning Management System. In 2005, the number of users registered on the Moodle site was 50,000, representing nearly 120 countries (Beatty & Ulasewicz, 2006).

To date, some new platforms were realised to provide students with educational services around the world. One of the recent developments in distance education is Massive Open Online Courses (MOOCs), and according to Daniel 'MOOCs are the educational buzzword of 2012' (2012b, p. 1). George Siemens, researcher at Canadian open university, and Stephen Downes, researcher at National Research Council of Canada, offered MOOC in 2008 (Mahraj, 2012). MOOC was established based on the Connectivism and Connective Knowledge to build an environment for teaching via building networks between participants (Downes, 2008). Esposito defines MOOC as 'a popular type of online open course, that provides free content and expertise to anyone in the world who wishes to enrol' (2012, p. 315). MOOC has many advantages for instance, 'it included a small credit-bearing course within a network; it was completely open and very large, and it included a unique aggregated network of blogs, which was one of the reasons why an unusually large number of online interactions took place in blogs rather than just in forums' (Mak, Williams, & Mackness, 2010, p. 275).

Coursera was found by two professors at Stanford University to provide students around the world with online courses: Andrew Ng (Director of the Artificial Intelligence Laboratory); and Daphne Koller (Computer Science Department) (Bruce, 2012). Coursera focused on the partnership with universities and educational institutions to offer classes in collaboration with universities of Princeton, Stanford, California Berkeley, Michigan, and Pennsylvania (Mahraj, 2012). Coursera was launched in February 2012 and at the end of April one million students were enrolled in Coursera (Barber, 2013) with more than 200 courses (Mallon, 2013).

After two weeks of launching Coursera, MIT and Harvard University launched edX to offer free online courses to students around the world, and stated an objective 'to exceed one billion student enrolments in the next decade' (Barber, 2013, p. 124). edX was released as a not-for-profit MOOC platform (Mahraj, 2012). On 1st August 2012 University of California Berkeley joined MIT and Harvard University in the edX project (Barber, 2013). Regarding certificates for students, 'After completing a course, participants receive a certificate from the "X University" from where the course originated' (Mallon, 2013, p. 47).

Another platform appeared in the distance education platform called Udacity. This platform was founded by Sebastian Thrun, David Stavens, and Mike Sokolsky and their goal of Udacity is democratizing education (Herman, 2012). Udacity is a for-profit platform for MOOCs (Mahraj, 2012). This platform provides courses in computer science, statistics, and physics with three different levels: beginner, intermediate; and advanced (Mallon, 2013).

E-learning systems are believed to be a recent application of information technology in the education sector. Therefore, there is still a lack of techniques to evaluate the success of these kinds of systems. The attempts of researchers to create suitable instruments to assess e-learning system success have been in different directions. Different criteria in evaluating e-learning system success have appeared because of differences in approaches adopted by different authors as to the term e-learning (Ozkan & Koseler, 2009). The studies that have dealt with this issue can be classified into four approaches: Technology Acceptance Model (TAM); user satisfaction approach; E-learning quality approach; and the DeLone and McLean approach. Previous research based on these approaches is now presented.

2.10.1. Technology Acceptance Model (TAM) approach

TAM is considered to be a common application in the information system field. The main purpose of using this approach is to measure the acceptance of using technology and the success of these technologies. In the context of e-learning systems, there are some models designed to investigate factors that are considered to be determinants affecting the usage and intention to use e-learning systems. The studies that adopted TAM in the e-learning systems field have changed some constructs of this model and extended the model.

Liaw (2001) suggested a model to discuss the acceptance of web-based learning by users. The model was proposed based on the TAM, social cognitive theory, and motivational perspective. The model focused on behavioural belief, perceived usefulness, perceived ease of use and social factors. The study found that perceptions of learners toward the web-based environment should be considered by educators and instructional designers of web-based instruction.

McFarland (2001) combined TAM and self-efficacy theory to understand usage behaviour and attitudes in the context of e-learning systems. The construct of age has been added to the proposed model. The empirical study found that TAM and self-efficacy theory are valid to understand and explain the usage of computers in the education arena. Furthermore, behaviour and attitude are determined by the age construct and that confirms the role of this factor in understanding e-learning system usage.

Stoel and Lee (2003) argued an important issue: how instructors can motivate students to accept web-based courseware. To address this issue, Stoel and Lee (2003) suggested that prior experience of students with the technologies may affect their acceptance. An empirical study was conducted to test the suggestion above. The analysis confirmed that experience of students with the technologies had a significant effect on ease of use and usefulness. In this regard, Stoel and Lee state that 'As student experience with a technology increases, they perceive it to be easier to use and more useful and therefore are more likely to use it' (2003, p. 364).

Based on TAM, Selim (2003) tested the Course Website Acceptance Model (CWAM). The empirical investigation found that 83 percent of the variance in the acceptance and use of course websites could be explained by usefulness and ease of use.

Yi and Hwang (2003) combined TAM with self-efficacy, enjoyment and learning goal orientation to predict the use of web-based information system. The study found that self-efficacy, enjoyment, and learning goal orientations are critical determinants of actual use.

Martins and Kellermanns (2004) employed the literature of management education, TAM, and change management to develop and test a model to predict the acceptance by students of a web-based course management system. Two types of factors have been considered as key constructs affecting the acceptance of the web-based management system by students: change-motivating (perceived incentive to use, perceived faculty encouragement, peer encouragement, and awareness of the capabilities of WebCT) and change-enabling (access to the system, availability of technical support, prior experience with computers and Web use, and self-efficacy in using the Web). The study results showed that 33.4 percent of perceived usefulness of the system could be explained by perceived incentive to use, perceived faculty encouragement, peer encouragement and perceived ease of use. 16.5 percent of perceived ease of use of the system was explained by availability of technical support, prior experience with computers and web use and awareness of the capabilities of the system.

Measuring the acceptance and adoption of e-learning by academic staff was the main purpose of an investigation conducted by Al-Alak and Alnawa (2011). The empirical investigation identified that perceived usefulness, perceived ease of use, computer knowledge and management support were significantly associated with intention to adopt e-learning. Normative pressure and computer anxiety had negative relationships with intention to adopt e-learning.

Some efforts focused on the acceptance and adoption of Mobile learning (M-learning). Huang et al. (2007) employed TAM to explain user behaviour of M-learning. The constructs of perceived mobility value and perceived enjoyment have been added to TAM. The study concluded that M-learning is considered an efficient tool in achieving learning activities. Perceived mobility value and perceived enjoyment had significant influence on intention to use M-learning. Many studies have been conducted in the M-learning acceptance field, for instance, Wang et al. (2009); Liu et al. (2010); Liaw et al. (2010); Ismail and Johari (2010); Park (2012) and Tsai (2013).

Significant efforts have been exerted to explore the factors affecting acceptance and use of e-learning systems. Most of these studies adopted TAM to achieve this purpose.

Table 2.15 summaries relevant studies conducted in the e-learning system field.

Table 2.15 Some Studies That Adopted TAM in the E-Learning System Arena

Author/s	Theoretical grounding of model	Constructs	Main findings
Gong et al. (2004)	TAM, Social Cognitive Theory (SCT), and Computer Self-Efficacy (CSE)	Perceived usefulness, perceived ease of use, attitude, and intention to use.	1. Behavioural intention explained by TAM factors. 2. Computer Self-Efficacy significantly affected acceptance the technology by teachers.
Hayashi (2004)	TAM, Computer Self-Efficacy, and Expectation-Confirmation Model (ECM)	Perceived usefulness, confirmation, satisfaction, and information system continence intention.	1. The relationships among CSE of online learners, perceived usefulness, confirmation, and satisfaction level were non-significant. 2. The effect of computer self-efficacy, as moderating factor, on learning outcome was non-significant.
Saadé & Bahli (2005)	TAM, and Cognitive absorption	Cognitive absorption (temporal dissociation, focused immersion, and heightened enjoyment); Perceived usefulness, perceived ease of use, and intention to use.	1. 26% of the variance in perceived usefulness explained by cognitive absorption and perceived ease of use. 2. The effect of cognitive absorption on perceived ease of use was very weak (R^2 6%) 3. Cognitive absorption significantly affected intention to use (R^2 28.9 %).
Ong and Lai (2006)	TAM, and Computer Self-Efficacy	Perceived usefulness, perceived ease of use, computer Self-Efficacy, behavioural intention to use, and gender.	1. Rating of men's self-efficacy, perceived usefulness, perceived ease of use, and behavioural intention to use el-earning was higher than women's. 2. Women were more strongly influenced by precipitations of computer self-efficacy and ease of use, and that men's usage decisions were more significantly influenced by their perceptions of usefulness of e-learning (Ong & Lai, 2006, p. 816).
Toral et al. (2007)	TAM	Learning goal orientation, application specific self-efficacy, enjoyment, focused immersion, curiosity, playfulness, voluntariness, ease of use, usefulness, and intention to use.	1. 44% of web-based educational tools have been used by 88% of students. 2. The external factors affected the using of a web-based tool were application specific self-efficacy, enjoyment, playfulness, and curiosity.
Limayem & Cheung (2008)	Expectation Confirmation Theory, User satisfaction	Perceived usefulness, confirmation, satisfaction, information system continuance intention, prior	1. Perceived usefulness and confirmation significantly influenced satisfaction. 2. 53% of the variance of information system continuance intention explained by perceived usefulness

		behaviour, habit, and information system continued use.	and satisfaction. 3. Habit was a negative moderate factor between information system continuance intention and information system continued use.
Lee et al. (2009)	TAM	Instructor characteristics, teaching materials, design of learning contents, playfulness, perceived usefulness, perceived ease of use, and intention to use e-learning.	1. Instructor characteristics and teaching materials were the main determinates of perceived usefulness. 2. Perceived usefulness and playfulness were the key determinants of intention to use construct. 3. The ease of use was the weakest predictor of the intention to use e-learning among the other predictor s.
Ku (2009)	The Perceived Resources and Technology Acceptance Model (PRATAM)	Perceived usefulness, perceived ease of use, perceived recourses, attitude toward using, behavioural intention to use, and actual system use.	1. PRATAM was a validated model to explain students' acceptance WebCT. 2. The effect of perceived resources on behavioural intention was non-significant. 3. The impact of behavioural intention on actual system use in pre-test and the influence of perceived resources on perceived usefulness in post-test were non-significant.
Abbad et al. (2009)	TAM	Subjective norms, Internet experience, system interactivity, self-efficacy, technical support, perceived usefulness, perceived ease of use, and intention to use.	1. Overall, the model explained 75% of the intention to use. 2. Perceived ease of use determined by two indicators: Internet experiences and self-efficacy. 3. Three indicators significantly affected perceived usefulness: perceived ease of use, self-efficacy, and technical support.
Sanchez & Hueros (2010)	TAM	Technical support, perceived ease of use, perceived usefulness, attitude, and system usage.	1. Technical support directly affected perceived ease of use, perceived usefulness, and attitude. 2. 41% of the variance in the system usage explained by perceived ease of use, perceived usefulness, and attitude.
Teo et al. (2011)	TAM	Perceived usefulness, perceived ease of use, attitude towards computer use, and intention to use.	1. The relationship between attitudes toward computer use and intention to use was non-significant. 2. Overall, the constructs of model explained the variance of intention to use technology by 51%.
Wang et al. (2011)	TAM	Internet self-efficacy, community environment, intrinsic motivation, perceived ease of use, perceived usefulness, and actual use.	1. Perceived ease of use had non-significant effect on perceived usefulness. 2. Perceived ease of use was non-significant determinate of actual use.

The issue of acceptance and adoption of e-learning systems has received considerable attention. Different factors and theories have been adopted to address this issue. TAM has been used commonly in the e-learning systems field. Many studies adopted and extended TAM. The main purpose of these extensions is to include a wide range of factors that may affect the acceptance of e-learning systems and to discover the role of these factors in acceptance. Studies offered evidence about the significant effect of some factors in the acceptance of e-learning systems, for instance, self-efficacy. However, there are some factors that need more investigation to identify their role in the acceptance of e-learning, for example, habit and perceived resources.

2.10.2. User satisfaction approach

User satisfaction has received considerable attention from researchers in the information system field. This attention includes a focus on e-learning systems. User satisfaction has been considered as a measure to assess e-learning system success. Sun et al. (2008) found six critical factors that drive successful e-learning: learner, instructor, course, technology, design and environmental. Based on the organisational perspective, Naveh et al. (2010) investigated students' use and satisfaction of learning management systems (LMS). According to this perspective, three organisational variables lead to student use and satisfaction of LMS. The organisational variables are the role definition and the departmental division as derived from orientation of the academic institution according to discipline goal, the commitment to hierarchical degree structures and accreditation processes as derived from coordinator mechanisms of the academic institution, and the regularised aspects of relationships among roles. The user satisfaction approach for assessing e-learning systems is commonly used by researchers. Details about this approach and the studies that adopted it are presented in Section 2.7.

2.10.3. E-learning quality approach

The issue of quality has been widely discussed in different arenas. The term of quality is no longer limited to use in manufacturing, but extends to different sectors and industries. In the education sector, quality is playing a key role in the activities and outcomes of this sector (Pawlowski, 2007). The importance of quality in higher education institutions has increased, especially after the growth in the number of students, universities and disciplines (Sahney, Banwet, & Karunes, 2010).

Most higher education institutions and organisations are employing new technology to deliver their services and products. The Internet revolution assisted universities to deliver educational services using multimedia and adopting e-learning systems. In spite of the widespread adoption of e-learning systems and the significant growth in use, the quality of e-learning remains the main issue facing the use and adoption of this type of electronic system (Concannon, Flynn, & Campbell, 2005; Ehlers & Pawlowski, 2006; Jung, Latchem, & Herrington, 2012; Pawlowski, Barker, & Okamoto, 2007).

This concern also includes organisations that adopted e-learning to train their employees. In this regard, Fry states that 'Organisations now seek metrics for evaluating e-learning and quality benchmarks are recommended' (2001, p. 233).

In 2002, Bizmedia published a report about the quality of e-learning. The results of the report were based on a European survey. This survey was hosted by European Training Village (ETV), and its results showed that 61 percent of the respondents (433 respondents from EU) rated the quality of e-learning negatively, fair or of poor quality (Massy, 2002).

Some studies pointed to an important issue affecting e-learning quality: the lack of methodologies and polices to evaluate this matter. The main reason for this shortfall is that quality of e-learning is a complicated perspective and different viewpoints exist among different stakeholders: managers, trainers, learners, instructors, and software developers. Ehlers (2004) pointed to three different dimensions of quality which lead to complexity in this concept: different meanings of quality; different actors' perceptions; and different levels of quality.

The importance of e-learning quality encouraged European countries to develop and adopt programs and projects related to e-learning quality. European cooperation provided some projects and programs that are employed in assessing and improving the quality of e-learning. According to the Swedish National Agency (2008), the main programs and projects are:

1. The European Commission's eLearning Action Plan
2. The European Union's eLearning program.

3. Horizontal E-learning Integrated Observation System (HELIOS).
4. Excellence.
5. Sustainable Environment for the Evaluation of Quality in E-learning.
6. The Triangle Project.
7. European University Quality in eLearning (UNIQUe).
8. Lifelong Programme 2007-2013.

There are different approaches that have been applied to evaluate the quality of e-learning, for instance, ISO 9000, EFQM Excellence Model, BAOL Quality Mark and ETB quality criteria.

According to Pawlowski (2003), the approaches of e-learning quality can be classified into two directions: Processes vs. Product-Orientation; and Requirements vs. Information/Documentation. Accordingly, Pawlowski (2003) suggested harmonising quality approaches in a common framework called the European Quality Observatory (EQO). CEN/ISSS Workshop Learning Technologies for a European Quality Framework have been employed by Pawlowski (2003) to compare the approaches of e-learning quality in more detail. The proposed model depends on two essential constructs. The first construct is Repository that includes some functions to support users. The second construct is Community that is used to extend and improve the model through processes of discussion in the community.

An important contribution to measure the quality of e-learning was presented by MacDonald et al. (2001). This contribution was a model to assess e-learning quality: Demand-Driven Learning Model (DDLM). The main objective of this model is to evaluate the benefits of Web-Based Learning (WBL) considering different stakeholders. DDLM includes five main constructs: structure, content, delivery, service and outcomes. The elements of superior structure are considered to be the main requirements for excellence of content, delivery and service. Consequently, enhancing the quality of content, delivery and service will optimise learner outcomes. The validity and reliability of DDLM has been tested and confirmed in studies conducted by MacDonald et al. (2002) and MacDonald and Thompson (2005). DDLM has been adopted by researchers in other studies to evaluate the quality of web-based learning in different arenas, for instance, MacDonald et al. (2008); MacDonald et al. (2008); MacDonald et al.(2009); and MacDonald et al. (2009).

Ehlers (2004) measured e-learning quality based on the learner's perspective. The main objective of the study was to identify critical aspects or criteria that are adopted by learners to evaluate the quality of e-learning. Ehlers (2004) assumed that the same quality approaches cannot evaluate the learners' attitude about the quality of e-learning because the learners have different preferences in regard to the quality of e-learning. The analysis identified seven main fields used by learners to evaluate the quality of e-learning and each field has sub-dimensions to measure the quality. Table 2.16 lists the fields and the dimensions of each field.

Table 2.16 Quality Fields and Their Dimensions

Quality Fields	Dimensions
Tutor support	Interaction centeredness, moderation of learning processes, learners vs. Content centeredness, individualised learner support, goal- vs. development centeredness, traditional communication media, synchronous communication media, and asynchronous communication media.
Cooperation and communication in the course	Social cooperation and discursive cooperation.
Technology	Adaptivity and personalisation, synchronous communication possibilities, and availability of content (technical).
Cost-Expectations-Value	Expectation of individualisation and need orientation, individual Non-Economic costs, economic costs, practical benefits, and interest in course and media usage.
Information transparency	Counselling and advise, organisational information, and information about course goal and contents,
Course structure	Personal support of learning processes, introduction to technical aspects and to the content, and tests and exams.
Didactics	Background material, multimedia enriched presentation material, structured and goal oriented course material, support of learning, feedback on learning progress, and individualized tasks.

(Source: Ehlers (2004))

Other studies have been conducted to investigate e-learning quality and to find measures, models and mythologies to evaluate this construct. Table 2.17 lists some of these studies and the main contribution of each one.

Table 2.17 Some Studies That Dealt With E-Learning Quality

Study	Contribution
Tinker (2001)	This study's contribution is to present a model to evaluate e-learning quality: 'The concord model for learning from Distance', with these dimensions: asynchronous collaboration, limited enrolment, expert facilitation, trust, clear schedules, excellent materials, good pedagogy, and quality assurance.
Frydenberg (2002)	In this study, the main area of e-learning quality standards were identified: executive commitment, technological infrastructure, student services, design and development, instruction and instructor services, program delivery, financial health, legal and regulatory requirements, and program evaluation.
Oliver (2005)	The study was established based on the reviewing the literature regarding to e-learning quality. The formworks have been proposed to evaluate e-learning quality concluded four discrete elements: the curriculum, the learning design, the learning resource, and the delivery processes.
Stefani et al. (2006)	Proposed model to evaluate the quality of Virtual Campuses. ISO 9126 standard has been employ as a basis to provide a set of quantifiable quality metrics for evaluating e-learning services. The metrics have been classified in three groups: reliability, usability, and efficiency metrics.
Barker (2007)	Provided a set of quality standards, called Canadian Recommended E-learning, can be used in evaluating learning technologies, distance learning, and student-centred learning.
Ehlers (2007)	The contribution of this research is in providing a new model - Quality Literacy - to develop quality in education and e-learning. Quality Literacy established based on the main condition is that quality development depends on the participation and negotiation between the educational stakeholders groups. Four dimensions identified of Quality Literacy: quality knowledge, quality experience, quality innovation, and quality analysis.
Leacock and Nesbit (2007)	This study has presented an instrument to evaluate the quality of e-learning called Learning Object Review Instrument (LORI). This instrument has nine dimensions of e-learning quality: content quality, learning goal alignment, feedback and adoption, motivation, presentation design, interaction usability, accessibility, reusability, and standards compliance.
Pawlowski (2007)	In this study, ISO/IEC 19796-1 has been presented and compared with existing approaches of quality. The steps of Quality Adaption Model (QAM) have been identified, and instrument has been prepared to bring the abstract standard into practice.
Ireland et al. (2009)	The contribution of this study was providing a new framework can be used to improve the quality of e-learning sites and learning quality of online student. The framework has been designed for a large multi-campus university. According to the proposed framework, developing the skills of the academics who design the e-learning sites is deemed to be the main approach to develop and improve e-learning quality.
Abdellatief et al. (2011)	In this study, a technique to evaluate e-learning has been proposed. This technique depends on the developer's perspective. Four main characteristics have been selected to measure the quality of e-learning, and each one has sub-characteristics to do this purpose: service content, system functionality, information technology, and system reliability.
Bremer (2012)	The contribution of this study is developing chain of procedures to conduct the model proposed by the University of Frankfurt (AKUE). Four main steps were suggested to implement AKUE: analysis, conception, implementation, and evaluation that can be conducted on the organisation and curriculum.
Ossiannilsson (2012)	In this study a conceptual framework of quality in the e-learning systems field. This conceptual framework was proposed based on the benchmarking of three international projects: E-excellence, the eLearning Benchmarking Exercise 2009, and the First Dual-Mode Distance Learning Benchmarking Club. The results of this study concluded that accessibility, flexibility, interactiveness, personalisation, and productivity should be considered to evaluate the e-learning in all levels of management and services.

Progressively, the quality of e-learning became a critical issue in many educational institutions and organisations. Considerable research has been undertaken by researchers and organisations to prepare models, methodologies and criteria for measuring e-learning quality. Two main issues are still encountered in efforts directed to the quality of e-learning. The first issue is the complexity of the quality concept. This issue leads to different approaches and methodologies in evaluating this construct. The second issue is related to the different stakeholders dealing with e-learning quality, such as, students, academic staff, trainers, management and developers. Thus, each group of stakeholders target different criteria and characteristics to assess the quality of e-learning. In spite of the two aforementioned issues, researchers still seek to identify the most suitable measures for assessing and developing the quality of e-learning.

2.10.4. DeLone and McLean approach

The DeLone and McLean model is deemed to be a common technique used to assess information systems success. Use of this model is not restricted merely to evaluating traditional information systems. Rather, it is also used to assess electronic information systems. E-learning systems are considered to be the most important IT projects in universities (Byoung-Chan et al., 2009). However, the evaluation of these systems still faces problems, as there is a lack of measurements to evaluate the success of these projects. The DeLone and McLean model is believed to be one of the most important contributions that can be used to address this issue in the e-learning field. The studies employing the DeLone and McLean model moved in two directions. The first direction focused on the test of validity of DeLone and McLean’s model in evaluating the success of e-learning system. Some of these studies adopted DeLone and McLean’s model as a whole and added additional constructs. Some studies tested DeLone and McLean’s model partially through focusing on specific constructs. The second direction formulated through studies that attempted to combine DeLone and McLean’s model with TAM. The main purpose of this combination of the two models is to identify a wide range of factors that affect the success of e-learning systems. Details of these two directions are provided in the next sections.

2.10.4.1. First direction: test the validity of the DeLone and McLean model

Holsapple and Lee-Post (2006) developed a model based on the DeLone and McLean model. This model considered the evaluation of e-learning system success at each stage of e-learning system development: design, delivery and outcome. The success of the design stage can be evaluated through quality dimensions: system, information and services. The second stage is the delivery of e-learning services. Use and user satisfaction are used to evaluate e-learning system success at this stage. In evaluating the e-learning system outcome stage, two types of aspects can be considered: positive aspects and negative aspects. To conduct this model practically, an action research methodology has been adopted. The results concluded that the proposed model is valid to evaluate the success of e-learning systems.

The DeLone and McLean model also has been used by Lin (2007). In this study, the use construct has been ignored and the author assumed that user satisfaction affects behavioural intention to use Online Learning System (OLS). The net benefit construct was replaced with actual OLS use. The study found that all the relationships among the model constructs were significant.

Another test of the DeLone and McLean model was undertaken by Yi et al. (2009) to evaluate the success of mobile learning systems. Some modifications have been undertaken on the model. The use construct has been replaced by perceived value and the net benefits replaced by intention to reuse. The empirical test of the model showed that user satisfaction is determined by information quality. However, the role of system quality and perceived value in determining user satisfaction were non-significant. Perceived value and user satisfaction were the main determinates of intention to reuse mobile learning systems.

The DeLone and McLean model has been updated by Adeyinka and Mutula (2010) to measure the success of WebCT course content management system (WebCT CCMS). Three new constructs have been added to the model: teaching and learning quality; students' self-regulated learning; and course content measuring system success. The empirical study confirmed that all the factors selected in the proposed model were significant in measuring the success of WebCT CCMS. However, the role of WBCT CCMS benefits, self-regulated learning and content knowledge in evaluating the success of WBCT CCMS was less than the other factors.

Klobas and McGill (2010) employed DeLone and McLean's model to assess the success of Learning Management Systems (LMS). An additional construct added to the model was user involvement (Instructor involvement and Student involvement). Measures of net benefits were limited to student benefits, and instructor benefits have not been considered in the model. In terms of the involvement construct, the empirical study found that student involvement is considered to be a main determinant of students' perception about the benefits to users of LMS. Another important result is that 57 percent of the variance in students' satisfaction was explained by quality dimensions of LMS: system, information and service. Satisfaction significantly affected benefits of LMS use and this result supports DeLone and McLean's model. Regarding the role of instructor involvement, Klobas and McGill state that 'instructor involvement contributes to student benefits by affecting LMS information quality which affects the benefits students say they receive from use through its effect on student satisfaction' (2010, p. 132). Finally, the study confirmed that the importance of individual differences is less than the involvement construct and quality dimensions of LMS in explaining LMS use, satisfaction and student benefits.

The effectiveness of an academic library portal was the main purpose of Masrek et al.'s (2010) study. Five constructs of DeLone and McLean's model were employed to achieve this purpose: information quality, system quality, service quality, user satisfaction and individual impact. The main result of the empirical study highlighted that 44.7 percent of the individual impact is explained by user satisfaction. 50.8 percent of the variance in user satisfaction is indicated by information quality, system quality and service quality.

There are many other studies that tested the validity of DeLone and McLean model in the e-learning systems of e-learning systems field, for instance, Freeze et al. (2010), Wang and Chiu (2011), Tella (2011), and Hassanzadeh et al. (2012).

The approach outlined above was established based on efforts that attempted to test the validity and reliability of DeLone and McLean's model. The empirical tests were in two directions: testing the model partially, and extending the model. Most of the studies concluded that the model (or specific constructs of the model) is valid and reliable to measure the success of e-learning systems.

2.10.4.2. Second Approach: Merging of DeLone & McLean's Model with TAM

A number of researchers focused on a combination of DeLone and McLean's model and TAM. Ramayah et al. (2010) tested the effect of quality factors in DeLone and McLean's model on behavioural intention. The results concluded that 59 percent of the variance in behavioural intention could be explained by quality factors (system quality, information quality and service quality). In the same vein, Wang and Wang (2009) studied the factors that affect adoption of web-based learning systems. The factors were selected based on DeLone and McLean's model and TAM. The main finding of the empirical study is that 82 percent of the variance in the perceived usefulness could be explained by information quality, perceived ease of use, and subjective norm. Subjective norm and perceived usefulness were the main determinants of intention to use. Overall, the whole model explained 56.2 percent of the variance in system use. However, the study found three relationships were non-significant: system quality and perceived usefulness; perceived ease of use and intention to use; and self-efficacy and intention to use.

Another attempt to mix DeLone and McLean's model with TAM was conducted by Almarashden et al. (2010). The proposed model is called Educational Technology Model (ETM). The ETM consist of three blocks: system design, usage, and outcome/net benefit. The results of structural equation modeling supported 14 of 15 hypotheses. All the factors selected in the model significantly affected the net benefits on two levels: users and organisations.

Hsieh and Cho (2011) suggested a model to compare e-learning tools' success. The suggested model was established based on the Seddon's model which was originally established based on DeLone and McLean's (1992) model. Three constructs of the DeLone and McLean model have been incorporated in the suggested model: information quality, satisfaction and learning outcome (net benefits). Three main constructs from TAM have been used to establish the model: perceived usefulness, ease of use and future use intention. Education, age, and gender have been taken into account as factors affecting intention to use. A study to test the model has been conducted with two tools: with Self-Paced tools and Instructor-Student Interactive tools. The empirical study concluded that the model successfully explained 45 percent and 65 percent of the variance in perceived usefulness, satisfaction, and behavioural intention in both kinds of e-learning system.

In summary, the DeLone and McLean model has been studied and tested in many different domains and with different systems and stakeholders. In the e-learning system field this model has evaluated the success of these systems. Studies of e-learning systems have adopted different methodologies. Some studies adopted this model partially and tested the validity of specific model constructs, while others intended to extend the model to identify more factors affecting e-learning system success. Finally, integrating DeLone and McLean's model with TAM was another direction to investigate factors for evaluating the success of e-learning systems.

2.11. Chapter summary

Chapter two has provided an extensive overview of the reviewed literature related to this study. The focus of this chapter is on the theories, issues, measures and conceptual frameworks related to the evaluation of the success of information and e-learning systems. The first section of this chapter focused on the literature related to the constructs of study model. As will be explained in the next chapters, the proposed model is theoretically supported by the literature in the information and e-learning systems arenas. Accordingly, the literature will be synthesised in chapter three to support the proposed model and to justify the relationships among the constructs of model. The issue of information systems success has received substantial attention by researchers in this field. Researchers adopt different methodologies and conceptual frameworks to evaluate the success of information systems. Thus, a review of the literature shows that there is a wide range of studies dealing with this issue. To overcome this problem and review the studies related to this research, the literature on information system success was classified into four approaches: TAM; user satisfaction approach; user involvement approach; and the DeLone and McLean approach. The same technique was adopted to review the literature related to the success of e-learning systems. The related studies are incorporated into four approaches: TAM; user satisfaction approach; e-learning quality approach; and the DeLone and McLean approach.

CHAPTER THREE

This chapter presents the model, philosophy, and approach of the study. The first part of the chapter describes the study model. The essential purpose of this section is to present the study model and the constructs selected to be included in the model. The second part is allocated to philosophies adopted in this study and the justification for employing them. The study approach forms the third part of this chapter. To conclude, the chapter presents the hypotheses and the theoretical background for the formulation of each hypothesis.

CHAPTER THREE: STUDY MODEL, PHILOSOPHY, AND APPROACH

3.1. Chapter introduction

Conducting research requires adopting methodological procedures to understand specific phenomena. The selection of the stages in undertaking the research needs to clearly identify the philosophy, approach, and method of the study. This study aims to identify factors affecting the success of an e-learning system. Therefore, identifying these factors, gathering them in one model, and testing the model is required to be in accordance with a specific paradigm and approach. This chapter provides the framework of the study model, philosophy and approach, along with the theoretical background to formulating the hypotheses.

3.2. Study model

The main objective of this study is to establish a model to measure the success of e-learning systems from different points of view. To achieve this purpose, eight constructs were selected for the model: IT infrastructure services; system quality; information quality; service delivery quality; perceived usefulness; user satisfaction; customer value; and organisational value. The selection of these constructs was based on their importance in measuring the success of information systems, and on the literature in the information systems and e-learning systems field. Table 3.1 outlines previous studies that adopted these constructs in measuring the success of information systems.

Table 3.1 List of Studies Supportive of Proposed Model

Constructs	Information Systems Field	E-learning Systems Field
IT Infrastructure Service	Broadbent and Weill (1997),Weill et al. (2002), Weill and Vitale (2002), Hwang et al. (2002), Murakami et al. (2007), Fink and Neumann (2007), King and Flor (2008), Bekkers (2009), Fink and Neumann (2009), Sobol and Klein (2009), Bhatt et al.(2010), Ramirez et al. (2010), Hicks et al. (2010).	Soong et al. (2001), Selim (2007), Ahmed (2010).

Constructs	Information Systems Field	E-learning Systems Field
System Quality	Bailey and Pearson (1983), Mahmood (1987), DeLone and McLean (1992) (2003), Wang and Strong (1996), Seddon (1997), Skok et al. (2001), Rai et al. (2002), McKinney et al. (2002), Iivari (2005), Bharati and Berg (2005), Byrd et al. (2006), Ifinedo (2006),Wang (2008), Zhi-yong et al. (2009), Gable et al. (2008), Landrum et al. (2010), Gorla et al. (2010), Gorla and Lin (2010).	Holsapple and Lee Post (2006), Roca et al. (2006), Wang et al. (2007), Liaw (2008b), Ozkan and Koseler (2009),Wang and Wang (2009), Ramayah et al. (2010), McGill and Klobas (2009), Islam (2011), Tella (2011), Islam (2012).
Information Quality	Bailey and Pearson (1983), Miller and Doyle (1987), DeLone and McLean (1992) (2003), Seddon (1997), Skok et al. (2001), Rai et al. (2002), Kahn et al. (2002), Lee et al. (2002), McKinney et al. (2002), Bharati and Berg (2005), Iivari (2005), Byrd et al. (2006), Ifinedo (2006), Nicolaou and McKnight (2006), Stvilia et al.(2007), Stvilia et al. (2008), Price et al.(2008), Gable et al. (2008), Wang (2008), Zhi-yong et al. (2009), Gorla et al. (2010), Gorla and Lin (2010), Landrum et al. (2010).	Holsapple and Lee Post (2006), Roca et al. (2006), Wang et al. (2007), Ozkan and Koseler (2009),Wang and Wang (2009), Ramayah et al. (2010).
Service Delivery Quality	Pitt et al. (1995), Dyke et al. (1997), Berry and Parasuraman (1997), Watson et al. (1998), Zeithaml et al. (2000), Liu and Arnett (2000), Cox and Dale (2001), Yoo and Douthu (2001), Zeithaml et al. (2002c), Zeithaml (2002), Wolfinbarger and Gilly (2003), Wilkin and Castleman (2003), Landrum and Prybutok (2004), Yang and Fang (2004), Parasuraman et al. (2005), Kettinger and Lee (2005), Yang et al. (2005), Lai (2006), Lee and Kozar (2006), Bauer, Falk, and Hammerschmidt (2006), Fassnacht and Koese (2006), Hwang and Kim (2007), Cristobal et al. (2007), Loiacono et al. (2002), Rauyruen and Miller (2007), Roses et al. (2009), McManus (2009), Park and Gretzel (2007), Ding et al. (2011), Udo et al. (2010).	Brigham (2001), McLoughlin and Luca (2001), Frydenber (2002), Mcgorry (2003), Chiu et al.(2005), Reid (2005), Oliver (2005), MacDonald and Thompson (2005), Roca et al. (2006), Holsapple and Lee Post (2006), Wang et al. (2007), Lee and Lee (2008), Wang and Wang (2009), Ozkan and Koseler (2009), Ramayah et al. (2010), Teo (2011), Hassanzadeh et al. (2012), Cheng (2012b).
Perceived Usefulness	Davis (1989), Seddon (1997), Venkatesh and Davis (2000), Rai et al. (2002), Hung (2003), Yang (2005), Byrd et al. (2006), Sabherwal et al. (2006), Landrum et al. (2007), Venkatesh and Bala (2008), Larsen et al. (2009), Landrum et al. (2010).	Arbaugh (2000b), Pituch and Lee (2006), Roca et al. (2006), Liaw (2007), Martinez-Torres et al. (2008), Lee-Post (2009), Wang and Wang (2009), Abbad et al. (2009), Teo (2011), Hsieh and Cho (2011), and M. C. Hung et al. (2011).

Constructs	Information Systems Field	E-learning Systems Field
User Satisfaction	Bailey and Pearson (1983), Ives et al. (1983), Baroudi et al. (1986), Lehman (1996), Doll and Torkzadeh (1988), DeLone and McLean (1992) (2003), Amoli and Farhoomand (1996), Seddon (1997), Skok et al. (2001), Rai et al. (2002), Xiao and Dasgupta (2002), McKinney et al. (2002), Xiao and Dasgupta (2005), Ong and Lai (2007), Wixom and Todd (2005), Iivari (2005), Sabherwal et al. (2006), McGill and Klobas (2008), Wang (2008), Gable et al. (2008), Landrum et al. (2010), Udo et al. (2010).	Arbaugh (2000b), Roca et al. (2006), Holsapple and Lee Post (2006), Wang et al. (2007), Shee and Wang (2008), Sun et al.(2008), Adeyinka and Mutula (2010), Wu et al. (2010), Naveh et al. (2010), T. C. Lin and Chen (2012), Ramayah and Lee (2012).
Customer Value (Internal customer)	Zmud (1983), Snitkin and King (1986), Aldag and Power (1986), Skok et al. (2001), Iivari (2005), Ifinedo (2006), Davern and Wilkin (2010).	Wang et al. (2007), McGill and Klobas (2008).
Customer Value (External)	Hitt and Brynjolfsson (1996), Shun and Yunjie (2006), Wang (2008), Chang et al. (2009), Kuo et al.(2009).	Chiu et al. (2005), Holsapple and Lee Post (2006), Adeyinka and Mutula (2010), Martinez-Torres et al. (2008), H. C. Wang and Chiu (2011).
Organisational Value	Benbasat and Dexter (1986), Miller and Doyle (1987), Hitt and Brynjolfsson (1996), Seddon (1997), Mirani and Lederer (1998), Amit and Zott (2001), Skok et al. (2001), Shang and Seddon (2002), Gable et al. (2008), Tzeng et al. (2008), Gorla et al. (2010), Gorla and Lin (2010).	Wang et al. (2007).

This study selected these constructs based on their importance as key measures of e-learning systems. However, there are rarely any studies that use all these constructs together in one model, especially in one that includes the IT infrastructure services, customer value, and organisational value. Furthermore, the study model is based on two types of relationships: direct effects and mediation effects (as shown in Figure 3.1).

In the study model service delivery quality is considered as a mediation factor between the dependent and independent constructs. Accordingly, employing service delivery quality as a mediation factor is useful in explaining and understanding the relationships effects between other constructs.

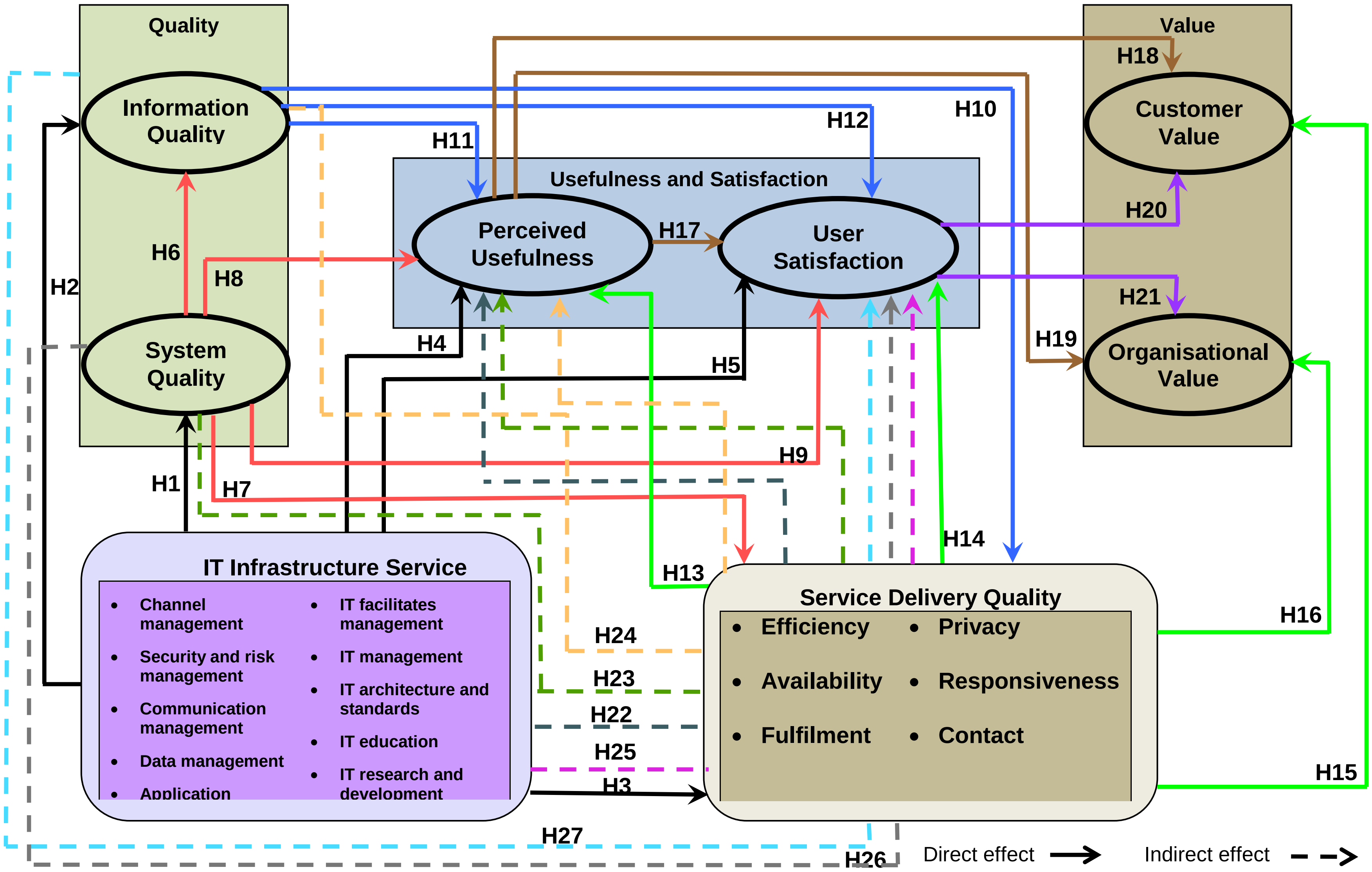


Figure 3.1 Study Model

3.3. Research philosophy

The study philosophy or paradigm is a crucial requirement in conducting research and eliciting valid results. Diverse paradigms should be considered when designing the study approach and method. According to Teddlie and Tashakkori (2010), paradigms play a vital role in guiding research, and in this regard they state that 'research must be conducted within the guidelines established by constructivism, post-positivism, or some other monolithic paradigm (p. 13).

There is a set of general philosophical assumptions that can be classified under two essential paradigms: ontology and epistemology (Maxwell, 2009). In this context Maxwell (2009) states that 'This use of the term *paradigm*, which derives from the work of the historian of science Thomas Kuhn, refers to a set of very general philosophical assumptions about the nature of the world (ontology) and how we can understand it (epistemology)' (p. 224). Accordingly, epistemological and ontological concepts should be considered in choosing the study approach and methods (Cater-Steel, 2004).

For this study, the positivist paradigm is adopted to identify factors affecting e-learning system success and to evaluate e-learning system success in higher education. The main justifications for adopting this paradigm are that it enables the study to test the proposed theoretical model, explains the causal relationships between the constructs of the suggested model, and enables the study to collect a wide range of quantitative data to test the suggested model.

Positivist philosophy is commonly used in quantitative social research due to the ability of this paradigm to understand any set of events and experiences, and identify the causes of these events (Dooley, 2001). Positivists 'prefer collecting data about an observable reality and search for regularities and causal relationships in the data to create law-like generalisations' (Saunders, Lewis, & Thornhill, 2012, p. 134). The positivist paradigm has some advantages, for instance, it is fast, economical, and a range of situations can be covered (Easterby-Smith, Thorpe, Jackson, & Lowe, 2008).

On the other hand, the interpretive approach can be used if there are no predefined dependent or independent variables and the knowledge of reality is gained via social constructions, for instance, language, consciousness, shared meaning, documents and other artefacts (Klein & Myers, 1999). One of the most important principles of interpretive research is the interaction between researchers and the subjects which, according to Klein and Myers Klein & Myers (1999) 'Requires critical reflection on how the research materials (or "data") were socially constructed through the interaction between the researchers and participants' (p. 72). There are some difficulties in conducting interpretive research, for instance, the stage of data collection requires sufficient resources and time, or there may be difficulties in analysing and interpretation the data, and in managing the research pace, progress, and end-points (Easterby-Smith et al., 2008).

The interpretive paradigm assumes that there are no predefined dependent and independent variables. Thus, this study did not adopt the interpretive paradigm because this study depends on the causality approach to establish and test the study model.

The main concern of critical research is to critique existing social systems and identify inconsistencies and conflicts that may be inherent within their structures (Orlikowski & Baroudi, 1991). However, this paradigm is not suitable for this study because critical research depends on the analysis of social and historical practices and tends to be longitudinal. Furthermore, 'The reliance on historical analyses is compatible with the belief that a phenomenon can only be understood historically, through an analysis of "what it has been, what it is becoming, and what is not". This analysis leads to research outcomes that differ from positivist research' (Orlikowski & Baroudi, 1991, p. 20).

With respect to ontology, the degree of subjectivity versus objectivity is believed to be central to this concept (Cater-Steel, 2004). Subjectivism is defined as 'An ontological position that asserts that entities are created from the perceptions and consequent actions of those social actors responsible for their creation' (Saunders et al., 2012, p. 682). The objectivism approach is defined as 'an ontological position that implies that social phenomena confront us as external facts that are beyond our reach or influence' (Bryman, 2012, p. 32).

Philosophically, nominalism or idealism espouses an individual's concept of reality. On the other hand, realists believe things exist in a real and concrete world (Cornford

& Smithson 1996) and that it is possible to know 'how things really are and how things really work' (Guba & Lincoln, 1994, p. 108).

An objective view is taken in this study by investigating the pertinent factors of e-learning system success, as well as considering various stakeholders' points of view about the effect of various factors on the success of e-learning systems.

3.4. Study approach

This study raises a number of research questions to investigate the factors affecting e-learning systems success and a model is proposed based on these factors. The proposed model is the theoretical basis of this study, and contributes to research in the field of information systems. According to James et al. (1982), 'Theory means a set (or sets) of interrelated causal hypotheses that attempt to explain the occurrence of phenomena, physical, biological, social, cultural, or psychological' (p. 27). Based on this definition, the causality approach is adopted in this study. The main justification for using this approach is that it provides the ability to show causal relationships among the factors of the phenomena occurring in a physical system (Atoji, Koiso, & Nishida, 2002).

Causality or 'cause and effect' approach is considered to be an important tool to discover phenomena. Causality is defined as the 'relationship between cause and effect. Everything that happens will have a cause, while each action will cause an effect' (Saunders et al., 2012, p. 666). Introduction of the causality approach has received considerable attention in social science and it is frequently used in the information systems field.

To establish a theoretical model there are five basic components that should be considered:

1. Phenomena or the variables that act as causes and effect.
2. Causal connection among the variables.
3. A theoretical rationale for each causal hypothesis.
4. Boundaries, which specify the context.
5. Stability, which implies that the hypothesised structure of causal connections will be consistent over specified time intervals (James et al., 1982, p. 27).

This study considered these five components in establishing the study model. The constructs of the model act as causes and effects; and these constructs link with each other based on the causal connection (component 1 and 2). Regarding component 3, all the study hypotheses are supported by the theoretical justifications; and the theoretical rationale was considered in formatting these hypotheses, as shown in section 3.5. In relation to boundaries, specific constructs and relationships were identified in the study model. Moreover, specific measurements are prepared to measure each construct in the study model. Accordingly, the model clearly identifies the context of study, which will be limited to the constructs of the study model. The stability of the model needs investigation, however, the suggested model will be tested in this study with (i) students, (ii) academic staff, and (iii) ICT staff. The results of testing the model with these three samples can provide indicators about the stability of the model.

3.5. Study hypotheses

Hypotheses can be of two types: null and alternative. The two types of hypotheses identify the nature of relationship between the variables. In this regard, Saunders et al. (2012) state 'The null hypothesis predicts that there will not be a significant difference or relationship between the variables … The alternative hypothesis predicts that there may be a significant difference or relationship between the variables' (p. 174).

The alternative hypothesis can be in two forms: two-sided (tailed) alternative and one-sided alternative (Sharpe et al. 2010). The two-sided alternative is used when proportions deviate from 50 percent in either direction, whereas the one-sided alternative focuses on deviations in only one direction (Sharpe et al. 2010). In this study the hypotheses are stated in the one-tailed alternative form. The study adopts the positivist paradigm that depends on a priori fixed relationships based on the literature in the information systems and e-learning systems field. Each relationship between the constructs of model is supported by previous studies. Accordingly, this study adopts the philosophical assumption that the relationship effects among the constructs of study model will be positively significant as indicated in previous literature.

The theoretical foundation and supportive literature to formulate the study hypotheses are outlined as follows.

3.5.1. Hypotheses of direct effect

According to the study model (shown in Figure 3.1), there are 21 direct relationships between the constructs of model that affect each other. The hypotheses are formulated to investigate these effects and to identify the nature and power of them. The hypotheses of direct effects are as follows.

3.5.1.1. IT infrastructure services

IT infrastructure services is selected in the study model as a foundation construct to achieve the success of e-learning systems. IT infrastructure services are the physical assets, human resources, knowledge, hardware, software, and telecommunications networks that are employed to deliver services and applications. The adoption of IT infrastructure services in the study model was based on the theoretical and empirical justification from the literature. In this regard, Xu et al. (2010) state that 'IT infrastructure is generally considered as the base of the organisations' IT portfolio and one of the most important IT resources' (p. 124). The role of IT infrastructure services in enhancing organisational performance has been confirmed by previous researchers (Silverman, 1999); (Bharadwaj, 2000); (Santhanam & Hartono, 2003); (Sobol & Klein, 2009); (Fink & Neumann, 2009); (Ramirez et al., 2010); and (Luo et al., 2012). Moreover, IT infrastructure is considered as a major resource in organisational competitive advantage (Bhatt et al., 2010).

IT infrastructure services were selected as a key construct to assess the success of information systems and previous results confirm this role (Finlay and Forghani (1998), Shang and Seddon, (2002), Palanisamy (2005), Sabherwal et al. (2006), Verdegem and Verleye (2009), Xu et al. (2010). In e-learning systems research, few studies have investigated the role of IT infrastructure services in the success of this type of system. Some studies adopted IT infrastructure to measure the success of e-learning systems, however, these studies adopted narrow measurements to assess this essential construct.

Based on this evidence about the significant impact of IT infrastructure services on organisational performance, competitive advantage, value and system success this construct is considered to be the foundation of e-learning system success. Accordingly, IT infrastructure services are hypothesised to be a determinant of five constructs in the proposed model.

System quality, information quality, and service delivery quality are used as key constructs to measure the success of e-learning systems. DeLone and McLean (2003) adopted these constructs as exogenous factors in their information system success model.

However, only a very limited number of studies have adopted factors that can determine or enhance system quality, information quality, and service delivery quality in the framework of information system success. The notion of these hypotheses is to investigate the role of IT infrastructure services in enhancing and supporting the quality of e-learning systems, information quality and service delivery quality. Accordingly, the suggested hypotheses are:

H1: IT infrastructure services significantly and directly affect system quality.

H2: IT infrastructure services significantly and directly affect information quality.

H3: IT infrastructure services significantly and directly affect service delivery quality.

Generally, IT infrastructure services can assist in enhancing organisational performance and stock price (Luo et al., 2012). However, the impact of IT infrastructure services on perceived usefulness and user satisfaction is still ambiguous, especially in the e-learning system field. For example, Hussein et al. (2007) found that there is a positive and significant correlation between IT infrastructure and perceived usefulness in the e-government area. Thompson (2010) found that IT infrastructure support did not significantly impact perceived usefulness. The same issue appears with the role of IT infrastructure services and its role in determining user satisfaction.

IT infrastructure services is assumed to be the construct that can support perceived usefulness via assisting students, academic staff and ICT staff to achieve their tasks effectively and enhance satisfaction attitudes toward the e-learning system. Based on this notion, hypotheses 4 and 5 were formulated:

H4: IT infrastructure services significantly and directly affects perceived usefulness.

H5: IT infrastructure services significantly and directly affects user satisfaction.

3.5.1.2. System quality

System quality is frequently employed to measure the success of information systems and e-learning system success (DeLone and McLean (1992); Dabholkar (1996); Chen and Wells (1999); DeLone and McLean (2003); Gable et al. (2003); Stoel & Lee (2003); DeLone & McLean (2004); Lewiecki et al. (2006); Wells et al. (2011); Islam (2012).

System quality is selected as a key construct in the study model. Based on the design of the proposed model, four factors are assumed to be affected by system quality: information quality, service delivery quality, perceived usefulness, and user satisfaction.

The model of DeLone and McLean (2003; 1992) assumed that system quality, information quality, and service quality directly affect user satisfaction and intention to use. Some studies that adopted the model of DeLone and McLean (2003) dealt with system quality, information quality and service quality as exogenous constructs and established there is no causal effect between them (Seddon and Kiew (1994); Jennex et al. (1998); DeLone and McLean (2004); McGill et al. (2003); Iivari (2005); Fan and Fang (2006); Lin (2007); Lee and Chung (2009); Pérez-Mira (2010).

However, limited studies considered the causal impacts between these three constructs. For example, Gorla et al. (2010) established that system quality significantly impacted information quality. Almutairi and Subramanian (2005) found a significant correlation between system quality and information quality; and, regarding the relationship between system quality and service quality, Bharati and Berg (2003) found a significant correlation between these two factors. This study, as mentioned before, adopts the causality approach. Accordingly, system quality is assumed to be a determinant of information quality and service delivery quality. Based on this notion, the formulated hypotheses are:

H6: System quality significantly and directly affects information quality.

H7: System quality significantly and directly affects service delivery quality.

Seddon and Kiew suggested that 'Increases in system quality will cause increase in usefulness' (1994, p. 101) and this claim is supported via an empirical study in which they found that system quality is an essential determinant of usefulness. Similar findings were obtained by Sabherwal et al. (2006), Liaw (2008a), Floropoulos, Spathis, Halvatzis, and Tsipouridou (2010), Landrum, Prybutok, Strutton, and Zhang (2008), Zheng, Zhao, and Stylianou (2012), and Wang and Lin (2012). Based on these findings about the impact of system quality on perceived usefulness, hypothesis 8 is formulated:

H8: System quality significantly and directly affects perceived usefulness.

DeLone and McLean state that 'Higher system quality is expected to lead to higher user satisfaction and use' (2003, p. 11). This claim is supported via the empirical investigations of Seddon and Kiew (1994), Wixom and Todd (2005), McGill and Klobas (2008) and Chen and Cheng (2009). This claim is also supported empirically in the e-learning system area by Holsapple and Lee-Post (2006), Landrum et al. (2008), and Chen (2010) who found that the quality of e-learning systems significantly impacts user satisfaction. Accordingly, it is hypothesised that:

H9: System quality significantly and directly affects user satisfaction.

3.5.1.3. Information quality

Information quality is an indispensable factor in assessing information systems success. Many studies in the information systems and e-learning systems field adopted information quality as an essential measure of system success. Poor information quality may lead to serious problems (Wang & Strong, 1996) due to the strategic role of information in the achievement of organisational goals and in organisational decision-making.

Based on the causality approach adopted in this study, information quality is assumed to be a determinant of three constructs: service delivery quality, perceived usefulness, and user satisfaction.

Lee, Choi, and Kang (2009) examined the impact of satisfaction of website information (information quality) on two sub-dimensions of service delivery quality: efficiency and fulfilment. The findings showed that information quality significantly impacted service quality and explained 44 percent of the efficiency and fulfilment. Thus, it is hypothesised that:

H10: Information quality significantly and directly affects service delivery quality.

Seddon and Kiew (1994) suggested, and empirically confirmed, that an increase in information quality leads to an increase in perceived usefulness. Similar findings were yielded by Rai et al. (2002), Landrum et al. (2008) were in agreement about this relationship in the context of a web-based library. They found a significant correlation between information quality and service delivery quality, but the impact of information quality on perceived usefulness was non-significant. The influence of information quality on perceived usefulness in the e-learning system arena was confirmed by studies undertaken by Lee and Kozar (2006) and Chen (2010). Hence, hypothesis 11 is proposed:

H11: Information quality significantly and directly affects perceived usefulness.

DeLone and McLean (1992) in their model suggested information systems as a determinant of user satisfaction. Various other studies empirically investigated this claim and found user satisfaction is significantly impacted by information quality (Rai et al. (2002); Fan and Fang (2006); Lin and Lee (2006); Jang et al. (2006); Wang and Liao (2008); Park et al. (2011). Based on empirical evidence about the relationship between information quality and user satisfaction, hypothesis 12 was formulated:

H12: Information quality significantly and directly affects user satisfaction.

Generally, higher information quality is assumed to increase the quality of services delivered to users, usefulness, and user satisfaction. Delivering educational services and information with high quality to users can be useful in enhancing the ability of users to achieve their tasks quickly and effectively, and improve their satisfaction toward the use of an e-learning system.

3.5.1.4. Service delivery quality

Service delivery quality is providing the services to customers taking into account the customers' needs and expectations. The role of service delivery quality in the success of information systems has been identified as an issue since the 1980s (Rockart, 1982). The role of service delivery quality in assessing and measuring the success of information systems has been confirmed via the creative contributions of studies by, for example, Pitt et al. (1995), Kettinger and Lee (1994), Li (1997), and Wilkin and Hewitt (1999). The results of these contributions are reflected in the updated model of DeLone and McLean (2003) who added service quality as a component of information system success.

It is to be expected that perceived usefulness would be affected by service delivery quality. Delivering educational services via electronic channels while considering quality aspects can be useful for users in undertaking their tasks effectively and speedily—subsequently enhancing their performance. This expectation about the relationship between service delivery quality and perceived usefulness is supported by Landrum et al. (2008) who found a significant influence of service quality on perceived usefulness. Accordingly, hypothesis 13 is proposed as follows:

H13: Service delivery quality significantly and directly affects perceived usefulness.

According to the updated model of DeLone and McLean (2003), user satisfaction is directly affected by service quality. Klobas and McGill (2010) tested this relationship in the context of a Learning Management System (LMS) and found that service quality significantly impacted user satisfaction. This finding is also supported empirically by studies conducted by Lin and Lee (2006), Bressolles et al. (2007), Wang and Liao (2008), Yi and Gong (2008), and Hsieh and Cho (2011). Therefore, it is hypothesised that:

H14: Service delivery quality significantly and directly affects user satisfaction.

Information systems should increase the benefits obtained by the customer via the use of these systems and applications. The benefits of adopting and using this system should be adding value for customers. For instance, e-learning systems services should enhance the ability of students to analyse and understand the information and concepts, and enhance social value. Parasuraman et al. (2005) conducted a study to evaluate the impact of electronic service quality on customer value and found 'customer assessments of SQ are strongly linked to perceived value and behavioural intentions' (2005, p. 2). It is hypothesised that:

H15: Service delivery quality significantly and directly affects customer value.

The study model assumes that organisational value can be supported by service delivery quality. In other words, delivering the services to users while considering quality aspects can be useful in increasing competitive advantage, reducing costs, and improving the organisation's reputation. In this regard, Gorla et al. (2010) examined the impact of service quality on organisational impacts. The results confirmed the significant and positive influence of service quality on organisational impacts. Thus, hypothesises 16 is formulated as follows:

H16: Service delivery quality significantly and directly affects organisational value.

3.5.1.5. Perceived Usefulness

Since the 1970s, perceived usefulness is a construct widely used by researchers to measure the acceptance and success of information systems (Christie, 1974); Lucas Jr (1975); Robey (1979); Larcker and Lessig (1980); Chenhall and Morris (1986); Davis (1989); Seddon and Kiew (1994); Doll et al. (1998); Venkatesh and Davis 2000); Venkatesh et al. (2003); Venkatesh, Thong, and Xu (2012).

The model proposed for this study is expected to show that perceived usefulness can enhance user satisfaction. Arbaugh (2000a) empirically supported this relationship and found that students' satisfaction toward course experiences can be enhanced via perceived usefulness of the electronic medium used to deliver the courses.

A later study by Drennan et al. (2005) also supported these findings and verified the significant role of perceived usefulness in enhancing user satisfaction. Therefore, it is hypothesised that:

H17: Perceived usefulness significantly and directly affects user satisfaction.

According to the suggested model of this study, the impact of perceived usefulness can include customer value. Johnson et al. (2008) suggest that perceived usefulness is affected by e-learning effectiveness. In their empirical investigations, e-learning effectiveness was measured by course instrumentality, course performance, and course satisfaction. Course instrumentality focused on the customer value generated via the use of the e-learning system. The results showed that perceived usefulness significantly impacted the three indicators for measuring e-learning effectiveness: course instrumentality, course performance and course satisfaction. Hypothesis 18 is formulated as follows:

H18: Perceived usefulness significantly and directly affects customer value.

Based on the study model, the final expected impact of perceived usefulness is on organisational value. In this regard, Park et al. (2011) suggest that organisational value is significantly impacted by perceived usefulness. The findings of the empirical study confirmed this significant influence. Thus, it is hypothesised that:

H19: Perceived usefulness significantly and directly affects organisational value.

3.5.1.6. User satisfaction

User satisfaction is considered a vital component in measuring the success of information systems (Bailey & Pearson, 1983; Chin et al., 1988; DeLone & McLean, 2003; DeLone & McLean, 1992; Gudigantala et al., 2010; Ives et al., 1983; Pike et al., 2010; Somers et al., 2003; Watson et al., 1998).

DeLone and McLean (2003) claim that net benefits are directly influenced by user satisfaction. The effect of user satisfaction on individual impact (customer value) was investigated by McGill et al. (2003); Wang and Liao (2008); Chen and Cheng (2009); Masrek et al. (2010); Adeyinka and Mutula (2010); and Koh et al. (2010). The results from all these studies confirm the significant role of user satisfaction as a determinant of customer value. Therefore, it is hypothesised that:

H20: User satisfaction significantly and directly affects customer value.

The impact of user satisfaction is not limited to customer value according to the study model, but includes organisational value as well. This relationship was examined by Ghobakhloo et al. (2011) and Koh et al. (2010) and the findings confirm the significance of user satisfaction in enhancing organisational value. Hypothesis 21 is formulated as follows:

H21: User satisfaction significantly and directly affects organisational value.

3.5.1.7. Customer value

Customer value has received considerable attention in the marketing literature. This factor is an essential factor for organisations in obtaining a competitive advantage (Woodruff, 1997). This attention is drawn from the information system literature and is due to extensions in e-commerce and using electronic applications in different areas such as education, banking and health. E-learning systems depend on delivering educational services via electronic channels. The current study expected that an e-learning system should enhance customer value and, based on the relationships in the study model, customer value is determined by three constructs: service delivery quality (H15); perceived usefulness (H18); and user satisfaction (H20).

3.5.1.8. Organisational value

One of the most important objectives of using information technology is to increase organisational value via financial benefits from IT, benefits of service quality, internal management benefits, and benefits from IT infrastructure (Le Roux, 2001). Therefore, organisational value is selected as a key component of the study model. According to the proposed model, organisational value is determined by three constructs: service delivery quality (H16); perceived usefulness (H19); and customer value (H21).

3.5.2. Hypotheses of mediator effect

Service delivery quality, as previously mentioned, has received considerable attention as a measure of information and e-learning system success (Liu and Arnett (2000); Cox and Dale (2001); O'Neill et al. (2001); Yang and Jun (2002); Wang et al. (2007); Park & Gretzel (2007); Adeyinka and Mutula (2010); Ding et al. (2011).

The proposed model in the current study adopts service delivery quality as a central construct in the model. The role of service delivery quality encompasses two elements: the direct effect and the mediation effect. Hypotheses 13, 14, 15 and 16 cover the direct impact of service delivery on the other constructs. Service delivery quality as a mediation construct has been examined and confirmed in prior studies. For example, Montoya-Weiss, Voss, and Grewal (2003) state that 'Modelling service quality as a mediator is consistent with prior research that has shown service quality perceptions are important indicators of customers' overall evaluations and market performance in service industries' (p. 499). Dean (2002) investigated the service quality of call centres as a mediation factor between customer orientation and loyalty. The results revealed that service quality partially mediated the relationship of orientation to loyalty. Similarly, Mandhachitara and Poolthong (2011) found that the effect of corporate social responsibility on repeat patronage intentions (behaviour loyalty) is mediated by perceived service quality.

Montoya-Weiss et al. (2003) proposed a model to investigate the determinants of online channel use and overall satisfaction. Service quality was selected to be the mediation factor between channel design perceptions and outcomes (overall satisfaction and online channel use). Lin and Hsieh (2006) investigated technology readiness and its role in customer perceptions and adoption of self-service technologies. Service quality was employed as a mediation factor between technology readiness and satisfaction. The findings confirmed that the impact of technology readiness on self-service technologies' satisfaction is mediated by the service quality of self-service technologies.

Prybutok, Zhang, and Ryan (2008) designed a model to study the effect of the leadership triad (leadership, strategic planning, and customer/market) and IT quality triad (information quality, system quality, and service quality) on e-government net benefits. The empirical study concluded that the leadership triad impacted net benefits via the IT quality triad.

These studies demonstrate the central role of service delivery quality in the models in evaluating the acceptance, success, and benefits of adoption and use of the electronic applications of information systems. The hypotheses of mediation effects of service delivery quality are formulated as below:

H22: The effect of IT infrastructure services on perceived usefulness is mediated by service delivery quality.

H23: The effect of system quality on perceived usefulness is mediated by service delivery quality.

H24: The effect of information quality on perceived usefulness is mediated by service delivery quality.

H25: The effect of IT infrastructure services on user satisfaction is mediated by service delivery quality.

H26: The effect of system quality on user satisfaction is mediated by service delivery quality.

H27: The effect of information quality on user satisfaction is mediated by service delivery quality.

Twenty-seven hypotheses were formulated to examine two types of relationships in the context of the proposed model. The first set of hypotheses focus on the direct impact of endogenous factors on exogenous factors; and the second set of hypotheses deal with mediation effects.

3.6. Chapter summary

Chapter three presented the study model and the constructs selected to establish this model. The overall philosophy of the study was also presented in this chapter. The positivist and objectivist paradigms are adopted for the study; and, as mentioned previously, this study also adopted the causality approach. This approach requires a theoretical rationale to establish each hypothesis. To achieve this condition, a specific Section (3.5) was allocated to presenting the hypotheses and the theoretical support and justification for each hypothesis.

CHAPTER FOUR

This chapter describes the research methodology used in this study. The first part of the chapter describes the study method. The second part is allocated to the selection of the study sample and justifications for using this sample. The collection method forms the third part of this chapter. The fourth section deals with questionnaire administration. The next section is allocated to presenting the statistical methods used to test study model. The indicators used to examine the validity and reliability are also presented in this chapter along with an outline of the procedures adopted to avoid response bias and non-response bias. Finally, details regarding ethical considerations in undertaking this study are presented.

CHAPTER FOUR: RESEARCH METHODOLOGY

4.1. Chapter introduction

The previous chapter presented the research philosophy, approach, model and theoretical justifications for the study. Subsequently, Chapter 4 describes the research methodology and discusses the selection of the most suitable methodology for this study. The purpose of this chapter is to justify the selection of the method of study, sample research, methods and instruments to collect data, and the methods adopted to analyse the data. The justification for selecting these methodological procedures is also presented in this chapter.

4.2. Research method

The research method is related to the selection of appropriate process to conduct the study. Different strategies have been identified to conduct research and there are enormous resemblances and overlaps among these methods (Zulu, 2007).

This study adopted the survey method, specifically the analytical survey.

Zikmund, Babin, Carr, and Griffin (2009) classified business research into three types based on the purpose of the research: exploratory; descriptive; and causal. Of these, qualitative and quantitative are the most common (Neuman, 2006).

In the information systems field, Williamson (2000) defines eight research methods: survey; case study; experimental design; systems development in information systems research; action research; ethnography; historical research; and the Delphi method. Some explanation will be provided to justify the selection of survey method for this research.

4.2.1. Case study

The case study is the most appropriate method to conduct the research if the researcher aims to investigate a specific issue in greater depth (Zulu, 2007). Yin defines the case study as ‘An empirical enquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomena and context are not clearly evident’ (1994, p. 13). The case study can be a single organisation; a single location; a person; or a single event (Bryman & Bell, 2011). The use of multiple-case study designs has increased in business and management studies. The main purpose of using multiple-case study is that the comparison between the cases can provide more understanding and explanation about the social phenomena under study (Bryman & Bell, 2011).

This study has not adopted the case study method because the results of this method cannot be generalised—which remains as the main disadvantage of the case study method (Zulu, 2007). One of the most important objectives of this study is to test the validity and reliability of the whole model to generalise the results; however, this objective cannot be achieved by adopting a case study method.

4.2.2. Experimental design

The experimental method is commonly used in natural sciences research (Neuman, 2007). The experimental design includes manipulation of an independent variable to investigate its effect on the dependent variable (Somekh & Lewin, 2005). However, there are many obstacles in obtaining the necessary level of control when the studies deal with organisational behaviour. Therefore, experimental design is rarely used in business and management studies (Bryman & Bell, 2011). This method was eliminated as an option for this study because it 'cannot experimentally manipulate important variables' (Stangor, 2011, p. 20). One of the key purposes of this study is to examine the importance of selected factors in the proposed model to measure the success of e-learning systems. Furthermore, including different groups and different dependent and independent factors increases the complexity of the experiment (Zikmund et al., 2009). This study includes eight constructs and one of these constructs, service delivery quality, plays a mediation role between the dependent and independent variables. The issue is not limited to the study model constructs but includes the sample as well because the study deals with three groups of stakeholders. Thus, it is difficult to control the experiment and obtain reliable results.

4.2.3. System development in information systems research

System development approach is known by two other names: engineering type research, and social engineering (Williamson, 2000). This method is related to theories of information systems design (Jones & Greoger, 2006). The main focus of the system development method is to test theory rather than establishing aspects of research, and this allows it to progress smoothly from development to evaluation (Williamson, 2000). However, Irani, Themistocleous, and Love (2003) claim that this approach fails to solve problems in the development of robust and flexible information systems. The main objective of this study is to evaluate the success of e-learning—not the development of these types of systems. Therefore, this method will not be adopted in this study.

4.2.4. Action research

The essential objective of this research is to develop a cause or enrich the conditions via increasing public awareness (Neuman, 2006). Leedy and Ormrod define action research as ‘A type of applied research that focuses on finding a solution to a local problem in a local setting’ (2010, p. 108). This method is used when there is a need to change the processes but the problems and their solution have not been identified (Zulu, 2007). This method was not considered a good fit in achieving the study objectives because this study does not aim to investigate any processes under change. The study aims to examine the success of an existing e-learning project. The drawback of action research is the weakness in internal and external validity (Powell & Connaway, 2004) and this may negatively impact the achievement of the study objective that focuses on establishing a valid and reliable model to assess the success of the e-learning system.

4.2.5. Ethnography

This method is adopted to study aspects of people or culture, and the researcher should be involved in this culture (Zulu, 2007). Observation is the main method used to gather data according to this research method. According to Zikmund et al., this method can be useful ‘when a certain culture is comprised of individuals who cannot or will not verbalise their thoughts and feelings’ (2009, p. 139). Ethnography method does not fit with the study approach and objectives. The proposed study model does not consider culture as a determinant of e-learning systems success. Thus, ethnography was eliminated as an option for this study.

4.2.6. Historical research

Historical research can be defined as ‘An effort to reconstruct or interpret historical events through the gathering and interpretation of relevant historical documents and/or oral histories’ (Leedy & Ormrod, 2010, p. 108). Researchers who adopt this method aim to build an accurate explanation and understanding about specific social phenomena based on the relevant data (Golder, 2000). Mason, McKenney, and Copeland (1997) claim that the history of using information technology in business can support managers by providing new understanding about managerial and economic processes and how they can utilise them to manage their organisations more effectively. The adoption of e-learning systems and more advanced information technologies in universities and organisations is an emerging phenomenon. Without a long history of events related to these systems, this method was deemed impractical for this study.

4.2.7. Delphi method

The Delphi method is defined by Loo (2002) as one that 'structures and facilitates group communication that focuses upon a complex problem so that, over a series of iterations, a group consensus can be achieved about some future direction' (2002, p. 763). Delphi method is a key method used to generate predictions that can be used in decision-making and subsequent activities. Okoli and Pawlowski (2004) state that Delphi research can be a useful method in new study fields and exploratory research. However, the Delphi method is not appropriate for this study since it aims to identify factors affecting the success of e-learning systems at the current time rather than to predict factors affecting these systems in the future.

4.2.8. Survey research

Survey method, specifically the analytical survey, is adopted in this study. The term survey literally means to 'look at or to see over or beyond or, in other words, to observe' (Powell & Connaway, 2004, p. 83). For the past 50 years, and especially during the last two decades, survey research has become an extremely scientific and accurate method to conduct research in different areas of the social sciences (Zikmund et al., 2009).

This method depends on asking the participants a set of pre-formulated questions (Zulu, 2007). The primary data is targeted in this type of research, and these data are collected from all or part of a population. The main purpose of collecting these data is 'to determine the incidence, distribution, and interrelationships of certain variables within the population' (Williamson, 2000, p. 71). Stangor (2011) claims that survey is a commonly used method due to its ability to collect a wide range of data about different variables in a relatively short timeframe. The main techniques used in survey research are questionnaires, interviews and observation.

Oppenheim (1992) identified two types of survey research: descriptive survey and analytical survey. The first type of survey research aims to ascertain from members of a population their opinions, characteristics, or/and understanding of how often specific events occur. The descriptive survey is not intended to show the relationships among the variables or/and explain anything about these relationships. The main objective of this survey is fact-finding and descriptive, and the data gathered in this type of survey can be employed in generating predictions via comparing the data from different times. Different stakeholders, for instance, governments, manufacturers and economists can employ surveys to collect necessary data for action.

Analytical survey research is designed to answer the question of 'why' rather than 'how many' or 'how often'. In other words, this type of research looks to provide explanation and clarification about the relationships between the variables, especially, the causality relationships. The analytical survey fits with the research philosophy and causality approach adopted in this study. Obtaining evidence about the relationships between variables could be via the causal research (Rao, 2002). Accordingly, the analytical survey method is selected to conduct this study.

The main justifications in selecting the survey method to undertake this study are:

- The use of this method enables the researcher to collect a wide range of data in a short timeframe (Stangor, 2011). This study is targeted at three types of stakeholders of e-learning systems: students, academic staff, and ICT staff; any other method may need more time to gather data from those stakeholders, especially with difficulties in accessing students who are enrolled solely in online courses.
- This method is fitting with studies adopting the causality approach, such as the current study. Survey method will assist in identify the nature and significance of relationships and effects among the model constructs in this study, and enable the researcher to provide explanations and understanding about these relationships.
- The results of this method can be generalised to the population. E-learning systems are commonly used in Australian educational institutions and organisations, and this study aims to obtain results that can be generalised to

these educational institutions and organisations and employed to enhance the success of e-learning systems.

Survey research is deemed highly flexible and a wide range of research questions can be utilised (Muijs, 2004). This aspect has been employed in this study. The proposed model has eight constructs, 27 relationships among the constructs, and service delivery quality has a mediation role between dependent and independent variables. Thus, survey method is an appropriate method to examine these complex issues.

Overall, a survey method is deemed suitable to gather suitable data to examine this model.

4.3. Research sampling

Research sampling is an essential stage in social research. The study sample should be determined accurately because it plays a key role in answering the research question(s) and achieving the study objectives (Brace, 2008). This stage is considered to be a critical issue facing researchers because of the difficulties in selecting participants from the population (Gill & Johnson, 2002). Zikmund et al. (2009) define sampling as an activity that 'Involves any procedure that draws conclusions based on measurements of a portion of the population' (2009, p. 68). The essential objective of social science studies is to test theories and hypotheses. However, it is impossible to reach all population members to include them in a study (Healey, 2009). To solve this problem, researchers tend to select a sample from the population of study. In this regard, Elsheikh states that 'This means that the researcher may consider a small group of people who are representative of a large group and therefore the results could be generalised more accurately for a large group of population' (2011, p. 187). Different designs have been proposed to select the sample. The sample designs can be classified into two groups. The first group is probability sampling and includes simple random sampling, stratified random sampling, proportional stratified sampling, cluster sampling, and systematic sampling. The second group is non-probability and includes convenience sampling, quota sampling, and purposive sampling (Leedy & Ormrod, 2010).

The study population is all the users of the e-learning system including students, academic staff, ICT staff, trainers, and management. However, enumerating all these groups of stakeholders in the context of this study is impractical. Thus, USQ has been selected to be the sample of this study. There are some justifications in adopting the USQ as a study sample:

- USQ is believed to be one of the pioneer universities in the distance education area.
- The three stakeholders included in this study: students, academic staff and ICT staff have frequent contact with e-learning systems at USQ and that means they have sufficient experience to participate in this study and provide useful opinions in relation to the success of the e-learning system.
- The researcher is enrolled in a PhD program at USQ and has access to information that is required for this study and that will assist in collecting data effectively and timely.
- The segment marketing of USQ focuses on distance education and the percentage of online students in 2010, 2011, and 2012 was 73.1 percent; 73.5 percent; and 73.4 percent respectively (USQ, 2012).
- One of the most important reasons in selecting USQ for conducting the study is that USQ’s Share of Australian Distance Education enrolments in 2009, 2010, and 2011 was 13.2 percent, 12.8 percent, and 12 percent respectively, and USQ share of International Distance Education enrolments in 2009, 2010, and 2011 was 41.9 percent, 40.6 percent, and 41 percent respectively.

More details and indicators of market share of USQ are provided in Table 4.1.

Table 4.1 Some indicators about USQ’s market

Indicators	2008	2009	2010	2011	2012
External/Online students	18,402	18,903	19,219	19,432	19,976
Total students enrolments	24,213	25,906	26,289	26,421	27,228
% Enrolment External	76%	72.9%	73.1%	73.5%	73.4%
Academic Staff (Full-time equivalent)	578	578	651	648	662
USQ Share of Queensland Providers enrolments	12.6%	12.2%	11.9%	11.9%	-
USQ Share of Australian Distance Education enrolments	13.7%	13.2%	12.8%	12.0%	-
USQ Share of International Students enrolments (Australian Providers)	2.5%	2.2%	2.0%	1.8%	-
USQ Share of International Distance Education enrolments	41.3%	41.9%	40.6%	41.0%	-
Market Share of Queensland Distance Education enrolments	53.5%	52.3%	51.9%	51.3%	-

Reference: (USQ, 2012)

The elements of the sample can be categorised by stratification based on common characteristics (Dooley, 2001). In this regard, Wang states that 'Stratified random sampling consists of taking random samples from various strata, which are different sub-populations with a large population' (2003, p. 147). In this study, the stakeholders of e-learning systems fall into three strata: students; academic staff; and ICT staff. These three stakeholder groups of the e-learning system at USQ are targeted. The key reason behind selecting those groups is to evaluate the success of the e-learning system from different points of view. Assessing the system with different users can be useful in identifying which factors are more important for each group of stakeholders, and which constructs can impact user satisfaction, customer value, and organisational value for each stakeholder.

The procedures of sampling in this study have been conducted in two stages.

- The first stage involved obtaining ethical approval to conduct the survey. The University of Southern Queensland's Human Research Ethics Committee approved the surveys. The approval letter is included in Appendix A.
- At the second stage, the permission from Deans of the five Faculties was sought: Faculty of Business and Law; Faculty of Sciences; Faculty of Arts; Faculty of Engineering and Surveying; and Faculty of Education. The permission from the Deans of the Faculty of Business and Law and Faculty of Arts was obtained to involve the external students and the academic staff in the survey. Permission from the Dean of the Faculty of Sciences includes external students in two departments and all academic staff in the Faculty. The Faculty of Engineering and Surveying provided the researcher permission to survey one course from each year of study. In regard to the academic staff, permission of the Faculty's Dean was limited to one department. However, the permission of that Department head was not received. Thus, academic staff from the Faculty of Engineering and Surveying did not participate in the survey. The Open Access College granted the researcher permission to survey academic staff. Unfortunately, the Faculty of Education rejected the researcher's request to conduct the survey with students and academic staff. Therefore, the Faculty of Education was eliminated from the study. Finally, the permission of the ICT Director resulted in ICT staff being included in the study.

Accordingly, the method used to select the study sample is convenience sampling. Zikmund et al. define convenience sampling as the ‘procedure of obtaining those people or units that are most conveniently available’ (2009, p. 396). Regarding the reason behind using this method, Denscombe (2010) states that ‘Because researchers have limited money and limited time at their disposal, it is quite reasonable that where there is scope for choice between two or more equally valid possibilities for inclusion in the sample, the researchers should choose the most convenient’ (2010, p. 38). The use of a convenience sample is suitable when the researcher can easily access potential respondents through existing contacts, and the organisation represents a ‘typical’ case (Saunders et al., 2012).

Keeping the above aspects of convenience sampling in perspective, the study adopted this method. Justification for the adoption of this method is as follows:

- Conducting the study in many different educational institutions would be prohibitively costly and time-consuming and selecting the USQ can assist in minimising the constraints of time and finance.
- The researcher had ready access to information on USQ related to the study, such as courses, academic staff, university structure, and faculties and departments. Also, the researcher could easily contact academic staff and senior management at the University.
- USQ is a typical case in the distance education area. According to information in Table 4.1, USQ occupies a healthy position in Australia and worldwide in the distance education industry. Thus, USQ can sufficiently represent the educational institutions that adopt e-learning systems.

4.4. Data collection method

This study, as mentioned before, adopts the survey method. Various methods can be used to collect data according to this method, for instance, door-to-door personal interview, mall intercept personal interview, telephone interview, mail survey, and Internet survey (Zikmund et al., 2009). Each method has advantages and disadvantages, thus, the advantages and disadvantages should be considered in selecting the most suitable method to gather data.

For this study, the Internet survey was selected as the most suitable method to gather the data from the sample. The justifications for employing this method are as follows:

- This study aims to investigate one of the most common web-based systems: e-learning systems. The users of e-learning systems must use the Internet to achieve the required activities, and they are familiar with using computers and that will make completion of the questionnaire easy for them.
- Completion of the questionnaire by respondents does not require that the researcher be available (Beins & McCarthy, 2012).
- In this study, it is impossible to collect the data face-to-face from the sample, especially external students because they are in different parts of Australia and the world. Therefore, the Internet survey is the most suitable method to overcome the obstacle of geographically dispersed external students.
- The use of Internet survey enables researchers to transfer the data to the statistical software package directly rather than enter it manually (Stangor, 2011). This eliminates the need to enter the data manually and avoids mistakes in entering the data.
- The cost of Internet survey is low and the response is quick. In this regard, Griffis et al. (2011) state that respondents may perceive electronic communications as more urgent than traditional methods. Accordingly, the cost of collecting data and the response time will be reduced, particularly for this study that includes three different and geographically dispersed samples.

Regarding Internet surveys, there are some potential problems facing researchers in the use of this method. Low response rate is the key disadvantage of Internet survey (Fan & Yan, 2010). In this respect, Zikmund et al. state that ‘When the computer user does not expect a survey on a Web site and participation is voluntary, response rates are low’ (2009, p. 227). This study adopted the Internet survey and used the web site and email to collect the data; and participation was voluntary. To avoid the problem of low response rate, two strategies were adopted in this study. The first strategy involved the allocation of prizes (three mobile iPhones) to motivate students, academic staff, and ICT staff to participate in this study. The second strategy involved sending the questionnaire a second time as a reminder to respondents to participate.

4.5. Questionnaire administration

Questionnaire has been selected as an instrument to collect the data. Questionnaire is a suitable instrument to collect the data based on the survey research method adopted in this study. Many advantages can be gained from using the questionnaire in this study: encouraging participants to answer frankly; eliminating interview bias; eliminating variation in the questioning process; facilitating collection and analysis of data; collecting large amount of data in a short timeframe; and it is economical to manage (Powell & Connaway, 2004). Questionnaires can be sent to people who live anywhere regardless of geographical boundaries (Leedy & Ormrod, 2010): this is considered the key advantage of using questionnaires in this study because the study sample, particularly students, are distributed in different countries around the world. Design and administration of the questionnaire is an important stage in conducting research (Wang, 2003). In this study, the items comprising the three questionnaires are adopted from previous studies. Administration of the three questionnaires was in four stages: format of questionnaire; scale of measurement; pilot study; and final questionnaire.

4.5.1. Format of questionnaire

Three questionnaires were prepared to measure the constructs of the proposed model. Each questionnaire was allocated to a specific sample of this study: students; academic staff; and ICT staff. The questionnaires have been designed based on previous studies in the information systems and e-learning systems field. The number of items in the first draft was 68 for students, 72 for academic staff, and 64 for ICT staff. Tables B.1, B.2, and B.3 in Appendix B shows these items.

4.5.2. Scale of measurement

Likert scale is the common scale to measure beliefs and people's perceptions about topics under investigation (Stangor, 2011). Zikmund et al. define Likert scale as 'A measure of attitude to allow respondents to rate how strongly they agree or disagree with carefully constructed statements, ranging from very positive to very negative attitudes toward some object' (2009, p. 318). Likert scale is based on a continuum with numbers assigned to indicate differences in the degree of aspects or characteristics from higher to lower order (Rao, 2002). Likert scale is suitable for this study because its main purpose is to evaluate e-learning system success via the attitude and opinions of three groups of stakeholders. The 5-point Likert scale was used in the three questionnaires of the study with a scale of: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree. Two additional choices were provided to give respondents more alternatives in selecting the most suitable option: 'Not applicable' and 'Don't Know'. According to Krosnick et al., these options are considered important for respondents as 'offering a no-opinion option should reduce the pressure to give substantive responses felt by respondents who have no true opinion' (2002, p. 371). 'Not applicable' can be selected to describe when the item cannot be applied to the e-learning system under study. 'Don't Know' is used to minimize non-attitude reporting (Krosnick et al., 2002).

4.5.3. Pilot study

Pilot study or pilot test is an important step before releasing the final instrument to collect the data. Stangor defines the pilot study as 'An initial practice test of a research procedure to see if it is working as expected' (2011, p. 424).

Many advantages can be gained in undertaking a pilot study:

- Pilot study can be used as an effective strategy to minimise problems in the study instrument (Muijs, 2004).
- Pilot study can assist in ensuring that the instructions, questions, and items in the questionnaire are clear. In addition, identifying additional contaminating factors that could impact the results is another essential function in the pilot study (Pallant, 2011).
- Pilot study can assist in creating clear and understandable questions to elicit information from participants. Furthermore, thoughts about the conceptual factors of interest can be generated via a pilot study (Stangor, 2011).
- The pilot study is considered to be an excellent method to ascertain the feasibility of the study (Leedy & Ormrod, 2010).

The pilot study can be conducted on a small group of persons from the population the researcher intends to sample (Muijs, 2004; Pallant, 2011). The interview can be used to conduct the pilot study in the survey research. In this regard, Bryman states that 'If the main study is going to employ mainly closed questions, open questions can be asked in the pilot study to generate the fixed-choice answers. Glock (1988), for example, extols the virtues of conducting qualitative interviews in preparation for a survey for precisely this kind of reason' (2011, p. 262).

The interview method has been adopted in this research to undertake the pilot study to identify and solve problems in the instrument. Three students enrolled in courses delivered via e-learning systems accepted an invitation to participate in a preliminary test of the pilot study. These students were native English speakers with prior experience with e-learning systems due to having used this system in their previous study. The pilot study included three academic staff members from USQ. Those academic staff members had experience in using the e-learning systems and two of them had knowledge of the information systems discipline that assisted in identifying and resolving problems in the instrument. Finally, interviews during the pilot study phase were carried out with two persons working in the e-learning systems field and with experience as ICT staff members.

Each person was interviewed twice. The first interview focused on delivering the questionnaire and providing the respondent with details about the study such as objective, sample, model constructs, and the benefits of study. The first interview sought to explain the main purpose of the interview and to seek their help in identifying any ambiguous, double barrelled, or repeated questions, and to determine any questions that might not be understandable to respondents.

The purpose of the second interview was to elicit their comments, feedback and explanation about the items in the questionnaires. Then, the identified items in the questionnaires for each group were reviewed, resolved or reworded (if necessary), based on the comments and recommendations of the interviewees. Table 4.2 summarises the results of the interviews of the pilot study and the changes subsequently adopted in the questionnaires.

Table 4.2 Summary of pilot study

Stakeholders	**Number of items in draft**	**Reworded questions**	**Eliminated questions**	**Added questions**	**Number of items in final questionnaire**
Students	68	18	14	-	54
Academic Staff	72	30	16	-	56
ICT Staff	64	2	1	4	67

The results in Table 4.2 indicate that some problems arose in the questionnaire, especially the repetition of some questions within the construct or with another construct. The suggestions of students, academic staff and ICT staff assisted in eliminating some questions due to their similarity with other questions. In addition, some questions were re-worded to be more appropriate and concise. Tables B.1, B.2, and B.3 in Appendix B show details of students, academic staff experts, and ICT staff experts' comments and actions undertaken to resolve the problems.

4.5.4. The final items of the questionnaires

The final questionnaires were prepared based on the suggested changes in the pilot study. Accordingly, the items are used in measuring each construct in the proposed model for each sample are now explained.

4.5.4.1. IT Infrastructure services

The items of IT infrastructure services were adopted from Fink and Neumann (2007) who based this instrument on earlier studies (Broadbent & Weill, 1997; Broadbent et al., 1999; Weill et al., 2002). The focus of this measure is the range and number of IT infrastructure services. The items adopted to measure IT infrastructure services are distributed in three groups: six items for the student sample; six items for academic staff; and ten items for ICT staff. Table 4.3 shows these items and the aspects for each item.

Table 4.3 Items of IT Infrastructure services

Code	Students	Aspects
ITIS1	The Division of ICT provides me with a wide range of electronic channels such as email, website, and call centres to connect with lecturers, students, and different divisions at USQ	Channels Management
ITIS2	The Division of ICT provides me with an e-learning service with a high level of technical security	Security
ITIS3	The Division of ICT provides me with data management advice and consultancy	Advice and Consultancy
ITIS4	The Division of ICT enables me to receive and exchange information and knowledge with lecturers and other students by using (e.g. electronic linkages and software applications)	Communication Infrastructure
ITIS5	The Division of ICT provides me with a wide range of facilities to perform e-learning activities, such as access to the library	Application Infrastructure
ITIS6	ICT provides me with technology advice and support services related to the e-learning system	Support Services
Code	**Academic Staff**	**Aspects**
ITIS1	The Division of ICT provides me with a wide range of channel management services (e.g. electronic channel to the students to support multiple applications, such as Web sites, call centres, mobile computing)	Channels Management

ITIS2	The Division of ICT provides the required security to the system (e.g. security policies, disaster planning, firewalls)	Security
ITIS3	The Division of ICT provides a wide range of communication services (e.g. network services, broadband services, Intranet capabilities	Communication Infrastructure
ITIS4	The Division of ICT provides a wide range of software applications and infrastructure when required (e.g. centralised management of applications, mobile and wireless applications, workflow applications)	Software Applications
ITIS5	The Division of ICT provides adequate systems	Maintain Services
ITIS6	The Division of ICT gives consideration to my evaluation of the system	Development and Evaluation
Code	**ICT Staff**	**Aspects**
ITIS1	The Division of ICT provides a wide range of channel management services (e.g. electronic channel to the students and staff to support multiple applications, such as web sites, call centres, mobile computing)	Channels Management
ITIS2	The Division of ICT provides a wide range of security and risk management services (e.g. security policies, disaster planning, firewalls)	Security
ITIS3	The Division of ICT provides a wide range of communication services (e.g. network/broadband services, Internet/extranet capabilities, groupware)	communication Services
ITIS4	The Division of ICT provides a wide range of data management services (e.g. key data independent of applications, centralised data warehouse, data management consultancy, storage area networks, knowledge management)	Data Management
ITIS5	The Division of ICT provides a wide range of application infrastructure services (e.g. centralised management of applications, middleware, mobile and wireless applications, ASP, workflow application)	Application Infrastructure
ITIS6	The Division of ICT provides a wide range of IT facilities management services (e.g. large scale processing/mainframe, server farms, common systems development environment)	IT Facilities
ITIS7	The Division of ICT provides a wide range of IT management services (e.g. IS planning, investment and monitoring, IS project management, negotiations with suppliers and outsourcers, service level agreements)	IT Management Services
ITIS8	The Division of ICT provides a wide range of IT architecture and standards services (e.g. specify and enforce architectures and standards for technologies, communications, data, applications, and work)	IT Architecture and Standards
ITIS9	The Division of ICT provides a wide range of IT education/training services	IT Education
ITIS10	The Division of ICT provides a wide range of IT research and development (R&D) services (e.g. identify and test new technologies for business purpose, evaluate proposals for new IS applications)	IT Research and Development

Some services of IT infrastructure cannot be measured from academic staff and students' perspective, for instance, IT architecture and standards and IT research and development. Therefore, gauging these services was limited to ICT staff because they have sufficient experience about these services. In addition, most of these items have been reworded to be appropriate to measure IT infrastructure services in the context of e-learning systems.

4.5.4.2. System quality

The measures prepared in the study of Sedera and Gable (2004) were adopted in this study to gauge systems quality. Sedera and Gable (2004) claim that the results of past studies conducted to measure information systems were conflicted. They base their opinion on the following flaws: poor measurement, for instance, using inappropriate measures of success; lack of theoretical grounding to select the appropriate measure of success; using myopic indicators of financial performance; employing poor survey instruments; and collecting the data with inappropriate approaches (Sedera, 2006). To overcome these faults in the previous measurements, Sedera and Gable (2004) prepared a new measurement approach to gauge the success of information systems. This measurement was designed based on the two stages of the 'research cycle': an exploratory stage and a confirmatory stage. In the exploratory stage, two types of surveys were designed: identification-survey and specification-survey.

In the confirmatory stage, a new survey was prepared: confirmation-survey. A total of 600 responses were gathered in their three surveys. The reliability and validity of these measures were tested; and exploratory factor analysis and confirmatory factor analysis were used in preparing those measures. This measurement can be considered a comprehensive measurement because it includes the main dimensions of measuring information systems success and the aspects to measure each dimension. This measurement was established considering the proper theoretical procedures to build the measurement through adopting and extending the 'research cycle' guidelines. In relation to Sedera and Gable's (2004) instrument, Petter, DeLone, and McLean state that 'The instrument has strong construct validity in that it captures multiple aspects of each variable, which is a dramatic change from much of the measurement of information system success constructs that focus on only one aspect of the construct' (2008, p. 224). The items of system quality used in this study are shown in Table 4.4.

Table 4.4 Items of system quality

Code	Students	Aspects
SQ1	The e-learning system is easy for me to use	Ease of use
SQ2	The e-learning system is easy for me to learn	Ease to learn
SQ3	The e-learning system meets my requirements	User requirements
SQ4	The e-learning system includes necessary features and functions for my study	System features
SQ5	The e-learning system does what it should	System accuracy
SQ6	The e-learning system user interface can be easily adapted to one's personal approach	Flexibility
SQ7	The e-learning system requires only the minimum number of fields and screens to achieve a task	Sophistication
SQ8	All data within e-learning system is fully integrated and consistent	Integration
Code	**Academic staff**	**Aspects**
SQ1	The e-learning system is easy for me to use	Ease of use
SQ2	The e-learning system is easy for me to learn	Ease to learn
SQ3	The e-learning system meets my requirements	User requirements
SQ4	The e-learning system includes necessary features and functions for teaching	System features
SQ5	The e-learning system always does what it should	System accuracy
SQ6	The e-learning system user interface can be easily adapted to one's personal approach	Flexibility
SQ7	The e-learning system requires only the minimum number of fields and screens to achieve a task	Sophistication
SQ8	All data within the e-learning system is fully integrated and consistent	Integration
Code	**ICT staff**	**Aspects**
SQ1	The e-learning system is easy for me to use, maintain, and support	Ease of use
SQ2	The e-learning system is easy for me to learn	Ease to learn
SQ3	The e-learning system meets the essential requirements for maintaining, supporting the system, and providing the services	User requirements
SQ4	The e-learning system includes necessary features and functions to achieve the required tasks	System features
SQ5	The e-learning system always does what it should	System accuracy
SQ6	The e-learning system user interface can be easily adapted to one's personal approach	Flexibility
SQ7	The e-learning system requires only the minimum number of fields and screens to maintain and support the system	Sophistication
SQ8	The e-learning system can be easily modified, corrected or improved	Customisation
SQ9	The e-learning system responds quickly during the busiest hours of the day	System Response

4.5.4.3. Information quality

The items used to measure this construct for the three samples have also been adopted from the study of Sedera and Gable (2004). The reasons for adopting these measures are the same as those mentioned for system quality (section 4.5.4.2).

Table 4.5 shows the items used to gauge information quality and the aspect of each item.

Table 4.5 Items of information quality

Code	Students	Aspects
IQ1	The e-learning system provides me with the outputs that I need	Importance
IQ2	Information needed from the e-learning system is always available for me	Availability
IQ3	Information from the e-learning system is in a form that is readily usable	Usability
IQ4	Information from the e-learning system is easy to understand	Understandability
IQ5	Information from the e-learning system is concise	Conciseness
Code	**Academic staff**	**Aspects**
IQ1	The provided information on the e-learning system is sufficient for my teaching needs	Importance
IQ2	The essential information to setup my teaching in e-learning environment is available	Availability
IQ3	Information from the e-learning system is in a form that is readily usable	Usability
IQ4	The information in the e-learning system is easy to understand	Understandability
IQ5	Information from the e-learning system appears to be well formatted	Format
IQ6	The information in the e-learning system is concise and enough for organising my course and teaching materials	Conciseness
Code	**ICT staff**	**Aspects**
IQ1	The e-learning system provides me with outputs that I need to maintain and support the system	Importance
IQ2	Information that I need from the e-learning system to maintain, support the system, and provide the services is always available	Availability
IQ3	Information from the e-learning system is in a form that is readily usable to maintain and support the system	Usability
IQ4	Information from the e-learning system is easy to understand	Understandability
IQ5	Information from the e-learning system is formatted well	Format
IQ6	Information from the e-learning system is concise	Conciseness
IQ7	Information from the e-learning system is up-to-date enough to maintain and support the system	Update

The items were re-worded extensively to be suitable to measure the aspects of information quality in the e-learning systems field and to be appropriate for each stakeholder. For instance, information quality for academic staff is related to teaching and educational activities, whereas ICT staff are looking for information with high quality to support and maintain the e-learning system.

4.5.4.4. Service delivery quality

The items of SDQ were adopted from Parasuraman et al. (2005). This instrument has two scales: E-S-QUAL that includes efficiency; fulfilment; system availability; and privacy, and E-RecS-QUAL that includes responsiveness; compensation; and contact. The second scale was used by Parasuraman et al. (2005) for customers who had non-routine encounters with sites. In this study, the two scales will be used together, as one scale, because the students are using the e-learning systems frequently to achieve their educational activities. In addition, contact and responsiveness are considered to be the main elements in providing services in e-learning systems. Students use the different electronic channels to keep in touch with academic staff to perform educational activities, receive comments and feedback and to share information with other students. For these reasons, the E-RecS-QUAL has been included in the E-S-QUAL. However, compensation is not included in this measurement model because it is not applicable in the context of e-learning systems.

Means-end framework was used as a theoretical foundation to establish this measurement. Six stages were conducted to create E-S-QUAL which involved: (1) articulating the meaning and domain of e-service quality via literature and a comprehensive qualitative study; (2) establishing 121 items which represented 11 dimensions as a preliminary scale and which were revised by two focus groups; (3) conducting the revised scale on a nationally representative sample of Internet users (549) via an online survey to evaluate their favourite sites; (4) conducting an iterative process to develop a parsimonious scale; (5) Confirmatory Factor Analysis and validity tests conducted on the final scale; (6) and a final survey conducted with customers of Amazon.com and Walmart.com to re-confirm the reliability and validity of scale and to test the importance of scale dimensions in impacting consumer value perception and loyalty intentions.

The main justification for adopting this measure in the study is that this scale was established based on the means-end as a theoretical foundation. In addition, a wide range of literature has been reviewed to select the dimensions and items of this scale, and this review of the literature was supported by a qualitative study. These procedures provided the scale with a strong theoretical grounding. Empirically, the validity and reliability of this instrument has been tested and the results confirm that the scale achieves good psychometric properties. The items used in this study to measure SDQ are shown in Table 4.6 (students), Table 4.7 (academic staff), and Table 4.8 (ICT staff).

Table 4.6 Measurement of SDQ for students

Code	Items	Sub-dimension
EFFI1	It is easy to get anywhere on ULearn	Efficiency
EFFI2	ULearn enables me to complete tasks quickly	
EFFI3	ULearn is well organised	
AVA1	ULearn is always available for me to perform learning activities	System Availability
AVA2	ULearn launches and runs right away	
AVA3	ULearn does not crash frequently	
FULF1	ULearn makes lectures, materials, and feedback available within a suitable time frame	Fulfilment
FULF2	ULearn quickly delivers answers about my queries	
FULF3	This site is truthful about its offerings	
FULF4	ULearn makes accurate promises about delivery of lectures materials and feedback	
PRIV1	ULearn protects information related to student records	Privacy
PRIV2	ULearn does not share my personal information with other sites and/or users	
PRIV3	ULearn protects information about my personal details and results	
RESP1	ULearn provides me with convenient options to change my enrolment	Responsiveness
RESP2	ULearn tells me what to do if my assignment is not marked	
RESP3	ULearn takes care of problems promptly	
CONT1	ULearn provides a telephone number to contact the university	Contact
CONT2	ULearn has Students Services representatives available online	
CONT3	ULearn allows me to discuss some issues with my lecturers	
CONT4	ULearn enables me to input comments and share information with other students	

It is worth mentioning that two items in the student questionnaire used to measure the contact dimension (CONT1 and CONT2) were selected from Parasuraman et al.'s (2005) instrument, and the two others (CONT3 and CONT4) were adopted from the study of Ong and Lai (2007).

Table 4.7 Measurement of SDQ for Academic staff

Code	Items	Sub-dimension
EFFI1	UTeach enables me to provide course information and knowledge to student	Efficiency
EFFI2	It is easy for me to get anywhere on UTeach	
EFFI3	Information at UTeach is well organised	
EFFI4	UTeach loads its pages fast	
AVA1	UTeach is always available for me to perform teaching activities	System Availability
AVA2	UTeach launches and runs right away	
AVA3	UTeach does not crash frequently	
FULF1	UTeach enables me to deliver lectures, material, and feedback to students when promised	Fulfilment
FULF2	UTeach makes lectures, material, and feedback available for delivery within a suitable time frame	
FULF3	UTeach enables me to deliver answers to students about their queries quickly	
PRIV1	UTeach does not allow display of full details of student records	Privacy

PRIV2	UTeach does not allow sharing the feedback of assignments of each student with the other students	
PRIV3	UTeach protects information related to personal details of students and results	
RESP1	UTeach tells me if my students received my feedback	Responsiveness
RESP2	UTeach takes care of problems and student enquires promptly	
CONT1	UTeach allows me to discuss issues with students	Contact
CONT2	This site offers the ability to speak to a live person if there is a technical problem	
CONT3	UTeach enables me to comment and share information	

In the academic staff questionnaire item CONT3 has been used from Ong and Lai's (2007) study to enrich the contact dimension and to make it more appropriate to e-learning systems.

Table 4.8 Measurement of SDQ for ICT staff

Code	Items	Sub-dimension
EFFI1	The e-learning system makes it easy to find what I need	Efficiency
EFFI2	It is easy to get anywhere on the e-learning system	
EFFI3	The e-learning system enables me to complete tasks quickly	
EFFI4	The e-learning system loads its pages fast	
AVA1	The e-learning system is always available for users	System Availability
AVA2	The e-learning system launches and runs right away	
AVA3	The e-learning system does not crash frequently	
FULF1	The e-learning system enables academic staff to delivers lectures, materials, and feedback when promised	Fulfilment
FULF2	The e-learning system quickly delivers answers to user queries	
FULF3	This system is truthful about its offerings	
PRIV1	The e-learning system protects information related to personal details of students and results	Privacy
PRIV2	The e-learning system does not share user personal information with other sites and /or users	
PRIV3	The e-learning system has adequate security features	
RESP1	The e-learning system provides students with convenient options to change their enrolment	Responsiveness
RESP2	This site tells students what to do if their assignments are not marked	
RESP3	The e-learning system takes care of problems reported by academic staff and students promptly	
RESP4	The response time of e-learning system is reasonable	
CONT1	The e-learning system has Students Services representatives available online	Contact
CONT2	The e-learning system offers the ability to speak to a live person if there is a technical problem	
CONT3	The e-learning system allows students to discuss some issues with their lecturers	
CONT4	The e-learning system enables users to comment and share information	

The two items of Ong and Lai (2007) used in the students' questionnaire have been used in the ICT staff instrument, and reworded to fit the ICT staff questionnaire.

The items of SDQ have been modified and reworded to be appropriate to measure the SDQ in the e-learning systems arena.

4.5.4.5. Perceived usefulness

Measurement of perceived usefulness has received substantial attention from researchers. The measurement provided by Davis (1989) can be considered the common instrument to gauge this construct. Its reliability and validity have been tested by Davis (1989), and Venkatesh and Davis (2000) retested the reliability and validity of perceived usefulness and the results strongly supported both aspects. Venkatesh and Bala (2008) developed a new version of TAM, namely, TAM3.

The reliability and validity of each construct including perceived usefulness has been examined. The results show that 'all constructs at each time period exhibited strong psychometric properties and satisfied the criteria of reliability and convergent and discriminant validity' (Venkatesh & Bala, 2008, p. 285). In addition, most of the studies that used the perceived usefulness construct in the information systems field adopted the measurement of Davis (1989). Studies dealing with e-learning systems acceptance employed Davis's (1989) measurement and its reliability and validity have been confirmed (e.g., Roca et al. (2006); Pituch & Lee (2006); Raaij & Schepers (2008); Martinez-Torres et al. (2008); Sørebø & Eikebrokk (2008); Wang & Wang (2009); Sanchez & Hueros (2010); Teo (2011); Cho (2011); Hunga et al. (2011)).

Based on the evidence of the reliability and validity of Davis's (1989) measurement, the items of this instrument have been adopted to measure perceived usefulness. Table 4.9 shows the items of perceived usefulness for the three groups of stakeholders.

Table 4.9 Items of perceived usefulness

Code	Students	Aspects
USEF1	Using the e-learning system in my study enables me to accomplish my tasks more quickly	Accomplish quickly
USEF2	Using the e-learning system improves my study performance	Improve performance
USEF3	Using the e-learning system in my study increases my productivity	Increasing productivity
USEF4	Using the e-learning system makes it easier to do my study	Easier study
USEF5	Overall, I find the e-learning system useful to my study	Overall usefulness
	Academic Staff	
USEF1	Using the e-learning system in my job enables me to accomplish my tasks more quickly	Accomplish quickly

USEF2	Using the e-learning system improves my job performance	Improve performance
USEF3	Using the e-learning system enhances my effectiveness in my job	Enhancing Effectiveness
USEF4	Using the e-learning system makes it easier to do my job	Easier Job
Code	**ICT Staff**	**Aspects**
USEF1	Using the e-learning system enables me in my job to support the users and provide the services more quickly	Accomplishing Quickly
USEF2	Using the e-learning system improves my job performance in supporting the users and providing the services	Improve performance
USEF3	Using the e-learning system in my job increases my productivity	Increasing productivity
USEF4	Using the e-learning system makes it easier to do my job and to support the different users	Easier Job
USEF5	I find the e-learning system to be useful in the work I do	Overall Usefulness

4.5.4.6. User satisfaction

User satisfaction is considered one of the most important factors in measuring the success of information systems. Different measures have been created to gauge this construct. The focus of early efforts was the satisfaction of internal customers with the outcomes of information technology and information systems. As a result of new and advanced developments in the information technology and information systems arena, particularly e-electronic systems, the measures of user satisfaction have been extended to include external customers. The variety of stakeholders of e-learning systems should be considered in measuring user satisfaction. Therefore, different aspects have been used in this study to gauge the satisfaction of each group of stakeholders according to their purpose of using the e-learning systems and to determine the extent of their satisfaction with these types of systems.

Five items were used to measure students' satisfaction with e-learning systems. The first two items, SATF1 and SATF2, have been adopted from the study of Roca et al. (2006). The remaining three items, SATF1, SATF2, and SATF3, were adopted from Arbaugh's (2000a) study.

The items used with academic staff sample were employed from two previous studies: Larsen et al. (2009) for items SATF1 and SATF2; and Liaw (2008a) for items SATF3 and SATF4.

According to the knowledge of the researcher, satisfaction of ICT staff with e-learning systems has not been measured before. Thus, there were some difficulties in selecting the items to gauge this construct. The first two items have been prepared by the researcher and focus on the decision to work in the e-learning systems area and whether working in this field meets the job expectations of ICT staff. Item SATF3 was taken from Liaw (2008a). Items SATF4 and SATF5 were employed from Staples et al. (2002). Table 4.10 shows these items and the aspect of each item.

The variety in the degree of user satisfaction can be useful to measure different aspects of satisfaction, for instance, satisfaction with using e-learning systems and satisfaction with e-learning functions. In addition, the variety in the measures can be useful in gauging the attitude of different stakeholders with different purposes in using e-learning systems.

Table 4.10 Items of user satisfaction

Code	Students	Aspects
SATF1	I am satisfied with the performance of the e-learning system	e-learning system performance
SATF2	I am satisfied with the experience of using the e-learning system	e-learning system experience
SATF3	my decision to study my degree through e-learning system was a wise one	Satisfaction with the decision
SATF4	If I had an opportunity to do another degree or course online, I would gladly do so	Re-use e-learning system
SATF5	I feel that the online courses serve my needs well	Students needs
Code	**Academic Staff**	**Aspects**
SATF1	Based on my experience with the e-learning system, I am contented using the system	Content with e-learning system
SATF2	Based on my experience with the e-learning system, I am satisfied using the system	Satisfaction with use e-learning system
SATF3	I am satisfied with using the e-learning system as a learning tool	Learning tool
SATF4	I am satisfied with using the e-learning system functions	Satisfaction with function
Code	**ICT Staff**	**Aspects**
SATF1	I am satisfied with my decision to work in the e-learning systems field	Decision
SATF2	Working with the e-learning system meets my job expectations	Job expectations
SATF3	I am satisfied with using the e-learning system functions	System functions
SATF4	My work with the e-learning system gives me a great senses of personal satisfaction	Personal satisfaction
SATF5	My work with the e-learning systems increases my feelings of self-esteem	Self-esteem

4.5.4.7. Customer value

Measuring value/benefits/impacts of information systems is still the main issue in this domain. Different measures have been proposed to measure these benefits. However, most of these measures are limited to the perspective of one stakeholder.

In this regard, Seddon (1997) states that 'To measure Net Benefits, one has to adopt some stakeholder's point of view about what is valuable and what is not' (1997, p. 246). This suggestion has been considered in this study via measuring customer value from three stakeholders' perspectives: students; academic staff; and ICT staff. Cameron (1978) proposed a measurement to evaluate the effectiveness of institutions in higher education. This instrument includes important measures related to students, for instance, student's academic personal development. These indicators have been considered in this study as well as the social value. Five items were used to measure customer value within the students' sample.

The first three items, adopted from Lee-Post (2009), CUSV1, CUSV2 and CUSV3, were employed to gauge the academic and personal development of students in using e-learning systems. Items CUSV3 and CUSV5, employed from Ledden, Kalafatis, and Samouel (2007) were applied to measure the social value of e-learning systems. The value to academic staff of using e-learning systems has been measured by four items: CUSV1 (Jen and Chao, 2008); CUSV2 (Sedera and Gable, 2004); and CUSV3 and CUSV4 (Staples et al. 2002). The items focused on measuring this construct based on the personal accomplishment and the experiences gained from using e-learning systems.

For the ICT staff sample the items of customer value have been collected from three previous studies: CUSV1 (Jen and Chao, 2008); CUSV2, CUSV4 and CUSV5 (Staples et al., 2002); and CUSV3 (Sedera and Gable 2004). The emphasis of these items is on the personal benefits, experiences and opportunities to be more employable in the future. Table 4.11 shows these items.

Table 4.11 Items of customer value

Code	**Students**	**Aspects**
CUSV1	The e-learning courses delivered by *ULearn* strengthen my ability to analyse and evaluate information related to my study	Increasing abilities
CUSV2	I gained an understanding of concepts and principles in my study area	Understanding concepts
CUSV3	The e-learning courses delivered by *ULearn* stimulated me to read further in my study area	Stimulation
CUSV4	People who are important to me think that taking my course through the e-learning system is a good thing to do	Social value 1
CUSV5	My family and my friends will see me in a better light when I have finished my degree	Social value 2
Code	**Academic staff**	**Aspects**
CUSV1	The e-learning system improves my work practices	Work practices

CUSV2	I have learnt much through the e-learning system	Learning
CUSV3	Using the e-learning system gives me a sense of accomplishment	Accomplishment
CUSV4	Using the e-learning system gives me a sense of fulfilment	Fulfillment
Code	**ICT staff**	**Aspects**
CUSV1	The e-learning system improves my work practices	Work practices
CUSV2	Working with the e-learning system contributes to my personal growth and development	Personal development
CUSV3	I have learned much through the e-learning system	Learning
CUSV4	Knowledge gained using the e-learning system will be helpful in future with other systems	Knowledge
CUSV5	Knowing how to maintain and support the e-learning system makes me more employable	Employability

4.5.4.8. Organisational value

E-learning systems outcomes can be affected by the performance of educational institutions, especially in institutions dependent on e-learning systems to provide educational services. Therefore, organisational value has been taken into account in this study to integrate with customer value and provide a comprehensive picture about the value of e-learning systems.

The items used to measure the organisational value for the academic staff sample have been collected from studies by Lederer et al. (2000)—items ORGV1, ORGV2, and ORGV6; Martinsons, Davison, and Tse (1999)—items ORGV4 and ORGV5; and Sedera and Gable (2004)—item ORGV3.

In respect to the ICT staff sample, items ORGV1 and ORGV5 were used from Lederer et al. (2000). Item ORGV2 was from Sedera and Gable (2004), and items ORGV3and ORGV4 were applied from Martinsons et al. (1999).

The items used to measure the organisational value focused on three main indicators: the institution's responsiveness to changes in the environment, cost of services, and relationships with the community. Table 4.12 shows the items used to gauge organisational value.

Table 4.12 Items of organisational value

Code	Academic staff	Aspects
ORGV1	The e-learning system enables USQ to respond quickly to change and develop the learning and teaching techniques	Developing Learning Techniques
ORGV2	The e-learning system enables USQ to respond more quickly to change	Responsiveness
ORGV3	The e-learning system is cost effective	Effective Cost
ORGV4	The e-learning system enables USQ to establish good relationships with the user community	Community Relationships
ORGV5	The e-learning system establishes and maintains a good image and reputation for USQ	Good Reputation
ORGV6	The e-learning system aligns with stated organisational goals	Organisational Goals

Code	ICT staff	Aspects
ORGV1	The e-learning system enables USQ to respond more quickly to change	Responsiveness
ORGV2	The e-learning system is cost effective	Effective Cost
ORGV3	The e-learning system enables USQ to establish good relationships with the user community	Community Relationships
ORGV4	The e-learning system establishes and maintains a good image and reputation for USQ	Good Reputation
ORGV5	The e-learning system can be used by the University to provide students and staff with new educational services	Educational Services

It worth mentioning that an open-ended question was added to the questionnaires: ‘Please write any comments about the factors affecting e-learning system success’. The purpose of open-ended questions is to provide respondents with the opportunity to present their opinions and information about the e-learning systems that could not be included in the closed-ended items. One of the main advantages of open-ended questions is it allows respondents to provide unique responses (Stangor, 2011).

4.6. Data Analysis

Different statistical methods are employed to describe the constructs of study and to test study hypotheses. Structural Equation Modelling is employed as a key technique to test the study models and examine the hypotheses. Furthermore, content analysis is employed to analyse the qualitative data collected via the open-ended question.

4.6.1. Structural Equation Modelling (SEM)

SEM was employed in this study to test the proposed model and examine the study model. SEM is deemed to be a common multivariate method used in the social sciences. In the 1920s Sewell Wright tried to disentangle the impact of genetics across generations by using simultaneous equations (Maruyama, 1997). The main contribution of Wright was developing path analysis, which is considered one of the essential foundations of SEM. This attempt can be considered the essential root of establishing SEM.

Hair et al. define SEM as ‘Multivariate technique combining aspects of factor analysis and multiple regression that enables the researcher to simultaneously examine a series of interrelated *dependence relationships* among the *measured variables* and *latent constructs* (*variates*) as well as between several latent constructs’ (2010, p. 634).

SEM is used to test different types of theoretical models and examine the relationships between those constructs (Schumacker & Lomax, 2004). The use of SEM in social sciences has increased, particularly in management disciplines such as management information systems (Gefen, Straub, & Boudreau, 2000), strategic management (Shook, Ketchen Jr, Hult, & Kacmar, 2004), and marketing management (Hair, Sarstedt, Ringle, & Mena, 2012). The wide use of SEM is due to the ability of this technique to develop and test the theories. In this regard Hair et al. state that 'SEM is particularly useful for the process of developing and testing theories and has become a quasi-standard in research' (2012, p. 312).

The justifications for using SEM in this study are:

- SEM enables testing of the whole model fit and provides comprehensive statistical indicators for assessing and modifying the models (Anderson & Gerbing, 1988; Kline, 2011).
- SEM allows researchers to obtain answers to interrelated research questions at three levels: single; systematic; and comprehensive analysis (Gefen et al., 2000).
- Purpura (1998) added another reason to use this technique—SEM is not limited to examining the relationships among constructs in models but is capable of testing the relationships among observed variables and constructs. The relationships between the observed variables and the construct can assist in identifying the weak variables that do not represent the construct significantly.
- Hankins, French, and Horne (2000) point out the advantages of SEM over multiple regression. First, multiple regression can be used to examine the effects of one or several independent factors on one dependent factor. SEM can be employed to examine complicated models that may include several independent factors and several dependent factors. Second, SEM allows researchers to evaluate the designed model and the extent to which this model fits with a particular dataset. Finally, the problem of interpretation in multiple regression is avoided in the SEM technique.

SEM is used in this study to test and modify the proposed model via the indicators of model fit. SEM will be used to examine the ability of the selected observed variables (aspects) in this study to significantly represent the construct. The suggested model in this study could be a complicated model due to the number of constructs and the number of relationships among them: 8 constructs and 27 relationships.

4.6.1.1. Components of SEM

SEM includes two main sub-models: the measurement model; and the structural model (Byrne, 2010).

Hair et al. define the measurement model as a 'Sub-model in SEM that (1) specifies the indicators for each constructs, and (2) assesses the reliability of each construct for estimating the causal relationships' (1998, p. 581). The latent variables cannot be measured directly because they are a theoretical construct, therefore, the observed or indicator variables should be identified (Zulu, 2007). By doing this, latent variables can be measured and the significance of each indicator in measuring this construct can be examined. The measurement model can be represented by using Confirmatory Factor Analysis (CFA) (Byrne, 2010).

CFA is used to describe the relationships between 'judgmentally developed content categories and the empirically derived constructs' (Turnbull, 1998). CFA is commonly used in establishing and testing the measurement models that are employed to study specific phenomena. According to Marsh (1985), there are three reasons why CFA is considered superior to exploratory factor analysis. First, CFA enables researchers to design models that are to be examined, whereas in exploratory factor analysis the control of researchers over the model is limited. Second, 'CFA parameter estimates are unique so long as the hypothesised model is identified' (Marsh, 1985, p. 432). Third, goodness-of-fit indicators such as Chi-Square, Goodness-of-Fit Index (GFI), Adjusted Goodness-of-Fit Index (AGFI), and Root Mean Square Error of Approximation (RMSEA) are provided by CFA, and researchers can use these indicators to assess different models using the same data and testing the fitness of the same model with data from different groups. In this regard, Doll et al. state that 'Confirmatory factor analysis involves the specification and estimation of one or more putative models of factor structure, each of which proposes a set of latent variables (factors) to account for covariance among a set of observed variables' (1994, p. 454). Finally, one of the most important motivations for using CFA is to test convergent and discriminant validity (Kline, 2011).

The structural model is always used to represent the hypotheses that are formulated in studies adopting SEM (Kline, 2011). Hair et al. define the structural model as a 'Set of one or more dependence relationships linking the hypothesised model's constructs' (1998, p. 583). The direct and indirect relationships between the constructs can be demonstrated via a structural model, and the amount of explained and unexplained variance can also be described in the model (C. L. Wang, 2003).

These two types of models, measurement and structural, are employed to examine the proposed model in this study. The validity and reliability of items, constructs, and the whole model are tested based on the results of examining the measurement model. The relationships among the model's constructs, testing the whole model fit, and making decisions to accept or reject the hypotheses are dependent on the results of the structural model.

4.6.1.2. Indicators of assessing Goodness-of-fit

The indicators of model fit are used to identify to what extent a model fits or is consistent with the data. In other words, the model fit shows the ability of the estimated model to predict the actual or observed input matrix (covariances or correlations) (Hair et al., 1998). In this respect, Barrett espoused that 'Model fit is adjudged according to how well a model predicts or explains that which is designed to predict or explain' (2007, p. 817). The indicators used are discussed next.

Different indicators were developed to assess goodness-of-fit. However, the classifications of these indicators differ from one author to another. For example, Schumacker and Lomax (2004) arranged the indicators in three groups: model fit; model comparison; and model parsimony. Hair, Black, Babin, Anderson, and Ronald (2006) classified the indicators into four groups: the basics of goodness-of-fit; absolute fit measures; incremental fit indices; and parsimony fit indices. Tabachnick and Fidell (2007) categorised the indices into five clusters: comparative fit indices; absolute fit index; indices of proportion of variance accounted; degree of parsimony fit indices; and residual-based fit indices. Hopper, Hooper, Coughlan, and Mullen (2008) suggested organising the indicators in three clusters: absolute fit indices; incremental fit indices; and parsimony fit indices. Holmes-Smith (2011) supports the view of Tabachnick and Fidell (2007) in categorising the indicators based on the residual in separate groups: fit statistics; residuals; incremental (or comparative) fit indices; and indices of model parsimony. Kline (2011) adopted categorisation with four groups of indices: absolute fit indices; incremental fit indices; a parsimony-adjusted index; and predictive fit index. The classification of Kline (2011) is a tripartite classification, but the parsimony indices have been separated into two groups: a parsimony-adjusted index; and predictive fit index. The classification, which is based on categorising model fit indicators in three groups, can be considered the common one. Based on this classification, the indicators can be grouped into three main clusters: absolute fit indices; incremental (or comparative) fit indices; and parsimony fit indices.

- **Absolute Fit Indices**

Chi-square χ^2 can be considered the main indicator to assess the fit model. Holmes-Smith defines χ^2 as 'a measure of the discrepancy between the matrix of implied variances and covariances ($\hat{\Sigma}$) and the matrix of empirical sample variances and covariances (S)' (2011, p. 7.2). A high value of χ^2 points to the model not fitting the data and not able to describe it, however, a small value of χ^2 refers to the model representing the data well (Hu & Bentler, 1998). χ^2 is sensitive to sample size (Bollen, 1989; Hu & Bentler, 1998). A very large or a very small sample size will often yield a significant chi-square value that can result in the rejection of a correct model' (Dai, 2010).

To solve this problem, Wheaton, Muthen, Alwin, and Summers (1977) proposed a new fit statistic, namely χ^2/degrees of freedom or relative/normed Chi-square (χ^2/df) (Hooper et al., 2008). The initial idea of Wheaton et al. was based on the premise that 'In applying this $\chi^{2,}$ we will want to assess varying χ^2/d.f. ratios across models in order to get a rough indication of fit per degree of freedom' (1977, p. 99). This indicator reduces the dependence χ^2 value on sample size (Bredahl, 2001). Therefore, normed Chi-square (χ^2/df) is frequently used to assess models. There are many suggestions offered to identify an acceptable normed Chi-square. Wheaton et al. suggested that 'We judge a ratio of around 5 or less as beginning to be reasonable' (1977, p. 99). The acceptable level of normed Chi-square according to Hair et al. (2010) is 1 to 3. Schumacker and Lomax (2004) suggested 1 to 5 as an acceptable level of normed Chi-square, and values less than 1 point to a poor fit reflect a need for improvement. The stringent acceptable level of this indicator is between 1 and 2 (Holmes-Smith, 2011; Stank, Goldsby, Vickery, & Savitskie, 2003). Kline (2011) has a different opinion about the acceptable level of normed Chi-square: 'Because there is little statistical or logical foundation for NC "normed Chi-square", it should have no role in model fit assessment' (2011, p. 204).

Root Mean Square Error of Approximation (RMSEA) is proposed by Steiger (1990) as a measure to assess model fit. According to Byrne (2010), there are three reasons behind some authors' recommendation to adopt RMSEA: 'It would appear adequately sensitive to model misspecification; commonly used interpretative guidelines would appear to yield appropriate conclusions regarding model quality; and it is possible to build confidence intervals around RMSEA values' (2010, p. 81).

Browne and Cudeck (1993) developed a measure called *P of Close Fit* (PCLOSE) to test the hypothesis that RMSEA ≤ 0.05. According to Holmes-Smith (2011) if the value of PCLOSE is less than 0.05—that is, the mean value of RMSEA, even it is less than 0.05 is due to chance alone; however, if the value of PCLOSE is more than 0.05 it is a close fit to the hypothesis.

There many arguments and suggestions about the acceptable level of RMSEA. Browne and Cudeck (1993) suggested 0.05 or less as a cut-off for this indicator. Hu and Bentler (1998) proposed the value 0.06 or less as an indicator for acceptable model fit. A stringent cut-off of 0.05 or less was suggested by Schumacker and Lomax (2004). In this regard, Hair et al. state that 'The question of what is a "good" RMSEA value is debatable but typically values are below 0.10 for most acceptable models' (2006, p. 784). The acceptable level of RMSEA recommended by Steiger (2007), as a stringent criterion, is 0.07. Bagozzi and Yi (2012) agreed with Steiger (2007) that 0.07 or less is a suitable cut-off of RMSEA.

Two measures can be used to assess the model fit based on the residual: Root Mean-square Residual (RMR); and the Standardised RMR (SRMR) (Holmes-Smith, 2011).

RMR is used to calculate the average difference between the variance-covariance matrix for the hypothesised model and the variance-covariance of the sample (Byrne, 2010). RMR can be significantly impacted by the scale used to measure the observed variables. Using different scales, e.g. 1-5 with some questions and 1-7 with other questions, can causes difficulties in interpreting the value of RMR (Hair et al., 2006; Hooper et al., 2008; Kline, 2011). RMR can be influenced by the sample size, the number of indicators per latent variable, the number of latent variables, and indicator loadings (Hu & Bentler, 1998). Therefore, recommendations have been provided to use Standardised RMR (SRMR) instead of RMR. Kline defines SRMR as ‘A measure of the mean absolute correlation residual, the overall difference between the observed and predicted correlations’ (2011, p. 209). Hu and Bentler (1998) suggest a cut-off value of SRMR of less than 0.08. The high value of SRMR indicates problems with outliers in the raw data (Holmes-Smith, 2011).

Jöreskog and Sörbom (1984) proposed an indicator to measure the discrepancy: Goodness-of-Fit Index (GFI). GFI was offered as an alternative to the Chi-Square statistic (Hooper et al., 2008). This indicator is influenced by the sample size (Byrne, 2010). Shevlin and Miles (1998) conducted an empirical study to investigate the effect of sample size on GFI value. The results concluded that there are no significant differences among the value of GFI when the sample is greater than 100. However, with a small sample (e.g. 50) the performance of GFI is poor. The cut-off of GFI is 0.90. In this respect Shevlin and Miles agreed that more than 0.90 is an acceptable level of GFI and state that ‘Jöreskog and Sörbom (1984) do not state a cut-off value for the GFI although it is common for value greater than 0.9 to be considered acceptable’ (1998, p. 86). In the same study, Shevlin and Miles (1998) recommended that the cut-off value for GFI should be ≥0.95 in the case of low to medium factor loadings, regardless of sample size.

The adjusted Goodness-of-Fit Index (AGFI) is a similar indicator to GFI but AGFI considers the degree of freedom in the specified model (Holmes-Smith, 2011). The value of GFI and AGFI range from 0.0 to 1.0 and, theoretically, their value can be negative (Byrne, 2010). The value of AGFI is usually lower than the value of GFI (Tu, Wang, & Chang, 2012). There is no agreement about the cut-off for AGFI. Some researchers recommend adopting a cut of 0.90 (Hooper et al., 2008). Chau (1997) suggested using 0.80 as a cut-off level for AGFI in the information systems field. Hair et al. claim that ‘No statistical test is associated with either GFI or AGFI, only guidelines to fit’ (2006, p. 747). Bagozzi and Yi (2012) agree with Hair et al. (2006) that there are no commonly-accepted cut-offs for GFI and AGFI.

- **Incremental (Comparative) fit indices**

Evaluating the model based on comparative fit indices focussed on comparing the fitted model with the baseline model, which is the null model or so-called independence model. A null model indicates that the measured variables are not correlated with each other (Bentler, 1990). The value of incremental indices is between zero (0.0) and one (1.0), where zero points to the fitted model being better than the null model and 1.0 points to the model being a perfect fit (Holmes-Smith, 2011).

Normed Fit Index (NFI) is an indicator of incremental fit proposed by Bentler and Bonett (1980). NFI can be calculated via comparing the χ^2 value of fitted model with the χ^2 value of the null model and dividing the result by χ^2 of the null model (Tabachnick & Fidell, 2007). The main limitation of NFI is that 'NFI may underestimate the fit of the model in good-fitting models with small samples' (Tabachnick & Fidell, 2007, p. 761). Non-normed Fit Index (NNFI) has been proposed to solve the issue of sample size via considering the degrees of freedom (Bentler & Bonett, 1980). Hu and Bentler state that 'TLI or RNI would behave as a Normed fit index asymptotically, but it could fall outside the 0-1 range when sample size was small or other underlying assumptions were violated' (1998, p. 435).

Holmes-Smith (2011) are in agreement with Hu and Bentler (1998) about NNFI being mathematically equivalent to the Tucker-Lewis Index (TLI) and the value of TLI which, if more than 1, points to a lack in model parsimony. It is worth mentioning that Hu and Bentler (1998) found a serious problem with using TLI, and NNFI is the high variability of those two indicators. The problem of variability may lead a poor fit when other statistics point toward a good fit model (Tabachnick & Fidell, 2007).

To solve problems in the NFI indicator, Bentler (1990) proposed a new measure, namely, Comparative Fit Index (CFI). Hair et al. (2006) claim that CFI is a commonly used indicator because it is insensitive to model complexity. Hu and Bentler (1998) recommend using CFI with small samples ($N \leq 250$) 'because the GLS and ADF-based TLI, BL89, RNI, and CFI underestimate their true-population values and have much larger variances that those based on ML at small sample size' (Hu & Bentler, 1998, p. 446). Bagozzi and Yi (2012) empirically confirmed that CFI is impacted by sample size. The cut-off value of CFI was more than 0.90 originally, however, Hu and Bentler (1998) recommend increasing the cut-off level to ≥ .95. On the other hand, the cut-off level of more than 0.90 is still acceptable to assess the models (Hair et al., 2006; Stank et al., 2003). Bagozzi and Yi (2012) suggested the value ≥ .93 as a cut-off for CFI instead of ≥ .95 because ≥ .95 can be considered a too stringent value.

- **Parsimony Fit Indices**

The purpose of using this type of index is to assess the ability of generalising the model to the population (Holmes-Smith, 2011). Mulaik et al. (1989) proposed two indices to measure the parsimony: Parsimony Goodness of Fit Index (PGFI) and Parsimony Normed Fit Index (PNFI). These indicators are based on the parsimony ratio which is the degree of freedom for the model under assessment divided by degree of freedom for the null model (Holmes-Smith, 2011). However, Hair et al. (2010) recommend using PGFI and PNFI only when comparing models and when the value of each indicator can be compared with the value of the same indicator for another model. These indicators are more useful when the comparison is made between two models and one of them is more complex than the other. Furthermore, there are arguments about the function of these indicators because the incremental fit indices provide similar evidence about the model parsimony (Hair et al., 2010). Accordingly, Hair et al. state that 'The use of parsimony fit indices remains somewhat controversial' (2010, p. 699). It is worth mentioning that Hair et al. (2010) considered AGFI as an indicator to measure parsimony of model alongside PNFI.

In this study, the same model will be tested with three different samples. However, due to the differences in sample sizes, two different types of SEM will be used to test the study model: covariance-based SEM and partial-least-squares based SEM. The indicators to measure the model fit based on each method will be different. Therefore, PGFI and PNFI will not be considered in this study because no comparisons will be made; and incremental fit indices will not be included in results that provide the same evidence about model parsimony (Hair et al., 2010).

- **Model fit indices and cut-off levels in this study**

Selecting suitable indices for assessing the model fit, and identifying the cut-off of each indicator are the main issues in the SEM literature (Hooper et al., 2008). In respect of this issue Hooper et al. state that 'With regards to which indices should be reported, it is not necessary or realistic to include every index included in the program's output as it will burden both a reader and a reviewer. Given the plethora of fit indices, it becomes a temptation to choose those fit indices that indicate the best fit' (2008, p. 56).

In respect to selecting the indices for model fit this decision can be considered difficult because models are different in many aspects, for instance, sample size, estimation procedures, model complexity, and/or violation of assumptions (Byrne, 2010). Hu and Bentler (1999) suggested a new approach to select model fit indices and the cut off for each one—Two-Index Presentation Strategies. This approach is based on the combination of two indices and identifies the cut-off for each one to evaluate the model fit. According to the Two-Index Presentation Strategies, indices can be reported as follows: TLI and SRMR, BL89 and SRMR, RNI (or CFI) and SRMR, Gamma Hat and SRMR, MC and SRMR, and RMSEA and SRMR. However, some combinations and the cut-off levels were not supported by other studies (Kline, 2011).

The cut-off level for GFI, AGFI, NNFI, and CFI (0.90) is believed to be the commonly acceptable level used by researchers (Hair et al., 2006). Hair et al. (2006) identified some factors that affect the index value, for instance, when the data used is simulated data the cut-off level of 0.90 is not supported as an acceptable rule. In addition, the data can be impacted by the true underlying distribution and that affects the incremental fit indices.

The cut-off suggested by Bagozzi and Yi (2012) will be used in this study. The main justification to adopt this rule of thumb is that the cut-off levels have been suggested based on empirical studies conducted by the authors. In respect to the cut-off 0.95, Bagozzi and Yi state that 'The criteria suggested for the RMSEA, NNFI, and CFI may be too stringent' (2012, p. 29). Finally, studies by Bagozzi were conducted in the management field, and the suggested cut-off levels of indices were based on studies conducted in the information systems area. The suggested cut-off levels are SRMR $\leq .07$, RMSEA $\leq .07$, NNFI$\geq .92$, and CFI $\geq .93$. The PCLOSE will be employed to test the RMSEA and the value of PCLOSE should be more than 0.05 to accept the close fit hypothesis. RMR is adopted as an absolute fit measure. However, there is no cut-off value to assess RMR (Schumacker & Lomax, 2004). The rule of thumb in this study is that the value close to zero indicates an excellent fit; whereas a high value (close to 1) indicates worst fit (Kline, 2011).

In spite of the fact that there are no specific cut-off levels for evaluating GFI and AGFI (Bagozzi & Yi, 2012; Hair et al., 2006) most studies still adopt 0.09 as a cut-off for GFI (Hair et al., 2006; Hooper et al., 2008). This value is also recommended by Chau (1997; 2001) for use in the information systems field.

The value of AGFI is usually lower than the value of GFI (Tu et al., 2012). According to Hooper et al. (2008) the accepted value of AGFI is ≥.90. MacCallum and Hong (1997), based on the results of an empirical study, suggest ≥.08 as a cut-off for AGFI. In the information systems field 0.08 has been suggested an acceptable level for AGFI (Chau, 1997; 2001). The value 0.90 will be used in this study as a cut-off level of GFI and AGFI. Table 4.13 summarises the model fit indices and the cut-off levels adopted in this study.

Table 4.13 Model fit indicess used in this study

Indices	Abbreviation	Acceptable level
Normed Chi-Square (χ^2/df)	(χ^2/df)	1-3
Root Mean Square Error of Approximation	RMSEA	≤0.07
P of Close Fit	PCLOSE	≥0.05
Root Mean Square Residual	RMR	Between 0 and 1
Standardized Root Mean Square Residual	SRMR	≤0.07
Goodness-of-Fit Index	GFI	≥.90
Adjusted Goodness-of-Fit Index	AGFI	≥.90
Non-normed Fit Index	NNFI	≥0.92
Comparative Fit Index	CFI	≥0.93

The selection of these indicators and cut-off levels was based on the recommendations of original studies in the SEM field and on the recommendations of empirical studies in the information systems field.

4.6.2. Partial Least Squares Structural Equation Modeling (PLS-SEM)

Partial Least Squares (PLS) is commonly used in the social sciences, especially in business research disciplines (Hair, Sarstedt, Pieper, & Ringle, 2012). More specifically, information system researchers paid substantial attention to this technique due to its ability in modelling constructs in the case of small to medium samples and non-normality (Chin, Marcolin, & Newsted, 2003). Hair et al. termed the PLS-SEM technique a 'Silver Bullet', and define it as 'a causal modelling approach aimed at maximizing the explained variance of the dependent latent constructs' (2011, p. 139). Developments in PLS-SEM lead to this technique being widely used in the social sciences.

The main developments in PLS-SEM (Hair, Sarstedt, Ringle, et al., 2012) include confirmatory trend analysis to test the model of construct measurement, impact performance analysis, response based segmentation techniques, analysing moderating effects, non-liner effects, and hierarchical component models. PLS can perform factor analysis combined with path analysis and then the two methods can be used to estimate the significance (t-value) of each path (Gefen et al., 2000). Hair et al. (2012) reviewed 204 journal papers to identify reasons for using PLS-SEM and put forward three key areas suitable for using this technique: non-normal data (102 studies, 50%), small sample size (94 studies, 46.8%), and the formative measurement of latent variables (67 studies, 32.84%).

Boulesteix and Strimmer (2007) identified three advantages for researchers in using PLS: PLS works effectively with data from small sample sizes and a large number of parameters; PLS has a high computational and statistical efficiency; and PLS is flexible and versatile in dealing with problems that may be solved. PLS provides indicators to evaluate reliability and validity, for instance, item reliability, convergent validity, and discriminant validity (Hulland, 1999). Furthermore, the goodness-of-fit can be evaluated in PLS. Several indicators are utilised to test the validation of the measurement model, model fit, and evaluation of the paths in the structural model. Goodness-of-Fit (GoF) is believed to be the key indicator to measure the overall fit in PLS path models (Henseler & Sarstedt, 2012). The value of GoF is between 0 and 1, and the high level of GoF points to better path model estimation (Karim, 2009). Cross-validated communality (H^2) is an essential index to measure the quality measurement model and to assess the predictive relevance of the measurement model (Tenenhaus, Vinzi, Chatelin, & Lauro, 2005). Regarding the cut-off predictive relevance Q^2, Hair et al. state that 'Resulting Q^2 values of larger than zero indicate that the exogenous construct have predictive relevance for the endogenous construct under consideration' (2011, p. 145). The quality of the structural model is evaluated using the cross-validated redundancy index (Predicative relevance Q2). This index is used to examine the predictive relevance for the structural model (Tenenhaus et al., 2005). In respect to the cut-off for

Predicative relevance Q2, Henseler et al. state that ‘Q2-values above zero give evidence that the observed values are well reconstructed and that the model has predictive relevance (Q2-values below zero indicate a lack of predictive relevance)’ (2009, p. 303).

Two main indicators can be used to evaluate the relationships between the paths in the PLS structural model: R^2 Coefficient of determination) values, and standardized path coefficient. In this regard Guo et al. state that ‘R^2 values of the dependent variables represent the predictiveness of the theoretical model and standardized path coefficients indicate the strength of the relationships between the independent and dependent variables’ (2011, p. 219). Regarding measuring the power of R^2, three levels were suggested: 0.670 substantial; 0.333 moderate; and 0.190 weak (Chin, 1998; Urbach & Ahlemann, 2010). Three levels of cut-off were adopted to assess the strength of path coefficient: 0.2 weak; value between 0.2 and 0.5 is moderate; and more than 0.5 is strong (Cohen, 1988; Sridharan, Deng, Kirk, & Corbitt, 2010).

4.6.3. Mediating effect

Mediating effect has become an essential and commonly used technique in basic and applied research (MacKinnon, Fritz, Williams, & Lockwood, 2007). Mediator factor analysis provides a clarification about how external physical events can have internal psychological significance (Baron & Kenny, 1986). As mentioned in chapter three, service delivery quality is a central construct in the proposed model. This construct is hypothesised to be a mediation factor in the model. Therefore, the method to analyse the mediation effect of service delivery quality is identified in this section. Hair et al. defines mediating effect as the ‘Effect of a third variable/construct intervening between two other related constructs’ (2010, p. 690). Figure 4. 1 shows the mediating effect.

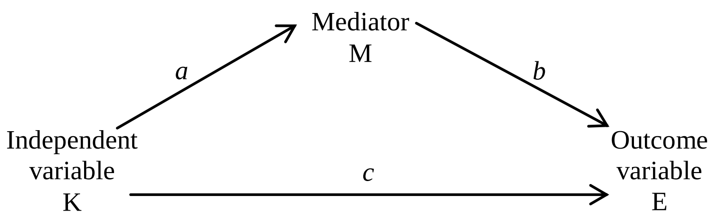


Figure 4. 1 Mediating Effect

(Baron & Kenny, 1986)

Testing the mediated effect can be conducted by three regression methods: test of causal steps; test of the difference in coefficient; and test of the product of coefficient (Fritz & MacKinnon, 2007). The causal steps approach is suggested by Baron and Kenny (1986). According to Hayes (2009), the causal steps is the most popular and the most-widely used approach to test the mediation. Hayes states that 'This approach requires the researcher to estimate each of the paths in the model and then ascertain whether a variable functions as a mediator by seeing if certain statistical criteria are met' (2009, p. 410).

Baron and Kenny (1986) established conditions to examine the mediation: 'A variable functions as a mediator when it meets the following conditions: (a) variations in levels of the independent variable significantly account for variations in the presumed mediator (i.e., Path *a* in Figure 4.1) (b) variations in the mediator significantly account for variations in the dependent variable (i.e., Path *b*) and (c) when paths *a* and *b* are controlled, a previously significant path between the independent and dependent variables is no longer significant, with the strongest demonstration of mediation occurring when path *c* is zero' (1986, p. 1176).

Hair et al. (2010) suggested two steps to test the mediation effect based on research by Baron and Kenny (1986). The first step is to establish the necessary individual relationships between the dependent, mediator, and independent variables. This step includes testing the three conditions stated by Baron and Kenny (1986):

- Independent variable (K) must significantly relate to the dependent variable (E).
- Independent variable (K) must significantly relate to the mediator variable (M).
- Mediator variable (M) must significantly relate to the dependent variable (E).

The second stage is to establish an initial model that includes only the direct effect of the independent variable on the dependent variable. Then, estimate a second model that includes the mediation variable, and the two additional paths: the direct effect of independent variable on mediator (path *a)* and the direct effect of mediator on dependent variable (path *b).* After that, the mediation could be assessed as follow:

- If the relationship between K and E (path *c*) is *significant and unchanged* once M is included in the model as an additional predictor (K and M now predict E), then mediation is not supported.
- If path (c) is *reduced but remains significant* when M is included as an additional predictor, the *partial mediation* is supported.
- If path (c) is reduced to a point where is not *statistically significantly* after M is included as a mediating construct, then *full mediation* is supported (Hair et al., 2010, p. 768).

These two steps are used to test the effect of IT infrastructure services, system quality, and information quality on perceived usefulness mediated by service delivery quality. These two steps also are employed to test the effects of IT infrastructure services, system quality, and information quality on user satisfaction mediated by service delivery quality.

4.6.4. Content analysis

As mentioned in Section 4.5.4.8, an open-ended question was included in the questionnaires. The comments received from the respondents were analysed using content analysis. Content analysis was used in this study to identify and categorise the most frequent keywords based on the comments of the surveyed users. Braun and Clarke define content analysis as: ‘Thematic analysis is a method for identifying, analysing and reporting patterns (themes) within data’ (2006, p. 79). The main purpose of employing content analysis is to compress the text into categories (Weber, 1990). Thematic analysis is used in this study to undertake content analysis because it is one of the most straightforward ways to conduct content analysis (Bergman, 2010).

The following procedures were adopted to conduct thematic analysis:

- Read and reread the text.
- Keep in mind the research questions.
- Use a ‘colour coding’ method to mark the words, phrases or sections that appear connected.
- Find a word that captures the ideas in each colour.

- List these words and review them.
- Reduce the list and merge ideas into groupings.
- When you can no longer move ideas, you have your themes (Roberts & Taylor, 2002, pp. 224-234).

These stages are achieved manually by the researcher to analyse each comment accurately and effectively. Quasi-quantification or quantification of themes can be used to report the results of thematic analysis (Bergman, 2010). Quasi-quantification or quantification can be employed to show the frequency and percentages of mentioning this theme or sub-theme by participants. Thematic analysis is not limited to counting explicit words or phrases but includes identification and description of the implicit and explicit ideas generated from analysing the data (Guest, MacQueen, & Namey, 2011). Accordingly, thematic analysis is used to identify the main factors affecting e-learning systems from different points of view. Furthermore, via this analysis the issues faced by each group of stakeholders are recognised. The results of thematic analysis are used to support the results and discussion of quantitative data.

4.7. Validity and Reliability

The validity and reliability of the instrument should be tested to verify the ability of the instrument to measure the constructs. The importance of validity and reliability comes from the effects of those two characteristics on the quality of data collected by researchers (Pallant, 2011). The effect of validity and reliability is not limited to data quality, but can include the research results and recommendations. The main difference in using validity and reliability is that reliability is related to consistency, whereas validity focuses on what the researcher intended to measure (Myrtveit & Stensrud, 2012). The reliability of measurements cannot be assured by validity, or vice versa. In this regard, Holmes-Smith states that ‘A measure may be consistent (reliable) but not accurate (valid). Alternatively, a measure may be accurate but not consistent’ (2011, p. 9.20). Traditional research designs depend on multiple regression to estimate the validity and reliability, and the measurement error was not considered. Thus, in the SEM approach more attention is given to validity and reliability of observed variables through incorporating measurement error adjustments in the analysis (Schumacker & Lomax, 2004). The indicators used in this study to assess the reliability and validity are presented next.

4.7.1. Validity

Validity is used to refer to two meanings: true or correct (Neuman, 2006). Validity is defined by Zikmund et al. as ‘The accuracy of a measure or the extent to which a score truthfully represents a concept’ (2009, p. 307)

Measurement validity is considered to be a critical concern in social research. Measurement validity is defined by Neuman as ‘how well the conceptual and operational definitions mesh with each other’ (2006, p. 192). In the context of SEM the measurement model is considered to be the first step in establishing and testing structural models. Thus, testing validity should be conducted before testing the structural model to assure that the indicators used to measure the constructs are valid. Testing the measurement model provides indicators to evaluate convergent and discriminant validity, and the structural model can be used to indicate nomological validity (Schumacker & Lomax, 2004). Three types of validity are adopted in this study—convergent validity, construct validity and discriminant validity—and each is described in turn below.

4.7.1.1. Convergent validity

Convergent validity is one of the most important aspects in assessing the instruments. This type of validity evaluates relationships between the observed variables and the constructs (Schumacker & Lomax, 2004). In other words, convergent validity means ‘multiple measures of the same construct hang together or operate in similar way’ (Neuman, 2006, p. 194). The loading is the measure to assess the convergent validity, and this type of validity is achieved when the value of factor loading is significantly different from zero (Holmes-Smith, 2011). The statistical significance of factor loading can be evaluated by the t-value (critical ratio). Each item loads in the construct and should exceed 0.50 to achieve convergent validity (Gefen and Straub (2005); Hair et al. (2006); Holmes-Smith (2011); Aggelidis and Chatzoglou (2012); Sun and Teng (2012).

4.7.1.2. Construct validity

Construct validity is a comprehensive measure of validity. According to Wang (2003) this type of validity includes three issues: unidimensionality; convergent validity; and discriminant validity. Gefen and Straub (2005) claim that convergent validity and discriminant validity are the main components of construct validity. Bagozzi and Yi define construct validity as ‘the extent to which indicators of a construct measure what they are purported to measure’ (2012, p. 18). The goodness-of- fit can be used to evaluate the construct validity. In other words, if the model achieves good fit that means it has construct validity (Holmes-Smith, 2011).

4.7.1.3. Discriminant validity

Discriminant validity is considered a key measure to test the instrument because ‘without it researchers cannot be certain whether results confirming hypothesized structural paths are real or whether they are a result of statistical discrepancies’ (Farrell, 2010, p. 324). A better technique for testing discriminant validity is to compare the average variance extracted (AVE) for any two constructs with the square correlation between the two constructs (Hair et al., 2006). To achieve discriminant validity value AVE should exceed the value of square correlation between the two constructs. However, the overlap between the two constructs can highlight that the indicators are measuring a single construct, not two (Holmes-Smith, 2011).

4.7.2. Reliability

Reliability is deemed to be a key aspect in measurements. Reliability refers to dependability or consistency of measurement (Neuman, 2006). Leedy and Ormrod definition of reliability as: ‘the consistency with which a measuring instrument yields a certain result when the entity being measured hasn’t changed’ (2010, p. 29). The indicators to measure reliability used in this study are explained next:

4.7.2.1. Squared Multiple Correlation (SMC) ‘item reliability’

The squared multiple correlation coefficient points to the amount of variance explained by the independent observed variables (Schumacker & Lomax, 2004). Squared multiple correlations can be used to measure the reliability of each item (Bagozzi & Yi, 2012). SMC exceeding 0.50 indicates that the observed variable has a good reliability, and 0.30 highlights an acceptable level of item reliability.

4.7.2.2. Construct reliability (composite reliability)

Construct reliability is employed to measure the reliability of all the observed variables that represent the construct. The main objective of calculating construct reliability is to test the internal consistency of the measures (Holmes-Smith, 2011). The rule of thumb of construct reliability is 0.70 (Hair et al., 2006). A value of construct reliability less than 0.70 can be acceptable if the CFA or causal model achieved satisfactory fit (Bagozzi & Yi, 2012).

Holmes-Smith (2011) points to three advantages of this indicator: construct reliability is calculated based on the estimates of model parameters; this measure is frequently used; and this measure can be calculated for constructs in a congeneric measurement model, CFA and path model with latent variables.

4.7.2.3. Cronbach's alpha

Cronbach's alpha is the most common measure to test internal consistency (Van Zyl, Neudecker, & Nel, 2000). The most important issue facing Cronbach's alpha is that the relationship between this measure and the number of items in the scale is positive (Hair et al., 2006). To solve this issue, Pallant (2011) suggested that reporting the mean inter-item correlation for the items is appropriate in the case of scales with a large number of items, and 0.2 to 0.4 is the recommended range for the inter-item correlation. The recommended level of Cronbach's alpha is 0.70, and 0.60 is acceptable for exploratory research (Hair et al., 2006). George and Mallery (2012) suggested a rule of thumb for Cronbach's alpha: $\alpha > 0.9$ – excellent; $\alpha > 0.8$ – good; $\alpha > 0.7$ – acceptable; $\alpha > 0.6$ – questionable; $\alpha > 0.5$ – poor; and $\alpha < 0.5$ – unacceptable.

4.7.2.4. Hancock and Mueller's 'maximised' reliability: Coefficient H

Coefficient H was formulated by Hancock and Mueller (2001) to assess measurement reliability. Coefficient H 'is a measure of the relation between a construct and its indicators' (Hancock, 2001, p. 387). Coefficient H has advantages over other reliability measures (Gagné & Hancock, 2006, p. 68): 'the value of Coefficient H can never be less than the reliability of its best indicators ... additional indicators can never diminish Coefficient H ... H can be viewed as the degree to which the indicators can capture information about the underlying factor, where additional indicators can only provide additional information about the construct and hence never detract therefrom'. The recommendation cut-off for Coefficient H is 0.70.

4.8. Response rate

The questionnaire was sent to students by courses examiners via the University Study Desk as a news item. Appendices C, D, and E show the cover letters and questionnaires for each stakeholder group. The questionnaire was sent to academic staff via the Associate Deans of Teaching and Learning by email. The ICT Director also used email to send the questionnaire to ICT staff involved with the e-learning system. The data from the study sample was collected between September 2011 and November 2011.

In total, the study includes 118 courses, and 5903 external students. Regarding academic staff, the questionnaire was sent to 388 academic staff members. The sample included only those ICT members dealing with e-learning systems (i.e. 24 ICT staff members). Table 4.14 shows the response rates of the three samples.

Table 4.14 Response rate of the three samples

Samples	Sent	Returned	Unusable	Usable	Response rate
Students	5903	732	12	720	12.2%
Academic staff	388	112	2	110	28.4%
ICT staff	24	22	-	22	91.6%

Some ranges of response rates were suggested by studies regarding the use of traditional methods to collect data (for example, a mail survey). Hart (1987) suggested that the common response rate in a business population is between 18 and 27 percent. Nachmias and Nachmias (1987) proposed between 20 percent and 40 percent as a typical response rate of mail survey. However, most studies confirmed that the response rate for Internet surveys is lower than a hard copy survey (Kaplowitz, Hadlock, & Levine, 2004; Ranchhod & Zhou, 2001; Shih & Fan, 2008). Tse et al. (1995) conducted a study to compare the response rates of two methods: e-mail versus mail. The results showed that the response rate from e-mail was 6 percent compared to 27 percent from mail. Similar results were obtained in a study by Tse (1998): 7 percent response from e-mail and 52 percent from a mail survey.

According to Ranchhod and Zhou (2001) some studies delivered response rates from email surveys of less than 3 percent. Rao (2002) confirmed that response rates in a range of studies relevant to customers who participate in Internet surveys is between 6 percent and 22 percent.

The response rate of the students sample, 12.2 percent, is slightly low but is still in the response rates range of studies that adopt an Internet survey—between 6 and 22 percent (Rao, 2002). The main reason for this low response rate could be the questionnaire length and the time needed to complete it. Students may have been too busy to complete the questionnaire, especially considering that the majority of external students are in employment. Furthermore, as the questionnaire focuses on different constructs to assess the success of e-learning systems, students could have felt that the questionnaire is too complicated and that could be one of the reasons for the low response rate. Three constructs out of eight in the questionnaire measured quality aspects: system quality; information quality; and service delivery quality. Students could have felt that the questionnaire items were repeated and they did not respond to them.

In regard to academic staff, the response rate was 28.4 percent and this is considered satisfactory because it exceeds the reasonable level for mail and e-mail surveys (Hart, 1987; Nachmias & Nachmias, 1987; Rao, 2002). The sample of ICT staff achieved an excellent response rate—91.6 percent.

4.9. Response and Non-Response bias

Response bias is one of the potential problems of research. Neumann defines response bias as ‘The tendency of some people to answer a large number of items in the same way (usually agreeing) out of laziness or a psychosocial predisposition’ (2007, p. 130). Different types of bias could occur during data collection stage, for example, acquiescence bias, extremity bias, interview bias, and social desirability bias (Zikmund et al., 2009). Acquiescence bias, extremity bias, and social desirability could materialise with survey studies, however, interview bias is related to qualitative studies. Therefore, interview bias does not influence this study because it adopted a quantitative approach. With acquiescence bias, respondents tend to agree with the items in the questionnaire regardless of the content (Beins & McCarthy, 2012). According to Zikmund et al. (2009) this type of bias occurs in research of new-products 'because respondents give positive connotations of the most new ideas' (Zikmund et al., 2009, p. 192). Extremity bias is defined by Ryan et al. as 'A tendency to provide extremity or variability judgments that are either high or low' (1996, p. 125).

To avoid response bias, Sharpe, De Veaux, and Velleman (2010) suggested that any misunderstanding, misinterpretation, and confusion should be identified and solved. This process is useful in reducing the different types of bias. Accordingly, this study adopted this approach via conducting a pilot study with three students, three academic staff members, and two ICT staff members. The main purpose of the pilot study was to confirm the questions were clear and understandable. Based on the results of the pilot study many changes were made to the questionnaire such as the elimination and re-wording of items, as detailed in Section 4.5.3 and Appendix B. Providing the respondents with other outlets in the survey can be useful in reducing acquiescence and extreme bias (Rao, 2002). Therefore, this approach was considered in the design of the study questionnaire. The respondents were provided with two additional options: 'I don't know' and 'Not applicable'. Furthermore, in the questionnaire a space was available for respondents to write additional comments and to note their emotional expressions. Social desirability bias may appear in research that deals with sensitive or personal topics (Zikmund et al., 2009). This type of bias may not influence this study because all the items in the questionnaire are concerned with e-learning systems and do not contain personal activities or topics. Heerwegh (2009) found that social desirability in an Internet survey was less than in face-to-face mode.

In respect to non-response bias, there are two types of this bias in the Internet survey: non-response bias through refusal and non-response through non-contact (Denscombe, 2010). Cranford et al. (2008) found three common reasons behind non-response-bias of Internet surveys: 45.7 percent 'too busy'; 18.1 percent 'not interested'; and 18.1 percent 'forgot to complete survey'. Non-response bias through refusal could happen 'if people feel ill at ease using computers or the Internet, the chances are that they will be reluctant to participate in online research' (Denscombe, 2010, p. 21). This type of bias is unlikley to occur in this study because all the educational and teaching activities of students and academic staff depend on the use of computers and the Internet. Thus, non-response bias through refusal is not an issue in this study.

One issue related to Internet survey is non-contact. This means that those who people who visit the website and complete the questionnaire may not be the cross-section of people that the researcher wishes to target. In this study and in regard to the student sample, this issue did not occur because the survey specifically targeted students who study online courses and these students are the only ones who have access to this particular website. Non-response through non-contact did not occur with academic staff and ICT staff samples because the survey was sent via email.

4.10. Ethical considerations

Ethics should be considered by researchers when conducting studies. Ethical considerations are a key issue encountered by researchers because there is a broad range of principles and there is only agreement about a few of them (Neuman, 2007). Ethics is defined by Malhotra at al. as 'The process of evaluating and addressing whether a particular action is right or wrong, good or bad' (2002, p. 27).

Conducting research ethically requires researchers to balance between the value of advancing knowledge and non-interference in the lives of others (Neuman, 2007).

The ethical approval for this study was gained from the University of Southern Queensland's Human Research Ethics Committee. The approval letter is included in Appendix A.

In this study, the purpose of the research study and the survey was explained to the participants. Participation in the survey was voluntarily and that is conveyed in the cover letter attached to each of the three questionnaires. Therefore, no pressure is applied to the participants to complete the survey. Finally, the data was treated confidentially and stored securely.

4.11. Chapter summary

This chapter outlined the research method adopted in this study. The survey method was selected to undertaken this study because it fits with the causality approach adopted in this study. Survey method enables the researcher to collect a wide range of data to examine the proposed model. Three stakeholder groups in e-learning systems at USQ were selected for the study sample: students; academic staff; and

ICT staff. This study used the same constructs with different items to measure e-learning systems success across three different sample groups. To increase the validity and reliability of the selected items was required, therefore the researcher modified and re-worded them to be suitable to measure the constructs. Moreover, to achieve this purpose a pilot study was conducted using interview method and the three questionnaires were modified based on the results of the pilot study. SEM was selected and justified to use in analysis of data. The selection of the suitable cut-off levels of model fit indicators is a main issue in SEM. Thus, a wide range of literature in the SEM and information systems field was reviewed to adopt suitable cut-off levels. The methods to avoid response and non-response bias were presented in this chapter. The ethical considerations also were taken into account to conduct the survey. Finally, the response rate of the three samples was presented and justified in this chapter.

CHAPTER FIVE

This chapter shows and tests the data collected from the students' sample. The first part of this chapter presents the descriptive statistics. The main purpose of this section is to describe the perceptions of students about each construct and item used in this study. In the second part, Structural Equation Modelling is used to test the study model and hypotheses. The third part presents the results of content analysis used to analyse the comments of students about the factors affecting the success of e-learning systems.

CHAPTER FIVE: DATA ANALYSIS OF STUDENTS SAMPLE

5.1. Introduction

Students are considered to be the major stakeholders in e-learning systems. Thus, their opinions about these systems can provide an effective assessment of factors relating to e-learning system success. Seven constructs were selected in the study model to evaluate the success of e-learning systems: IT infrastructure services; system quality; information quality; service delivery quality; perceived usefulness; user satisfaction; and customer value. Organisational value was not included in the study model for students because this group of stakeholders is considered to be inexperienced in issues regarding organisational performance, goals, university reputation, and competitive advantage.

5.2. Descriptive statistics

The completion of descriptive statistics is an essential stage in statistical analysis procedures. Zikmund et al. define descriptive statistics as ‘Statistics which summarize and describe the data in a simple and understandable manner’ (2009, p. 413). The main function of descriptive statistics is to check variables for any violation of the assumptions that are the basis of the statistical techniques adopted to address research questions (Pallant, 2011).

The scale used in the questionnaire for this study included five points: 1 ‘Strongly Disagree’, 2 ‘Agree’, 3 ‘Neutral’, 4 ‘Agree, 5 ‘Strongly Agree’. Two additional choices were provided to give respondents more alternatives in selecting the most suitable option: ‘Not applicable’ and ‘Don’t Know’. According to Krosnick et al. these options are considered important for respondents as ‘offering a no-opinion option should reduce the pressure to give substantive responses felt by respondents who have no true opinion’ (2002, p. 371). ‘Not applicable’ can be selected to describe when the item cannot be applied to the e-learning system under study. ‘Don’t Know’ is used to minimize non-attitude reporting (Krosnick et al., 2002).

Two main statistical indicators were used to describe the data: mean and standard deviation. The number and percentages of ‘Don’t know’ and ‘Not applicable’ responses are considered in this section to identify the non-attitude responses. Missing data is also reported in this section of the study. Tests of the normality of data distribution were conducted using two statistics indicators: skewness and kurtosis.

It is worth mentioning that ‘Don’t know’ and ‘Not applicable’ were used at this stage only to describe the respondents with non-opinions about the items. Then, those two responses were treated as missing data (Holman & Glas, 2005; Lord, 1974).

5.2.1. IT infrastructure services

Perceptions of IT infrastructure services were measured using six items. The descriptive indicators for IT Infrastructure services are shown in Appendix F Table F.1. The means of the IT infrastructure services items ranged between 3.961 for ITIS3 and 4.111 for ITIS5. These means indicate that the items were highly accepted by the respondents.

Among all constructs in the study model the ‘Don’t know’ option received the highest percentages in the items regarding IT infrastructure services constructs. ‘Don’t Know’ was selected by 7.9, 7.5, 6, 4.6, 4 and 3 percent of students in response to the items ITIS3, ITIS6, ITIS5, ITIS2, ITIS1, and ITIS4 respectively. These percentages are considered relatively high compared to other constructs in the study model. It is thought that the main reason behind selecting this response by students is that some students, particularly overseas students, do not have experiences with the ICT Division at USQ and they may not aware of the services provided by the ICT division.

The percentage of the ‘Not applicable’ option ranged between 0.7 and 1.5 percent and is considered low. Regarding the missing data, the highest percentage of missing data was in item ITIS5 with 3.2 percent; and the missing data of other items ranged between 1.4 and 1.8 percent.

The indicators of descriptive statistics showed the positive attitude of online students toward the role of IT infrastructure services to support and enhance their study via electronic channels. The number of students who selected ‘Don’t know’ and ‘Not applicable’ can be considered relatively low. The missing values were extremely low. These low percentages of ‘Don’t know, ‘Not applicable’, and missing data indicate that surveyed students paid attention in responding to the questionnaire and they have adequate experience related to the items of the questionnaire.

5.2.2. E-learning system quality

Eight items were employed to assess the e-learning system quality from the online students' point of view. The descriptive indicators of system quality are shown in Appendix F Table F.2. The items' means were between 3.548 for SQ6 and 4.022 for SQ1. The means of items confirmed that respondents tend to accept these items and agree about the quality aspects of e-learning systems. In regard to the 'Don't know' option, two items showed high percentages relating to this option compared with the other items in the same construct: SQ6 (3.2 percent) and SQ7 (2.5 percent). The percentages of 'Don't know' in the other items were extremely low—between 0.1 and 1.0 percent. The percentages of the 'Not applicable' choice were between 0.1 and 0.4 percent and considered extremely low. The number of missing values was extremely low with percentages between 0.3 and 0.8 percent. It appears that students who participated in the survey have a positive attitude toward the quality aspects of e-learning systems.

5.2.3. Information quality

The means of information quality items ranged between 3.851 for IQ5 and 4.011 for IQ3. Based on the items' means, students' opinions tend to agree that information generated from e-learning systems is of high quality. Information quality is believed to be the construct that has the lowest values of 'Don't know', 'Not applicable' and missing data among all the constructs of the study model, and the percentages do not exceed 0.8 percent—as shown in Appendix F Table F.3.

5.2.4. Service delivery quality

Service delivery quality was selected as a central construct in the proposed model. Twenty items were used to measure this construct. These items were distributed on six sub-dimensions: efficiency (3 items); availability (3); fulfilment (3); privacy (3); responsiveness (3); and contact (4). The means of SDQ items highlighted that students agreed that educational services delivered by USQ take into account the criteria of quality. The means of SDQ items ranged between 3.649 for RESP2 and 4.301 for item CONT4, as shown in Appendix F Table F.4.

Items of efficiency and availability dimensions had the lowest percentages of 'Don't know', 'Not applicable' and missing data among all the items of SDQ, and were between 0.1 and 0.8 percent. The items of responsiveness and contact collected the highest percentages of 'Don't know', 'Not applicable' and missing data among all the items of SDQ and were between 2.4 and 8.1 percent. It appears the key reason behind these high percentages may be that most students at USQ are overseas students and therefore may not have interaction with the ICT Division at USQ. The item '*ULearn provides a telephone number to contact the university'* had the highest percentage of 'Don't know' among the items of contact dimension; and among the items of SDQ was 8.1 percent. This percentage may indicate that some students do not use the phone to contact the university due to the cost involved. The highest rate of missing data was in the items of privacy dimension, PRIV1, PRIV2, and PRIV3 (1.7, 2.1 and 1.8 percent respectively).

Responses of students towards the items of service delivery quality show that students agreed about the sub-dimensions of service delivery quality. In other words, efficiency, availability, fulfillment, privacy, responsiveness, and contact aspects are taken into account in the services delivered to students by USQ.

5.2.5. Perceived usefulness

Five items were utilised to survey students' opinions about the role of e-learning systems for enhancing their study performance (perceived usefulness). Students tend to agree about the perceived usefulness of the e-learning system such as ability to accomplish tasks quickly, improve study performance, and make study easier. The means of perceived usefulness items were between 3.675 for USEF3 and 4.039 for USEF5. The missing data was extremely low, between 0.3 and 0.4 percent, as shown in Appendix F Table F.5. 'Don't know' and 'Not applicable' responses were extremely low—not exceeding 1.1 percent.

5.2.6. User satisfaction

User satisfaction is considered an essential indicator to measure e-learning systems. Five items were used to measure this construct and the means of these items ranged between 3.851 for SATF2 and 3.993 for SATF5—as shown in Appendix F Table F.6. These means indicate that students are satisfied with the e-learning system. The missing data related to this construct were very low with percentages between 0.4 and 0.7 percent. The percentage of students who selected the 'Not applicable' choice was extremely low, between 0.1 and 1.1 percent. Item SATSF4 '*If I had an* *opportunity to do another degree or course online, I would gladly do so'* received the highest response of the 'Not applicable' choice (1.3 percent). This percentage can be viewed as normal because some students may not have sufficient experience to make such a decision. The percentages of 'Not applicable' for the remaining items were between 0.1 and 1.1 percent.

5.2.7. Customer value

Five items were employed to measure the customer value focusing on enhancing student abilities, understanding, stimulation, and social value. Appendix F Table F.7 depicts the indicators descriptive of the customer value construct. The means of items ranged between 3.830 for CUSV3 and 4.134 for CUSV2. These means indicate that students agree about the value of adopting the e-learning system. The percentages of missing data were between 1.4 and 2.2 percent. Items of social value CUSV4 '*People who are important to me think that taking my course through the e-learning system is a good thing to do'* and CUSV5 '*My family and my friends will see me in a better light when I have finished my degree*' received the highest responses of the 'Don't know' and 'Not applicable' choices. The percentages of 'Don't know' were 7.2 and 6 percent for CUSV4 and CUSV5 respectively; and 2.1 and 1.8 percent for 'Not applicable' respectively. The main reason behind the high percentage of these options may be that students are uncertain about their families' and friends' feelings toward finishing their study via e-learning.

This section is allocated to describing the data collected from the sample of students enrolled in online courses at USQ. Mean and standard deviation were the main indicators used to describe the data. The missing data of each item and constructs are described in this section. Two additional options of responses were used in the study scale: 'Don't know' and 'Not applicable'. The percentages of respondents selecting those two options are also reported in this section.

5.3. Treatment of missing data, outliers, and normality

Missing data occurs because respondents do not fill a particular item or fill it incorrectly (Muijs, 2004). There are different methods to estimate the missing data. The imputation method is preferred if the missing data is under 10 percent (Hair et al., 2010). Raymond and Roberts (1987) found that regression imputation was the best method in estimating missing data based on the measure of discrepancy. As mentioned before, the responses of 'Don't know' and 'Not applicable' will be treated as missing data. The missing data in the students' sample, including 'Don't know' and 'Not applicable' were under 10 percent—except for ITIS3 and ITIS6 at 10.5 and 10.6 percent respectively. Therefore, the imputation regression method was employed to estimate the missing data in the student sample.

After estimating the missing data, the existence of outlying values should be identified in the set of data. Outliers are defined by Pallant as 'Cases with values well above or well below the majority of other cases' (2011, p. 64). Uncorrected miscoding can be considered the most obvious cause of outliers (Holmes-Smith, 2011). According to Holmes-Smith (2011) there are two approaches to identify outliers. The first approach is identifying the outliers through the frequency distribution of each item and the minimum and maximum values. The value out of the range (scale points) can be considered outlier value. The second approach is identifying the outliers by the histogram distribution of each variable.

In regard to the current study, outliers should not occur because the data was not coded manually but imported electronically from Survey Monkey to SPSS. In spite of that, the outliers were checked via frequency distributions and the values confirmed between 1 and 5 (the range of scale used in this study).

Distribution normality was tested using two statistical indicators: skewness and kurtosis. Appendix F Table F.8 shows the skewness and kurtosis of each items used in this study after estimating the missing data. Skewness and kurtosis of each items used in this study after estimating the missing data. In this context, Peat and Barton state that 'Any values above +3 or below -3 are a good indication that the variables is not normally distributed' (2005, p. 31) Based on these criteria, and as shown in Appendix F Table F.8, the items used in this study were normally distributed. Therefore, there are no actions required to treat the data and these data will be input to the next stage of analysis and to test the study model.

5.4. Measurement model and testing study model and hypotheses

Students are considered key stakeholders of e-learning systems. Thus, this group of stakeholders was included in this study. Structural equation modeling is employed in this study as an essential statistical technique to analysis the data. Five steps were undertaken to analyse the student data.

5.4.1. Stage One: One-factor congeneric measurement model

The one-factor congeneric measurement model was undertaken using confirmatory factor analysis. Dragovic (2004) used one set of data to establish three types of measurement models: parallel; tau-equivalent; and congeneric. The results highlighted that the congeneric model was superior compared with the other two models. One-factor congeneric measurement was conducted with each construct separately.

Confirmatory factor analysis (CFA) is used to conduct the one-factor congeneric measurement model to test the model fit of each construct. The main justification in employing this statistical method is that '(a) CFA allows the researcher to formulate specific models that are to be tested … and (b) CFA provides a chi-square test and other goodness-of-fit indicators of the ability of the different models (e.g., first-order vs. higher-order models) to fit the same data, and of the same model to fit the data from different groups' (Marsh, 1985p. 432). This technique is used to identify items which have a high error variance, the parameters that have a low squared multiple correlation, and to determine items with high modification indices. This stage was conducted until the model fitted. The codes are used to represent each item, for example, ITIS1 means the first item of IT infrastructure service construct and SQ2 means the second item of system quality. The details of codes and items are shown in Chapter 4 (Section 4.5.4.). The results of these analyses are now detailed.

5.4.1.1. IT infrastructure services

Six items were input at the first iteration of conducting one-factor congeneric measurement: ITIS1 channels management; ITIS2 security; ITIS3 advice and consultancy; ITIS4 communication infrastructure; ITIS5 application infrastructure; and ITIS6 support services. The model fit indicators were: CMIN/DF 13.718; GFI 0.947; AGFI 0.877; CFI 0.928; NNFI 0.879; RMR 0.027; SRMR; 0.0467; RMSEA 0.133. Two iterations were conducted to eliminate non-significant items in measuring IT infrastructure services, and to improve the indicators of model fit. The results of the first iteration indicate that item ITIS2 '*The Division of ICT provides me with an e-learning service with a high level of technical security'* has a high level of residual covariation (modification indices) with ITIS6 '*ICT provides me with technology advice and support services related to the e-learning system'*. The value of residual covariation between those two factors was 35.266. Both items are theoretically related to services of e-learning, and the security service can be considered as one type of service provided to students by the ICT Division. In spite of eliminating ITIS2 there is still high residual covariation (23.087) between ITIS3 and ITIS5. The Standardized Residual Covariances, which show the discrepancy between variables, indicate that ITIS5 has a high standardized residual covariance value with ITIS1, ITIS3, and ITIS6 and were -1.246, -2.050, and 1.358 respectively. Item ITIS5 '*The Division of ICT provides me with a wide range of facilities to perform e-learning activities, such as access to the library'* is associated with the other items in the scale because theoretically all the items are measuring the infrastructure services. However, this item was formulated in a general form and it should be more specific, especially for students because they are not dealing frequently with these services. Thus, ITIS5 was eliminated from the construct.

The results at the final iteration were: CMIN/DF 1.628; GFI 0.998; AGFI 0.989; CFI 0.998; NNFI 0.995; RMR 0.007; SRMR 0.0124; RMSEA 0.030; PCLOSE 0.647. These results confirm that the model has an excellent fit; Figure 5.1 and Figure 5.2 show the IT infrastructure measurement model at the first iteration and at the final iteration.

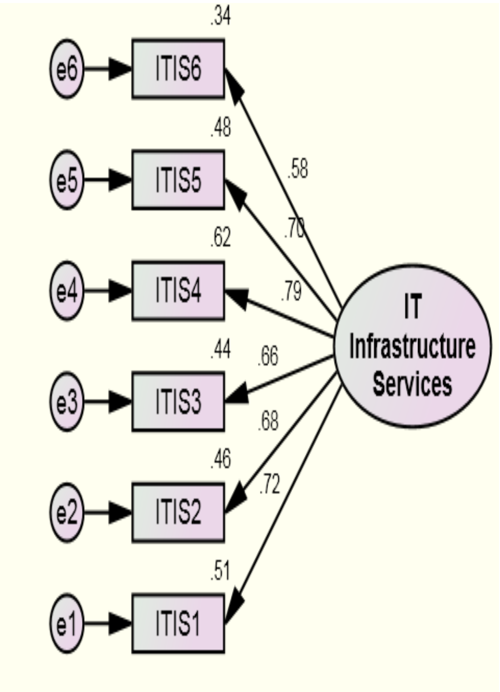


Figure 5.1One-factor congeneric measurement model of IT infrastructure (First iteration)

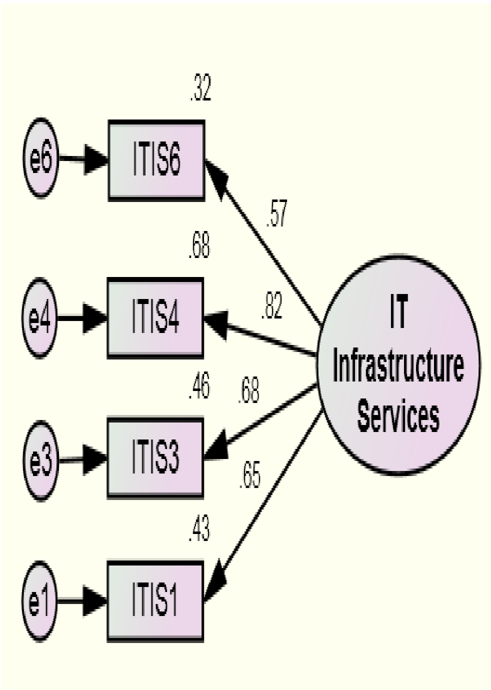


Figure 5.2 One-factor congeneric measurement model of IT infrastructure (Final iteration)

5.4.1.2. System quality

Eight items were input at the first iteration, each item representing a specific aspect of system quality: SQ1 ease of use; SQ2 ease to learn; SQ3 user requirements; SQ4 system features; SQ5 system accuracy; SQ6 flexibility; SQ8 integration. At the first iteration the model fit indicators were: CMIN/DF 24.412; GFI 0.837; AGFI 0.706; CFI 0.853; NNFI 0.974; RMR 0.071; SRMR 0.0754; RMSEA 0.180; PCLOSE 0.000.

The highest value of residual covariation was between items SQ7 and SQ8 (100.959). SQ7 is '*The e-learning system requires only the minimum number of fields and screens to achieve a task'* and it represents the Sophistication aspect. Item SQ8 represents the aspect of Integration: '*All data within e-learning system is fully integrated and consistent'*. In line with the statistical finding, theoretically, these two items are also associated as the integration of e-learning systems with different software and applications makes it a more sophisticated system. In this regard, Paré and Sicotte (2001) used integration as a key dimension to measure information technology sophistication. Furthermore, Themistocleous, Irani, and Love (2004) claim that sophistication of systems can be used to indicate the integration capabilities of these systems.

The decision was made to eliminate SQ7 to solve this problem. The reason behind this decision was that SQ7 had the lowest Standardised Regression Weight (0.598) and the lowest Squared Multiple Correlation (0.358) among all the observed variables in the system quality constructs. The second highest residual covariation was between items SQ1 and SQ2; the value of residual covariation was 97.238. These two aspects, ease of use and ease to learn, are very close to each other because both represent the ease of e-learning systems. The Standardised Regression Weights and the Squared Multiple Correlations of both items were very close. Thus, the indicators of model fit were used to decide that the item should be eliminated to improve the model. SQ2 was deleted because the model fit indices with SQ1 are better than the model fit with SQ2.

The results of conducting the CFA on the system quality construct at the fourth iteration highlighted that item SQ4 '*The e-learning system includes necessary features and functions for my study'* has a high residual covariation with SQ3 '*The e-*

learning system meets my requirements', and with SQ6 '*The e-learning system user interface can be easily adapted to one's personal approach'*. The values of residual covariation were 22.822 and 28.960 respectively.

Item SQ4 'system features' is theoretically associated with items SQ3 'user requirements' and item SQ6 'flexibility'. In this regard, Saarinen states that 'High system quality requires a good user interface and, in the long run, flexibility, allowing changes in the processing style, and adaptation to new requirements' (1996, p. 107). In other words, if the system meets user requirements that means it has sufficient features to achieve the objectives of using the e-learning system. Therefore, meeting user requirements can be used to assess system features. Based on this theoretical justification, SQ4 was eliminated as an observed variable to measure the system quality construct.

At the final iteration, the highest residual covariation value was 58.9 between SQ6 'flexibility' and SQ8 'integration'. SQ6 was eliminated because it had the lowest value of the Standardized Regression Weights and the Squared Multiple Correlations. The theoretical grounds to support elimination of SQ6 is that Byrd and Turner (2000) employed integration of data and functionality as a key indicator to measure system flexibility alongside flexibility of IT personnel and modularity. Therefore, integration can be adopted to measure the flexibility of e-learning systems. The model fit indicators after conducting the final iteration were: CMIN/DF 2.262; GFI 0.997; AGFI 0.984; CFI 0 .998; NNFI 0.993; RMR 0.011; SRMR 0.128; RMSEA 0.042; PCLOSE 0.512. These results show that the model achieved an excellent fit.

Figure 5.3 and Figure 5.4 show the system quality measurement model at the first iteration and at the final iteration. Table 5.1 shows the indicators of system quality model fit in each iteration and depict the system quality measurement model at the first iteration and at the final iteration.

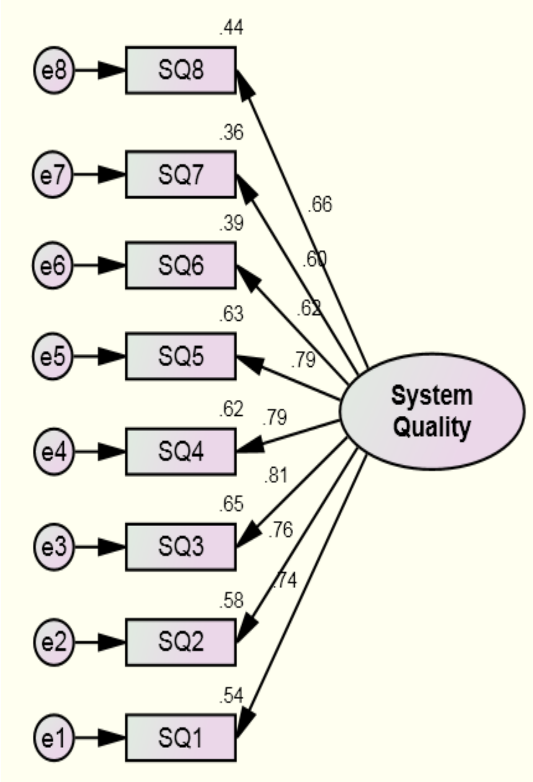


Figure 5.3 One-factor congeneric measurement model of system quality (First iteration)

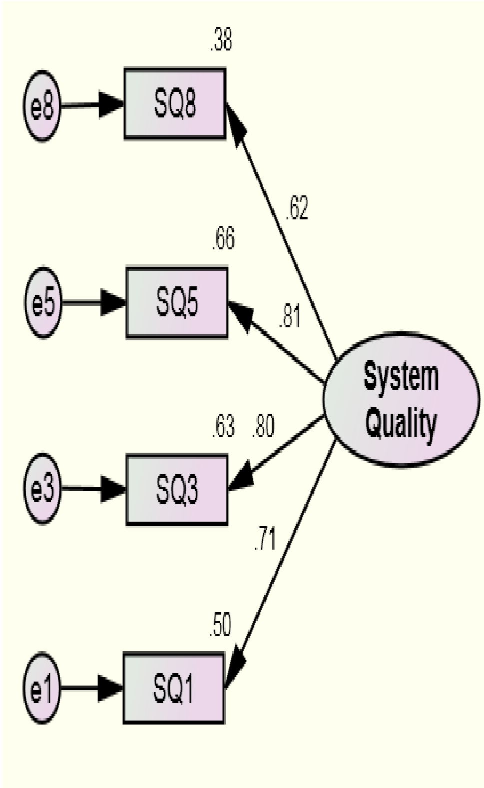


Figure 5.4 One-factor congeneric measurement model of system quality (Final iteration)

Table 5.1 Results of one-factor congeneric measurement model of system quality

Iteration	deleted item	CMIN/ DF	GFI	AGFI	CFI	NNFI	RMR	SRMR	RMSEA	PCLOSE
1	-	24.412	.837	.706	.853	.794	.071	.0754	.180	.000
2	SQ7	21.329	.891	.782	896	.843	.054	.0596	.168	.000
3	SQ2	17.761	.928	.832	.928	.880	.055	.0572	.153	.000
4	SQ4	15.725	.957	.870	.947	.894	.044	.0453	.154	.000
5	SQ6	2.262	.997	.984	.998	.993	.011	.0128	.042	.512

These results show that the model improved through the five iterations and an excellent model fit was achieved at the fifth iteration.

5.4.1.3. Information quality

Five items were input at the first iteration of the one-factor congeneric measurement for information quality: IQ1 importance; IQ2 availability; IQ3 usability; IQ4 understandability; and IQ5 conciseness. The model fit indicators of the first iteration were: CMIN/DF 6.591; GFI 0.98; AGFI 0.951; CFI 0.975; NNFI 0.958; RMR 0.018; SRMR 0.0257; RMSEA 0.088; PCLOSE 0.002.

Item IQ1 ‘*The e-learning system provides me with the outputs that I need*’ had a high residual covariation with item IQ4 ‘*Information from the e-learning system is easy to understand*’. The theoretical link between those two aspects is that the importance of information depends on the ability of students to understand the information. The theoretical relationship between the information importance aspect and the information understandability aspect is complicated because the cognitive style influences the assessment of information importance and understanding information (Berry, Jeffery, & Aurum, 2005).

At the second iteration, after deleting one item, IQ1 ‘importance aspect’, the model achieved an excellent fit and the results were: CMIN/DF 1.034; GFI 0.999; AGFI 0.993; CFI 1.000; NNFI 1.000; RMR 0.006; SRMR 0.0087; RMSEA 0.007; PCLOSE 0.784.

The first and final iteration of one-factor congeneric measurement model of information quality is depicted in Figure 5.5 and Figure 5.6.

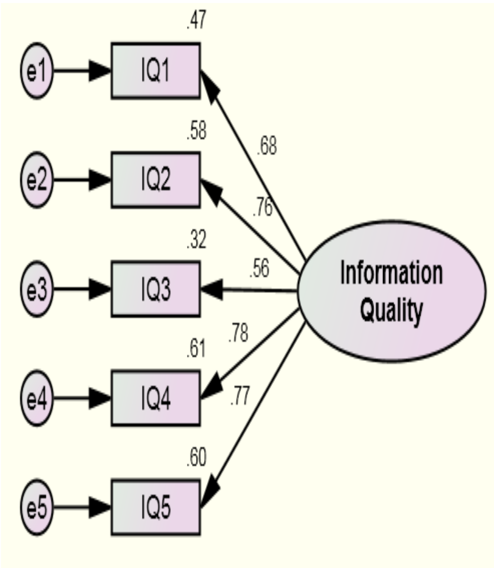


Figure 5.5 One-factor congeneric measurement model of information quality (First iteration)

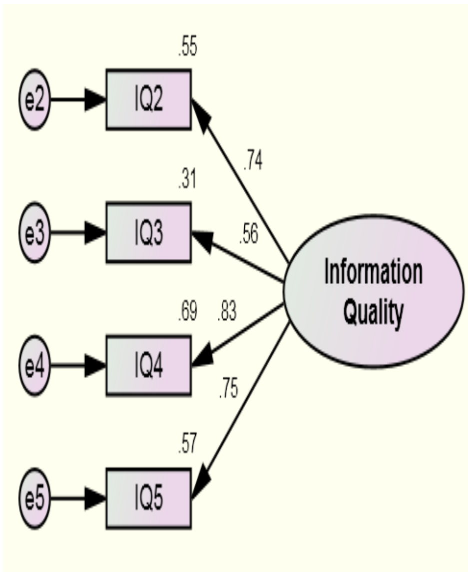


Figure 5.6 One-factor congeneric measurement model of information quality (Final iteration)

5.4.1.4. Service delivery quality

The service delivery quality construct comprised 20 items and represented six sub-dimensions: efficiency; availability; fulfilment; privacy; responsive; and contact. First-order factor analysis was conducted on this construct. The indicators of model fit at the first iteration were: CMIN/DF 5.498; GFI 0.891; AGFI 0.853; CFI 0.892;

NFFI 0.868; RMR 0.054; SRMR 0.0711; RMSEA 0.079; PCLOSE 0.000. These results show that the measurement model does not fit. Non-significant items needed to be eliminated to improve the goodness-of-fit model measurement.

Seven iterations were undertaken using first-order CFA. At each stage of iteration one item was eliminated to improve the fit of model. After those seven iterations, 14 items were yielded: efficiency (3 items); availability (2); fulfilment (3); privacy (2); responsive (2); and contact (2). The eliminated items were AVA1, FULF4, PRIV1, RESP1, CONT1 and CONT2. The elimination process of the six items from the SDQ was performed based on theoretical and statistical grounds. For example, at the third iteration CONT2 '*ULearn enables me to input comments and share information with other students*' was deleted. This item had a high residual covariation, 50.429, with CONT1 '*ULearn allows me to discuss some issues with my lecturers'*. Both items represent the contact dimension of SDQ and both were focused on sharing information with other stakeholders. The model fit indices after conducting the final iteration were: CMIN/DF 1.896; GFI 0.977; AGFI 0.961; CFI 0.987; NNFI 0.981; RMR 0.018; SRMR 0.0236; RMSEA 0.035; PCLOSE 0.995. Figure 5.7 and Figure 5.8 depict the CFA model at the first and the final iteration. Table 5.2 shows details of the seven iterations and the model fit indices in each one.

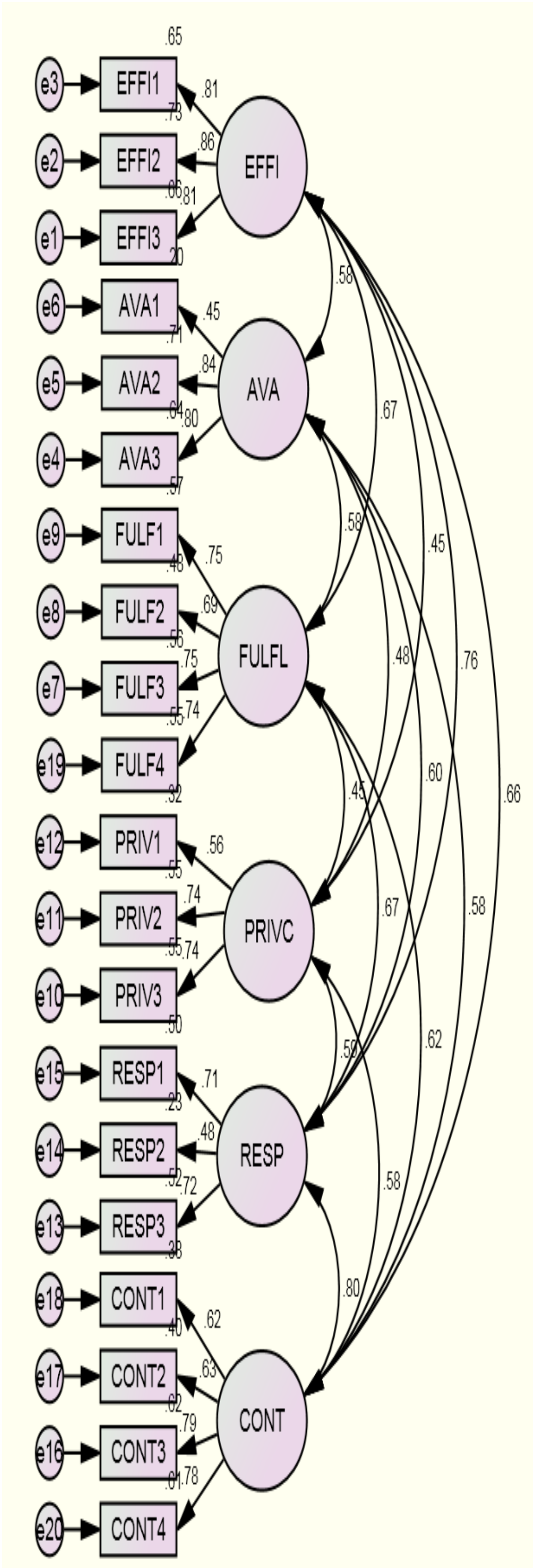


Figure 5.7 CFA measurement model of SDQ (First iteration)

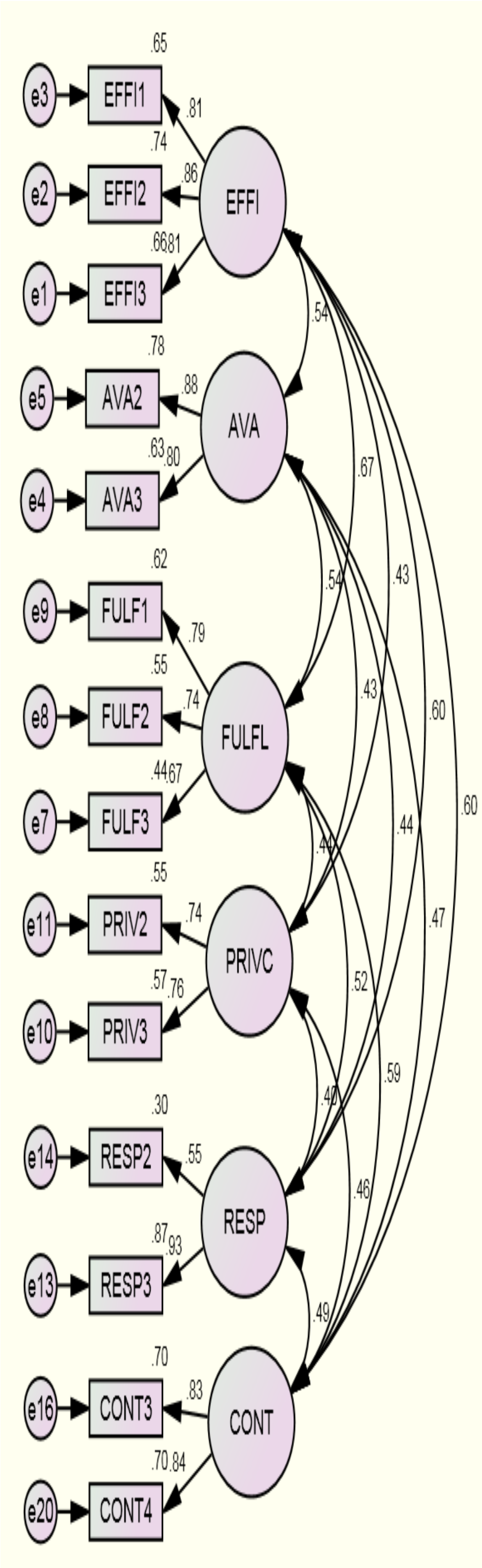


Figure 5.8 CFA measurement model of SDQ (Final iteration)

Table 5.2 CFA Goodness-of-fit indicators of the SDQ

Iteration	Deleted item	CMI N/DF	GFI	AGFI	CFI	NNFI	RMR	SRMR	RMSEA	PCLOSE
1	-	5.49	.891	.853	.892	.868	.054	.0711	.097	.000
2	AVA1	4.15	.918	.886	.929	.911	.032	.0444	.066	.000
3	CONT2	4.20	.925	.893	.933	.915	.034	.0482	.067	.000
4	FULF4	3.87	.936	.906	.943	.925	.033	.0470	.063	.000
5	RESP1	3.09	.954	.930	.962	0.948	.029	.0427	.054	.180
6	CONT1	2.00	.973	.956	.983	0.977	0.21	.0282	.037	.993
7	PRIV1	1.89	.977	.961	.987	0.981	0.18	.0236	.035	.995

The indicators of final iteration confirm that the measurement model achieved an excellent fit and all the indicators meet the acceptable level.

5.4.1.5. Perceived Usefulness

Five items were used to measure the perceived usefulness construct. The indicators of the initial perceived usefulness one-factor congeneric measurement model were: CMIN/DF 17.615; GFI 0.954; AGFI 0.861; CFI 0.964; NNFI 0.929; RMR 0.24; SRMR 0.0297; RMSEA 0.152; PCLOSE 0.000. These results highlighted that the model does not fit and needs modification to improve and reach the best fit. The value of modification indices between item USEF4 and USEF5 was 35.190 and it was the highest among all the values. This value indicates that those two items have a high residual covariation. Item USEF4 is '*Using the e-learning system makes it easier to do my study'* and item USEF5 is '*Overall, I find the e-learning system useful to my study'*. The items are related because item USEF4 measures the aspect of 'easier study' and USEF5 gauges 'overall usefulness'. Therefore, theoretically those two items are related and USEF4 measures a specific aspect of perceived usefulness and USEF5 measures this construct totally. USEF4 also has a residual covariation with USEF2 '*Using the e-learning system improves my study performance*', but the value of modification indices of USEF4 with USEF2 is less than the value of USEF4 with USEF5. Thus, USEF4 was eliminated from the perceived usefulness construct. The model fit indicators after eliminating USEF4 were: CMIN/DF 11.584; GFI 0.984; AGFI 0.919; CFI 0.987; NNFI 0.960; RMR 0.17; SRMR 0.0227; RMSEA 0.121; PCLOSE 0.003. The indicators show that the model improved but still does not fit. The main reason is the high residual covariation between USEF1 '*Using the e-learning system in my study enables me to accomplish my tasks more quickly'* and USEF5 'overall usefulness'. This issue has been solved by making covering error variance terms of those two items. The results of the third iteration confirmed that the model improved and fitted, and the indicators of model fit were: CMIN/DF 1.412; GFI 0.999; AGFI 0.990; CFI 0.999, NNFI 0.998, RMR 0.0042; SRMR 0.0042; RMSEA 0.024; PCLOSE 0.556. Figure 5.9 and Figure 5.10 show the first and the final iteration of perceived usefulness one-factor congeneric measurement model.

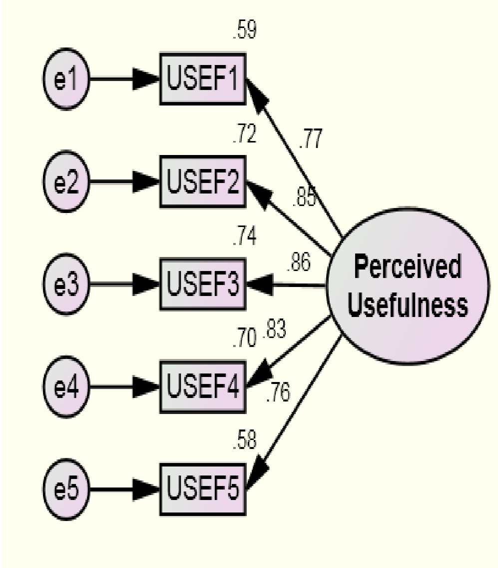


Figure 5.9 One-factor congeneric measurement model of perceived usefulness (First iteration)

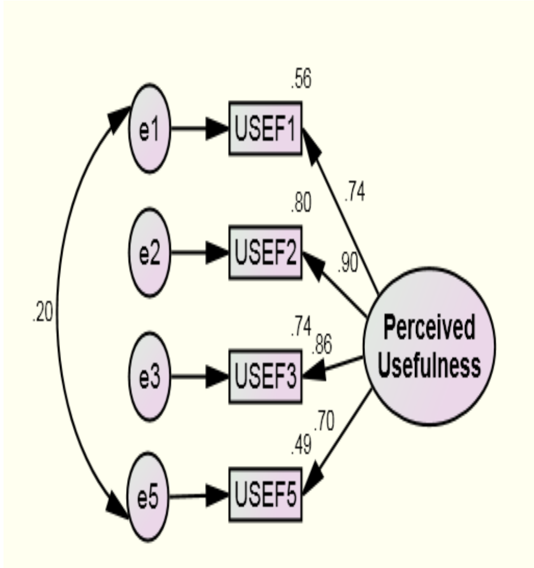


Figure 5.10 CFA One-factor congeneric measurement model of perceived usefulness (Final iteration)

5.4.1.6. User satisfaction

One-factor congeneric measurement model has been undertaken with the user satisfaction construct as well. Five items were input to CFA at the first iteration and the results were CMIN/DF 62.469; GFI 0.868; AGFI 0.603; CFI 0.840; NNFI 0.679; RMR 0.087; RMSEA 0.292; PCLOSE 0.000. These results indicated a considerable problem with this construct. Thus, the problems in this construct needed to be identified and solved. The modification indices showed a high cross loading between SATF4 '*If I had an opportunity to do another degree or course online, I would gladly do so*' and items SATF1 '*I am satisfied with the performance of the e-learning system'*, SATF2 '*I am satisfied with the experience of using the e-learning system'*, and SATF3 '*my decision to study my degree through e-learning system was a wise one'*. Therefore, item SATF4 has been eliminated. The results after deleting SATF4 were CMIN/DF 4.357; GFI 0.994; AGFI 0.971; CFI 0.995; NNFI 0.985; RMR 0.017; SRMR; 0.0204; RMSEA 0.068; PCLOSE 0.201. Based on the results of the second iteration, the model significantly improved. However, there is still a cross loading between SATF3 and SATF5 and this issue has been solved by making covering error variance terms of those two items. The results of the third iteration were CMIN/DF 2.734; GFI 0.998; AGFI 0.981; CFI 0.999; NNFI 0.992; RMR 0.006; SRMR 0.0075; RMSEA 0.049; PCLOSE 0.379. Figure 5.11 and Figure 5.12 show the first and the third (final) user satisfaction one-factor congeneric measurement model.

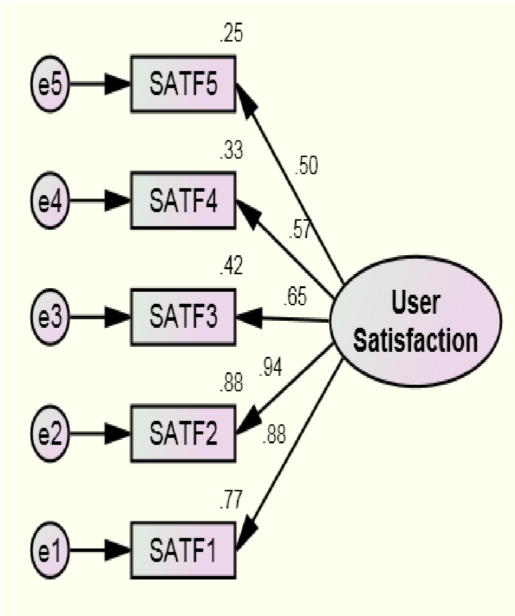


Figure 5.11 One-factor congeneric measurement model of user satisfaction (First iteration)

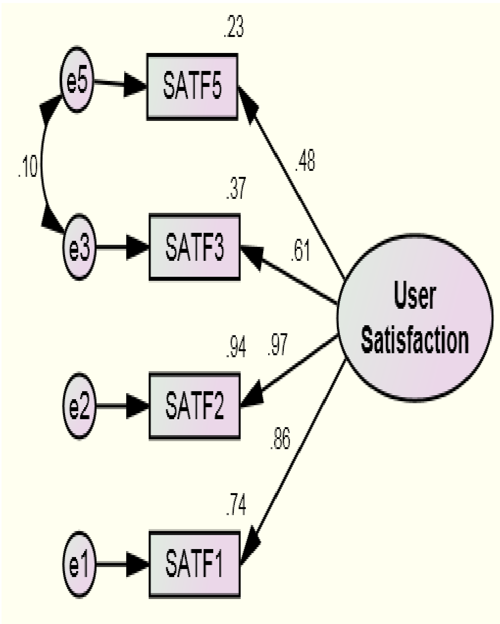


Figure 5.12 CFA One-factor congeneric measurement model of user satisfaction (Final iteration)

5.4.1.7. Customer value

In respect of customer value, five items were employed to measure this construct: CUSV1 increasing abilities; CUSV2 understanding concepts; CUSV3 stimulation; CUSV4 social value 1; and CUSV5 social value 2. Three iterations were undertaken to reach the fit model. The indicators of initial model were CMIN/DF 14.531; GFI 0.958; AGFI 0.873; CFI 0.943; NNFI 0.887; RMR 0.032; SRMR 0.0465; RMSEA 0.137; PCLOSE 0.000. These results show that the model does not fit. Two other iterations were conducted to improve the model. At the second iteration item CUSV5 '*My family and my friends will see me in a better light when I have finished my degree'* was deleted due to the high residual covariation with item CUSV4 '*People who are important to me think that taking my course through the e-learning system is a good thing to do'*. Theoretically, both items are related because they are measuring the social value of the e-learning system. Item CUSV5 has the lowest Squared Multiple Correlation (0.294) and the lowest Regression Weight (0.543) among the items of customer value construct. Therefore, item CUSV5 was eliminated, and the model fit indicators were: CMIN/DF 14.531; GFI 0.958; AGFI 0.873; CFI 0.943; NNFI 0.887; RMR 0.032; SRMR 0.0465; RMSEA 0.137; PCLOSE 0.000. The results show that there is still a cross loading between CUSV1 and CUSV2. This issue has been solved by making covering error variances terms of those two items to improve the model fit. The results after undertaking these iterations were CMIN/DF 2.432; GFI 0.997; AGFI 0.971; CFI 0.997; NNFI 0.98; RMR 0.007; SRMR 0.0105; RMSEA 0.059; PCLOSE 0.237. The outputs of CFA point to the validity of items in measuring the study constructs, and these items represent the constructs adequately. Figure 5.13 and Figure 5.14 show the model for the customer value construct at the first and final iteration.

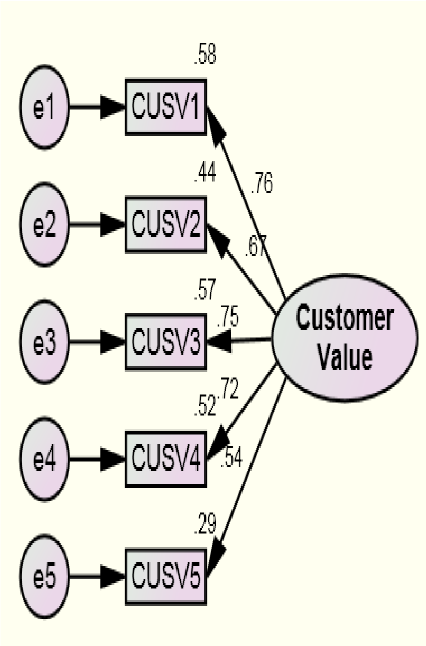


Figure 5.13 CFA One-factor congeneric measurement model of customer value (First iteration)

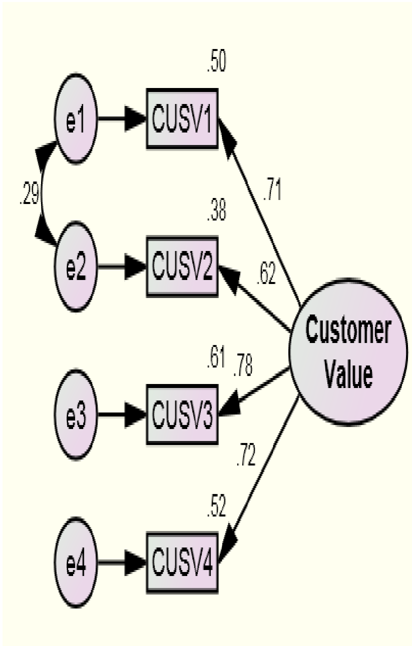


Figure 5.14 One-factor congeneric measurement model of customer value (Final iteration)

5.4.1.8. Summary of CFA One-factor Congeneric Measurement models

The section reported on the tests of the one-factor congeneric measurement model. Confirmatory factor analysis was employed to achieve this stage. All seven constructs were tested separately using this technique and the fitness of the one-factor congeneric measurement models was achieved. The results of this stage are summarised in Table 5.3.

Table 5.3 Summary of conducting one-factor congeneric measurement model (Student Sample)

Factor	Items input	Items output	Eliminated items	Aspects of Eliminated items
IT infrastructure Services	6	4	ITIS2	Security
			ITIS5	Application infrastructure
System Quality	8	4	SQ2	Ease to learn
			SQ4	System features
			SQ6	Sophistication
			SQ7	Flexibility
Information Quality	5	4	IQ1	Importance
Services Delivery Quality	20	14	AVA1	Availability
			FULF4	Fulfillment
			PRIV1	Privacy
			RESP1	Responsiveness
			CONT1	Contact
			CONT2	Contact
Perceived Usefulness	5	4	USEF4	Easier Study
User satisfaction	5	4	SATF4	Satisfied with decision
Customer Value	5	4	CUSV5	Social value 2

5.4.2. Stage two: Exogenous and endogenous factors first-order CFA

In the second step, confirmatory factor analysis (CFA) was conducted with all exogenous factors separately, and then the same procedure was undertaken with endogenous factors. Holmes-Smith and Rowe (1994) used this method to eliminate any cross-loading across constructs. This type of CFA was used in this study for the same purpose and to improve the model fit. This stage was also adopted in studies by Vivek (2009) and Ghandour (2010).

The output of the one-factor congeneric measurement model will be the input to this stage. Four constructs were considered as exogenous factors: IT infrastructure services; system quality; information quality; and SDQ. These constructs are deemed to be essential requirements to make the e-learning useful for stakeholders, to enhance user satisfaction, and to make the output of e-learning system valuable for the stakeholders. The three remaining constructs were considered endogenous factors: perceived usefulness; user satisfaction and customer value. Those three constructs are treated as results and output of the exogenous factors.

The results of the first iteration of CFA with exogenous constructs were: CMIN/DF 3.866; GFI 0.884; AGFI 0.858; CFI 0.915; NNFI 0.904; RMR 0.034; SRMR 0.0468; RMSEA 0.063; PCLOSE 0.000. The modification indices showed that item IQ3 '*Information from the e-learning system is in a form that is readily usable'* has a high residual covariation with item IQ4 '*Information from the e-learning system is easy to understand*'; and elimination of one of these items may assist in improving the model fit. IQ3 represents the Usability aspect of information quality and IQ4 the understandability aspect. Panach, Condori-Fernández, Valverde, Aquino, and Pastor (2008) used understandability as a measure of usability. Furthermore, understandability is considered a key attribute of usability by ISO/IEC 9126-1 (2001). Thus, IQ3 was deleted from the model. The indicators of model fit, after deleting IQ3, were: CMIN/DF 3.244; GFI 0.913; AGFI 0.892; CFI 0.935; NNFI 0.926; RMR 0.032; SRMR 0.0428; RMSEA 0.056; PCLOSE 0.11. Most of the indicators, except CMIN/DF, indicate that the model is good. However, residual covariances highlighted that the item FULF3 '*This site is truthful about its offerings'* has a high residual covariation with system quality items. This aspect is likely related to the accuracy of the system in delivering services and required information to users. The effect of this item on the full model can be identified by comparing the model fit indices for the full model with the same indicators in the modified model. In this regard, James et al. state that 'After examination of parameter estimate, fit indexes, and residuals, researchers can conduct model modification to the original hypothesized model to have a better or more parsimonious model' (2006, p. 327). FULF3 was eliminated from the model and the results were: CMIN/DF 3.052; GFI 0.922; AGFI 0.902; CFI 0.943; NNFI 0.934; RMR 0.030; SRMR 0.0402; RMSEA 0.053; PCLOSE 0.99. The fit indicators of the modified model confirm that the model significantly improved after elimination of FULF3. These results confirm that the model has been significantly improved, the cross loading across constructs has been reduced, and the measurement model of exogenous factors presents goodness-of-fit. Figure 5.15 depicts the CFA of exogenous constructs.

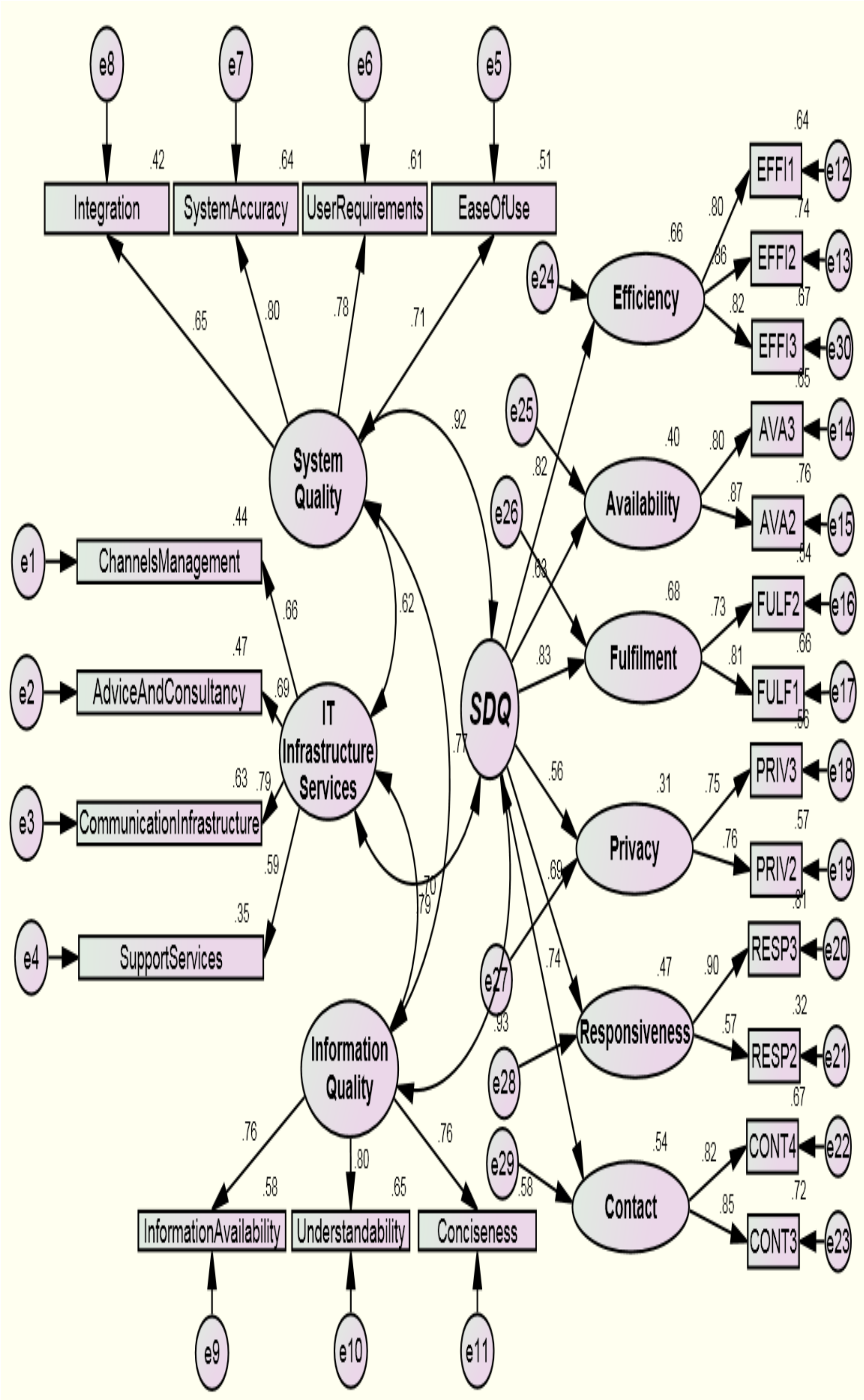


Figure 5.15 Results of CFA of exogenous constructs

As mentioned previously, perceived usefulness, user satisfaction, and customer value were considered as the endogenous factors, and confirmatory factor analysis is conducted with these constructs. Twelve observed variables were input to this procedure: perceived usefulness (4); user satisfaction (4); customer value (4). The results of the initial model were: CMIN/DF 7.611; GFI 0.917; AGFI 0.872; CFI 0.933; NNFI 0.913; RMR 0.048; SRMR 0.0623; RMSEA 0.096; PCLOSE 0.000. These results highlight that the model does not fit with the data and the problems should be identified to conduct the modification.

The key purpose of this stage, as mentioned before, is to identify the cross loading among the factors in the model and reduce it. The results of the modification indices indicate that item SATF5 '*I feel that the online courses serve my needs well*' has a high residual covariation with SATF1 '*I am satisfied with the performance of the e-learning system'*, and with the perceived usefulness construct. Theoretically, achievement of students' needs and their satisfaction about the system are associated with e-learning system performance. In this regard, Au et al. state that 'users will give high evaluation based not only on the inherent characteristics of a system, but also on the extent to which that system meets their tasks needs and their individual abilities' (2002, p. 457). Gorla (2003) confirmed that there is a positive relationship between system performance and perceived usefulness, therefore, performance can be used as an indicator of perceived usefulness. Based on these theoretical justifications, item SATF5 was eliminated from the user satisfaction construct, and the model fit indicators were: CMIN/DF 7.476; GFI 0.919; AGFI 0.870; CFI 0.930; NNFI 0.914; RMR 0.048; SRMR 0.0623; RMSEA 0.102; PCLOSE 0.000. The modification indices indicated that SATF3 '*If I had an opportunity to do another degree or course online, I would gladly do so*' has a high residual covariation with other observed variables and constructs. The values of residual covariation between item SATF3 and other items were SATF1 21.635, perceived usefulness construct 32.719, and customer value 27.557. SATF3 also has the lowest standardized regression weight (0.642) and the lowest squared multiple correlation (0.412) between the other two items in the user satisfaction construct. These indicators highlight that this item is problematic, and may affect the results and the quality of the proposed model. Therefore, this item was deleted as an observed variable to measure user satisfaction. The model fit indices after elimination of SATF3 were:

CMIN/DF 6.467; GFI 0.944; AGFI 0.904; CFI 0.960; NNFI 0.943; RMR 0.028; SRMR 0.0374; RMSEA 0.87; PCLOSE 0.000.

USEF5 '*Overall, I find the e-learning system useful to my study'* was employed to measure overall perceived usefulness. However, this item has a high residual covariation with item USEF2 '*Using the e-learning system improves my study performance'* and USEF3 '*Using the e-learning system in my study increases my productivity'*; the values being 17.583 and 8.286 respectively. The items of perceived usefulness were adopted from Davis (1989). This measurement is used widely in the information systems field, and many studies tested the validity and reliability of this instrument. Some of these studies highlighted items that can be used and items that should be eliminated. In this context, Doll et al. state that 'Among the six usefulness items, only two (U3 and U5) were recommended/used across all studies' (1998, p. 842).

U3 maps to item USFE3 in this study and item U5 maps to USEF4. Item USEF5, which represents the aspect of 'overall usefulness', was eliminated from the measurement of previous studies due to cross loading or low validity and reliability in measuring perceived usefulness. For that reason, USEF5 was removed from the measurement of perceived usefulness in this study because of the high residual covariation with other items. The model fit improved and indicators of fit were: CMIN/DF 3.451; GFI 0.975; AGFI 0.953; CFI 0.984; NNFI 0.976; RMR 0.020; SRMR 0.0278; RMSEA 0.58; PCLOSE 0.146.

Four items were input at this stage to measure the customer value construct. The outcome of this iteration indicated that CUSV3 '*The e-learning courses delivered by ULearn stimulated me to read further in my study area'* has a high residual covariation with two items from the customer value construct: CUSV4 '*People who are important to me think that taking my course through the e-learning system is a good thing to do'* and CUSV1 '*The e-learning courses delivered by ULearn strengthen my ability to analyse and evaluate information related to my study'*. People close to the students can influence them to adopt e-learning courses. This encouragement stimulates the student to use e-learning systems that increase the ability of a student to analysis and evaluate the information provided via e-learning systems. Hence, students can be motivated to read further and adopt the e-learning courses as a consequence of encouragement from their peers and family. Based on this theoretical justification and the statistical indicators, CUSV3 was eliminated from the customer value construct as it practically conveyed the same meaning as CUSV1. The model fit indicators were: CMIN/DF 2.553; GFI 0.985; AGFI 0.968 CFI 0.992; NNFI 0.987; RMR 0.020; SRMR 0.0263; RMSEA 0.46; PCLOSE 0.604. These indicators confirm that the model fit significantly improved. Figure 5.16 and Figure 5.17 depict the confirmatory factor analysis of endogenous constructs at the first and final iteration.

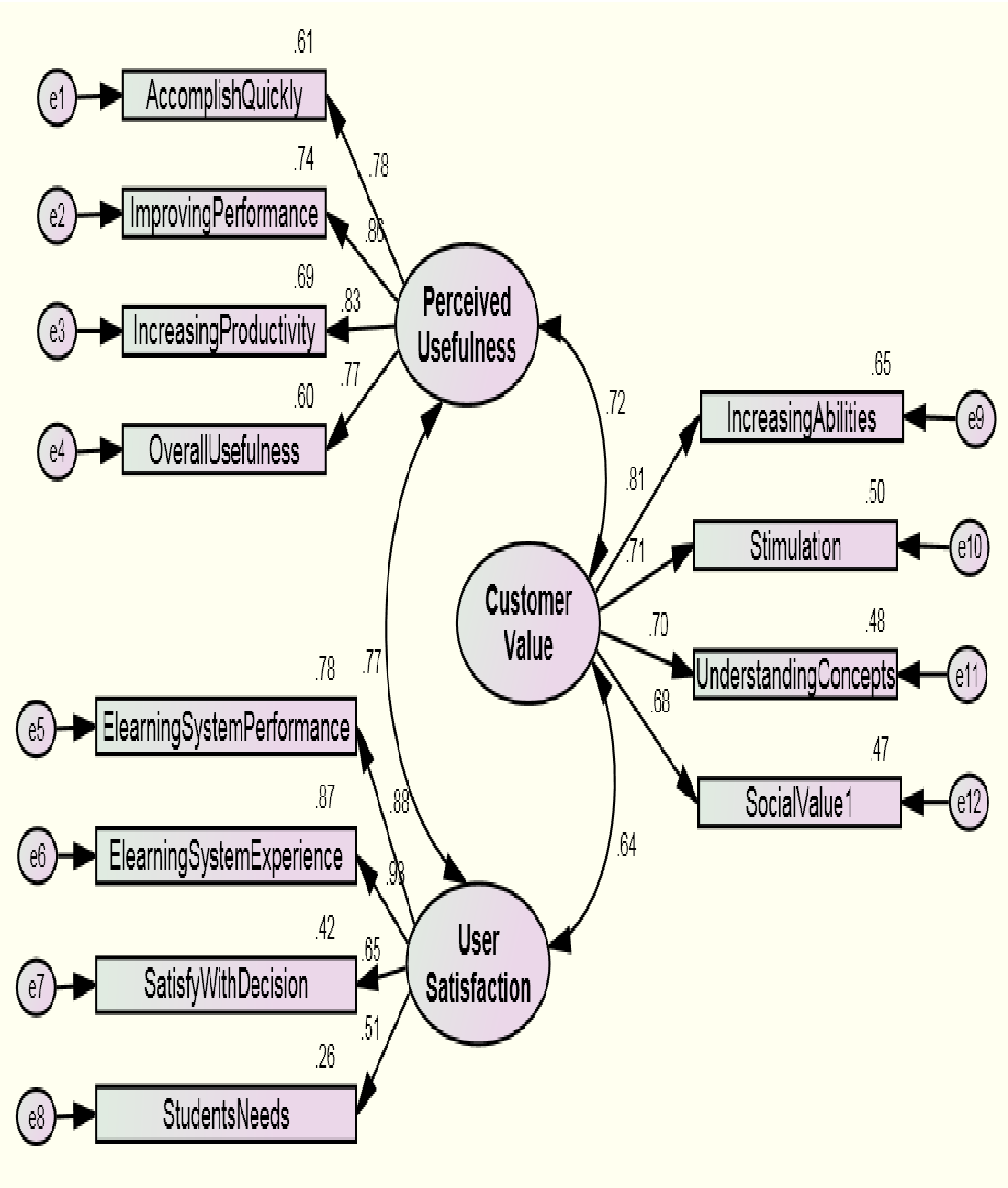


Figure 5.16 Results of CFA of endogenous constructs (Initial model)

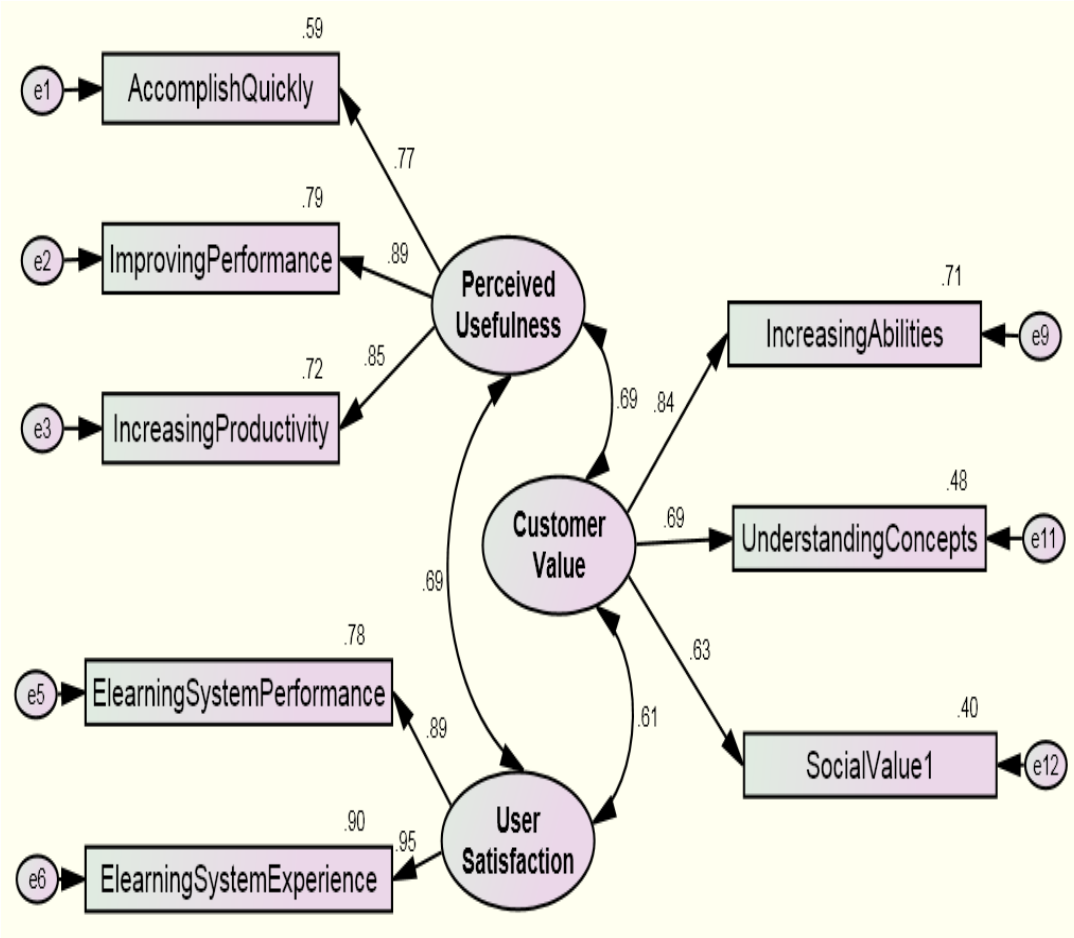


Figure 5.17 Results of CFA of endogenous constructs (Final iteration)

At this phase of analysis two types of confirmatory factor analysis were conducted: confimatory factor analysis of exogenous constructs and confimatory factor analysis of the endogenous construct. The key purpose of conducting this analysis is to eliminate the cross loading between the constructs and improve the model fit.

5.4.3. Stage three: Measurement model

SEM includes two main sub-models: the measurement model and the structural model (Byrne, 2010). Hair et al. define the measurement model as ‘Sub-model in SEM that (1) specifies the indicators for each construct, and (2) assesses the reliability of each construct for estimating the causal relationships’ (1998, p. 581). The latent variables cannot be measured directly because they are theoretical constructs, therefore, the observed or indicator variables should be identified (Zulu, 2007). By doing this, latent variables can be measured and the significance of each indicator in measuring this construct can be examined. The measurement model can be represented using Confirmatory Factor Analysis (CFA) by combining the two models of Exogenous and Endogenous in one model. The results of the measurement model were: CMIN/DF 2.878; GFI 0.903; AGFI 0.883; CFI 0.937; NNFI 0.929; RMR 0.029; SRMR 0.0401; RMSEA 0.051; PCLOSE 0.286. Figure 5.18 shows the results of performing the measurement model using confirmatory factor analysis.

The results of performing CFA to test the measurement model confirm that the model has a good fit. All the indicators exceeded the acceptable level, except AGFI, which was 0.883—close to the acceptable level is 0.90. The key reason behind the small gap between the AGFI of the measurement model and the cut off value is the complexity of the model. In this regard, Jais (2007) claims that GFI and AGFI can be affected by model complexity, and model complexity can contribute to reducing the value of those two indices. The measurement model in this study can be considered as a complex model because it includes seven constructs and 33 observed variables. In addition, service delivery quality contains six sub dimensions. Therefore, 0.85 was considered an acceptable level of AGFI (Jais, 2007).

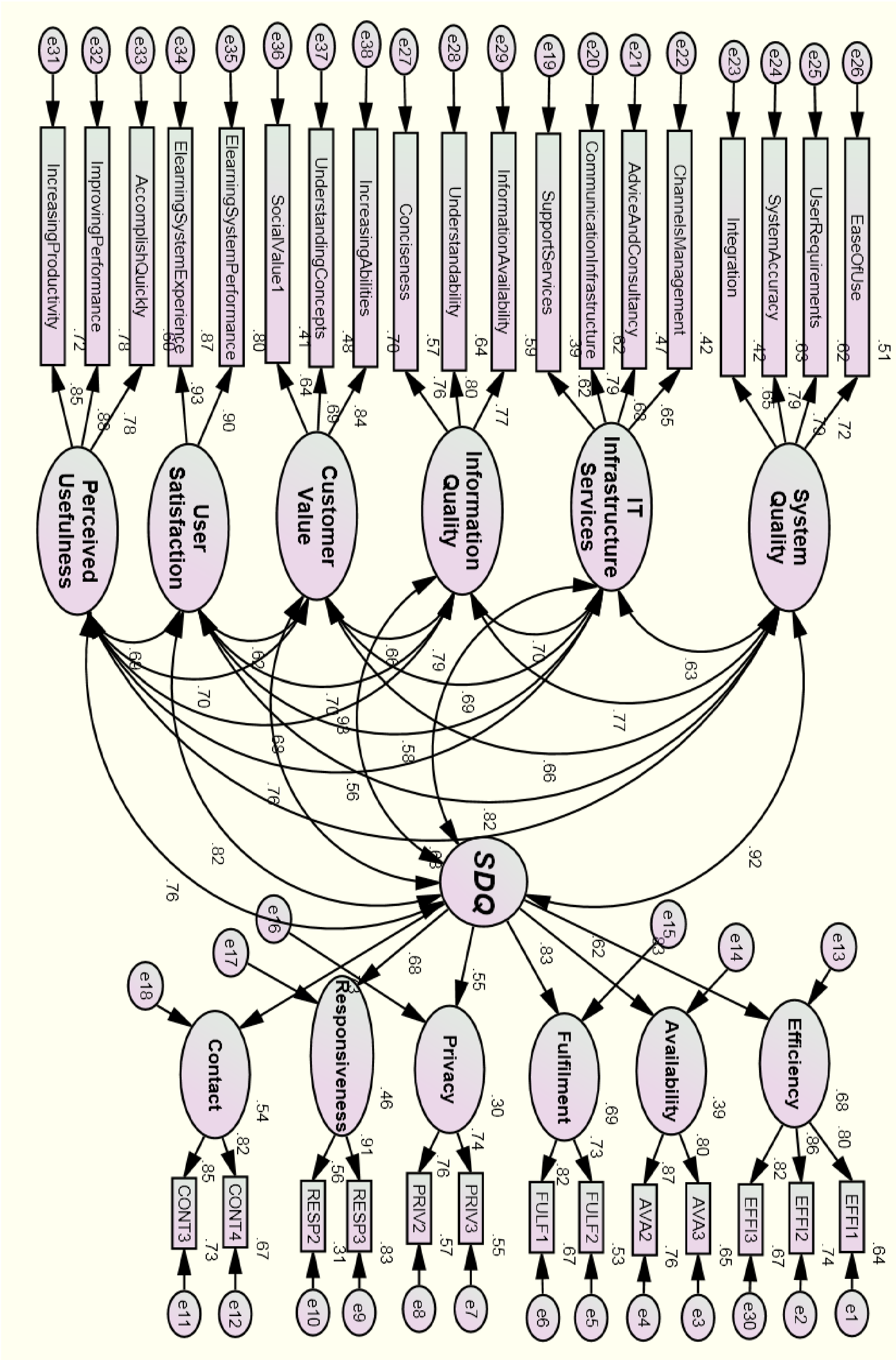


Figure 5.18 Measurement model of student sample

Based on these results, the measurement model does not need to be re-specified because it achieved a good fit. Stage one, one-factor congeneric measurement, and stage two, exogenous and endogenous factors first-order CFA, were useful in identifying the problems of each construct and items, and assisted in reducing the cross loading between the observed variables. As a result, these two stages positively influenced the quality of the measurement model and effectively improved it.

5.4.4. Stage Four: Testing the validity and reliability

Testing validity and reliability of measurement is an essential stage. The shortfalls in validity and reliability of the measurement instrument may lead to negative effects on the quality of data.

The outputs of testing the measurement model are employed as the input to assess the reliability and validity of the proposed model. Table 5.4 shows the results of performing CFA to test the measurement model.

Table 5.4 Results of CFA measurement model

Variables		Constructs	Estimate	S.E.	C.R.	P	SRW	SMC
Sub-Dimensions of Service Delivery Quality								
Efficiency	←	SDQ	1.305	.083	15.739	.001	.826	.682
Availability	←	SDQ	.881	.072	12.196	.001	.621	.386
Fulfillment	←	SDQ	1.108	.077	14.315	.001	.829	.686
Privacy	←	SDQ	.641	.063	10.157	.001	.547	.299
Responsiveness	←	SDQ	1.089	.074	14.636	.001	.680	.463
Contact	←	SDQ	1.000				.733	.538
Items of Service Delivery Quality								
EFFI1	←	Efficiency	1.000				.797	.635
EFFI2	←	Efficiency	1.021	.041	24.947	.001	.863	.744
EFFI3	←	Efficiency	1.017	.043	23.487	.001	.816	.666
AVA2	←	Availability	1.132	.065	17.498	.001	.874	.763
AVA3	←	Availability	1.000				.804	.646
FULF1	←	Fulfillment	.973	.053	18.318	.001	.816	.666
FULF2	←	Fulfillment	1.000				.728	.530
PRIV2	←	Privacy	1.133	.099	11.449	.001	.756	.572
PRIV3	←	Privacy	1.000				.745	.555
RESP2	←	Responsiveness	.700	.061	11.461	.001	.560	.314
RESP3	←	Responsiveness	1.000				.910	.828
CONT3	←	Contact	1.000				.853	.727
CONT4	←	Contact	.854	.042	20.496	.001	.818	.669
IT Infrastructure Services								
Channels Management	←	IT Infrastructure Services	1.000				.647	.419
Advice and Consultancy	←	IT Infrastructure Services	1.197	.080	14.932	.001	.684	.467
Communication Infrastructure	←	IT Infrastructure Services	1.294	.079	16.409	.001	.785	.616
Support Services	←	IT Infrastructure Services	.993	.072	13.865	.001	.622	.387

System Quality							
Ease of Use	←	System Quality	.976	.059	16.445	.001	.717	.515
User Requirements	←	System Quality	1.052	.060	17.657	.001	.785	.617
System Accuracy	←	System Quality	1.011	.057	17.807	.001	.794	.631
Integration	←	System Quality	1.000				.649	.421
Information Quality								
Information Availability	←	Information Quality	1.000				.765	.585
Understandability	←	Information Quality	.933	.043	21.522	.001	.802	.644
Conciseness	←	Information Quality	.972	.048	20.250	.001	.758	.574
Perceived Usefulness								
Accomplish Quickly	←	Perceived Usefulness	.874	.037	23.904	.001	.778	.605
Improve performance	←	Perceived Usefulness	1.051	.037	28.157	.001	.883	.779
Increasing Productivity	←	Perceived Usefulness	1.000				.846	.716
User Satisfaction								
E-learning System Performance	←	User Satisfaction	.958	.027	35.018	.001	.897	.805
E-learning System Experience	←	User Satisfaction	1.000				.934	.872
Customer Value								
Increasing Abilities	←	Customer Value	1.404	.077	18.224	.001	.839	.705
Understanding Concepts	←	Customer Value	1.000				.691	.478
SocialValue1	←	Customer Value	1.122	.075	14.988	.001	.638	.408

C.R Critical Ratio; SRW: Standardized Regression Weight; SMC: Squared Multiple Correlation

Five tests are used to assess the reliability of the model: Squared Multiple Correlation (SMC) ‘item reliability’; Cronbach's alpha; Coefficient H; Construct Reliability (composite reliability) (CR); Average variance extracted (AVE).

Squared Multiple Correlation (SMC) ‘item reliability’ is deemed to be a key indicator to measure the reliability of each item (observed variable). The recommended level of SMC is > 0.30 (Holmes-Smith, 2011). Table 5.4 shows the SMC for each item. Twenty eight items out of 38 exceeded 0.50, which represents 78 percent of all the items. Six items were between 0.408 and 0.478. Three items were less than 0.4: RESP2 (0.314); Support Service (0.387); and Availability (0.386). However, the SMC of privacy was 0.299 and it is very close to the acceptable level. This item will be used to measure the service delivery quality because it significantly (at p<0.001) represents the service delivery quality construct. The value of SMC highlighted that all the items used to measure the constructs of the model are reliable.

Cronbach's alpha is a useful test to assess the reliability of internal consistency. The cut off level of this indicator is 0.70. All the constructs in the model, with one exception, exceeded the acceptable level with values in the range between .912 and .877, as shown in Table 5.5. However, the Cronbach's alpha for responsiveness was .675, and it is less than the acceptable level. When the reliability of this sub-dimension was tested with Coefficient H, Construct Reliability (composite reliability), and Average Variance Extracted (AVE) it exceeded the acceptable level in these tests. In addition, indicators of Squared Multiple Correlation and Factor loading highlighted the ability of this sub-dimension (responsiveness) to measure the SDQ. Furthermore, the standardized regression weight values of two items of responsiveness were more than 0.5, 0.560 and 0.910, and both were significant.

Coefficient H, as proposed by Hancock and Mueller (2001), is used to measure construct reliability. The recommended level of Coefficient H is 0.70. The results of calculating Coefficient H were between 0.721 and 0.916, and these values confirm that the constructs achieved a good level of reliability.

Average Variance Extracted was also used to test the reliability of constructs. All the constructs and sub-dimensions of SDQ, except IT infrastructure services, exceeded the acceptable level of 0.50. The value of Average Variance Extracted for IT infrastructure services was 0.472, which is very close to the acceptable level of 0.50. This value was a result of the relativity low values of squared multiple correlation. The other test of reliability, Cronbach's alpha, Coefficient H, and construct reliability support the reliability of IT infrastructure services construct.

Table 5.5 Reliability indicators

Construct	Cronbach's alpha	Coefficient H	Construct Reliability	AVE
IT infrastructure Services	.778	.793	.780	.472
System Quality	.825	.836	.827	.546
Information Quality	.819	.820	.819	.601
SDQ	.877	.881	.859	.639
Efficiency	.865	.869	.780	.681
Availability	.825	.835	.826	.704
Fulfilment	.745	.757	.748	.598
Privacy	.720	.721	.727	.563
Responsiveness	.675	.841	.718	.571
Contact	.822	.824	.822	.698
Perceived Usefulness	.874	.884	.875	.700
User Satisfaction	.912	.916	.912	.838
Customer Value	.764	.799	.769	.530

Validity of measurement was tested using different statistical indicators. The convergent validity focuses on testing relationships between the construct and the observed variables. According to this type of validity, the factor loading of each item should be statistically significant and the value of the factor loading should be above 0.50. The values of factor loading for the items used in this study were between 0.560 and 0.934, confirming the validity of the constructs. In addition, the critical ratio of these indicators was more than 1.96 and indicates that all the regressions are significant. Construct validity is employed to test the validity of indicators to measure their constructs. The indices of goodness-of-fit measures point to construct validity.

Table 5.6 shows the results of conducting the one-factor congeneric measurement model. The seven constructs in this study have achieved a good fit and the indices provide evidence of the validity of those constructs.

Table 5.6 Results of the one-factor congeneric measurement model

Constructs	**Model Fit Indices**								
	CMIN /DF	GFI	AGFI	CFI	NNFI	RMR	SRMR	RMSEA	PCLOSE
IT Infrastructure Services	1.628	.998	.989	.998	.995	.007	.0124	.030	.647
System Quality	2.262	.997	.984	.998	.993	.011	.0128	.042	.512
Information Quality	1.034	.999	.993	1.00	1.00	.006	.0087	.007	.784
SDQ	1.896	.977	.961	.987	.981	.018	.0236	.035	.995
Perceived Usefulness	1.412	.999	.990	.999	.998	.0042	.0042	.024	.556
User Satisfaction	2.734	.998	.981	.999	.992	.006	.0075	.049	.379
Customer Value	2.432	.997	.971	.997	.98	.007	.0105	.059	.237

The key method to measure discriminant validity depends on the rule of thumb that the square root of average variance extracted of each construct should be more than its correlation with other constructs (Chin, 1998; Guo et al., 2011; Liang, Saraf, Hu, & Xue, 2007). Table 5.7 shows the results of conducting this method and it achieved a satisfactory level of discriminant validity.

Table 5.7 Analysis of discriminant validity

Constructs	IT Infrastructure Services	System Quality	Information Quality	SDQ	Perceived Usefulness	User Satisfaction	Customer Value
IT Infrastructure Services	**.687**						
System Quality	.625	**.738**					
Information Quality	.700	.770	**.775**				
SDQ	.793	. 917	.933	**.799**			
Perceived Usefulness	.564	.680	.682	.759	**.837**		
User Satisfaction	.577	.818	.702	.816	.695	**.915**	
Customer Value	.683	.661	.665	.756	.697	.617	**.728**

Stage four of analysis of the student sample data focused on testing the reliability and validity of measurement used in this study. Five tests were used to assess the reliability: Squared Multiple Correlation (SMC) ‘item reliability’; Cronbach's alpha; Coefficient H; Construct Reliability (composite reliability) (CR); Average Variance Extracted (AVE). The results of these tests confirm the reliability of the instrument used in this study.

Three types of validity were employed to examine the measurement: convergent validity; construct validity; and discriminant validity. The findings of these types of validity test indicate that the measurement is valid to measure the constructs of e-learning system success.

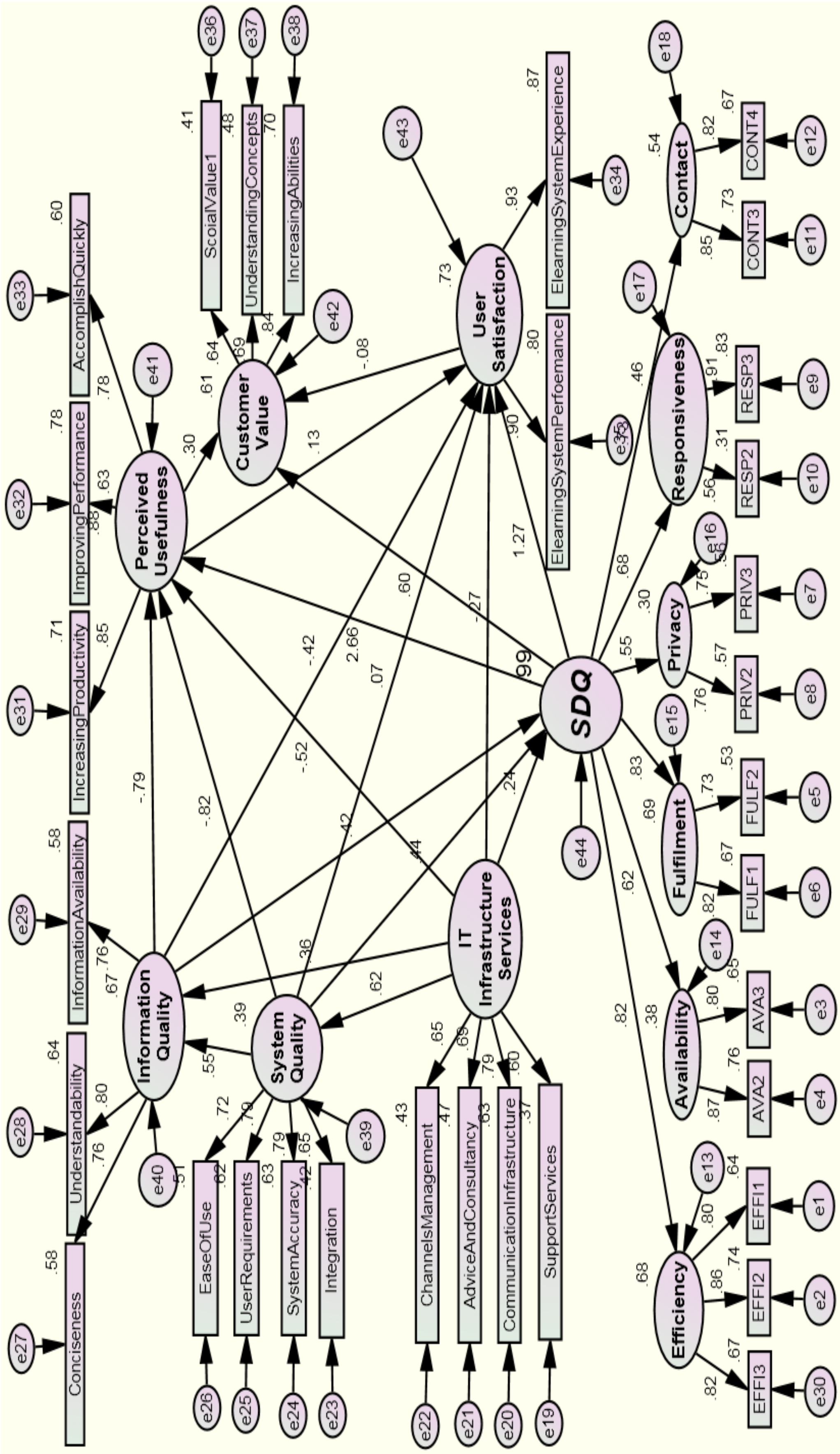
5.4.5. Testing the study model and hypotheses

The proposed model was designed to achieve the critical objective of measuring the success of e-learning systems. Seven constructs were selected to test the success of an e-learning system from the students’ point of view. The model can be considered complex because it includes seven constructs, 32 observed variables, and there are different paths among the constructs. The relationships between constructs are not limited to the direct effects, but also include the mediation role of some constructs.

5.4.5.1. Testing the initial model

The emphasis of the first test is on the initial model. The relationships between the model construct is examined and the model fit indices are provided. Figure 5.19 depicts the result of testing the study model.

Figure 5.19 Test of the study model for Student Sample



The model fit indicators of testing those seven constructs in one model were: CMIN/DF 2.901; GFI 0.902; AGFI 0.882; CFI 0.936; NNFI 0.928; RMR 0.030; SRMR 0.0411; RMSEA 0.051; PCLOSE 0.235. These results highlighted that the model achieved a good fit. However, AGFI, 0.883, is less than the acceptable level, 0.90. This result of AGFI appeared to be due to the complexity of the model because AGFI is sensitive to complexity (Jais, 2007). Table 5.8 shows the results of testing the paths among the construct in the model.

Table 5.8 Results of regression analysis of the model

Endogenous factor		Exogenous factor	Estimate	S.E.	C.R.	P
System Quality	←	IT Infrastructure Services	.865	.077	11.176	.001
Information Quality	←	IT Infrastructure Services	.504	.072	6.948	.001
SDQ	←	IT Infrastructure Services	.257	.043	5.955	.001
Perceived Usefulness	←	IT Infrastructure Services	-.859	1.156	-.743	.457
User Satisfaction	←	IT Infrastructure Services	-.476	.762	-.624	.532
Information Quality	←	System Quality	.557	.056	9.967	.001
SDQ	←	System Quality	.337	.040	8.499	.001
Perceived Usefulness	←	System Quality	-.967	.1.512	-.743	.457
User Satisfaction	←	System Quality	.084	.966	.087	.931
SDQ	←	Information Quality	.316	.042	7.576	.001
Perceived Usefulness	←	Information Quality	-.925	1.425	-.649	.516
User Satisfaction	←	Information Quality	-.523	.922	-.567	.571
Perceived Usefulness	←	SDQ	4.117	4.455	.924	.355
User Satisfaction	←	SDQ	2.090	3.058	.683	.494
Customer Value	←	SDQ	.585	.080	7.297	.001
User Satisfaction	←	Perceived Usefulness	.134	.167	.804	.421
Customer Value	←	Perceived Usefulness	.191	.038	4.998	.001
Customer Value	←	User Satisfaction	-.048	.040	-1.215	.224

The results of regression tests confirmed the essential role of IT infrastructure services in achieving quality of e-learning system, information quality, and service delivery quality. IT infrastructure services significantly impacted the system quality, and the standardised regression coefficient (β) is 0.865 with critical ratio (t-value) 11.176 at significance level 0.001. Information quality affected by IT infrastructure services and the standardised regression coefficient is 0.504 with critical ratio 6.948 at significance level 0.001. IT infrastructure significantly impacted service delivery quality of e-learning system (β 0.257, t-value 5.955, $p<0.001$).

The quality of e-learning system, as an exogenous factor, significantly influenced information quality of e-learning system as an endogenous factor (β 0.557, t-value 9.967, $p<0.001$). The result of analysing the effect path from information quality to service delivery quality confirmed the significant impact of information quality on service delivery quality (β 0.316, t-value 7.576, $p<0.001$). Based on these results, IT infrastructure services, system quality, and information quality can be considered the main determinates of e-learning system service delivery quality. In other words, quality of e-learning system service delivered to students depends on the number and range of IT infrastructure services and the quality aspects of the system and information.

According to the study model, four constructs were hypothesized as determinants of perceived usefulness: IT infrastructure services; system quality; information quality; and service delivery quality. The direct effects of these four constructs on perceived usefulness were non-significant: IT infrastructure service (β -0.859, t-value -0.743, $p<0.457$); (system quality β -0.967, t-value -0.967, $p<0.457$); (information quality β -0.925, t-value -0.649, $p<0.516$); (service delivery quality β 4.117, t-value 0.924, $p<0.355$).

These results were the outcome of testing the whole model without consideration of the mediation role of service delivery quality. Thus, the next stages is allocated to test the mediation hypotheses and to obtain the final model.

5.4.5.2. Testing the mediation of SDQ on perceived usefulness

This study adopted the mediation to assess the relationships between the model constructs. This technique is frequently by researchers in social sciences (Baron & Kenny, 1986).

According to Baron and Kenny (1986), there are four conditions necessary to test the mediation: (1) the predictor factor must significantly affect the dependent factor; (2) the predictor factor must significantly affect the mediator factor; (3) mediator factor must significantly affect the dependent factor; and (4) the predictor factor must have no significant effect on the dependent factor when the mediator variable is controlled (full mediation) or the effect should significantly reduce (partial mediation).

To test the mediation, Hair et al. (2010) suggested two steps.

The first is step is testing the necessary individual relationships between the constructs which must be significant (conditions 1 to 3 in Baron & Kenny (1986)). According to these conditions:

- IT infrastructure services, system quality, and information quality must significantly affect perceived usefulness.
- IT infrastructure services, system quality, and information quality must significantly affect service delivery quality.
- Service delivery quality must significantly affect perceived usefulness.

The relationships between the predictor factors, mediator factor and dependent factor were examined and the results indicated that the first three conditions of testing the mediation were achieved. The results of testing the effect of IT infrastructure services, system quality, and information quality (predictor variables) on perceived usefulness (dependent factor) were significant: (β 1.180, t-value 13.440, $p<0.001$) (β 0.870, t-value 14.800, $p<0.001$) (β 0.865, t-value 16.873, $p<0.001$) respectively (first condition). IT infrastructure services, system quality, and information quality significantly impacted service delivery quality (mediator variable): (β 1.301, t-value 13.078, $p<0.001$) (β 0.778, t-value 14.444, $p<0.001$) (β 0.804, t-value 16.416, $p<0.001$) respectively (second condition). The effect of service delivery quality on perceived usefulness (the third condition) was significant based on the regression results (β 1.178, t-value 14.294, $p<0.001$).

These results supported the three conditions of the mediation. Perceived usefulness was significantly affected by the predictor constructs: IT infrastructure services; system quality; and information quality (first condition). The predictor constructs also significantly impacted service delivery quality (dependent factor), and these significant effects supported the second condition. The third condition was achieved via the significant effect of service delivery quality (mediator factor) on perceived usefulness.

The second step includes two sub steps. These are: (1) establishing an initial model with only the direct effect between the predictor factor and the dependent factor; (2) estimating a second model which includes the mediating variable, the effect of the predictor factor on the mediator, and the effect of the mediator on the dependent variable. After testing those two models a comparison was made of relationships between the two models to identify the type of mediation. The conditions to identify the type of mediation are shown in Table 5.9.

Table 5.9 Conditions to identify the type of mediation

Conditions: If the relationship between predictor variable and dependent variable after the mediation variable is added to the model as an additional predictor:	**Mediation Outcome**
Significant and unchanged	No Mediation
Reduced but remains significant	Partial Mediation
Reduces to a point where it is not statistically significant	Full Mediation

To conduct sub-step (1), the initial model with only the direct effect between the predictor factors and the dependent factor was estimated. The findings of the test show that the effects of IT infrastructure services on perceived usefulness are significant at $p< 0.05$. Also, system quality and information quality significantly affected perceived usefulness at $p< 0.001$ as shown in Table 5.10.

Table 5.10 Results of regression analysis of the initial model without mediation paths (Perceived Usefulness)

Endogenous factor		Exogenous factor	Estimate	S.E.	C.R.	p
System Quality	←	IT Infrastructure Services	.860	.078	11.091	.001
Information Quality	←	System Quality	.559	.056	9.905	.001
Information Quality	←	IT Infrastructure Services	.504	.073	6.944	.001
Perceived Usefulness	←	Information Quality	.376	.086	4.379	.001
Perceived Usefulness	←	System Quality	.425	.078	5.412	.001
Perceived Usefulness	←	IT Infrastructure Services	.213	.091	2.334	.020
User Satisfaction	←	SDQ	.440	.051	8.609	.001
User Satisfaction	←	Information Quality	-.025	.077	-.320	.749
User Satisfaction	←	System Quality	.639	.077	8.279	.001
User Satisfaction	←	Perceived Usefulness	.228	.046	4.930	.001
User Satisfaction	←	IT Infrastructure Services	-.042	.080	-.531	.595
Customer Value	←	SDQ	.419	.049	8.585	.001
Customer Value	←	User Satisfaction	.017	.034	.493	.622
Customer Value	←	Perceived Usefulness	.273	.033	8.234	.001

The model fit indicators were: CMIN/DF 5.901; GFI 0.868; AGFI 0.842; CFI 0.857; NNFI 0.841; RMR 0.185; SRMR 0.241; RMSEA 0.076; PCLOSE 0.000.

Sub-step (2) involved estimating the model with the mediating variable (service delivery quality), the effect of predictor factors (IT infrastructure services, system quality, and information quality) on the mediator, and the effect of the mediator on the dependent variable (perceived usefulness). This model was already tested in this study at the earlier stage in the study (see section 5.4.5; Figure 5.19; and Table 5.8).

The results of sub-step (2) highlighted that significant changes occurred in the relationships between the constructs. Table 5.11 depicts the changes that occurred due to the addition of the mediator variable (service delivery quality), and paths of the effects of IT infrastructure services, system quality, and information quality on perceived usefulness, and the path of the effect of service delivery quality on perceived usefulness.

Table 5.11 Comparison between the initial model without mediation and initial model with mediation for students' sample (Perceived Usefulness)

Relationships			Initial model without mediation		Initial model with mediation	
			C.R	**p**	**C.R**	**p**
Perceived Usefulness	←	IT Infrastructure Services	2.334	.020	-.743	.457
Perceived Usefulness	←	System Quality	5.412	.001	-.639	.523
Perceived Usefulness	←	Information Quality	4.379	.001	-.649	.516
SDQ	←	IT Infrastructure Services	-	-	5.955	.001
SDQ	←	System Quality	-	-	8.499	.001
SDQ	←	Information Quality	-	-	7.576	.001
Perceived Usefulness	←	SDQ	-	-	.924	.355

After testing the two models, a comparison of relationships was made between the initial model without mediation and the model with mediation to identify the type of mediation following the mediation rule. If the relationship between the predictor variable and the dependent variable reduces to a point where it is not statistically significant after the mediation variable is added to the model as an additional predictor, then full mediation is supported (Hair 2010).

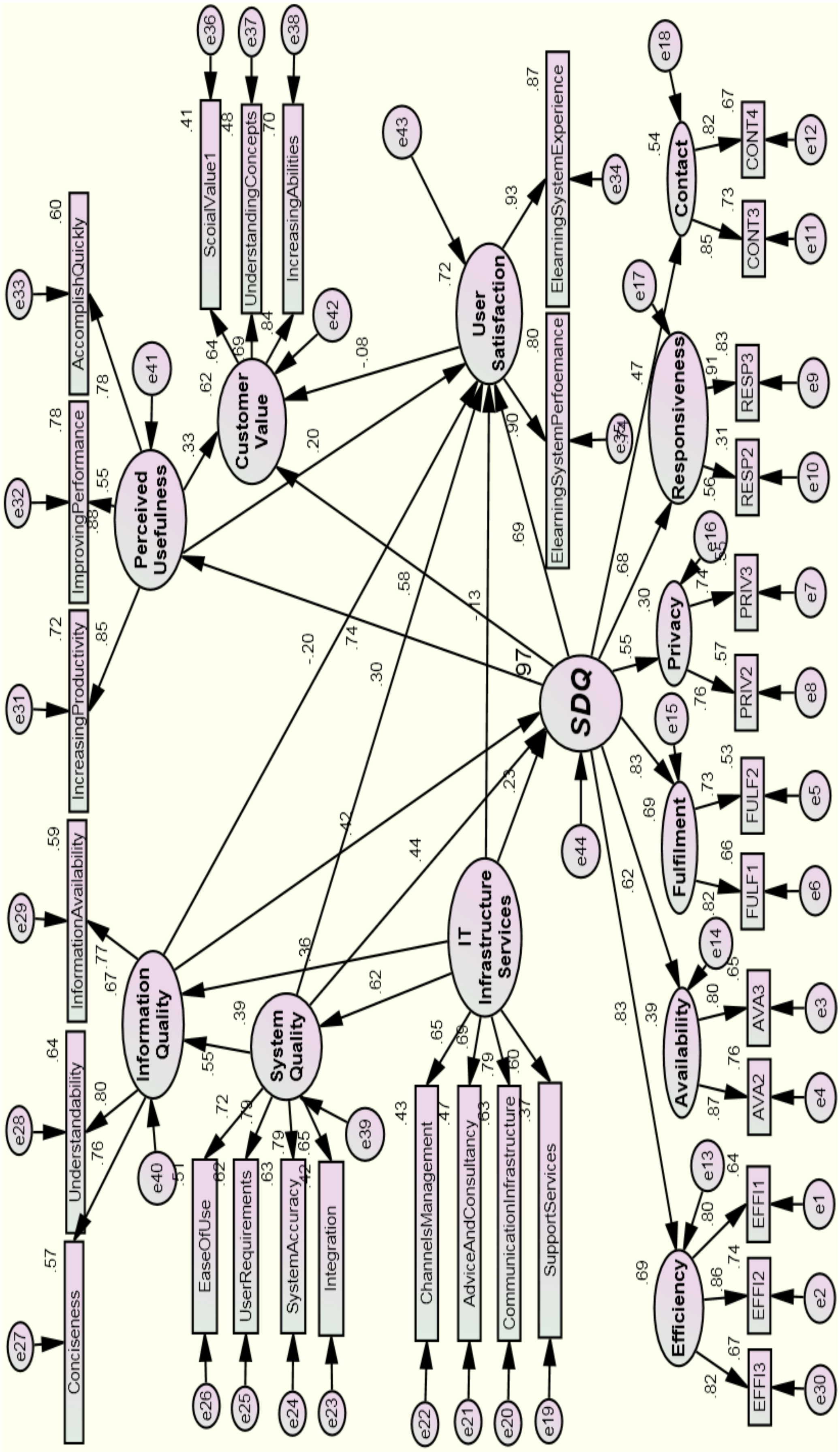
The findings show that the relationships between the predictor variables and the dependent variable were significant in the initial model with only direct effect between the predictor factors and the dependent factor. These relationships became non-significant once the mediating factor was added—denoting it was a fully mediated model. The effect of IT infrastructure, system quality, and information quality on perceived usefulness was statistically significant in the initial model without the mediation variable. The same relationships became statistically non-significant after linking the predictor variables with the mediator variable and linking the mediator variable with the dependent variable. The results in Table 5.11 indicate that the relationship between the predictor variables (IT infrastructure services, system quality, and information quality) and the dependent factor (perceived usefulness) was fully mediated by service delivery quality. Consequently, these findings tend to support the full meditation model.

Figure 5.20 shows the study model after confirming that the relationship between IT infrastructure services, system quality, and information quality is fully mediated by service delivery quality. Table 5.12 depicts the results of regression analysis between the constructs.

Table 5.12 Study model with mediation role of SDQ between predictor factors and perceived usefulness for student sample

Endogenous factor		Exogenous factor	Estimate	S.E.	C.R.	P
System Quality	←	IT Infrastructure Services	.866	.077	11.176	.001
Information Quality	←	System Quality	.558	.056	9.968	.001
Information Quality	←	IT Infrastructure Services	.504	.073	6.947	.001
SDQ	←	IT Infrastructure Services	.242	.041	5.830	.001
SDQ	←	System Quality	.340	.039	8.768	.001
SDQ	←	Information Quality	.319	.041	7.845	.001
Perceived Usefulness	←	SDQ	1.148	.076	15.155	.001
User Satisfaction	←	SDQ	1.129	1.024	1.102	.271
User Satisfaction	←	Information Quality	-.250	.336	-.745	.456
User Satisfaction	←	System Quality	.374	.350	1.068	.286
User Satisfaction	←	Perceived Usefulness	.210	.049	4.319	.001
User Satisfaction	←	IT Infrastructure Services	-.231	.256	-.902	.367
Customer Value	←	SDQ	.566	.078	7.270	.001
Customer Value	←	User Satisfaction	-.047	.039	-1.189	.234
Customer Value	←	Perceived Usefulness	.206	.037	5.630	.001

Figure 5.20 Testing study model with mediation role of SDQ between predictor factor and perceived usefulness



5.4.5.3. Testing the mediation of SDQ on user satisfaction

Five factors were hypothesised as determinates of user satisfaction: IT infrastructure services; system quality; information quality; service delivery quality; and perceived usefulness. The results of regression testing, as shown in Table 5.12, indicate that only perceived usefulness significantly affected user satisfaction (β 0.210, t-value 4.319, p<0.001), and the results of the remaining factors were IT infrastructure services (β -0.231, t-value -0.902, p<0.367), system quality β (0.374, t-value 1.068, p<0.286), information quality (β -0.250, t-value -0.745, P 0.286), and service delivery quality (β 1.129, t-value 1.102, P 0.271).

The study hypothesised that the effect of IT infrastructure service, system quality, and information quality on user satisfaction is mediated by service delivery quality.

The two steps proposed by Hair et al. (2010) to test the service delivery quality as mediator between the predictor factors and perceived usefulness as the dependent factor were employed to test the effect of IT infrastructure services, system quality, and information quality on user satisfaction mediated by service delivery quality.

The first step is to test the three conditions of the mediation. These conditions focus on the significant relationship between the constructs. The results are shown in Table 5.13.

Table 5.13 Results of testing mediation role of SDQ between the predictor factors and user satisfaction

	Estimate	C.R	P	Conditions
IT Infrastructure Services → User Satisfaction	.571	.6.819	.001	First condition
System Quality → User Satisfaction	.841	13.089	.001	
Information Quality → User Satisfaction	.726	11.557	.001	
IT Infrastructure Services →SDQ	1.325	12.981	.001	Second condition
System Quality →SDQ	.748	14.555	.001	
Information Quality →SDQ	.807	16.591	.001	
SDQ → User Satisfaction	1.143	10.560	.001	Third condition

The results of testing the effect of IT infrastructure services, system quality, and information quality as predictor variables on user satisfaction (dependent factor) were significant. These results confirmed the first condition. IT infrastructure services, system quality, and information quality significantly impacted service delivery quality (mediator variable). These significant impacts achieved the second condition of the mediation. The effect of service delivery quality on user satisfaction (the third condition) was significant based on the regression result (β 1.143, t-value 10.560, p<0.001).

Sub-step (1) focuses on estimating the initial model with only the direct effects between the predictor factors and the dependent factor. The findings of the test show that the effect of system quality on user satisfaction is significant (β 0.712, t-value 9.355, p<0.001). However, the effects of IT infrastructure services and information quality on user satisfaction were non-significant, according to the results of regression analysis were (β 0.027, t-value 0.838, P 0.735), (β 0.062, t-value 0.817, P 0.414) respectively.

According to Hair et al. (2010), the second step includes two sub-steps: establishing an initial model with only the direct effect between the predictor factor and the dependent factor; and estimating a second model which includes the mediating variable, the effect of the predictor factor on the mediator, and the effect of the mediator on the dependent variable.

Sub-step (2), the mediating variable (service delivery quality), the effect of predictor factors (IT infrastructure services, system quality, and information quality) on the mediator, and the effect of the mediator on the dependent variable (user satisfaction), was already tested as shown in Figure 5.20 and Table 5.12.

After testing the two models, a comparison of relationships was made between them to identify the type of mediation, as shown in Table 5.14.

Table 5.14 Comparison between the initial model without mediation and initial model with mediation for students' sample (User Satisfaction)

Relationships			Initial model without mediation		Initial model with mediation	
			C.R	P	C.R	P
User Satisfaction	←	IT Infrastructure Services	.338	.735	-.902	.367
User Satisfaction	←	System Quality	14.426	.001	1.068	.286
User Satisfaction	←	Information Quality	.817	.414	-.250	.456
SDQ	←	IT Infrastructure Services	-	-	5.830	.001
SDQ	←	System Quality	-	-	8.768	.001
SDQ	←	Information Quality	-	-	7.845	.001
User Satisfaction	←	SDQ	-	-	1.102	.271

The above results confirm that IT infrastructure services and information quality have no significant effect on user satisfaction. Accordingly, the hypotheses of the mediation role, partial or full, of SDQ between the IT infrastructure services and information quality with user satisfaction are not supported.

In regard to system quality, the following mediation rule is met for this construct. If the relationship between the predictor variable and dependent variable reduces to a point where it is not statistically significant after the mediation variable is added to the model as an additional predictor, then full mediation is supported. The findings (see Table 5.12) show that the relationship between system quality and user satisfaction was significant in the initial model with only the direct effect between the predictor factors and the dependent factor. This relationship became non-significant once the mediating factor was added—which means it was a fully mediated model.

5.4.5.4. Test of the final model

Mediation is not supported in regard to the relationship between IT infrastructure services, information quality, and service delivery quality with user satisfaction. On the other hand, service delivery quality played a full mediation factor between system quality of e-learning systems and user satisfaction. Figure 5.21 shows the final model after considering the above findings. The model achieved a good fit, and the results were: CMIN/DF 2.883; GFI 0.902; AGFI 0.883; CFI 0.936; NNFI 0.928; RMR 0.030; SRMR 0.0411; RMSEA 0.051; PCLOSE 0.272. Table 5.15 depicts the results of regression analysis between the constructs of the model, strength of path coefficient, and power of R^2.

Table 5.15 Results of regression analysis of the final model

Exogenous factor		Endogenous factor	R^2	R^2 Power	Estimate	Strength	C.R.	P
IT Infrastructure Services	→	System Quality	.388	Moderate	.866	Strong	11.170	.001
System Quality	→	Information Quality	.670	Substantial	.557	Strong	9.960	.001
IT Infrastructure Services	→	Information Quality			.505	Strong	6.956	.001
Information Quality	→	SDQ	.983	Substantial	.320	Moderate	7.971	.001
System Quality	→	SDQ			.341	Moderate	8.856	.001
IT Infrastructure Services	→	SDQ			.242	Moderate	5.892	.001
SDQ	→	Perceived Usefulness	.549	Moderate	1.148	Strong	15.127	.001
Information Quality	→	User Satisfaction	.734	Substantial	-.594	Strong	-3.611	.001
Perceived Usefulness	→	User Satisfaction			.201	Moderate	4.237	.001
IT Infrastructure Services	→	User Satisfaction			-.491	Moderate	-3.865	.001
SDQ	→	User Satisfaction			2.218	Strong	7.989	.001
SDQ	→	Customer Value	.614	Moderate	.569	Strong	7.265	.001
Perceived Usefulness	→	Customer Value			.209	Moderate	5.780	.001
User Satisfaction	→	Customer Value			-.052	Weak	-1.313	.189

Three levels of cut-off were adopted to assess the strength of path coefficient: 0.2 weak; between 0.2 and 0.5 moderate; and more than 0.5 strong (Cohen, 1988; Sridharan et al., 2010). Fourteen relationships were examined between the constructs of the final study model of students' sample. One relationship was weak, six were moderate, and seven were strong.

Regarding measuring the power of R^2, three levels were suggested: 0.670 substantial; 0.333 moderate; and 0.190 weak (Chin, 1998; Urbach & Ahlemann, 2010). IT infrastructure service moderately explained 38.8 percent of the variance in the system quality of e-learning systems based on the students' perceptions. Substantial percent (67 percent) of the variance in information quality was explained by two constructs: IT infrastructure services and system quality. IT infrastructure services, system quality, and information quality explained a substantial variance (98.3 percent) in service delivery quality. This considerable percent indicates the role of these constructs in supporting and enhancing the service delivery quality of e-learning systems. Service delivery quality explained 54.9 percent of the variance in perceived usefulness of e-learning systems that can be considered moderate. The variance in user satisfaction was 73.4 percent and was explained by four constructs: IT Infrastructure services; information quality; perceived usefulness; and service delivery quality. Customer value was affected by three constructs, service delivery quality, perceived usefulness, and user satisfaction that explained 61.4 percent of the variance.

To summarise, all the relationship effects among the constructs of study model, except one, ranged between moderate and strong. The power of R^2 of exogenous factors to explain the variance in endogenous factors ranged between moderate and substantial. These indicators confirmed the effective selection of model constructs and sound assumptions about the relationships among these constructs.

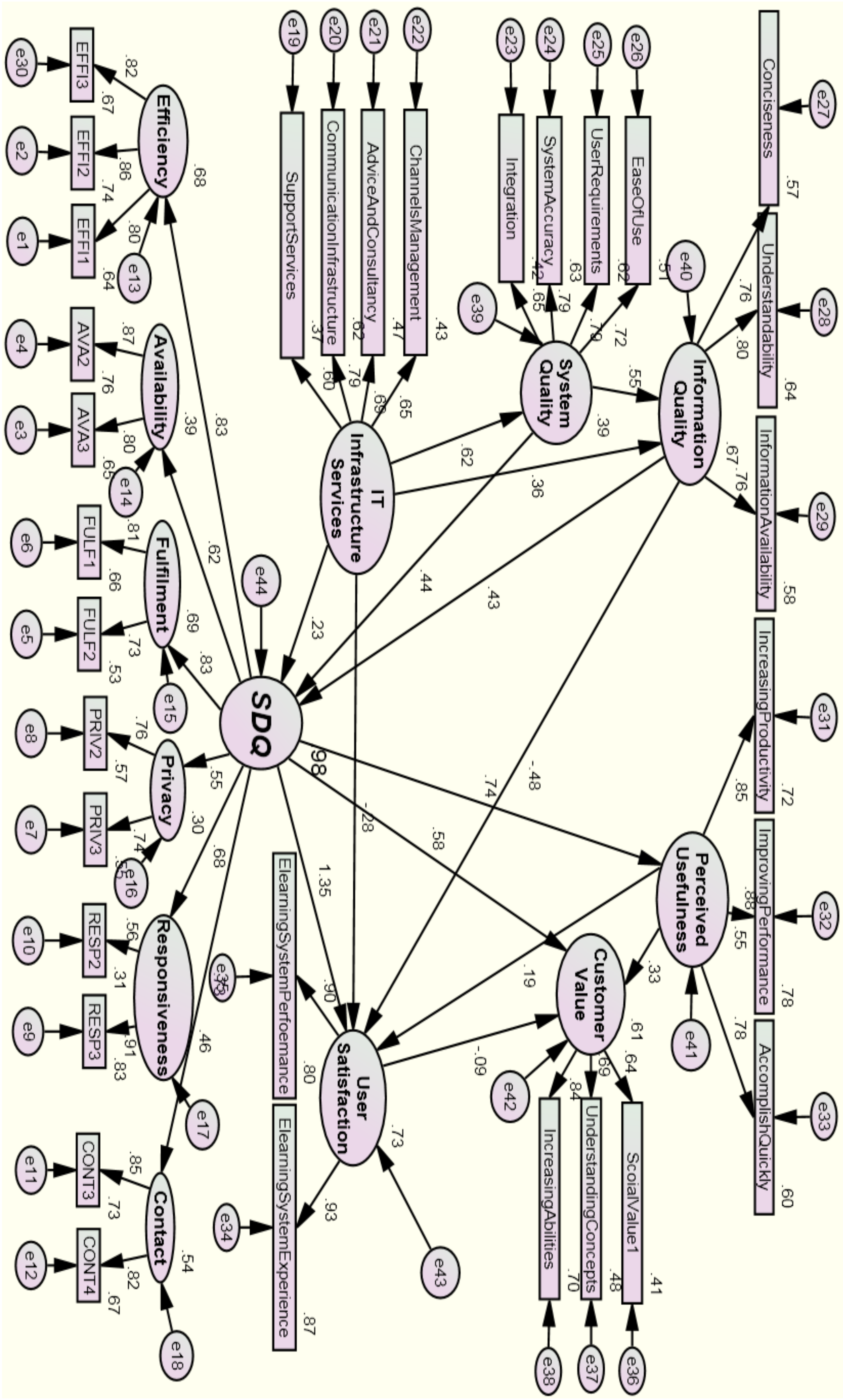


Figure 5.21 Testing the final model

5.5. Outcomes of hypotheses tests

This section describes the testing of the study model with the student sample. The reliability and validity of the model was examined and confirmed. The model achieved a good fit and all the indicators were accepted. IT infrastructure services significantly and directly affected system quality, information quality, and service delivery quality, and the regression results were (β 0.866, t-value 11.170, P 0.001), (β 0.505, t-value 6.659, P 0.001), and (β 0.242, t-value 5.892, P 0.001) respectively. These results supported three hypotheses: (H1) '*IT Infrastructure Services significantly and directly affect System Quality'*; (H2) '*IT Infrastructure Services significantly and directly affect Information Quality'* and (H3) '*IT Infrastructure Services significantly and directly affect Service Delivery Quality'*. Furthermore, IT infrastructure services significantly influenced perceived usefulness (β 0.211, t-value 2.334, P 0.020). This result was obtained from testing the mediation role of service delivery quality between IT infrastructure services and perceived usefulness. Thus, hypothesis (H4) '*IT Infrastructure Services significantly and directly affect Perceived Usefulness'* is accepted. The hypothesis (H5) '*IT Infrastructure Services significantly and directly affect User Satisfaction'* is rejected because the impact of IT infrastructure services on user satisfaction was significantly negative (β -0.491, t-value -3.865, P 0.001).

Based on the study model, system quality significantly influences four endogenous factors: information quality; service delivery quality; perceived usefulness; and user satisfaction. System quality directly and significantly impacted information quality and service delivery quality and the regression results were (β 0.557, t-value 9.960, P 0.001) and (β .341, t-value 8.856, P 0.001) respectively. These findings lead to accepting two hypotheses: (H6) '*System Quality significantly and directly affects Information Quality*' and (H7) '*System Quality significantly and directly affects Service Delivery Quality'*. The direct influence of system quality on perceived usefulness and user satisfaction was examined in the context of procedures to test the mediation role of service delivery quality. The outcomes of testing these relationship effects showed that system quality significantly influenced perceived usefulness and user satisfaction, and the results of regression analysis were (β 0.425, t-value 5.412, P 0.001) and (β 0.637, t-value 8.640, P 0.001). These results supported two hypotheses: (H8) '*System Quality significantly and directly affects Perceived*

Usefulness' and (H9) *'System Quality significantly and directly affects User Satisfaction'*.

According to the study model, information quality assumed to be a key determinant of three constructs: service delivery quality; perceived usefulness; and user satisfaction. Based on these relationship effects, three hypotheses were formulated: (H10) '*Information Quality significantly and directly affects Service Delivery Quality';* (H11*) 'Information Quality significantly and directly affects Perceived Usefulness'*; and '*Information Quality significantly and directly affects User Satisfaction'* (H12). The results of regression analysis to estimate the impact of information quality on service delivery quality, perceived usefulness, and user satisfaction were (β 0.320, t-value 7.971, P 0.001), (β 0.376, t-value 4.379, P 0.001), and (β -0.594, t-value - 3.611, P 0.001) respectively. The outcome of regression tests supported the hypotheses related to impacts of information quality on service delivery quality and perceived usefulness. However, hypothesis (H12) is rejected due to the negative impact of information quality on user satisfaction.

Based on the suggested model, three constructs are hypothesised to be affected by services delivery quality: perceived usefulness; user satisfaction; and customer value. Regression results confirmed the significant influence of service delivery quality, and the results were (β 1.148, t-value 15.127, P 0.001), (β 2.218, t-value 7.989, P 0.001), and (β 0.569, t-value 7.265, P 0.001) respectively. Accordingly, three hypotheses were accepted: (H13) '*Service Delivery Quality significantly and directly affects Perceived Usefulness';* (H14) *'Service Delivery Quality significantly and directly affects User Satisfaction';* and (H15) '*Service Delivery Quality significantly and directly affects Customer Value'.* The direct influence of perceived usefulness on user satisfaction was examined and the results were (β 0.201, t-value 4.237, P 0.001). Hence, the hypothesis that (H17) '*Perceived Usefulness significantly and directly affects User Satisfaction'* is supported.

Customer value is used to measure the benefits of using an e-learning system by students. The proposed model hypothesized that customer value is affected by three constructs: service delivery quality; perceived usefulness; and user satisfaction. The results supported the significant effect of two factors on customer value: service delivery quality (β 0.569, t-value 7.265, P 0.001); and perceived usefulness (β 0.209, t-value 5.780, P 0.001). Based on these results, hypotheses (H15) '*Service Delivery*

Quality significantly and directly affects Customer Value' and (H18) '*Perceived Usefulness significantly and directly affects Customer Value'* is supported. The outcomes of examining the influence of user satisfaction on customer value were (β -0.052, t-value -1.313, P 0.189). These results confirmed the non-significant impact of user satisfaction on customer value. Consequently, hypothesis (H20) '*User Satisfaction significantly and directly affects Customer Value'* is not accepted. Hypotheses (H16) '*Service delivery quality significantly and directly affects organisational value*', (H19) '*Perceived usefulness significantly and directly affects organisational value'* and (H21) *'User satisfaction significantly and directly affects organisational value'* were not tested with the student sample because students do not have sufficient experience about the organisational performance, productivity, and competitive advantages. Accordingly, the construct of organisational value and the hypotheses related to it were included only in the model of academic staff and ICT staff.

Six hypotheses were formulated to examine the mediation role of service delivery quality between the predictor factors, IT infrastructure services, system quality, and information quality, and the dependent factors, perceived usefulness and user satisfaction. The results of testing the mediation role of service delivery quality highlighted that the impact of IT infrastructure services, system quality, and information quality is fully mediated by service delivery quality. These outcomes of mediation analysis supported three hypotheses: (H22) '*The effect of IT infrastructure services on Perceived Usefulness is mediated by Service Delivery Quality'*; (H23) '*The effect of System Quality on Perceived Usefulness is mediated by Service Delivery Quality'*; and (H24) '*The effect of Information Quality on Perceived Usefulness is mediated by Service Delivery Quality'*.

The effect of IT infrastructure services, system quality, and information quality on user satisfaction mediated by service delivery quality was tested. The outcome of mediation showed that the impact of system quality on user satisfaction is fully mediated by service delivery quality. Thus, hypothesis (H26) '*The effect of System Quality on User Satisfaction is mediated by Service Delivery Quality'* is accepted.

However, the results confirmed that the impact of IT infrastructure services and information quality on user satisfaction is not mediated by service delivery quality. Accordingly, two hypotheses were rejected: (H25) '*The effect of of IT infrastructure* *services on User Satisfaction is mediated by Service Delivery Quality'* and (H27) '*The effect of Information Quality on User Satisfaction is mediated by Service Delivery Quality'.*

5.6. Content Analysis of Students' Comments

Students' comments about the factors affecting the success of the e-learning system were analysed using content analysis. Analysing these comments enables identification and classification of the main issues faced by external students regarding e-learning systems. The study questionnaire included 54 items. Only one of these was an open-ended question, namely: *'Please write any comments about the factors affecting e-learning system success'*. The comments received from the respondents were analysed using content analysis. The main purpose of employing content analysis is to sort the text into categories (Weber 1990); and this methodology was used in this study to identify and categorise the most frequently occurring keywords from comments provided by the surveyed students. Out of 720 only 249 students answered the optional open-ended question with 435 comments on different constructs of e-learning systems. Content analysis of these comments revealed a range of issues and factors affecting e-learning system success. Table 5.23 shows the themes and sub-themes derived from analysing the students' comments.

5.6.1. Service Delivery Quality

This construct gathered 194 comments (44.6 percent of responses). Based on this percentage this theme is considered to be the most important theme. Service delivery quality includes eight sub-themes: responsiveness; system availability; contact; interaction; fulfilment; efficiency; privacy; and library services.

5.6.1.1. Efficiency

From the students' comments relating to this construct, 45.9 percent were focused on efficiency. Subsequently, three issues related to efficiency were identified: web design (46 comments; 51.6 percent); inconsistent function/content across courses (28 comments; 31.5 percent); and accessibility (15 comments; 16.9 percent). Most of the comments tended to be negative: web design 78 percent negative; inconsistent function/content across courses 100 percent negative; and accessibility 73.3 percent negative.

Table 5. 16 Themes and sub-themes of content analysis of students' comments

Construct	Sub themes	Frequency and Percentage		Direction of comments			
				Negative		Positive	
		F	%	F	%	F	%
System Quality (83 comments out of 435) 19.1%	Overall system quality	30	36.1	-	-	30	100
	Ease to use	9	10.8	3	33.3	6	66.7
	User requirement	3	3.7	1	33.6	2	66.7
	Ease of understand	3	3.7	1	33.6	2	66.7
	Integration	2	2.4	2	100	-	-
	System functions:	29	34.9				
	• Navigation	*17*	*58.6**	14	82.4	3	17.6
	• EASE	*7*	*24.1*	7	100	-	-
	• Enrolment	*5*	*17.3*	5	100	-	-
	Platform incompatibility	7	8.40	7	100	-	-
Information Quality (71 comments) 16.3%	Information availability:	37	52.0				
	• Materials availability	*19*	*51.4*	16	84.2	3	15.8
	• Lecture recording	*9*	*24.3*	9	100	-	-
	• Video recording	*9*	*24.3*	9	100	-	-
	Conciseness	4	5.6	4	100	-	-
	Usability	7	9.9				
	• Materials usability	*2*	*28.6*	1	50.0	1	50.0
	• Quality of lecture recording	*5*	*71.4*	5	100	-	-
	Importance	8	11.3	4	50.0	4	50.0
	Format	5	7.04	5	100		
	Understandability	5	7.04	3	60.0	2	40.0
	Update	5	7.04	3	60.0	2	40.0
Service Delivery Quality (194 comments) 44.6%	Responsiveness	17	8.7	14	82.4	3	17.6
	System availability	24	12.4	18	75.0	6	25.0
	Contact	27	13.9	24	88.9	3	11.1
	Interaction	11	5.7	11	100	-	-
	Fulfillment	16	8.2	14	87.5	2	15.5
	Efficiency :	89	45.9				
	• Inconsistent function/content across courses	*28*	*16.9*	28	100	-	-
	• Accessibility	*15*	*31.5*	11	73.3	4	26.7
	• Web design	*46*	*51.6*	40	87.0	6	13.0
	Privacy	4	2.1	2	50.0	2	50.0
	Library Services	6	3.1	4	66.7	2	33.3
Perceived Usefulness (48 comments) 11%	-	48	-	1	2.10	47	97.9
User Satisfaction (10 comments) 2.3%	-	10	-	4	40.0	6	60.0
Self-efficacy and IT infrastructure services support (29 comments) 6.7%	Lecturer ability	18	62.1	17	94.4	1	5.60
	ICT Staff	4	13.8	-	-	4	100
	Student training	5	17.2	5	100	-	-
	Staff training	2	6.9	2	100	-	-

*The frequency and percent show in italic font were calculated based on the sub themes

The structure of the e-learning system interface (web design) is the most frequent problem faced by external students. Students considered the design of the website confusing and they encountered problems using the website. In this regard, students state that '*It is easy to get lost in the array of links and university-related tabs, not knowing where you need to go*' (survey response #254); '*Ulearn is quite convoluted in its structure. If one starts from the USQ home page it often takes four screens, each which opens a new web page and requires re-signing-in*' (#332); and '*ULearn can become confusing, particularly when accessing the study desk. I found that all of the links can be annoying when you are in a rush to obtain information'* (#604).

The problem of inconsistent function/content across courses occurs because there is no standard format or style used by academic staff to organise their courses on the StudyDesk. Inconsistent functionality and content across courses means that the student needs to know the details and structure of each course to collect the required information. This issue is time consuming for students in finding information and students may miss some important information due to inconsistency of content. Regarding this issue, students state that '*Keeping web page presentation the same i.e. it appears that between courses the layout of pages can vary greatly, and this gets to be confusing*' (#19); and '*I dislike how every course home page is set out slightly differently. You have to get you head around each one. i.e. where lectures are posted*' (#326).

Based on the students' comments, accessibility of an e-learning system is a critical issue for external students as indicated by the following responses: '*However, my computer was a bit slow when I tried to access components of Uconnect such as Ulearn, Udo etc. I thought this was because of the fact that a new tab was opened when [I] clicked on each of these features*' (#212); and '*Not everyone has access to the Internet all of the time. Downloading and playing back whenever time permits, without connecting to the Internet, would be more beneficial to study*' (#492).

5.6.1.2. Contact

The second sub-theme of service delivery quality was contact—resulting in 27 comments at 13.9 percent of comments. Most of the students' comments (88.9 percent) were negative. The main purpose of communication is to enhance interaction between students, their peers and academic staff, however, external students still face problems in this regard. This is evident from comments by students, for example: '*It seems hard to get true dialogue occurring over a chat room in the University but people are willing to chat on other social media sites*' (#273). Another problem is that sometimes external students cannot locate contact details of support staff: '*The student representatives need to be more easily findable, so students can identify who they are and raise any issues with them*' (#560).

5.6.1.3. System availability

System availability was the third sub-theme of service delivery quality. This sub-theme collected 24 comments with 12.4 percent. Of these comments, 75 percent were negative and 25 percent were positive. Regarding this issue, students state that ' *they dislike needing to be connected to the Internet to access information.(means study is less portable, especially in remote or rural areas)*' (#55); *'The factors that may affect e-learning system is when the website is down to technical reasons and you can't access information required at that time when needed'* (#703). Students are aware that system availability not only depends on system support at the university level, but is also affected by quality and availability of technology of the end user: '*Depends on the quality of Internet access at home-patchy Internet service in some regional areas can make the system slower, especially when looking through multiple tabs' (#292).*

5.6.1.4. Responsiveness

Seventeen comments (8.7 percent) pointed to responsiveness as a critical factor of e-learning system success. Students always direct their queries to academic staff and they expect to receive responses within a reasonable timeframe. Some students encounter problems with delays in receiving answers to their queries: '*E-learning tools still require a commitment from the course examiner to respond promptly to queries and put up information in a format that is easy to access and use'* (#346); and *'Sometimes the response from lecturers can be a bit slow but I can also appreciate that there are a lot of people asking the same question over, making this a tedious job for lecturers to sift through these and respond'* (#253).

5.6.1.5. Fulfillment

Fulfillment, as a sub-theme of service delivery quality, gathered 16 comments with 8.2 percent of total comments. Fulfillment is an essential sub-dimension of service delivery quality. This sub-dimension is related to the delivery of the service within a suitable timeframe and the truthfulness of the site offerings. However, some external students have negative feelings toward e-learning system fulfillment and negative comments comprised 87.5 percent of fulfillment comments. For instance, '*Timing of lecture uploads is sometimes several days after the lecture has been delivered so affects timing of weekly study*' (#208); and '*My main problem with the e-learning system is the sometimes late availability of lectures on the study desk which is probably due to the lecturers being in control of when they post them on the study desk'* (#545).

5.6.1.6. Interaction

Students provided 11 commented negative comments about interaction with academic staff and peers. For example, '*The level of interactivity is limited'* (#60); '*Lecturers/teachers who refuse to use, read or contribute to forums should not be allowed to take external courses*' (#120); and '*However, in some time the interaction via communications channel faces some problems*' (#259).

5.6.1.7. Library services

From the responses, 2.1 percent of the comments pointed to the library. Some students expressed dissatisfaction with the library: '*It is very frustrating trying to place a reserve in the library website and having to log in again through UConnect (even if you are already logged in)' (#418).*

5.6.1.8. Privacy

Privacy collected the lowest frequency of comments by students with only 4 comments (2.1 percent). The comments were evenly divided in two directions: 50 percent negative and 50 percent positive. For example, '*The security should be more safety' (#701) and 'I have found it* [e-learning system] *to be secure' (#220).*

5.6.2. System quality

Analysis of students' comments established that system quality is considered one of the most important factors affecting the success of the e-learning system. Seven sub-themes were identified under e-learning system quality, namely: overall system quality; ease of use; user requirement; ease of understanding; integration; system functions; and platform incompatibility.

This theme collected 83 comments (19.1 percent). Of these comments 36 percent focused on the sub-theme of 'overall quality of e-learning system'. Students were in agreement about the overall quality of the e-learning system. In this regard, students state that *'The system itself is good'* (#61); *'It is a good system'* (#63); '*System seems pretty good*' (#123); '*Very comprehensive online system*' (#153); '*Generally works great*' (#194); '*USQ's e-learning is one the best that I have used*' (#212); and '*It's a great online system*' (#385). All the comments about the overall quality of the e-learning system were positive.

The second sub-theme, based on the number of comments, was the system function, with 39 comments (34.9 percent). Analysis of students' comments shows that there are some issues related to three key functions in the e-learning system: navigation, EASE (Electronic Assignment Submission Environment), and enrolment. Regarding the navigation function, 82.4 percent of students who commented on this function expressed dissatisfaction with this aspect. For instance, '*Hard to navigate*' (#40); '*Learning to navigate the system is a little difficult*' (#52); '*It can take a long time to find things*' (#112); '*I found it very hard to adapt and navigate the entire website*' (#244); '*It is not always easy to find particular points of interest*' (#254); and '*The site is not easy to navigate*' (#716).

EASE is used by students to submit assignments and teaching staff have the ability to mark and manage grades online. Moodle includes its own assignment submission function, but is considered only suitable for small courses with one marker. EASE was designed for large courses with multiple markers. EASE has a 'Marker Management Module' that allows markers to log in, mark electronically, and upload assignment marks and feedback directly into the system.

However, students face some challenges regarding EASE, for example '*EASE is sometimes not available, which makes it very difficult for those students in remote* *areas to send their assignments through on time'* (#307); and '*I dislike using EASE to submit my assignments as I have had difficulties with it*' (#326). Some students feel that EASE is not integrated with the e-learning system at the University: '*I think for an e-learning system where people learn, access materials and talk about assessments, it is weird that EASE is not integrated into USQStudyDesk—we are required to rekey our login details to access this feature which should already be available for consolidation and ease of access*' (#635). All the comments relating to EASE were negative.

The third sub-theme relates to the enrolment function. Students tended to encounter some difficulties when enrolling in courses: '*I think Udo is probably to worst for enrolment and managing units*' (#270); and '*The enrolment system in UDo/Student Centre is confusing with the enrolment cart and study plan etc, and is a battle that I procrastinate fighting each semester due to its difficulty'* (#418).

Ease of use of the e-learning system collected 10.8 percent of students' comments. Of these, 66.7 percent related to ease of use of the e-learning system, for instance, '*I have been consistently surprised by the ease and adaptability of online learning*' (#216); '*It's always available and easy to use'* (#235); *'I find E Learning quick and easy to use'* (#241); and '*I am currently happy with the e-learning system and find it easy to use'* (#542). However, 33.3 percent of respondents believe that the e-learning system is not easy to use, as evidenced by the following comments: '*The USQ ULearn system is more difficult to use then previous e-learning systems I have used*' (#68); and '*Too hard to learn and use*' (#639).

Platform incompatibility was identified as a key issue (8.4 percent) faced by students in dealing with e-learning systems. This leads to difficulties in using some modern devices to access the e-learning systems. All the comments were in a negative direction, for example, '*Difficult to do perhaps, but I do all work on an iPad and the e-learning system does not allow for this*' (#59); and '*Have attempted to use my ipad to look at notes and Ulearn is not optimised for this or appears to be supported*' (#620).

User requirements and ease of understanding were identified as sub-themes of e-learning system quality, with three comments for each sub-theme (3.7 percent). Two comments were in a positive direction and one comment was negative.

Regarding user requirements, one student stated, '*It meets my needs sufficiently in this area*' (#362). In the context of ease of understanding the e-learning system, another student stated, '*I have found it to be reliable and easy to understand as I am not the quickest with computer knowledge*' (#220).

Finally, integration was the final sub-theme of system quality with two negative comments (2.4 percent), including, '*Two major weaknesses I find is that there are multiple systems being used to achieve the same or very similar purposes, e.g. submission of assignments*' (#332).

5.6.3. Information quality

Content analysis of students' comments identified information quality as a key factor in e-learning system success. This construct received 71 comments (16.3 percent). These comments were distributed into seven sub-themes as follows.

5.6.3.1. Information availability

The information availability sub-theme received 52 percent of all comments relating to information quality. This percentage confirms the important role of information availability in the success of information systems from the viewpoint of students. The comments about information availability were classified into three categories: materials availability (19 comments; 51.4 %); lecture recording (9 comments; 24.3%); and video recording (9 comments; 24.3%).

From the students' comments on materials availability, 84.2 percent pointed to the lack of information and the quality of study materials. For instance, '*I like to read the text, listen to the lecture and then do practical exercises etc. and the lecture not being available can be unhelpful' (#383);* and *'The e-portal did not provide most of the lecture notes from USQ, past years questions, sample exercises to enhance the subjects and case studies for the subjects'* (#623).

Nine comments of students, which made up 24.3 percent, criticized the availability and quality of 'Lecture recording'. Similarly, nine students criticized the lack in 'video recording'. All these comments were negative. Regarding lecture recording, students stated, for example, *'The one thing that could improve my experience would be to have lectopia (lecture recordings with the lecture sides at the same time)'* (#96); *'Lack of lecture audio recording'* (#100); and *'I think it should be obligatory* *that every subject uploads a recorded lecture so we aren't teaching ourselves all the time' (#501).*

In the context of video recording, students state that '*It would be cool to have visual tutorials where you could see the lecturer working through the problems on the board in front of you*' (#32); '*Some course required to listened lecture recording or video lecture but it was not available for my previous study*' (#80); and '*Wish that all lectures had video as well as sound as this makes it a lot fairer in comparison to on-campus students*' (#378).

5.6.3.2. Importance of information

Eight students (11.3 percent) commented on the ability of the materials and information to assist them in achieving the educational tasks and enhancing their knowledge. The comments were distributed equally: 50 percent negative and 50 percent positive. Regarding the negative comments one student stated, '*I am consistently disappointed with poor study materials being uploaded, especially when I know that on campus students would have a lot of extra materials to use to study'* (#143). In regard to the positive comments, another student stated that *'The system is easy to use and understand, and provides most of the information required to complete the course*' (#633).

5.6.3.3. Usability

The availability of materials is somewhat meaningless for external students without usability. Regarding information quality, 9.9 percent of the comments related to the usability of information. These comments were twofold: quality of lecture recording (5 comments) and materials usability (2 comments).

All the comments about the quality of lecture recording were negative, for example, '*The only drawback I see at USQ about e-learning is the quality of the lecture recording provided to students. Some of the lecture recordings have very poor sound quality and funny irritating background sound*' (#411); '*As an external student I get very frustrated when no lectures are provided and when they are poor quality recordings*' (#164); and '*It is let down by the quality of the recordings of lectures. Up to 20% of my lectures have sound problems*' (#173).

Two comments related to materials usability—one negative and one positive: '*Information about test times not consistent and content (says test is module 1-4, but includes questions from module 5 etc.'* (#100); and '*I believe the StudyDesk is a crucial element of every course when studying externally. It contains extremely useful information as well as aiding students in feeling connected with the lecturer and other students*' (#53).

5.6.3.4. Format

This sub-theme received 7.04 percent (5 comments) of all comments relating to information quality. All the comments were negative and that means students face challenges regarding the format of information, for example: '*The only problem I see with the system is that the course information is too spread out (such as information being on the course main page as well is in the course content link), and it makes it easy to miss important information'* (#198); *'It's a great online system, where it can fall down is due to the lectures busy schedules and their ability to have the documents and information ready at the appropriate times and in a good format for external students'* (#385); and *'If all the same sort of information is in the same format it can assist in the ease of integration with new parts of the system'* (#566).

5.6.3.5. Understandability

Understandability appeared as a sub-theme of information quality with five comments (7.04 percent): three negative and two positive. Regarding the negative feelings of students toward this sub-theme, students commented that *'Information needs to be available more clearly'* (#421) and *'E-learning takes a lot of extra time as things that are not clear in lecture notes can take days to clear up e.g. questions & answers back & forth from lecturer on studydesk which would take minutes to clear up in a face to face lecture situation'* (#608). The ease of understand the information was clear in the comment of one student: '*I have had really easy to follow subjects where the information is easily accessible and easy to understand'* (#252).

5.6.3.6. Updated information

Students' comments confirm that they believe information should be regularly updated. This sub-theme received 7.04 percent of the comments (three negative and two positive). For example, *'Some study materials that are provided are in desperate need of an update'* (#556)*;* and *'It gets better each and every time there is an update'* (#612).

5.6.3.7. Conciseness

Four students negatively commented about the information conciseness aspect. The negative feelings were as a result of repetitious information or a surplus of information: *'Not to cram too much into each page and not to double up on information between sections'* (#19); and '*This form of learning has information overload and too much time is spent sifting through these communications instead of doing study'* (#454).

5.6.4. Perceived Usefulness

Content analysis of students' comments show that perceived usefulness is a key theme of e-learning system success. From the responses, 97.9 percent of the students' comments confirmed that the e-learning system is useful: '*The system is very effective for me in my studying'* (#7); *'The e-learning system enables me to work and finish my degree*' (#58); '*E-learning gives me the flexibility I need to successfully complete my study. I would not be able to do it any other way'* (#76); '*E-Learning has provided me with the opportunity to study, which would otherwise not be possible for me'* (#95); '*Awesome for long distance students, watching the lectures at night or at a time that suits*' (#334); '*Being able to do my degree via e-learning is perfect for my personal situation and am grateful that it is available*' (#595); '*Overall the e-learning system is an easy tool to use that makes learning by distance more accessible*' (#619); and '*I find that e-learning is a much better way of learning for me. While I don't have the face-to-face learning, I can get through my material at a faster pace or even at a slower pace if something occurs*' (#644).

These comments indicate that students are often involved in employment that precludes them from studying on-campus; thus, an e-learning system provides them with an excellent opportunity to study effectively and complete their degree.

5.6.5. User satisfaction

User satisfaction received 10 percent of the students' comments. Of these, 60 percent were positive with students expressing satisfaction with the e-learning system, for example: '*All in all, I found USQ's e-learning very effective. I would not hesitate to take up more studies through USQ in the future*' (#212); *'And I will continue to recommend this form of study to friends and co-workers'* (#216); and *'I would not do a degree in another manner'* (#644). However, 40 percent of students' comments about the satisfaction theme were negative, for example: *'Overall, I am extremely dissatisfied with the online/external product offer'* (#64); *'As an external student I feel very distant'* (#501)*;* and *'The dissatisfaction with this course has already been made clear by other students and the facilitators should be well aware of how badly this course was executed'* (#685).

5.6.6. Self-efficacy and IT infrastructure services support

The theme of self-efficacy and support elicited 29 comments (6.7 percent). The students' comments regarding this theme were split into four sub-themes: lecturer ability (18 comments; 62.1 percent); students' training (5 comments; 17.2 percent); ICT staff (4 comments; 13.8); and staff training (2 comments; 6.9 percent).

Students believe that the issues relating to lack of information, inconsistency across courses/content, limited interaction, and other issues are due to a shortfall in the ability of lecturers to effectively utilise and manage the e-learning system. Students claim that some of the lecturers do not appropriately use all the functions and tools of the system. A lecturer's ability is an important factor in enhancing the academic performance of students. In this regard, students state that '*Some lecturers do not provide the options to fast forward*' (#15); and *'Unfortunately, you sometimes have lecturers that don't embrace the system or help external students. This is what makes the e-Learning experience not so good'* (#681). Another student linked the effectiveness of the e-learning system to the abilities of lecturers: '*E-learning is only as effective as the lecturers' abilities to utilise it appropriately*' (#31). Some students indicated that problems with their study are due to the late delivery of materials to external students: '*More troubles come from lecturers not uploading material early enough*' (#123). Based on these feelings, two students indicated that academic staff need more training about using the e-learning system: *'I think better training of the lecturers about how to maintain quality of the lectures could improve this*' (#173) and *'This may include professional development training so lecturers are more familiar with the particular software*' (#248).

Students feel that they need more training to utilise the functions of the e-learning system. Students confirmed that there are no training materials or manual available to support them: *'New students certainly need to invest a LOT of time in exploring it and its capabilities. I do both on campus and online courses, my knowledge of ULearn is enough to get me through these courses with relative ease, but I don't feel I'm getting its full potential'* (#40); *'However, this is assisted by the support system, which greatly helps when a new or technology-illiterate scholar may need to find their feet, such as the question or the particularly helpful step-by-step tutorial guides. This is particularly useful, as it assists multiple groups of 'learning techniques'—kinaesthetic, aural, etc.'* (#254*);* and *'Just to give a small book of instruction on how to use the e-learning and some small tips on how to go places inside the e-learning area and this may make it a little easier for first time users to get around'(#516).*

Students' feelings toward the ICT staff were positive (four positive comments). Students who deal with ICT staff confirmed that they are friendly and have good experiences: '*As far as I can see ICT are running a fully professional department. Everything works very well and efficiently* (#30)*;'It is a good system and the ICT staff are friendly and helpful'* (#63)*;* and *'I haven't had much to do with ICT apart from a couple technical support calls regarding email and logon issues. They handled it very good and were very friendly*!' (#310).

5.7. Chapter summary

This chapter was allocated to analysing the student sample data. The descriptive part presented the means and standard deviations of each item used in the study questionnaire. Furthermore, the response rate of 'Don't know' and 'Not applicable' were described; along with the treatment of missing data and a description of method, normality, and outliers. The second part focused on establishing the measurement model and testing the study model and hypotheses. This included five stages: (1) one-factor congeneric measurement model; (2) Exogenous and Endogenous factor first-order; (3) measurement model; (4) testing the validity and reliability; and (5) testing study model and hypotheses.

The results of examining the model with 720 responses from the student sample confirmed the validity and reliability of the items, constructs, and the whole model to measure the success of e-learning systems.

The content analysis was used to analyse the comments received from students. The main themes obtained from content analysis were system quality, information quality, service delivery quality, perceived usefulness, user satisfaction, and self-efficacy and support.

CHAPTER SIX

This chapter describes and tests the data from the academic staff sample. This chapter includes three main sections. The first section is assigned to describing the data collected from academic staff and examining the normality and treatment of missing data. The second section is allocated to testing the measurement model and examines the reliability and validity of the model. A description of testing the structural model and the hypotheses forms the third section of this chapter. Finally, the comments received from the Academic staff were analysed using Content Analysis.

CHAPTER SIX: DATA ANALYSIS OF ACADEMIC STAFF SAMPLE

6.1. Introduction

Academic staff are essential stakeholders and internal customers of e-learning systems and are responsible for providing students with study materials, advice, feedback, and different teaching activities. In regard to e-learning systems, these activities should be performed by academic staff via electronic channels. Thus, evaluating the success of e-learning systems based on the perspective of academic staff provides a different view about the factors affecting this type of system and the relationships between these factors.

6.2. Descriptive statistics

Descriptive statistics are believed to be an essential part of data analysis. Descriptive statistics can be used to identify the respondents' attitude towards each item and the variables of the survey. Furthermore, identifying violation in variables can be conducted using descriptive statistics indicators.

Two statistics were used to describe the responses of academic staff: means and standard deviation. The sample of academic staff was 110 responses. A 5-point scale was used to measure the attitude of academic staff toward constructs of e-learning systems success: 1 'Strongly Disagree', 2 'Agree', 3 'Neutral', 4 'Agree', 5 'Strongly Agree'. Additionally, 'Not applicable' and 'Don't know' choices were used to provide respondents with more alternatives in selecting the most suitable option and to identify non-attitude responses. 'Not applicable' and 'Don't know' are treated as missing data before testing the study model (Holman & Glas, 2005; Lord, 1974). The frequencies and percentages of those two options and the missing data are also described in this section.

6.2.1. IT infrastructure services

In regard to IT infrastructure services, six items were used to measure the IT infrastructure services. The indicators of descriptive statistics, responses of 'Not applicable' and 'Don't know', and missing data are shown in Appendix G Table G.1.

The mean value of each item indicates that academic staff agreed on the availability of IT infrastructure services to serve and support the e-learning system. The means ranged between 3.277 for ITIS1 and 3.722 for ITIS2. The frequency of 'Not applicable' was zero for all the items of IT infrastructure services construct. The nil percentage of this option highlights that IT infrastructure services are essential to the e-learning system from the viewpoint of academic staff. In addition, academic staff are aware of the role these services play in supporting the e-learning system. The percentage of responses of 'Don't know' was between zero for ITIS5 and 2.7 percent for ITIS6. The missing data was extremely low and did not exceed 1.8 percent.

6.2.2. System quality

Eight items were employed to measure system quality aspects from the viewpoint of academic staff. The percentage of respondents who selected the 'Not applicable' option regarding system quality items was zero, as depicted in Appendix G Table G.2. This nil response highlights that academic staff are in agreement that these items measure systems quality in the e-learning systems arena. The means of system quality items ranged between 3.063 for SQ7 and 3.715 for SQ4. These means indicate that academic staff accept the items used to gauge systems quality construct and agree on the existence of system quality aspects in the e-learning system at USQ. In the context of the 'Don't know' choice, respondents did not select this option in five items: SQ1; SQ2; SQ3; SQ5; and SQ8; whereas SQ4 received the highest percentage of 'Don't know' choices at 2.7 percent. In addition, there two items received 0.9 percent of the 'Don't know' option: SQ6 and SQ7. Missing data was extremely low and was 0.9 percent in five items: SQ2; SQ3; SQ4; SQ5; and SQ6. There are no missing data in the other items.

6.2.3. Information quality

Information quality was measured using six items. Academic staff were in agreement with the items of information quality. The means of information quality items ranged between 3.5 and 3.654 for IQ1 and IQ2 respectively, as shown in Appendix G Table G.3. The percentage of 'Don't know' and 'Not applicable' choices was zero in this construct. The nil responses of those options show that academic staff are totally aware about the items employed to measure this construct. Missing data were in only one item and was a low percentage: IQ2 (2.7 percent).

6.2.4. Service delivery quality

Service delivery quality was measured using six sub-dimensions and these sub-dimensions employed 20 items. These items and the responses about each item are shown in Appendix G Table G.4. The means of these items of this construct indicate that academic staff have a positive attitude toward the service delivery quality of the e-learning system at USQ. The means ranged between 3.281 for EFFI3 and 4.009 for PRIV3. The responses of 11 items out 20 received zero percentage of ‘Don’t know’ choice, and the other items collected between 0.9 and 3.6 percent.

Regarding the ‘Not applicable’ option, the percentages of all the items were zero, except for AVA1 that was 0.9 percent. These nil responses of ‘Not applicable’ toward this construct highlight that academic staff are knowledgeable about the dimensions that can be used to evaluate the service delivery quality; and they agree with the indicators used to measure this construct. Eleven items out of 20 included missing data, however, the percentages of missing data are relatively low and do not exceed 2.7 percent.

6.2.5. Perceived usefulness

Four items were employed to measure the perceived usefulness construct. Appendix G Table G.5 depicts the descriptive indicators of perceived usefulness items. The items’ means of this construct ranged between 3.427 for USEF1 and 3.642 for USEF3. These means highlight that academic staff have positive opinions toward the role of e-learning systems in enhancing their job performance. The other outcome from Appendix G Table G.5 is that academic staff have sufficient experience in identifying the role of perceived usefulness in job performance and have clear opinions and attitudes about this construct. This indicator was collected based on the percentages of ‘Don’t know’ and ‘Not applicable’ options which were zero for the four items of the perceived usefulness construct. Missing data occurred in two items and were extremely low: USEF2 1.8 percent and USEF3 0.9 percent.

6.2.6. User satisfaction

User satisfaction was gauged by four items and the descriptive indicators of these items are shown in Appendix G Table G.6. Demonstrably, academic staff have clear attitudes toward items of user satisfaction, as demonstrated by the zero response rate of ‘Don’t know’ and ‘Not applicable’. Two items had missing data (SATF2 1.8 percent and SATF3 0.9 percent), however, these percentages are considered to be very low. The mean values of user satisfaction items reflect that academic staff positively accepted these items and the means ranged between 3.445 for SATF4 and 3.633 for item SATF3.

6.2.7. Customer value

Customer value was selected to be the outcome of e-learning system success. This construct was measured using four items. The items’ means show that academic staff can receive value via using e-learning systems, and feel positive toward the value that can be generated from using this system. The means ranged between 3.272 for CUSV4 and 3.638 for CUSV2. The percentage of ‘Not applicable’ was zero—no respondent selected this option. ‘Don’t know’ has been selected by respondents twice in item CUSV2 and CUSV3 with percentage 0.9. Missing data occurred in one item, CUSV2, and the percentage of these missing data was 1.8, as shown in Appendix G Table G.7.

6.2.8. Organisational value

The impacts of using e-learning on the university, based on the perspectives of academic staff, are measured by the organisational value construct. Six items were used to gauge this construct, as shown in Appendix G Table G.8. The items’ mean confirmed that the e-learning system contributes in supporting the organisational value according to academic staff opinions. The means were between 3.418 for item ORGV2 and 3.800 for item ORGV3. These means indicate the positive attitude of academic staff toward the role of an e-learning system in achieving organisational value. A small number of academic staff had no opinion about some items of organisational value because they selected the ‘Don’t know’ option. The percentage of respondents who selected this option was between 0.9% and 2.7% and these percentages are believed to be low. The responses of ‘Not applicable’ were zero, and the missing data was only in item ORGV5, and it was extremely low: 0.9%.

6.3. Treatment of missing data, outliers, and normality for academic staff sample

Different methods can be employed to treat missing data. Acceding to Hair et al. (2010), the imputation method is preferred if the missing data is under 10 percent. The responses of ‘Don’t know’ and ‘Not applicable’ are treated as missing data as well. The percentage of missing data of the academic staff, including ‘Don’t know’ and ‘Not applicable’ was extremely low and does not exceed 4.5 percent. Hence, imputation regression method was used to estimate the missing data.

The data collected for academic staff sample were imported electronically from Survey Monkey to SPSS. Thus, outliers cannot occur in this study because the data was not coded manually. However, the outliers were checked via frequency distributions and the values were confirmed 1 and 5 (the range of scale used in this study).

Two statistical tests were used to examine the normality: skewness and kurtosis. Appendix G Table G.9 depicts the skewness and kurtosis of each item of the academic staff questionnaire after estimating the missing data. According to the criteria +3 -3 and as shown in Appendix G Table G.9, the items adopted in this study are distributed normally.

6.4. Establish the measurement model and test study model and hypotheses of academic staff sample

Sample size in structural equation modelling is an essential issue. Different rules of thumb were proposed to identify the sufficient sample size for running structural equation modelling such as 5 observations per parameter, 10 observations per parameter, 50 observations per variable, and no less 100 (Muthén & Muthén, 2002).

The rule of thumb that 5 subjects per variable is accepted by Bentler and Chou (1987) on the condition that the data should be normally distributed, and 10 subjects per variable is considered suitable for other distributions.

Some rules of thumb were based on the sample size of the previous studies. In that context, Breckler (1990) reviewed 72 articles employing SEM and found that the median of sample size was 198. Schumacker and Lomax (2004) examined some articles and concluded that the sample size was between 250 and 500 subjects.

Barrett (2007) strictly recommended using a sample more than 200: 'SEM analyses based upon samples of less than 200 should simply be rejected outright for publication unless the population from which a sample is hypothesized to be drawn is itself small or restricted in size' (2007, p. 820). Kline (2011) considered 200 cases as a typical sample size in SEM.

Bagozzi and Yi (2012) recommended that sample size should be above 100, and preferably above 200. However, a sample of less than 100 leads to the model becoming untenable unless the model is very simple.

Hair et al. (2010) proposed suggestions of sample size based on model complexity and characteristics of the measurement model:

- Minimum sample size 100: models should contain five or less constructs. Each construct should have more than three observed variables. The communalities of each observed variable should be ≥ 0.6.
- Minimum sample size 150: models should include seven constructs or fewer. Modest communalities (0.5) is accepted, and no under-identified constructs.
- Minimum sample size 300: models contain seven or fewer constructs, lower communalities (below 0.45). The multiple under-identified constructs should be less than three.
- Minimum sample size 300: models have a large numbers of constructs. The communalities of some factor can be lower, and/or having fewer than three measured items.

Conducting SEM with a small sample size may lead to problems such as failure in achieving the assumption of multivariate normality, reliability of indicators tend to be low, and model misspecification can affect the model fit indices, parameter estimate accuracy, and the likelihood of cross-validation (Jackson, 2003). Schumacker and Lomax also agree about the large sample size in SEM and state that 'the researcher often requires a much larger sample size to maintain power and obtain stable parameter estimates and standard errors' (2004, p. 49).

The size of the academic staff sample in this study is 110 and can be considered relatively small. The study model can be complex because it includes eight constructs and 56 observed variables. In addition, most of the model fit indicators are affected by sample size (Anderson & Gerbing, 1988; Hoppe & Breitner, 2003; Jais, 2007; Kline, 2011).

Models based on SEM can be designed by using two approaches: (1) covariance-based structural equation modelling (CBSEM) supported by software such as LISREL, AMOS, EQS, SEPATH, and RAMONA; and (2) the component-based approach PLS (Urbach & Ahlemann, 2010).

The size of the student sample was large (720), and the data represented the model well in spite of the complexity of the proposed model. However, the approach of covariance-based structural equation modelling (CBSEM) was not used with the academic staff sample due to the insufficient sample size and the complexity of the study model.

Therefore, the component-based approach PLS was adopted to test the study model with academic staff sample. One of the most important advantages of component-based approach PLS is the ability to deal with a small sample size (Urbach & Ahlemann, 2010). The empirical study of Hsu, Chen, and Hsieh (2006) found that the approach of component-based PLS is quite robust despite the problem of small sample size.

Testing the model with the academic staff sample consists of two stages: measurement model and structural model.

6.4.1. First stage: Measurement model

The main purpose of establishing and testing the measurement model is to show how each observed variable relates to their construct (Guo et al., 2011). Testing reliability and validity can be performed through the measurement model. Item reliability is considered a key indicator in testing the measurement model. Carmines and Zeller (1979) suggested that the factor loading of items should be ≥ 0.70 as an acceptable level of item reliability. However, a factor loading of 0.50 is considered acceptable by Hulland (1999), and even 0.40 can be an acceptable level (Chin, 1998). Factors less than 0.40 should be eliminated from the model.

SmartPLS2 M3 is used to test the study model with academic staff sample. The study model includes eight constructs and each construct is measured by more than four observed variables. Service delivery quality is measured by six sub-dimension factors which include 18 items (observed variables).

Running the model at the first iteration showed that all the factors are loaded with a value more than 0.60, except for three factors: ITIS2 0.563; USEF1 0.562; and ORGV2 0.538. Figure 6. 1 shows the results of testing the measurement model with academic staff sample; and Table 6.1 depicts the loading and cross loading of the constructs.

Figure 6. 1 Results of testing the measurement model of Academic staff sample

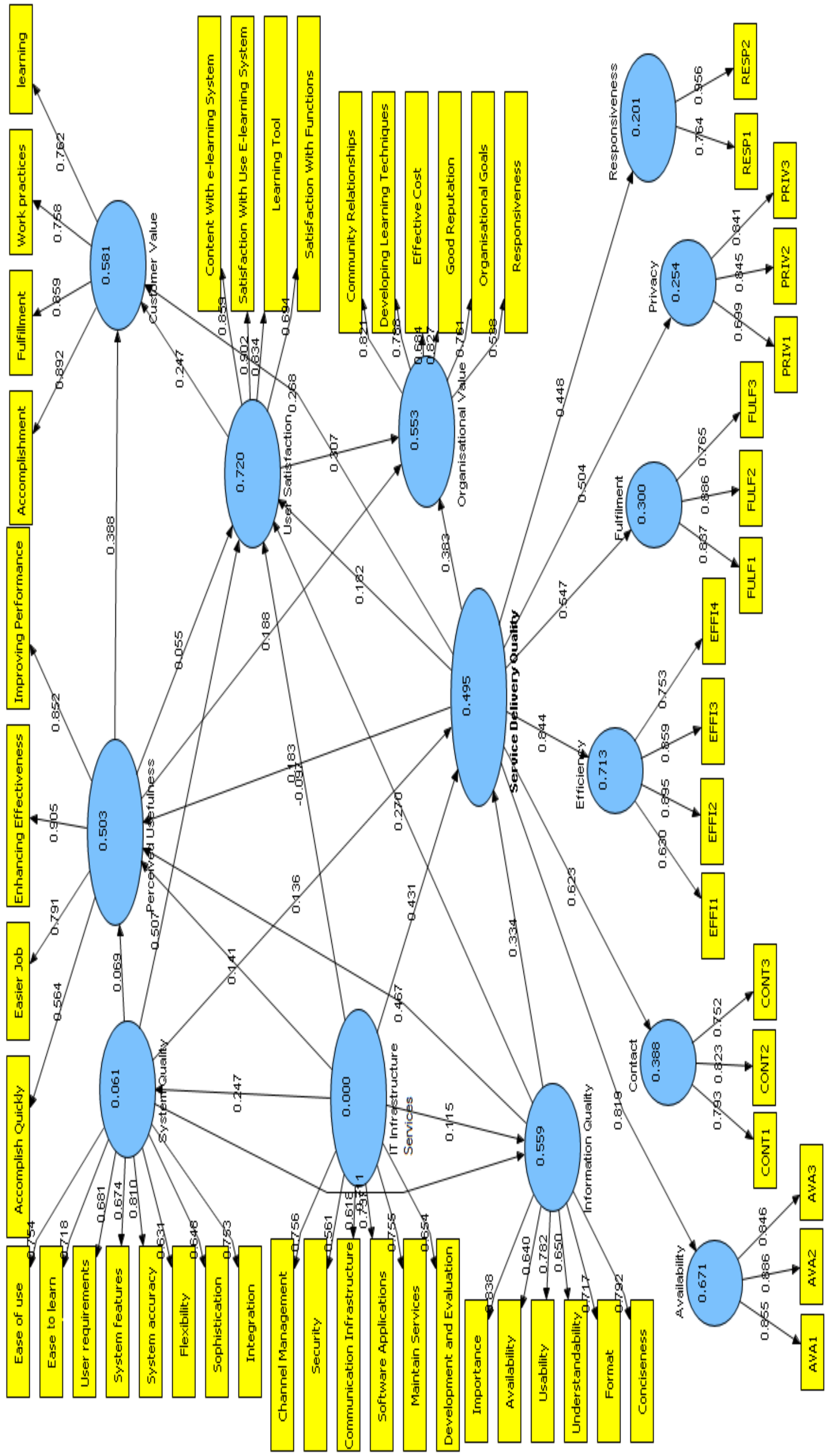


Table 6.1 Loading and cross loading of the constructs of the Academic staff sample

Constructs	Aspects	AVA	CONT	EFFI	FULF	PRIV	RSPE	ITIS	SQ	IQ	PU	SATF	CUSV	ORGV	t-value
Availability	AVA1	**.855**	.303	.547	.153	.280	.282	.481	.351	.326	.313	.392	.476	.495	29.36
	AVA2	**.886**	.270	.593	.233	.256	.220	.451	.412	.397	.402	.482	.482	.496	33.43
	AVA3	**.846**	.278	.560	.324	.367	.182	.500	.354	.312	.360	.369	.416	.507	26.69
Contact	CONT1	.201	**.793**	.323	.341	.104	.081	.234	.254	.270	.216	.206	.299	.424	10.23
	CONT2	.267	**.822**	.250	.106	.285	.106	.216	.176	.159	.097	.206	.280	.433	15.60
	CONT3	.301	**.752**	.308	.318	.337	.356	.150	.183	.239	.210	.272	.267	.321	10.05
Efficiency	EFFI1	.365	.421	**.630**	.329	.105	-.021	.249	.319	.386	.368	.410	.326	.407	7.328
	EFFI2	.537	.279	**.895**	.284	.284	.300	.446	.490	.626	.529	.500	.565	.516	46.91
	EFFI3	.555	.212	**.859**	.222	.227	.264	.453	.319	.479	.507	.349	.515	.464	27.93
	EFFI4	.604	.308	**.753**	.158	.162	.290	.365	.237	.320	.266	.326	.432	.381	14.77
Fulfillment	FULF1	.212	.184	.207	**.837**	-.033	.151	.232	.208	.297	.382	.261	.184	.171	13.05
	FULF2	.302	.339	.322	**.886**	.196	.139	.269	.164	.311	.300	.296	.139	.270	24.65
	FULF3	.155	.282	.221	**.765**	.198	.160	.319	.265	.310	.364	.276	.283	.296	12.88
Privacy	PRIV1	.107	.270	.073	-.028	**.699**	.158	-.020	.078	.029	.013	.045	.094	.136	6.626
	PRIV2	.278	.239	.234	.156	**.845**	.160	.120	.126	.114	.127	.155	.184	.194	17.75
	PRIV3	.379	.260	.249	.180	**.841**	.210	.227	.180	.165	.235	.176	.182	.286	18.64
Responsiveness	RESP1	.101	.052	.104	.089	.131	**.764**	.088	.084	.189	.138	.115	.101	-.049	7.223
	RESP2	.297	.293	.316	.193	.230	**.956**	.235	.272	.304	.293	.263	.409	.263	42.36
IT infrastructure services	Channel Management	.439	.236	.462	.205	.121	.147	**.756**	.282	.337	.325	.247	.404	.386	14.39
	Security	.233	.179	.187	.301	-.024	-.025	**.563**	.010	.092	.137	.003	.029	.184	3.769
	Communication Infrastructure	.182	.104	.247	.276	-.034	.199	**.620**	.148	.161	.220	.061	.140	.246	4.838
	Software Applications	.341	.090	.236	.274	.081	.237	**.737**	.121	.184	.231	.102	.234	.260	7.211
	Maintain Services	.493	.158	.369	.270	.214	.103	**.754**	.160	.216	.378	.190	.362	.318	10.44
	Development and Evaluation	.451	.233	.372	.113	.198	.173	**.653**	.185	.158	.242	.206	.458	.369	7.841
System quality	Ease of Use	.311	.248	.353	.187	.182	.147	.164	**.752**	.578	.411	.543	.328	.441	14.38
	Ease to Learn	.214	.172	.343	.157	.148	.165	.095	**.716**	.465	.342	.485	.308	.394	12.05
	User Requirements	.255	.175	.140	.244	.064	.111	.091	**.677**	.523	.313	.611	.367	.372	10.74
	System Features	.280	.123	.208	.161	.105	.117	.086	**.674**	.455	.321	.573	.306	.434	9.167
	System Accuracy	.377	.216	.282	.239	.214	.253	.242	**.809**	.578	.424	.622	.470	.502	20.93
	Flexibility	.232	.165	.324	.095	.157	.265	.264	**.631**	.464	.314	.437	.580	.419	10.33
	Sophistication	.341	.130	.385	.183	-.054	.249	.246	**.654**	.482	.479	.572	.496	.422	12.51
	Integration	.394	.229	.412	.143	.155	.055	.194	**.755**	.565	.423	.678	.486	.495	15.99

Constructs	Aspects	AVA	CONT	EFFI	FULF	PRIV	RSPE	ITIS	SQ	IQ	PU	SATF	CUSV	ORGV	t-value
Information Quality	Importance	.288	.241	.448	.287	.097	.260	.170	.660	**.823**	.451	.598	.535	.447	21.29
	Availability	.381	.234	.478	.266	.250	.157	.363	.448	**.659**	.415	.458	.355	.419	8.727
	Usability	.302	.196	.410	.132	.096	.224	.160	.634	**.758**	.416	.662	.466	.371	13.06
	Understandability	.287	.111	.455	.312	.030	.243	.188	.419	**.681**	.200	.506	.538	.368	14.93
	Format	.253	.246	.401	.320	.072	.202	.241	.455	**.724**	.515	.505	.474	.465	11.35
	Conciseness	.238	.245	.336	.268	.097	.228	.189	.636	**.769**	.439	.598	.417	.403	13.21
Perceived usefulness	Accomplish Quickly	.344	.248	.393	.173	.100	.143	.149	.467	.456	**.562**	.439	.331	.405	5.423
	Improve performance	.290	.191	.396	.409	.208	.181	.370	.356	.516	**.853**	.345	.554	.462	24.44
	Enhancing Effectiveness	.344	.201	.452	.359	.159	.206	.373	.412	.543	**.906**	.467	.592	.514	43.85
	Easier Job	.337	.093	.436	.331	.106	.309	.326	.473	.616	**.792**	.532	.615	.428	18.53
User Satisfaction	Content With e-learning System	.421	.139	.395	.304	.101	.253	.172	.741	.692	.525	**.859**	.531	.541	29.54
	Satisfaction With Use E-learning System	.437	.299	.472	.269	.168	.150	.202	.694	.713	.513	**.901**	.528	.541	41.02
	Learning Tool	.310	.264	.362	.244	.217	.152	.101	.674	.545	.459	**.836**	.479	.535	17.87
	Satisfaction With Functions	.423	.277	.431	.295	.079	.252	.301	.523	.509	.368	**.694**	.502	.449	11.89
Customer Value	Work Practices	.345	.230	.428	.281	.010	.252	.510	.381	.505	.584	.426	**.758**	.511	31.66
	Learning	.459	.216	.447	.249	.141	.171	.260	.520	.511	.552	.534	**.762**	.639	12.24
	Accomplishment	.479	.310	.521	.182	.255	.370	.374	.516	.563	.599	.545	**.892**	.659	43.32
	Fulfillment	.449	.415	.533	.064	.240	.344	.331	.515	.506	.484	.510	**.859**	.584	31.66
Organisational Value	Developing Learning Techniques	.536	.402	.503	.217	.183	.199	.417	.571	.539	.533	.541	.769	**.788**	18.56
	Responsiveness	.263	.301	.355	.110	.234	.238	.219	.280	.280	.295	.345	.515	**.538**	
	Effective Cost	.390	.341	.412	.303	.122	.052	.281	.431	.435	.412	.504	.422	**.684**	5.510
	Community Relationships	.450	.348	.419	.241	.263	.227	.322	.437	.411	.468	.499	.588	**.821**	24.81
	Good Reputation	.440	.400	.414	.259	.213	.019	.412	.512	.430	.412	.473	.478	**.827**	20.46
	Organisational Goals	.457	.401	.376	.181	.207	.098	.318	.466	.369	.404	.401	.416	**.761**	12.41

AVA=Availability; CONT=Contact; EFFI=Efficiency; FULF=Fulfillment; PRIV=Privacy; ITIS= IT infrastructure services; SQ=System Quality; IQ=Information Quality; PU=Perceived Usefulness; SATF=User Satisfaction; CUSV=Customer Value; ORGV=Organisational Value.

The reliability of the measurement was tested using four indicators: Cronbach's Alpha; Coefficient H; Composite reliability; and Average Variance Extracted. Table 6.2 shows the results of calculating these indicators.

Table 6.2 Reliability indicators of academic staff sample

	Cronbach's Alpha	Coefficient H	Composite Reliability	AVE
Availability	.827	.889	.897	.743
Contact	.700	.836	.832	.623
Efficiency	.793	.882	.868	.625
Fulfillment	.776	.881	.869	.690
Privacy	.725	.854	.839	.636
Responsiveness	.703	.923	.855	.749
IT Infrastructure Services	.779	.850	.839	.468
System Quality	.858	.896	.890	.505
Information Quality	.831	.844	.877	.544
Perceived Usefulness	.784	.904	.865	.622
User Satisfaction	.841	.912	.894	.682
Customer Value	.835	.904	.890	.672
Organisational Value	.832	.895	.879	.552

Cronbach's alpha is a key test to assess the reliability of internal consistency. The cut off level of this indicator is 0.70. All the constructs in the model exceeded the acceptable level and the values were between .700 and .858, as shown in Table 6.2.

Coefficient H was used to measure the construct reliability. The recommended level of Coefficient H is 0.70. The results of calculating Coefficient H were between 0.836 and 0.923, and these values confirm that the constructs achieved a good level of reliability.

Construct reliability is also used to assess the internal consistency of the measurement. The acceptable level of this indicator is 0.70. All the constructs exceeded the level of 0.80 of composite reliability. According to Hinton, Brownlow, McMurray, and Cozens (2004) the composite reliability between 0.90 and 0.70 can be considered high reliability. Accordingly, the constructs in this study achieved a high level of reliability based on the composite reliability indicator.

In regard to average variance extracted, all the constructs and sub-dimensions of SDQ, except IT infrastructure services, went above the acceptable level of 0.50. The value of average variance extracted of IT infrastructure services was 0.468. The other tests of reliability, Cronbach's alpha, Coefficient H, and Construct Reliability supported the reliability of the IT infrastructure services construct.

The results of loading and cross loading in Table 6.1 confirm the validity of the measurement because item loadings in the assigned construct were higher than the other constructs in the scale.

In the context of validity, two types of validity were tested in this study with academic staff sample: convergent validity; and discriminant validity. To identify the main purpose of each type of validity, Gefen and Straub state that 'convergent validity is shown when each measurement item correlates strongly with its assumed theoretical construct, while discriminant validity is shown when each measurement item correlates weakly with all other construct except for the one which it is theoretically associated' (2005, p. 92).

Three criteria are considered the main condition to achieve the convergent validity: (1) significant factor loading and value more than 0.70; (2) the value of average value extracted should be more than 0.50; and (3) composite reliability of each item should exceed 0.80 (Guo et al., 2011). However, there are many arguments and suggestions about cut-off values of these indicators. For example, factor loading with 0.40 (Chin, 1998) and 0.50 (Hulland, 1999) are accepted. The recommended level of composite reliability is 0.70 (Hair et al., 2006).

The three criteria of convergent validity were achieved regarding the measurement model of academic staff sample. Table 6.1 shows the loading and cross loading of all the items. The factor loading of all the items was more than 0.6, except for three items between 0.538 and 0.563. Furthermore, all the items were significant and the t-value was more than 1.96 as shown in Table 6.1. All the constructs—with the exception of IT infrastructure services—met the second criteria - namely, AVE. The values of this index are depicted in Table 6.2. Finally, all the constructs achieved a high composite reliability and the values were between 0.836 and 0.923.

The results of calculating the three criteria above confirm the convergent validity of the measures used to evaluate the success of e-learning system from the perspective of academic staff.

The second type of validity test in this study is discriminant validity, and to achieve this validity the square root of average variance extracted from each construct should be more than its correlation with other constructs (Chin, 1998; Guo et al., 2011; Liang et al., 2007). There is an important issue regarding discriminant validity: should the sub-dimensions of service delivery quality be included in the comparison with squared root of average variance extracted; or should it only be limited to the latent variable? According to Akter, D'Ambra, and Ray (2011) the sub-dimensions of the hierarchical model (second-order model) in PLS should be included in assessing the discriminant validity of this construct. Thus, the sub-dimensions of service delivery quality were included in evaluating the discriminant validity. The software of PLS supported this aspect and calculated the correlation between the latent factor and the sub-dimensions of other latent factors. However, outcomes of correlation between the latent factors and the sub-dimensions of other latent factors are not available from AMOS that is used to analyse the student sample data. Table 6.3 shows the results of conducting this method, which achieved a sufficient level of discriminant validity.

Table 6.3 Discriminant validity of Academic staff sample

	ITIS	SQ	IQ	PU	USAT	CUSV	ORGV	AVA	CONT	EFFI	FULF	PRIV	RESP
ITIS	**.684**												
SQ	.247	**.710**											
IQ	.290	.739	**.737**										
PU	.396	.538	.661	**.789**									
USAT	.230	.801	.724		**.826**								
CUSV	.448	.589	.630	.667	.616	**.820**							
ORGV	.449	.617	.555	.575	.627	.732	**.743**						
AVA	.554	.430	.392	.416	.481	.530	.578	**.862**					
CONT	.250	.259	.286	.225	.293	.357	.493	.328	**.789**				
EFFI	.487	.434	.568	.533	.501	.589	.560	.657	.374	**.791**			
FULF	.327	.250	.354	.411	.335	.235	.299	.276	.331	.308	**.831**		
PRIV	.166	.171	.141	.182	.172	.201	.270	.349	.313	.253	.156	**.797**	
RESP	.211	.237	.298	.272	.242	.349	.184	.263	.243	.278	.178	.222	**.865**

AVA=Availability; CONT=Contact; EFFI=Efficiency; FULF=Fulfillment; PRIV=Privacy; ITIS= IT infrastructure services; SQ=System Quality; IQ=Information Quality; PU=Perceived Usefulness; SATF=User Satisfaction; CUSV=Customer Value; ORGV=Organisational Value.

The first stage of analysis focused on the measurement model of the academic staff sample. Four indicators were used to measure the reliability: Cronbach’s Alpha; Coefficient H; Composite reliability; and Average Variance Extracted. These indicators confirmed that the model constructs achieved a good level of reliability. Two types of validity were tested regarding academic staff sample: convergent validity; and discriminant validity. The results of examining the validity showed that the measurement achieved convergent validity and a satisfactory level of discriminant validity.

6.4.2. Second Stage: Structural model of academic staff sample

The structural model focuses on testing paths between the constructs of the study model and makes decisions about the hypotheses.

Before testing the structural model the model should be validated. Examining model validation includes the measurement model, structural model, and each structural regression equation (Tenenhaus et al., 2005).

Two indicators were used to validate the measurement model: Goodness-of-Fit (GoF); and Cross-validated communality (H^2). The quality of the structural model is evaluated using cross-validated redundancy index (Predicative relevance Q^2).

The results of these three indicators to examine the validation of measurement and structural models are shown in Table 6.4.

Table 6.4 Indicators of validation of measurement and structural models

Constructs	Predicative relevance Q^2	Cross-validated communality H^2	GoF
Availability	0.509	0.470	0.525
Contact	0.215	0.252	
Customer Value	0.370	0.444	
Efficiency	0.454	0.383	
Fulfilment	0.191	0.393	
IT Infrastructure Services	-	0.210	
Information Quality	0.283	0.366	
Organisational Value	0.269	0.384	
Perceived Usefulness	0.280	0.353	
Privacy	0.155	0.289	
Responsiveness	0.145	0.284	
Service Delivery Quality	0.123	0.211	
System Quality	0.025	0.349	
User Satisfaction	0.461	0.459	

All the values of Cross-validated communality H^2 were well above the threshold level of zero. The value of GoF is between 0 and 1, and the high level of GoF points to better path model estimation (Karim, 2009). Academic staff model achieved a good level of fit and the value of GoF was 0.525. This index highlighted that the model of academic staff sample achieved a good overall fit.

Regarding the cut-off predictive relevance Q^2, all the constructs achieved values more than zero, as shown in Table 6.4. These values indicate that the structural model has a good predictive relevance.

Two main indicators were used to evaluate the relationships between the paths in the PLS structural model: R^2 (Coefficient of determination) values, and standardized path coefficient. Bootstrapping method was used to test the significance of paths in the study model. Chin (1998) suggested bootstrapping conducted with 500 samples. Figure 6.2 and Table 6.5 show the results of testing the paths between model constructs.

Regarding measuring the power of R^2, three levels were suggested: 0.670 substantial; 0.333 moderate; and 0.190 weak (Chin, 1998; Urbach & Ahlemann, 2010). Five values of R^2 had a moderate power, and one achieved a substantial power. However, the impact of IT infrastructure services on system quality achieved a weak R^2: 6 percent.

Three levels of cut-off were adopted to assess the strength of path coefficient: 0.2 weak; value between 0.2 and 0.5 is moderate; and more than 0.5 is strong (Cohen, 1988; Sridharan et al., 2010). Twenty-one relationships were tested between the PLS model of academic staff. Nine relationships were weak, ten were moderate, and two were strong.

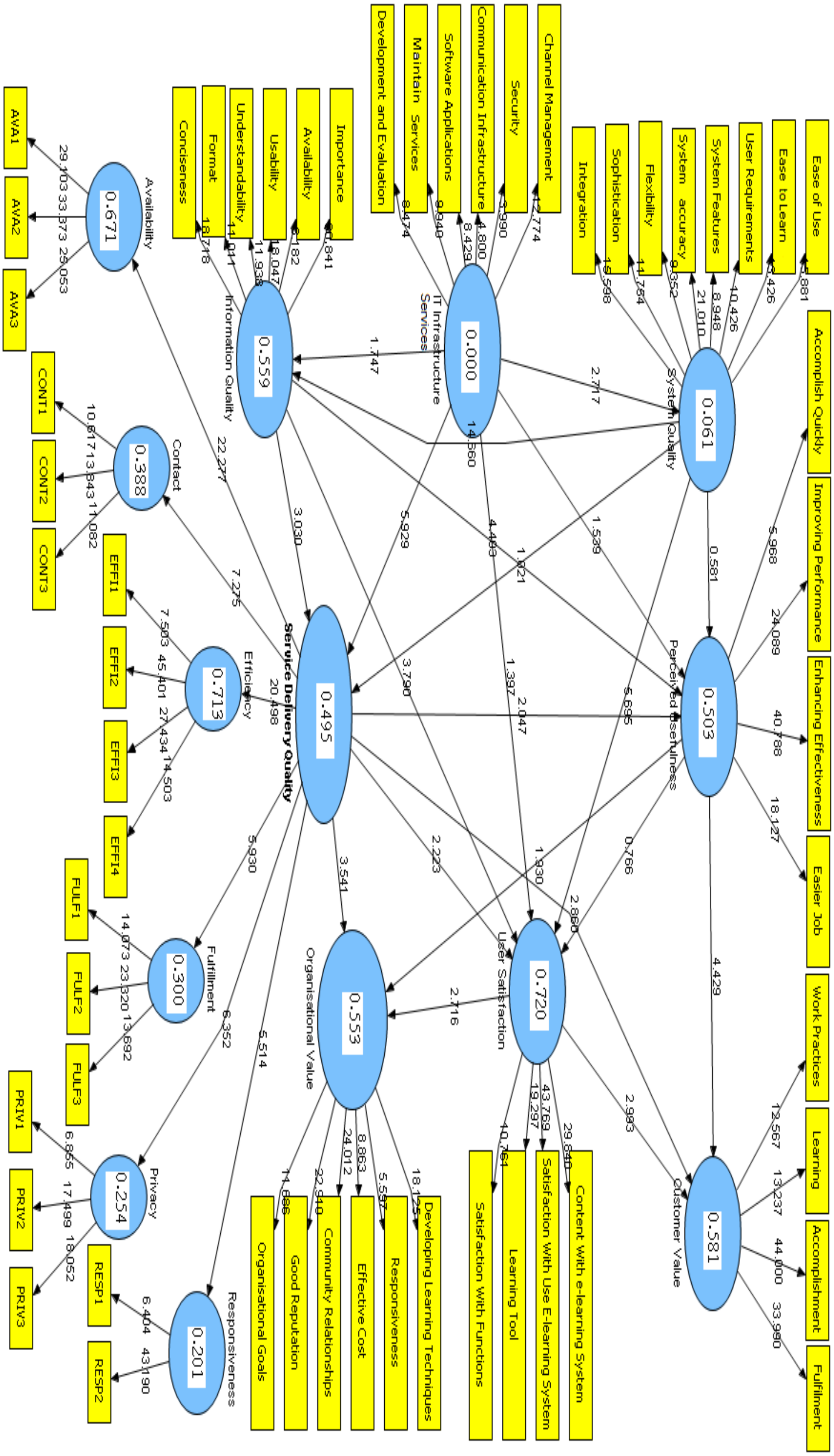


Figure 6.2 Test the study model of Academic staff Sample

Table 6.5 The results of regression analysis of testing the academic staff model

Relationships	Path Coefficients	Strength	t-value
IT Infrastructure Services →Information Quality	0.122	Weak	1.746*
IT Infrastructure Services →Perceived Usefulness	0.139	Weak	1.539 $^{N.S}$
IT Infrastructure Services →Service Delivery Quality	0.433	Moderate	5.928***
IT Infrastructure Services →System Quality	0.261	Moderate	2.716**
IT Infrastructure Services →User Satisfaction	-0.094	Weak	1.397 $^{N.S}$
Information Quality →Perceived Usefulness	0.464	Moderate	4.402***
Information Quality →Service Delivery Quality	0.323	Moderate	3.029**
Information Quality →User Satisfaction	0.270	Moderate	3.790***
Perceived Usefulness →Customer Value	0.380	Moderate	4.428***
Perceived Usefulness →Organisational Value	0.185	Weak	1.929*
Perceived Usefulness →User Satisfaction	0.053	Weak	0.766 $^{N.S}$
Service Delivery Quality →Customer Value	0.276	Moderate	2.859**
Service Delivery Quality →Organisational Value	0.402	Moderate	3.540***
Service Delivery Quality →Perceived Usefulness	0.186	Weak	2.046*
Service Delivery Quality →User Satisfaction	0.188	Weak	2.223*
System Quality →Information Quality	0.710	Strong	14.659***
System Quality →Perceived Usefulness	0.065	Weak	0.580 $^{N.S}$
System Quality →Service Delivery Quality	0.144	Weak	1.020 $^{N.S}$
System Quality →User Satisfaction	0.500	Strong	5.694***
User Satisfaction →Customer Value	0.246	Moderate	2.993**
User Satisfaction →Organisational Value	0.292	Moderate	2.716**

*significant at level 0.05 ** Significant at level 0.01; *** significant at level 0.001; N.S not significant

The R^2 shows the proportion of the dependent variable which is explained by the independent variables. Table 6.6 depicts R^2 values in the model.

Table 6.6 R^2 values in the model of academic staff

Endogenous factors	Exogenous factors	R^2	R^2 Power
IT Infrastructure services	System quality	0.061	Weak
IT Infrastructure services /System quality	Information quality	0.559	Moderate
IT Infrastructure services /System quality/ Information quality	SDQ	0.495	Moderate
IT Infrastructure services /System quality/information quality /SDQ	Perceived usefulness	0.503	Moderate
IT Infrastructure services /System quality/Information quality/SDQ/Perceived usefulness	User satisfaction	0.720	Substantial
SDQ/Perceived usefulness/User satisfaction	Customer value	0.581	Moderate
SDQ/Perceived usefulness/User satisfaction	Organisational value	0.553	Moderate

The results of testing the model using PLS confirm the significant role of IT infrastructure services in systems quality of the e-learning system (β 0.261, t-value 2.716, P 0.01). The value of R^2 was 0.061, in other words 6 percent of the variance in e-learning systems quality can be explained by the IT infrastructure services.

Two constructs were the main determinants of information quality: IT infrastructure services and systems quality. The impact of system quality on information quality was the strongest in the model (β 0.710, t-value 14.659, P 0.001). IT infrastructure services significantly affected information quality (β 0.199, t-value 1.746, P 0.05). IT infrastructure services and system quality explained 55.9 percent of the variance in information quality of e-learning systems.

Service delivery quality plays a central role in the proposed model. Three constructs were assumed to be determinants of service delivery quality: IT infrastructure services; system quality; and information quality. The impact of IT infrastructure services and information quality on service delivery quality were significant and the regression results were (β 0.433, t-value 5.928, P 0.001) and (β 0.323, t-value 3.029, P 0.01) respectively. However, system quality had minimal significant impact on service delivery quality (β 0.144, t-value 1.020, P 0.05). These three constructs explained 49.5 percent of the variance in service delivery quality. This percentage shows the crucial role of these constructs in delivering high quality educational services to students via e-learning systems.

Four endogenous factors were hypothesised as determinants of perceived usefulness: IT infrastructure services; system quality; information quality; and service delivery quality. These factors explain 50.3 percent of the variance in perceived usefulness. Two endogenous factors significantly impacted perceived usefulness: information quality (β 0.464, t-value 4.402, P 0.001); and service delivery quality (β 0.186, t-value 2.046, P 0.05). However, the impact of IT infrastructure services and system quality on perceived usefulness was not significant (β 0.139, t-value 1.539, P 0.05) and (β 0.065, t-value 0.580, P 0.05) respectively.

User satisfaction is a key indicator in measuring e-learning systems success. In this study, user satisfaction is assumed to be a result of five constructs: IT infrastructure services; system quality; information quality; service delivery quality; and perceived usefulness. These five endogenous factors explained 72 percent of the variance in user satisfaction. Three factors significantly affected user satisfaction and the results were system quality (β 0.500, t-value 5.694, P 0.001), information quality (β 0.270, t-value 3.790, P 0.001), and service delivery quality (β 0.188, t-value 2.223, P 0.01). However, the influence of IT infrastructure services and perceived usefulness on user satisfaction was not significant and the results were (β -0.094, t-value 1.379, P 0.05) and (β 0.053, t-value 0.766, P 0.05) respectively.

Customer value and organisational value are the exogenous factors in the proposed model, and it is assumed that both are affected by three endogenous factors: service delivery quality; perceived usefulness; and user satisfaction. The variance in customer value explained 58.1 percent of these endogenous factors. Furthermore, those three factors significantly impacted customer value: service delivery quality (β 0.276, t-value 2.859, P 0.01); perceived usefulness (β 0.380, t-value 4.428, P 0.001); and user satisfaction (β 0.246, t-value 2.993, P 0.01). In regard to organisational value, 55.3 percent of the variance in this exogenous factor is explained by the three endogenous factors. Service delivery quality, perceived usefulness, and user satisfaction significantly impacted organisational value and the results were (β 0.402, t-value 3.540, P 0.001), (β 0.185, t-value 1.929, P 0.05), (β 0.292, t-value 2.716, P 0.01) respectively.

These results were the outcome of testing the whole model without consideration of the mediation role in service delivery quality. Therefore, the next stages allocated to test the mediation and to obtain the final model.

6.4.3. Third stage: Testing the mediation of SDQ on perceived usefulness

The study hypothesized that the effect of IT infrastructure services, system quality and information quality on perceived usefulness is mediated by service delivery quality. The two steps proposed by Hair et al. (2010) are adopted in this study to test the mediation. The first step is examining the necessary individual relationships between the predictor, mediation and dependent factors that must be significant (conditions 1 to 3 in Baron & Kenny 1986). Accordingly, IT infrastructure services, system quality and information quality (predictor factors) must significantly affect perceived usefulness (independent factor) and service delivery quality (mediation factor). In addition, service delivery quality must significantly impact perceived usefulness. The results of testing the relationships between the predictor, mediation, and dependent factors confirm that the three conditions were achieved and the results are shown in Table 6.7.

Table 6.7 Results of testing mediation role of SDQ between the predictor factors and perceived usefulness for academic staff sample

Relationships	coefficient	t-value	Conditions
IT Infrastructure Services → Perceived Usefulness	0.403	4.469***	First condition
System Quality → Perceived Usefulness	0.542	5.862***	
Information Quality → Perceived Usefulness	0.508	5.739***	
IT Infrastructure Services →SDQ	0.562	7.059***	Second condition
System Quality →SDQ	0.488	5.058***	
Information Quality →SDQ	0.554	6.581***	
SDQ → Perceived Usefulness	0.554	7.442***	Third condition

*significant at level 0.05 ** Significant at level 0.01; *** significant at level 0.001; N.S not significant

The second step of testing mediation comprises two sub steps. The first of these sub-steps is testing the initial model with only the direct influence of the predictor factors (IT infrastructure services, system quality, and information quality) on the dependent factor (perceived usefulness). The findings of the test show that the effects of IT infrastructure services and information quality on perceived usefulness were significant. However, the effect of system quality on perceived usefulness was non-significant. The results of testing the initial model with only the direct impact of predictor factors on the independent factor are depicted in Figure 6. 3. The results of regression analysis of the initial model without mediation paths for Academic staff are shown in Table 6.8.

Figure 6. 3 Results of regression analysis of the initial model without mediation paths for Acadmic staff sample

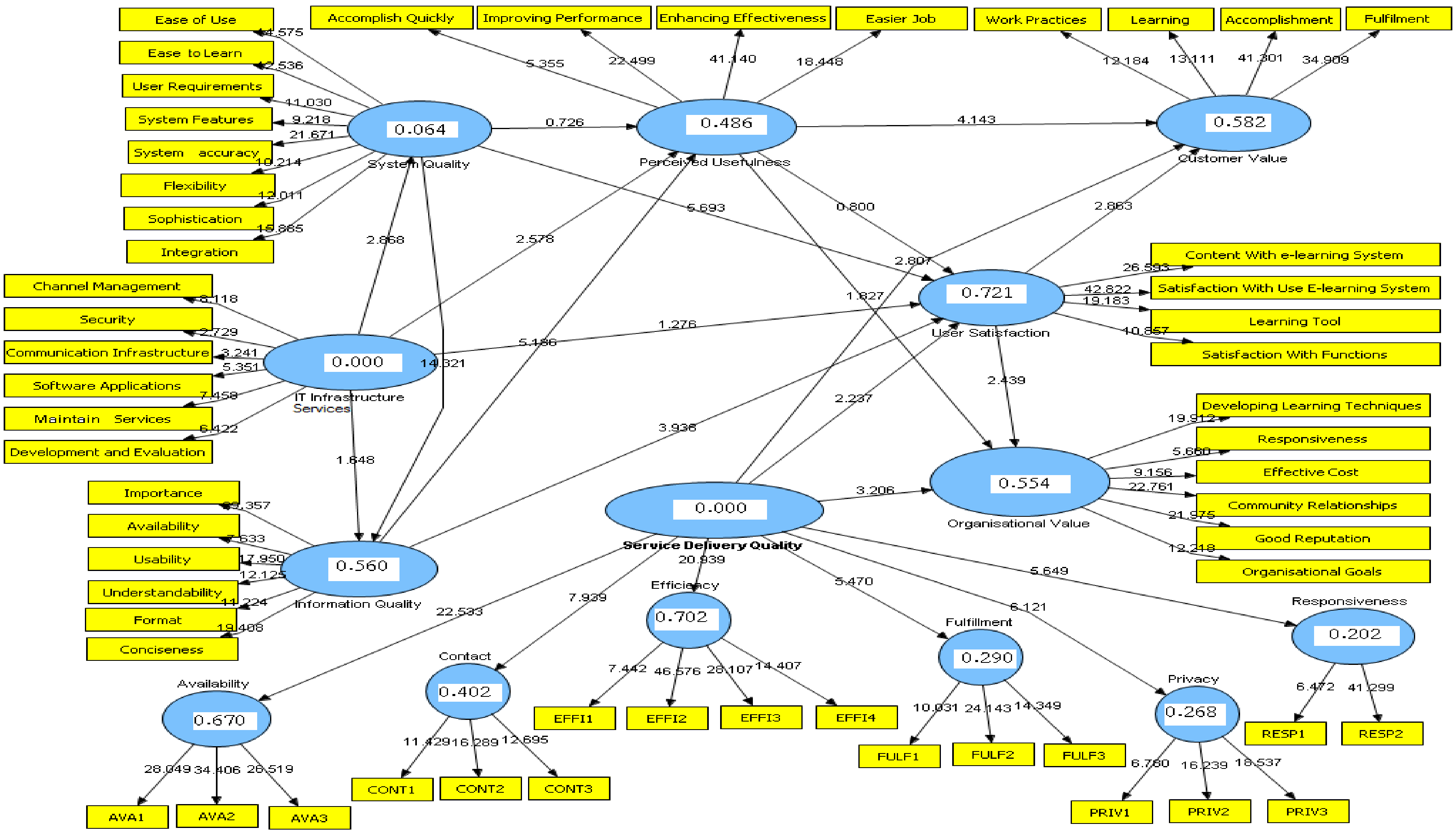


Table 6.8 Regression results of testing the initial model of SDQ mediation for Academic staff sample (Perceived Usefulness)

Relationships	Path Coefficients	Strength	t-value
IT Infrastructure →Information Quality	0.123	Weak	1.647 N.S
IT Infrastructure →Perceived Usefulness	0.227	Moderate	2.578**
IT Infrastructure →System Quality	0.289	Moderate	2.868**
IT Infrastructure →User Satisfaction	-0.085	Weak	1.275 N.S
Information Quality →Perceived Usefulness	0.520	Strong	5.186***
Information Quality →User Satisfaction	0.277	Moderate	3.938***
Perceived Usefulness →Customer Value	0.385	Moderate	4.143***
Perceived Usefulness →Organisational Value	0.195	Weak	1.826*
Perceived Usefulness →User Satisfaction	0.060	Weak	0.799 N.S
Service Delivery Quality → Customer Value	0.280	Moderate	2.807**
Service Delivery Quality →Organisational Value	0.391	Moderate	3.206**
Service Delivery Quality →User Satisfaction	0.179	Weak	2.237**
System Quality →Information Quality	0.709	Strong	14.320***
System Quality →Perceived Usefulness	0.088	Weak	0.726 N.S
System Quality →User Satisfaction	0.493	Moderate	5.692***
User Satisfaction →Customer Value	0.240	Moderate	2.862**
User Satisfaction →Organisational Value	0.293	Moderate	2.438**

*significant at level 0.05 ** Significant at level 0.01; *** significant at level 0.001; N.S not significant

The second sub step involves estimating a second model that includes the mediating variable, the effect of the predictor factor on the mediator, and the effect of the mediator on the dependent variable. Sub-step (2) was already tested and the results are shown in Figure 6.2 and Table 6.5.

A comparison between the results of the two models (without mediation and with mediation) was conducted and the results are depicted in Table 6.9.

Table 6.9 Comparison between the initial model without mediation and initial model with mediation (SDQ) for academic staff sample

Relationships			Initial model without mediation		Initial model with mediation	
			coefficient	t-value	coefficient	t-value
Perceived Usefulness	←	IT Infrastructure Services	0.222	2.578**	0.137	1.478 N.S
Perceived Usefulness	←	System Quality	0.092	0.726 N.S	0.064	0.570 N.S
Perceived Usefulness	←	Information Quality	0.513	5.186***	0.458	4.602***
SDQ	←	IT Infrastructure Services	-	-	0.435	5.871***
SDQ	←	System Quality	-	-	0.137	0.984 N.S
SDQ	←	Information Quality	-	-	0.322	3.175***
Perceived Usefulness	←	SDQ	-	-	0.190	2.020*

*significant at level 0.05 ** Significant at level 0.01; *** significant at level 0.001; N.S not significant

The results indicate that significant changes occurred in the effect of the IT infrastructure services on perceived usefulness. This effect was significant in the initial model and became non-significant when the mediation path was added to the model. This significant change confirmed that the effect of IT infrastructure on perceived usefulness is fully mediated by service delivery quality.

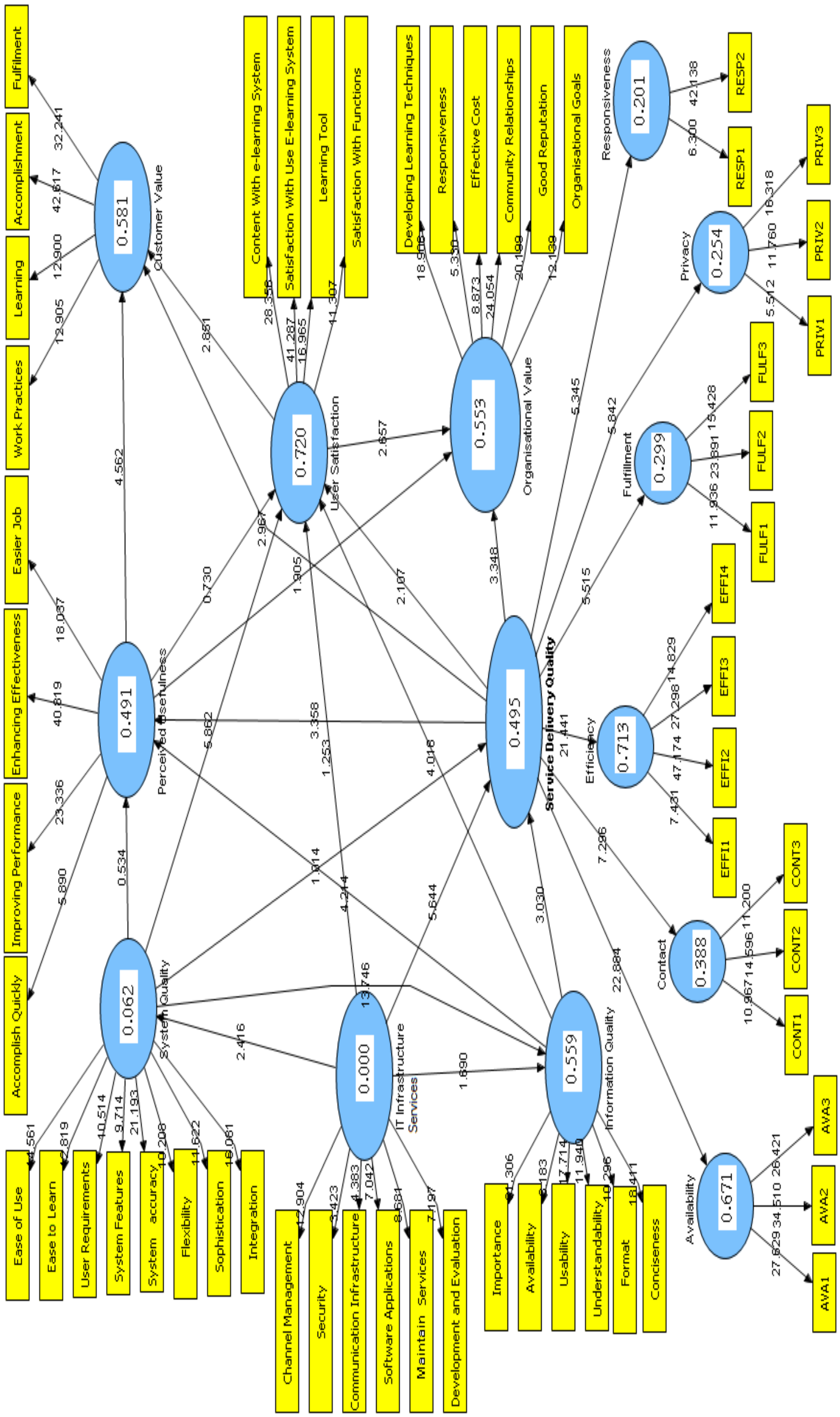
The relationship between information quality and perceived usefulness is reduced after adding the mediation factor to the model, but still significant. In this regard, Hair et al. state that 'If C, *the effect of predictor factor on dependent factor*, is reduced but remains significant when M, *mediator factor*, is included as an additional predictor, then partial mediation is supported' (2010, p. 752). Accordingly, the impact of information quality on perceived usefulness is partially mediated by service delivery quality. However, the impact of system quality on perceived usefulness did not change after adding the mediation factor and remains non-significant. Thus, the mediation role of service delivery quality between system quality and perceived usefulness is not supported. Table 6.10 depicts the results of regression analysis between the constructs of the model. Figure 6.4 shows the final model after considering the above findings.

Table 6.10 Results of conducting the model after testing the mediation role of SDQ for academic staff sample (Perceived Usefulness)

Relationships	Path Coefficients	Strength	t-value
IT Infrastructure Services→Information Quality	0.122	Weak	1.689*
IT Infrastructure Services →Service Delivery Quality	0.435	Moderate	5.644***
IT Infrastructure Services →System Quality	0.264	Moderate	2.415**
IT Infrastructure Services →User Satisfaction	-0.089	Weak	1.253 N.S
Information Quality →Perceived Usefulness	0.464	Moderate	4.214***
Information Quality →Service Delivery Quality	0.318	Moderate	3.030**
Information Quality →User Satisfaction	0.275	Moderate	4.017***
Perceived Usefulness →Customer Value	0.385	Moderate	4.562***
Perceived Usefulness →Organisational Value	0.188	Weak	1.905*
Perceived Usefulness →User Satisfaction	0.054	Weak	0.729 N.S
Service Delivery Quality →Customer Value	0.276	Moderate	2.967**
Service Delivery Quality →Organisational Value	0.404	Moderate	3.348***
Service Delivery Quality →Perceived Usefulness	0.263	Moderate	3.358***
Service Delivery Quality →User Satisfaction	0.182	Weak	2.107*
System Quality →Information Quality	0.704	Strong	13.745***
System Quality →Perceived Usefulness	0.065	Weak	0.533 N.S
System Quality →Service Delivery Quality	0.143	Weak	1.014 N.S
System Quality →User Satisfaction	0.497	Moderate	5.861***
User Satisfaction →Customer Value	0.240	Moderate	2.851**
User Satisfaction →Organisational Value	0.287	Moderate	2.656**

*significant at level 0.05 ** Significant at level 0.01; *** significant at level 0.001; N.S not significant

Figure 6.4 Results of conducting the model after testing the mediation role of SDQ



6.4.4. Testing the mediation of SDQ on user satisfaction

The same procedures were performed to test the mediation role of service delivery quality between the IT infrastructure services, systems quality, and information quality, as predictor factors, and user satisfaction as the dependent factor.

At the first step the individual relationships between the factors were examined and the results are shown in Table 6.11.

The first condition emphasises the impact of the predictor factors (IT infrastructure services, system quality, and information quality) on the dependent factor (user satisfaction). The outcomes of testing these relationships were significant, except the direct effect of IT infrastructure services on user satisfaction. The second condition focuses on the effect of the predictor factors on the mediator factor (service delivery quality). The results of analysis show that the three predictor factors were significantly influenced by the mediator factor and these results confirmed achieving the second condition. The third condition relates to the impact of the mediator factor on the dependent factor. The third condition was achieved due to the significant effect of service delivery quality on user satisfaction.

Table 6.11 Results of testing mediation role of SDQ between the predictor factors and user satisfaction

Relationships	Coefficient	t-value	Conditions
IT Infrastructure Services → User satisfaction	0.021	0.226$^{N.S}$	First condition
System Quality → User satisfaction	0.697	10.141***	
Information Quality → User satisfaction	0.674	10.173***	
IT Infrastructure Services →SDQ	0.599	6.718***	Second condition
System Quality →SDQ	0.489	5.107***	
Information Quality →SDQ	0.561	6.846***	
SDQ → User satisfaction	0.348	2.991**	Third condition

*significant at level 0.05 ** Significant at level 0.01; *** significant at level 0.001; N.S not significant

The second step of testing mediation comprised two sub steps—firstly testing the initial model with only the direct effect of the predictor factors (IT infrastructure services, system quality, and information quality) on the dependent factor (user satisfaction). The outcomes of the examination of the initial model show that the effects of system quality and information quality on user satisfaction were significant. However, the effect of IT infrastructure services on user satisfaction was not significant. The outcomes of examining the initial model with only the direct effect of predictor factors on independent factors are depicted in Figure 6. 5 and Table 6.12.

Figure 6. 5 Results of regression analysis of the initial model without mediation paths of user satisfaction for Academic staff sample

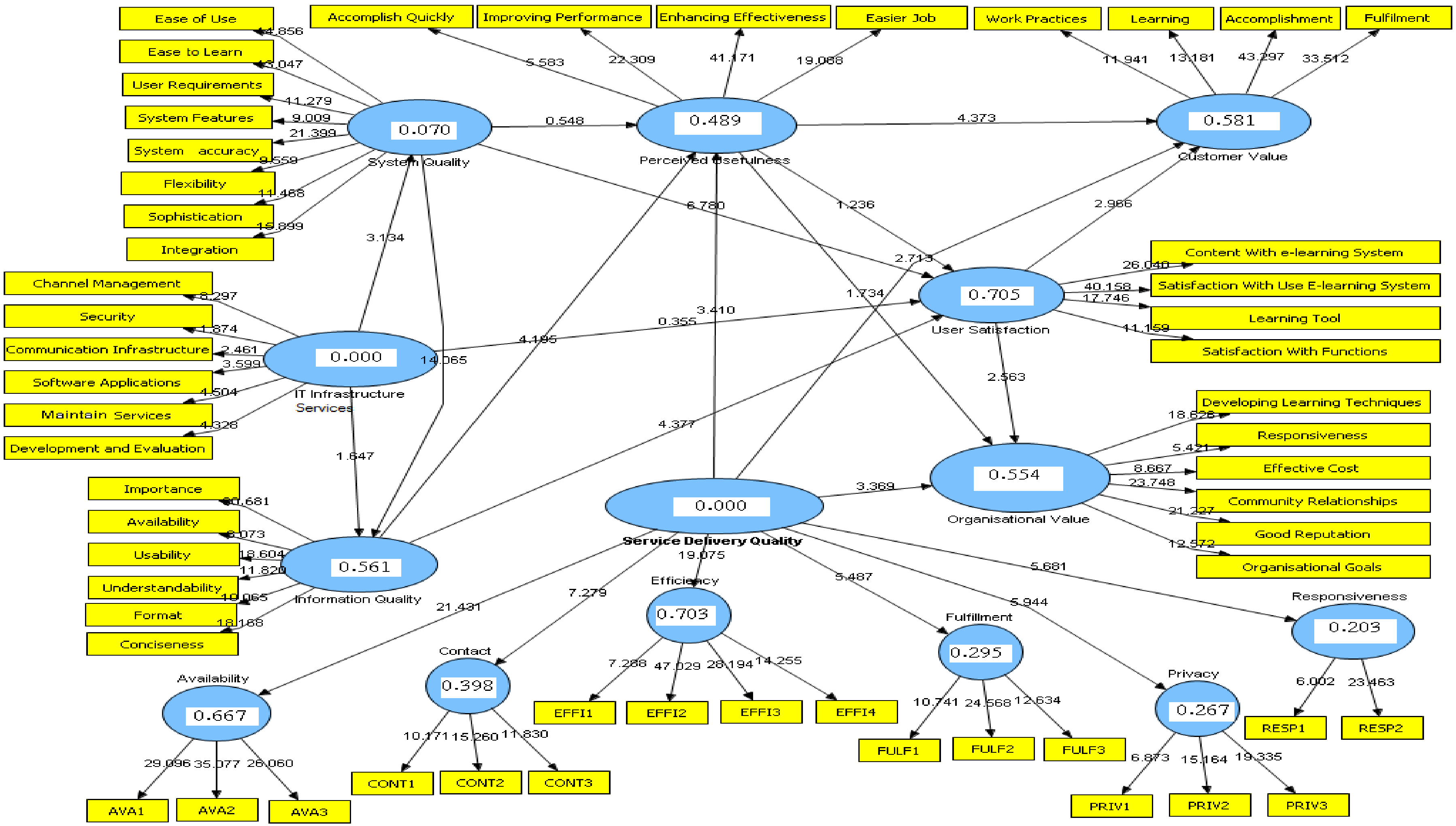


Table 6.12 Results of regression analysis of the initial model without mediation (User Satisfaction)

Relationships	Path Coefficients	Strength	t-value
IT Infrastructure Services →Information Quality	0.129	Weak	1.647 N.S
IT Infrastructure Services →System Quality	0.292	Moderate	3.134***
IT Infrastructure Services →User Satisfaction	-0.008	Weak	0.355 N.S
Information Quality →Perceived Usefulness	0.454	Moderate	4.195***
Information Quality →User Satisfaction	0.310	Moderate	4.376***
Perceived Usefulness →Customer Value	0.388	Moderate	4.372***
Perceived Usefulness →Organisational Value	0.198	Weak	1.733*
Perceived Usefulness →User Satisfaction	0.077	Weak	1.236 N.S
Service Delivery Quality →Customer Value	0.270	Moderate	2.713**
Service Delivery Quality →Organisational Value	0.390	Moderate	3.368***
Service Delivery Quality →Perceived Usefulness	0.266	Moderate	3.410***
System Quality →Information Quality	0.704	Strong	14.064***
System Quality →Perceived Usefulness	0.075	Weak	0.548 N.S
System Quality →User Satisfaction	0.533	Strong	6.780***
User Satisfaction →Customer Value	0.243	Moderate	2.966**
User Satisfaction →Organisational Value	0.294	Moderate	2.562**

*significant at level 0.05; ** Significant at level 0.01; *** significant at level 0.001; N.S not significant

A comparison between the results of the two models (without mediation and with mediation) was conducted and the results are shown in Table 6.13. This comparison depicts the changes that occurred due to the addition of the mediator variable (service delivery quality), the paths of IT infrastructure services, system quality, and information quality effects on user satisfaction, and the path of service delivery quality impact on user satisfaction.

Table 6.13 Comparison between the initial model without mediation and initial model with mediation (User satisfaction)

Relationships			Initial model without mediation		Initial model with mediation	
			coefficient	t-value	coefficient	t-value
User Satisfaction	←	IT Infrastructure Services	-0.008	0.355 N.S	0.089	1.253 N.S
User Satisfaction	←	System Quality	0.533	6.780***	0.497	5.861***
User Satisfaction	←	Information Quality	0.310	4.376***	0.275	4.017***
SDQ	←	IT Infrastructure Services	-	-	0.435	5.644***
SDQ	←	System Quality	-	-	0.143	1.014 N.S
SDQ	←	Information Quality	-	-	0.318	3.030**
User Satisfaction	←	SDQ	-	-	0.182	2.107*

*significant at level 0.05; ** Significant at level 0.01; *** significant at level 0.001; N.S not significant

The results indicate that the impact of system quality and information quality on user satisfaction were reduced after adding the mediation factor. Accordingly, the partial mediation is supported in this case (Baron & Kenny, 1986; Fritz & MacKinnon, 2007; Hair et al., 2010). The impact of system quality and information quality on user satisfaction is partially mediated by service delivery quality. However, the impact of IT infrastructure services on user satisfaction did not change after adding the mediation factor, and remains non-significant. Thus, the mediation role of service delivery quality between IT infrastructure services and user satisfaction is not supported.

Based on these results, the model is shown in Figure 6.4 and the results in Table 6.10 are the final model of academic staff sample.

The mediation role of service delivery quality between the predictor factors (IT infrastructure services, system quality and information quality) and the independent factors (perceived usefulness and user satisfaction) was tested and the model was mis-specified according to the outcome of these tests.

After examining the direct affect among the construct of the study model and testing the mediation role of service delivery quality, the indicators of evaluating the validation of the final structural model were tested. Three indicators were used to achieve this purpose and the results are shown in Table 6.14.

Table 6.14 Indicators of evaluation the final structral model of academic staff

Constructs	R^2	R^2 Power	Predicative relevance Q^2	GoF
Availability	.671	Substantial	.496	0.500
Contact	.388	Moderate	.237	
Efficiency	.713	Substantial	.440	
Fulfillment	.299	Weak	.192	
Privacy	.254	Weak	.156	
Responsiveness	.201	Weak	.129	
IT Infrastructure services	-	-	-	
System Quality	.062	Weak	.032	
Information Quality	.559	Moderate	.305	
Perceived Usefulness	.491	Moderate	.295	
Service Delivery Quality	.495	Moderate	.140	
User Satisfaction	.720	Substantial	.486	
Customer Value	.581	Moderate	.369	
Organisational Value	.553	Moderate	.301	

The indicators shown in Table 6.14 highlight that the model achieved a good validation because all the values of Predicative relevance Q2 exceeded zero and the GoF was 0.500. These two indicators confirmed the quality of the model. Regarding R^2, these values did not change after testing the mediation role of service quality. The changes conducted on the model were limited to eliminate the direct impact of IT infrastructure services on perceived usefulness because this effect is fully mediated by service delivery quality.

The explained variance of the system was 6.2 percent and this percentage is explained by IT infrastructure services. However, this percentage is the lowest among all the others in the model. The explained variance of user satisfaction was the highest in the model: 72 percent. Five constructs contributed to this percentage: IT infrastructure services; system quality; information quality; service delivery quality; and perceived usefulness. The variance information quality, perceived usefulness, service delivery quality, customer value and organisational value were explained by 55.9, 49.1, 49.5, 58.1 and 55.3 percent respectively.

6.5. Outcomes of hypotheses tests

IT infrastructure services were assumed to be a determinant of five constructs: system quality; information quality; service delivery quality; perceived usefulness, and user satisfaction. The results confirm the significant and direct impact of IT infrastructure services on system quality, information quality, and service delivery quality, and the regression results were (β 0.264, t-value 2.415, P 0.01), (β 0.122, t-value 1.689, P 0.05), and (β 0.435, t-value 5.644, P 0.001) respectively. These results supported three hypotheses: (H1) '*IT Infrastructure Services significantly and directly affects System Quality'*; (H2) *'IT Infrastructure Services significantly and directly affects Information Quality'* and (H3) '*IT Infrastructure Services significantly and directly affects Service Delivery Quality'*. The analysis of results examined the mediation role of service delivery quality between IT infrastructure services and perceived usefulness and confirmed the direct and significant influence of IT infrastructure services on perceived usefulness. The regression outcomes were (β 0.227, t-value 2.578, P 0.05). Hence, hypothesis (H4) '*IT Infrastructure Services significantly and directly affects Perceived Usefulness'* is accepted. However, the direct effect of IT infrastructure services on user satisfaction was not significant and the regression results were (β -0.089, t-value 1.253, P 0.05). Based on these results, (H5) '*IT Infrastructure Services significantly and directly affects User Satisfaction'* is rejected.

According to the proposed model in this study, system quality directly and significantly influences four factors: information quality; service delivery quality; perceived usefulness; and user satisfaction. Information quality and user satisfaction were directly and significantly affected by system quality and the regression results were (β 0.704, t-value 13.745, P 0.001) and (β .497, t-value 5.861, P 0.001) respectively. Accordingly, two hypotheses were accepted: (H6) '*System Quality significantly and directly affects Information Quality'* and (H9) '*System Quality significantly and directly affects User satisfaction'*. The outcomes of testing the effect of system quality on service delivery quality and perceived usefulness show that the impact of system quality on these two constructs was not significant and the results of regression analysis were (β 0.143, t-value 1.014, P 0.05) and (β 0.065, t-value 0.533, P 0.05). These results do not support two hypotheses: (H7) '*System Quality significantly and directly affects Service Delivery Quality'* and (H8) *'System Quality significantly and directly affects Perceived Usefulness'*.

Information quality is hypothesized to be a determinant of three constructs: service delivery quality; perceived usefulness; and user satisfaction. The outcomes of regression analysis support the significant and direct effect of information quality on these three constructs and the results were (β 0.318, t-value 3.030, P 0.01), (β 0.464, t-value 4.214, P 0.001), and (β 0.275, t-value 4.017, P 0.001) respectively. According to these results three hypotheses were accepted: (H10) '*Information Quality significantly and directly affects Service Delivery Quality';* (H11) *'Information Quality significantly and directly affects Perceived Usefulness'*; and (H12) '*Information Quality significantly and directly affects User Satisfaction'.*

Perceived usefulness, user satisfaction, customer value, and organisational value are assumed to be influenced by service delivery quality. The regression results highlight that all four constructs were significantly and directly influenced by service delivery quality. The regression outcomes of service delivery quality impacts were (perceived usefulness β 0.263, t-value 3.358, P 0.001), (user satisfaction β 0.182, t-value 2.107, P 0.05), (customer value β 0.276, t-value 2.967, P 0.01), and (organisational value β 0.404, t-value 3.348, P 0.001). Consequently, four hypotheses were supported: (H13) '*Service Delivery Quality significantly and directly affects Perceived*

Usefulness'; (H14) *'Service Delivery Quality significantly and directly affects User Satisfaction';* (H15) '*Service Delivery Quality significantly and directly affects Customer Value' and* (H16) '*Service Delivery Quality significantly and directly affects Organisational Value'.*

The direct impact of perceived usefulness on user satisfaction, customer value, and organisational value was examined and the results were (β 0.054, t-value 0.729, P 0.05), (β 0.385, t-value 4.562, P 0.001), and (β 0.188, t-value 1.905, P 0.05) respectively. Based on these consequences, two hypotheses were accepted: (H18) *'Perceived Usefulness significantly and directly affects Customer Value' and* (H19) *'Perceived Usefulness significantly and directly affects Organisational Value';* and one was rejected: (H17) '*Perceived Usefulness significantly and directly affects User Satisfaction'.*

User satisfaction was embraced in the study model to be a determinant of customer value and organisational value. The regression outcomes of user satisfaction on user customer value and organisational value were (β 0.240, t-value 2.851, P 0.01) and (β 0.287, t-value 2.656, P 0.01). According to these results, two hypotheses are supported: (H20) *'User Satisfaction significantly and directly affects Customer Value' and* (H21) *'User Satisfaction significantly and directly affects Organisational Value'.*

The hypotheses of mediation role of service delivery quality between the predictor factors (IT infrastructure services, system quality, and information) and the dependent factors (perceived usefulness and user satisfaction) were examined in this section.

The consequences of mediation analysis indicated that the impact of IT infrastructure services on perceived usefulness is fully mediated by service delivery quality. Furthermore, the impact of information quality on perceived usefulness is partially mediated by service delivery quality. These results of mediation analysis lead to accepting two hypotheses: (H22) '*The effect of IT Infrastructure Services on Perceived Usefulness is mediated by Service Delivery Quality'* and (H24) '*The effect of Information Quality on Perceived Usefulness is mediated by Service Delivery Quality'*. However, service delivery quality does not play a mediating role between system quality and perceived usefulness. Thus, hypothesis (H23) '*The effect of*

System Quality on Perceived Usefulness is mediated by Service Delivery Quality' is rejected.

The influence of IT infrastructure services, system quality, and information quality on user satisfaction mediated by service delivery quality was examined. The results of mediation tests confirm that the impact of system quality and information quality on user satisfaction is partially mediated by service delivery quality. Accordingly, two hypotheses were accepted: (H26) '*The effect of System Quality on User Satisfaction is mediated by Service Delivery Quality'* and (H27) '*The effect of Information Quality on User Satisfaction is mediated by Service Delivery Quality'.* However, the outcome of mediation tests indicated that the impact of IT infrastructure services on user satisfaction is not mediated by service delivery quality. Therefore, the hypothesis that (H25) '*The effect of IT infrastructure services on User Satisfaction is mediated by Service Delivery Quality'* is rejected.

6.6. Content analysis of comments from academic staff

Content analysis was employed to analyse the comments of academic staff relating to factors that may affect the success of the e-learning system. The main purpose of this analysis is to identify and classify the main issues faced by academic staff regarding e-learning systems and the factors impacting on the success of this system.

Only one item in the questionnaire was an open ended question: 'Please write any comments about the factors affecting e-learning system success'. The comments received from academic staff were analysed using content analysis to identify and categorise the most frequent keywords based on the comments of the surveyed academic staff.

Twenty three academic staff members from 110 respondents answered the optional open ended question with 54 comments on different constructs of e-learning systems. Conducting content analysis on these comments indicated a range of issues and factors influencing e-learning system success. Table 6.15 shows the themes and sub-themes collected from the analysis of comments by academic staff. The factors that emerged from content analysis are as follows.

Table 6.15 Themes and sub-themes of content analysis of academic staff comments

Themes	Sub theme	Frequency and percentage		Direction of comments			
		F	%	Negative		Positive	
				F	%	F	%
Service delivery quality (20 comments out of 54 comments) 37%	Efficiency	5	25	5	100	-	-
	Responsiveness	3	15	3	100	-	-
	Contact	3	15	2	66.7	1	33.3
	System availability	3	15	3	100	-	-
	Web design	3	15	2	67.7	1	33.3
	Interaction	3	15	3	100	-	-
System quality (16 comments) 29.6%	Ease of use	4	25	3	75	1	25
	System function:	4	25	3	75	1	25
	• Navigation	*2*	*50*	*1*	*50*	*1*	*50*
	• Enrolment	*1*	*25*	*1*	*100*	-	-
	• Overall	*1*	*25*	*1*	*100*	-	-
	Integration	2	12.5	2	100	-	-
	User requirements	2	12.5	2	100	-	-
	Flexibility	2	12.5	2	100	-	-
	Friendliness	1	6.25	1	100	-	-
	Platform incompatibility	1	6.25	1	100	-	-
IT infrastructure services support (7 comments) 13%	-	7	-	7	100	-	-
Usefulness (4comments) 7.4%	-	4	-	-	-	4	100
Skill (4 comments) 7.4%	-	4	-	4	100	-	-
Information quality (2 comments) 3.7%	Availability	1	50	1	100		
	Update	1	50	-	-	1	100
User Satisfaction (1 comment) 1.9%	-	1	-	-	-	1	100

6.6.1. Service delivery quality

This theme received 37 percent of academic staff comments. Their comments about service delivery quality were distributed into six sub- themes: efficiency 25 percent; responsiveness 15 percent; contact 15 percent; system availability 15 percent; web design 15 percent; and interaction 15 percent.

As shown in Table 6.15, efficiency collected 25 percent of academic staff comments relating to service delivery quality. All the comments about this sub-theme were negative, for example, '*Running reports is slow and cumbersome*' (#8); '*Constant* *page loading delays are frustrating*' (#45); and '*Certain aspects, like loading recorded lecture slides, is very long-winded*' (#56).

In the context of responsiveness, academic staff claim that students face problems regarding response time by ICT staff: '*I have forwarded several student questions with study desk problems through to ICT and they never get responded to directly. I only get a response if I do it myself. This doesn't project a good image to students*' (#2). Academic staff members expressed dissatisfaction with the e-learning system because it does not provide them with adequate reporting systems about their correspondence with students, and they cannot deliver assignments to students after marking via the system itself: '*There is nowhere you can find students have received your correspondence successfully or not*' (#68); and '*Would like the ability to return assignment pdf files through Moodle and not having to use EASE as another system to learn and use*' (#75).

Contact was selected by the academic staff as a sub-theme of service delivery. Academic staff perceive that external contact is ineffective: '*The email system is totally perverse and ineffective. Few students actually receive or are aware of emails'* (#8) and *'It would be better if it can be linked to the staff mailbox, and whenever there is a student's inquiry, prompt notice can be given'* (#100). However, some academic staff expressed satisfaction in using the electronic communication channels to interact with students: '*It is also handy for all the students to meet electronically and discuss the unit content and philosophies'* (#30).

Academic staff face problems regarding interaction with students. The limited level of interaction is recognized as an issue impacting on the success of the e-learning system: *'Encouraging student participation is a key issue. Only a few students use the system to full effect. A large percentage only participates if assessment is tied to their participation'* (#10); and *'You cannot be assured the interaction with students has gone well'* (#68).

System availability was identified by academic staff as a critical factor affecting teaching activities. The slow loading of interface pages and system failures in achieving the required outcomes are the main issues faced by academic staff. Responses relating to this issue included: *'Time delays with incidents re study desk availability and information regarding crashes is frustrating for students and staff'*

(#45); and *'Systems such as EASE frequently fail or malfunction, losing settings that have been inserted previously'* (#57).

Academic staff identified web design as a factor influencing the success of the e-learning system. The comments of academic staff focus on shortfalls in the current design and what they see as desirable in the interface, for example, *'Is not a very 'pretty' user interface'* (#2) and *'The ability to see the interface from the students point of view- thus try to continually make the interface user friendly for first time users'* (#21).

6.6.2. System Quality

System quality appeared as a key theme (29.6%) in the comments by academic staff. These comments were distributed into seven sub-themes: ease of use; system functions; integration; user requirement; flexibility; friendly; and platform incompatibility.

Ease of use of e-learning was identified by academic staff as an essential sub-theme of system quality. Some issues encountered by academics relate to ease of use of the e-learning system. In this regard, academic staff state that *'The systems are 'clunky' and time consuming to use. They dictate what I can and can't do even when I want to do something in a way that suits my teaching'* (#8); and '*The previous version of UConnect (USQConnect) was far better and required fewer 'clicks' in order to achieve the goal*' (#56).

The second important sub-theme of system quality identified by academic staff was system function. Academic staff perceived some difficulties in the optimal use of the e-learning system functions. For example, one academic staff member pointed to problems with the navigation function, stating that *'Finding a copy of messages that I send to students using 'participants' is impossible and I don't receive a copy*' (#8). Another academic staff member commented about the problems in the enrolment function: '*And the latest enrolment process is disliked by many students—and staff'* (#56).

One of the important aspects of e-learning system quality is integration. This aspect was recognized by academic staff as an issue encountered in the system. Completing tasks quickly can be supported by integrating the e-learning system with other software and systems. However, academic staff claim there is disparity in the integration between the e-learning system and other software: '*It is a nightmare of a system for a new user. It is not integrated into EASE. It is not integrated into Turnitin'* (#8); and *'Integration with ICE courseware development requires training and can be constraining'* (#45).

Academic staff also offered opinions on the flexibility of the e-learning system as some of the problems encountered subsequently reduce the effectiveness of using this system: *'Increasing divisional separation within the organisational structure has increased the inflexibility of the systems management at USQ (from a user perspective, at least), reducing the effectiveness and capacity for responsive adaptation within the e-learning system in the last couple of years'* (#22).

At times, the e-learning system could not meet the requirements of academic staff in achieving their teaching activities. For example, *'Would be good if there was an easier way to enter mathematics formulas*' (#75).

The final two sub-themes of system quality were user friendliness and platform incompatability. Regarding these two sub-themes, academic staff stated that *'Compared to Blackboard, our system is not very user friendly'* (#2); and *'USQ e-learning system is developed under Moodle source code which is not well supported by all systems and devices for students to use. Most of universities are using BlackBoard as e-learning tool to provide full functions of activity and to support all types of mobile/computer device to their students such as QUT, UQ and Griffith Universities'* (#110).

6.6.3. IT infrastructure services support

Thirteen percent of comments by academic staff focused on support. Some comments about this theme indicated that there is a shortfall in the support offered to academic staff: '*Inadequate infrastructure to support the e-Learning system causes delays and occasionally failures that causes stress and anxiety to academics and students alike'* (#39). Furthermore, some academic staff believe there is insufficient support provided to modify the courses: *'No consideration or support is offered to the students' learning outcomes or the academics need to modify the administration of the courses'* (#60). Other comments criticized the support provided by the ICT division, for example, '*Modifications and improvements to systems are not made quickly enough due to internal ICT policies over-riding the needs of academic staff.*

No after-hours support is provided for teaching activities on weekends' (#57); and *'It also has very limited staff and student support. As far as I am aware there are only two people in the University that support Study Desk*' (#2).

6.6.4. Perceived usefulness

This theme elicited by four positive comments from academic staff: '*I think the e-learning system has some use when I'm teaching English to international students. It is a useful tool*' (#15); '*The system has a few bugs but overall it is an asset in teaching my internal and external students*' (#30); '*That said, for 80% of the time, it does what it is supposed to do and is useful*' (#45); and '*E-learning system is very useful for task accomplishment both for student and teachers/examiners*' (#97).
These comments indicate that academic staff use the e-learning system in accomplishing their educational tasks and feel it is a useful system in achieving this goal.

6.6.5. Skill

This theme is represented by 7.4 percent of comments received from academic staff. The comments focus on skill as a determinant in the success of e-learning systems: *'Computer literacy in English is difficult for students whose first language isn't English'* (#15); *'Sound digital literacy skills'* (#21); and *'Personal skills in using computers'* (#99).

6.6.6. Information quality

Two comments were offered by academic staff in relation to information quality. The first comment emphasised the availability of information and was negative: *'In some instances, the study desk is not 'intuitive' and it is hard to find some information—for example, how many students are enrolled in a course'* (#5). The second comment focused on the positive role of the e-learning system in enabling academic staff to provide students with updated information: *'It allows me to give my students current information related to their field of study'* (#30).

6.6.7. User satisfaction

Only one comment emphasised user satisfaction: '*I am enjoying the study desk and what it has to offer*' (#5).

6.7. Chapter summary

This chapter detailed the method undertaken to test the study in the context of the academic staff sample. The perceptions of academic staff and missing data were presented in the first part of this chapter: descriptive statistics. Procedures for treating missing data and testing for normality were detailed at the second part of chapter six. The third section of the chapter included two key sub-parts: firstly, the testing of the measurement model of the academic staff sample and testing the validity and reliability of the items and constructs. The second sub-part focused on testing the study model and hypotheses of the study. The results of testing the study model using academic staff sample concluded that the model achieved a good quality with this sample. Content analysis was conducted to analyse the comments of Academic staff. The results of content analysis showed that there are seven factors affecting the success of e-learning system: service delivery quality; system quality; support; perceived usefulness; skills; information quality; and user satisfaction.

CHAPTER SEVEN

This chapter reports the analysis of the data from the ICT staff sample. Partial Least Squares Structural Equation Modelling is employed to examine the study model of this sample. Two key stages are used to test the study model: examining the measurement model for ICT staff sample and testing the structural model. Different statistical indicators are used to test the reliability and validity of items and constructs of the study model. Two kinds of relationships are examined: direct effects and the mediation. Furthermore, content analysis was employed to analyse the comments from ICT staff about the factors that impact e-learning system success.

CHAPTER SEVEN: DATA ANALYSIS OF ICT STAFF SAMPLE

7.1. Introduction

ICT staff are believed to be key stakeholders in e-learning systems. ICT staff deal with and contact different stakeholders of e-learning systems such as students and academic staff. The main role of ICT staff regarding e-learning systems is to support and maintain these types of systems. Different tasks are performed by ICT staff, for example, dealing with system problems, updating systems, providing users with consultations, and maintaining the contact network between the different stakeholders of e-learning systems. Therefore, the opinions of ICT staff are useful in evaluating e-learning system success. This chapter is allocated to testing the study model in the context of ICT staff sample.

7.2. Descriptive statistics of ICT staff sample

The statistical descriptive indicators are presented in this section to describe the attitude of ICT staff toward the constructs of the study model. A five-point Likert scale (1 *strongly disagree* as low to 5 *strongly agree* as high) was used in the questionnaire of this study to measure the opinions of respondents about the model constructs. Two more choices were added to the scale: ‘Don’t know’ and ‘Not applicable’ to provide respondents with more alternatives when selecting their most suitable option and to identify non-attitude responses. The missing data and responses of ‘Don’t know’ and ‘Not applicable’ are described in this section. The number of responses in the ICT staff was 22.

The frequency of missing data was extremely low with only two missing values. The ‘Don’t know’ option was selected only twice by respondents. The percentage of ICT respondents selecting the ‘Not applicable’ option was zero. These low percentages of missing data, ‘Don’t know’ and ‘Not applicable’ choices highlight the fact that ICT staff are knowledgeable about the items in the questionnaire and they have experience about the constructs of the study model.

7.2.1. IT infrastructure services

Ten items were used to measure IT infrastructure services. The means of these construct items ranged between 3.181 for ITIS10 and 4.00 for ITIS3, as shown in Appendix H Table H.1. These means indicate that ICT staff have positive attitudes toward IT infrastructure services at the University. ICT staff agree about the availability of a wide range of IT infrastructure services at USQ to support the e-learning system. Regarding the 'Don't know' option, only a one respondent selected this option (in item ITIS8), and the percent of this option is 4.5.

7.2.2. System Quality

Nine items were employed to measure the quality of e-learning systems based on ICT staff perceptions. The descriptive indicators of system quality are shown in Appendix H Table H.2. The means of system quality items ranged between 3.263 for SQ5 and 4.272 for SQ9. The means of four items were more than 4.00 and point to ICT staff strongly agreeing about the quality of the e-learning system: SQ1; SQ2; SQ3; and SQ9. The other items obtained means no less than 3.00 and no more than 3.99 and indicates the agreement of ICT staff about the quality aspects of the e-learning system. Missing data occurred only once in item SQ7, and the percentage is 4.5.

7.2.3. Information quality

Seven items were used to measure the information quality of the e-learning system from the ICT staff's point of view. The items' means of information quality were between 3.454 for IQ5 and 3.772 for IQ1 as shown in Appendix H Table H.3. The items' means of information quality show that ICT staff agree about the existence of quality aspects in the information generated by e-learning system.

7.2.4. Service delivery quality

Service delivery quality includes six sub-dimensions and these sub-dimensions were measured using 20 items: efficiency 4 items; availability 3; fulfilment 3; privacy 3; responsiveness 4; and contact 4. The descriptive indicators of each item are shown in Appendix H Table H.4. The means of SDQ items ranged between 3.136 for EFFI4 and 4.318 for PRIV1. The items' means indicate that ICT staff have a positive attitude toward the service delivery quality of the e-learning system at USQ. One response to the item AVA3 was 'Don't know' and the percent of this choice was 4.5.

7.2.5. Perceived usefulness

Perceived usefulness measured five items as shown in Appendix H Table H.5. The items' means of perceived usefulness ranged between 3.318 for USEF1 and 3.510 for USEF2. The means of perceived usefulness items indicate that ICT staff have positive attitudes toward the role of e-learning systems in enhancing their job performance. Furthermore, the e-learning system enables ICT staff to support the other stakeholders of this system and provide them with the services they needed.

7.2.6. User satisfaction

User satisfaction is considered to be a key construct in the study model. Five items were employed to measure user satisfaction of ICT staff as shown in Appendix H Table H.6. The means of user satisfaction items show that ICT staff positively accepted these items and the means ranged between 3.227 for SATF5 and 3.909 for SATF1.

7.2.7. Customer value

Customer value was used in the study model to identify the value which can be collected by users of e-learning systems due to adopt this system. Five items were used to measure the customer value construct. The lowest mean in this construct collected by CUSV1 was 3.318 and the highest mean gathered by CUSV3 was 3.863, as shown in Appendix H Table H.7. The responses of customer value items indicate that working with e-learning systems can provide ICT staff with value regarding experiences, skill development, and opportunity to employ. In other words, ICT staff feel positively toward the value that can be generated from working in an e-learning systems field.

7.2.8. Organisational value

Benefits can be gained by the University as a result of adopting an e-learning system—as measured using six items. Appendix H Table H.8 depicts the items used to measure the organisational value and a description of each item. According to ICT staff opinions, organisational value can be supported by e-learning systems. The means of organisational value items were between 3.00 for ORGV1 and 4.00 for

ORGV2. These means reflect the positive attitude of ICT staff toward the role of e-learning systems in supporting organisational value.

Regarding outliers, the data collected from the ICT staff were imported electronically from Survey Monkey to SPSS. However, the outliers were checked via frequency distributions and the values were confirmed 1 and 5 (the range of scale used in this study).

Two statistical tests were used to examine the normality: skewness and kurtosis. Appendix H Table H.9 shows the skewness and kurtosis of each item of the ICT staff questionnaire. Based on the criteria +3 -3 and as shown in Appendix H Table H.9, the items used in this study are distributed normally.

7.3. Measurement model of ICT staff sample

Establishing the measurement model can be considered an essential step in the structural equation modelling technique. The importance of this step comes from the role of this step in specifying the indicators for each construct and evaluating the construct validity (Hair et al., 2010). The measurement model also provides indicators about convergent and discriminant validity (Schumacker & Lomax, 2004). The measurement model was conducted with ICT staff data to identify the relationship between the constructs and their observed variables and to identify the weak indicators that do not measure the constructs. Then, testing the reliability and validity was conducted using different statistical indicators.

The measurement model of ICT staff sample includes eight constructs and 67 observed variables: IT infrastructure services (10 observed variables); system quality (9); information quality (7); service delivery quality (21 distributed in six sub-dimensions); perceived usefulness (5); user satisfaction (5); customer value (5); and organisational value (5).

The component-based approach PLS was used to test the study model with the ICT staff sample. This technique is believed to be appropriate for the ICT staff sample (22 respondents) because it has the ability to deal with a small sample size (Urbach & Ahlemann, 2010) and is quite robust for the problem of small sample size (Hsu et al., 2006). The results of testing the measurement model of ICT staff sample are shown in Figure 7. 1 and Table 7.1.

Figure 7. 1 Measurement Model of ICT staff sample (First iteration)

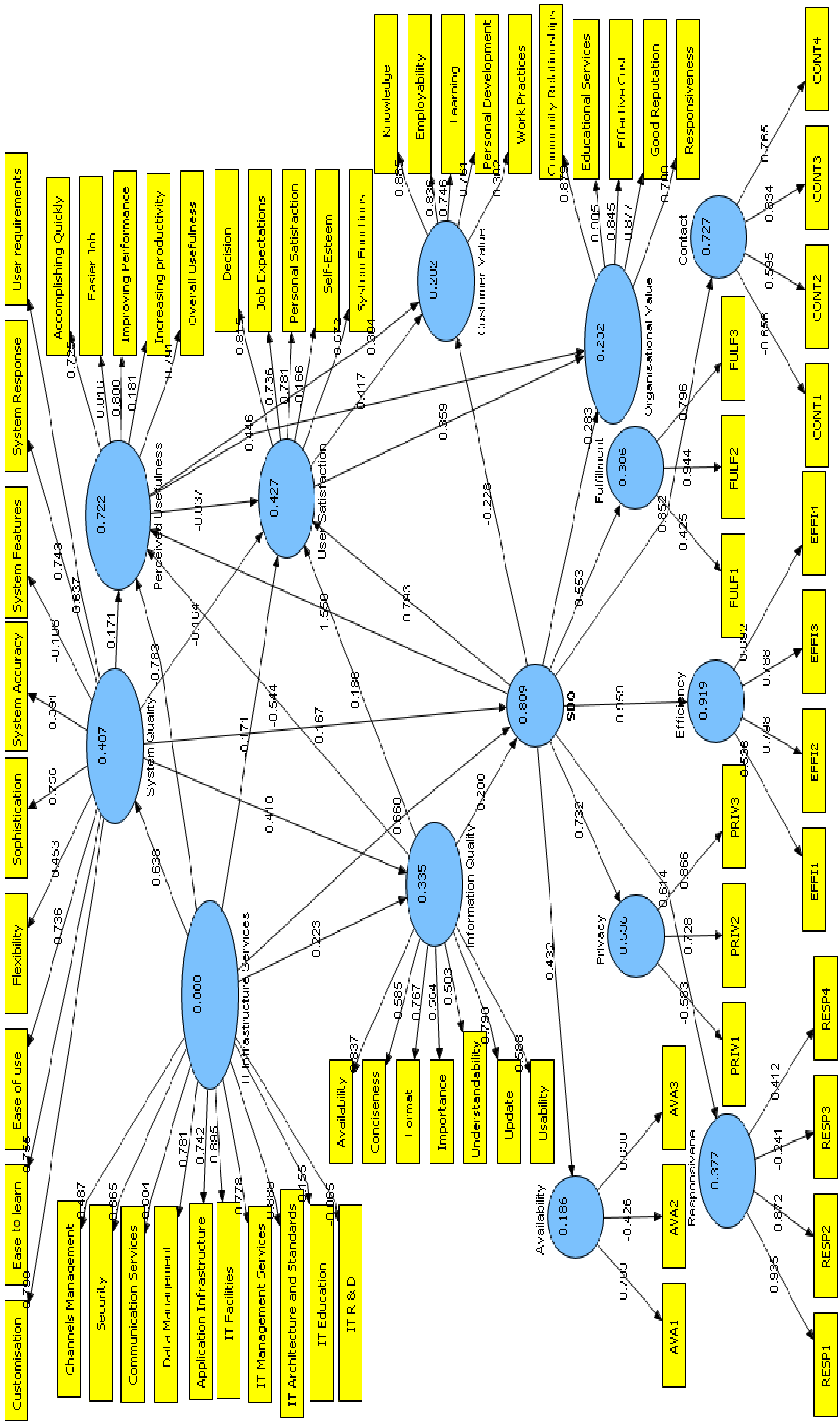


Table 7.1 Factors loading and t-value for ICT staff measurement model

Construct	Aspects/Items	Factor Loading	t-value
IT Infrastructure services	Channels Management	0.487	4.678***
	Security	0.665	4.946***
	communication services	0.684	2.519*
	Data Management	0.781	3.845***
	Application infrastructure	0.742	4.584***
	IT Facilities	0.897	5.408***
	IT management services	0.778	4.221***
	IT architecture and standards	0.888	6.499***
	IT education	0.155	0.556 N.S
	IT research and development	-0.065	0.232 N.S
System Quality	Ease of use	0.736	2.221*
	Ease to learn	0.775	3.001**
	User requirements	0.637	1.766 N.S
	System features	-0.108	0.277 N.S
	System accuracy	0.391	1.239 N.S
	Flexibility	0.453	1.518 N.S
	Sophistication	0.756	3.793***
	Customisation	0.790	3.584***
	System Response	0.743	2.882**
Information Quality	Importance	0.564	2.131*
	Availability	0.837	3.387***
	Usability	0.588	2.113*
	Understandability	0.503	1.480 N.S
	Format	0.767	2.880**
	Conciseness	0.585	2.023*
	Update	0.798	3.216**
Service Delivery Quality	EFFI1	0.536	2.227*
	EFFI2	0.798	4.261***
	EFFI3	0.788	5.954***
	EFFI4	0.692	2.352*
	AVA1	0.783	1.538 N.S
	AVA2	-0.426	0.674 N.S
	AVA3	0.638	1.229 N.S
	FULF1	0.425	1.147 N.S
	FULF2	0.944	4.304***
	FULF3	0.796	2.422*
	PRIV1	-0.583	2.056*
	PRIV2	0.728	3.256**
	PRIV3	0.866	4.766***
	RESP1	0.935	2.385*
	RESP2	0.872	2.211*
	RESP3	-0.241	0.527 N.S
	RESP4	0.412	1.140 N.S
	CONT1	-0.656	2.223*
	CONT2	0.595	2.282*
	CONT3	0.834	6.579***
	CONT4	0.765	2.991**
Perceived Usefulness	Accomplishing Quickly	0.725	2.773**
	Improve performance	0.800	3.225**
	Increasing productivity	0.181	0.506 N.S
	Easier Job	0.816	2.015*
	Overall Usefulness	0.791	1.753 N.S

Construct	Aspects/Items	Factor Loading	t-value
User Satisfaction	Decision	0.815	2.178*
	Job expectations	0.736	3.904***
	System functions	0.672	2.412*
	Personal satisfaction	0.781	3.685***
	Self-esteem	-0.166	0.414 N.S
Customer Value	Work practices	0.302	0.811 N.S
	Personal development	0.761	2.357*
	Learning	0.746	2.404*
	Knowledge	0.885	2.628**
	Employability	0.836	2.061*
Organisational Value	Responsiveness	0.700	3.029**
	Effective Cost	0.845	3.695***
	Community Relationships	0.789	3.918***
	Good Reputation	0.877	3.807***
	Educational Services	0.905	4.161***

*significant at level 0.05 ** Significant at level 0.01; *** significant at level 0.001; N.S not significant

These results show that the relationships between latent constructs and some observed variables were not significant. In other words, the non-significant observed variables are inappropriate to measure the constructs.

These non-significant factors impact the quality of the latent construct used in the model. Table 7.2 depicts the quality criteria of the measurement model at the first iteration. Cross-validated communality H^2 was used to measure the quality of the measurement model. The results of cross-validated communality H^2 for the first iteration of the measurement model are depicted in Table 7.2.

Table 7.2 Indicators of ICT measurement model quality at the first iteration

Constructs	Cronbach's Alpha	Coefficient H	Composite Reliability	AVE	H^2
Availability	0.507	0.714	0.355	0.400	-0.423
Contact	-0.088	0.833	0.549	0.516	0.194
Efficiency	0.664	0.825	0.800	0.505	0.151
Fulfillment	0.591	0.910	0.783	0.568	0.220
Privacy	0.134	0.823	0.426	0.540	0.121
Responsiveness	0.424	0.912	0.646	0.465	0.201
IT Infrastructure Services	0.846	0.929	0.881	0.483	0.324
System Quality	0.791	0.873	0.831	0.403	0.218
Information Quality	0.795	0.881	0.849	0.454	0.214
Perceived Usefulness	0.740	0.868	0.813	0.497	0.262
User Satisfaction	0.750	0.848	0.840	0.569	0.088
Customer Value	0.836	0.897	0.844	0.541	0.081

The indicators in Table 7.2 show that the measurement model of ICT staff has problems related to validity and reliability indicators. AVE should exceed 0.50 and some of the constructs were less than this cut-off: availability 0.40; IT infrastructure services 0.482; information quality 0.454; and system quality 0.403. The composite reliability indicates that availability and privacy are problematic sub-dimensions to measure SDQ because both do not exceed the recommended level and were 0.355 and 0.426 respectively. Cronbach's Alpha also points to problems in the reliability of some constructs in the model: availability 0.507; contact -0.088; efficiency 0.664; fulfilment 0.591; privacy 0.134; and responsiveness 0.424. All the values of cross-validated communality H^2 were more than zero, except availability, and that indicated predictive relevance of the measurement model.

The problems in the reliability of the measurement model should be solved before performing the structural model. Therefore, non-significant observed factors with a loading less than 0.4 were eliminated from the measurement model. One observed factor was eliminated in each iteration, and Table 7.3 shows the eliminated observed variables, factor loading, and the t-value of each one.

Table 7.3 Eliminated items from the measurement model of ICT staff sample

Constructs	Eliminated items	Factor Loading	t-value
IT Infrastructure Services	IT R&D	-0.065	0.232
	IT Education	0.159	0.593
System Quality	System features	-0.117	0.316
	Flexibility	0.454	1.474
	System accuracy	0.383	1.359
	User requirements	0.481	1.877
Information Quality	Understandability	0.492	1.460
Service Delivery Quality	AVA2	-0.421	0.715
	AVA1	0.889	1.717
	AVA3	0.834	1.645
	RESP3	-0.224	0.492
	RESP3	0.435	1.132
	PRIV1	-0.577	1.832
	FULF1	0.425	1.100
	CONT1	-0.655	1.669
Perceived Usefulness	Increasing productivity	0.182	0.487
User Satisfaction	Self-esteem	-0.179	0.447
Customer Value	Work practices	0.288	0.843

Eighteen (18) items were eliminated from the measurement model of ICT staff sample. All these items were not significant and seven items were negatively related to their constructs. The factor loadings of AVA1 and AVA2 were 0.889 and 0.834

and these levels of loading can be considered high and acceptable. However, the availability dimension totally was non-significant and the factor loading of this sub-dimension on the SDQ construct was 0.303 with t-value 0.742. In other words, the AVA2 and AVA3 adequately measured the availability; on the other hand, the availability was an non-significant sub-dimension to measure the SDQ. Hence, the whole sub-dimension of availability was eliminated from the measurement model. Figure 7.2 depicts the measurement model of ICT staff sample after conducting the final iteration. The factor loading and cross loading of measurement model items are shown in Table 7.4.

Figure 7.2 Measurement Model of ICT staff sample (Final iteration)

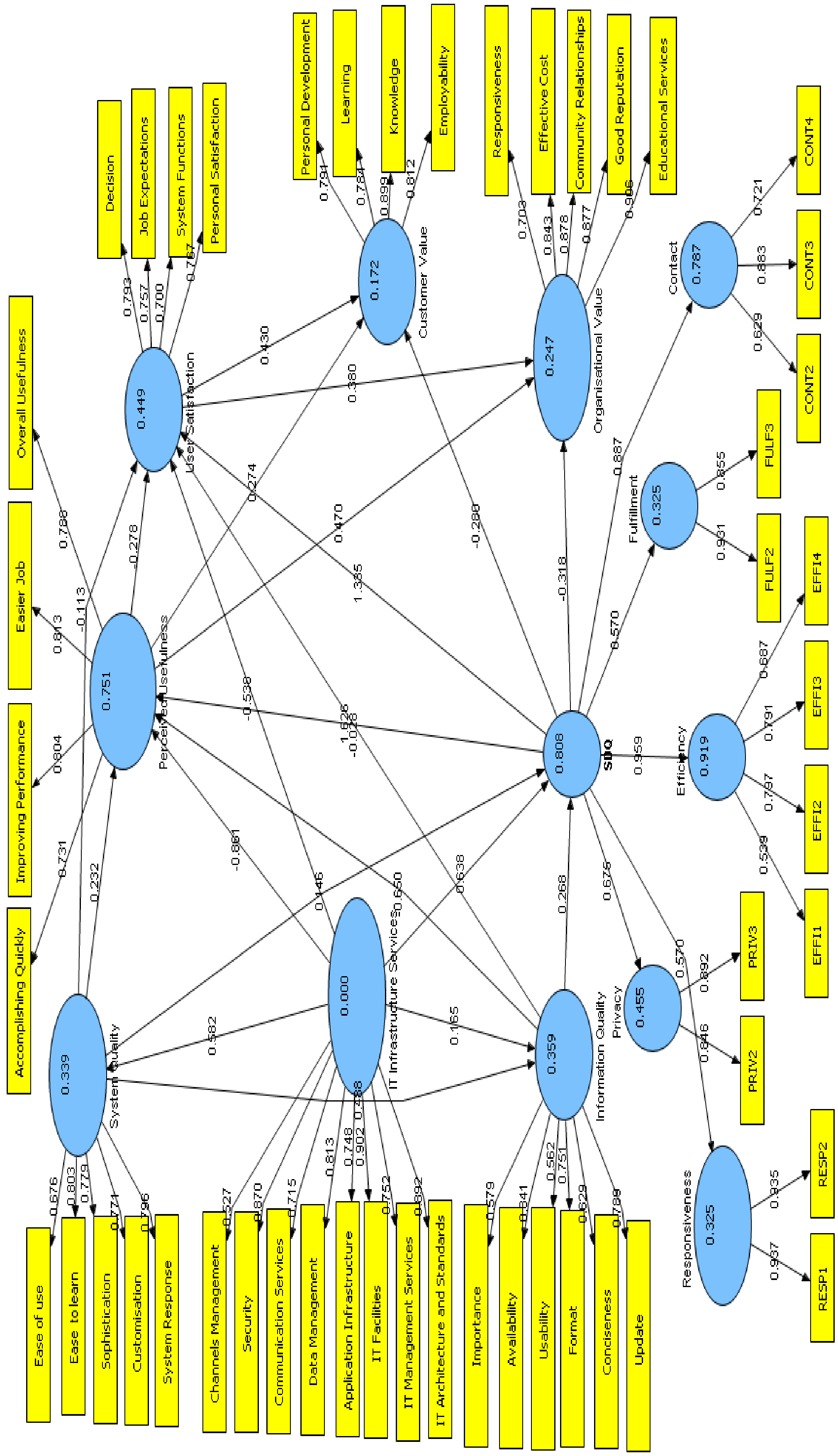


Table 7.4 Cross loading of ICT staff model

constructs	aspects	CONT	EFFI	FULF	PRIV	RESP	ITIS	SQ	IQ	PU	SATF	CUSV	ORGV	t-value
Contact	CONT2	.629	.498	.495	.397	.269	.613	.314	.429	.293	.423	.038	.045	2.550*
	CONT3	.883	.715	.436	.423	.430	.653	.315	.494	.445	.291	-.013	.119	7.177***
	CONT4	.721	.657	.016	.268	.417	.468	.479	.463	.537	.195	.226	.081	3.163**
Efficiency	EFFI1	.529	.539	.331	.416	.173	.168	.289	.357	.370	.283	-.047	-.201	2.370*
	EFFI2	.594	.797	.649	.511	.341	.658	.461	.491	.322	.719	.199	.381	5.817***
	EFFI3	.678	.791	.180	.656	.368	.678	.549	.475	.408	.371	.128	.041	6.313***
	EFFI4	.578	.687	.086	.386	.415	.491	.646	.635	.344	.185	.006	-.028	2.505*
Fulfillment	FULF2	.464	.469	.931	.412	.077	.540	.166	.369	.193	.722	.223	.255	6.268***
	FULF3	.261	.328	.855	.203	.052	.238	.340	.468	.111	.689	.241	.316	3.446**
Privacy	PRIV2	.305	.540	.339	.846	.111	.494	.308	.335	.213	.341	.009	.102	3.942***
	PRIV3	.521	.667	.295	.892	.075	.609	.627	.468	.336	.306	.163	-.204	4.743***
Responsiveness	RESP1	.476	.441	.056	.008	.937	.415	.457	.083	.633	.081	-.147	.179	2.200*
	RESP2	.460	.423	.083	.190	.935	.403	.556	.199	.664	.101	-.130	.204	2.264*
IT Infrastructure Services	Channels Management	.417	.381	.194	.021	.049	.527	.078	.353	-.087	.093	-.029	-.214	2.132*
	Security	.618	.706	.493	.560	.289	.870	.367	.328	.199	.439	.136	.022	5.964***
	Communication services	.614	.514	.191	.318	.321	.715	.077	.107	.244	.051	.175	.175	2.979**
	Data Management	.600	.615	.362	.644	.211	.813	.411	.256	.145	.176	.087	-.113	4.840***
	Application Infrastructure	.623	.665	.355	.517	.287	.748	.477	.376	.487	.394	.203	-.175	5.699***
	IT Facilities	.641	.748	.477	.554	.440	.902	.608	.434	.177	.382	-.053	-.011	5.551***
	IT Management Services	.576	.696	.411	.447	.340	.752	.487	.395	.254	.461	.012	.219	4.103***
	IT Architecture and standard	.718	.811	.311	.650	.581	.892	.718	.459	.511	.336	-.102	-.068	6.393***
System Quality	Ease of use	.168	.351	.278	.327	.305	.251	.676	.467	.096	.334	-.018	-.158	1.984*
	Ease to learn	.310	.442	.198	.210	.584	.373	.803	.410	.386	.138	-.277	-.159	3.976***
	Sophistication	.565	.647	.223	.522	.304	.602	.779	.443	.433	.272	.345	-.154	5.942***
	Customization	.379	.614	.001	.464	.481	.507	.771	.329	.395	.250	-.002	-.132	3.915***
	System Response	.345	.510	.328	.526	.418	.419	.796	.592	.329	.294	-.192	-.319	3.755***
Information Quality	Importance	.336	.353	.374	.404	.153	.295	.472	.579	-.034	.168	-.003	-.109	2.680**
	Availability	.659	.610	.442	.497	.276	.437	.489	.841	.199	.328	.036	-.116	6.429***
	Usability	.243	.260	.471	.129	-.184	.108	.108	.562	-.064	.476	.213	-.105	2.183*
	Format	.411	.493	.128	.205	.057	.213	.312	.751	.068	.390	.108	-.161	3.204**
	Conciseness	.310	.463	.373	.298	.058	.285	.483	.629	.218	.349	.019	-.021	2.985**
	Update	.514	.602	.167	.343	.142	.443	.484	.789	.087	.293	-.064	-.148	4.007***

		CONT	EFFI	FULF	PRIV	RESP	ITIS	SQ	IQ	PU	SATF	CUSV	ORGV	t-value
Perceived Usefulness	Accomplishing Quickly	.309	.324	-.040	.169	.188	.317	.589	.047	.731	.044	-.168	.016	2.063*
	Improve performance	.454	.406	.045	.322	.755	.259	.511	.204	.804	.147	.031	.133	2.469*
	Easier Job	.401	.333	.139	.335	.324	.289	.157	-.110	.813	.258	.524	.472	3.665***
	Overall Usefulness	.565	.492	.302	.167	.448	.262	.316	.297	.788	.464	.146	.426	3.333***
User Satisfaction	Decision	.344	.382	.534	.168	.049	.198	.079	.316	.456	.793	.339	.423	2.692**
	Job Expectations	.112	.380	.614	.411	-.076	.195	.178	.514	-.052	.757	.127	.110	3.527***
	System Functions	.253	.482	.592	.251	.210	.413	.386	.239	.209	.700	.300	.389	2.469*
	Personal Satisfaction	.478	.499	.660	.339	.083	.456	.400	.434	.317	.767	.250	.006	4.383***
Customer Value	Personal Development	-.017	-.179	.260	-.121	-.396	-.110	-.228	-.101	.018	.187	.791	.173	2.383*
	Learning	.002	-.021	.153	.077	-.290	-.067	-.205	-.082	.003	.141	.784	.322	2.636**
	Knowledge	.091	.099	.206	.085	-.022	.076	-.028	.043	.266	.356	.899	.430	3.269**
	Employability	.187	.351	.212	.252	.024	.171	.239	.210	.331	.356	.812	.297	2.320*
Organisational Value	Responsiveness	-.108	-.119	.038	-.124	.184	-.222	-.285	-.222	.174	-.005	-.152	.703	4.252***
	Effective Cost	.211	.075	.265	-.161	.225	-.047	-.224	-.083	.430	.232	.364	.843	6.171***
	Community Relationships	.108	.034	.346	-.124	.128	.042	-.309	-.160	.239	.267	.343	.878	7.102***
	Good Reputation	.107	.176	.263	.052	.146	.054	-.100	-.198	.382	.402	.433	.877	6.497***
	Educational Services	.047	.131	.311	-.031	.190	-.033	-.218	-.054	.331	.371	.357	.906	6.359***

*significant at level 0.05 ** Significant at level 0.01; *** significant at level 0.001; N.S not significant

CONT=Contact; EFFI=Efficiency; FULF=Fulfillment; PRIV=Privacy; ITIS= IT infrastructure services; SQ=System Quality; IQ=Information Quality; PU=Perceived Usefulness; SATF=User Satisfaction; CUSV=Customer Value; ORGV=Organisational Value.

The results of the final iteration of the ICT staff sample measurement model indicate that there are no cross loading among the items of the constructs, and the factor loading of the items was between 0.527 and 0.937. Furthermore, all the items were statistically significant that confirms the ability of these observed variables to measure their constructs.

7.4. Testing the reliability and validity of the model

Reliability of the measurement model of ICT staff was tested using four indicators: Cronbach's Alpha; Coefficient H; Composite Reliability; and AVE. The cross-validated communality H^2 also was used to measure the quality of the measurement model. The results of calculating these indicators are shown in Table 7.5.

Table 7.5 Reliability indicators of ICT staff sample after griminted the weak items

Constructs	Cronbach's Alpha	Coefficient H	Composite Reliability	AVE	H^2
Contact	.601	.840	.793	.565	.149
Efficiency	.664	.825	.800	.506	.144
Fulfilment	.755	.902	.888	.799	.350
Privacy	.680	.865	.861	.756	.256
Responsiveness	.858	.934	.934	.876	.529
IT Infrastructure Services	.911	.945	.927	.618	.477
System Quality	.825	.881	.876	.587	.366
Information Quality	.786	.875	.849	.501	.262
Perceived Usefulness	.801	.868	.865	.616	.277
User Satisfaction	.749	.844	.841	.570	.245
Customer Value	.850	.904	.893	.677	.296
Organisational Value	.902	.936	.925	.713	.527

The results in Table 7.5 highlight that the reliability indicators and cross-validated communality H^2 of ICT staff measurement model were significantly improved after deleting the weak items.

Cronbach's Alpha is believed to be one of the most important indicators of reliability. This indicator was significantly improved at the final iteration of the measurement model. However, the value of Cronbach's Alpha is affected by the number of items used to measure the construct and the sample size. In this regard, Javali state that 'The good quantity of reliability estimate is observed in the sample size of 50 or more' (2011, p. 1). The ICT sample size is 22, and this small sample size may affect the value of Cronbach's Alpha of three sub-dimensions of SDQ: contact 0.601; efficiency 0.664; and privacy 0.680.

The problem of reliability was solved by using Coefficient H because this indicator has advantages over other indicators, for instance, 'Even if an item has zero correlation it will not detract from the composite reliability as it would in say, Cronbach's Alpha' (Holmes-Smith, 2011, pp. 9-23). Thus, testing reliability was supported by Coefficient H and the results of this indicator were between 0.825 and 0.945. The value of Coefficient H for all constructs exceeded the recommended level 0.70, and these values point to the construct of the ICT staff model achieving a good level of reliability.

The construct reliability was tested employing the composite reliability indicator. Testing this indicator at the first iteration highlighted a problem in the reliability of some constructs of the measurement model. The recommended level of composite reliability is 0.70. At the final iteration, all the constructs achieved highly composite reliability and the values were between 0.793 and 0.927. These consequences confirmed that the reliability of the measurement model according to this indicator was significantly improved.

Finally, the reliability of ICT staff measurement model was examined using average variance extracted. The AVE values at the first iteration of measurement model were as follows: availability 0.40, IT infrastructure services 0.482, information quality 0.454, and system quality 0.403. At the final iteration the AVE significantly improved and were IT infrastructure services 0.618, information quality 0.501, and system quality 0.587.All the constructs exceeded the acceptable level, 0.50, and were between 0.501 and 0.876.

The cross-validated communality H^2 indicated that the measurement model achieved a predictive relevance because all the values of H^2 exceeded zero and were between 0.144 and 0.529. This indicator confirmed the quality of measurement model to evaluate the success of e-learning systems based on ICT staff perspectives.

The validity of the measurement model of the ICT staff sample was examined using two indicators: convergent and discriminant validity.

The convergent validity depends on three key criteria: (1) factor loading; (2) average value extracted; and (3) composite reliability. The model of ICT staff sample achieved the three criteria of convergent validity. All the items, as shown in Table 7.4 had significant factor loading and exceeded more than 0.60, except four items were between 0.527 and 0.579. Three significance levels were utilised to evaluate the items: 0.05, 0.01, and 0.001. Twenty-seven (27) items out of 49, 55.1 percent, were significant at level 0.001, nine items, 18.4 percent, were significant at level 0.01, and 13 items, 26.5 percent, were significant at level 0.05.

The average value extracted for all constructs exceeded the acceptable level, 0.50, and confirm the convergent validity—as shown in Table 7.5.

The third criterion of convergent validity is composite reliability. This criterion was achieved in the model of ICT staff sample and all the values of composite reliability were more than 0.80, excluding contact at 0.793.

The model of ICT staff achieved good convergent validity according to the above three indicators and confirmed that the items of measurement model are strongly related to their constructs in the study model.

The final indicator of validity tested was the discriminant validity. To achieve this validity the square root of average variance extracted of each construct should be more than its correlation with other constructs (Chin, 1998; Guo et al., 2011; Liang et al., 2007). Table 7.6 shows the results of conducting this method, which achieved a sufficient level of discriminant validity.

Table 7.6 Discriminant validity of ICT staff sample

	ITIS	SQ	IQ	PU	USAT	CUSV	ORGV	CONT	EFFI	FULF	PRIV	RESP
ITIS	**.786**											
SQ	.582	**.766**										
IQ	.448	.583	**.708**									
PU	.035	.446	.138	**.785**								
USAT	.411	.333	.480	.332	**.755**							
CUSV	.055	-.01	.055	.238	.350	**.822**						
ORGV	-.020	-.24	-.01	.392	.342	.382	**.844**					
CONT	.769	.484	.614	.567	.395	.102	.112	**.752**				
EFFI	.845	.686	.686	.501	.574	.118	.105	.835	**.711**			
FULF	.461	.264	.455	.177	.786	.356	.311	.422	.456	**.894**		
PRIV	.638	.551	.466	.320	.369	.106	-.072	.483	.699	.361	**.869**	
RESP	.437	.540	.150	.692	.097	-.148	.204	.500	.461	.074	.105	**.936**

AVA=Availability; CONT=Contact; EFFI=Efficiency; FULF=Fulfillment; PRIV=Privacy; ITIS= IT infrastructure services; SQ=System Quality; IQ=Information Quality; PU=Perceived Usefulness; SATF=User Satisfaction; CUSV=Customer Value; ORGV=Organisational Value.

7.5. Testing the structural model of ICT staff sample

Sample size needs to be considered when using covariance-based structural equation modelling techniques. This technique needs at least 200 subjects as a sample (Kline, 2011). To overcome this issue, the partial least squares structural equation modelling approach, proposed by Wold (1974) and frequently used by researchers in the management and information systems field (Ringle, Sarstedt, & Straub, 2012), was adopted. In this regard, Gefen et al. state that 'PLS path modelling shares with least squares regression the ability to obtain parameter estimates at relatively lower sample sizes' (2011, p. vii). Goodhue et al. point to the advantage of using PLS: 'It is still a convenient and powerful technique that is appropriate for many research situations, such as complex models with sample size that would be too small for covariance-based SEM techniques' (2006, p. 10).

The sample size of ICT staff in this study (22 responses) is considered a small sample. Such a sample size has been used in previous studies. For instance, Lee (1994) used PLS to analysis a sample study of 18 subjects. Chin et al. (2003) examined a partial least squares model with various sample sizes: 20; 50; 100; 150; 200; and 500. The results confirm that 'sample size, in general, did not influence the consistency of the estimation' (2003, p. 30). Therefore, partial least squares structural equation modelling approach is adopted to analyse the study model for ICT staff sample.

However, there remains a problem in examining the study model in that the model is complicated and includes eight constructs, 49 observed variables, and 24 relationships among the constructs. According to Goodhue, 'PLS does not provide researchers with a magic bullet for achieving adequate statistical power at small sample sizes' (2006, p. 10). Bootstrapping method is used to examine the statistical significance of path coefficient (Chin et al., 2003). The study adopts this method to test the structural model of ICT staff sample. In this regard, Goodhue et al. found that 'PLS does not have an advantage in terms of detecting statistical significance at small sample size' (2006, p. 1). As mentioned previously, the proposed model in this study can be complicated and that may affect the power of relationships among the constructs due to the small sample size. To solve this issue, the method used by Liang et al. (2007) was employed to test the structural model of ICT staff sample. To meet the requirement of sample size, this method depends on examining the impact of each exogenous factor on each endogenous factor separately. Therefore, several PLS models were tested to determine the impact of each exogenous factor on its related endogenous factor. Testing the study model focused on two types of effect: direct effect and mediation.

7.5.1. Testing the direct impacts

The emphasis in this section is on testing the direct effects among the constructs of the study model. The influence of each exogenous factor on each endogenous factor is tested in a separate PLS model due to sample size requirements.

7.5.1.1. IT infrastructure services

According to the study model, the IT infrastructure services construct is considered to be the foundation to achieve system quality, information quality, service delivery quality, perceived usefulness, and user satisfaction. IT infrastructure services significantly affected system quality and service delivery quality and the results were (β 0.630, t-value 5.115, P 0.001, R^2 39.7%), (β 0.849, t-value 17.787, P 0.001, R^2 72%) respectively. These results confirm two hypotheses of the study: (H1) '*IT Infrastructure Services significantly and directly affect System Quality'* and (H3) *'IT Infrastructure Services significantly and directly affect Service Delivery Quality'*. However, IT infrastructure services did not significantly affect information quality of e-learning systems (β 0.490, t-value 1.629, P 0.05, R^2 24%) and this result leads to rejecting hypothesis (H2) '*IT Infrastructure Services significantly and directly affect Information Quality'*. IT infrastructure services played a key role in service delivery quality; and 72 percent of the variance in service delivery quality can be explained by IT infrastructure services. The IT infrastructure services construct contributed to explaining 39.7 percent of the variance in system quality. The contribution of IT infrastructure services in explaining the variance of information quality was 24 percent. Figure 7.3, Figure 7.4, and Figure 7.5 show the PLS result of testing these relationships effects.

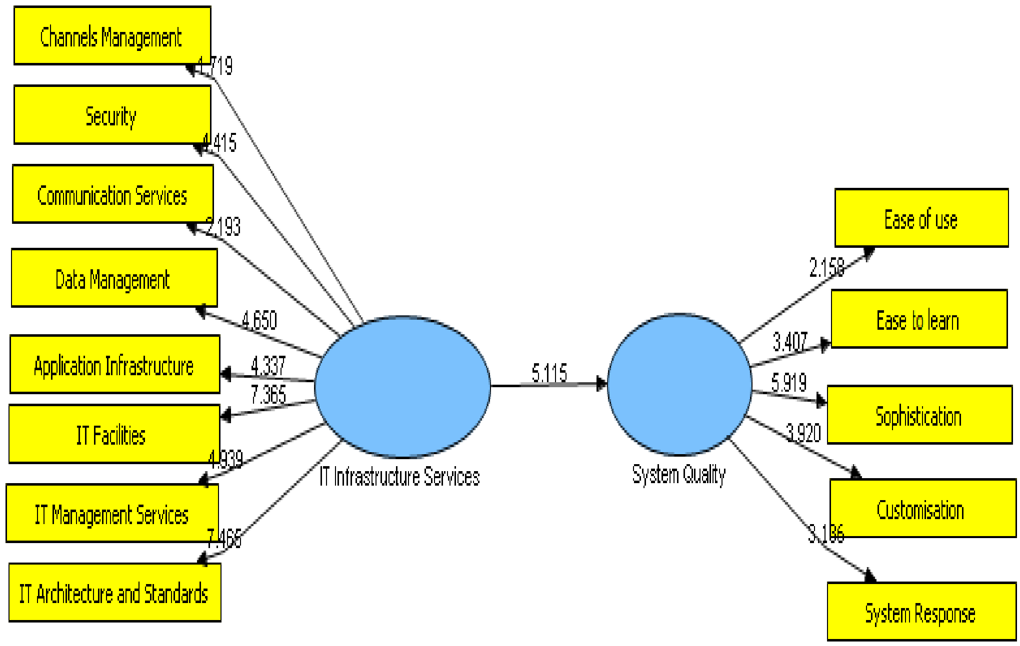


Figure 7.3 PLS analysis of impact of IT infrastructure services on System quality

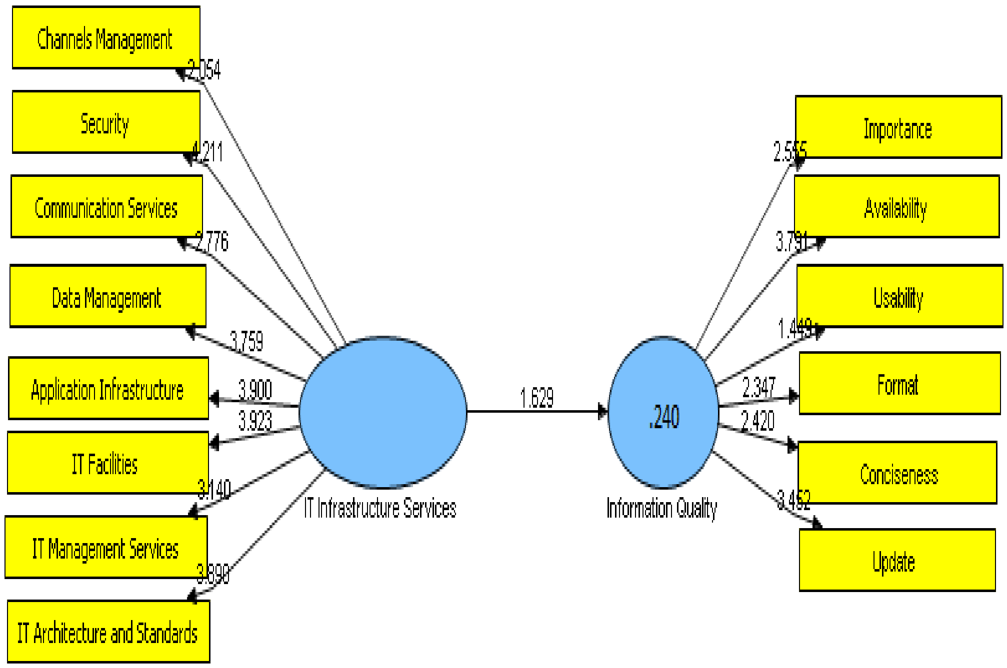


Figure 7.4 PLS analysis of impact of IT infrastructure services on information quality

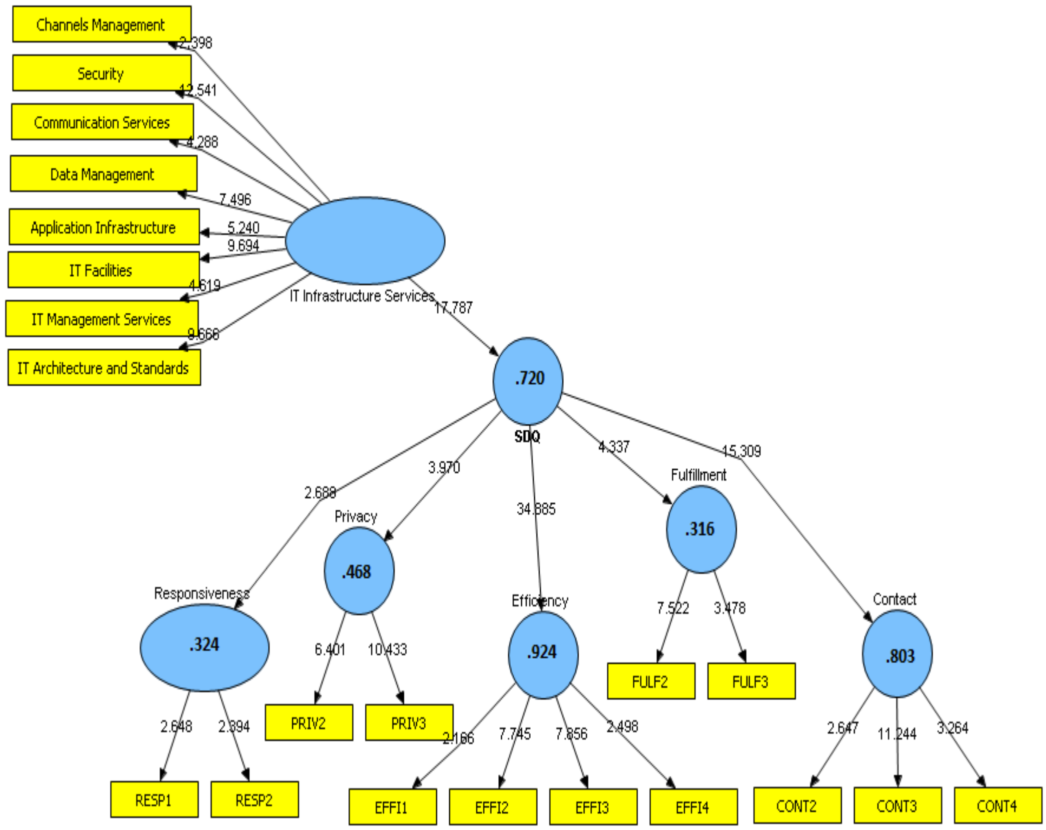


Figure 7.5 PLS analysis of impact of IT infrastructure services on SDQ

IT infrastructure services are assumed to influence perceived usefulness and user satisfaction according to the study model. The results of the PLS analysis demonstrate that IT infrastructure services did not significantly impact perceived usefulness (β 0.457, t-value 1.597, P 0.05, R^2 20.9%). Based on these results hypothesis (H4) '*IT Infrastructure Services significantly and directly affect Perceived Usefulness'* is rejected. User satisfaction is significantly influenced by IT infrastructure services (β 0.496, t-value 3.722, P 0.001, R^2 24.6%). The outcomes of PLS analysis support hypothesis (H5) '*IT Infrastructure Services significantly and directly affect User Satisfaction'*. The IT infrastructure services construct contributed to explaining 20.9 percent of the variance in perceived usefulness (non-significant effect) and 24.6 percent of variance in user satisfaction (significant effect). Figure 7.6 and Figure 7.7 depict the PLS results of these two relationships effects.

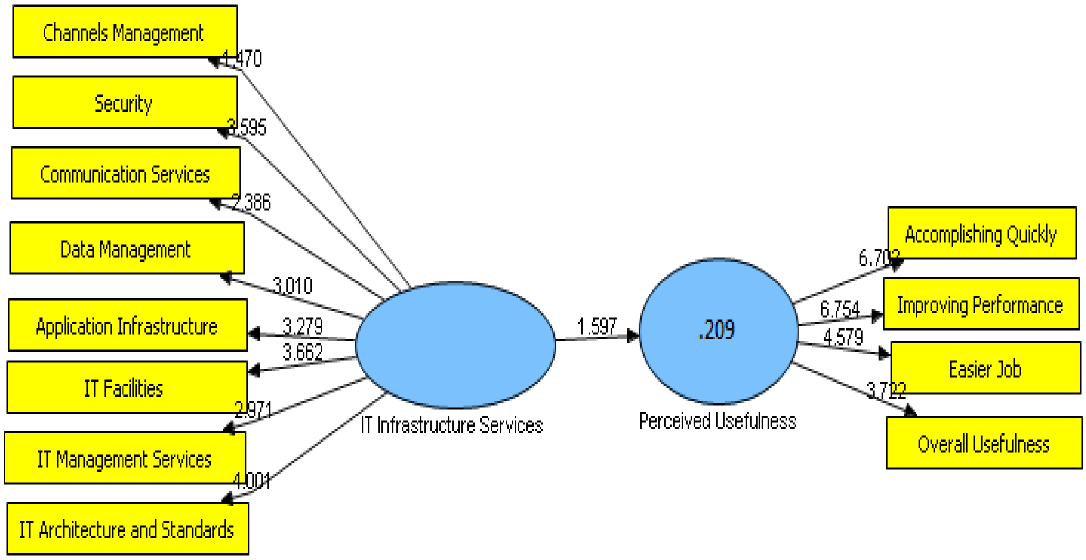


Figure 7.6 PLS analysis of impact of IT infrastructure services on perceived usefulness

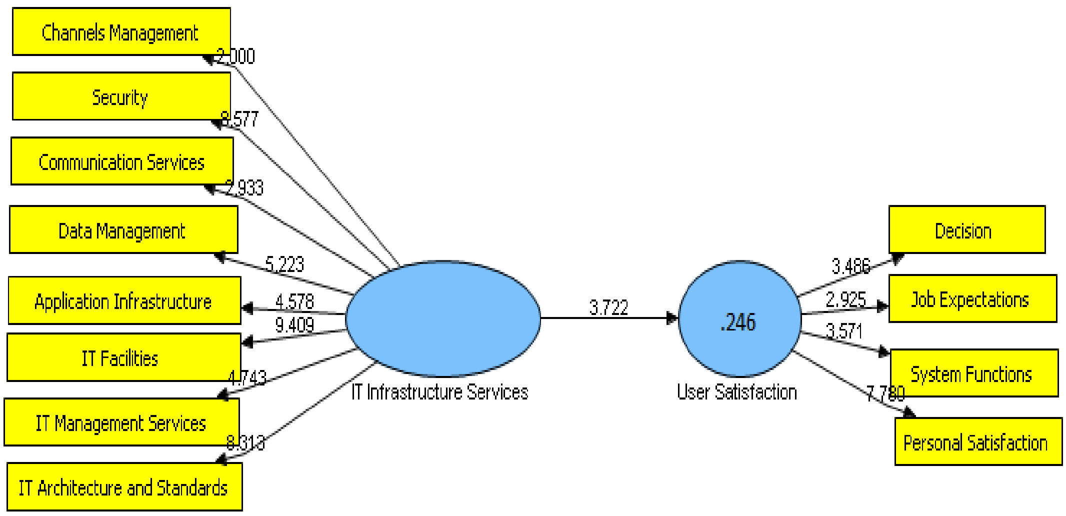


Figure 7.7 PLS analysis of impact of IT infrastructure services on user satisfaction

Testing the direct effect of IT infrastructure services shows the crucial role of this construct in supporting system quality, service delivery quality, and user satisfaction. However, this construct did not significantly influence information quality and perceived usefulness.

7.5.1.2. System quality

System quality was selected as a key construct to measure the success of e-learning systems. The design of the study model shows that system quality is hypothesised to impact four endogenous constructs: information quality; service delivery quality; perceived usefulness; and user satisfaction.

The results of PLS confirmed the significant influence of system quality on information quality (β 0.636, t-value 2.445, P 0.01, R^2 40.5%). The value of R^2 confirmed that 40.5 percent of the variance in information quality can be explained by system quality. Hypothesis (H6) '*System Quality significantly and directly affects Information Quality*' is accepted based on these outcomes; and Figure 7.8 shows PLS results.

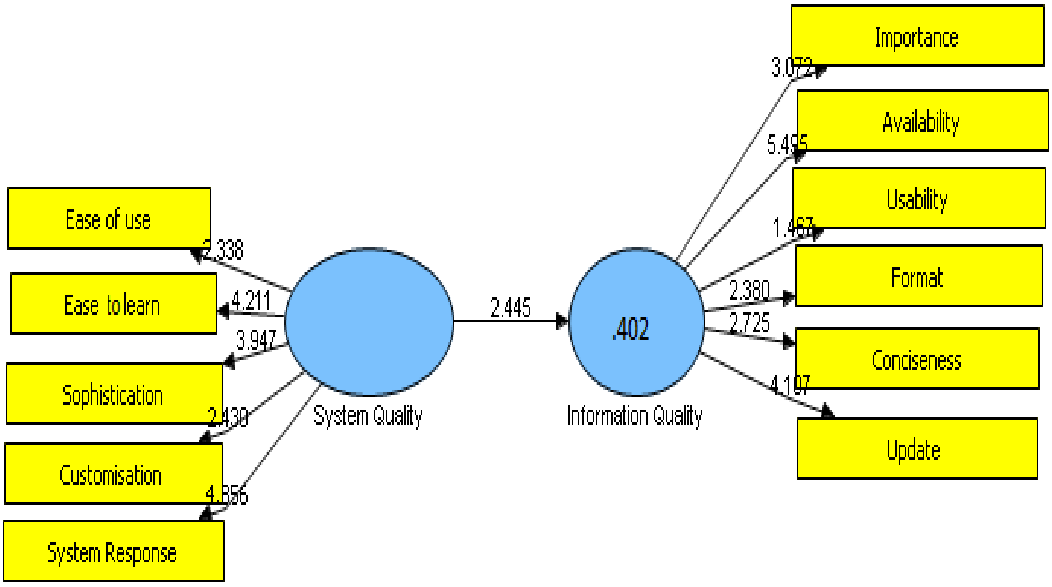


Figure 7.8 PLS analysis of impact of system quality on information quality

Another role of system quality in the proposed model of the current study is to support the service delivery quality of e-learning systems. PLS results, as shown in Figure 7.9, confirm the positive and supportive role of system quality in enhancing service delivery quality (β 0.694, t-value 5.711, P 0.001, R^2 48%). The value of R^2, 48 percent, points to the essential function of system quality in supporting the the service delivery quality of e-learning systems. Accordingly, hypothesis (H7) '*System Quality significantly and directly affects Service Delivery Quality'* is supported.

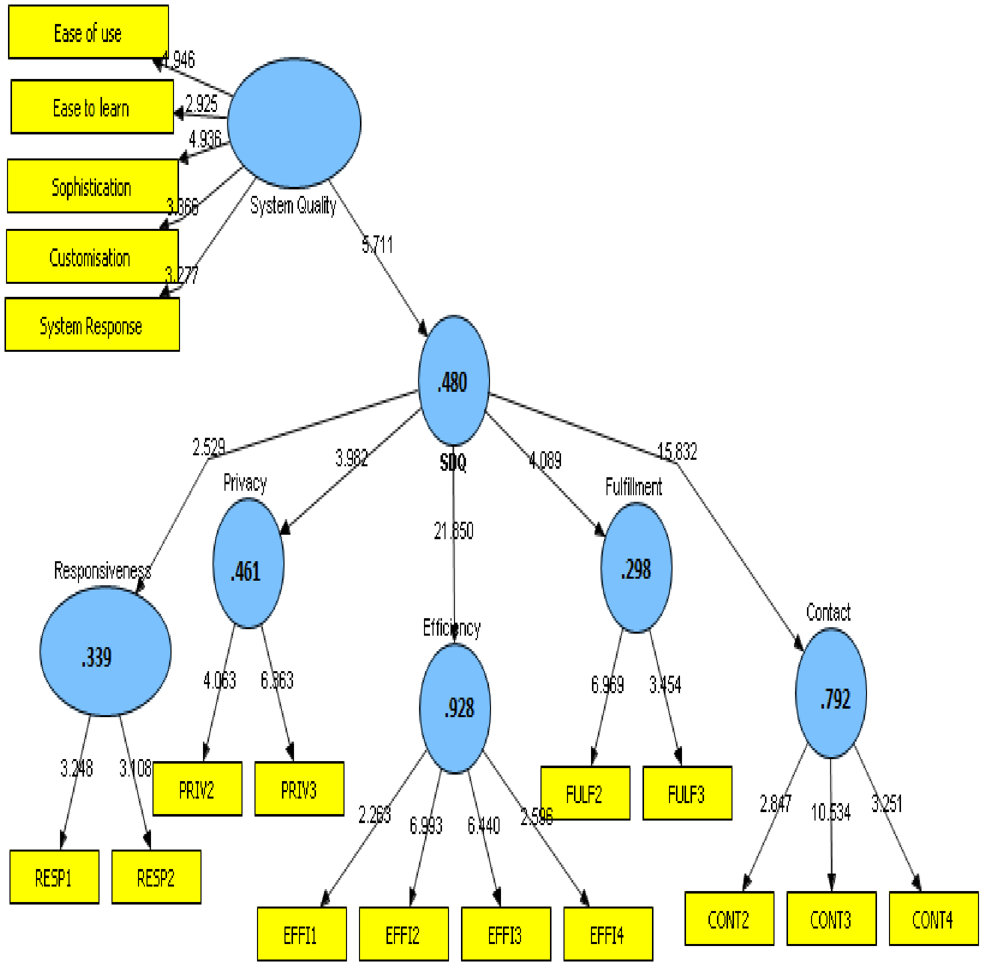


Figure 7.9 PLS analysis of impact of system quality on service delivery quality

Perceived usefulness and user satisfaction are assumed to be impacted by quality of e-learning systems. The results analysis of the PLS model pointed to the significant impact of the system quality construct on perceived usefulness (β 0.582, t-value 2.752, P 0.01, R^2 33.9%). Consequently, hypothesis (H8) '*System Quality significantly and directly affects Perceived Usefulness'* is accepted. However, the outcome of analysis shows that the impact of system quality on user satisfaction was not significant (β 0.463, t-value 1.023, P 0.05, R^2 21.5%). These results support the rejection of the hypothesis that (H8) '*System Quality significantly and directly affects User Satisfaction'*. The results of system quality on perceived usefulness and user satisfaction are shown in Figure 7.10 and Figure 7.11.

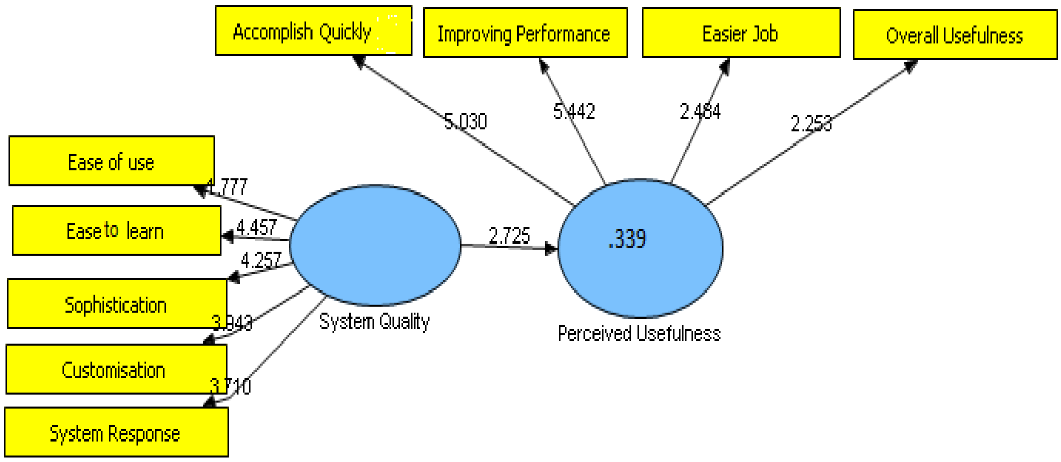


Figure 7.10 PLS analysis of impact of system quality on perceived usefulness

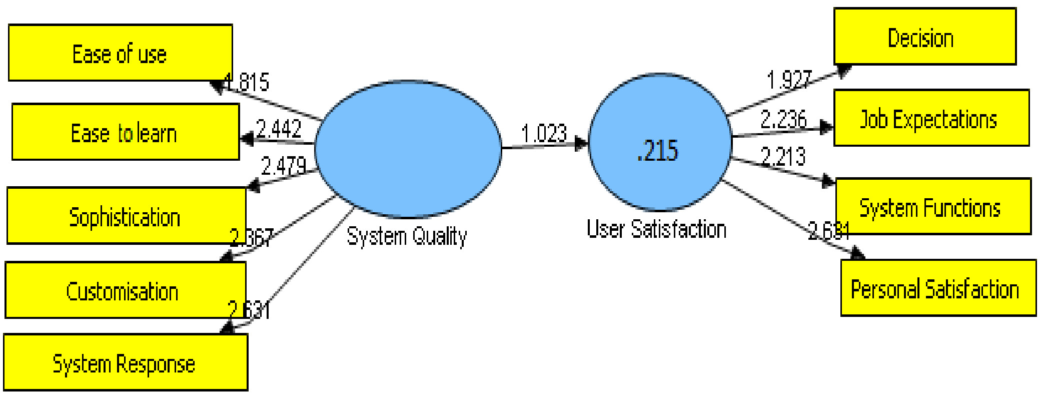


Figure 7.11 PLS analysis of impact of system quality on user satisfaction

The outcomes of examining the impact of system quality as an exogenous construct on the endogenous constructs confirms the crucial role of this factor in the success of e-learning system based on ICT staff perceptions.

7.5.1.3. Information Quality

Information quality construct is frequently used to evaluate the success of information systems, especially e-learning systems. Information quality was taken into account as an essential construct to assess the success in the proposed model in this study. The direct influence of information quality, as an exogenous construct, should include three constructs: service delivery quality; perceived usefulness; and user satisfaction. To test the impact of information quality on service delivery quality, PLS model was implemented and the results are shown in Figure 7.12.

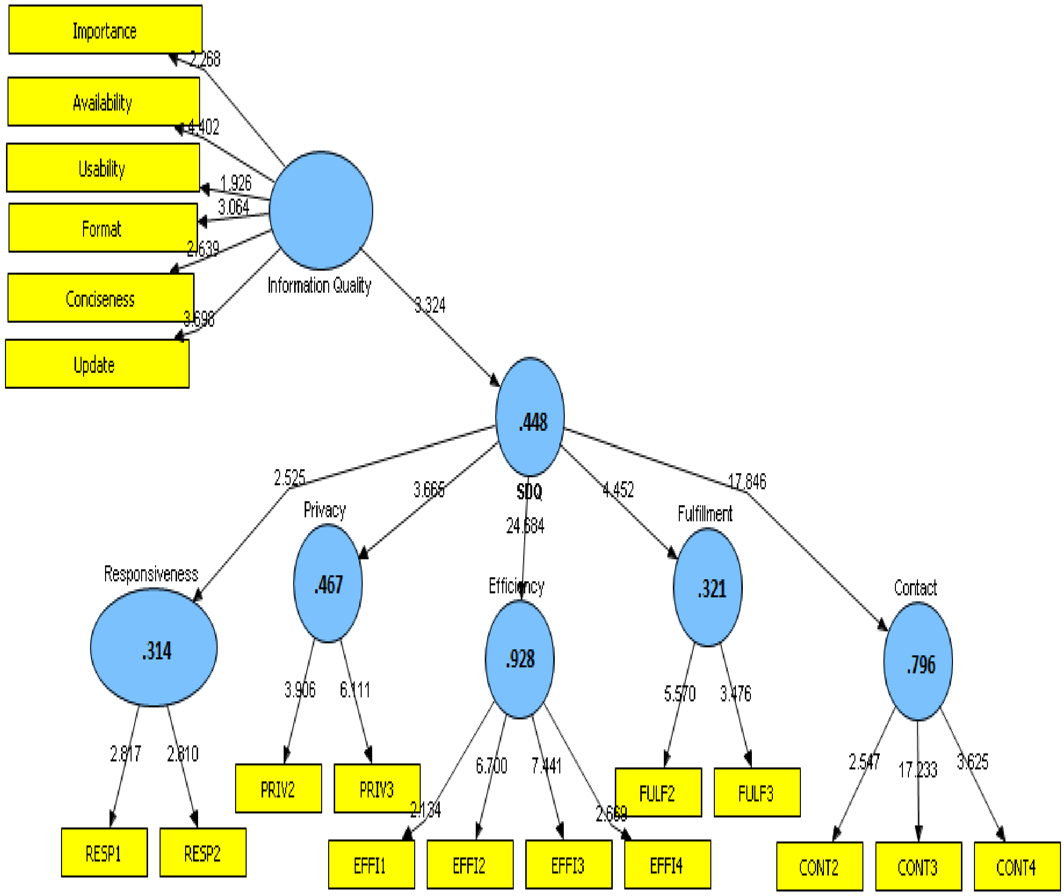


Figure 7.12 PLS analysis of impact of information quality on service delivery quality

The results of testing the effect of information quality on service delivery quality were (β 0.669, t-value 3.3243, P 0.001, R^2 44.8%). The t-value highlights the significant role of information quality in supporting service delivery quality. According to R^2, 44.8 percent of the variance in service delivery quality can be explained by information quality according to the viewpoint of ICT staff. These results support hypothesis (H10) '*Information Quality significantly and directly affects Service Delivery Quality'*.

The impact of information quality on perceived usefulness was tested using PLS, as shown in Figure 7.13, and the results were (β 0.371, t-value 0.656, P 0.05, R^2 13.7%). The explained variance of perceived usefulness by information quality was relatively low and not significant at 13.7 percent. These outcomes of the PLS test do not support hypothesis (H11) '*Information Quality significantly and directly affects Perceived Usefulness'*.

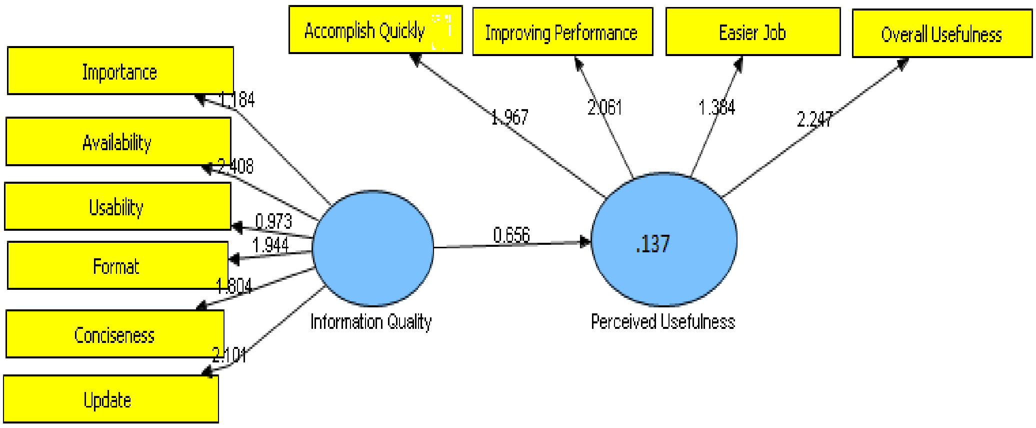


Figure 7.13 PLS analysis of impact of information quality on perceived usefulness

The impact of information quality on user satisfaction was examined and the results were (β 0.586, t-value 3.490, P 0.001, R^2 34.4%). The percentage of information quality in explaining the variance in user satisfaction was 34.4 percent. Based on these results, hypothesis (H12) '*Information Quality significantly and directly affects User Satisfaction'* is accepted. Figure 7.14 shows the PLS model of testing the effect of information quality on user satisfaction.

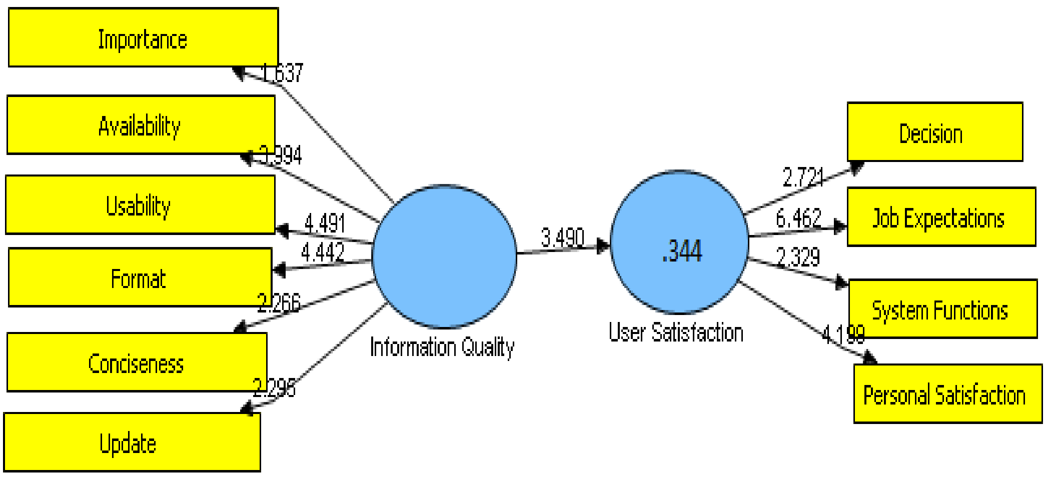


Figure 7.14 PLS analysis of impact of information quality on user satisfaction

Based on the perceptions of ICT staff, information quality significantly impacted service delivery quality and user satisfaction. However, this construct did not significantly impact perceived usefulness.

7.5.1.4. Service delivery quality

Service delivery quality is a central construct in the study model. The expected role of this construct is to enhance perceived usefulness, user satisfaction, customer value, and organisational value.

Regarding the role of service delivery quality to support the perceived usefulness, results of PLS model, as shown in Figure 7.15, confirmed this role (β 0.658, t-value 5.121, P 0.001, R^2 43.2%). The ability of service delivery to explain the variance in perceived usefulness was significant and relatively high at 43.2 percent. Accordingly, hypothesis (H13) '*Service Delivery Quality significantly and directly affects Perceived Usefulness'* is accepted.

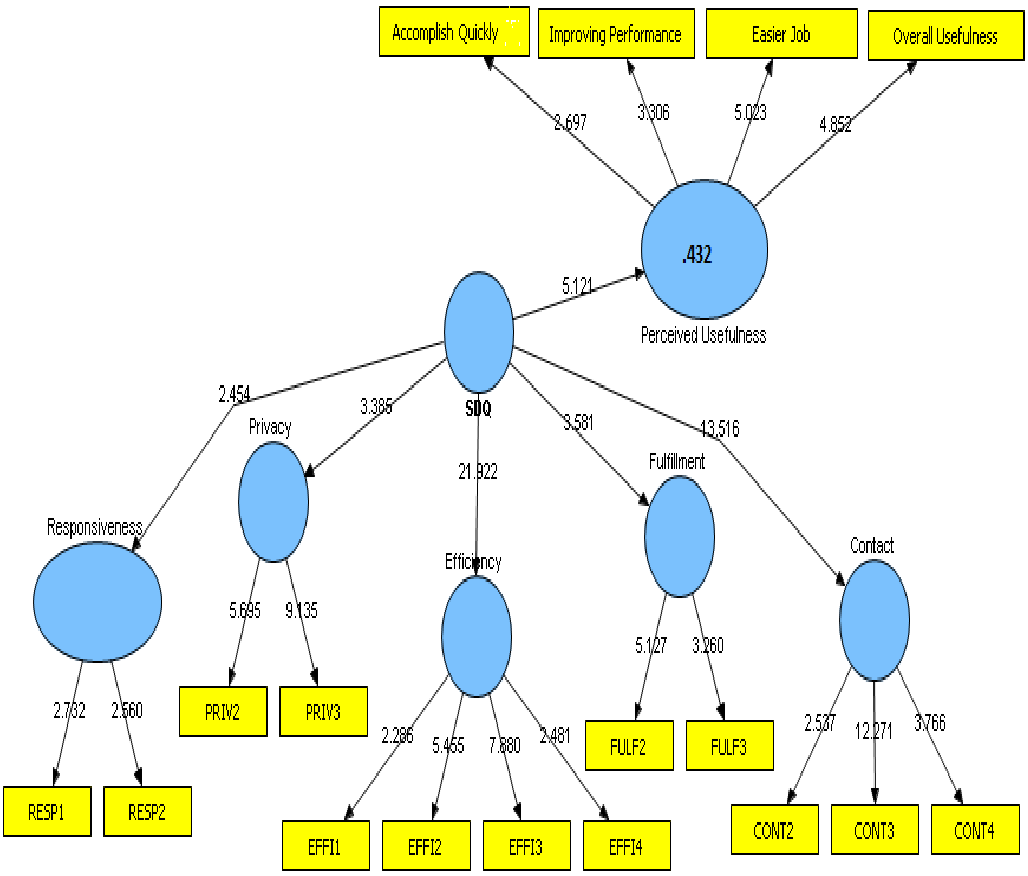


Figure 7.15 PLS analysis of impact of service delivery quality on perceived usefulness

The results of service delivery quality effect on user satisfaction are shown in Figure 7.16. The PLS model confirmed the significant influence of service delivery quality on user satisfaction (β 0.685, t-value 5.153, P 0.001, R^2 40.3%). This significant function of service delivery quality on user satisfaction is supported by the ability of this construct to explain user satisfaction which was 40.3 percent. Consequently, hypothesis (H14) '*Service Delivery Quality significantly and directly affects User Satisfaction'* is supported.

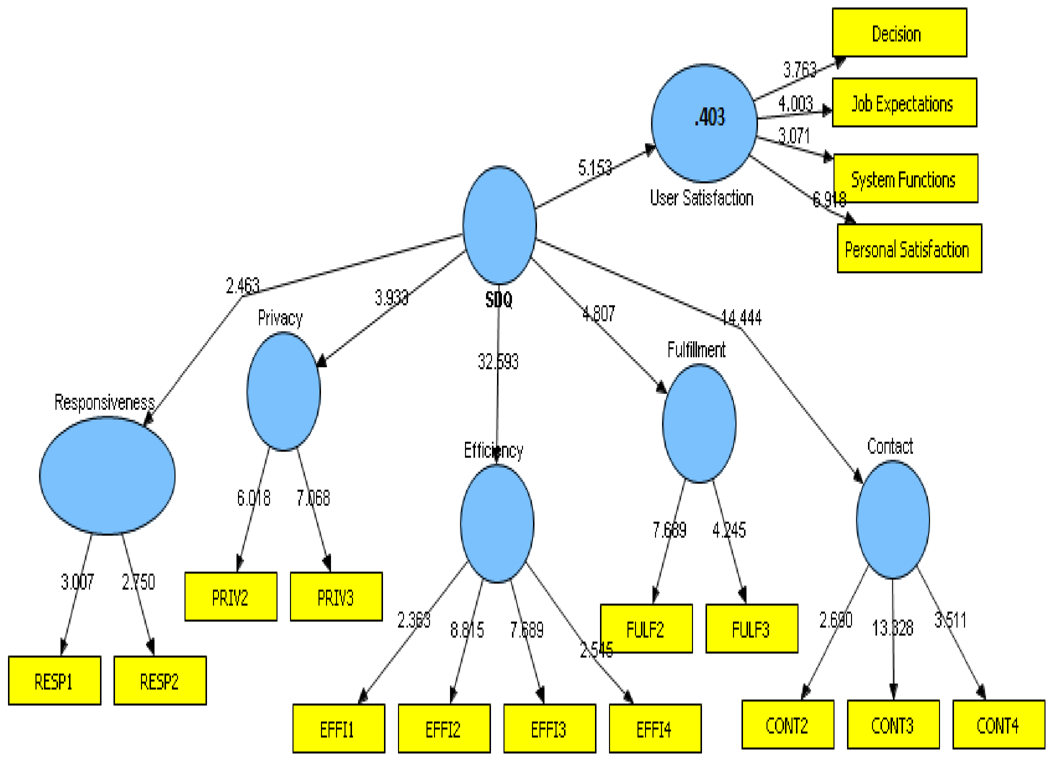


Figure 7.16 PLS analysis of impact of service delivery quality on user satisfaction

The study model hypothesised that service delivery quality significantly affects customer value and organisational value. However, the PLS analysis results do not confirm the impact of service delivery quality on customer value and organisational value and the outcomes were (β -0.360, t-value 0.729, P 0.05, R^2 13%) and (β 0.238, t-value 0.622, P 0.05, R^2 5.7%) respectively. The power of service delivery quality in explaining the variance in customer value and organisational value was low: 13 and 5.7 percent respectively. The results of these two PLS models are depicted in Figure 7.17 and Figure 7.18.

Two hypotheses were rejected based on the above outcomes: (H15) '*Service Delivery Quality significantly and directly affects Customer Value' and* (H16) *'Service Delivery Quality significantly and directly affects Organisational Value'.*

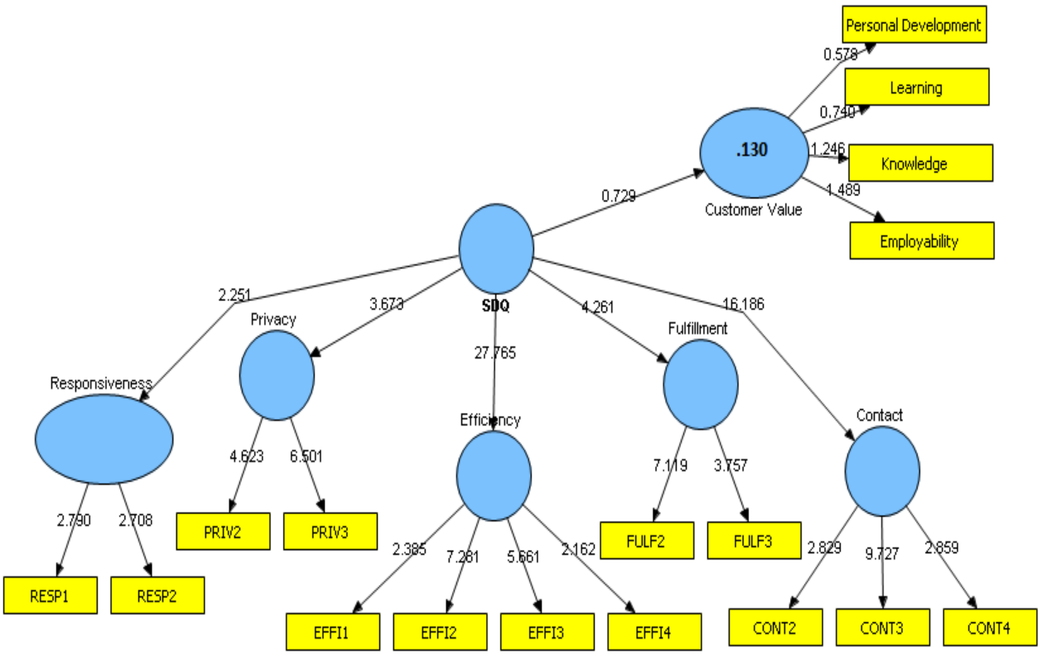


Figure 7.17 PLS analysis of impact of service delivery quality on customer value

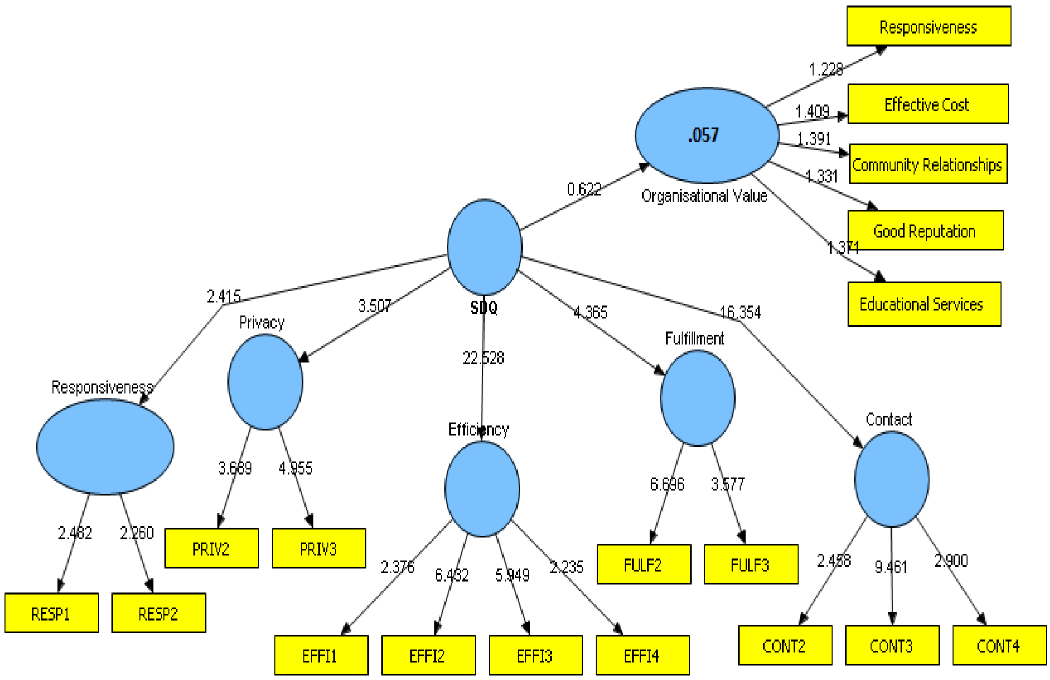


Figure 7.18 PLS analysis of impact of service delivery quality on organisational value

Service delivery quality played a major role in supporting and enhancing perceived usefulness and user satisfaction of e-learning systems based on the opinions of ICT staff. On the other hand, this role was not significant for two constructs: customer value and organisational value.

7.5.1.5. Perceived usefulness

Perceived usefulness is a commonly used construct to measure the success and acceptance of e-learning systems. The study model hypothesised that perceived usefulness significantly affects customer value and organisational value. user satisfaction, customer value, and organisational value.

Analysis of the PLS model showed a positive and significant effect of perceived usefulness on user satisfaction (β 0.528, t-value 2.138, P 0.05, R^2 27.9%). Perceived usefulness contributed to explaining 27.9 percent of the variance in user satisfaction. Figure 7.19 depicts the PLS model of this relationship.

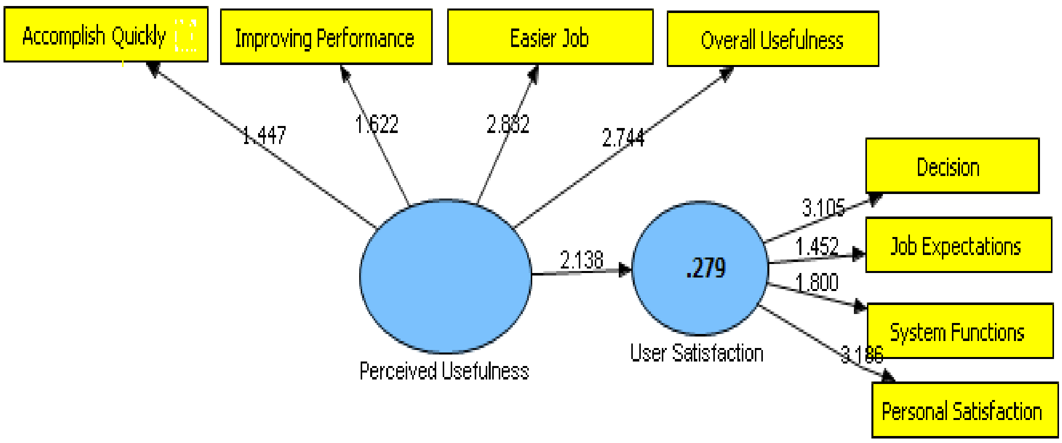


Figure 7.19 PLS analysis of impact of perceived usefulness on user satisfaction

According to the study model, customer value (ICT staff value) was assumed to be affected by perceived usefulness. However, hypothesis (H18) '*Perceived Usefulness significantly and directly affects customer value'* is rejected. The rejection of this hypothesis is based on the results of PLS test that were (β 0.652, t-value 1.034, P 0.05, R^2 42.5%) as shown in Figure 7.20. In spite of the high percentage of the variance in user satisfaction that is explained by perceived usefulness (42.5 percent) and the high path coefficient (0.652), this path is not significant.

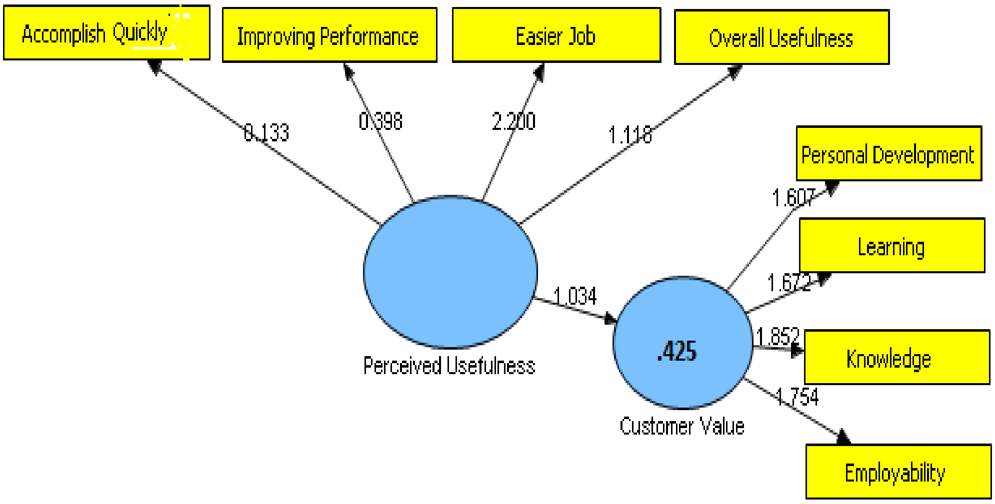


Figure 7.20 PLS analysis of impact of perceived usefulness on customer value

The final expected impact of perceived usefulness was on organisational value. The results of performing PLS test were (β 0.490, t-value 1.857, P 0.05, R^2 24%), as depicted in Figure 7.21. The t-value indicates that the impact of perceived usefulness on organisational value is significant at level 0.05. Hence, the hypothesis that (H19) '*Perceived Usefulness significantly and directly affects organisational value'* is accepted.

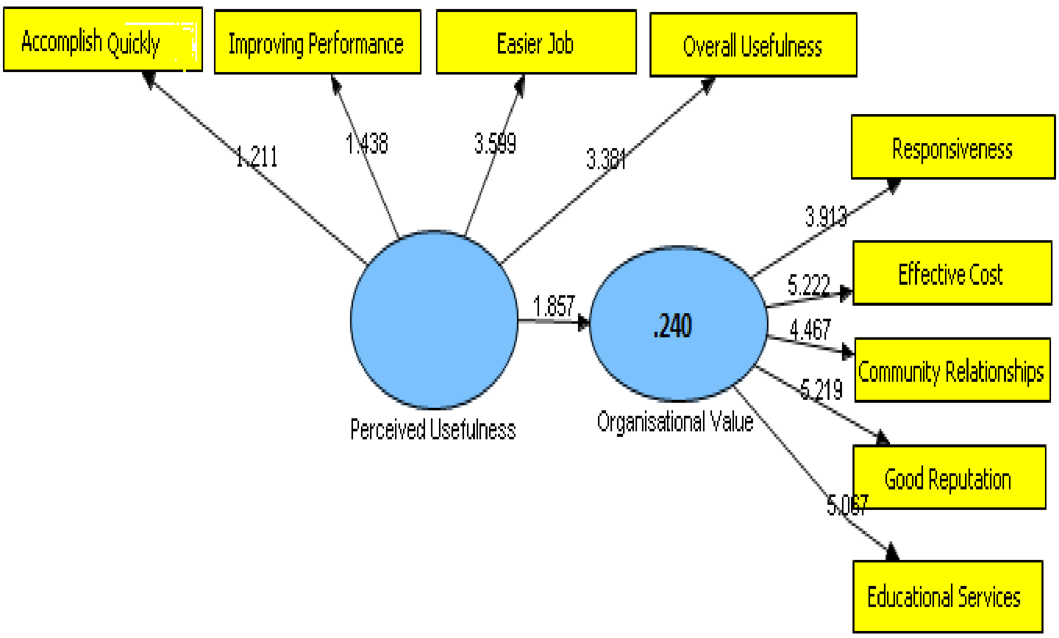


Figure 7.21 PLS analysis of impact of perceived usefulness on organisational value

7.5.1.6. User satisfaction

User satisfaction is employed as a key measure to evaluate the e-learning system from the point of view of ICT staff. This construct is assumed to be a determinant of customer value and organisational value. However, the role of user satisfaction in supporting the two types of value is not confirmed—as shown in Figure 7.22 and Figure 7.23.

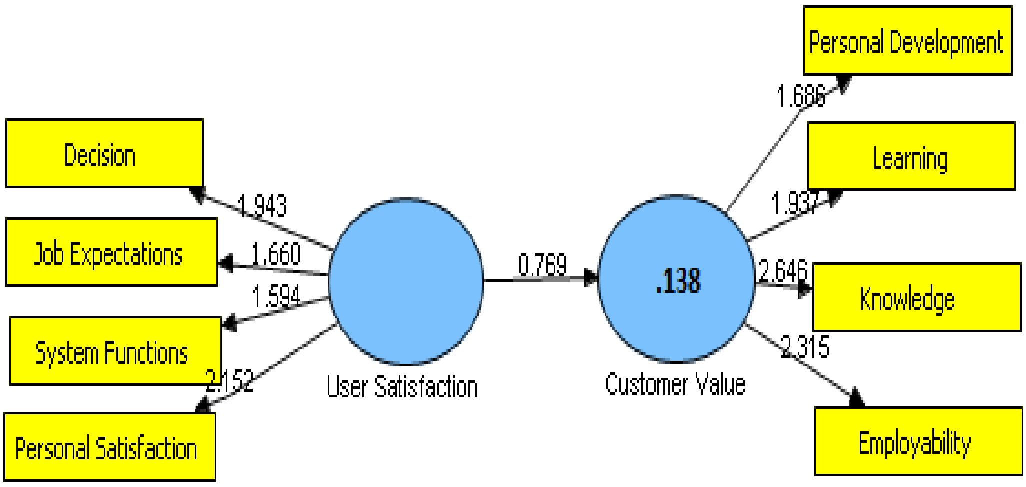


Figure 7.22 PLS analysis of impact of user satisfaction on customer value

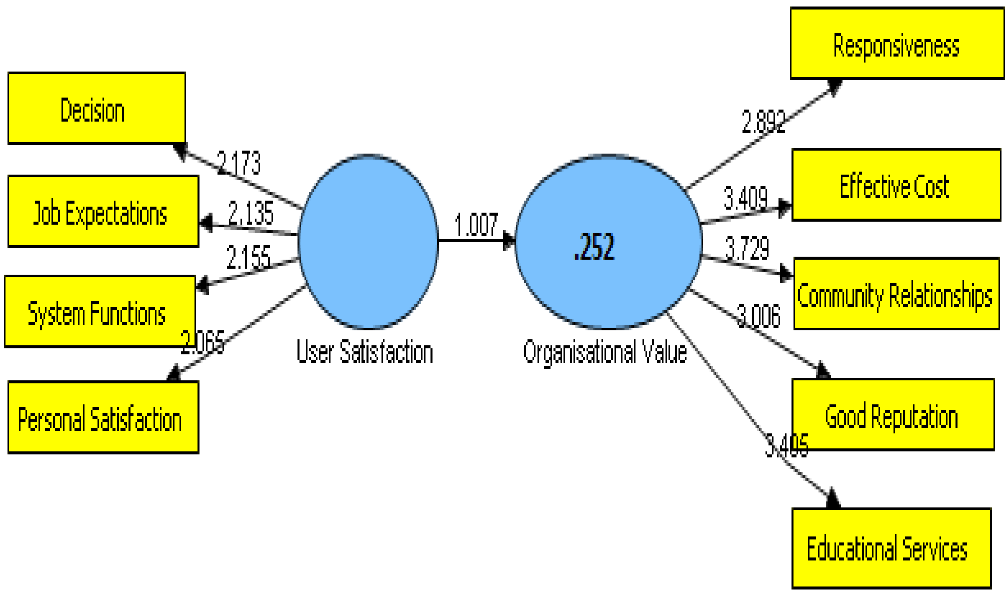


Figure 7.23 PLS analysis of impact of user satisfaction on organisational value

The results of the PLS models to investigate the impact of user satisfaction on customer value and organisational value were (β 0.371, t-value 1.007, P 0.05, R^2 13.8%) and (β 0.502, t-value 0.769, P 0.05, R^2 25.2%) respectively. User satisfaction explained 13.8 percent of the variance in customer value and 25.2 percent of the organisational value. These outcomes support the rejection of two hypotheses: (H20) '*User Satisfaction significantly and directly affects Customer value'* and (H21) '*User Satisfaction significantly and directly affects organisational value'*.

7.5.1.7. Customer value

Customer value construct is hypothesised to be directly affected by three exogenous factors: service delivery quality; perceived usefulness; and user satisfaction. The results of conducting PLS models (see Figure 7.17, Figure 7.20, and Figure 7.22) show that the three exogenous factors did not significantly impact the customer value construct.

7.5.1.8. Organisational value

This construct is also considered as a totally endogenous factor in the study model. The determinants of this factor are service delivery quality, perceived usefulness, and user satisfaction. The analysis of the PLS models show that organisational value is significantly affected by perceived usefulness (see Figure 7.21), however, service delivery quality and user satisfaction did not significantly affect the organisational value (see Figure 7.18 and Figure 7.23).

The R^2, GoF, and Q^2 are employed to assess the structural model. These three indicators are reported for each PLS model tested in the context of ICT staff sample. The results are shown in Table 7.7.

Table 7.7 the results of calculating R2, GoF, and Q2 for each PLS model for ICT staff

PLS model	Path Coefficient	Strength	R^2	R^2 Power	GoF	Q^2
IT Infrastructure Services →System Quality	.630***	Strong	.397	Modeate	.487	.036
IT Infrastructure Services →Information Quality	.490$^{N.S}$	Moderate	.240	Modeate	.366	.053
IT Infrastructure Services →Service Delivery Quality	.849***	Strong	.720	Substantial	.849	.088
IT Infrastructure Services →Perceived Usefulness	.457$^{N.S}$	Moderate	.209	Modeate	.663	.105

PLS model	Path Coefficient	Strength	R^2	R^2 Power	GoF	Q^2
IT Infrastructure Services →User Satisfaction	.490***	Moderate	.246	Modeate	.383	.045
System Quality →Information Quality	.636**	Strong	.402	Modeate	.214	.294
System Quality → Service Delivery Quality	.694***	Strong	.480	Modeate	.554	.069
System Quality → Perceived Usefulness	.582**	Strong	.339	Modeate	.203	.188
System Quality →User Satisfaction	$.463^{N.S}$	Moderate	.215	Modeate	.340	.437
Information Quality → Service Delivery Quality	.669***	Strong	.448	Modeate	.520	.092
Information Quality → Perceived Usefulness	$.371^{N.S}$	Moderate	.137	Weak	.259	.294
Information Quality →User Satisfaction	.586***	Strong	.344	Modeate	.279	.387
Service Delivery Quality →Perceived Usefulness	.658***	Strong	.432	Modeate	.530	.188
Service Delivery Quality →User Satisfaction	.685***	Strong	.403	Modeate	.507	.206
Service Delivery Quality →Customer Value	$-.360^{N.S}$	Moderate	.130	Weak	.281	.256
Service Delivery Quality →Organisational Value	$.238^{N.S}$	Moderate	.057	Weak	.195	.235
Perceived Usefulness →User Satisfaction	.528*	Strong	.279	Modeate	.392	.233
Perceived Usefulness →Customer Value	$.652^{N.S}$	Strong	.425	Modeate	.448	.305
Perceived Usefulness →Organisational Value	.490*	Strong	.240	Modeate	.392	.181
User Satisfaction →Customer Value	$.371^{N.S}$	Moderate	.138	Weak	.292	.250
User Satisfaction →Organisational Value	$.509^{N.S}$	Strong	.252	Modeate	.397	.211

*significant at level 0.05 ** Significant at level 0.01; *** significant at level 0.001; N.S not significant

The GoF values were in the range 0.120 to 0.934. These values indicate that the PLS models of ICT staff sample achieved a good level of fit. The predictive relevance Q^2 was used to evaluate the validation of the PLS models. All the values of predictive relevance Q^2 were positive and greater than zero as shown in Table 7.7.

7.5.2. Testing the mediation effect

Investigating the mediation role of service delivery quality between the predictor factors (IT infrastructure services, system quality, and information quality) and the dependent factors (perceived usefulness and user satisfaction) in the proposed model is one of the key purposes of this study. Thus, the mediation role of service delivery quality in the context of ICT staff sample is tested.

7.5.2.1. Testing the mediation role of SDQ on perceived usefulness

Service delivery quality is assumed as a mediation construct between the predictor factors (IT infrastructure, system quality, and information quality) and the dependent factor (perceived usefulness).

The two steps proposed by Hair et al. (2010) are employed to examine the mediation. The first step is to examine the necessary individual relationships between the predictor, mediation, and dependent factors—which must be significant (conditions 1 to 3 in Baron & Kenney 1986). Based on these conditions, IT infrastructure services, system quality, and information quality (predictor factors) must significantly impact perceived usefulness (independent factor) and service delivery quality (mediation factor). Service delivery quality must significantly influence perceived usefulness.

The second step of testing mediation comprised two sub steps: (1) testing the initial model with only the direct effect between the predictor factors, IT infrastructure services, system quality, and information quality, on the dependent factor, perceived usefulness.

These two steps are already tested and described in section 7.4.1. The main justification to test these two steps earlier is that the PLS models include only two constructs and that leads to consider them as initial models. The results of testing these two steps are shown in Table 7.8.

Table 7.8 Results of testing mediation role of SDQ between the predictor factors and perceived usefulness

Relationships	Coefficient	t-value	Conditions
IT Infrastructure Services → Perceived usefulness	.457	1.597$^{N.S}$	First condition
System Quality → Perceived usefulness	.582	2.752**	
Information Quality → Perceived usefulness	.371	.656$^{N.S}$	
IT Infrastructure Services →SDQ	.849	17.787***	Second condition
System Quality →SDQ	.694	5.711***	
Information Quality →SDQ	.669	3.324***	
SDQ → Perceived usefulness	.658	5.121***	Third condition

*significant at level 0.05 ** Significant at level 0.01; *** significant at level 0.001; N.S not significant

The outcomes of the test show that the effects of system quality on perceived usefulness were significant. However, IT infrastructure services and information quality did not significantly influence perceived usefulness. The first condition is only achieved by system quality. Conditions two and three were achieved. IT infrastructure services and information quality do not affect perceived usefulness via service delivery quality because these constructs do not meet the conditions of mediation role. Therefore, sub-step (2) is limited only to system quality because it achieved the three conditions of mediation test.

Based on these results two hypotheses are rejected: (H22) '*The effect of IT Infrastructure Services on Perceived Usefulness is mediated by Service Delivery Quality*' and (H24) '*The effect of Information Quality on Perceived Usefulness is mediated by Service Delivery Quality*'.

Sub step (2) estimates a second model that includes the mediating variable, the effect of the predictor factor on the mediator, and the effect of the mediator on the dependent variable. The results after conducting this step are shown in Figure 7.24.

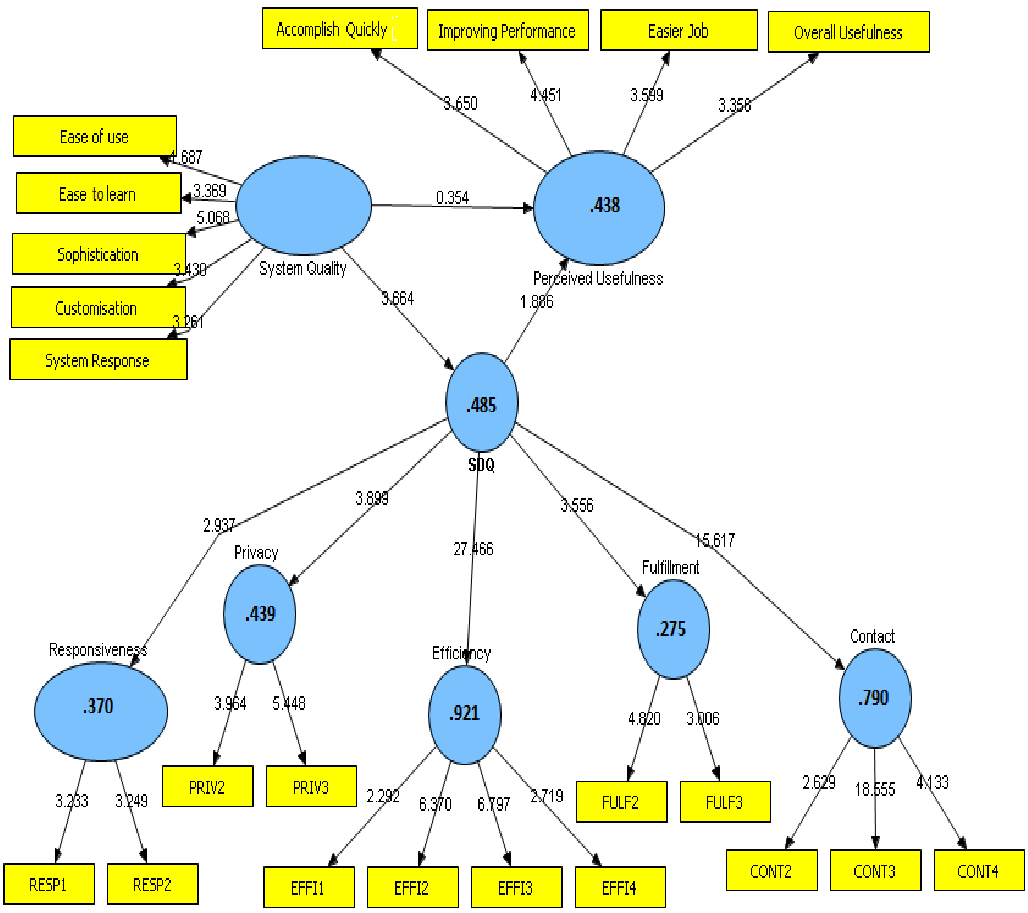


Figure 7.24 Testing the model of system quality impact on perceived usefulness with mediation

The outcomes of testing the model show that system quality significantly impacted service delivery quality and 48.5 percent of the variance in service delivery quality can explain by system quality (β 0.696, t-value 3.664, P 0.001, R^2 48.5%). The impact of service delivery quality on perceived usefulness is significant at level 0.05 and the results were (β 0.573, t-value 1.886, P 0.05). However, the impact of system quality on perceived usefulness was not significant as the results indicate (β 0.120, t-value 0.354, P 0.05). System quality and service delivery quality explained 43.8 percent of the variance in the perceived usefulness.

A comparison between the results of the two models (without mediation and with mediation) was conducted and the results are shown in Table 7.9.

Table 7.9 Comparison between the initial model without mediation and initial model with mediation

Relationships			**Initial model without mediation**		**Initial model with mediation**	
			Coefficient	t-value	Coefficient	t-value
Perceived Usefulness	←	System Quality	.582	2.752**	.120	.354 N.S
SDQ	←	System Quality	-	-	.696	3.664***
Perceived Usefulness	←	SDQ	-	-	.573	1.886*

*significant at level 0.05 ** Significant at level 0.01; *** significant at level 0.001; N.S not significant

The key purpose of this comparison is to depict the changes that occurred due to the addition of the mediator variable service delivery quality.

The results point to the fact that significant changes occurred in the effect of system quality on perceived usefulness. System quality significantly affected perceived usefulness at the initial model, however, this effect became non-significant after adding the mediator factor, service delivery quality. This significant change confirmed that the effect of system quality on perceived usefulness is fully mediated by service delivery quality. The final model of system quality impacted on perceived usefulness mediated by service delivery quality (see Figure 7.25). The results of the final model after considering the mediation role of service delivery quality highlight that system quality significantly influenced service delivery quality and 48.3% of the variance in service delivery quality can be explained by this construct (β 0.695, t-value 6.290, P 0.001, R^2 48.3%). Perceived usefulness was significantly impacted by service delivery quality (β 0.659, t-value 5.675, P 0.001, R^2 43.4%). 43.4 percent of the variance in this construct was explained by the direct effect of service delivery quality and the indirect effect of system quality via service delivery quality. As a result, the hypothesis (H23) '*The effect of System Quality on Perceived Usefulness is mediated by Service Delivery Quality'* is accepted.

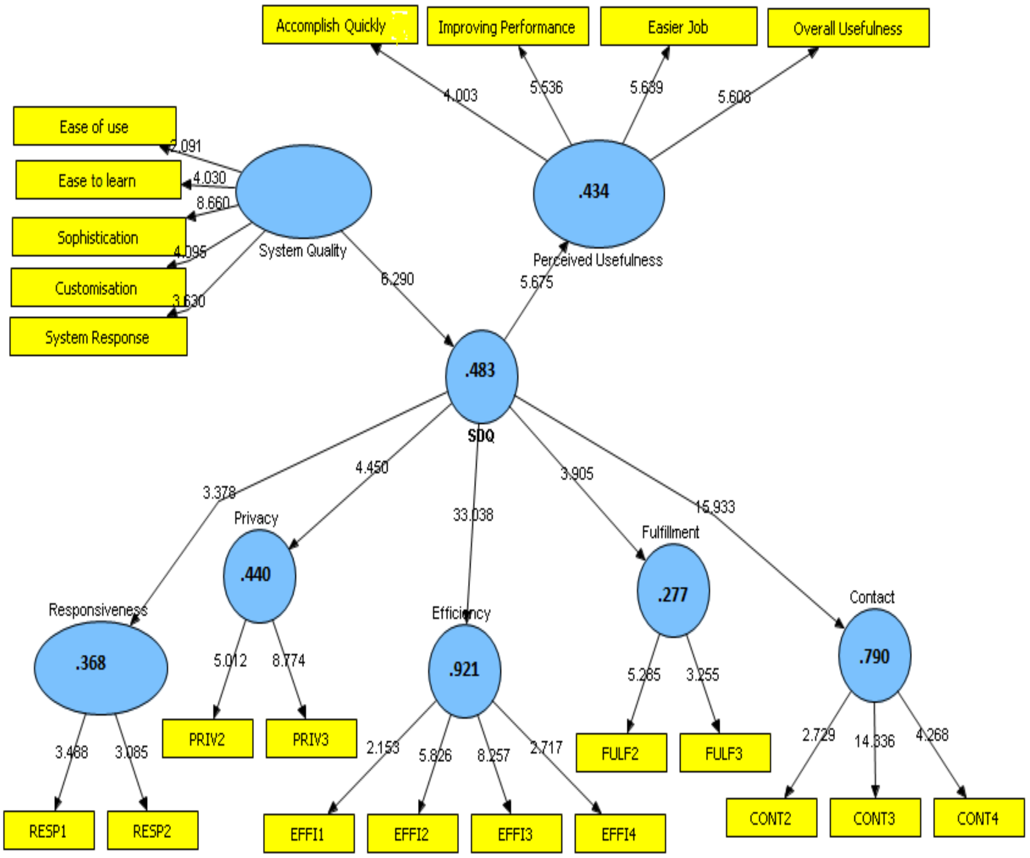


Figure 7.25 Testing the final model of system quality impact on perceived usefulness with full mediation by service delivery quality

7.5.2.2. Testing the mediation role of SDQ on user satisfaction

The same procedures were employed to test the impact of IT infrastructure services, system quality, and information quality on user satisfaction mediated by service delivery quality. The results of testing the necessary individual relationships between the predictor factors (IT infrastructure services, system quality, and information quality), mediation (service delivery quality), and dependent factors (user satisfaction) are shown in Table 7.10.

Table 7.10 Results of testing mediation role of SDQ between the predictor factors and user satisfaction

Relationships	Coefficient	t-value	Conditions
IT Infrastructure Services → User satisfaction	.496	3.722***	First condition
System Quality → User satisfaction	.463	1.023N.S	
Information Quality → User satisfaction	.586	3.490***	
IT Infrastructure Services →SDQ	.849	17.787***	Second condition
System Quality →SDQ	.694	5.711***	
Information Quality →SDQ	.669	3.324***	
SDQ → User satisfaction	.685	5.153***	Third condition

*significant at level 0.05 ** Significant at level 0.01; *** significant at level 0.001; N.S not significant

The three conditions of individual relationships were achieved, except the first condition of system quality impact on user satisfaction. For that reason, the hypothesis (H26) '*The effect of System Quality on User Satisfaction is mediated by Service Delivery Quality'* is rejected because the relationship between system quality and user satisfaction did not met the required condition of mediation (first condition). The emphasis of sub step (2) is on including the mediating variable and the effect of the mediator on the dependent variable. The outcomes of performing this step with IT infrastructure services are shown in Figure 7.26.

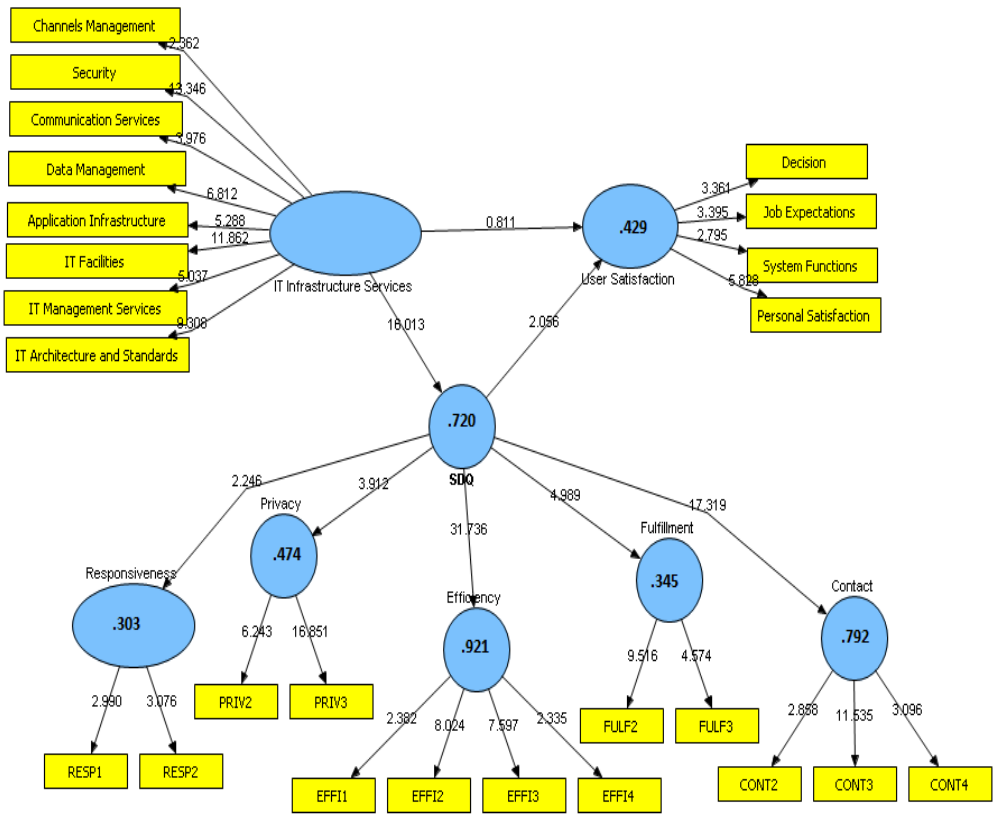


Figure 7.26 Testing the model of IT infrastructure services impact on user satisfaction with mediation

The consequences of testing this model confirmed that IT infrastructure services significantly impacted service delivery quality (β 0.848, t-value 16.013, P 0.001, R^2 72%). According to these results, 72 percent of the variance in service delivery quality is explained by IT infrastructure services. User satisfaction is significantly influenced by service delivery quality (β 0.961, t-value 2.056, P 0.05). However, IT infrastructure had no significant influence on user satisfaction (β 0.402, t-value .811, P 0.05). IT infrastructure services and service delivery quality explained 42.9 percent of the variance in user satisfaction.

A comparison between the results of the two models (without mediation and with mediation) was conducted and the outcomes are shown Table 7.11.

Table 7.11 Comparison between the initial model without mediation and initial model with mediation for IT infrastructure services

Relationships			**Initial model without mediation**		**Initial model with mediation**	
			coefficient	t-value	coefficient	t-value
User Satisfaction	←	IT Infrastructure Services	.496	3.722***	0.401	0.811 N.S
SDQ	←	IT Infrastructure Services	-	-	.848	16.013***
User Satisfaction	←	SDQ	-	-	.960	2.066*

*significant at level 0.05 ** Significant at level 0.01; *** significant at level 0.001; N.S not significant

The results in Table 7.11 indicate that the effect of IT infrastructure services on user satisfaction was reduced significantly and confirms the full mediation role of service delivery quality between IT infrastructure services and user satisfaction. The hypothesis that (H25) '*The effect of IT Infrastructure Services on User Satisfaction is mediated by Service Delivery Quality'* is accepted; and Figure 7.27 shows the full mediation role of service delivery quality between IT infrastructure services and user satisfaction.

The results of PLS model in Figure 7.27 show that 71.4 percent of the service delivery quality is explained by IT infrastructure services, and the regression analysis results were (β 0.845, t-value 16.182, P 0.001). The effect of service delivery quality on user satisfaction was positive and significant (β 0.627, t-value 4.849, P 0.001). The direct effect of service delivery quality and indirect effect of IT infrastructure service, via service delivery quality, explained 39.3 percent of the variance in user satisfaction.

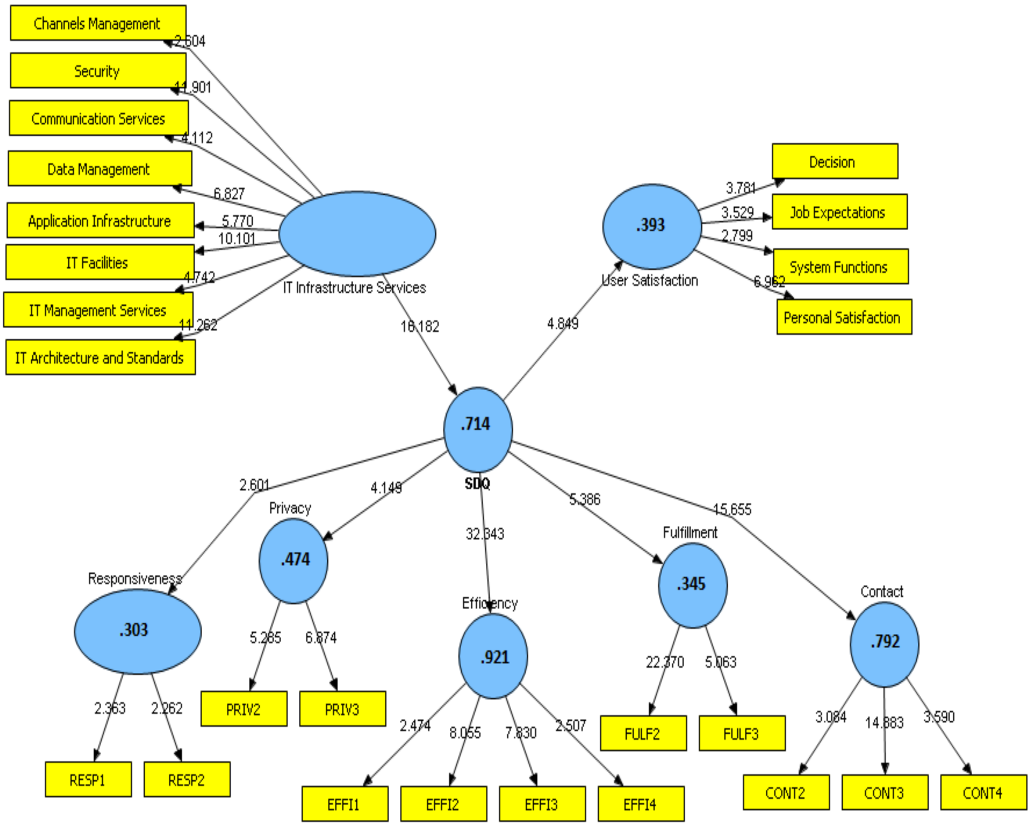


Figure 7.27 Testing the final model of IT infrastructure services impact on user satisfaction with full mediation by service delivery quality

The PLS model was performed to test the impact of information quality on user satisfaction after adding the mediator factor, service delivery quality, and the effect of mediator on dependent factor. The outcomes of conducting this step are shown in Figure 7.28. The outcomes of examining this PLS model show that information quality significantly affected service delivery quality and the latter significantly influenced user satisfaction, and the regression results were (β 0.652, t-value 3.733, P 0.001) and (β 0.509, t-value 2.321, P 0.05) respectively. Information quality explained 42.5% of the variance in the service delivery quality. 41.9 percent of the variance in user satisfaction was explained by information quality and service delivery quality.

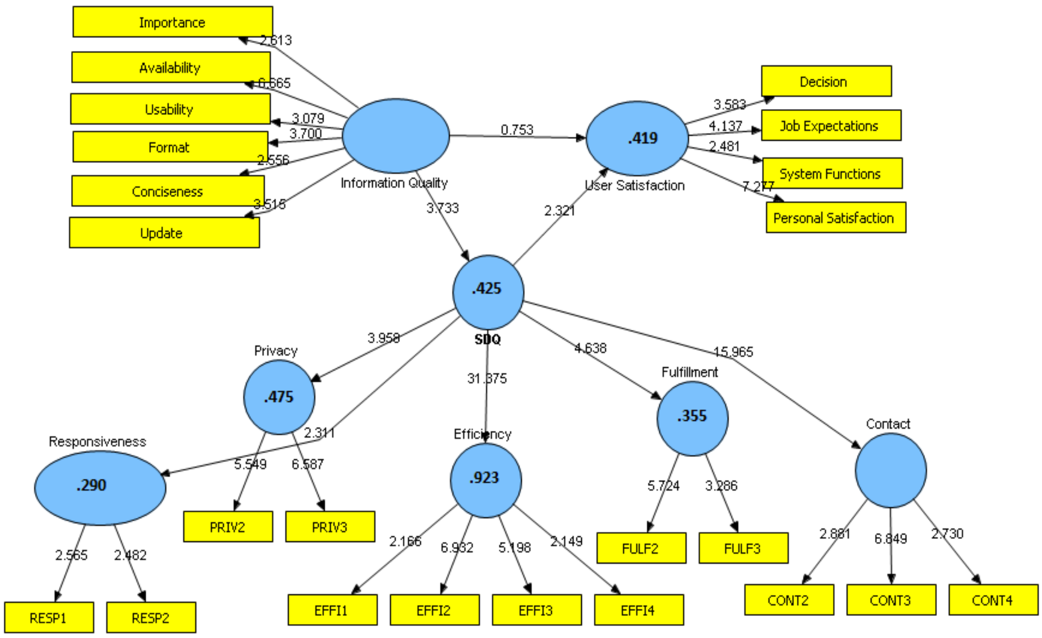


Figure 7.28 Testing the model of information quality impact on user satisfaction with mediation

A comparison between the results of the two models (without mediation and with mediation) was made and the outcomes are shown in Table 7.12.

Table 7.12 Comparison between the initial model without mediation and initial model with mediation for information quality

Relationships			Initial model without mediation		Initial model with mediation	
			coefficient	t-value	coefficient	t-value
User Satisfaction	←	Information quality	.586	3.490***	.188	.753 N.S
SDQ	←	Information quality	-	-	.651	3.733***
User Satisfaction	←	SDQ	-	-	.508	2.321*

*significant at level 0.05 ** Significant at level 0.01; *** significant at level 0.001; N.S not significant

The results of comparing the two models (without mediation and with mediation) show that the effect of information quality on user satisfaction was significant and became non-significant after adding the mediator factor, service delivery quality. The significant reduction in this relationship confirms the full mediation role of service delivery quality between information quality and user satisfaction. Hence, hypothesis (H27) '*The effect of Information Quality on User Satisfaction is mediated by Service Delivery Quality'* is accepted. Figure 7.29 shows the PLS model of full mediation role of service delivery quality between information quality and user satisfaction.

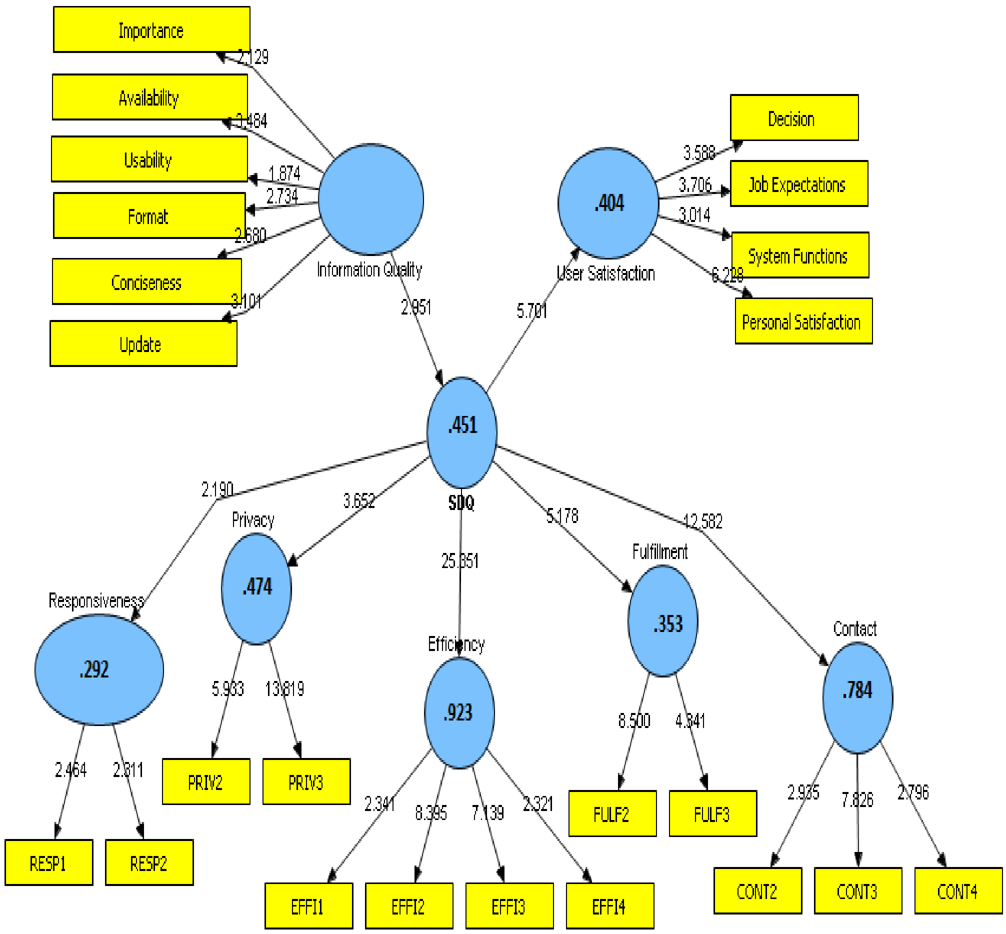


Figure 7.29 Testing the final model of information quality impact on user satisfaction with full mediation by service delivery quality

According to the result shown in Figure 7.29, service delivery quality is significantly affected by information quality (β 0.671, t-value 2.951, P 0.01, R^2 45.1%) and 45.1 percent of the variance in service delivery quality is explained by information quality. User satisfaction is significantly influenced by service delivery quality (β 0.508, t-value 2.321, P 0.05). The direct impact of service delivery quality and the indirect effect of information quality via the latter contributed to explaining 45.1 percent of the variance in user satisfaction.

The indicators for evaluating the validation of structural model and the path for the full mediation PLS models were tested and the results are shown in Table 7.13.

Table 7.13 Indicators of evaluation the validation of full mediation models of ICT staff

Constructs			**Indicators**		
Predictor	**Mediator**	**Dependent**	**R^2**	**GoF**	**Q^2**
System quality	Service delivery quality	Perceived usefulness	.434	.540	.252
IT infrastructure services	Service delivery quality	User satisfaction	.393	.592	.200
Information Quality	Service delivery quality	User satisfaction	.404	.506	.229

In summary, service delivery quality plays a significant role as a mediation factor between system quality and perceived usefulness; and between IT infrastructure services, information quality, as predictor factors, and user satisfaction, as dependent factor. However, this role was not confirmed between IT infrastructure services, information quality and perceived usefulness, or between system quality and user satisfaction.

As mentioned previously, the relationships among the model constructs of ICT staff were separately tested due to sample size requirements. The direct effects between the constructs were tested and then the mediation role of service delivery quality was examined. All the PLS models regarding the ICT staff sample tested in this chapter were gathered in one model as shown in Figure 7. 30. Three labels were used to identify the level of significance:

* Significance level at 0.05; ** Significance level at 0.01; *** Significance level at 0.001; and N.S Not Significant.

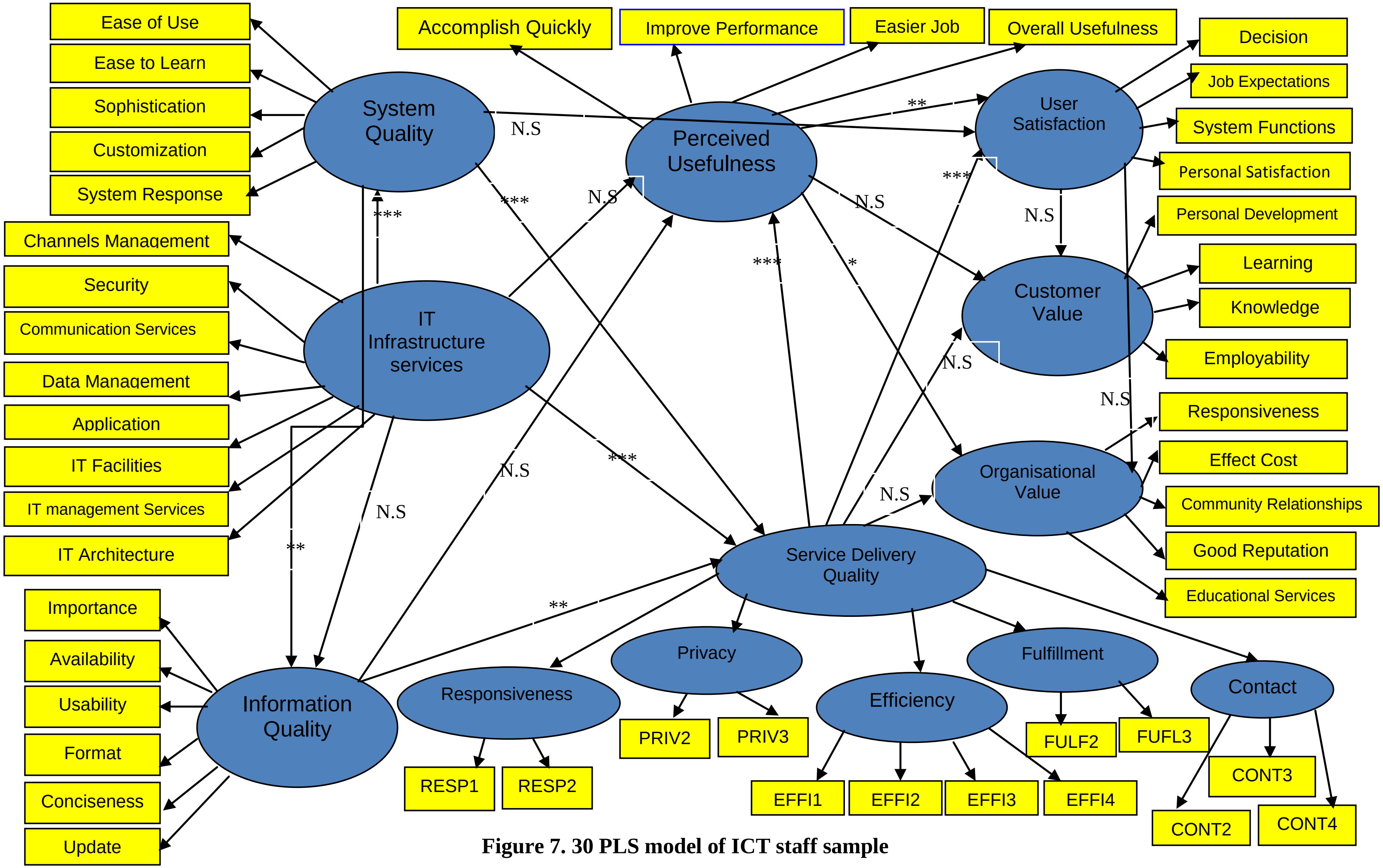


Figure 7. 30 PLS model of ICT staff sample

7.6. Content Analysis of ICT Staff Comments

The ICT staff sample was small (22 respondents) and only three comments were received from this sample. These comments focused on factors impacting the success of e-learning based on the perceptions of ICT staff.

The first comment was comprehensive and includes different factors that impact the success of the e-learning system: '*The e-learning system in the end is only a framework. The student experience of e-learning, and therefore I would say success of the system, is also heavily influenced by the quality of the lecturer's learning approach, design, content, use and operation of the e-learning system. If the e-learning interface is cluttered, inconsistent, confusing and not up-to-date (e.g. with content for study) then the system will not work for the student*' (#3).

The factors of e-learning system success identified in this comment were students' experiences, lecturers' learning approach, system quality, information quality, and web design.

The second comment emphasises the 'e-learning system profile' and ICT staff as stakeholders in the e-learning system: '*At USQ we have a number of systems that work together as a portfolio to form the "e-learning system", although the main system is Moodle. Different ICT staff also interact with it quite different[ly], as users, administrators, infrastructure design and support, and may have different experiences and get different things from it*' (#5).

The third comment identified support to mobile devices as a critical issue in e-learning: *'Need to do more to support mobile devices'* (#12).

In spite of the small number of comments from ICT staff, these comments were useful in identifying the factors that impact on the success of e-learning systems.

7.7. Chapter summary

This chapter focused on the ICT staff sample. The sample of ICT staff was the smallest among the three samples of study: students; academic staff; and ICT staff. The first part of the analysis described the perceptions of ICT staff toward factors affecting the success of e-learning systems. To overcome the issue of small sample size, PLS was employed to test the measurement model and the study hypotheses. The measurement model was tested at the second stage of the analysis and different indicators were employed to examine the reliability and validity of the items, constructs, and the whole measurement model. Subsequently, the structural model and hypotheses were tested. To meet the sample size requirements for testing the PLS model, the relationships among the constructs in the proposed model were separately examined; followed by an analysis of the mediation role of service delivery quality between the predictor factors (IT infrastructure services, system quality, and information quality) and the dependent factors (perceived usefulness and user satisfaction).

The results of analysing the data of ICT staff sample confirmed the validity and reliability of the model to evaluate the success of e-learning based on the ICT staff perspective. The content analysis showed that the factors impacting the success of e-learning system based on the ICT staff perceptions were were students' experiences, lecturers' learning approach, system quality, information quality, web design, and platform compatibility.

CHAPTER EIGHT

This chapter discusses the results of testing the study model with the three stakeholder groups of e-learning systems. The first section of the chapter discusses the results of the measurement model and the validity and reliability aspects to measure each construct. The second section is allocated to discussing the results of testing the hypotheses based on the perceptions of students, academic staff, and ICT staff. The final section concludes the chapter with a discussion of the content analysis results.

CHAPTER EIGHT: DISCUSSION OF RESULTS

8.1. Introduction

This study proposed a model to measure e-learning systems success within different groups of stakeholders. The model was tested with three stakeholders: students, academic staff, and ICT staff with details of the results from examining the model provided in chapters 5, 6 and 7 respectively. Further details about testing the models and the hypotheses, and the contribution of the study are provided in this chapter. This chapter discuss the results obtained in chapter 5, 6, and 7. This chapter is divided into three sections. The first section discusses the results of measurement models. Discussion of structural models and testing the hypotheses is reported in the second section of this chapter. The third section is allocated to discussion of the results of content analysis of comments for students, academic staff, and ICT staff.

8.2. Measurement model

Analysis of the data and collating the results requires methodological procedures to achieve these stages of the study. The current study deals with three stakeholder groups and different sets of data. Structural equation modeling was employed to analyse the three sets of data. Two approaches were adopted to test the proposed model with the three stakeholders: (1) covariance-based structural equation modelling (CBSEM) using AMOS software to analyse the data from the students' sample. (2) The component-based approach PLS using SmartPLS2 M3. This approach was adopted to analyse the data of academic staff and ICT staff. Both approaches were based on two models: measurement model and structural model. The measurement model shows how each observed variable relates to their construct (Guo et al., 2011). The findings from examination of the measurement model for each construct and each stakeholder group (students, academic staff, and ICT staff) are now discussed.

8.2.1. IT Infrastructure services

This study adopted IT infrastructure services as a foundation construct to achieve the success of e-learning systems. For the student sample, six items were used to measure this construct and each item was employed to measure a specific aspect:

channels management, security, advice and consultancy, communication infrastructure, application infrastructure, and support services. However, two items were eliminated as measures of IT infrastructure services: security and application infrastructure. Elimination of those two items was based on theoretical and statistical grounds as explained in section 5.2.1. The indicators of the measurement model confirmed the reliability and validity of this construct in assessing e-learning system success.

Regarding the academic staff sample, the measurement model indicates that IT infrastructure services is a valid and reliable construct to measure the success of e-learning systems. The six items used to measure this construct based on the academic staff perspective were significant and no items were deleted. Those six items were channels management, security, communication infrastructure, software application, maintain services, and development and evaluation. The results support the significant role of IT infrastructure in measuring information system success from the viewpoint of academic staff.

ICT staff perceptions about the significance of IT infrastructure as a construct to measure e-learning systems success were investigated in this study. Ten items were employed to gauge IT infrastructure services based on the opinions of this stakeholder group: channels management, security, communication services, data management, application infrastructure, IT facilities, IT management services, IT architecture and standards, IT education, IT research and development. However, IT education and IT research and development were not significant in measuring IT infrastructure services.

These findings regarding the valid and reliable role of IT infrastructure services in assessing the success of e-learning systems are consistent with results of studies by Selim (2007) and Ahmed (2010). However, these studies were conducted with one stakeholder group and adopted limited aspects to measure this construct.

8.2.2. System quality

Ease of use, user requirements, system accuracy, and integration were significant aspects for students in measuring the quality of e-learning systems. However, four items did not significantly represent the quality of e-learning systems: ease to learn, system features, flexibility, sophistication.

Academic staff have positive perceptions about eight aspects of system quality: ease of use, ease to learn, user requirements, system features, system accuracy, flexibility, sophistication, integration. Based on academic staff perspectives, these eight aspects significantly represented the quality of e-learning system.

Regarding ICT staff, five items significantly represented e-learning system quality: ease of use, ease to learn, sophistication, customisation, and system response. Four aspects did not significantly represent e-learning system quality based on ICT staff perspectives: system features, flexibility, system accuracy, and user requirements.

The results from the measurement model confirm that quality of an e-learning system is a valid and reliable construct as a measurement of e-learning systems success. This finding is in agreement with results of studies undertaken in the e-learning system field, for instance, Volery and Lord (2000), Holsapple and Lee-Post (2006), Brown (2002), Liaw (2008a), Ozkan and Koseler (2009), Wang and Wang (2009), H. C. Wang and Chiu (2011), Islam (2011) and Tella (2011).

8.2.3. Information quality

The study assumed that information quality is a key measure of the success of an e-learning system. Regarding the students' sample, three items significantly represented the information quality of e-learning systems: availability; understandability; and conciseness. However, the other two items, importance and usability, were not significant.

Six items were used to measure the information quality of the e-learning system: importance, availability, usability, understandability, format, and conciseness. These six aspects significantly represented information quality based on academic staff perceptions.

Importance, availability, usability, understandability, format, conciseness, and updated were the aspects employed to gauge the information quality of the e-learning system for the ICT staff sample. These aspects, excluding understandability, were significant in representing the information quality construct.

This result is in agreement with studies by Roca et al. (2006), Holsapple and Lee-Post (2006), Wang et al. (2007), Wang and Wang (2009), Ozkan and Koseler (2009), Freeze et al. (2010) and Alkhattabi et al. (2010) all of whom found that system quality is a valid and reliable construct to assess the success of e-learning systems.

8.2.4. Service delivery quality

The E-S-QUAL scale was adopted in this study to assess the service delivery quality of e-learning systems. Most of the studies dealing with this construct (e.g. Roca et al. (2006); Lin (2007); Wang et al. (2007) adopted a limited number of items to measure this construct. However, the current study adopted the whole scale to assess the service delivery quality.

Twenty items distributed across six sub-dimensions were adopted to measure this construct within the student sample: efficiency (3 items); system availability (3); fulfillment (4); privacy (3); responsiveness (3); and contact (4). Seven items were eliminated as measures of service delivery quality because they did not significantly represent the construct of service delivery quality.

The six sub-dimensions of service delivery quality were measured using 18 items for the academic staff sample. The measurement model results indicate that the six sub-dimensions significantly represented the construct of service delivery: efficiency (4 items); system availability (3); fulfillment (3); privacy (3); responsiveness (2); and contact (3).

The opinions of ICT staff regarding service delivery quality were gauged using 21 items distributed over six sub-dimensions. The availability sub-dimension was eliminated as a measure of service delivery quality because it did not significantly represent the construct of service delivery quality. Five other items from different sub-dimensions were eliminated as they did not significantly represent the measurement of service delivery quality.

System availability is related to correct performance of the technical functions of the system (Parasuraman et al., 2005). E-learning systems are no different to traditional or electronic information systems, and may face technical problems. For example, the system will not be available to the user when it is temporarily suspended for maintenance. The design of the e-learning systems interface (website) may affect system availability if the site is complicated and has excessive content. These types of sites need high-speed Internet connection to load pages, and this aspect may be not available on some devices used to access e-learning services, such as mobile phones. Issues of system availability are not only related to the ICT Division at the university, but depend on the facilities of students as well. In this regard Parasuraman et al. state that 'companies may not have full control over performance on this dimension (availability); the equipment at the customer's end (e.g., type of computer and Internet connection) is also likely to affect performance on this dimension' (2005, p. 18).

The results presented here confirm the role of service delivery quality as an essential construct in assessing the success of e-learning systems as previously found by many researchers (e.g. Holsapple and Lee-Post (2006); Roca et al. (2006); Y. S. Wang et al. (2007); Landrum et al. (2008); Adeyinka and Mutula (2010); Almarashded et al. (2010); Masrek et al. (2010); Ozkan and Koseler (2009); Teo (2011); H. C. Wang and Chiu (2011), Hassanzadeh et al. (2012) and Cheng (2012a)) have investigated and the results presented here confirm this role.

8.2.5. Perceived usefulness

Perceived usefulness is adopted in this study to evaluate the success of e-learning systems via enhancing the job performance of academic and ICT staff; and the academic performance of students.

For the student sample, only two aspects out of five were significant to measure the perceived usefulness: accomplish quickly and improve performance. The results from using these two items to measure perceived usefulness seem to be consistent with a study by Doll et al. (1998).

Perceived usefulness was measured using four aspects: accomplish quickly; improve performance; enhance effectiveness; and easier job. The findings confirm that these four aspects significantly represent the construct of perceived usefulness based on the perceptions of academic staff.

Regarding ICT staff, four aspects significantly represented this construct based on the perception of ICT staff: accomplish quickly; improve performance; easier job; and overall usefulness. However, one aspect was not significant in measuring the perceived usefulness: increasing productivity.

These results further support the idea of using perceived usefulness to measure the success of an e-learning system success based on different points of view and with different stakeholders.

The validity and reliability of perceived usefulness as an indicator to measure the success of e-learning systems were confirmed by previous studies such as McFarland (2001), Stoel and Lee (2003), Martins and Kellermanns (2004), Gong et al. (2004), Saadé and Bahli (2005), Roca et al. (2006) , Pituch and Lee (2006), Ong and Lai (2006), Toral et al. (2007), Ngai et al. (2007), Martinez-Torres et al. (2008), Van Raaij and Schepers (2008), Liaw (2008a), Abbad et al. (2009), Sørebø and Eikebrokk (2008), W. T. Wang and Wang (2009), Cho et al. (2009), Byoung-Chan et al. (2009), Sánchez and Hueros (2010), Teo (2011), Hsieh and Cho (2011), and Hung et al. (2011).

8.2.6. User satisfaction

User satisfaction was selected to be a central construct of the e-learning success model in this study. The items used to measure the students' satisfaction about e-learning reflected five aspects: e-learning system performance; e-learning system experience; satisfaction with decision; re-use e-learning system; and students' needs. However, only two aspects significantly represented user satisfaction for the student sample: e-learning system performance and e-learning system experience.

Content within the e-learning system, satisfaction with use of the e-learning system, learning tool, and satisfaction with system function were the aspects used to measure the satisfaction of academic staff with the e-learning system. These four aspects significantly represented the construct of user satisfaction based on the perspectives of academic staff.

User satisfaction of ICT staff toward the e-learning system was measured by five aspects: satisfaction with decision to work in the e-learning field; job expectations; system function; personal satisfaction; and self-esteem. These aspects, except for self-esteem, significantly represented the construct of user satisfaction based on the view of ICT staff.

The results from the measurement model regarding user satisfaction confirm the validity and reliability of this construct to measure e-learning system success. In addition, user satisfaction is significant in measuring the success of the e-learning system from different points of view (with different stakeholders).

These findings are consistent with the results of studies by Arbaugh (2000a), Hayashi et al. (2004),Chiu et al. (2005), Eom et al. (2006), Lee and Hwang (2007), Sun et al. (2008), Shee and Wang (2008), Ho and Dzeng (2010); Larsen et al. (2009); Limayem and Cheung (2008), Wu et al. (2010), Lin and Chen (2012) and Ramayah and Lee (2012) which confirm that user satisfaction is a significant construct to measure e-learning system success.

8.2.7. Customer value

Customer value constructs were selected as a result of the relationships between the constructs of the study model mentioned previously in this section. Five aspects were employed as measures of customer value from the students' point of view. The first three items relate to increased ability to evaluate information, understanding concepts, and stimulation. The other two items measured the social value that can be gained by students as a result of using the e-learning system. The results concluded that three aspects significantly represent customer value based on students' perspectives: increasing abilities; understanding concept; and social value.

This study hypothesized that customer value is a key measure of e-learning systems success from the perspective of academic staff. Four aspects were used to gauge the customer value of academic staff: improve work practices; learning; sense of accomplishment; and sense of fulfillment. The four aspects significantly represent the customer value of e-learning systems according to academic staff perspectives.

The customer value perspective of ICT staff was measured using five items and the aspects of these items are: improve work practices, personal development, learning, knowledge, and employability. These aspects, with the exception of work practices, significantly represented the construct of customer value to measure the success of the e-learning system based on ICT staff perspectives.

The crucial role of customer value in measuring the success of information systems and web-based systems was confirmed by previous studies such as Fiore et al. (2005), Shun and Yunjie (2006), Yang and Jolly (2009), Chang et al. (2009), and Kim et al. (2009).

8.2.8. Organisational value

Organisational value was the dependent factor in the proposed model, alongside customer value. Six items were utilised to gauge organisational value from the viewpoint of academic staff: developing learning techniques; responsiveness; effective cost; community relationships; good reputation; and organisational goals. These six aspects were significant in measuring the construct of organisational value based on the perspective of academic staff. Organisational value was also measured based on the perceptions of ICT staff using five items: responsiveness to change; effective cost; community relationships; good reputation; educational services. The results from the measurement model confirm that these five aspects were significant in measuring organisational value according to ICT staff.

The findings also confirmed the reliability and validity of organisational value as a measure of e-learning system success based on the views of both academic staff and ICT staff. These results are supported by the literature (for example, Lin and Lee (2006); Gorla et al. (2010); Kim et al. (2009); Wang and Liao (2008)).

In summary, Table 8.1 shows the study constructs and the significant aspects to measure each construct for each of three stakeholder groups: students, academic staff, and ICT staff.

Table 8.1 Summary of the significant aspects in measuring e-learning system success based on different points of view

Construct	Student	Academic staff	ICT staff
IT Infrastructure Services	Channels management	Channels management	Channels management
	Advice and consultancy	Security	Security
	Communication infrastructure	Communication infrastructure	Communication services
	Support services	Maintain services	management services
	-	Software application	Application infrastructure
	-	Development and evaluation	IT architecture and standards
	-	-	Data management IT
	-	-	IT facilities
System Quality	Ease of use	Ease of use	Ease of use
	-	Ease to learn	Ease to learn
	User requirements	User requirements	-
	System accuracy	System accuracy	System response
	-	Sophistication	Sophistication
	Integration	Integration	-
	-	System features	Customization
	-	Flexibility	-

Construct	Student	Academic staff	ICT staff
Information Quality	-	Importance	Importance
	Availability	Availability	Availability
	-	Usability	Usability
	Understandability	Understandability	Update
	-	Format	Format
	Conciseness	Conciseness	Conciseness
Service delivery quality	Efficiency	Efficiency	Efficiency
	System availability	System availability	-
	Fulfillment	Fulfillment	Fulfillment
	Privacy	Privacy	Privacy
	Responsiveness	Responsiveness	Responsiveness
	Contact	Contact	Contact
Perceived usefulness	Accomplish quickly	Accomplish quickly	Accomplish quickly
	Improve performance	Improve performance	Improve performance
	-	Easier job	Easier job
	-	Enhance effectiveness	Overall usefulness
User Satisfaction	E-learning system performance	Content with e-learning system	Satisfaction with decision
	E-learning system experience	Satisfaction with use e-learning	Job expectations
	-	Satisfaction with system function	System function
	-	Learning tool	Personal satisfaction
Customer Value	Increase abilities	Improve work practices	Personal development
	Understanding concept	Learning	Learning
	Social value	Sense of accomplishment	Knowledge
	-	Sense of fulfillment	Employability
Organisational value	-	Developing learning techniques	Educational services
	-	Responsiveness	Responsiveness
	-	Effective cost	Effective cost
	-	Community relationships	Community relationships
	-	Good reputation	Good reputation
	-	Organisational goals	-

8.3. The structural model and hypotheses

The structural model focuses on testing the relationships between the constructs based on the model design and 27 hypotheses formulated to investigate these relationships. A model to measure the success of e-learning system is suggested in this study and the same model was employed with three stakeholders: students; academic staff; and ICT staff. The same set of hypotheses proposed in this study was examined with the data of the three samples. The discussion of the relationships among the constructs of the proposed model is based on the hypotheses formulated in this study. The discussion of hypotheses is overviewed based on the relationships between the eight key constructs in the model.

8.3.1. IT infrastructure services hypotheses

Five hypotheses were formulated to investigate the impact of IT infrastructure services on the proposed model. The results of each hypothesis are now discussed.

- **H1: IT infrastructure services significantly and directly affect system quality**

Hypothesis (H1) is supported by the research findings for all three samples: students; academic staff; and ICT staff.

The main role of IT infrastructure services, according to these findings is to support the quality of e-learning systems to deliver educational services to students effectively. The availability of IT infrastructure services such as channel management; advice and consultancy; communication and infrastructure; and support services are significantly supported by e-learning systems quality aspects: ease of use; user requirement; system accuracy; and integration.

Regarding the students' sample; IT infrastructure services affect system quality via services provided to students. Channel management services can be considered essential services of IT infrastructure used to support the students in achieving their tasks. Through this service, the ICT Division provides students with a wide range of electronic channels to connect and interact with academic staff and that is helpful in meeting user requirements. Furthermore, the advice and consultancy services can contribute to supporting students, via the solving of technical problems facing them. The integration between the systems and providing users with supported systems and services or software are considered one of the most important services of the IT infrastructure. The e-learning system platform needs to be integrated with other software to achieve all the required educational objectives. For instance, the university adopted Moodle to provide the e-learning services and, at the same time other software—EASE 'Electronic Assignment Submission Environment', ICE, 'Integrated Content Environment', and Camtasia (Lecture recordings)—was integrated with this platform to provide full (comprehensive) services to users.

For academic staff, aspects of e-learning system quality such as ease of use, ease to learn, accuracy, flexibility, less sophistication, and integration can assist in performing their roles effectively. Some advantages can be obtained from flexibility of e-learning systems. For instance, variety in the communication channels can provide academic staff with different options for contacting students. Moreover, the flexibility can assist the user if there is any problem with the main options via the provision of alternative options.

The role of IT infrastructure services on the quality of e-learning system was confirmed by the ICT staff as well. The availability of IT infrastructure services contributes to enhancing the quality of e-learning system based on the view of IT staff. For instance, the security of e-learning is a key IT infrastructure service. If the e-learning system is secure and safe that means fewer problems and threats—and that will assist the ICT staff in maintaining, supporting and providing services effectively, and supporting system response.

These findings are consistent with results of a study by Gichoya (2005) who found that the ICT facilities quality directly affects information systems quality. Hussein et al. (2007) tested the impact of information system facilities on the success of e-government. According to Hussein et al. (2007), 'IS facilities refers to the availability of IS/IT infrastructure provided during any IS project implementation' (p. 615). Based on this view and the empirical study, Hussein et al. (2007) found that there is a positive and significant relationship between IS facilities and e-government system quality.

- **H2: IT infrastructure services significantly and directly affect information quality**

The findings based on the students and academic staff samples support hypothesis (H2). Three aspects of information quality of e-learning systems were significant in this study: availability; understand ability; and conciseness. These aspects are deemed to be essential for students to achieve the required educational tasks via electronic channels. IT infrastructure services are considered to be the foundation to support these aspects. For instance, availability of information is a key requirement by students to be aware about information relating to their courses, the important dates in each semester such as assignment due dates, exam dates, and course materials for their subjects. Effective delivery of this information depends on requirements such as electronic channels, a high security environment to exchange information, and associated support services. These requirements can be achieved via the availability of IT infrastructure services to support the e-learning system. The results of testing this hypothesis in regard to the students' sample are in agreement with Hartono's (2010) findings that confirmed the significant effect of IT infrastructure capability on quality of shared information. The present results seem to be consistent with results of Hussein et al. (2007) who found that IT infrastructure is significantly and positively associated with information quality of e-government systems.

The findings from the academic staff sample indicate that IT infrastructure services are crucial to deliver the materials and information to the students with high quality. For example, academic staff deliver materials and feedback to students via electronic channels and the aspects of information quality are evaluated by students. The information quality aspects are dependent on the method of displaying this information, date of release, format, and conciseness. To consider these aspects with materials and information delivered to students, a wide range of IT infrastructure services should be available for academic staff for instance, the electronic channels, communication infrastructure, and support services.

However, this hypothesis is not supported in relation to ICT staff sample. The main justification for this non-significant relationship is that ICT staff provides the users of e-learning system with support and maintains services and mostly deals with technical information and issues related to e-learning systems and the reasonability of delivering the information and study materials is of academic staff.

H3: IT infrastructure services significantly and directly affect service delivery quality

The results of testing the study model supported hypothesis (H3) and confirmed the role of IT infrastructure services in enhancing the service delivery quality on all the three levels for stakeholders: students; academic staff; and ICT staff.

Delivering e-learning services with high quality requires availability of IT infrastructure services. The availability of a wide range of IT infrastructure services is believed to be the main foundation in delivering lectures, materials, feedback, and answers to students' queries in a suitable timeframe. For instance, the security of the system is an important requirement of users. One of the most important responsibilities of IT infrastructure is the security of e-learning systems. IT infrastructure services can also contribute to enhancing responsiveness via offering convenient options to students and academic staff facing academic or technical problems. E-learning systems depend on the connection between the service providers and users via multimedia. Adopting e-learning systems requires a wide range of electronic channels and effective management to sustain and improve these channels. Offering and managing these channels is one of the most important services of IT infrastructure. The availability of these channels enables students and academic staff to connect with each other and with other university staff. Consequently, IT infrastructure services are essential for academic staff and students because academic staff aim to meet students' educational and service needs, and to support the quality aspect in delivering these services; and the students require high quality educational services via the e-learning system.

Regarding ICT staff, availability of IT infrastructure services enables them to support the e-learning system effectively and to deliver adequate service to the users. For instance, the availability of electronic channels enables the ICT staff to engage with users effectively, solve their problems, and provide them with information quickly. In addition, the variety of these channels supports the ICT staff in dealing with problems reported by academic staff and students.

The results of testing H3 are consistent with the opinion of da Silva and e Abreu (2010) who state that 'The primary purpose of an IT infrastructure is to support and enhance IT services, so they are the foundation upon which the business process that drive an organisation's success are based' (p. 171).

- **H4: IT infrastructure services significantly and directly affect perceived usefulness**

Hypothesis (H4) focuses on the effect of IT infrastructure services on perceived usefulness. The results of testing the study model supported this hypothesis on the level of students and academic staff.

IT infrastructure services play a significant role in enhancing the perceived usefulness for students via increasing productivity, improving the performance of students, and assisting students to accomplish their study tasks quickly. Channel management services can enable students to connect with staff and different divisions in the university. This service can be supported by another service, communication services which support the students in exchanging information and knowledge with each other and with academic staff. Another significant service of IT infrastructure is advice and consultancy provided to the students.

IT infrastructure plays a critical role in generating perceived usefulness for academic staff. In other words, IT infrastructure services assist academic staff in performing their jobs effectively, enhance their performance, and increase their productivity. IT infrastructure services affect perceived usefulness via the services provided to those users. Channel management services can be considered essential services of IT infrastructure that are used to support academic staff in achieving their tasks. Through this service, the ICT Division provides academic staff with a wide range of electronic channels to connect and interact with students who are using the e-learning systems. The security services of the e-learning systems can contribute to supporting the perceived usefulness, via providing a secure environment to exchange information with students, deliver the materials, and respond to students' enquiries quickly. Integration between the systems and providing users with supported systems or software are considered one of the most important services of IT infrastructure. This finding supports a previous study of Hussein et al. (2007) in the e-government area which links IT infrastructure with perceived usefulness.

However, hypothesis (H4) is not supported by the ICT staff sample data. Thompson (2010) found that the IT infrastructure support did not significantly impact perceived usefulness. ICT staff may feel that their experiences, skills, and self-efficacy are the key factors in enhancing job performance. This opinion is empirically supported by previous studies such as McFarland (2001), Stoel and Lee (2003), Gong and Yu (2004), Ong and Lai (2006), and Sanchez and Hueros (2010).

- **H5: IT infrastructure services significantly and directly affect user satisfaction**

The findings of this study support hypothesis (H5) only for ICT staff. Regarding the student's sample, the impact of IT infrastructure services on student satisfaction was unusual as it was negatively significant. Students occasionally face technical problems related to the use of the e-learning systems and they can obtain instructions to solve these problems from the ICT Division staff. Students do not deal with the ICT Division frequently and may lead to them not having enough experience about the services provided by this Division. Also, students may not be aware of the role of

ICT staff in managing, maintaining, and delivering the services regarding e-learning systems. Furthermore, content analysis of students' comments showed that many issues faced by students can be caused by the lack of IT infrastructure services. For example, students have problems regarding contact with academic staff and their subsequent responsiveness. Channel management and availability of a wide range of communications tools between the stakeholders of an e-learning system is an essential service of IT infrastructure. The shortfall in this service leads to the generation of a negative attitude toward the IT infrastructure services and that negatively affects students' satisfaction. Siritongthaworn and Krairit (2006) found that communication facilitation is an essential aspect affecting student satisfaction. The problems and issues related to IT infrastructure services can negatively impact students' satisfaction toward the e-learning system.

Academic staff may have constant contact with ICT Division staff to assist with problems confronting them; however, comments received from academic staff indicate that there are still some issues of concern for academic staff in relation to ICT staff support, communication, and the responsiveness of the ICT Division. These issues may have influenced the feelings of academic staff toward the IT infrastructure services that could have resulted in the lack of significance in hypothesis (H5). Furthermore, there are many other factors that may affect user satisfaction, for instance, perceived self-efficacy and perceived usefulness (Liaw et al. (2007)).

The findings of the study support hypothesis (H5) based on ICT staff sample. The satisfaction of ICT staff is affected by the IT infrastructure services. The availability of IT infrastructure services is believed to be the essential requirement for the ICT staff to achieve the required tasks. For instance, the availability of different channels to connect the user assists them to respond to users quickly and solve their problems effectively. Furthermore, the availability of communication services, IT facilities, and IT research and development can assist ICT in performing their job effectively and that leads to enhancing their satisfaction about working with the e-learning system. According to the results of Hussein et al. (2007), IT infrastructure facilities construct is a key determinant of user satisfaction.

In this section, the results of five hypotheses related to the impact of IT infrastructure services on system quality, information quality, service delivery quality, perceived usefulness, and user satisfaction were discussed. The results confirmed the key role of IT infrastructure services in the success of e-learning systems.

8.3.2. System quality hypotheses

Based on the study model relationships, system quality is hypothesised to be a determinant of four constructs: information quality; service delivery quality; perceived usefulness; and user satisfaction. Four hypotheses were formulated and tested to investigate these relationships. The results of these tests are now discussed.

- **H6: System quality significantly and directly affects information quality**

The results of data analysis and testing the hypotheses confirmed that hypothesis (H6) is supported across the three samples: students; academic staff; and ICT staff.

The results of testing the study model show that quality of e-learning systems plays a critical role in generating information of high quality and delivering educational services to students effectively. System quality aspects such as system accuracy, system flexibility, system sophistication, and system integration play a key function in generating information of high quality to support students in their educational activities. For example, ease of use of the e-learning system is considered a significant aspect of system quality. This aspect can assist students in collecting the required information easily and quickly. Also, ease of use can be helpful in understanding the information generated from the e-learning system.

One of the most important responsibilities of academic staff who adopted the e-learning system is the delivery of high quality information and materials to students. E-learning system quality plays an essential role in achieving this responsibility. For example, information should be delivered to students in a suitable format, usable, and understandable. These aspects could not be achieved without the availability of a set of functions and features in the e-learning system. These features and functions enable academic staff to provide students with information and materials that are easy to understand and use.

ICT staff are responsible for supporting the e-learning system and providing the users with services. Achieving these tasks effectively depends on the relationship between the quality of e-learning and information quality. In other words, the aspects of the e-learning system contribute to generating information of high quality. The aspect of an e-learning system's ability to respond quickly enables ICT staff to provide users with information they need and that will enhance the availability aspect of information quality. The flexibility of the e-learning system enables ICT staff to deliver the information to users in a suitable format.

The results of testing H6 are consistent with findings of studies by Almutairi and Subramanian (2005), Hussein et al. (2007), Gorla et al. (2010) and Floropoulos et al. (2010).

- **H7: System quality significantly and directly affects service delivery quality**

The study findings confirm the significant impact of system quality on service delivery quality based on students' perceptions. The aspects of accuracy, flexibility, less sophistication, and integration of e-learning systems can assist students to perform their educational tasks more quickly and to access the system from anywhere worldwide. System availability may relate to less sophisticated systems. In other words, if the interface of the system is not complicated students can use lower speed Internet connection, and accessing the system will be easier. The integration of e-learning systems enables students to perform their tasks effectively. The integration between the e-learning system and EASE may support students in submitting their assignments more effectively. The flexibility of e-learning systems provides some advantages, for instance, availability of different channels of connection can offer different options for students to connect with academic staff and the university. Moreover, the flexibility of systems can provide students with alternative options if there is any problem with the main options.

The results of testing the study model with ICT staff data supported hypothesis (H7). The significant and positive role of system quality in enhancing the service delivery quality is supported based on the perceptions of ICT staff. Some customisations should be made to the e-learning system. The ease at which these customisations can be adopted by the ICT staff is one of the most important aspects of e-learning system quality. These customisations can contribute to improving service delivery quality. Modifications to the e-learning system may assist in developing navigation, accessibility, downloading, and completing the tasks quickly. All these advantages can be classified under service delivery quality and specifically under the efficiency sub-dimension. The system response aspect relates to the ability of the system to respond quickly during the busiest hours of the day. Availability of this aspect assists in improving two dimensions of service delivery quality: responsiveness and contact. These results are supported by the results of studies by Bharati and Berg (2003), and Yoon and Kim (2009).

However, this hypothesis is not supported by the academic staff sample. The content analysis of academic staff comments shows that there are some issues identified by academic staff regarding system quality, for example, ease of use, system functions, and integration. Another important issue identified by academic staff is that there is a shortfall in support provided to academic staff by the ICT Division. The lack of significance in the effect of system quality on service delivery quality may be explained by the perception of academic staff that delivering educational services to users with high quality is one of the responsibilities of the ICT Division and depends on the support and facilities provided by this division. The support should include ensuring the quality of the e-learning system, software quality, system integration, and system flexibility. Thus, the lack of support provided by the ICT Division is considered one of the main causes of problems experienced in delivering services to users based on academic staff perceptions.

- **H8: System quality significantly and directly affects perceived usefulness**

The outcomes of analysis show that hypothesis (H8) is supported by two samples: students and ICT staff.

System quality is related to ease of use of the system, user requirements, system accuracy, and integration. Perceived usefulness focuses on the role of the e-learning system to assist students to perform and achieve their study objectives effectively. According to the study findings, the quality of the e-learning system contributes to the perceived usefulness of this system and enriches the study performance and productivity of students. For instance, if the e-learning system meets students' requirements it will assist them to improve their performance and productivity and will enhance the quick accomplishment of tasks. This result is supported by the studies of Liaw (2008a) and Islam (2011), which were also conducted with external students. Some studies undertaken on other systems also support this finding, for example, Floropoulos (2010) (Taxation information system), and Landrum et al. (2008) (online library).

The availability aspect of system quality supports ICT staff in performing their job effectively. Ease to learn the e-learning system by ICT staff will allow them to support, maintain, and provide users with services quickly, easily, and with a high performance level. The same situation occurs when the e-learning system is less sophisticated. Complexity in the e-learning system may result in increased labour in supporting and maintaining the system. The performance of some tasks related to e-learning system may encounter difficulties due to the complexity of the system. The significant impact of system quality on perceived usefulness was supported by a study by Park et al. (2011) conducted with digital content providers. This relationship receives significant support from earlier studies in the information system field such as Seddon and Kiew (1994), and Fan and Fang (2006).

However, hypothesis (H8) was not supported by the academic staff sample. The non-significant effect of system quality on perceived usefulness can be justified by the shortfall in self-efficacy and skills to use the e-learning system. The comments of students show that many academic staff do not have the adequate ability and skills required to use the e-learning system effectively. Also, the comments of academic staff focus on skills as an essential issue regarding using the e-learning system. Accordingly, the e-learning system ease of use, ease to learn, flexibility, and accuracy are not sufficient to enable academic staff to do their job due to the shortfall in their self-efficacy and skills to deal with this system and use all potential functions. These results are consistent with results of a study by Wang and Wang (2009) conducted with university instructors in which they found that system quality had no significant effect on perceived usefulness of e-learning system. According to Lewis, Agarwal, and Sambamurthy (2003) perceived usefulness is affected by personal innovativeness with technology. In addition, the students' comments placed emphasis on the lecturers' ability to use the e-learning system. Thus, academic staff may not have the personal innovativeness with technology to use the functions of the e-learning system to enhance their job performance and productivity.

- **H9: System quality significantly and directly affects user satisfaction**

Testing hypothesis (H9) of the study shows that the effect of system quality on user satisfaction was significant for both students and academic staff. These results support hypothesis (H9).

Two indicators were significant in measuring user satisfaction in the students' sample: satisfaction with e-learning system performance; and satisfaction with e-learning system experience. System quality appeared as a main determinant of user satisfaction based on students' perceptions. The impact of system quality on user satisfaction can be explained by the ease of use of the system, ability of the system to meet user requirements, system accuracy and integration, and contribution to aiding students in gaining more experience with the e-learning system and, thus, enhancing the performance of the system. These findings are supported by the studies of Ozkan et al. (2009), Lin (2007), Chiu et al. (2007), Almarashded et al. (2010); Freeze et al. (2010), Islam (2011) and H. C. Wang and Chiu (2011) who confirmed the significant impact of system quality on user satisfaction based on the students' perceptions. This hypothesis is also supported by studies conducted with other information systems applications such as online community (Zheng, Zhao, & Stylianou (2009); Lin & Lee, 2006), mobile banking (Chung & Kwon, 2009), online shopping (Chen & Cheng, 2009), e-government (Wang & Liao, 2008), and library portal (Masrek et al., 2010).

Similar findings emerged with academic staff. System quality plays a significant role in enriching the experiences of academic staff with the e-learning system. The aspects of the system are clearly related to user satisfaction. For example, the availability of necessary features and functions for the e-learning system will support user satisfaction with system function and will enable the academic staff to effectively achieve their teaching activities. In addition, if the system meets academic staff requirements relating to performance of their job, accuracy of the system, ease to learn, and flexibility it will enhance their satisfaction of using the e-learning system. This finding is consistent with study results by Seddon and Kiew (1994) and Landrum et al. (2008).

However, hypothesis (H9) is not supported by the ICT sample. In other words, system quality did not significantly affect ICT staff satisfaction. The main justification for this non-significant influence is that most of the ICT staff are qualified and have experience regarding support for the e-learning system. Therefore, the aspects of ease of use of the system, ease to learn, sophistication, customisation, and system response may not be considered as key issues in their experience. The non-significant impact of system quality on user satisfaction was found in previous studies such as Jang et al. (2006) and Floropoulos et al. (2010).

The results of the influence of system quality on information quality, service delivery quality, perceived usefulness, and user satisfaction were discussed in this section. The outcomes of hypotheses (H6), (H7), (H8), and (H9) confirmed the role of systems quality as key construct in the success of e-learning systems.

8.3.3. Information quality hypotheses

According to the study model, three constructs are affected by information quality: service delivery quality; perceived usefulness; and user satisfaction. Hence, three hypotheses were formed to examine these relationships. The results of these hypotheses are discussed below.

- **H10: Information quality significantly and directly affects service delivery quality**

Examination of the study hypotheses shows that information quality plays a key role in supporting the service delivery quality according to perceptions of students, academic staff and ICT staff. These results support hypothesis (H10).

The critical role of information quality in supporting SDQ based on the students' perceptions has been investigated and confirmed in this study. The aspects of information quality, availability, understandability, and conciseness are deemed to be essential for students in achieving their required educational tasks via electronic channels. For instance, students need to receive some information at the start of the course regarding topics in their course, course leader/examiner, assignment due dates, assessment details, examinations, and text and materials required for the course. This information should be available to students in a concise and understandable form. During delivery of the course, these aspects should be considered in the course materials provided to students. The efficiency of services is associated with the ability of students to explain and understand the content of materials. Students cannot obtain the course materials, feedback, or connect with other stakeholders without system availability. Moreover, if the e-learning system is available but the output of this system is unavailable, it will not be an effective system. Information quality can contribute to enhance students' satisfaction toward the educational services delivered by e-learning systems.

Regarding academic staff perceptions, the significant impact of information quality on service delivery quality was confirmed. Academic staff need to deliver the materials and information to students in a suitable timeframe, provide answers and feedback, take care of academic issues, and contact students online. Achieving these tasks adequately means delivering the educational service to students while considering quality aspects. Information quality contributes to delivering the services while considering aspects of quality. Availability of information in the e-learning system supports academic staff in their efforts to deliver the information and materials to students according to the prescribed timeframe. Information availability enhances a major sub-dimension of service delivery quality: fulfillment. Usability and understandability of information is generated from the e-learning system and can assist academic staff to deliver the materials and courses requirements to students quickly and effectively. Problems with information and materials, such as conflict, complexity, and ambiguity, may lead to a delay in releasing the information, outdated information reaching students, and resulting in information overload for students.

The impact of information quality on service delivery quality was also significant and supports hypothesis (H10). The key task of ICT staff is to maintain and support the e-learning system. The availability of information to ICT staff enables them to achieve their tasks effectively. For example, information about technical problems reported by students or academic staff assists ICT staff in identifying and solving problems quickly and effectively. In this case, the availability of information contributes to improving the responsiveness of ICT staff and the efficiency of service delivery quality. Likewise, sometimes the e-learning system provides important information about threats that may influence the system or the documents. Based on this information, the ICT staff will take action to resolve this issue and that, in turn, will assist in delivering services to users in a secure environment.

Studies by Bharati and Berg (2003) and Yoon and Kim (2009) support the results of testing hypothesis (H10); they found that service delivery quality is significantly affected by information quality.

- **H11: Information quality significantly and directly affects perceived usefulness**

The study results confirm that perceived usefulness is significantly affected by information quality according to students' and academic staff perceptions.

The aspects of information quality are clearly related to perceived usefulness of the e-learning system. The study performance and productivity of students depends on the availability of materials and information related to the study area. Availability of these materials and information are the foundations for students to prepare for educational tasks such as assignment and exams. However, the availability of information is not the only aspect required to enhance the perceived usefulness of the e-learning system—understandability and conciseness are also factors. These two aspects can assist students to achieve the required tasks quickly and enhance the perceived usefulness of e-learning systems. Overload and ambiguities in the information and materials means students need more time to filter and identify important and usable information. The results of testing this hypothesis are consistent with studies conducted in the e-learning system arena such as Lee (2006) and Hsieh and Cho (2011). Moreover, studies in the information system field such as those by Seddon and Kiew (1994), Landrum et al. (2008), and Floropoulos et al. (2010) support the significant influence of information quality on perceived usefulness.

Similar findings emerged in testing the effect of information quality on perceived usefulness regarding the academic staff sample. Accordingly, hypothesis (H11) is supported in the context of academic staff sample. Aspects of information quality such as importance, availability, usability, understandability, format, and conciseness play a key role in enhancing the perceived usefulness of e-learning systems for academic staff via supporting the quick accomplishment of tasks, improve performance, enhancing effectiveness and making the job easier. For instance, the ability of the system to download information and materials in a specific format allows academic staff to accomplish tasks quickly and makes their job easier. The results of testing this hypothesis are consistent with the findings of Wang and Wang (2009) who undertook their study with full-time instructors at universities and found that information quality significantly influenced perceived usefulness.

However, hypothesis (H11) is not supported by the ICT staff sample. The main justification for the lack of significance in the impact of information quality on perceived usefulness is that the ICT staff always work in the support area and maintain the e-learning system. The task of maintaining e-learning systems is related to specific timeline schedules. Moreover, the support of the e-learning system by ICT staff continues via the technical support or the consultation process provided to users. Finally, the problems and issues regarding the e-learning system sometimes may not be reported by the system itself but, rather, the users report these problems and issues to the ICT Division. This result is consistent with the findings of Fan and Fang (2006) from a study conducted with people working to support Data System's WorkFlow ERP systems.

- **H12: Information quality significantly and directly affects user satisfaction**

Hypothesis (H12) was formulated to examine the influence of information quality on user satisfaction. The results support hypothesis (H12) for two samples: academic staff; and ICT staff, and reject for the third sample: students.

Regarding the student sample, the impact of information quality on students' satisfaction was unexpected as it was negatively significant. Wang and Chiu (2011) justified the negative effect of information quality on user satisfaction by stating that 'However, better information quality did not satisfy users in the e-learning process. The insignificant influence may be due to the limited capabilities of users who have less experience in using an e-learning system for cooperative learning' (p. 1798).

Justification can be offered regarding the current study by some issues related to information quality identified via content analysis. For example, the availability of information is considered the main issue confronting students and 84 percent of students commented negatively about this issue. Moreover, there were some issues regarding usability, importance, understandability, and update of the information. These issues negatively reflected in the students' perceptions and satisfaction toward the e-learning system. Additionally, information provided to students by academic staff is related to study topics and materials. Students may not be satisfied about the volume of information that is delivered to them, as they require more time and effort to revise all that material. The above discussion provides reasons why the effect of information quality on user satisfaction appeared as a negative with the student sample.

The result of testing the effect of information quality on user satisfaction was significant based on perceptions of academic staff. Aspects of information quality significantly impacted user satisfaction of academic staff. For instance, availability, usability, importance, and understandability of the information support academic staff satisfaction in using the e-learning system as a learning tool. Moreover, these aspects contribute to enriching the satisfaction levels of academic staff regarding functions of the e-learning system and the use of the system. These results are supported by the findings of Chen and Cheng's (2009) study which found that service quality significantly impacted user satisfaction. Moreover, similar results were found in the context of e-government in a study by Wang and Liao (2008).

Examination of hypothesis (H12) with the ICT staff sample indicated that information quality significantly impacted user satisfaction. The availability of information quality aspects such as importance, availability, and usability plays a positive role in supporting ICT staff satisfaction via enhancing their satisfaction about system functions, job expectations, satisfaction about the decision to work in the e-learning system field, and personal satisfaction. This result is consistent with a study by Roldán and Leal (2003) conducted on an executive information system that established that information quality significantly impacted user satisfaction.

As mentioned above, system quality was hypothesised as a key construct in the proposed model. The results confirmed the important role of this construct and its significant impact on other constructs in the study model.

8.3.4. Service delivery quality hypotheses

Service delivery quality was selected as a central construct in the study model. This construct plays a dual role: direct and meditation effects. Consequently, service delivery quality was hypothesised to directly impact four constructs in the study model: perceived usefulness; user satisfaction; customer value; and organisational value. This section discusses the results of these relationships.

- **H13: Service delivery quality significantly and directly affects perceived usefulness**

The outcomes of examining the study model established that service delivery quality significantly influenced the perceived usefulness from three points of view: students, academic staff, and ICT staff. These findings support hypothesis (H13) for the three samples.

Delivery of services with consideration of quality aspects leads to all stakeholders of the e-learning system feeling positively toward the usefulness of this system. For instance, delivering the educational service to students within a suitable timeframe, quick delivery of answers to students' enquiries, protecting the personal information of students, and availability of communication channels will assist students to accomplish tasks quickly, and improve their study performance and productivity. This result is consistent with a study by Landrum et al. (2008) which found that service quality significantly impacted perceived usefulness.

Service delivery quality, in the same way, affected perceived usefulness of e-learning based on academic staff perceptions. In other words, the availability of an e-learning system, a well-organised web design, fast loading of interface pages, the ability to deliver answers to students quickly, and the ability to contact students using different channels will enable academic staff to provide students with educational services quickly, easily, and enhance the effectiveness and job performance of academic staff. The significant impact of information quality on perceived usefulness was confirmed by a study on student information systems (SIS) conducted by Rai et al. (2002).

ICT staff perceptions were consistent with student and academic staff perceptions regarding the influence of service delivery quality on perceived usefulness. The satisfaction of ICT staff with the decision to work in the e-learning system and the positive job expectations is supported by the ability of the system to deliver the services to users with high quality. Service delivery quality can also affect the personal satisfaction of ICT staff to work with this type of system.

- **H14: Service delivery quality significantly and directly affects user satisfaction**

Analysis of the results of the study confirms the essential role of service delivery quality in supporting user satisfaction. Service delivery quality supports the satisfaction of different groups of stakeholders of e-learning systems: students;

academic staff; and ICT staff. Based on these findings hypothesis (H14) is supported by the three samples of study.

Service delivery quality can be considered an essential determinate of students' satisfaction. Service delivery quality plays a critical role in creating and enhancing user satisfaction that, in turn, contributes to the success of e-learning systems. These results relating to the role of service delivery quality in enhancing the success of e-learning systems and as a major construct in evaluating e-learning systems match the findings of Holsapple and Lee-Post (2006), Roca et al. (2006), Lin (2007), Wang et al. (2007), Ozkan and Koseler (2009), Wang and Wang (2009), Almarashded et al. (2010), Wang and Chiu (2011) and Adeyinka and Mutula (2010). The effect of service delivery quality on user satisfaction can be explained by considering the role of the sub-dimensions of this construct on user satisfaction. For example, the fulfillment dimension of service delivery quality is related to the veracity of the e-learning system and the time needed to receive the answers to enquiries. Delivering lectures, materials, and feedback to students in a reasonable timeframe can enhance the students' trust toward the e-learning system and that can, subsequently, improve the students' satisfaction with the system. Students sometime have enquiries related to educational tasks, managerial issues, and technical problems and need to receive answers quickly. Therefore, response time is considered to be an essential indicator in evaluating the fulfillment of the e-learning system. The aspects of accessibility, veracity of the system, and quick response time are critical aspects in developing students' performance and enhancing their satisfaction toward using the e-learning system.

The findings of the study show that service delivery quality is a critical construct in academic staff satisfaction. Effective delivery of educational services to students may increase the satisfaction levels of academic staff. For example, the efficiency of e-learning is related to ease of access to the system. Accessing the e-learning system by academic staff from different areas and using different devices helps them feel satisfied using this system. In addition, achieving teaching tasks quickly via e-learning systems can contribute to generating positive feelings towards using these types of systems. Moreover, organising the e-learning system and the interface (website) may assist academic staff in finding the information they need easily and that will lead to time saving. The results of testing this hypothesis are consistent with results of studies by Lin and Lee (2006), Floropolos et al. (2010), Chen and Cheng (2009), and Wang and Liao (2008),

Delivering services to users while also considering quality aspects can increase satisfaction levels of ICT staff. The main task of ICT staff is supporting the e-learning system and the users. The availability of service delivery quality sub-dimensions can play a crucial role in enhancing the satisfaction of ICT staff in working with e-learning system. For example, responsiveness is related to the response time and the details provided to users to solve problems. The shortfalls in time or in methods to fix problems can create negative feelings by users toward the system and that will reflect negatively on the ICT staff. Therefore, the ability of ICT staff to solve the problems and support the user quickly and effectively will increase their personal satisfaction and satisfaction to work with this system. This result is supported by different studies in the information systems discipline, for instance, Jang et al. (2006), Gong et al. (2004), and Landrum et al. (2008).

- **H15: Service delivery quality significantly and directly affects customer value**

According to hypothesis (H15), service delivery quality is a key determinant of customer value. The findings of the study support hypothesis (H15) on two levels: students and academic staff.

Accordingly, service delivery quality plays a critical role in creating customer value for students. The aspects of ease of use, accessibility, veracity of the system, the ability to exchange information, availability of e-learning system, and availability of contact channels are critical aspects in developing students' understanding, students' ability to analysis and evaluate information related to their study, and enhancing their social value from using the e-learning system.

Service delivery quality also plays a crucial role in supporting the customer value of academic staff. Delivering the services to students without problems and with quality can enhance the sense of accomplishment and fulfilment for academic staff. Moreover, the availability of the system, the ability to access the system anywhere, the availability of channels to contact students, and the ability of the system to enable academic staff to deliver the materials and information to the user quickly and easily improves the work practices of academic staff and enhances their experience in using the system.

However, this hypothesis is not supported by the ICT staff sample. The absence of a significant impact of service delivery quality on customer value can be justified by the fact that the measures of customer value were focused on knowledge, learning, personal development, and employability. ICT staff have sufficient experience and knowledge about this system, therefore, working with this system to deliver the services to users may not lead to significant improvements in their knowledge and experience.

According to model of DeLone and McLean (2003) there is no direct impact from service delivery quality to customer value (individual benefits). Thus, most studies that adopted this model in the e-learning system success field do not link service delivery directly to customer value, for example, Fan and Fang (2006), Chen and Cheng (2009); Lin and Lee (2006), Wang and Liao (2008), Lee and Chung (2009), and Adeyinka and Mutula (2010).

- **H16: Service delivery quality significantly and directly affects organisational value**

This hypothesis was tested only with academic staff and ICT staff samples. The tests of the study model support hypothesis (H16) and confirm the significant role of service delivery quality in enhancing organisational value. Delivering the services with high quality can enhance the organisational value via providing the university with a good reputation among students and communities, supporting achievement of organisational goals, reducing costs, developing learning techniques via using updated technologies in educational activities, and effectively responding to the changes in the external organisational environment. These results are consistent with a study by Gorla et al. (2010) that confirmed the significant role of service quality in enhancing organisational value.

However, this hypothesis is not supported by the ICT staff sample. ICT staff may feel there are other issues that should be considered to increase organisational value. For instance, ICT staff are very close to the innovation; and updated information technologies can be adopted by the university to develop performance. Thus, the ICT staff may feel that the use of updated and advanced information technology can be considered a priority in improving the organisational value. This issue was identified via the comments of ICT staff and particularly when they spoke about the need to support mobile devices. This opinion can illustrate the direction of ICT in enhancing the organisational value via adopting updated and advanced information technologies.

This section discussed the results of the direct impact of service delivery quality on the four constructs in the study model. The significant role of service delivery quality to enhance the perceived usefulness and user satisfaction was confirmed for the three samples. The influence of this construct on customer value and organisational value was confirmed in some cases and not in others.

8.3.5. Perceived usefulness hypotheses

Three hypotheses were formulated to test the effect of perceived usefulness on user satisfaction, customer value, and organisational value. Discussion of the results of these hypotheses is as follows.

- **H17: Perceived usefulness significantly and directly affects user satisfaction**

The results of the study support hypothesis (H17) on two levels: students and ICT staff samples.

Perceived usefulness plays a positive role in creating student satisfaction toward e-learning systems. The progress in the students' performance and productivity due to use of e-learning systems can be supported in producing a positive attitude of students toward using this system and to reuse it. These findings are consistent with the results of studies conducted on students who adopted e-learning systems, for instance, Shi, Chen, Ryan and Wu (2004), Lee and Hwang (2007), Limayem and Cheung (2008), Johnson et al. (2008), Sun et al. (2008), Almarashded et al. (2010); Islam (2011).

Perceived usefulness of the e-learning system can increase ICT staff satisfaction. The aspects of quick accomplishment, improvement in performance job, and making the task easier can support ICT staff satisfaction via supporting a positive attitude about job expectations, system functions, and enhancing personal satisfaction. This result is consistent with the findings of Park et al. (2011) and Landrum et al. (2008).

However, hypothesis (H17) is not supported by the academic staff sample. Accordingly, perceived usefulness had no significant impact on academic staff satisfaction. Support of the e-learning system was an essential issue identified by academic staff in the content analysis. The absence of a significant effect of perceived usefulness on academic staff satisfaction could be due to lack of support from the ICT Division. The academic staff need support from the ICT Division that assist them accomplish their educational tasks quickly, and increase their academic effectiveness and performance. However, the shortfall in the support provided to academic staff influenced the perceived usefulness and that reflects on their satisfaction in using the e-learning system. A previous study conducted with an e-learning system used by university college teachers obtained the same results: perceived usefulness had no significant impact on user satisfaction (Larsen et al., 2009). Furthermore, the same results were yielded by a study by Hung et al. (2011) conducted on academic teachers. The reason behind the lack of significant influence of perceived usefulness on user satisfaction may be the mandatory use of e-learning systems by the academic staff. Sørebø and Eikebrokk (2008) conducted a study about information continuance with mandatory use. Their results show that perceived usefulness had no significant impact on user satisfaction in the mandatory usage environment. In this regard, Sørebø and Eikebrokk (2008) state that 'It is plausible to believe that such as a gain in performance may generate stronger feelings of satisfaction when "use of the technology" is a result of one's own choice, rather that when it is mandated' (p. 2367).

- **H18: Perceived usefulness significantly and directly affects customer value**

Hypothesis (H18) emphasizes the significant influence of perceived usefulness on customer value. The findings of the study showed that this hypothesis is supported with two samples of the study: students and academic staff.

The results of the empirical study indicate that perceived usefulness is a key determinant of customer value based on students' perceptions. The ability of students to analyse and evaluate the information and to understand the main concept about the study module depends on how useful is the e-learning systems for the students.

Similar findings related to hypothesis (H18) were found for the academic staff sample. An explanation of this relationship is as follows: developing work practices, learning more about the system, and achieving a sense of accomplishment and fulfilment by academic staff are effected by the aptitude of the system to empower academic staff to accomplish their tasks quickly and more easily and thus improve performance and effectiveness of academic staff.

However, hypothesis (H18) was not supported by the ICT staff sample. The results showed that perceived usefulness had no significant effect on the customer value construct. The ICT staff agreed about the usefulness of the e-learning system and that means ICT staff can achieve tasks quickly, and working with this system is easy. In other words, the issues facing ICT staff may not be challenges for them. The customer value of ICT staff emphasises enhanced personal development, knowledge and learning via the e-learning system. This non-significant relationship could be because the ICT staff may feel that working with the current e-learning system is easy and there is no opportunity to learn more or receive more experience/knowledge or personal development.

- **H19: Perceived usefulness significantly and directly affects organisational value**

Hypothesis (H19) was tested only with academic staff and ICT staff samples. The findings of the study conclude that this hypothesis supported the significant impact of perceived usefulness on organisational value with the academic staff and ICT staff samples.

Academic staff have sufficient experience of the educational institution’s objectives and responsibilities. As shown in descriptive statistics (Section 5.2.5), the academic staff are aware about the role of the e-learning system to increase their performance and assist them to accomplish their job quickly and effectively. Universities can employ the usefulness of e-learning systems perceived by the academic staff to enhance the strategic position, competitive advantages, and improve the organisational reputation.

Hypothesis (H19) is also supported by the analysis of the ICT staff data. Hence, perceived usefulness is one of the determinants of organisational value. The positive feelings of ICT staff toward the usefulness of e-learning systems contribute to enhancing the organisational value via supporting the effective cost, enhancing the relationship with community, and establishing a good reputation of the university.

The significant role of perceived usefulness in enhancing the organisational value based on the perceptions of digital content providers was confirmed by Park et al. (2011).

The role of perceived usefulness in the proposed model was discussed in this section. The significant effect of perceived usefulness on user satisfaction and customer value was confirmed for the student sample. The impact of this construct on user satisfaction, customer value, and organisational value for academic staff and ICT staff was confirmed in some cases and not in others.

8.3.6. User satisfaction hypotheses

The study model hypothesised that user satisfaction is a determinant of customer value and organisational value. Accordingly, two hypotheses were formulated to examine these two relationships. The results of testing the effect of user satisfaction on customer value and organisational value are discussed as follows.

- **H20: User satisfaction significantly and directly affects customer value**

Hypothesis (H20) relates to the effect of user satisfaction on customer value. The results of testing this hypothesis were not supported in two samples: students and ICT staff.

Regarding students' perceptions, user satisfaction did not significantly support customer value. User satisfaction focused on the satisfaction of students about system performance and the experience of using the e-learning system. Customer value includes the measure of concept understandability and the ability to analyse and evaluate the information; these indicators may depend on the students' characteristics. In a study by Volery and Lord (2000) it was shown that instructor-friendly behaviour with students, understandability of student problems, proper understanding of IT, and persuasion of interaction between students are the factors that lead towards student satisfaction. Thus, concept understandability and the ability to analyse and evaluate information by students may be affected by other factors which can be considered more important than the students' satisfaction with the e-learning system. Moreover, the study by Bhuasiri, Xaymoungkhoun, Zo, Rho, and Ciganek (2012) showed that the learners' characteristics, for instance, computer self-efficacy, Internet self-efficacy, and attitude toward e-learning, are critical success factors of e-learning systems. Thus, any shortfall in these characteristics can negatively affect user satisfaction and the value that can be gained from this system.

Similar results were yielded from testing hypothesis (H20) with ICT staff. The impact of user satisfaction on customer value was non-significant. The measures of customer value of ICT focused on personal development, learning, knowledge, and employability. User satisfaction has not affected this value for ICT staff because they already have the required skills to support and maintain the e-learning systems.

The tests with the academic staff sample established that user satisfaction was a key determinant of customer value. This result confirms the significant impact of user satisfaction in improving work practices of academic staff, learning more from the e-learning system, and enhancing accomplishment and fulfillment. The results from hypothesis (H20) are consistent with a study conducted by Fan and Fang (2006) who found that user satisfaction significantly influenced individual impact. Moreover, a study by Wang and Liao (2008), which was conducted on an e-government system, found that user satisfaction significantly affected the perceived net benefit of e-government.

- **H21: User satisfaction significantly and directly affects organisational value**

The results of the study regarding hypothesis (H21) deviated into two directions: supported by Academic staff; and rejected by ICT staff.

According to academic staff perceptions, organisational value is affected by user satisfaction. The aspects of academic staff satisfaction are clearly related to supporting organisational value. Satisfaction of academic staff with the e-learning system, contentment with the system, satisfaction with this as a learning tool, and satisfaction with functions of the e-learning system contribute to supporting organisational goals, cost effectiveness, enhancing the relationship with community, and improving the reputation of the university. Satisfaction of academic staff with e-learning systems can motivate them to provide users with high quality materials, information, and educational services that will reflect on the university value, such as its reputation and relationships with community. This finding is supported by the study results of Park et al. (2011), Koh et al. (2010) and Ghobakhloo et al. (2011) who also found that organisational benefits are significantly impacted by user satisfaction.

However, hypothesis (H21) is not supported based on ICT staff perceptions. The non-significant influence of user satisfaction on organisational value may be explained by the fact that the main responsibility of ICT is to support and maintain the e-learning system and they may feel that establishing and supporting University value is the responsibility of top management and academic staff at the university. The lack of significant impact of service delivery quality on organisational value was also evident in a previous study by Pérez-Mira (2010).

As mentioned previously, two types of relationships were suggested in the proposed model. The first type is the direct impacts that were formulated in 21 hypotheses. The results of these 21 hypotheses were discussed in this section. The second type of relationship is the mediating effect discussed in the next section.

8.3.7. Mediation effect hypotheses

The second type of relationship in the proposed model is the mediation effect. Service delivery quality was selected to play a role of mediation in the study model. Six hypotheses were formulated to investigate the mediation effect in the study model. Results of these hypotheses are discussed as follows.

- **H22: The effect of IT infrastructure services on perceived usefulness is mediated by service delivery quality**

The findings of the study supported hypothesis (H22) for the students and academic staff samples. The effect of IT infrastructure on perceived usefulness occurs via SDQ dimensions. In regard to this relationship, the security services of the e-learning systems can contribute to supporting perceived usefulness of students and academic staff, via the provision of a secure environment to exchange information with other students and academic staff, downloading materials, and receiving answers to students' enquiries quickly. These services cannot be achieved without considering the aspects of SDQ such as responsiveness, contact, and availability. Integration between the core e-learning system and complementary software is considered one of the most important services of the IT infrastructure. E-learning system platforms should be integrated with other software to achieve all the required educational activities of students and teaching activities of Academic staff. For example, in this study the University adopted Moodle to provide the core e-learning services and, at the same time, other software is integrated with this platform to provide comprehensive services to the users: EASE (assignment submission); ICE (study material authoring); and Camtasia (lecture recording). Efficiency of e-learning systems, which is a sub-dimension of SDQ, can be considered an essential requirement in achieving integration between e-learning systems and other software. Efficiency focuses on ease of access to the system, ability to quickly accomplish tasks, and a well-organised web site. Thus, integration should be established considering these aspects of SDQ.

However, hypothesis (H22) is not supported according to results of testing this hypothesis with the ICT sample. This non-significant relationship is justified by the fact that the educational services, information, and materials are delivered to external students by the academic staff. The ICT staff responsibility is to support delivering the services to the end users and to solve the technical problems affecting this process. It is worth mentioning that the direct effect of IT infrastructure services on perceived usefulness was non-significant, as shown in testing hypothesis (H4).

- **H23: The effect of system quality on perceived usefulness is mediated by service delivery quality**

Hypothesis (H23) emphasises the mediation role of service delivery quality between system quality and perceived usefulness. This hypothesis is supported for the students and ICT samples.

System quality affected perceived usefulness via the sub-dimensions of e-learning SDQ: efficiency; availability; fulfilment; privacy; responsiveness; and contact. The aspects of accuracy, flexibility, less sophistication, and integration of e-learning systems can assist students to perform their educational tasks more quickly and to access the system from anywhere worldwide. System availability may relate to less sophisticated systems. In other words, if the interface of the system is uncomplicated, students may need lower speed Internet connection, and accessing the systems will be easy and that may lead to increasing productivity of students, improve performance, and accomplishing tasks quickly. The role of ICT staff in this situation is to support this positive relationship via design of the system with a simple and secure interface, and enhancing the ease of access to the system.

The integration of e-learning systems will enable students to accomplish their tasks effectively. EASE is an important software application that supports e-learning at

USQ. This software is used by students to submit assignments. The integration between the e-learning system and EASE may support students in submitting their assignments effectively and quickly. Establishing this integration via ICT staff support services can enhance the perceived usefulness of the e-learning system for students and make the process of delivering service, materials, and information more effective. The aspects of e-learning system quality contribute to enhancing the perceived usefulness, but under one condition: the availability and consideration of SDQ aspects.

However, hypothesis (H23) is not supported by the results of analysis of the data from the academic staff sample. The reason for this outcome could be, as mentioned in testing hypothesis (H8), academic staff fail to employ all the functions and features of the e-learning system due to their lack of skill and self-efficacy and that affects delivery of the services to the end users.

- **H24: The effect of information quality on perceived usefulness is mediated by service delivery quality**

The findings of the study confirmed that service delivery quality plays a mediation role between information quality and perceived usefulness for the samples of students and academic staff.

Information quality aspects such as availability, understandability, and conciseness are critical requirements in providing students with high quality educational services, materials and information. The perceived usefulness of e-learning system services relates to the ability of students to explain and understand information and the content of materials. Service delivery quality plays an essential role in explaining and supporting the relationship between information quality and perceived usefulness. For instance, system availability, as a sub-dimension of service delivery quality enables students to receive course materials, information, feedback, and to connect with academic staff and other students. Furthermore, academic staff cannot provide students with materials and information without availability of an e-learning system. Moreover, if the e-learning system is available but the output of this system (information availability) is unavailable, it will not be an effective system. Therefore, information systems quality aspects cannot enhance the perceived usefulness without considering the SDQ dimensions to achieve these educational activities.

Accordingly, the critical role of service as a mediation factor between information quality and perceived usefulness is confirmed on the level of service providers, academic staff, and service recipients i.e. students.

However, the mediation role of service delivery quality between information quality and perceived usefulness for ICT staff is not confirmed. This non-significant relationship can be explained by the fact that ICT staff continually support the e-learning system in the case of availability of reports about problems in the e-learning system. In other words, ICT staff perform their tasks of supporting and maintaining the e-learning system regardless of the availability of service quality aspects such as fulfillment, availability, and efficiency of the system.

- **H25: The effect of IT infrastructure services on user satisfaction is mediated by service delivery quality**

Analysis of data shows that the mediation role of service delivery quality between IT infrastructure services and user satisfaction is confirmed only for ICT staff sample.

ICT staff perceptions toward the factors of e-learning system success confirmed the mediation role of service delivery quality between IT infrastructure services and user satisfaction. The IT infrastructure services assist the ICT staff to maintain and support the e-learning system and enable them to enhance the service delivery via availability of system, enabling academic staff to deliver the materials quickly, enabling students to receive the materials and services effectively, and facilitating communication between the users. This integration between these two constructs, IT infrastructure services and service delivery quality, can empower ICT staff to achieve the required tasks effectively and that leads to enhancing their satisfaction about working with the e-learning system.

However, hypothesis (H25) is not supported by the academic staff sample. The main reason behind this outcome of the role of service delivery quality as a mediation factor is that academic staff continue to encounter some issues related to service delivery quality. The content analysis of academic staff comments shows that 37 percent of their comments were about issues related to sub-dimensions of service delivery quality such as efficiency, contact, responsiveness, and web design. Moreover, the support provided by the ICT Division to academic staff was a key issue identified by academic staff. These issues may negatively impact on the role of service delivery quality as a mediation construct and also affect user satisfaction regarding e-learning systems.

Regarding the students' sample, the mediation role of service delivery quality between IT infrastructure services and user satisfaction is not confirmed. This insignificant relationship could be because of the issues related to service delivery quality such as system efficiency, contact, and web design. These issues are shown in the content analysis (Section 5.6). Accordingly, these issues in service delivery can enhance negative feelings among students toward this system.

- **H26: The effect of system quality on user satisfaction is mediated by service delivery quality**

The findings of the study conducted with the students and academic staff samples supported hypothesis (H26). Accordingly, the quality of the e-learning system supports the satisfaction of academic staff with this system via service delivery quality dimensions. For instance, the ability of the e-learning system to meet academic staff requirements can enhance the fulfillment and efficiency of the e-learning system via enabling academic staff to deliver the services and materials to students quickly and effectively; that will support the satisfaction of academic staff in using the e-learning system as a learning tool.

Regarding the students' sample, the mediation role of service delivery quality between system quality and user satisfaction can be explained by the fact that system quality contributes to supporting and delivering the services to users effectively—and that can enhance user satisfaction. For example, ease of use e-learning systems, system accuracy, and integration with complementary systems assist students to easily access the system and complete their tasks quickly. Accordingly, these aspects of system quality can enhance positive feelings among students toward this system.

The results of analysis of the ICT staff sample confirmed that service delivery quality was not a mediation construct between system quality and user satisfaction. These findings do not support hypothesis (H26). ICT staff may feel that they are responsible for supporting and maintaining the system, and delivering educational services to the users is the main responsibility of academic staff.

- **H27: The effect of information quality on user satisfaction is mediated by service delivery quality**

Hypothesis (H27) is supported on two levels: academic staff and ICT staff samples. These results show that the service delivery quality is a mediator between information quality and user satisfaction.

Information quality is a critical factor in providing students with high quality educational services, materials, and information. User satisfaction is one the most significant factors in supporting academic staff to obtain the benefits of the e-learning system. This relationship between information quality and user satisfaction needs to be supported by the service delivery quality constructs. For example, providing students with materials, information, and educational services in a suitable time requires an efficient system to achieve this purpose. Furthermore, the availability of an e-learning system, as a sub-dimension of service delivery quality, enables the academic staff to deliver these materials to students effectively. Shortfalls in the availability of the system may negatively affect academic staff because they will be unable to connect with students and provide them with educational services in the required timeframe.

The mediation role of service delivery quality between information quality and user satisfaction was confirmed. The availability of concise, updated, usable, and well-formatted information will allow the ICT staff to maintain and support the e-learning system and enable them to enhance the quality of service delivery. For instance, the availability of contact tools between students and academic staff can enhance the interaction between the stakeholders of the e-learning system and that leads to enhanced user satisfaction with the system. This positive role of service delivery between information quality and user satisfaction can enhance the satisfaction levels of ICT staff working with e-learning systems.

However, service delivery quality is not considered as a mediating factor between information and user satisfaction in the students' sample. This relationship can be justified by the fact that user satisfaction may be affected by the ability of students to understand the materials and information, interaction between students and academic staff, and the support provided to students.

To summarise, the results of 27 hypotheses were discussed in Sections 8.3. The discussion was supported by the literature on the information systems and e-learning systems. The justifications and explanations about each relationship in the study model were provided. Table 8.2 (on the following page) shows a summary of the outcomes of each hypothesis for each stakeholder group.

Table 8.2 Outcome of each hypothesis for each stakeholder

Constructs	Code	Hypotheses	Stakeholder group		
			Student	Academic Staff	ICT Staff
IT Infrastructure Services	**H1**	IT Infrastructure Services significantly and directly affect System Quality	Accepted	Accepted	Accepted
	H2	IT Infrastructure Services significantly and directly affect Information Quality	Accepted	Accepted	Rejected
	H3	IT Infrastructure Services significantly and directly affect Service Delivery Quality	Accepted	Accepted	Accepted
	H4	IT Infrastructure Services significantly and directly affect Perceived Usefulness	Accepted	Accepted	Rejected
	H5	IT Infrastructure Services significantly and directly affect User Satisfaction	Rejected (Significantly negative)	Rejected	Accepted
System Quality	**H6**	System Quality significantly and directly affects Information Quality	Accepted	Accepted	Accepted
	H7	System Quality significantly and directly affects Service Delivery Quality	Accepted	Rejected	Accepted
	H8	System Quality significantly and directly affects Perceived Usefulness	Accepted	Rejected	Accepted
	H9	System Quality significantly and directly affects User Satisfaction	Accepted	Accepted	Rejected
Information Quality	**H10**	Information Quality significantly and directly affects Service Delivery Quality	Accepted	Accepted	Accepted
	H11	Information Quality significantly and directly affects Perceived Usefulness	Accepted	Accepted	Rejected
	H12	Information Quality significantly and directly affects User Satisfaction	Rejected (Significantly negative)	Accepted	Accepted
Service Delivery Quality	**H13**	Service Delivery Quality significantly and directly affects Perceived Usefulness	Accepted	Accepted	Accepted
	H14	Service Delivery Quality significantly and directly affects User Satisfaction	Accepted	Accepted	Accepted
	H15	Service Delivery Quality significantly and directly affects Customer Value	Accepted	Accepted	Rejected
	H16	Service Delivery Quality significantly and directly affects Organisational Value	Not tested	Accepted	Rejected

Perceived Usefulness	**H17**	Perceived Usefulness significantly and directly affects User Satisfaction	Accepted	Rejected	Accepted
	H18	Perceived Usefulness significantly and directly affects Customer Value	Accepted	Accepted	Rejected
	H19	Perceived Usefulness significantly and directly affects Organisational Value	Not tested	Accepted	Accepted
User Satisfaction	**H20**	User Satisfaction significantly and directly affects Customer Value	Rejected	Accepted	Rejected
	H21	User Satisfaction significantly and directly affects Organisational Value	Not tested	Accepted	Rejected
Mediation Effect	**H22**	The effect of IT Infrastructure Services on Perceived Usefulness is mediated by Service Delivery Quality	Accepted (Full Mediation)	Accepted (Full Mediation)	Rejected (No Mediation)
	H23	The effect of System Quality on Perceived Usefulness is mediated by Service Delivery Quality	Accepted (Full Mediation)	Rejected (No Mediation)	Accepted (Full Mediation)
	H24	The effect of Information Quality on Perceived Usefulness is mediated by Service Delivery Quality	Accepted (Full Mediation)	Accepted (Partial Mediation)	Rejected (No Mediation)
	H25	The effect of IT Infrastructure Services on User Satisfaction is mediated by Service Delivery Quality	Rejected (No Mediation)	Rejected (No Mediation)	Accepted (Full Mediation)
	H26	The effect of System Quality on User Satisfaction is mediated by Service Delivery Quality	Accepted (Full Mediation)	Accepted (Partial Mediation)	Rejected (No Mediation)
	H27	The effect of Information Quality on User Satisfaction is mediated by Service Delivery Quality	Rejected (No Mediation)	Accepted (Partial Mediation)	Accepted (Full Mediation)

8.4. Discussion of content analysis results

Content analysis was employed to analyse the comments received from the students, academic staff, and ICT staff. The results were consistent with the quantitative results regarding factors affecting the success of e-learning systems. According to students' perceptions, service delivery quality, system quality, information quality, perceived usefulness, self-efficacy and IT infrastructure services (support service), and user satisfaction are the main factors influencing the success of the e-learning system and most of the issues students face are due to shortfalls in one or more of these factors.

The factor of self-efficacy and IT infrastructure services (support service) was identified in the content analysis. This factor was not considered in the study model and was not measured in the study survey. The most important issues identified with this factor were the lecturers' ability to use the e-learning systems and the training of the students in e-learning systems . Students suggested that academic staff do not use all the functions of the e-learning system and that leads to lack of information, limited interaction, and more problems. Academic staff knowledge plays a significant role in enhancing user satisfaction toward e-learning systems. Eom et al. (2006) also found that instructor knowledge and facilitation significantly impacted students' satisfaction. Collis (1991) highlighted this issue as a key factor in success of online delivery: 'It is not the technology but the instructional implementation of the technology that determines the effects on learning' (p. 146).

Academic staff quality as a key factor in the success of e-learning systems is confirmed by the studies of Volery and Lord (2000), Ozkan and Koseler (2009), Palocsay and Stevens (2008), Frick, Chadha, Watson, Wang, and Green (2009), Lim and Morris (2009), and Bhuasiri et al. (2012).

The issue of training students and academic staff to use the e-learning systems optimally was identified by the students' sample. In this regard, Bonk, Wisher, and Lee (2004) state that 'There is a need for training instructors (and their supervisors) in the task structuring required to guide knowledge exploration and communication among learning participants' (p. 61). The problem of training was also identified by Perreault, Waldman, Alexander, and Zhao (2002) who claim that the training is limited because the focus is on a specific software such as video conferencing.

Finally, the support of ICT staff was identified as an important factor in e-learning system success. ICT staff play a significant role in supporting students and providing them with advice and consultation to deal with problems and issues related to use of the e-learning system.

Regarding service delivery quality there is consistency between the results of the quantitative method and the content analysis. The sub-dimensions collected in the survey appeared as critical success factors in the content analysis of the students' sample. More details emerged from the content analysis, especially relating to efficiency of service delivery quality. For example, inconsistent functions/content across courses is the most important issue faced by students in dealing with e-learning systems. The structure of each course web site is different and that requires students to be aware of the structure of each course. Moreover, web design was identified as a key issue affecting the success of e-learning systems. Students need to open many pages and it can take a considerable length of time for them to obtain the information they need.

Interaction between students and academic staff is recognized as a key issue in the e-learning system field. The lack of interaction between students and academic staff may negatively affect the academic performance of students. In regards to the importance of interaction, Collis (1991) states that ‘Interactivity appears to be an important component of a learning experience involving audio-visual media, but the interactivity can take place in a variety of ways, such as through the teachers; or students’ activities stimulated by teachers’ (p. 141).

The results of a study by Arbaugh (2000a) found that instructor emphasis on interaction significantly and positivity impacted students’ satisfaction. Liaw and Huang (2013) empirically confirmed the significant role an interactive learning environment plays in enhancing perceived usefulness, perceived satisfaction and perceived self-regulation.

Regarding system quality, e-learning system functions appears to impact on the success of e-learning systems, particularly the functions of navigation, assignment submission, and enrolment. These issues make students feel confused and may result in increased time required by students to achieve some tasks. The other issue in the context of system quality is platform incompatibility. Students encounter problems using mobile devices, iPads, or different operating systems such as Apple Macintosh. This issue negatively influences external students because it mandates the use of specific devices and operating systems.

The survey study also focuses on the quality of study materials. Via content analysis of students’ comments, some issues related to information quality were identified, for instance, availability of lecture recordings, video recordings, and the quality of lecture and video recordings. These issues negatively influenced students' satisfaction and may influence the academic performance of students.

Students strongly agreed about the perceived usefulness of e-learning systems. The reason behind this agreement is that most of the external students are in employment and e-learning is a flexible mode of education delivery. External students are not required to be on campus to attend classes. Thus, they can watch lecture videos, listen to lecture recordings, or revise the study materials according to their own schedules.

The results of the surveys and content analysis are consistent on factors affecting the success of the e-learning system. The factors identified in the content analysis were service delivery quality, system quality, support, perceived usefulness, self-efficacy, information quality, and user satisfaction. It is worth mentioning that self-efficacy was identified from students' comments but not collected by the survey study.

Self-efficacy of academic staff was highlighted by students as an essential factor of e-learning system success. Recent attention has been paid to self-efficacy in the e-learning system field. The results of a study by Joo, Lim, and Kim (2013) provided empirical evidence about the significant role of self-efficacy in supporting user satisfaction, achievement, and persistence. Moreover, the study of Liaw and Huang (2013) found that self-efficacy is a determinant of perceived satisfaction and perceived usefulness. As mentioned in chapter 7 (section 7.6), only three comments were received from ICT staff. However, these comments were considered in the content analysis and some issues were subsequently identified from these comments. The ICT staff point of view focuses on the other stakeholders and some of the critical success factors relating to students' experiences, and lecturers' learning approaches. Furthermore, system quality, information quality, and web design were identified as critical factors affecting the success of the e-learning system. Interaction between ICT staff, users, and infrastructure design and support were recognized as factors influencing the success of the e-learning system.

Finally, support for mobile devices is a critical issue faced by ICT staff. Lack of support for these devices to deliver the educational services may lead to dissatisfaction of e-learning systems by users. results and content analysis.

Table 8.3 shows a comparison for the three stakeholders between the factors affecting the success of the e-learning system based on the quantitative results and content analysis.

Table 8.3 Results of quantitative and content analysis

Constructs	Students		Academic staff		ICT staff	
	Quantitative	Content Analysis	Quantitative	Content Analysis	Quantitative	Content Analysis
IT Infrastructure Services	*	*	*	*	*	*
System Quality:	*	*	*	*	*	*
Ease of use	*	*	*	*	*	-
Ease to learn	-	-	*	-	*	-
User requirements	*	*	*	*	-	-
System features	-	-	*	-	-	-
System accuracy	*	-	*	-	-	-
Flexibility	-	-	*	-	-	-
Sophistication	-	-	*	-	*	-
Integration	*	*	*	*	-	-
Ease of understanding	-	*	-	-	-	-
System functions	-	*	-	*	-	-
Platform incompatibility	-	*	-	*	-	*
System response	-	-	-	-	*	-
Customization	-	-	-	-	*	-
Flexibility	-	-	-	*	-	-
Friendly	-	-	-	*	-	-
Information Quality:	*	*	*	*	*	*
Importance		*	*	-	*	-
Availability	*	*	*	*	*	-
Usability	-	*	*	-	*	-
Understandability	*	*	*	-	-	-
Format	-	*	*	-	*	-
Conciseness	*	*	*	-	*	-
Update	-	*	-	*	*	-
Service Delivery Quality:	*	*	*	*	*	*
Efficiency	*	*	*	*	-	-
System Availability	*	*	*	*	*	-
Fulfillment	*	*	*	-	*	-
Privacy	*	*	*	-	*	-
Responsiveness	*	*	*	*	*	-
Contact	*	*	*	*	*	-
Web design	-	*	-	*	-	*
Library services	-	*	-	-	-	-
Interaction	-	*	-	*	-	*
Perceived Usefulness	*	*	*	*	*	-
User Satisfaction	*	*	*	*	*	-
Customer Value	*	-	*	-	*	-
Organisational Value	*	-	*	-	*	-
Self-efficacy	-	*	-	*	-	*

*identified as significant constructs to evaluate the success of e-learning systems

As shown in Table 8.3, there is consistency in the factors affecting the success of the e-learning system. Different aspects emerged from the content analysis to measure each construct based on the perceptions of the students, academic staff, and ICT staff. Some of these aspects are consistent with the aspects used in the three surveys and that supports the reliability and validity of these aspects in measuring the success of e-learning systems.

8.5. Chapter summary

Chapter 8 was allocated to discussing the results of the study. The results were discussed in three sections. The first section discussed the results of the measurement model. The study adopted Structural Equation Modelling and testing the measurement model is the first stage in this technique. The results confirm that the constructs selected in the study model were valid and reliable to measure the success of the e-learning system. The second section is related to the subsequent stage of Structural Equation Modeling that examines the structural model and tests the hypotheses. The results of testing each hypothesis on the three samples were discussed in detail and compared with the information systems and e-learning systems literature. The third section discussed the results of content analysis of comments from students, academic staff, and ICT staff. The results totally support the proposed model to measure the success of e-learning systems with different stakeholders.

CHAPTER NINE

This chapter provides the conclusions, contributions, recommendations, limitations and future research directions. The first part of this chapter provides an overview of the study. The main purpose of this section is to describe the procedures adopted for the study and the results of the study objectives. The second section proffers the contributions of the study. Section three provides recommendations of the study. Finally, the chapter concludes with an outline of the study's limitations and recommendations for future research.

CHAPTER NINE: CONCLUSION AND RECOMMENDATIONS

9.1. Chapter Introduction

E-learning systems are relatively recent applications in universities, educational institutions and organisations. There are many issues confronting individual users, organisations, and top management in relation to these types of systems. One of the most relevant issues is measuring the success of e-learning systems. Previous studies that investigated e-learning systems ignored the issue of multiple stakeholders and only focusing on particular group i.e. students. Moreover, the role of IT infrastructure services to achieve the success of e-learning systems is still ambiguous. Thus, this study was conducted to fill the current research gap. The previous chapters were allocated to introducing the study background and problems (chapter 1), Reviewing the literature (chapter 2), establishing the theoretical model of study (chapter 3), describing the research methodology adopted for the study (chapter 4), providing details of the empirical study (chapters 5, 6, and 7), and explaining the results (chapter 8). Chapter 9 presents a conclusion about the study and provides in detail a summary of the previous eight chapters.

9.2. Conclusion

The adoption of e-learning systems has increased extensively in educational institutions and organisations in recent times. However, these types of systems still present some challenging issues. Evaluating the success of e-learning systems is seen as one of the most important issues encountered by educational institutions and organisations. One of the crucial reasons behind this issue is the disagreement that persists about the factors that impact the success of e-learning systems. Moreover, this issue becomes more complicated because of the variety of stakeholders involved in e-learning systems. This can make the assessment problematic or complex because of variations in the indicators and point of views about the success of e-learning systems.

Therefore, this study deals with the issue of measuring the success of an e-learning system and establishing a model to measure the success of the e-learning system from different points of view. This study aimed to achieve three essential objectives as follows.

9.2.1. Objective one: E-learning systems success factors

Objective One: to identify those factors which affect e-learning systems success and place them in a holistic model.

This objective was achieved based on three stages of work. The first stage involved a comprehensive review of the literature and development of a theoretical framework. Accordingly, eight constructs were selected to assess the success of e-learning systems: IT infrastructure services; system quality; information quality; service delivery quality; perceived usefulness; user satisfaction; customer value; and organisational value. As mentioned previously, the selection of these constructs was based on the literature on information systems and e-learning systems, as shown in chapter three (Section 3.2).

The second stage involved gathering these constructs in one model and establishing the relationships between them. Establishing the relationships among these constructs in the context of the proposed model was achieved by formulating the hypotheses between these constructs based on the causality approach. Twenty-seven hypotheses were proposed to represent the relationships among the constructs of the model. One of the most important conditions in establishing relationships based on the causality approach is the need for theoretical support. To achieve this condition, each hypothesis is supported by the literature and by the previous empirical research examining the suggested relationships—as shown in chapter three (Section 3.5).

The selection of factors affecting the success of e-learning systems and the suggested relationships were based on theoretical grounds and supported by empirical studies. The third stage of selecting these constructs was through empirical research. The study was conducted with three stakeholder groups of the e-learning system: students, academic staff, and ICT staff. The quantitative data of the study was collected via the survey and, additionally, qualitative data was gathered via one open-ended question.

Confirmatory factor analysis was employed to examine the measurement model of the students' sample to identify the reliability and validity of each construct in measuring the success of the e-learning system. Moreover, the measurement models of academic staff and ICT staff samples were tested using PLS. The measurement models were supported by the indicators of reliability and validity such as

Cronbach's alpha, coefficient H, construct reliability, AVE, convergent validity, and construct validity.

The results of the measurement model confirm that the eight constructs selected in the study model to measure the success of e-learning systems are valid and reliable to measure this phenomena from different points of view (students, academic staff and ICT staff): IT infrastructure services; system quality; information quality; service delivery quality; perceived usefulness; user satisfaction; customer value; and organisational value.

The analysis was not limited to the main constructs, but also included the validity and reliability of the items used to measure each construct. All the non-significant items were eliminated from the measurement model.

The results of the empirical study support the selection of these constructs to measure the success of the e-learning system based on the theoretical framework and the literature.

Content analysis of students', academic staff and ICT staff comments was undertaken to identify the factors affecting the success of e-learning systems. The results of the content analysis show that there is consistency between the factors identified in the quantitative and qualitative analysis. Regarding the students and academic staff samples, six essential constructs were identified as factors to assess the success of the e-learning system: system quality; information quality; service delivery quality; perceived usefulness; user satisfaction; and self-efficacy and IT infrastructure services.

The five factors identified via the ICT staff comments were IT infrastructure services, system quality, information quality, service delivery quality, and self-efficacy.

The second phase of the first objective of the study is related to gathering the factors identified from the literature in a model to measure the success of the e-learning system. As mentioned in chapter three (Section 3.3), the positivist paradigm was adopted to establish the study model. The positivist paradigm depends on a priori of fixed relationships. Therefore, gathering the study constructs in a model and identifying the relationships among the constructs is supported by the literature and the theoretical foundations. The present study suggested that there were 27 relationships between the constructs of the proposed model. Twenty-one of these dealt with direct effects and six were allocated to measuring the mediation effect of service delivery quality. These relationships were formulated as hypotheses of the study and each hypothesis was based on the theoretical foundation—as shown in chapter three (Section 3.5).

To sum up, the first objective was to identify factors impacting the success of an e-learning system and to place them in a holistic model. This objective was achieved based on the theoretical foundation from the information systems and e-learning systems fields and supported by the empirical test undertaken based on the data collected from the three samples of study: students, academic staff, and ICT staff.

9.2.2. Objective two: test the proposed model

Objective Two: to test the validity and reliability of the proposed model and to confirm that the model is suitable to measure the success of e-learning systems from different points of view.

The second objective focused on measuring the validity and reliability of the proposed study model. This objective required the collection of actual data. Data collection involved three sets of data gathered from three stakeholder groups of the e-learning system. All the Indicators were used to measure the reliability and validity of the items, constructs, and the whole model with the three samples confirmed the validity and reliability of the indicators and constructs used to measure the success of e-learning systems.

Regarding the whole model, the indicators of model fit were used to assess the validity of the model. The results of testing the measurement and structural model show that the indicators of fit model met the cut-off level of these indicators and confirmed the validity of the models—as shown in chapter five, six, and seven (Sections 5.4.3, 5.4.5.3, 6.4.2,7.4, and 7.5.1.8)

Cross validity is necessary if substantial modifications have been undertaken on the original model. Regarding the proposed study model, no substantial modifications were made to the study model with the three samples. In addition, the suggested model was tested three times with each set of data and the results for each model confirmed the validity of the whole model to measure the success of e-learning systems.

In summary, the validity and reliability of the study model were considered with the three samples of study. The reliability and validity of each item was examined via convergent validity and reliability (squared multiple correlation). The reliability of constructs was measured using composite reliability, Cronbach's alpha, and Coefficient H. The validity of constructs was assessed by construct validity and discriminant validity. The validity of the whole model of students' sample was confirmed via the model fit indicators; and academic staff and ICT staff models used Goodness-of-Fit (GoF), Cross-validated communality (H2), and Predictive relevance (Q2).

9.2.3. Objective three: direct and mediation effect

Objective Three: to determine the type and power (significance) of relationships between those factors in the context of the proposed model, and to measure the direct and indirect effects between constructs of the study model.

This objective has been achieved via the structural model that includes the dependence relationships connecting the model constructs (Hair et al., 2010). The links between the constructs of the study model were represented by the study hypotheses. Twenty-seven hypotheses were formulated to examine two types of relationships: direct and mediation.

Twenty-one hypotheses focused on the direct effect of exogenous factors on endogenous factors and the determinants of endogenous constructs. A few brief observations regarding the students' sample are provided:

a) IT infrastructure services played a significant positive role as a determinant of system quality, information quality, service delivery quality, and perceived usefulness.

b) The quality of e-learning system significantly affected four constructs: information quality; service delivery quality, perceived usefulness; and user satisfaction.

c) Information quality is a significant key determinant of service delivery quality and perceived usefulness.

d) The vital role of service delivery quality is confirmed via the significant influence of this construct on perceived usefulness, user satisfaction, and customer value.

e) Perceived usefulness is significant in determining two constructs: user satisfaction and customer value.

f) Service delivery quality, perceived usefulness, and user satisfaction significantly impacted customer value.

g) Service delivery quality, perceived usefulness, and user satisfaction were significant determinants of organisational value in the study model.

h) The influence of IT infrastructure services, system quality, and information quality on perceived usefulness is partially mediated by service delivery quality.

i) Service delivery quality played a significant role as a mediation factor between system quality and user satisfaction.

j) The mediation role of service delivery quality in regard to the impact of IT infrastructure services and information quality on user satisfaction is not confirmed.

Concluding remarks about the relationships among the constructs of the study model for the academic staff sample are as follows:

a) IT infrastructure services is a significant determinant of system quality, Information quality, service delivery quality, and perceived usefulness.

b) The quality of the e-learning system significantly influenced two constructs in the proposed model: information quality and user satisfaction.

c) Three constructs significantly impacted information quality: service delivery quality, perceived usefulness, and user satisfaction.

d) Service delivery quality is a key determinant of four constructs: perceived usefulness; user satisfaction; customer value; and organisational value.

e) Perceived usefulness is a determinant for only one construct based on academic staff perceptions: customer value.

f) Service delivery quality, perceived usefulness, and user satisfaction were significant determinants of customer value.

g) Service delivery quality, perceived usefulness, and user satisfaction determined organisational value in the study model.

h) The effect of IT infrastructure services and information quality on perceived usefulness is mediated by service delivery quality.

i) The mediation role of service delivery quality between system quality and perceived usefulness is not confirmed.

j) The influence of system quality and information quality on user satisfaction is mediated by service delivery quality.

k) Service delivery quality is not confirmed as a mediating construct between IT infrastructure services and user satisfaction.

Concluding remarks about the results of examining the study model with ICT staff sample are as follows:

a) Three constructs significantly determined IT infrastructure services in the proposed model: system quality; service delivery quality; and user satisfaction.

b) The quality of the e-learning system significantly impacted three constructs in the proposed model: information quality; service delivery quality; and perceived usefulness.

c) Information quality significantly influenced two constructs: service delivery quality and user satisfaction.

d) Two constructs significantly impacted service delivery quality: perceived usefulness and user satisfaction.

e) Perceived usefulness is a determinant of two constructs: user satisfaction and organisational value.

f) The study model assumed that customer value of ICT staff was significantly influenced by three constructs: service delivery quality; perceived usefulness; and user satisfaction. However, this assumption was not supported.

g) Organisational value is impacted only by perceived usefulness.

h) The impact of IT infrastructure services and information quality on perceived usefulness was not mediated by service delivery quality.

i) Service delivery quality is a significant mediation factor between system quality and perceived usefulness.

j) The effect of system quality and information quality on user satisfaction is mediated by service delivery quality.

k) The mediation role of service delivery quality between IT infrastructure services and user satisfaction is not confirmed.

Table 9.1 lists the suggested determinants of endogenous constructs based on the proposed model and the significant determinants based on the results of the empirical study for the three samples.

Table 9.1 Proposed and significant determinants of endogenous constructs

Constructs	Determinants according to study model	Significant Determinants		
		Students	**Academic staff**	**ICT**
System quality	IT infrastructure services	IT infrastructure services	IT infrastructure services	IT infrastructure services
Information quality	IT infrastructure services; System quality	IT infrastructure services; System quality	IT infrastructure services; System quality	System quality
Service delivery quality	IT infrastructure services; System quality; Information quality	IT infrastructure services; System quality; Information quality	IT infrastructure services; Information quality	IT infrastructure services; System quality; Information quality
Perceived usefulness	IT infrastructure services; System quality; Information quality; Service delivery quality	IT infrastructure services; System quality; Information quality; Service delivery quality	IT infrastructure services; Information quality; Service delivery quality	System quality; Service delivery quality
User satisfaction	System quality; Service delivery quality; Perceived usefulness	IT infrastructure services; System quality; Information quality; Service delivery quality; Perceived usefulness	System quality; Information quality; Service delivery quality	IT infrastructure services; Information quality; Service delivery quality; Perceived usefulness

Customer value	Service delivery quality; Perceived usefulness User satisfaction	Service delivery quality; Perceived usefulness	Service delivery quality; Perceived usefulness; User satisfaction	No factor significantly impacted customer value
Organisational value	Service delivery quality; Perceived usefulness User satisfaction	Not tested	Service delivery quality; Perceived usefulness User satisfaction	Perceived usefulness

Achievement of objective 3 was undertaken via examining the structural model of the study with the three samples. The decisions related to accepting or rejecting the hypotheses of the study were based on the results of examining the study model with the three samples: student; academic staff; and ICT staff.

9.2.4. Objective four: IT infrastructure services and e-learning systems success

To identify the role of IT infrastructure services in the success of e-learning systems.

In the proposed model IT infrastructure services was considered a foundation to achieve the success of e-learning systems. According to the study model, IT infrastructure services is assumed to be the basis of system quality, information quality, service delivery quality, perceived usefulness, and user satisfaction. Two stages were undertaken to achieve objective four. The first stage in the measurement model was to test the reliability and validity of this construct. The results confirm that IT infrastructure services construct is a valid and reliable to measure the success of e-learning system success from different points of view: students, academic staff, and ICT staff (Sections 5.4.3; 5.4.4; 6.4.1; and 7.3)

The second stage in achieving objective four involved testing the effects of IT infrastructure services on system quality, information quality, service delivery quality, perceived usefulness, and user satisfaction in the context of the study model. This construct played a significant role in the proposed model to measure the success of e-learning systems in the students' sample. All five suggested impacts of IT infrastructure services on the proposed model were significant. IT infrastructure service significantly influenced system quality, information quality, service delivery quality, perceived usefulness, and user satisfaction. However, the effect of IT infrastructure services on user satisfaction was significantly negative.

In relation to academic staff and ICT staff, IT infrastructure services significantly impacted three out of five constructs: system quality; service delivery quality; perceived usefulness (for academic staff); and user satisfaction (for ICT staff).

These results confirm the crucial role of IT infrastructure services in measuring the success of e-learning systems and as a key construct impacting the success of these types of systems.

9.3. Study contributions

This study has made several contributions in regard to knowledge and theory, and practice.

9.3.1. Contribution to knowledge and theory

This research proposed and tested a model to measure the success of e-learning systems. The study model was established and examined based on a specific philosophy and methodological approach. This research made contributions to knowledge and theory in the information systems and e-learning systems fields as follows:

a) One of the contributions of this study is in developing and testing a model to assess e-learning systems success. This new model is holistic because different perspectives have been considered in relation to technical, user attitude, delivery via the internet, and organisational aspects. Furthermore, this model examined three different stakeholders of e-learning systems: students; academic staff; and ICT staff. The results support the validity of this model to measure the success of e-learning systems from different points of view.

b) The results of this study confirmed the validity and reliability of McLean and DeLone's model to measure the success of e-learning systems. This study has extended the McLean and DeLone's model by adding the construct of IT infrastructure services as a foundation to achieve the success e-learning systems. Furthermore, this study extended the impacts between the constructs of study model via investigating the direct and the mediation effect.

c) IT infrastructure services is rarely used to measure the success of e-learning systems. One of the most important contributions of this study was exploring and identifying the vital role of this construct as an essential component in the success of e-learning systems.

d) There is a lack of empirical evidence about the impact of IT infrastructure services in enhancing the quality aspects of e-learning systems and the attitude of users toward such systems. This research provides empirical evidence about the role of IT infrastructure services in enhancing system quality, information quality, service delivery quality, perceived usefulness, and user satisfaction.

e) Service delivery quality was used in previous studies to measure the success of information systems and e-learning systems. However, most of these studies measured this construct with narrow aspects and limited items. This study pays considerable attention to service delivery quality and measured it via a whole scale, E-S-QUAL, that includes six sub-dimensions. Accordingly, this was measured by different aspects and the validity and reliability of this measurement, E-S-QUAL, is confirmed in the context of the e-learning field. Moreover, this study contributed to identifying the mediation role of service delivery quality. The results confirm that service delivery quality plays a significant role as a mediation construct between IT infrastructure services, system quality, and information quality as exogenous factors; and perceived usefulness and user satisfaction as endogenous factors. This empirical evidence about the mediation role of service delivery quality is a key contribution to the e-learning systems field.

f) Most of the previous studies in the information systems field generally—and e-learning systems field specifically—deal with system quality, information quality, and service delivery quality as exogenous factors and there are no relationship effects among them. In this study, the causality approach was adopted. Accordingly, system quality was assumed to be a determinant of information quality. Moreover, system quality and information quality were hypothesised to impact service delivery quality. Therefore, this study provides empirical evidence about the relationship effects between the quality aspects of e-learning systems, information, and service.

g) Another contribution is through measuring the value of an e-learning system. Perez-Mira (2010) states that 'Individual impact per se is the most ambiguous to define … Organisational impact does not have a clear and defined measurement variable' (p. 25). Two different views of value were employed to measure the net benefits of e-learning systems, dealing with customer value and organisational value. These two types of value provided a comprehensive picture about the individual benefits generated by e-learning systems for students, academic staff, and ICT staff. Furthermore, benefits are also achieved by the university via the successful adoption of e-learning systems.

h) This study brings issues facing educational institutions in achieving successful e-learning systems to the attention of researchers that will be useful in future studies in this area.

9.3.2. Contribution to practice

This study was conducted empirically and the results obtained based on three sets of data were gathered from three groups of stakeholders of e-learning systems. Accordingly, several contributions achieved by this study for practitioners as follows:

a) This study provides universities and other education institutions with a model and instruments to enable them to evaluate e-learning systems success based on different points of view and with different stakeholders.

b) This study attempts to bring awareness to educational institutions of the important role of IT infrastructure services and service delivery quality in the success of e-learning systems.

c) Educational institutions can consider the issues identified in this study that impact on the success of e-learning systems—issues such as lecturers' ability, staff training, and IT infrastructure services.

d) This study can bring the attention of universities' top management to the impacts of e-learning systems on organisational value via enhancing competitive advantage, quick response to environmental changes, and cost reductions.

e) This study can assist USQ and other educational institutions using e-learning systems to identify problems and shortfalls in the successful utilisation of their systems.

f) This study provides USQ with information about the problems and issues facing the success of e-learning systems. The issues identified are based on the perceptions of students, academic staff, and ICT staff. These issues include lack of training, problems in system functions, self-efficacy, and inconsistent function/content across courses.

g) Some recommendations and solutions were proposed and delivered to USQ to address these problems.

h) Some recommendations and solutions are offered to educational institutions to enhance the success of e-learning systems.

i) Recommendations on how to improve service delivery quality and identification of the important factors that affect creating and enhancing customer and organisational value have been derived from the study.

9.4. Recommendations

As mentioned previously, a model to evaluate the success of e-learning was proposed and tested with three groups of stakeholders of an e-learning system. Several general recommendations can be offered to educational institutions, with specific recommendations to USQ.

The recommendations to educational institutions that adopt e-learning systems are as follows:

a) The main recommendation to the educational institutions is that proper evaluation of e-learning systems should be considered. Different aspects should be taken into account in the assessment process, for instance, IT infrastructure services, aspects of systems quality, information quality, service delivery quality, perceived usefulness, user satisfaction, value of e-learning system, self-efficacy, and support.

b) The opinions of different stakeholders regarding the success of e-learning systems should be considered to assess the system and to improve the services provided via the system to students, academic staff, ICT staff, and management.

c) Based on these findings the significant recommendation to educational institutions that adopt e-learning systems is to pay considerable attention to IT infrastructure services via developing and maintaining this infrastructure. In addition, it is recommended that the investment budget in IT infrastructure services should be adequate to provide an extensive range of services. More attention should also be paid to the role of IT infrastructure services in supporting students in different ways. For instance, considering students' evaluation and feedback about ICT division performance, adapting more channels to enable students to contact ICT staff such as using chat, and providing students with some online courses or educational videos and lectures about using e-learning systems and the main functions of these systems.

d) The results of the study identified service delivery quality as a critical factor in the success of e-learning systems via the direct and mediation impacts of this construct. Thus, this construct should be evaluated frequently. The evaluation processes can be aided by diagnosing the problems and shortfalls in delivering services to users. The evaluation processes in educational institutions can be undertaken via a survey of students who withdraw from the online courses and students who continue to study using e-learning systems.

e) The attitude of academic and ICT staff toward service delivery quality should be considered in assessing e-learning systems because the opinions of these groups of stakeholders will provide a comprehensive picture about the performance of the e-learning system in relation to service delivery quality. Aspects of IT infrastructure services, system quality, and information quality should be considered in evaluating the success of e-learning systems and the factors that impact these aspects should be identified based on the perceptions of academic staff and ICT staff.

f) Factors that affect perceived usefulness of e-learning should be taken into account by top management in educational institutions to enhance this construct. For instance, aspects of system quality such as system accuracy, system flexibility, system sophistication, and system integration should be supported and, at the same time, any attention paid to these aspects should be in the context of e-learning system success dimensions.

g) Educational institutions should pay attention to support services provided to e-learning systems users. Lack of support negatively reflects on user performance and attitude toward e-learning systems. One of the solutions to address the issue of support is using direct channels to chat between students and staff. For instance, the use of Skype by academic staff to reply to student enquires.

h) Enhance the self-efficacy of academic staff via training programs to optimise the use of the e-learning system and functions of the system. Moreover, academic staff should be provided with training about the software that supports and is integrated with the e-learning system.

i) Providing students with information, materials, and knowledge in a consistent format. For instance, the management of educational institutions should recommend academic staff provide students with video lectures, recordings, and sufficient materials in an acceptable timeframe. Furthermore, educational institutions should adopt a standardised approach (template) to save users time, make navigation easier, and reduce confusion about information location.

j) Web design should be considered by universities and ICT divisions. The website should be simple and easy to navigate and browse. Most students experience problems browsing the website as they need to open multiple pages and use multiple passwords to obtain the information they need or to reach to the required page.

k) An important issue that should be considered and solved by educational institutions is that of platform incompatibility. This issue has been confirmed by the three stakeholders surveyed in this study: students; academic staff; and ICT staff.

The following specific actions are recommended to USQ to improve the success of the e-learning system:

a) USQ should adopt a standard template to present course content. The standard design of the course can assist in reducing confusion, duplication and conflicting information, and enhance the capabilities of navigation.

b) Provide external students with sufficient materials to assist them in gaining the expected knowledge and experience from online study. The materials should not be limited to PowerPoint lecture slides, but should also include video and audio recordings. The software and e-learning system tools should be compatible with emerging technologies such as smart phones and tablets using the Android and Apple operating systems.

c) The issue of sound problems in lecture recordings should be addressed. USQ should improve the quality of Camtasia or adopt alternative software to enhance the quality of materials delivered to students.

d) Enhance the connection and interaction between external students and academic staff using different channels such as Skype, and use telephone communication to respond to urgent situations with students.

e) Provide students with training materials such as training manuals and instruction videos on how to use the e-learning system. Furthermore, tips about the use of each function, navigation, and enrolment should be delivered to new users of e-learning systems.

f) Introduce mandatory training for academic staff in the use of the e-learning system.

g) In respect to user satisfaction, this issue should also be considered by the educational institution and other organisations. User satisfaction should be set as an essential objective for educational institutions and the percentage of achievement of this objective should be evaluated annually. Surveys can be used to evaluate students' attitudes toward e-learning systems. In addition, the number of students who are re-using this system can be considered an indicator of satisfaction in using the system and benefits of this system.

h) Service delivery quality dimensions should be improved to enhance perceived usefulness, user satisfaction, customer value and organisational value. More attention should be paid to accessibility and to enabling students' access via different devices such as mobile phone and tablets. In addition, the e-learning interface should be clear, easy to navigate, and easy to use by students. These aspects are useful for students in the effective achievement of their tasks. More contact channels such as chat rooms with ICT staff, low cost international phone calls and social networks should be established to support the fulfillment dimension by reducing the response time for student enquiries. Contact channels should be improved via creating channels with low cost. Developing these contact channels can improve the responsiveness and contact dimensions. Developing service delivery quality can contribute to increasing the success of e-learning systems.

9.5. Limitations and future studies

This study provides empirical evidence about factors affecting the success of e-learning systems by testing the proposed model. However, the study has some limitations. These are as follows.

a) The main limitation of this study is that the sample of the study is limited to one university. Conducting the study in many different institutions would be prohibitively costly and time-consuming, but is an option for future research.

b) The number of ICT staff sample is small (22 participants) and that can be considered a main barrier to generalising the results of this study to the ICT staff community.

c) The response rate of the students' sample was 12.4% and this percentage can be considered relatively low. The main reason behind this low rate is the length of the questionnaire and the approximate time of 15 minutes needed by students to complete it. Students may not have had time to complete the questionnaire, especially considering that the majority of external students are in employment.

d) This study was limited to e-learning in the higher education sector and did not include e-learning systems in industrial organisations. This limitation can be an obstacle to generalising the findings of this student group to organisations adopting e-learning systems due to the differences between the environment of universities and industrial organisations and the purpose of using this system.

e) Some important factors that could evaluate the success of e-learning were not considered in survey questionnaire. These included self-efficacy of academic staff and student training. However, these factors emerged during the content analysis based on the respondents' comments.

f) This study did not include the senior management and e-learning systems designers while investigating the factors that affect the success of e-learning systems. These two stakeholder groups could have provided worthy opinions about the factors that impact the success of e-learning systems.

To overcome these limitations and to provide researchers with future research directions, some suggestions are provided as follows:

a) Test the validity and reliability of the study model in other educational institutions and organisations to identify the strengths and weaknesses of this model.

b) In future work, senior management and e-learning systems designers should be included when studying the factors that impact the success of e-learning systems.

c) More attention should be paid to IT infrastructure services and the role of this construct in the success of e-learning systems. For instance, the impacts of IT infrastructure services on customer and organisational value of e-learning systems needs more investigation. Moreover, critical factors mediating between IT infrastructure and the success of e-learning systems could be explored.

d) For future studies, the mediation role of system quality, information quality, and service delivery quality in evaluating the success of e-learning systems should be considered, and explanations about the factors contributing to these relationships should be offered.

e) The efforts of researchers should focus on factors that are considered to be determinants of user satisfaction with different stakeholders. Most studies focus on single stakeholders, usually students, and ignore other stakeholders such as academic staff and ICT staff. In addition, determinants of user satisfaction should be explored considering the nature of using e-learning systems: voluntary or mandatory.

f) This study assumed that service delivery quality, perceived usefulness, and user satisfaction significantly affect the customer value and organisational value, specifically the ICT staff perceptions. However, the results showed that these three constructs had no significant impact on the ICT staff value. Only the perceived usefulness had significant effect on organisational value. Therefore, more investigations are needed to explore the factors that enhance the customer and organisational value based on the ICT staff perceptions.

g) The lectures' ability to use e-learning systems, self-efficacy of academic staff, and student training should be taken into account as essential factors to evaluate the success of e-learning systems in the future studies. The role of these factors in the success of e-learning systems and specifically on the user satisfaction, customer value, and organisational value should be investigated.

These limitations can be avoided by researchers in the future. The suggested model can be adopted by researchers to add further contributions to the body of knowledge in the e-learning system field.

9.6. Closing remarks

In summary, this research investigated an essential issue in the e-learning system field: the success of e-learning systems. The key objectives of this study are to identify the factors affecting the success of e-learning system and place them in a holistic model and test the model empirically. Accordingly, a theoretical model was proposed to address this issue and empirically examined with three groups of stakeholders: students; academic staff and ICT staff. The results confirmed that the model is valid and reliable to measure the success of e-learning systems.

This research provided a clear picture about the factors affecting the success of e-learning systems based on the opinions of different stakeholders. Moreover, the role of IT infrastructure services as a key factor in the success of e-learning systems was investigated and confirmed.

This research contributed to the theory and knowledge through proposing a valid and reliable model to measure the success of e-learning systems. Furthermore, this research contributed to practice through the empirical study that undertaken to test the study model. Based on the results of empirical studies, two types of recommendations were proposed based on the results of the study: general recommendations to educational institutions; and recommendations to USQ.

The stated objectives in this research have been achieved and recommendations about measuring the success of e-learning systems are proposed to the educational institutions and raised to the senior management of USQ.

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APPENDICES

Appendix A: Ethics Approval of USQ

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Tuesday, 28 June 2011

Mr Ahmed Younis Mohammad Alsabawy
Faculty of Business / School of Information Systems
USQ Toowoomba Campus

Dear Mr Alsabawy

Re: PhD Research Project.

The Chair of the USQ Fast Track Human Research Ethics Committee (FTHREC) recently reviewed your responses to the FTHREC's conditions placed upon the ethical approval for the below project. Your proposal now meets the requirements of the *National Statement on Ethical Conduct in Human Research (2007)* and full ethics approval has been granted.

Project Title	Measuring e-learning system success
Approval no.	H11REA090
Expiry date	01/07/2012
FTHREC Decision	**Approved**

The standard conditions of this approval are:

(a) conduct the project strictly in accordance with the proposal submitted and granted ethics approval, including any amendments made to the proposal required by the HREC
(b) advise (email: ethics@usq.edu.au) immediately of any complaints or other issues in relation to the project which may warrant review of the ethical approval of the project
(c) make submission for approval of amendments to the approved project before implementing such changes
(d) provide a 'progress report' for every year of approval
(e) provide a 'final report' when the project is complete
(f) advise in writing if the project has been discontinued.

For (c) to (e) forms are available on the USQ ethics website: http://www.usq.edu.au/research/ethicsbio/human

Please note that failure to comply with the conditions of approval and the *National Statement (2007)* may result in withdrawal of approval for the project.

You may now commence your project. I wish you all the best for the conduct of the project.

Helen Phillips
Ethics Officer
Office of Research and Higher Degrees

Toowoomba • Springfield • Fraser Coast   usq.edu.au

Appendix B: Pilot study responses from three types of e-learning systems stakeholders

Table B.1 Pilot study of students

No	Questions (Before)	Student 1 comments	Student 2 comments	Student 3 comments	Action	Questions (After)
Information Quality						
1	The e-learning system provides me with output that seems to be exactly what I need	Better to remove "seems to be"		The e-learning system provides me with the outputs that I need	Accepted the suggestions of students 1 and 3	The e-learning system provides me with the outputs that I need
2	Information needed from the e-learning system is always available for me					Information needed from the e-learning system is always available for me
3	Information from the e-learning system is in a form that is readily usable			Similar to 4		Information from the e-learning system is in a form that is readily usable
4	Information from the e-learning system is easy to understand		(it sounds similar to 3)			Information from the e-learning system is easy to understand
5	Information from the e-learning system appears to be readable, clear, and well formatted	Similar to question 4	(this question is similar to 3 and 4)	Similar to 4	Eliminated	-
6	Information from the e-learning system is concise					Information from the e-learning system is concise
System Quality						
7	The e-learning system is easy for me to use					The e-learning system is easy for me to use
8	The e-learning system is easy for me to learn					The e-learning system is easy for me to learn
9	The e-learning system meets my requirements					The e-learning system meets my requirements
10	The e-learning system includes necessary features and functions		(Necessary features and functions for what? Do you mean		Added 'for my study'	The e-learning system includes necessary features and functions for my study

No	Questions (Before)	Student 1 comments	Student 2 comments	Student 3 comments	Action	Questions (After)
			necessary for my study?)			
11	The e-learning system always does what it should			Always means 100% should be "almost"	always has eliminated	The e-learning system does what it should
12	The e-learning system user interface can be easily adapted to one's personal approach					The e-learning system user interface can be easily adapted to one's personal approach
13	The e-learning system requires only the minimum number of fields and screens to achieve a task					The e-learning system requires only the minimum number of fields and screens to achieve a task
14	All data within e-learning system is fully integrated and consistent					All data within e-learning system is fully integrated and consistent
15	The e-learning system can be easily modified or corrected	For ICT staff	I guess this question for the staff not for students	I can't correct it	Eliminated	-
Perceived Usefulness						
16	Using the e-learning system in my study enables me to accomplish my tasks more quickly					Using the e-learning system in my study enables me to accomplish my tasks more quickly
17	Using the e-learning system improves my study performance					Using the e-learning system improves my study performance
18	Using the e-learning system in my study increases my productivity	Similar to question 19	similar to 19	Similar to 19		Using the e-learning system in my study increases my productivity
19	Using the e-learning system enhances my effectiveness in my study	Similar to questions 18 and 17	similar to 17 and 18		Eliminated	-
20	Using the e-learning system makes it easier to do my study					Using the e-learning system makes it easier to do my study
21	Overall, I find the e-learning system useful to my study					Overall, I find the e-learning system useful to my study

No	Questions (Before)	Student 1 comments	Student 2 comments	Student 3 comments	Action	Questions (After)
User Satisfaction						
22	I am satisfied with the performance of the e-learning system					I am satisfied with the performance of the e-learning system
23	I am satisfied with the experience of using the e-learning system					I am satisfied with the experience of using the e-learning system
24	My decision to use the e-learning system was a wise one		suggestion : my decision to study my degree through e-learning system was a wise one	Was there a choice? No decision was made	Accepted the suggestion of student 2	my decision to study my degree through e-learning system was a wise one
25	I am satisfied with my decision to take a course via the Internet	Similar to question 24	(What course??)		Eliminated	-
26	If I had an opportunity to take another course via the Internet, I would gladly do so		Suggestion: do another degree or course online		Accepted the suggestion of student 2	If I had an opportunity to do another degree or course online, I would gladly do so
27	I feel that this course served my needs well	(Because of the e-learning?)	(do you mean e-learning)		I feel that the online courses serve my needs well	I feel that the online courses serve my needs well
Service Delivery Quality						
28	*ULearn* makes it easy to find what I need		(is it Ulearn in particular or e-learning in general)	Similar to 1	Eliminated	-
29	It is easy to get anywhere on *ULearn*					It is easy to get anywhere on ULearn
30	*ULearn* enables me to complete tasks quickly					ULearn enables me to complete tasks quickly
31	Information at this site is well organised		(What site?)	Similar to 35	Eliminated	-

No	Questions (Before)	Student 1 comments	Student 2 comments	Student 3 comments	Action	Questions (After)
32	*ULearn* loads its pages fast		(Doesn't depend on the Internet service where you are?)	Similar to 30	Eliminated	-
33	*ULearn* is simple to use	Similar to question28	(similar to 28)	Similar to 7	Eliminated	-
34	*ULearn* enables me to get on it quickly	How?	(similar to 30)		Eliminated	-
35	*ULearn* is well organised	Similar to question 31				ULearn is well organised
36	*ULearn* is always available for me to perform learning activities					ULearn is always available for me to perform learning activities
37	*ULearn* launches and runs right away					ULearn launches and runs right away
38	*ULearn* does not crash			almost never crash	Not crash frequently	ULearn does not crash frequently
39	Pages at *ULearn* do not freeze after I enter my information	What sort of information? Assignment, discussion?	(similar to 38)		Eliminated	-
40	This site delivers lectures, materials, and feedback when promised		(What site?)	Similar to 41	Eliminated	-
41	This site makes lectures, materials, and feedback available for delivery within a suitable time frame	Be consistent and state which site			*ULearn* used instead of site	ULearn makes lectures, materials, and feedback available within a suitable time frame
42	*ULearn* quickly delivers answers about my queries					ULearn quickly delivers answers about my queries
43	This site is truthful about its offerings					This site is truthful about its offerings
44	*ULearn* makes accurate promises about delivery of lectures materials and feedback	Similar to 40 and 41		Similar to 40	Eliminated	-

No	Questions (Before)	Student 1 comments	Student 2 comments	Student 3 comments	Action	Questions (After)
45	*ULearn* protects information related to student records					ULearn protects information related to student records
46	*ULearn* does not share my personal information with other sites	(Third parties?)	(and/or users)	Similar to 47	Suggestion of student2 accepted	ULearn does not share my personal information with other sites and/or users
47	This site protects information about my personal details and results	(This site?)			*ULearn* used instead of site	ULearn protects information about my personal details and results
48	*ULearn* provides me with convenient options to change my enrolment					ULearn provides me with convenient options to change my enrolment
49	*ULearn* provides me with convenient options to withdraw from course/program	Similar to 48		Similar to 48	Eliminated	-
50	This site tells me what to do if my assignment is not marked	(This site)			*ULearn* used instead of site	ULearn tells me what to do if my assignment is not marked
51	*ULearn* takes care of problems promptly					ULearn takes care of problems promptly
52	*ULearn* provides a telephone number to reach the university					ULearn provides a telephone number to contact the university
53	*ULearn* has Students Services representatives available online					ULearn has Students Services representatives available online
54	*ULearn* offers the ability to speak to a live person if there is a problem	Similar to 52		Live person? Question 52	Eliminated	-
55	*ULearn* allows me to discuss some issues with my lecturers					ULearn allows me to discuss some issues with my lecturers
56	*ULearn* enables me to input comments and share information with other students					ULearn enables me to input comments and share information with other students
IT Infrastructure Services						
57	The Division of ICT provides me with a wide range of electronic channels such as email, website,					The Division of ICT provides me with a wide range of electronic channels such as email, website,

No	Questions (Before)	Student 1 comments	Student 2 comments	Student 3 comments	Action	Questions (After)
	and call centres to connect with lecturers, students, and different divisions at USQ					and call centres to connect with lecturers, students, and different divisions at USQ
58	The Division of ICT provides me with e-learning service with high level of technical security	With an e-learning with a high level....			Accepted	The Division of ICT provides me with an e-learning service with a high level of technical security
59	The Division of ICT provides me with data management advice and consultancy					The Division of ICT provides me with data management advice and consultancy
60	The Division of ICT enables me to receive and exchange information and knowledge with lecturers and other students by using (e.g. electronic linkages and software applications					The Division of ICT enables me to receive and exchange information and knowledge with lecturers and other students by using (e.g. electronic linkages and software applications)
61	The Division of ICT provides me with a wide range of facilities to achieve e-learning activities, such as access to the library		to achieve (perform)		Accepted student 2 suggestion	The Division of ICT provides me with a wide range of facilities to perform e-learning activities, such as access to the library
62	ICT provides me with technology advice and support services related to the e-learning system					ICT provides me with technology advice and support services related to the e-learning system
Customer Value						
63	The e-learning courses delivered by *ULearn* strengthened my ability to analyse and evaluate information		Strengthened (related to my study)		Accepted the suggestion	The e-learning courses delivered by *ULearn* strengthen my ability to analyse and evaluate information related to my study
64	The e-learning courses delivered by *ULearn* helped me to develop the ability to solve problems	Similar to question 63	(similar to 63)		Eliminated	-
65	I gained an understanding of concepts and principles in this field	(Which filed, Is the field of e-learning of in the study	(Which field?)		In my study area added instead of in this field	I gained an understanding of concepts and principles in my study area

No	Questions (Before)	Student 1 comments	Student 2 comments	Student 3 comments	Action	Questions (After)
		field?)				
66	The e-learning courses delivered by *ULearn* stimulated me to read further in this area	(Which area?)	stimulated (urge); (which area?, the area of my study)		My study area replaced with this area	The e-learning courses delivered by *ULearn* stimulated me to read further in my study area
67	People who are important to me think that taking my course is a good thing to do	People (fellow students?); course (online?)	(you mean do my study online through e-learning system)		Suggestion of student 2 adopted	People who are important to me think that taking my course through the e-learning system is a good thing to do
68	My family and my friends will see me in better light when I have finished my degree			In a better	Correction of student 3 adopted	My family and my friends will see me in a better light when I have finished my degree

Table B.2 Pilot Study of Academic Staff

No	Questions (Before)	Academic staff member 1 comments	Academic staff member 2 comments	Academic staff member 3 comments	Researcher Action	Questions (After)
Information Quality						
1	The e-learning system provides me with output that seems to be exactly what I need	to be accurate	The information provided on e-learning system is sufficient for my teaching needs	The comments of Academic staff member were about the whole instrument	Adopted the suggestion of academic staff member 2	The provided information on the e-learning system is sufficient for my teaching needs
2	Information that I need from the e-learning system is always available	Delete always ; can replace "available" with "accessible"	The essential information to setup my teaching in e-learning environment is always available		Adopted the suggestion of academic staff member 2, and always removed from this item	The essential information to setup my teaching in e-learning environment is available
3	Information from the e-learning system is in a form that is readily usable		The provided information in e-learning system is useful and assisted me in my teaching		Adopted the original item	Information from the e-learning system is in a form that is readily usable
4	Information from the e-learning system is easy to understand	Clarity and concise	The information in the e-learning system is easy to understand		Adopted the suggestion of academic staff member 2	The information in the e-learning system is easy to understand
5	Information from the e-learning system appears to be readable, clear, and well formatted	similar to Q3	The format of the information	Duplicate in the question, readable, clear,	Information from the e-learning system appears to	Information from the e-learning system appears to be well formatted

No	Questions (Before)	Academic staff member 1 comments	Academic staff member 2 comments	Academic staff member 3 comments	Researcher Action	Questions (After)
			provided in the e-learning system is well organised, and easy to track	and well formatted three different things	be well formatted	
6	Information from the e-learning system is concise		The information in the e-learning system is concise and enough for organising my course and teaching materials.		Adopted the suggestion of academic staff member 2	The information in the e-learning system is concise and enough for organising my course and teaching materials
System Quality						
7	The e-learning system is easy for me to use					The e-learning system is easy for me to use
8	The e-learning system is easy for me to learn			The questions should be simple	Most of the questions have been reworded to be more simple	The e-learning system is easy for me to learn
9	The e-learning system meets my requirements					The e-learning system meets my requirements
10	The e-learning system includes necessary features and functions	X, part of Q9 requirement	The e-learning system includes necessary features and functions for teaching		Adopted the suggestion of academic staff member 2	The e-learning system includes necessary features and functions for teaching
12	The e-learning system user interface can be easily adapted to one's personal approach					The e-learning system user interface can be easily adapted to one's personal approach

No	Questions (Before)	Academic staff member 1 comments	Academic staff member 2 comments	Academic staff member 3 comments	Researcher Action	Questions (After)
13	The e-learning system requires only the minimum number of fields and screens to achieve a task		The e-learning system requires less effort to achieve a task through minimum number of fields and screens		The e-learning system requires minimal effort to achieve a task through minimum number of fields and screens	The e-learning system requires only the minimum number of fields and screens to achieve a task
14	All data within the e-learning system is fully integrated and consistent					All data within the e-learning system is fully integrated and consistent
15	The e-learning system can be easily modified, corrected or improved	X; Not related to Academic staff		Has more than one aspect	Eliminated	-
			Perceived Usefulness			
16	Using the e-learning system in my job enables me to accomplish my tasks more quickly		Using the e-learning system in my job enables me to accomplish my tasks quickly		Adopted the suggestion of academic staff member 2	Using the e-learning system in my job enables me to accomplish my tasks more quickly
17	Using the e-learning system improves my job performance					Using the e-learning system improves my job performance
18	Using the e-learning system in my job increases my productivity	Similar to Q19			Eliminated	-
19	Using the e-learning system enhances my effectiveness in my job	Similar to Q18				Using the e-learning system enhances my effectiveness in my job
20	Using the e-learning system makes it easier to do my job		Using the e-learning system eases my job		Adopted the original item	Using the e-learning system makes it easier to do my job

No	Questions (Before)	Academic staff member 1 comments	Academic staff member 2 comments	Academic staff member 3 comments	Researcher Action	Questions (After)
21	Overall, I find the e-learning system useful to my job	General item to measure the usefulness, should be more specific			Eliminated	-
			User Satisfaction			
22	Based on my experience with the e-learning system, I am very contented using the system	similar to Q24, Q25			Removed “very” from the item	Based on my experience with the e-learning system, I am contented using the system
23	Based on my experience with the e-learning system, I am very satisfied using the system	Removed “very”			Removed “very” from the item	Based on my experience with the e-learning system, I am satisfied using the system
25	Based on my experience with the e-learning system, I am very pleased using the system	similar to Q22, Q24			Eliminated	-
26	I am satisfied with using e-learning system as a learning assisted tool	Add “Based on my experience”	I am satisfied with using e-learning system as a learning tool		Adopted the suggestion of academic staff member 2	I am satisfied with using the e-learning system as a learning tool
27	I am satisfied with using the e-learning system function	Similar to Q23	I am satisfied with using the e-learning system functions		Adopted the suggestion of academic staff member 2	I am satisfied with using the e-learning system functions
			Service Delivery Quality			
28	UTeach enables me to provide the course information and the knowledge to student					UTeach enables me to provide course information and knowledge to student
29	It is easy for me to get anywhere on UTeach					It is easy for me to get anywhere on UTeach
30	UTeach enables me to complete my tasks quickly		UTeach enables me to	Similar to item 15	Eliminated	-

No	Questions (Before)	Academic staff member 1 comments	Academic staff member 2 comments	Academic staff member 3 comments	Researcher Action	Questions (After)
			complete my tasks quickly			
31	Information at this site is well organised		Information at UTeach is well organised		Adopted the suggestion of academic staff member 2	Information at UTeach is well organised
32	UTeach loads its pages fast					UTeach loads its pages fast
33	UTeach is simple to use for me	Similar to Q7 and Q30	UTeach is simple to use		Eliminated	-
34	UTeach enables me to get on it quickly	Similar to Q32			Eliminated	-
35	UTeach is well organised	Similar to Q 31	UTeach is well organised		Eliminated	-
36	UTeach is always available for me to perform teaching activities					UTeach is always available for me to perform teaching activities
37	UTeach launches and runs right away					UTeach launches and runs right away
38	UTeach does not crash	Similar to Q30	UTeach does not crash frequently		Adopted the suggestion of academic staff member 2	UTeach does not crash frequently
39	Pages at UTeach do not freeze after entering the information		Similar to 38		Eliminated	-
40	This site enables me to deliver lectures, material, and feedback to students when promised	Remove "When promised"	UTeach enables me to deliver lectures, material, and feedback to students when promised		Adopted the suggestion of academic staff member 2	UTeach enables me to deliver lectures, material, and feedback to students when promised
41	This site makes lectures, material, and feedback available for delivery within a suitable time frame	Similar to Q36 have any of them	UTeach makes lectures, material, and feedback		Adopted the suggestion of academic staff member 2	UTeach makes lectures, material, and feedback available for delivery within a suitable time frame

No	Questions (Before)	Academic staff member 1 comments	Academic staff member 2 comments	Academic staff member 3 comments	Researcher Action	Questions (After)
			available for delivery within a suitable time frame			
42	UTeach enables me to deliver answers to students about their queries quickly	OK	UTeach enables me to deliver answers to students about their queries quickly		Adopted the suggestion of academic staff member 2	UTeach enables me to deliver answers to students about their queries quickly
43	This site does not allow me to get full details of student records	This site allow me to get the required details of student records	UTeach does not show full details of student records		UTeach does not allow display of full details of student records	UTeach does not allow display of full details of student records
44	UTeach does not share the feedback of assignments of each student with the other students		UTeach does not allow to share the feedback of assignments of each student with the other students		UTeach does not allow sharing the feedback of assignments of each student with the other students	UTeach does not allow sharing the feedback of assignments of each student with the other students
45	This site protects information related to personal details of students and results		UTeach protects information related to personal details of students and results		Adopted the suggestion of academic staff member 2	UTeach protects information related to personal details of students and results

No	Questions (Before)	Academic staff member 1 comments	Academic staff member 2 comments	Academic staff member 3 comments	Researcher Action	Questions (After)
46	UTeach tells me if my teaching activities are not processed	UTeach tells me if my students received my feedback			Adopted the suggestion of academic staff member1	UTeach tells me if my students received my feedback
47	UTeach takes care of problems promptly	UTeach takes care of problems and student quires promptly			Adopted the suggestion of academic staff member 1	UTeach takes care of problems and student enquires promptly
48	UTeach allows me to discuss issues with students			Are the questions in this instrument suitable for e-learning systems domain?	All the questions have been used in previous studies and the reliability and validity of them have been tested. In addition, most of these questions have been employed to measure these factors in e-learning systems area	UTeach allows me to discuss issues with students
49	This site offers the ability to speak to a live person if there is a technical problem					This site offers the ability to speak to a live person if there is a technical problem
51	The Division of ICT provides me with a wide range of channel management services (e.g. electronic channel to the students to support multiple applications, such as Web sites, call centres, mobile computing)			The references of questions should be mentioned	The references of each question have been mentioned in the methodology chapter	The Division of ICT provides me with a wide range of channel management services (e.g. electronic channel to the students to support multiple applications, such as Web sites, call centres, mobile computing)

No	Questions (Before)	Academic staff member 1 comments	Academic staff member 2 comments	Academic staff member 3 comments	Researcher Action	Questions (After)
52	The Division of ICT provides me with a wide range of security and risk management services (e.g. security policies, disaster planning, firewalls)	The division of ICT provides the required security to the system (e.g. security policies, disaster planning, firewalls)			Adopted the suggestion of academic staff member 1	The division of ICT provides the required security to the system (e.g. security policies, disaster planning, firewalls)
53	The Division of ICT provides me with a wide range of communication services in the context of the e-learning system (e.g. network services, broadband services, Intranet capabilities)	The Division of ICT provides a wide range of communication services (e.g. network services, broadband services, Intranet capabilities)			Adopted the suggestion of academic staff member 1	The Division of ICT provides a wide range of communication services (e.g. network services, broadband services, Intranet capabilities)
54	The Division of ICT provides me with a wide range of data management services (e.g. key data independent of applications, centralized data warehouse, data management consultancy, storage area networks, knowledge management)	Similar 55			Eliminated	-

No	Questions (Before)	Academic staff member 1 comments	Academic staff member 2 comments	Academic staff member 3 comments	Researcher Action	Questions (After)
55	The Division of ICT provides me with a wide range of application infrastructure services (e.g. centralized management of applications, mobile and wireless applications, workflow applications)	The Division of ICT provides a wide range of software application and infrastructure when required (e.g. centralized management of applications, mobile and wireless applications, workflow applications)			Adopted the suggestion of academic staff member 1	The Division of ICT provides a wide range of software applications and infrastructure when required (e.g. centralized management of applications, mobile and wireless applications, workflow applications)
56	The Division of ICT provides me with a wide range of IT facilities management services (e.g. large scale processing/mainframe, common systems development environment)	The Division of ICT provides a maintenance to the system adequately			Adopted the suggestion of academic staff member 1	The Division of ICT provides maintenance to the systems adequately
		The Division of ICT gives considers my evaluation of the system				The Division of ICT gives consideration to my evaluation of the system
Customer Value						
57	The e-learning system changed my work practices	Replace "changed" with			Adopted the suggestion of academic staff	The e-learning system improves my work practices

No	Questions (Before)	Academic staff member 1 comments	Academic staff member 2 comments	Academic staff member 3 comments	Researcher Action	Questions (After)
		"improves"			member 1	
58	I experienced the immediate benefits of the e-learning system	"Repeated question"			Eliminated	-
59	The e-learning improves my job satisfaction	"Repeated question" ; there are whole construct about satisfaction			Eliminated	-
60	I have learnt much through the presence of the e-learning system				I have learnt much through e-learning system	I have learnt much through the e-learning system
61	Using the e-learning system gives me a sense of accomplishment			Are there any difference between your study and the studies have been used by the researcher to collect the items of questionnaire?	There are many differences between this study and the previous studies especially with the objective, approach, philosophy, and the constructs of study model.	Using the e-learning system gives me a sense of accomplishment
62	Using the e-learning system gives me a sense of fulfilment					Using the e-learning system gives me a sense of fulfillment
	Organisational Value					
63	The e-learning system enhances competitiveness or create strategic advantage	Say one of them "competitiveness" or "strategic advantage"	Not related to Academic staff		Eliminated	-

No	Questions (Before)	Academic staff member 1 comments	Academic staff member 2 comments	Academic staff member 3 comments	Researcher Action	Questions (After)
64	The e-learning system enables USQ to respond more quickly to change		The e-learning system enables USQ to respond quickly to change and develop the learning and teaching techniques		Adopted the suggestion of academic staff member 2	The e-learning system enables USQ to respond quickly to change and develop the learning and teaching techniques
	The e-learning system enables USQ to respond more quickly to change					The e-learning system enables USQ to respond more quickly to change
65	The e-learning system is cost effective					The e-learning system is cost effective
66	The e-learning system enables USQ to establish good relationships with the user community					The e-learning system enables USQ to establish good relationships with the user community
67	The e-learning system establishes and maintains a good image and reputation with management	Remove “with management”			The e-learning system establishes and maintains a good image and reputation for USQ	The e-learning system establishes and maintains a good image and reputation for USQ
68	The e-learning system has resulted in overall productivity improvement	General question and not measure adequately			Eliminated	-
69	The e-learning system aligns with stated organisational goals					The e-learning system aligns with stated organisational goals
70	The e-learning system provides new products or services to students and staff	“Similar to Q 69”			Eliminated	

No	Questions (Before)	Academic staff member 1 comments	Academic staff member 2 comments	Academic staff member 3 comments	Researcher Action	Questions (After)
71	The e-learning system provide improved products or services to students and staff	"Part of Q 63"			Eliminated	
72	The e-learning system has resulted in better positioning for e- Business	"Part of Q 63"			Eliminated	

Table B.3 Pilot Study of ICT Staff

No	Questions (Before)	ICT expert 1 comments	ICT expert 2 comments	Action	Questions (After)
1	The e-learning system provides me with outputs that I need to maintain and support the system		The notices of expert 2 were general about the whole instrument		The e-learning system provides me with outputs that I need to maintain and support the system
2	Information that I need from the e-learning system is always available		There are duplicate between the questions in usefulness and user satisfaction	All the questions of user satisfaction have been reformulated and new questions with different aspects have been employed	Information that I need from the e-learning system to maintain, support the system, and provide the services is always available
3	Information from the e-learning system is in a form that is readily usable		The questions should be focus on the support the system by ICT staff not using the system	Most of the questions in the instrument changed to include support and maintain the e-learning system	Information from the e-learning system is in a form that is readily usable to maintain and support the system
4	Information from the e-learning system is easy to understand		Some questions should focus on the role of ICT staff to support the system to enhance the academic staff teaching activities and students educational activities	Many questions have been used to measure this matter for instance the questions in the construct of service delivery and IT infrastructure services	Information from the e-learning system is easy to understand
5	Information from the e-learning system appears to be well	Do not use appears		"Appears" Removed from	Information from the e-learning system is formatted well

No	Questions (Before)	ICT expert 1 comments	ICT expert 2 comments	Action	Questions (After)
	formatted			the item	
6	Information from the e-learning system is concise		Question about developing the system should be add	Question 14	Information from the e-learning system is concise
					Information from the e-learning system is up-to-date enough to maintain and support the system
	System Quality				
7	The e-learning system is easy for me to use				The e-learning system is easy for me to use, maintain, and support
8	The e-learning system is easy for me to learn				The e-learning system is easy for me to learn
9	The e-learning system meets my requirements				The e-learning system meets the essential requirements for maintaining, supporting the system, and providing the services
10	The e-learning system includes necessary features and functions to achieve the required tasks				The e-learning system includes necessary features and functions to achieve the required tasks
11	The e-learning system always does what it should				The e-learning system always does what it should
12	The e-learning system user interface can be easily adapted to one's personal approach				The e-learning system user interface can be easily adapted to one's personal approach
13	The e-learning system requires only the minimum number of fields and screens to achieve a task				The e-learning system requires only the minimum number of fields and screens to maintain and support the system
14	The e-learning system can be easily modified, corrected or improved				The e-learning system can be easily modified, corrected or improved
					The e-learning system responds quickly during the busiest hours of the day
	Perceived Usefulness				
15	Using the e-learning system in my job enables me to accomplish my				Using the e-learning system enables me in my job to support the users and provide the services more quickly

No	Questions (Before)	ICT expert 1 comments	ICT expert 2 comments	Action	Questions (After)
	tasks more quickly				
16	Using the e-learning system improves my job performance				Using the e-learning system improves my job performance in supporting the users and providing the services
17	Using the e-learning system in my job increases my productivity				Using the e-learning system in my job increases my productivity
18	Using the e-learning system makes it easier to do my job				Using the e-learning system makes it easier to do my job and to support the different users
					I find the e-learning system to be useful in my the work I do
			User Satisfaction		
19	Based on my experience with the e-learning system, I am contented using the system	These all seem to be the same question, duplicate question		New five questions have been employed to measure ICT satisfaction. These items can be used to measure different aspects of ICT staff satisfaction for instance, satisfy with decision to work in e-learning system field, meeting job expectations, system function, personal satisfaction, and self-esteem.	I am satisfied with my decision to work in the e-learning systems field
20	Based on my experience with the e-learning system, I am satisfied using the system				Working with the e-learning system meets my job expectations
21	I am satisfied with using the e-learning system in my job				I am satisfied with using the e-learning system functions
22	I am satisfied with using the e-learning system function				My work with the e-learning system gives me a great senses of personal satisfaction
					My work with the e-learning systems increases my feelings of self-esteem

No	Questions (Before)	ICT expert 1 comments	ICT expert 2 comments	Action	Questions (After)
Service Delivery Quality					
23	The e-learning system makes it easy to find what users need				The e-learning system makes it easy to find what I need
24	It is easy to get anywhere on the e-learning system				It is easy to get anywhere on the e-learning system
25	The e-learning system enables users to complete tasks quickly				The e-learning system enables me to complete tasks quickly
26	The e-learning system loads its pages fast				The e-learning system loads its pages fast
27	The e-learning system is always available for users				The e-learning system is always available for users
28	The e-learning system launches and runs right away				The e-learning system launches and runs right away
29	The e-learning system does not crash frequently				The e-learning system does not crash frequently
30	The e-learning system enables academic staff to delivers lectures, materials, and feedback when promised				The e-learning system enables academic staff to delivers lectures, materials, and feedback when promised
31	The e-learning system quickly delivers answers to user queries				The e-learning system quickly delivers answers to user queries
32	This system is truthful about its offerings				This system is truthful about its offerings
33	The e-learning system protects information related to personal details of students and results				The e-learning system protects information related to personal details of students and results
34	The e-learning system does not share user personal information with other sites and /or users				The e-learning system does not share user personal information with other sites and /or users
35	The e-learning system has adequate security features				The e-learning system has adequate security features
36	The e-learning system provides students with convenient options to change their enrolment				The e-learning system provides students with convenient options to change their enrolment

No	Questions (Before)	ICT expert 1 comments	ICT expert 2 comments	Action	Questions (After)
37	This site tells students what to do if their assignments are not marked				This site tells students what to do if their assignments are not marked
38	The e-learning system takes care of problems reported by students promptly	Add academic staff and delete item 39		The e-learning system takes care of problems reported by academic staff and students	The e-learning system takes care of problems reported by academic staff and students promptly
39	The e-learning system takes care of problems reported by Academic Staff promptly	Same the above		Eliminated	-
40	The e-learning system provides a telephone number to contact the university	Same 41		Eliminated	-
41	The e-learning system has Students Services representatives available online				The e-learning system has Students Services representatives available online
42	The e-learning system offers the ability to speak to a live person if there is a technical problem				The e-learning system offers the ability to speak to a live person if there is a technical problem
43	The e-learning system allows students to discuss some issues with their lecturers				The e-learning system allows students to discuss some issues with their lecturers
44	The e-learning system enables users to comment and share information				The e-learning system enables users to comment and share information
IT Infrastructure Services					
45	The Division of ICT provides a wide range of channel management services (e.g. electronic channel to the students and staff to support multiple applications, such as web sites,				The Division of ICT provides a wide range of channel management services (e.g. electronic channel to the students and staff to support multiple applications, such as web sites, call centres, mobile computing)

No	Questions (Before)	ICT expert 1 comments	ICT expert 2 comments	Action	Questions (After)
	call centres, mobile computing)				
46	The Division of ICT provides a wide range of security and risk management services (e.g. security policies, disaster planning, firewalls)				The Division of ICT provides a wide range of security and risk management services (e.g. security policies, disaster planning, firewalls)
47	The Division of ICT provides a wide range of communication services (e.g. network services, broadband services, Internet capabilities, extranet capabilities, groupware)				The Division of ICT provides a wide range of communication services (e.g. network services, broadband services, Internet capabilities, extranet capabilities, groupware)
48	The Division of ICT provides a wide range of data management services (e.g. key data independent of applications, centralized data warehouse, data management consultancy, storage area networks, knowledge management)				The Division of ICT provides a wide range of data management services (e.g. key data independent of applications, centralized data warehouse, data management consultancy, storage area networks, knowledge management)
49	The Division of ICT provides a wide range of application infrastructure services (e.g. centralized management of applications, middleware, mobile and wireless applications, ASP, workflow application)				The Division of ICT provides a wide range of application infrastructure services (e.g. centralized management of applications, middleware, mobile and wireless applications, ASP, workflow application)
50	The Division of ICT provides a wide range of IT facilities management services (e.g. large scale processing/mainframe, server farms, common systems development environment)				The Division of ICT provides a wide range of IT facilities management services (e.g. large scale processing/mainframe, server farms, common systems development environment)
51	The Division of ICT provides a wide range of IT management services (e.g. IS planning,				The Division of ICT provides a wide range of IT management services (e.g. IS planning, investment and monitoring, IS project management, negotiations with

No	Questions (Before)	ICT expert 1 comments	ICT expert 2 comments	Action	Questions (After)
	investment and monitoring, IS project management, negotiations with suppliers and outsourcers, service level agreements)				suppliers and outsourcers, service level agreements)
52	The Division of ICT provides a wide range of IT architecture and standards services (e.g. specify and enforce architectures and standards for: technologies, communications, data, applications, and work)				The Division of ICT provides a wide range of IT architecture and standards services (e.g. specify and enforce architectures and standards for technologies, communications, data, applications, and work)
53	The Division of ICT provides a wide range of IT education services to users such as training in the use of IT				The Division of ICT provides a wide range of IT education services to users such as training in the use of IT
54	The Division of ICT provides a wide range of IT research and development (R&D) services (e.g. identify and test new technologies for business purpose, evaluate proposals for new IS applications				The Division of ICT provides a wide range of IT research and development (R&D) services (e.g. identify and test new technologies for business purpose, evaluate proposals for new IS applications)
Customer Value					
55	The e-learning system improves my work practices				The e-learning system improves my work practices
56	I experienced the immediate benefits of the e-learning system				Working with the e-learning system contributes to my personal growth and development
57	I have learnt much through the e-learning system				I have learned much through the e-learning system
58	Knowledge gained using the e-learning system will be helpful in future with other systems				Knowledge gained using the e-learning system will be helpful in future with other systems
59	Knowing how to maintains and support the e-learning system makes me more employable				Knowing how to maintain and support the e-learning system makes me more employable

No	Questions (Before)	ICT expert 1 comments	ICT expert 2 comments	Action	Questions (After)
Organisational Value					
60	The e-learning system enables USQ to respond more quickly to change				The e-learning system enables USQ to respond more quickly to change
61	The e-learning system is cost effective				The e-learning system is cost effective
62	The e-learning system enables USQ to establish good relationships with the user community				The e-learning system enables USQ to establish good relationships with the user community
63	The e-learning system establishes and maintains a good image and reputation for USQ				The e-learning system establishes and maintains a good image and reputation for USQ
64	The e-learning system provides new products or services to students and staff				The e-learning system can be used by the University to provide students and staff with new educational services

Appendix C: Student questionnaire

Dear Student

I would like to invite you to participate in this survey, which is an important part of my **PhD** study: "**Measuring e-learning system success**". The purpose of this study is to evaluate the success of e-learning system at USQ and to determine the factors which affect this system.

The questions are designed to enable quick and easy responses. Most of the questions can be answered simply by clicking the appropriate circle. Completing the questionnaire should take less than 10 minutes. The questionnaire focuses on the **e-learning system** at USQ, in particular, **USQ Study Desk** which is part of the **ULearn** function in **UConnect**.

An iPhone has been allocated as a prize for Students who participate in this survey. Provide your email address to enter the draw.

Please, click on the following link to participate in the survey:

https://www.surveymonkey.com/s/elearningsystemsuccessstudents

The questionnaire includes Five-Points Scale to answer the questions: strongly agree =5, strongly disagree=1. In addition, two options have been added: Don't Know and Not Applicable.
Don't Know means you have no experience about the item.
Not Applicable means you have experience about the item but it is not applicable in the current e-learning system.

This survey is approved by USQ (H11REA090.1). If you have any queries regarding the ethical conduct of this research you can contact the Research Ethics Office by email: ethics@usq.edu.au or phone +61746312690.

Participation in this survey is voluntary. Please be assured that your responses will be treated as strictly confidential and you will not be individually identified.

If you have any queries at all please do not hesitate to contact me.
Thank you for taking the time to respond.

PhD Student
Ahmed Younis Alsabawy
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E-learning System Success (Students)

1. Information and System Quality

Please tick ONE answer to describe your response to each statement

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Don't know	N/A
a) The e-learning system provides me with the outputs that I need	○	○	○	○	○	○	○
b) Information needed from the e-learning system is always available for me	○	○	○	○	○	○	○
c) Information from the e-learning system is in a form that is readily usable	○	○	○	○	○	○	○
d) Information from the e-learning system is easy to understand	○	○	○	○	○	○	○
e) Information from the e-learning system is concise	○	○	○	○	○	○	○
f) The e-learning system is easy for me to use	○	○	○	○	○	○	○
g) The e-learning system is easy for me to learn	○	○	○	○	○	○	○
h) The e-learning system meets my requirements	○	○	○	○	○	○	○
i) The e-learning system includes necessary features and functions for my study	○	○	○	○	○	○	○
j) The e-learning system does what it should	○	○	○	○	○	○	○
k) The e-learning system user interface can be easily adapted to one's personal approach	○	○	○	○	○	○	○
l) The e-learning system requires only the minimum number of fields and screens to achieve a task	○	○	○	○	○	○	○
m) All data within e-learning system is fully integrated and consistent	○	○	○	○	○	○	○

Page 1

E-learning System Success (Students)

2. Usefulness, User Satisfaction, and Service Quality

Please tick ONE answer to describe your response to each statement

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Don't know	N/A
a) Using the e-learning system in my study enables me to accomplish my tasks more quickly	○	○	○	○	○	○	○
b) Using the e-learning system improves my study performance	○	○	○	○	○	○	○
c) Using the e-learning system in my study increases my productivity	○	○	○	○	○	○	○
d) Using the e-learning system makes it easier to do my study	○	○	○	○	○	○	○
e) Overall, I find the e-learning system useful to my study	○	○	○	○	○	○	○
f) I am satisfied with the performance of the e-learning system	○	○	○	○	○	○	○
g) I am satisfied with the experience of using the e-learning system	○	○	○	○	○	○	○
h) My decision to study my degree through e-learning system was a wise one	○	○	○	○	○	○	○
i) If I had an opportunity to do another degree or course online, I would gladly do so	○	○	○	○	○	○	○
j) I feel that the online courses serve my needs well	○	○	○	○	○	○	○
k) It is easy to get anywhere on ULearn	○	○	○	○	○	○	○
l) ULearn enables me to complete tasks quickly	○	○	○	○	○	○	○
m) ULearn is well organized	○	○	○	○	○	○	○
n) ULearn is always available for me to perform learning activities	○	○	○	○	○	○	○
o) ULearn launches and runs right away	○	○	○	○	○	○	○
p) ULearn does not crash frequently	○	○	○	○	○	○	○

E-learning System Success (Students)

3. Service Quality Delivery

Please tick ONE answer to describe your response to each statement

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Don't know	N/A
a) ULearn makes lectures, materials, and feedback available within a suitable time frame	◯	◯	◯	◯	◯	◯	◯
b) ULearn quickly delivers answers about my queries	◯	◯	◯	◯	◯	◯	◯
c) ULearn is truthful about its offerings	◯	◯	◯	◯	◯	◯	◯
d) ULearn makes accurate promises about delivery of lectures materials and feedback	◯	◯	◯	◯	◯	◯	◯
e) ULearn protects information related to student records	◯	◯	◯	◯	◯	◯	◯
f) ULearn does not share my personal information with other sites and/or users	◯	◯	◯	◯	◯	◯	◯
g) ULearn protects information about my personal details and results	◯	◯	◯	◯	◯	◯	◯
h) ULearn provides me with convenient options to change my enrolment	◯	◯	◯	◯	◯	◯	◯
i) ULearn tells me what to do if my assignment is not marked	◯	◯	◯	◯	◯	◯	◯
j) ULearn takes care of problems promptly	◯	◯	◯	◯	◯	◯	◯
k) ULearn provides a telephone number to contact the university	◯	◯	◯	◯	◯	◯	◯
l) ULearn has Student Services representatives available online	◯	◯	◯	◯	◯	◯	◯
m) ULearn allows me to discuss some issues with my lecturers	◯	◯	◯	◯	◯	◯	◯
n) ULearn enables me to input comments and share information with other students	◯	◯	◯	◯	◯	◯	◯

E-learning System Success (Students)

4. IT Infrastructure Services and Customer Value

Please tick ONE answer to describe your response to each statement

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Don't know	N/A
a) The Division of ICT provides me with a wide range of electronic channels such as email, website, and call centres to connect with lecturers, students, and different divisions at USQ	○	○	○	○	○	○	○
b) The Division of ICT provides me with an e-learning service with a high level of technical security	○	○	○	○	○	○	○
c) The Division of ICT provides me with data management advice and consultancy	○	○	○	○	○	○	○
d) The Division of ICT enables me to receive and exchange information and knowledge with lecturers and other students by using (e.g. electronic linkages and software applications)	○	○	○	○	○	○	○
e) The Division of ICT provides me with a wide range of facilities to perform e-learning activities, such as access to the library	○	○	○	○	○	○	○
f) ICT provides me with technology advice and support services related to the e-learning system	○	○	○	○	○	○	○
g) The e-learning courses delivered by ULearn strengthen my ability to analyse and evaluate information related to my study	○	○	○	○	○	○	○
h) I gained an understanding of concepts and principles in my study area	○	○	○	○	○	○	○
i) The e-learning courses delivered by ULearn stimulated me to read further in my study area	○	○	○	○	○	○	○
j) People who are important to me think that taking my course through the e-learning system is a good thing to do	○	○	○	○	○	○	○
k) My family and my friends will see me in a better light when I have finished my degree	○	○	○	○	○	○	○

Please add comments about the factors affecting e-learning system success:

If you want to participate in the prize draw to win an Apple iPhone, please write your email address in the box below:

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Appendix D: Academic staff questionnaire

Dear Academic staff member

I would like to invite you to participate in this survey, which is an important part of my **PhD** study: "**Measuring e-learning system success**". The purpose of this study is to evaluate the success of e-learning system at USQ and to determine the factors which affect this system.

The questions are designed to enable quick and easy responses. Most of the questions can be answered simply by clicking the appropriate circle. Completing the questionnaire should take less than 10 minutes. The questionnaire focuses the **e-learning system** at USQ, in particular, **USQ Study Desk** which is part of the **UTeach** function in **UConnect**.

Please, click on the following link to participate in the survey:

https://www.surveymonkey.com/s/elearningsystemsuccessacademicstaff

The questionnaire includes Five-Points Scale to answer the questions: strongly agree =5, strongly disagree=1. In addition, two options have been added: Don't Know and Not Applicable.
Don't Know means you have no experience about the item.
Not Applicable means you have experience about the item but it is not applicable in the current e-learning system.

An iPhone has been allocated as a prize for Academic staff who participate in this survey. Provide your email address to enter the draw.

This survey is approved by USQ (H11REA090.1). If you have any queries regarding the ethical conduct of this research you can contact the Research Ethics Office by email: ethics@usq.edu.au or phone +61746312690.

Participation in this survey is voluntary. Please be assured that your responses will be treated as strictly confidential and you will not be individually identified.

If you have any queries at all please do not hesitate to contact me.
Thank you for taking the time to respond.

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Supervisor
Associate Prof. Aileen Cater-Steel
Faculty of Business / University of Southern Queensland

E-learning System Success (Academic Staff)

1. Information and System Quality

Please tick ONE answer to describe your response to each statement

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Don't know	N/A
a) The information provided on the e-learning system is sufficient for my teaching needs	○	○	○	○	○	○	○
b) The essential information to setup my teaching in e-learning environment is available	○	○	○	○	○	○	○
c) Information from the e-learning system is in a form that is readily usable	○	○	○	○	○	○	○
d) The information in the e-learning system is easy to understand	○	○	○	○	○	○	○
e) Information from the e-learning system appears to be well formatted	○	○	○	○	○	○	○
f) The information in the e-learning system is concise and adequate for organising my course and teaching materials	○	○	○	○	○	○	○
g) The e-learning system is easy for me to use	○	○	○	○	○	○	○
h) The e-learning system is easy for me to learn	○	○	○	○	○	○	○
i) The e-learning system meets my requirements	○	○	○	○	○	○	○
j) The e-learning system includes necessary features and functions for teaching	○	○	○	○	○	○	○
k) The e-learning system does what it should	○	○	○	○	○	○	○
l) The e-learning system user interface can be easily adapted to one's personal approach	○	○	○	○	○	○	○
m) The e-learning system requires minimal effort to achieve a task through minimum number of fields and screens	○	○	○	○	○	○	○
n) All data within the e-learning system is fully integrated and consistent	○	○	○	○	○	○	○

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E-learning System Success (Academic Staff)

2. Usefulness, User Satisfaction, and Service Quality

Please tick ONE answer to describe your response to each statement

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Don't know	N/A
a) Using the e-learning system in my job enables me to accomplish my tasks more quickly	○	○	○	○	○	○	○
b) Using the e-learning system improves my job performance	○	○	○	○	○	○	○
c) Using the e-learning system enhances my effectiveness in my job	○	○	○	○	○	○	○
d) Using the e-learning system makes it easier to do my job	○	○	○	○	○	○	○
e) Based on my experience with the e-learning system, I am contented using the system	○	○	○	○	○	○	○
f) Based on my experience with the e-learning system, I am satisfied using the system	○	○	○	○	○	○	○
g) I am satisfied with using the e-learning system as a learning tool	○	○	○	○	○	○	○
h) I am satisfied with using the e-learning system functions	○	○	○	○	○	○	○
i) UTeach enables me to provide the course information and the knowledge to students	○	○	○	○	○	○	○
j) It is easy for me to get anywhere on UTeach	○	○	○	○	○	○	○
k) Information at UTeach is well organized	○	○	○	○	○	○	○
l) UTeach loads its pages fast	○	○	○	○	○	○	○
m) UTeach is always available for me to perform teaching activities	○	○	○	○	○	○	○
n) UTeach launches and runs right away	○	○	○	○	○	○	○
o) UTeach does not crash frequently	○	○	○	○	○	○	○

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E-learning System Success (Academic Staff)

3. Service Delivery Quality

Please tick ONE answer to describe your response to each statement

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Don't know	N/A
a) UTeach enables me to deliver lectures, material, and feedback to students when promised	○	○	○	○	○	○	○
b) UTeach makes lectures, material, and feedback available for delivery within a suitable time frame	○	○	○	○	○	○	○
c) UTeach enables me to deliver answers to students about their queries quickly	○	○	○	○	○	○	○
d) UTeach does not allow display of full details of student records	○	○	○	○	○	○	○
e) UTeach does not allow sharing the feedback of assignments of each student with the other students	○	○	○	○	○	○	○
f) UTeach protects information related to personal details of students and results	○	○	○	○	○	○	○
g) UTeach tells me if my students received my feedback	○	○	○	○	○	○	○
h) UTeach takes care of problems and student queries promptly	○	○	○	○	○	○	○
i) UTeach allows me to discuss issues with students	○	○	○	○	○	○	○
j) UTeach offers the ability to speak to a live person if there is a technical problem	○	○	○	○	○	○	○
k) UTeach enables me to comment and share information	○	○	○	○	○	○	○

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E-learning System Success (Academic Staff)

4. IT Infrastructure and Value

Please tick ONE answer to describe your response to each statement

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Don't know	N/A
a) The Division of ICT provides me with a wide range of channel management services (e.g. electronic channel to the students to support multiple applications, such as Web sites, call centres, mobile computing)	○	○	○	○	○	○	○
b) The Division of ICT provides the required security for the system (e.g. security policies, disaster planning, firewalls)	○	○	○	○	○	○	○
c) The Division of ICT provides a wide range of communication services (e.g. network services, broadband services, Intranet capabilities	○	○	○	○	○	○	○
d) The Division of ICT provides a wide range of software applications and infrastructure when required (e.g. centralized management of applications, mobile and wireless applications, workflow applications)	○	○	○	○	○	○	○
e) The Division of ICT provides maintenance to the systems adequately	○	○	○	○	○	○	○
f) The Division of ICT gives consideration to my evaluation of the system	○	○	○	○	○	○	○
g) The e-learning system improves my work practices	○	○	○	○	○	○	○
h) I have learnt much through the e-learning system	○	○	○	○	○	○	○
i) Using the e-learning system gives me a sense of accomplishment	○	○	○	○	○	○	○
j) Using the e-learning system gives me a sense of fulfillment	○	○	○	○	○	○	○
k) The e-learning system enables USQ to respond quickly to change and to develop learning and teaching techniques	○	○	○	○	○	○	○
l) The e-learning system enables USQ to respond more quickly to change	○	○	○	○	○	○	○
m) The e-learning system is cost effective	○	○	○	○	○	○	○
n) The e-learning system enables USQ to establish good relationships with the user community	○	○	○	○	○	○	○
o) The e-learning system establishes and maintains a good image and reputation for USQ	○	○	○	○	○	○	○
p) The e-learning system aligns with stated organisational goals	○	○	○	○	○	○	○

Please add comments about the factors affecting e-learning system success:

If you want to participate in the prize draw to win an Apple iPhone, please write your email address in the box belwo:

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Appendix E: ICT staff questionnaire

Dear ICT Staff Members

I would like to invite you to participate in this survey, which is an important part of my **PhD** study: "**Measuring e-learning system success**". The purpose of this study is to evaluate the success of the e-learning system at USQ and to determine the factors which affect this system.

The questions are designed to enable quick and easy responses. Most of the questions can be answered simply by clicking the appropriate circle. Completing the questionnaire should take less than 10 minutes. The questionnaire focuses on the **e-learning system** at USQ.

The questionnaire includes Five-Points Scale to answer the questions: strongly agree =5, strongly disagree=1. In addition, two options have been added: Don't Know and Not Applicable.
Don't Know means you have no experience about the item.
Not Applicable means you have experience about the item but it is not applicable in the current e-learning system.

An iPhone has been allocated as a prize for ICT staff who participate in this survey. Provide your email address to enter the draw.

Please, click on the following link to participate in the survey:

https://www.surveymonkey.com/s/ICTstaff

This survey is approved by USQ's Ethics Committee (H11REA090.1). If you have any queries regarding the ethical conduct of this research you can contact the Research Ethics Office by email: ethics@usq.edu.au or phone +61746312690.

Participation in this survey is voluntary. Please be assured that your responses will be treated as strictly confidential and you will not be individually identified.

If you have any queries at all please do not hesitate to contact me.
Thank you for taking the time to respond.

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Supervisor
Associate Prof. Aileen Cater-Steel
Faculty of Business / University of Southern Queensland

E-learning System Success (ICT Staff)

1. Information and System Quality

Please tick ONE answer to describe your response to each statement

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Don't know	N/A
a) The e-learning system provides me with outputs that I need to maintain and support the system	○	○	○	○	○	○	○
b) Information that I need from the e-learning system to maintain, support the system, and provide the services is always available	○	○	○	○	○	○	○
c) Information from the e-learning system is in a form that is readily usable to maintain and support the system	○	○	○	○	○	○	○
d) Information from the e-learning system is easy to understand	○	○	○	○	○	○	○
e) Information from the e-learning system is formatted well	○	○	○	○	○	○	○
f) Information from the e-learning system is concise	○	○	○	○	○	○	○
g) Information from the e-learning system is up-to-date enough to maintain and support the system	○	○	○	○	○	○	○
h) The e-learning system is easy for me to use, maintain, and support	○	○	○	○	○	○	○
i) The e-learning system is easy for me to learn	○	○	○	○	○	○	○
j) The e-learning system meets the essential requirements for maintaining, supporting the system, and providing the services	○	○	○	○	○	○	○
k) The e-learning system includes necessary features and functions to achieve the required tasks	○	○	○	○	○	○	○
l) The e-learning system always does what it should	○	○	○	○	○	○	○
m) The e-learning system user interface can be easily adapted to one's personal approach	○	○	○	○	○	○	○
n) The e-learning system requires only the minimum number of fields and screens to maintain and support the system	○	○	○	○	○	○	○
o) The e-learning system can be easily modified, corrected or improved	○	○	○	○	○	○	○
p) The e-learning system responds quickly during the busiest hours of the day	○	○	○	○	○	○	○

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E-learning System Success (ICT Staff)

2. Usefulness, User Satisfaction , and Service Delivery Quality

Please tick ONE answer to describe your response to each statement

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Don't know	N/A
a) Using the e-learning system enables me in my job to support the users and provide the services more quickly	◯	◯	◯	◯	◯	◯	◯
b) Using the e-learning system improves my job performance in supporting the users and providing the services	◯	◯	◯	◯	◯	◯	◯
c) Using the e-learning system in my job increases my productivity	◯	◯	◯	◯	◯	◯	◯
d) Using the e-learning system makes it easier to do my job and to support the different users	◯	◯	◯	◯	◯	◯	◯
e) Overall, I find the e-learning system useful in the work I do	◯	◯	◯	◯	◯	◯	◯
f) I am satisfied with my decision to work in the e-learning systems field	◯	◯	◯	◯	◯	◯	◯
g) Working with the e-learning system meets my job expectations	◯	◯	◯	◯	◯	◯	◯
h) I am satisfied with using the e-learning system functions	◯	◯	◯	◯	◯	◯	◯
i) My work with the e-learning system gives me a great senses of personal satisfaction	◯	◯	◯	◯	◯	◯	◯
j) My work with the e-learning systems increases my feelings of self-esteem	◯	◯	◯	◯	◯	◯	◯
k) The e-learning system makes it easy to find what I need	◯	◯	◯	◯	◯	◯	◯
l) It is easy to get anywhere on the e-learning system	◯	◯	◯	◯	◯	◯	◯
m) The e-learning system enables me to complete tasks quickly	◯	◯	◯	◯	◯	◯	◯
n) The e-learning system loads its pages fast	◯	◯	◯	◯	◯	◯	◯
o) The e-learning system is always available for users	◯	◯	◯	◯	◯	◯	◯
p) The e-learning system launches and runs right away	◯	◯	◯	◯	◯	◯	◯
q) The e-learning system does not crash frequently	◯	◯	◯	◯	◯	◯	◯

E-learning System Success (ICT Staff)

3. Service Delivery Quality

Please tick ONE answer to describe your response to each statement

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Don't know	N/A
a) The e-learning system enables academic staff to deliver lectures, materials, and feedback when promised	◯	◯	◯	◯	◯	◯	◯
b) The e-learning system quickly delivers answers to user queries	◯	◯	◯	◯	◯	◯	◯
c) This system is truthful about its offerings	◯	◯	◯	◯	◯	◯	◯
d) The e-learning system protects information related to personal details of students and results	◯	◯	◯	◯	◯	◯	◯
e) The e-learning system does not share user personal information with other sites and /or users	◯	◯	◯	◯	◯	◯	◯
f) The e-learning system has adequate security features	◯	◯	◯	◯	◯	◯	◯
g) The e-learning system provides students with convenient options to change their enrolment	◯	◯	◯	◯	◯	◯	◯
h) This site tells students what to do if their assignments are not marked	◯	◯	◯	◯	◯	◯	◯
i) The e-learning system takes care of problems reported by academic staff and students promptly	◯	◯	◯	◯	◯	◯	◯
j) The response time of the e-learning system is reasonable	◯	◯	◯	◯	◯	◯	◯
k) The e-learning system has Students Services representatives available online	◯	◯	◯	◯	◯	◯	◯
l) The e-learning system offers the ability to speak to a live person if there is a technical problem	◯	◯	◯	◯	◯	◯	◯
m) The e-learning system allows students to discuss some issues with their lecturers	◯	◯	◯	◯	◯	◯	◯
n) The e-learning system enables users to comment and share information	◯	◯	◯	◯	◯	◯	◯

E-learning System Success (ICT Staff)

4. Information Technology Infrastructure Services

Please tick ONE answer to describe your response to each statement

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Don't know	N/A
a) The Division of ICT provides a wide range of channel management services (e.g. electronic channel to the students and staff to support multiple applications, such as web sites, call centres, mobile computing)	◯	◯	◯	◯	◯	◯	◯
b) The Division of ICT provides a wide range of security and risk management services (e.g. security policies, disaster planning, firewalls)	◯	◯	◯	◯	◯	◯	◯
c) The Division of ICT provides a wide range of communication services (e.g. network services, broadband services, internet capabilities, extranet capabilities, groupware)	◯	◯	◯	◯	◯	◯	◯
d) The Division of ICT provides a wide range of data management services (e.g. key data independent of applications, centralized data warehouse, data management consultancy, storage area networks, knowledge management)	◯	◯	◯	◯	◯	◯	◯
e) The Division of ICT provides a wide range of application infrastructure services (e.g. centralized management of applications, middleware, mobile and wireless applications, ASP, workflow application)	◯	◯	◯	◯	◯	◯	◯
f) The Division of ICT provides a wide range of IT facilities management services (e.g. large scale processing/mainframe, server farms, common systems development environment)	◯	◯	◯	◯	◯	◯	◯
g) The Division of ICT provides a wide range of IT management services (e.g. IS planning, investment and monitoring, IS project management, negotiations with suppliers and outsourcers, service level agreements)	◯	◯	◯	◯	◯	◯	◯
h) The Division of ICT provides a wide range of IT architecture and standards services (e.g. specify and enforce architectures and standards for technologies, communications, data, applications, and work)	◯	◯	◯	◯	◯	◯	◯
i) The Division of ICT provides a wide range of IT education services to users such as training in the use of IT	◯	◯	◯	◯	◯	◯	◯
j) The Division of ICT provides a wide range of IT research and development (R&D) services (e.g. identify and test new technologies for business purpose, evaluate proposals for new IS applications)	◯	◯	◯	◯	◯	◯	◯

E-learning System Success (ICT Staff)

5. Customer and Organizational Value

Please tick ONE answer to describe your response to each statement

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Don't know	N/A
a) The e-learning system improves my work practices	◯	◯	◯	◯	◯	◯	◯
b) Working with the e-learning system contributes to my personal growth and development	◯	◯	◯	◯	◯	◯	◯
c) I have learned much through the e-learning system	◯	◯	◯	◯	◯	◯	◯
d) Knowledge gained using the e-learning system will be helpful in future with other systems	◯	◯	◯	◯	◯	◯	◯
e) Knowing how to maintain and support the e-learning system makes me more employable	◯	◯	◯	◯	◯	◯	◯
f) The e-learning system enables USQ to respond more quickly to change	◯	◯	◯	◯	◯	◯	◯
g)The e-learning system is cost effective	◯	◯	◯	◯	◯	◯	◯
h) The e-learning system enables USQ to establish good relationships with the user community	◯	◯	◯	◯	◯	◯	◯
i) The e-learning system establishes and maintains a good image and reputation for USQ	◯	◯	◯	◯	◯	◯	◯
j) The e-learning system can be used by the University to provide students and staff with new educational services	◯	◯	◯	◯	◯	◯	◯

Please add comments about the factors affecting e-learning system success:

If you want to participate in the prize draw to win an Apple iPhone, please write your email address in the box below:

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Appendix F: Statistical Descriptives and Normality Test of Student Sample

Table F. 1 Statistical descriptives of IT infrastructure services

IT Infrastructure Services									
Code	**Items**	**Mean**	**S.D.**	**Don't Know**		**N.A.**		**Missing Data**	
				N	%	N	%	N	%
ITIS1	The Division of ICT provides me with a wide range of electronic channels such as email, website, and call centres to connect with lecturers, students, and different divisions at USQ	4.088	0.884	29	4	5	0.7	11	1.5
ITIS2	The Division of ICT provides me with an e-learning service with a high level of technical security	3.864	1.002	33	4.6	8	1.1	12	1.7
ITIS3	The Division of ICT enables me to receive and exchange information and knowledge with lecturers and other students by using, e.g. electronic linkages and software applications	3.691	1.059	57	7.9	8	1.1	11	1.5
ITIS4	The Division of ICT provides me with a wide range of facilities to perform e-learning activities, such as access to the library	4.050	1.036	22	3.1	5	0.7	13	1.8
ITIS5	The Division of ICT provides me with data management advice and consultancy	4.111	0.882	43	6	6	0.8	23	3.2
ITIS6	ICT provides me with technology advice and support services related to the e-learning system	4.032	1.020	54	7.5	11	1.5	10	1.4

S.D.: Standard Deviation; N.A.: Not Applicable

Table F. 2 Statistical descriptives of system quality

System Quality									
Code	**Items**	**Mean**	**S.D.**	**Don't Know**		**N.A.**		**Missing Data**	
				N	%	N	%	N	%
SQ1	The e-learning system is easy for me to use	4.022	0.902	2	0.3	1	0.1	-	-
SQ2	The e-learning system is easy for me to learn	3.958	0.906	2	0.3	1	0.1	-	-
SQ3	The e-learning system meets my requirements	3.934	0.889	1	0.1	1	0.1	2	0.3
SQ4	The e-learning system includes necessary features and functions for my study	3.963	0.886	2	0.3	2	0.3	2	0.3
SQ5	The e-learning system does what it should	3.932	0.861	4	0.6	1	0.1	6	0.8
SQ6	The e-learning system user interface can be easily adapted to one's personal approach	3.548	1.131	23	3.2	3	0.4	4	0.6
SQ7	The e-learning system requires only the minimum number of fields and screens to achieve a task	3.553	1.092	18	2.5	1	0.1	4	0.6
SQ8	All data within e-learning system is fully integrated and consistent	3.662	1.039	7	1	1	0.1	3	0.4

S.D.: Standard Deviation; N.A.: Not Applicable

Table F.3 Statistical descriptives of information quality

Information Quality									
Code	**Items**	**Mean**	**S.D.**	**Don't Know**		**N.A.**		**Missing Data**	
				N	%	N	%	N	%
IQ1	The e-learning system provides me with the outputs that I need	4.002	0.839	6	0.8	2	0.3	1	0.1
IQ2	Information needed from the e-learning system is always available for me	3.924	0.929	1	0.1	1	0.1	1	0.1
IQ3	Information from the e-learning system is in a form that is readily usable	4.011	0.880	1	0.1	1	0.1	-	-
IQ4	Information from the e-learning system is easy to understand	3.935	0.886	-	-	1	0.1	4	0.6
IQ5	Information from the e-learning system is concise	3.851	0.864	1	0.1	1	0.1	1	0.1

S.D.: Standard Deviation; N.A.: Not Applicable

Table F.4 Statistical descriptives service delivery quality

Code	Items	Service Delivery Quality	Mean	S.D.	Don't Know		N.A.		Missing Data	
					N	%	N	%	N	%
EFFI1	It is easy to get anywhere on ULearn	Efficiency	3.783	1.010	2	0.3	1	0.1	4	0.6
EFFI2	ULearn enables me to complete tasks quickly		3.789	0.946	1	0.1	1	0.1	4	0.6
EFFI3	ULearn is well organised		3.742	1.003	3	0.4	1	0.1	5	0.7
AVA1	ULearn is always available for me to perform learning activities	Availability	3.869	0.913	4	0.6	1	0.1	6	0.8
AVA2	ULearn launches and runs right away		3.832	0.936	2	0.3	1	0.1	5	0.7
AVA3	ULearn does not crash frequently		3.993	0.922	5	0.7	2	0.3	6	0.8
FULF1	ULearn makes lectures, materials, and feedback available within a suitable time frame	Fulfillment	3.808	0.929	4	0.6	3	0.4	3	0.4
FULF2	ULearn quickly delivers answers about my queries		3.684	1.009	13	1.8	9	1.3	7	1
FULF3	This site is truthful about its offerings		3.885	0.890	18	2.5	4	0.6	4	0.6
FULF4	ULearn makes accurate promises about delivery of lectures materials and feedback		3.810	0.944	13	1.8	4	0.6	4	0.6
PRIV1	ULearn protects information related to student records	Privacy	4.024	0.880	18	2.5	2	0.3	12	1.7
PRIV2	ULearn does not share my personal information with other sites and/or users		4.025	0.944	21	2.9	11	1.5	15	2.1
PRIV3	ULearn protects information about my personal details and results		4.028	0.864	15	2.1	2	0.3	13	1.8
RESP1	ULearn provides me with convenient options to change my enrolment	Responsiveness	4.114	0.978	26	3.6	6	0.8	6	0.8
RESP2	ULearn tells me what to do if my assignment is not marked		3.649	1.207	36	5	9	1.3	18	2.5
RESP3	ULearn takes care of problems promptly		3.798	1.083	41	5.7	7	1	4	0.6
CONT1	ULearn provides a telephone number to contact the university	Contact	4.191	0.941	58	8.1	3	0.4	5	0.7
CONT2	ULearn has Students Services representatives available online		3.903	1.003	26	3.6	6	0.8	8	1.1
CONT3	ULearn allows me to discuss some issues with my lecturers		4.110	0.895	19	2.6	3	0.4	5	0.7
CONT4	ULearn enables me to input comments and share information with other students		4.3013	0.772	17	2.4	1	0.1	3	0.4

S.D.: Standard Deviation; N.A.: Not Applicable

Table F.5 Statistical descriptives of perceived usefulness

Perceived usefulness									
Code	**Items**	**Mean**	**S.D.**	**Don't Know**		**N.A.**		**Missing Data**	
				N	%	N	%	N	%
USEF1	Using the e-learning system in my study enables me to accomplish my tasks more quickly	3.795	0.909	5	0.7	2	0.3	2	0.3
USEF2	Using the e-learning system improves my study performance	3.688	0.978	8	1.1	3	0.4	2	0.3
USEF3	Using the e-learning system in my study increases my productivity	3.675	0.965	6	0.8	3	0.4	3	0.4
USEF4	Using the e-learning system makes it easier to do my study	3.835	0.973	5	0.7	3	0.4	3	0.4
USEF5	Overall, I find the e-learning system useful to my study	4.039	0.865	3	0.4	1	0.1	2	0.3

S.D.: Standard Deviation; N.A.: Not Applicable

Table F.6 Statistical Descriptives of User Satisfaction

User Satisfaction									
Code	**Items**	**Mean**	**S.D.**	**Don't Know**		**N.A.**		**Missing Data**	
				N	%	N	%	N	%
SATF1	I am satisfied with the performance of the e-learning system	3.867	0.896	2	0.3	1	0.1	5	0.7
SATF2	I am satisfied with the experience of using the e-learning system	3.851	0.904	-	-	2	0.3	5	0.7
SATF3	My decision to study my degree through e-learning system was a wise one	3.941	1.044	8	1.1	8	1.1	3	0.4
SATF4	If I had an opportunity to do another degree or course online, I would gladly do so	3.932	1.053	9	1.3	4	0.6	5	0.7
SATF5	I feel that the online courses serve my needs well	3.993	0.958	4	0.6	3	0.4	4	0.6

S.D.: Standard Deviation; N.A.: Not Applicable

Table F.7 Statistical descriptives of customer value

Customer Value									
Code	**Items**	**Mean**	**S.D.**	**Don't Know**		**N.A.**		**Missing Data**	
				N	%	N	%	N	%
CUSV1	The e-learning courses delivered by ULearn strengthen my ability to analyse and evaluate information related to my study	3.957	0.912	18	2.5	3	0.4	16	2.2
CUSV2	I gained an understanding of concepts and principles in my study area	4.134	0.776	5	0.7	3	0.4	12	1.7
CUSV3	The e-learning courses delivered by ULearn stimulated me to read further in my study area	3.830	0.985	6	0.8	4	0.6	13	1.8

CUSV4	People who are important to me think that taking my course through the e-learning system is a good thing to do	4.053	1.148	52	7.2	15	2.1	10	1.4
CUSV5	My family and my friends will see me in a better light when I have finished my degree	4.038	1.179	43	6	13	1.8	13	1.8

S.D.: Standard Deviation; N.A.: Not Applicable

Table F. 8 Normality of Data Distribution of Student Sample

Items	Skewness	Kurtosis
IT infrastructure services		
The Division of ICT provides me with a wide range of electronic channels such as email, website, and call centres to connect with lecturers, students, and different divisions at USQ	-.838	2.269
The Division of ICT provides me with an e-learning service with a high level of technical security	-.620	2.029
The Division of ICT provides me with data management advice and consultancy	-.087	.933
The Division of ICT enables me to receive and exchange information and knowledge with lecturers and other students by using (e.g. electronic linkages and software applications)	-.659	2.181
The Division of ICT provides me with a wide range of facilities to perform e-learning activities, such as access to the library	-.876	2.857
ICT provides me with technology advice and support services related to the e-learning system	-.784	2.994
System quality		
The e-learning system is easy for me to use	-1.125	1.657
The e-learning system is easy for me to learn	-.985	1.288
The e-learning system meets my requirements	-.907	1.114
The e-learning system includes necessary features and functions for my study	-1.075	1.891
The e-learning system does what it should	-.914	1.704
The e-learning system user interface can be easily adapted to one’s personal approach	-.235	-.097
The e-learning system requires only the minimum number of fields and screens to achieve a task	-.349	-.003
All data within e-learning system is fully integrated and consistent	-.658	.311
Information quality		
a) The e-learning system provides me with the outputs that I need	-1.011	2.266
b) Information needed from the e-learning system is always available for me	-.895	.726
c) Information from the e-learning system is in a form that is readily usable	-1.087	1.668
d) Information from the e-learning system is easy to understand	-.936	1.145
e) Information from the e-learning system is concise	-.874	1.265
Service delivery quality		
k) It is easy to get anywhere on ULearn	-.838	.547
l) ULearn enables me to complete tasks quickly	-.847	.874
m) ULearn is well organised	-.777	.481
n) ULearn is always available for me to perform learning activities	-.747	.667
o) ULearn launches and runs right away	-.780	.527
p) ULearn does not crash frequently	-.953	1.421
a) ULearn makes lectures, materials, and feedback available within a suitable time frame	-.919	1.417
b) ULearn quickly delivers answers about my queries	-.781	1.689

c) ULearn is truthful about its offerings	-.752	2.481
d) ULearn makes accurate promises about delivery of lectures materials and feedback	-.811	1.680
e)ULeran Protects information related to student recored	-.595	1.419
f)ULearn does not share my personal information details with other sites and /or users	-.559	.642
g)Ulearn protects information about my personal details and results	-.622	1.455
h) ULearn provides me with convenient options to change my enrolment	-1.214	2.156
i)ULearn tells me what to do if my assignment is not marked	-.424	.285
j) ULearn takes care of problems promptly	-.448	1.130
k) ULearn provides a telephone number to contact the university	-.461	1.772
l)ULearn has Student Services representative available online	-.692	1.596
m) ULearn allows me to discuss some issues with my lecturers	-.958	2.579
n) ULearn enables me to input comments and share information with other students	-.960	2.968
Perceived usefulness		
a) Using the e-learning system in my study enables me to accomplish my tasks more quickly	-.790	1.292
b) Using the e-learning system improves my study performance	-.490	.580
c) Using the e-learning system in my study increases my productivity	-.489	.490
d) Using the e-learning system makes it easier to do my study	-.731	.741
e) Overall, I find the e-learning system useful to my study	-.995	1.605
User satisfaction		
f) I am satisfied with the performance of the e-learning system	-.974	1.326
g) I am satisfied with the experience of using the e-learning system	-1.081	1.604
h) My decision to study my degree through e-learning system was a wise one	-1.040	1.618
i) If I had an opportunity to do another degree or course online, I would gladly do so	-.838	.643
j) I feel that the online courses serve my needs well	-1.094	1.661
Customer value		
g) The e-learning courses delivered by ULearn strengthen my ability to analyse and evaluate information related to my study	-.773	2.025
h) I gained an understanding of concepts and principles in my study area	-1.146	3.940
i) The e-learning courses delivered by ULearn stimulated me to read further in my study area	-.697	.683
j) People who are important to me think that taking my course through the e-learning system is a good thing to do	-.983	2.106
k) My family and my friends will see me in a better light when I have finished my degree	-.895	1.297

Standard error of Skewness is 0.091; Standard error of Kurtosis is 0.182

Appendix G: Statistical descriptives and normality test of Academic staff sample

Table G.1 Statistical descriptive of IT infrastructure services for academic staff sample

IT Infrastructure Services									
Code	**Items**	**Mean**	**S.D.**	**Don't Know**		**N.A.**		**Missing Data**	
				N	%	N	%	N	%
ITIS1	The Division of ICT provides me with a wide range of channel management services (e.g. electronic channel to the students to support multiple applications, such as Web sites, call centres, mobile computing)	3.277	1.021	1	0.9	-	-	2	1.8
ITIS2	The Division of ICT provides the required security for the system (e.g. security policies, disaster planning, firewalls)	3.722	0.862	1	0.9	-	-	2	1.8
ITIS3	The Division of ICT provides a wide range of communication services (e.g. network services, broadband services, Intranet capabilities	3.669	0.933	2	1.8	-	-	1	0.9
ITIS4	The Division of ICT provides a wide range of software applications and infrastructure when required (e.g. centralized management of applications, mobile and wireless applications, workflow applications)	3.427	0.971	1	0.9	-	-	-	-
ITIS5	The Division of ICT provides maintenance to the systems adequately	3.500	1.002	-	-	-	-	-	-
ITIS6	The Division of ICT gives consideration to my evaluation of the system	3.324	1.012	3	2.7	-	-	2	1.8

S.D.: Standard Deviation; N.A.: Not Applicable

Table G.2 Statistical descriptive of system quality for academic staff sample

System Quality									
Code	**Items**	**Mean**	**S.D.**	**Don't Know**		**N.A.**		**Missing Data**	
				N	%	N	%	N	%
SQ1	The e-learning system is easy for me to use	3.681	0.907	-	-	-	-	-	-
SQ2	The e-learning system is easy for me to learn	3.633	0.867	-	-	-	-	1	0.9
SQ3	The e-learning system meets my requirements	3.4.3	0.331	-	-	-	-	1	0.9
SQ4	The e-learning system includes necessary features and functions for teaching	3.715	1.028	3	2.7	-	-	1	0.9
SQ5	The e-learning system does what it should	3.651	0.906	-	-	-	-	1	0.9

SQ6	The e-learning system user interface can be easily adapted to one's personal approach	3.220	1.039	1	0.9	-	-	1	0.9
SQ7	The e-learning system requires minimal effort to achieve a task through minimum number of fields and screens	3.063	1.077	1	0.9	-	-	-	-
SQ8	All data within the e-learning system is fully integrated and consistent	3.145	1.003	-	-	-	-	-	-

S.D.: Standard Deviation; N.A.: Not Applicable

Table G.3 Statistical descriptive of information quality for academic staff sample

Information Quality									
Code	**Items**	**Mean**	**S.D.**	**Don't Know**		**N.A.**		**Missing Data**	
				N	%	N	%	N	%
IQ1	The information provided on the e-learning system is sufficient for my teaching needs	3.50	0.843	-	-	-	-	-	-
IQ2	The essential information to setup my teaching in e-learning environment is available	3.654	0.922	-	-	-	-	3	2.7
IQ3	Information from the e-learning system is in a form that is readily usable	3.645	1.009	-	-	-	-	-	-
IQ4	The information in the e-learning system is easy to understand	3.618	0.867	-	-	-	-	-	-
IQ5	Information from the e-learning system appears to be well formatted	3.583	0.928	-	-	-	-	2	1.8
IQ6	The information in the e-learning system is concise and adequate for organising my course and teaching materials	3.587	0.964	20	-	-	-	1	0.9

S.D.: Standard Deviation; N.A.: Not Applicable

Table G.4 Statistical descriptive of service delivery quality for academic staff sample

	Service Delivery Quality									
Code	**Items**		**Mean**	**S.D.**	**Don't Know**		**N.A.**		**Missing Data**	
					N	%	N	%	N	%
EFFI1	UTeach enables me to provide the course information and the knowledge to students	Efficiency	3.724	0.891	-	-	-	-	1	0.9
EFFI2	It is easy for me to get anywhere on UTeach		3.318	1.022	-	-	-	-	-	-
EFFI3	Information at UTeach is well organised		3.281	1.032	-	-	-	-	-	-
EFFI4	UTeach loads its pages fast		3.403	1.131	1	0.9	-	-	1	0.9
AVA1	UTeach is always available for me to perform teaching activities	Availability	3.376	1.086	-	-	1	0.9	1	0.9
AVA2	UTeach launches and runs right away		3.546	0.989	-	-	-	-	2	1.8
AVA3	UTeach does not crash frequently		3.618	0.967	-	-	-	-	-	-
FULF1	UTeach enables me to deliver lectures, material, and feedback to students when promised	Fulfillment	3.900	0.676	-	-	-	-	-	-
FULF2	UTeach makes lectures, material, and feedback available for delivery within a suitable time frame		3.881	0.673	-	-	-	-	-	-
FULF3	UTeach enables me to deliver answers to students about their queries quickly		3.803	0.840	-	-	-	-	3	2.7
PRIV1	UTeach does not allow display of full details of student records	Privacy	3.926	0.899	4	3.6	-	-	1	0.9
PRIV2	UTeach does not allow sharing the feedback of assignments of each student with the other students		3.863	0.851	2	1.8	-	-	-	-
PRIV3	UTeach protects information related to personal details of students and results		4.009	0.795	1	0.9	-	-	-	-
RESP1	UTeach tells me if my students received my feedback	Responsiveness	3.633	1.111	4	3.6	-	-	1	0.9
RESP2	UTeach takes care of problems and student queries promptly		3.361	1.089	1	0.9	-	-	2	1.8
CONT 1	UTeach allows me to discuss issues with students	Contact	3.759	0.905	-	-	-	-	2	1.8
CONT 2	UTeach offers the ability to speak to a live person if there is a technical problem		3.50	1.156	2	1.8	-	-	2	1.8
CONT 3	UTeach enables me to comment and share information		3.954	0.762	-	-	-	-	1	0.9

S.D.: Standard Deviation; N.A.: Not Applicable

Table G.5 Statistical descriptive of perceived usefulness for academic staff sample

Perceived Usefulness									
Code	**Items**	**Mean**	**S.D.**	**Don't Know**		**N.A.**		**Missing Data**	
				N	%	N	%	N	%
USEF1	Using the e-learning system in my job enables me to accomplish my tasks more quickly	3.427	0.999	-	-	-	-	-	-
USEF2	Using the e-learning system improves my job performance	3.518	0.869	-	-	-	-	2	1.8
USEF3	Using the e-learning system enhances my effectiveness in my job	3.642	0.897	-	-	-	-	1	0.9
USEF4	Using the e-learning system makes it easier to do my job	3.536	0.973	-	-	-	-	-	-

S.D.: Standard Deviation; N.A.: Not Applicable

Table G.6 Statistical descriptive of User satisfaction for Academic staff sample

User Satisfaction									
Code	**Items**	**Mean**	**S.D.**	**Don't Know**		**N.A.**		**Missing Data**	
				N	%	N	%	N	%
SATF1	Based on my experience with the e-learning system, I am contented using the system	3.563	0.953	-	-	-	-	-	-
SATF2	Based on my experience with the e-learning system, I am satisfied using the system	3.490	0.952	-	-	-	-	2	1.8
SATF3	I am satisfied with using the e-learning system as a learning tool	3.633	0.958	-	-	-	-	1	0.9
SATF4	I am satisfied with using the e-learning system functions	3.445	0.944	-	-	-	-	-	-

S.D: Standard Deviation; N.A: Not Applicable

Table G.7 Statistical descriptive of customer value for Academic staff sample

Customer Value									
Code	**Items**	**Mean**	**S.D.**	**Don't Know**		**N.A.**		**Missing Data**	
				N	%	N	%	N	%
CUSV1	The e-learning system improves my work practices	3.609	0.846	-	-	-	-	-	-
CUSV2	I have learnt much through the e-learning system	3.638	0.961	1	0.9	-	-	2	1.8
CUSV3	Using the e-learning system gives me a sense of accomplishment	3.372	0.975	1	0.9	-	-	-	-
CUSV4	Using the e-learning system gives me a sense of fulfillment	3.272	1.012	-	-	-	-	-	-

S.D.: Standard Deviation; N.A.: Not Applicable

Table G.8 Statistical descriptive of organisational vlue for academic staff sample

Organisational Value									
Code	**Items**	**Mean**	**S.D.**	**Don't Know**		**N.A.**		**Missing Data**	
				N	%	N	%	N	%
ORGV1	The e-learning system enables USQ to	3.445	0.846	1	0.9	-	-	-	-

	respond quickly to change and to develop learning and teaching techniques								
ORGV2	The e-learning system enables USQ to respond more quickly to change	3.418	0.961	1	0.9	-	-	-	-
ORGV3	The e-learning system is cost effective	3.800	0.975	2	1.8	-	-	-	-
ORGV4	The e-learning system enables USQ to establish good relationships with the user community	3.609	1.012	-	-	-	-	-	-
ORGV5	The e-learning system establishes and maintains a good image and reputation for USQ	3.770	1.015	3	2.7	-	-	1	0.9
ORGV6	The e-learning system aligns with stated organisational goals	3.763	0.957	2	1.8	-	-	-	-

S.D.: Standard Deviation; N.A.: Not Applicable

Table G.9 Normality of Data Distribution of Academic Staff Sample

Items	Skewness	Kurtosis
IT infrastructure services		
The Division of ICT provides me with a wide range of channel management services (e.g. electronic channel to the students to support multiple applications, such as Web sites, call centres, mobile computing)	-.457	-.271
The Division of ICT provides the required security for the system (e.g. security policies, disaster planning, firewalls)	-.476	.294
The Division of ICT provides a wide range of communication services (e.g. network services, broadband services, Intranet capabilities	-.789	.601
The Division of ICT provides a wide range of software applications and infrastructure when required (e.g. centralized management of applications, mobile and wireless applications, workflow applications)	-.540	.319
The Division of ICT provides maintenance to the systems adequately	-.752	.334
The Division of ICT gives consideration to my evaluation of the system	-.303	-.208
System quality		
The e-learning system is easy for me to use	-.745	.414
The e-learning system is easy for me to learn	-.703	.628
The e-learning system meets my requirements	-.321	-.613
The e-learning system includes necessary features and functions for teaching	-.677	-.083
The e-learning system does what it should	-.499	-.110
The e-learning system user interface can be easily adapted to one's personal approach	-.184	-.758
The e-learning system requires minimal effort to achieve a task through minimum number of fields and screens	-.381	-.864
All data within the e-learning system is fully integrated and consistent	-.406	-.692
Information quality		
The information provided on the e-learning system is sufficient for my teaching needs	-.421	-.556
The essential information to setup my teaching in e-learning environment is available	-.646	-.079
Information from the e-learning system is in a form that is readily usable	-.667	-.367
The information in the e-learning system is easy to understand	-.441	-.493
Information from the e-learning system appears to be well formatted	-.663	.196
The information in the e-learning system is concise and adequate for organising my course and teaching materials	-.695	-.112
Service delivery quality		

UTeach enables me to provide the course information and the knowledge to students	-.768	.634
It is easy for me to get anywhere on UTeach	-.308	-.814
Information at UTeach is well organised	-.439	-.467
UTeach loads its pages fast	-.730	-.281
UTeach is always available for me to perform teaching activities	-.579	-.476
UTeach launches and runs right away	-.681	.126
UTeach does not crash frequently	-.713	-.105
UTeach enables me to deliver lectures, material, and feedback to students when promised	-.704	1.434
UTeach makes lectures, material, and feedback available for delivery within a suitable time frame	-.406	.519
UTeach enables me to deliver answers to students about their queries quickly	-.821	1.298
UTeach does not allow display of full details of student records	-.345	-.248
UTeach does not allow sharing the feedback of assignments of each student with the other students	-.211	-.510
UTeach protects information related to personal details of students and results	-.370	-.398
UTeach tells me if my students received my feedback	-.177	-1.076
UTeach takes care of problems and student queries promptly	-.252	-.680
UTeach allows me to discuss issues with students	-.745	.198
UTeach offers the ability to speak to a live person if there is a technical problem	-.226	-.794
UTeach enables me to comment and share information	-1.203	2.578
Perceived usefulness		
Using the e-learning system in my job enables me to accomplish my tasks more quickly	-.716	.132
Using the e-learning system improves my job performance	-.651	.282
Using the e-learning system enhances my effectiveness in my job	-.882	.869
Using the e-learning system makes it easier to do my job	-.772	.184
User satisfaction		
Based on my experience with the e-learning system, I am contented using the system	-.574	-.197
Based on my experience with the e-learning system, I am satisfied using the system	-.424	-.391
I am satisfied with using the e-learning system as a learning tool	-.595	-.273
I am satisfied with using the e-learning system functions	-.298	-.817
Customer value		
The e-learning system improves my work practices	-1.088	1.326
I have learnt much through the e-learning system	-.297	-.259
Using the e-learning system gives me a sense of accomplishment	-.465	-.156
Using the e-learning system gives me a sense of fulfillment	-.588	.158
Organisational value		
The e-learning system enables USQ to respond quickly to change and to develop learning and teaching techniques	-.456	-.352
The e-learning system enables USQ to respond more quickly to change	-.579	.078
The e-learning system is cost effective	-.595	.425
The e-learning system enables USQ to establish good relationships with the user community	-.563	-.112
The e-learning system establishes and maintains a good image and reputation for USQ	-.696	.287
The e-learning system aligns with stated organisational goals	-.684	.501

Standard error of Skewness is 0.230; Standard error of Kurtosis is 0.457

Appendix H: Statistical descriptives and normality test of Academic staff sample

Table H.1 Statistical descriptive of IT Infrastructure services for ICT staff sample

Code	Items	Mean	S.D.
ITIS1	The Division of ICT provides a wide range of channel management services (e.g. electronic channel to the students and staff to support multiple applications, such as web sites, call centres, mobile computing)	3.818	.906
ITIS2	The Division of ICT provides a wide range of security and risk management services (e.g. security policies, disaster planning, firewalls)	3.772	1.151
ITIS3	The Division of ICT provides a wide range of communication services (e.g. network services, broadband services, Internet capabilities, extranet capabilities, groupware)	4.000	.872
ITIS4	The Division of ICT provides a wide range of data management services (e.g. key data independent of applications, centralized data warehouse, data management consultancy, storage area networks, knowledge management)	3.863	1.082
ITIS5	The Division of ICT provides a wide range of application infrastructure services (e.g. centralized management of applications, middleware, mobile and wireless applications, ASP, workflow application)	3.545	1.056
ITIS6	The Division of ICT provides a wide range of IT facilities management services (e.g. large scale processing/mainframe, server farms, common systems development environment)	3.454	1.143
ITIS7	The Division of ICT provides a wide range of IT management services (e.g. IS planning, investment and monitoring, IS project management, negotiations with suppliers and outsourcers, service level agreements)	3.363	1.093
ITIS8	The Division of ICT provides a wide range of IT architecture and standards services (e.g. specify and enforce architectures and standards for technologies, communications, data, applications, and work)	3.590	1.181
ITIS9	The Division of ICT provides a wide range of IT education services to users such as training in the use of IT	3.681	1.129
ITIS10	The Division of ICT provides a wide range of IT research and development (R&D) services (e.g. identify and test new technologies for business purpose, evaluate proposals for new IS applications)	3.181	1.180

S.D.: Standard Deviation

Table H.2 Statistical descriptive of system quality for ICT staff sample

Code	Items	Mean	S.D.
SQ1	The e-learning system is easy for me to use, maintain, and support	4.045	.898
SQ2	The e-learning system is easy for me to learn	4.136	.774
SQ3	The e-learning system meets the essential requirements for maintaining, supporting the system, and providing the services	4.181	.732
SQ4	The e-learning system includes necessary features and functions to achieve the required tasks	3.909	.750
SQ5	The e-learning system always does what it should	3.263	.935
SQ6	The e-learning system user interface can be easily adapted to one's personal approach	3.454	.962
SQ7	The e-learning system requires only the minimum number of fields and screens to maintain and support the system	3.772	1.342

SQ8	The e-learning system can be easily modified, corrected or improved	3.954	.785
SQ9	The e-learning system responds quickly during the busiest hours of the day	4.272	.882

S.D.: Standard Deviation

Table H.3 Statistical descriptive of information quality for ICT staff sample

Code	Items	Mean	S.D.
IQ1	The e-learning system provides me with outputs that I need to maintain and support the system	3.727	.882
IQ2	Information that I need from the e-learning system to maintain, support the system, and provide the services is always available	3.681	.779
IQ3	Information from the e-learning system is in a form that is readily usable to maintain and support the system	3.772	.528
IQ4	Information from the e-learning system is easy to understand	3.545	1.143
IQ5	Information from the e-learning system is formatted well	3.454	1.010
IQ6	Information from the e-learning system is concise	3.590	.796
IQ7	Information from the e-learning system is up-to-date enough to maintain and support the system	3.500	.912

S.D.: Standard Deviation

Table H.4 Statistical descriptive of service delivery quality for ICT staff sample

Code	Items	Sub-Dimension	Mean	S.D.
EFFI1	The e-learning system makes it easy to find what I need	Efficiency	3.590	.796
EFFI2	It is easy to get anywhere on the e-learning system		3.818	.852
EFFI3	The e-learning system enables me to complete tasks quickly		3.909	1.019
EFFI4	The e-learning system loads its pages fast		3.136	1.125
AVA1	The e-learning system is always available for users	Availability	4.181	.795
AVA2	The e-learning system launches and runs right away		4.272	.935
AVA3	The e-learning system does not crash frequently		4.181	.906
FULF1	The e-learning system enables academic staff to deliver lectures, materials, and feedback when promised	Fulfillment	4.090	.68376
FULF2	The e-learning system quickly delivers answers to user queries		3.772	.97257
FULF3	This system is truthful about its offerings		3.636	.90214
PRIV1	The e-learning system protects information related to personal details of students and results	Privacy	4.318	.646
PRIV2	The e-learning system does not share user personal information with other sites and /or users		3.954	.898
PRIV3	The e-learning system has adequate security features		3.681	.893
RESP1	The e-learning system provides students with convenient options to change their enrolment	Responsiveness	3.545	1.143
RESP2	This site tells students what to do if their assignments are not marked		3.363	1.255
RESP3	The e-learning system takes care of problems reported by academic staff and students promptly		3.500	1.224

RESP4	The response time of the e-learning system is reasonable		3.409	1.181
CONT1	The e-learning system has Students Services representatives available online	Contact	4.181	.92231
CONT2	The e-learning system offers the ability to speak to a live person if there is a technical problem		3.727	.82703
CONT3	The e-learning system allows students to discuss some issues with their lecturers		3.772	.97257
CONT4	The e-learning system enables users to comment and share information		3.272	.98473

S.D.: Standard Deviation

Table H.5 Statistical descriptive of perceived usefulness for ICT staff sample

Code	Items	Mean	S.D.
USEF1	Using the e-learning system enables me in my job to support the users and provide the services more quickly	3.318	1.210
USEF2	Using the e-learning system improves my job performance in supporting the users and providing the services	3.510	1.057
USEF3	Using the e-learning system in my job increases my productivity	3.409	1.259
USEF4	Using the e-learning system makes it easier to do my job and to support the different users	3.363	1.093
USEF5	Overall, I find the e-learning system useful in the work I do	3.500	1.144

S.D.: Standard Deviation

Table H.6 Statistical descriptive of user satisfaction for ICT staff sample

Code	Items	Mean	S.D.
SATF1	I am satisfied with my decision to work in the e-learning systems field	3.909	.750
SATF2	Working with the e-learning system meets my job expectations	3.863	.940
SATF3	I am satisfied with using the e-learning system functions	3.772	.869
SATF4	My work with the e-learning system gives me a great senses of personal satisfaction	3.545	1.056
SATF5	My work with the e-learning systems increases my feelings of self-esteem	3.227	1.066

S.D.: Standard Deviation

Table H.7 Statistical descriptive of customer value for ICT staff sample

Code	Items	Mean	S.D.
CUSV1	The e-learning system improves my work practices	3.318	1.170
CUSV2	Working with the e-learning system contributes to my personal growth and development	3.545	.800
CUSV3	I have learned much through the e-learning system	3.863	.833
CUSV4	Knowledge gained using the e-learning system will be helpful in future with other systems	3.500	1.011
CUSV5	Knowing how to maintain and support the e-learning system makes me more employable	3.409	.796

S.D.: Standard Deviation

Table H.8 Statistical descriptive of organisational value for ICT staff sample

Code	Items	Mean	S.D.
ORGV1	The e-learning system enables USQ to respond more quickly to change	3.636	.847
ORGV2	The e-learning system is cost effective	4.000	.755
ORGV3	The e-learning system enables USQ to establish good relationships with the user community	3.909	.811
ORGV4	The e-learning system establishes and maintains a good image and reputation for USQ	3.818	.795
ORGV5	The e-learning system can be used by the University to provide students and staff with new educational services	3.727	.827

S.D.: Standard Deviation

Table H.9 Normality of Data Distribution of ICT Staff Sample

Items	Skewness	Kurtosis
IT Infrastrcuture Services		
The Division of ICT provides a wide range of channel management services (e.g. electronic channel to the students and staff to support multiple applications, such as web sites, call centres, mobile computing)	-.453	-.308
The Division of ICT provides a wide range of security and risk management services (e.g. security policies, disaster planning, firewalls)	-.951	.231
The Division of ICT provides a wide range of communication services (e.g. network services, broadband services, Internet capabilities, extranet capabilities, groupware)	-.473	-.423
The Division of ICT provides a wide range of data management services (e.g. key data independent of applications, centralized data warehouse, data management consultancy, storage area networks, knowledge management)	-1.194	1.258
The Division of ICT provides a wide range of application infrastructure services (e.g. centralized management of applications, middleware, mobile and wireless applications, ASP, workflow application)	-.530	.191
The Division of ICT provides a wide range of IT facilities management services (e.g. large scale processing/mainframe, server farms, common systems development environment)	-.824	.219
The Division of ICT provides a wide range of IT management services (e.g. IS planning, investment and monitoring, IS project management, negotiations with suppliers and outsourcers, service level agreements)	-.338	-.463
The Division of ICT provides a wide range of IT architecture and standards services (e.g. specify and enforce architectures and standards for technologies, communications, data, applications, and work)	-.599	.082
The Division of ICT provides a wide range of IT education services to users such as training in the use of IT	-.609	-.079
The Division of ICT provides a wide range of IT research and development (R&D) services (e.g. identify and test new technologies for business purpose, evaluate proposals for new IS applications)	-.194	-.590
System Quality		
The e-learning system is easy for me to use, maintain, and support	-.961	.722
The e-learning system is easy for me to learn	-.926	1.469
The e-learning system meets the essential requirements for maintaining, supporting the system, and providing the services	-1.103	2.628
The e-learning system includes necessary features and functions to achieve the required tasks	.154	-1.106

The e-learning system always does what it should	-.607	.334
The e-learning system user interface can be easily adapted to one's personal approach	-.387	-.901
The e-learning system requires only the minimum number of fields and screens to maintain and support the system	-1.211	1.750
The e-learning system can be easily modified, corrected or improved	-.566	.499
The e-learning system responds quickly during the busiest hours of the day	-1.054	.452
Information Quality		
The e-learning system provides me with outputs that I need to maintain and support the system	-.317	-.345
Information that I need from the e-learning system to maintain, support the system, and provide the services is always available	-.674	.504
Information from the e-learning system is in a form that is readily usable to maintain and support the system	-.264	.136
Information from the e-learning system is easy to understand	-.858	.543
Information from the e-learning system is formatted well	-.777	.305
Information from the e-learning system is concise	-.327	-.036
Information from the e-learning system is up-to-date enough to maintain and support the system	-.413	-.617
Services Delivery Quality		
The e-learning system makes it easy to find what I need	-.327	-.036
It is easy to get anywhere on the e-learning system	-.637	.291
The e-learning system enables me to complete tasks quickly	-1.288	2.125
The e-learning system loads its pages fast	-.071	-.117
The e-learning system is always available for users	-.977	1.306
The e-learning system launches and runs right away	-1.375	1.420
The e-learning system does not crash frequently	-.773	.654
The e-learning system enables academic staff to deliver lectures, materials, and feedback when promised	-1.097	2.465
The e-learning system quickly delivers answers to user queries	-.182	-.939
This system is truthful about its offerings	-.021	-.646
The e-learning system protects information related to personal details of students and results	-.404	-.540
The e-learning system does not share user personal information with other sites and /or users	-.772	.297
The e-learning system has adequate security features	-.608	-.097
The e-learning system provides students with convenient options to change their enrolment	-.438	-.428
This site tells students what to do if their assignments are not marked	-.772	-.321
The e-learning system takes care of problems reported by academic staff and students promptly	-.257	-.935
The response time of the e-learning system is reasonable	-.524	-.166
The e-learning system has Students Services representatives available online	-1.390	2.383
The e-learning system offers the ability to speak to a live person if there is a technical problem	-.537	.197
The e-learning system allows students to discuss some issues with their lecturers	-.182	-.939
The e-learning system enables users to comment and share information	.049	.552
Perceived USfulness		
Using the e-learning system enables me in my job to support the users and provide the services more quickly	-.682	-.072
Using the e-learning system improves my job performance in supporting the users and providing the services	-1.195	1.297
Using the e-learning system in my job increases my productivity	-.534	.750
Using the e-learning system makes it easier to do my job and to support the different users	-.819	.313

Overall, I find the e-learning system useful in the work I do	-.734	-.510
User Satisfaction		
I am satisfied with my decision to work in the e-learning systems field	-.591	.859
Working with the e-learning system meets my job expectations	-.084	-1.201
I am satisfied with using the e-learning system functions	-.473	-.077
My work with the e-learning system gives me a great senses of personal satisfaction	.002	-1.140
My work with the e-learning systems increases my feelings of self-esteem	-.499	.252
Customer Value		
The e-learning system improves my work practices	-.496	-.354
Working with the e-learning system contributes to my personal growth and development	-.775	.008
I have learned much through the e-learning system	-.812	.783
Knowledge gained using the e-learning system will be helpful in future with other systems	.000	-.979
Knowing how to maintain and support the e-learning system makes me more employable	.327	-.036
Organisational Value		
The e-learning system enables USQ to respond more quickly to change	-.213	-.285
The e-learning system is cost effective	-.728	1.179
The e-learning system enables USQ to establish good relationships with the user community	-.414	.001
The e-learning system establishes and maintains a good image and reputation for USQ	-.274	-.080
The e-learning system can be used by the University to provide students and staff with new educational services	-.537	.197

Standard error of Skewness is 0.491; Standard error of Kurtosis is 0.953