ICT SERVICE QUALITY MEASUREMENT FRAMEWORK FOR MALAYSIAN UNIVERSITIES CONTEXT

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Dedicated to:

My beloved father and mother, En. Mohd. Nor and Pn. Rosnah,
My husband Norizal Khushairi,
My princess Marsya Nur Nabilah and Natrah Nur Najwa,
My prince Muhammad Al Sufi Hazim and,
All my family members, lecturers and colleagues.

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Above all, I am thankful to Allah for his blessings. Praise be to Him.

ABSTRACT

Lack of quantitative research on ICT service quality (ICTSQ) impedes the collection of important information to improve ICT services (ICTS). The gap between the assessment of ICTSQ and the implementation by ICTS stakeholders leads to the need for this research. Current ICTSQ studies only identify service quality factors and attributes for assessing ICTSQ. This research developed a more comprehensive framework that identifies the structure of ICTSQ measurement comprising ICTS components, quality factors, quality attributes and key performance indicators (KPIs) of ICTSQ. The framework development adopted a mixed-method approach. It used qualitative data gathered from a case study of four Malaysian universities and a survey of ICTS stakeholders within 35 public and private universities in Malaysia. The study focused on ICTS within the university context because of its important role in creating significant impacts in many areas such as investment, customer loyalty, profitability, and competitive advantage. The findings from the case studies were used to verify the KPIs in the initial framework developed during the preliminary study. The rubric for ICTSQ measurement was then developed from the qualitative study. For the quantitative analysis of survey data, methods such as descriptive analysis, reliability analysis, regression analysis and ANOVA were used to produce a more reliable framework. All seven hypotheses on ICTSQ proposed in this framework were tested and accepted. The analysis showed that there were significant differences in terms of ICTSQ among ICTS stakeholders. The research also developed a web-based tool for measuring ICTSQ to validate the framework. The performance level of each ICTSQ KPI within the framework can be used as a guideline for ICTS stakeholders to improve their ICTSQ.

ABSTRAK

Ketandusan kajian kuantitatif ke atas kualiti servis ICT (KSICT) telah menghalang pengumpulan maklumat penting bagi memperbaiki servis ICT (SICT). Jurang antara penilaian KSICT dan perlaksanaan oleh pihak berkepentingan SICT membawa kepada keperluan kajian ini. Pelbagai kajian KSICT semasa hanya mengenalpasti faktor-faktor dan atribut-atribut kualiti bagi penilaian KSICT. Kajian ini membangunkan suatu kerangka yang lebih komprehensif bagi mengenalpasti struktur pengukuran KSICT terdiri daripada komponen SICT, faktor kualiti, atribut kualiti dan petunjuk prestasi utama (KPI) KSICT. Pembangunan kerangka ini telah mengguna pakai pendekatan kaedah-bercampur. Ia menggunakan data kualitatif yang dikumpul daripada kajian kes empat universiti di Malaysia dan kaji selidik ke atas pihak berkepentingan SICT di 35 universiti awam dan swasta di Malaysia. Kajian ini memfokus pada SICT dalam konteks universiti kerana peranannya yang penting bagi mewujudkan impak ketara dalam pelbagai bidang seperti pelaburan, kesetiaan pelanggan, keuntungan dan kelebihan daya saing. Hasil daripada kajian kes digunakan untuk mengesahkan KPI di dalam kerangka permulaan yang dibangunkan semasa kajian awalan. Rubrik bagi pengukuran KSICT kemudiannya dibangunkan daripada kajian kualitatif. Bagi analisis kuantitatif data kaji selidik, kaedah-kaedah seperti analisis deskriptif, analisis kebolehpercayaan, analisis regressi dan ANOVA digunakan untuk menghasilkan kerangka yang lebih dipercayai. Kesemua tujuh hipotesis KSICT yang cadangkan bagi kerangka ini telah diuji dan diterima. Analisis menunjukkan bahawa terdapat perbezaan ketara dari segi KSICT di kalangan pihak berkepentingan SICT. Kajian juga membangunkan alat berasaskan-web untuk mengukur KSICT bagi mengesahkan kerangka. Tahap prestasi setiap KPI KSICT di dalam kerangka ini dapat digunakan sebagai garis panduan bagi pihak berkepentingan SICT untuk memperbaiki KSICT mereka.

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LIST OF ABBREVIATIONS

BSC - Balance Scorecard
IS/IT - Information System/Information Technology
ICT - Information and Communication Technology
ICTS - Information and Communication Technology Service
ICTSQ - Information and Communication Technology Service Quality
MUs - Malaysian University (s)
MOHE - Ministry of Higher Education
KPI - Key Performance Indicator
CSF - Critical Success Factor
ANOVA - Analysis of Variance
MAMPU - Malaysian Administrative Modernisation and Management Planning Unit
MAPITA - ICT Director Association of Local Higher Education Institutions
SQL - Structured Query Language
HTML - Hypertext Markup Language
PHP - Hypertext Preprocessor
ITGI - Information Technology Governance Institute
ISO - International Organization for Standard
ITIL - Information Technology Infrastructure Library
COBIT - Control Objectives for Information and Related Technology
CMMI - Capability Maturity Model Integration
SLA - Service Level Agreement
KICTSP - Knowledge, Information and Communication Technology Strategic Plan

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CHAPTER 1

INTRODUCTION

1.1 Overview

In relation to the initial stage of research occurring from the early 1980s to late 1990s concerning service quality improvement, the majority of researchers mainly focused on the manufacturing, marketing and industrial sectors (i.e. Parasuraman *et al.*, 1985; Simons *et al.*, 1997; Bertchold, 1999; Wisner, 1999). Subsequently, the focus was concentrated on service industries (i.e. Ong and Koch, 1994; Chow-Chua and Goh, 2002; Firdaus, 2005) when the governments of various countries realized specifically that service industries play an important role and have a great impact on a nation’s economy. However, the influence of drastic dependence growth of Information System/Information Technology (IS/IT) or Information and Communication Technology (ICT) further improves the service quality in the field of ICT within these various sectors (i.e. Zeithaml *et al.*, 1990; Doran and Smith, 2004; Santos, 2003; Liou and Chen, 2006).

Until today, numerous models and frameworks have been developed relating to service quality (SQ) assessment, measurement and improvement in many sectors, including those related to IS/IT or ICT studies. However, many of the models or frameworks have not focused on or considered the later stages of SQ and ICT service quality (ICTSQ) measurement after various factors and attributes have been identified. Most of the previous researchers focused more on understanding, determining and defining the service quality factors and attributes based on the context involved (i.e. Berkley and Gupta, 1994; Dabholkar, 2000; Zhu *et al.*, 2002; Azizah, 2003).The same focus of research still continues from time to time due to reasons such as the diversity and idiosyncrasies of services (Philip and Hazlett, 1997) and the elusive nature of SQ construct (Firdaus, 2005).

Furthermore, it seems that none of the ICTSQ measurement tools have been developed based on previous research in differing contexts. As a result, it is extremely difficult to measure the ICTSQ. It was agreed upon by other previous researchers such as Teas (1993) and, Pitt and Watson (1995) that there is a need for a specific tool to measure quality in the field of ICT service (ICTS). This study attempts to respond to the problems related to the ICTSQ studies, which mainly refer to the need to extend research of ICTSQ measurement and suggest a new framework for measuring ICTSQ. The research will take into consideration the ICTS category, ICTS types and ICTS quality factors and attributes based on Malaysian Universities (MUs) context, as well as by adapting some of the previous framework of SQ related to ICTS and IS/IT governance. Hence, the outcome of this study is a tool for measuring the ICTSQ based on a developed framework.

This chapter encompasses eight sections, as shown in Figure 1.1. The chapter begins with section 1.1 which introduces the area of concern for this study. Sections 1.2 and 1.3 provide discussion of the problems occurring in the area of research. The research objectives are then discussed in section 1.4. Section 1.5 then provides the research hypotheses, and the research scope is discussed in section 1.6. The significance of the research is described in section 1.7 and finally, section 1.8 describes the structure of the thesis which gives an overview of the whole research.

Section	**Description**
Section 1.1 Overview	Introduces the chapter and gives an overview of the sections.
Section 1.2 Problem Statement	Describes the problem statements of the research.
Section 1.3 Research Questions	Describes the research questions.
Section 1.4 Research Objectives	States the objectives of the research.
Section 1.5 Research Hypotheses	Outlines research hypotheses for this study.
Section 1.6 Research Scope	Describes the scope of the research.
Section 1.7 Significance of the Research	Describes the significance of the study based on its contribution to theory, practice and methodology.
Section 1.8 Structure of the Thesis	Describes the structure of the thesis and gives an overview of the whole research.

Figure 1.1: Organization of Chapter 1

1.2 Problem Statement

Some writings concerning previous models on SQ assessment and measurement in the field of ICTS studies have been reviewed. The main problem emerging in the field of ICTSQ is:

How to measure the ICTSQ within MUs context?

The main problem of this research is shaped by the following three issues as shown below:

1) The need for measurement and assessment of ICTSQ

Due to scenarios such as diversity, idiosyncrasies, and clearly complex and continuous changes in services, measurement and assessment of ICTSQ should be done continuously (Doran and Smith, 2004; Philip and Hazlett, 1997; Pitt and Watson, 1995). In addition, there is no specific measurement tool which is adequate for the ICTSQ measurement in this particular context. Although many previous researchers claimed that their model is a generic model for all services and provides a general tool for measuring SQ (i.e. Parasuraman *et al*., 1985), it is still inadequate due to the intrinsic nature of the ICTS. Therefore, other previous researchers such as Teas (1993) and Pitt and Watson (1995) agreed that ICTSQ measurement requires a specific measuring tool. Due to these problems, there is an urgent need to carry out research which proposes a systematic and practical way to measure ICTSQ and which provides ICTSQ measurement methods and tools.

2) Limited research conducted in the area of ICTSQ measurement

The initial studies related to ICT quality and ICTS quality are mostly based on physical aspects, but not the services aspect (Pitt and Watson, 1995; Rose *et al*., 2001; Jiang *et al*., 2003). In recent times, only a few researchers were involved in the ICTSQ studies. However, while most of these researches have contributed a great deal towards understanding, determining and defining the SQ factors and attributes, they have not focused on the extent of measuring ICTSQ (i.e. Berkley and Gupta, 1994; Dabholkar, 1996; Zhu *et al*., 2002; Azizah, 2003). Therefore, there are still several unresolved issues that need to be addressed pertaining to the ICTSQ measuring elements, measuring methods and tool development based on various contexts.

3) The important role of ICTS and ICTSQ within the Malaysian University (MU) context

According to Azizah (2003), besides focusing on the core activities of teaching and learning, MU also acts as a promotional role for both the ICT and technological development of the country. Thus, ICTS also plays an important role within the context of MU. Additionally, ICTS impacts significantly on many factors such as organizational investment, customer loyalty, profitability and competitive advantage (Jiang *et al*., 2003; Kang and Bradley, 1999; Pitt and Watson, 1995) for this context. On top of this, the impact of globalization in education (Sylvester and Meagan, 2002; Mark, 2005) and democratization of education (Lynn Davies, 2002; Marginson *et al*., 2006) in university influences the quality improvement of ICTS which increases from decade to decade. Thus, the study related to ICTSQ improvement, including measuring of ICTSQ, has become very important within the current context of MUs. Based on the mentioned problems, this study attempts to fill the gap which has emerged in the ICTSQ studies. The gap is illustrated in Figure 1.2.

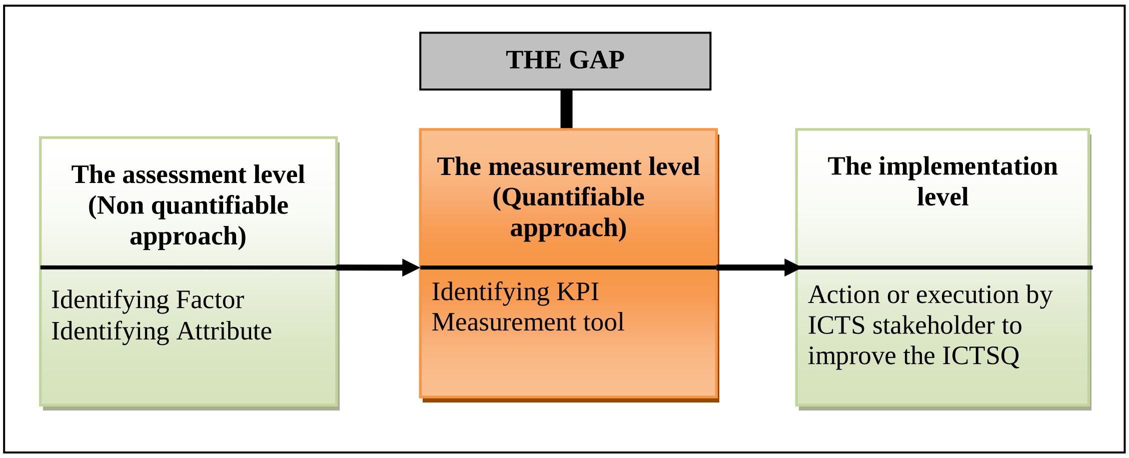

THE GAP
The assessment level (Non quantifiable approach)
Identifying Factor
Identifying Attribute
The measurement level (Quantifiable approach)
Identifying KPI
Measurement tool
The implementation level
Action or execution by ICTS stakeholder to improve the ICTSQ

Figure 1.2: The Gap in relation to this Study

There was a gap in the previous researches of ICTSQ field between the assessment level of ICTSQ and the implementation level by ICTS stakeholders. Most researchers in the assessment level were only contributed on understanding, determining and defining the service quality factors and attributes as well as not consider extending the research to the quantitative measurement level. This gap leads to the need of this research that focuses on a systematic and quantifiable approach to measure ICTSQ. It has been tailored for the development of a framework that describes the building blocks for ICTSQ measurement. At this stage, additional contributions in terms of key performance indicator (KPI) and ICTSQ measurement framework is developed besides determining current quality factors and attributes in the context involved.

1.3 Research Questions

The main problem stated in the problem statement section is anticipated to be solved by answering the following research questions:

1) What is the scope of ICTS within the current context of MUs?

The diversity, idiosyncrasies, clearly complex and continuous changes in ICTS scenarios led to the need for further understanding and review of the ICTS categories, ICTS types, ICTS providers and ICTS users within MUs context in order to measure the ICTSQ.

2) What are the elements to be considered in measuring ICTSQ?

There are only a small number of researches related to ICTSQ improvement and measurement. An obvious deficiency in ICTSQ measurement can create problems such as difficulties in assessing, managing, monitoring and improving of ICTS. Due to this problem, enhancement at the initial stage of ICTSQ studies is encouraged, thus focusing more on the measurement of ICTSQ. The measuring of ICTSQ will consider the ICTSQ factors and attributes, related critical success factors (CSFs), quantifiable approach of measurement as well as the development of KPIs and measurement tool.

3) What is the appropriate framework to measure ICTSQ based on the context of MUs?

The importance of the role of ICT and ICTS within the context of MUs has influenced the need for research works related to the ICTSQ improvement and measurement. Based on this study, an appropriate framework is proposed to measure ICTSQ in this context.

1.4 Research Objectives

The main objective of this study is to propose a framework for measuring ICTSQ within the context of MUs. The framework will be developed according to the needs and scenario of ICTSQ from the MUs context. The objectives of this study are:

1) To review and identify the scope of ICTS and ICTSQ measurement within the current context of MUs.
2) To identify the elements in measuring ICTSQ.
3) To develop a framework for measuring ICTSQ based on the context of MUs.

1.5 Research Hypotheses

The research hypotheses that can be developed in this study are listed as below:

H1: There is a significant relationship between ICTS Governance and ICT Operation Services

H2: There is a significant relationship between ICTS Governance and ICT Community Services

H3: There is a significant relationship between ICTS Governance towards ICT Operation Services and ICT Community Services

H4: There is a significant difference between ICTS stakeholders towards ICT Operation Services

H5: There is a significant difference between ICTS stakeholders towards ICT Community Services

H6: There is a significant difference between ICTS stakeholders towards ICTS Governance

H7: The ICT Community Services are important for MUs

1.6 Research Scope

This research covers the ICTSQ framework with the outcome covering the elements of ICTSQ measurement based on the MUs context. The scope and limitation of this research are encompassed as below:

i) The unit of analysis for this research is the Malaysian Universities (MUs) organization that leads to analysis of the higher education sector. MUs in the scope of this research encompass public and private universities in Malaysia that are registered with the Ministry of Higher Education (MOHE).

ii) The feedback for this study will only focus on providers and users who are directly involved with the MUs context (in house providers and users). Therefore, the external ICTS providers and external users are not involved in the case study and survey.

1.7 Significance of the Research

The importance of this research is contributed to by three different perspectives. These are as follows:

1) Theoretical

- Provides a clear understanding of ICTS and ICTSQ from ICTS stakeholders within MUs context.
- Provides a clear description of ICTSQ measurement elements in the form of quality factors, quality attributes, CSFs and KPIs.

2) Practical

- Provides awareness to the ICTS stakeholders within MUs context on the current ICTS scope and importance of ICTSQ improvement.
- Provides a set of guidelines to the ICTS units within MUs context on how to measure ICTSQ.
- Provides a measurement tool that can be used for measuring ICTSQ.

3) Methodological

- Suggests an appropriate approach for measuring ICTSQ based on the context of MUs to ICTS practitioners.

1.8 Structure of the Thesis

The thesis is organized into nine chapters, as shown in Figure 1.2. There are inter-relationships between different chapters and sections. It is suggested that the chapters should not be read in isolation in order to provide a clearer understanding the of the research flow. Therefore, briefly revisiting the related sections and chapters will assist in understanding the thesis.

Chapter 1 introduces the research area of concern. The chapter begins with a description of the research background, encompassing the focus of previous research relating to service quality improvement, problems arising based on previous frameworks and models in SQ and ICT studies. The chapter proceeds with a problem statement, containing a brief argument concerning the absence of an appropriate framework for measuring ICTSQ at MUs. The chapter then clearly describes the research questions and the research aim. The scope of the research is intended to clarify the context of MUs and covers the current scope of ICTS. The research importance is also described based on its contribution to theory, practice and methodology. Finally, the chapter briefly views the structure of the thesis.

Chapter 2 reviews the literature related to the scope of ICTSQ measurement. The discussion commences with the scope of ICTS within MUs which encompasses ICTS stakeholders, categories and types of ICTS and ICTS governance. The chapter then reviews and compares previous SQ models, highlights the limitations and advantages of the models and identifies the factors involved. The chapter proceeds with a discussion on CSFs with regard to ICTS. To place the discussion within the scope of SQ measurement, this chapter also reviews previous measurement models and frameworks in general and ICTS specifically.

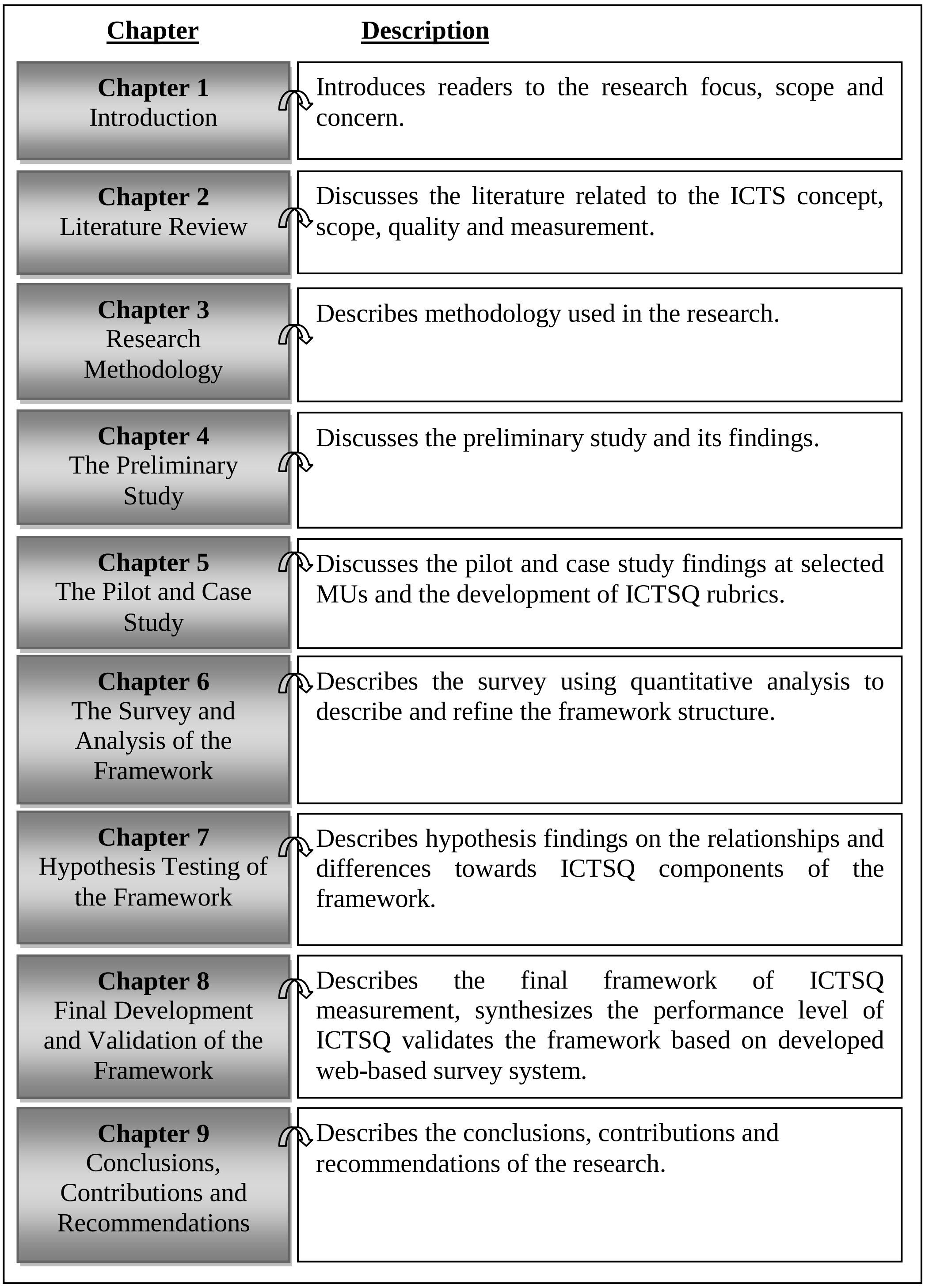
The chapter then describes the KPIs as a selected approach in measuring ICTSQ. Further, lists of the KPIs from previous related research are reviewed in this discussion. This chapter continues with a basic explanation regarding the IT Service Maturity Model in relation to the framework proposed by the research. In summary, the conceptual model is described in this chapter to demonstrate the relationships of the concepts used for the development of ICTSQ framework proposed by this research.

Chapter 3 describes the methodology used in the research. The chapter begins by introducing the research paradigms and research approach which best suits this research. It briefly describes post-positivism paradigms and mixed-method approaches that are used to develop the framework in this research. The chapter continues with an explanation of the research design by using the research operational framework. Through this framework, the chapter describes the phases and activities of the research in detail. The chapter then discusses methods and tools used in the research. They include data collection methods and tools such as survey and case studies, questionnaires and interviews, Likert scales and rubrics. To position the discussion within the context of MUs, the chapter also describes the types and number of MUs involved in this research. The chapter then proceeds with a discussion on methods for analyzing the framework and performance including reliability analysis, regression, analysis of variance (ANOVA) and cross tabulation.

Chapter 4 proceeds with a discussion on preliminary findings with regard to the scope of ICTS, the governance component for ICTS and considered factors and attributes for ICTSQ based on MUs context. The description concerns the current scope of ICTS which includes ICTS categories and types and, ICTS stakeholders. The component of governance is also considered in this preliminary phase and concentrates on its important role of supporting the implementation of the entire ICTS. For every ICTS category, factors and attributes from literature works are reviewed based on the suggestion of experts and practitioners during the preliminaries.

Finally, based on factors and attributes considered in this phase, the lists of relevant KPIs for the context of MUs are developed. To develop practical KPIs that can be used to measure ICTSQ in the selected context, the development of KPIs should be considered from various parties of ICTS stakeholders. The chapter then subsequently proceeds with a suggestion for attaining the relevant KPIs through description of a KPI Model and initial ICTSQ measurement structure.

Chapter 5 discusses the process and findings of the pilot and case study conducted at four selected MUs. The chapter proceeds by describing the pilot findings regarding ICTSQ implementation at selected MUs. It was performed by testing the survey instrument of initial lists of the KPIs. The focus group interviews conducted in the case study is to justify the findings of relevant KPIs for measuring ICTSQ and then proposes the ICTSQ framework structure and rubrics. The purpose of rubrics as described in this chapter is to achieve a consistent view of ICTSQ performance level; ranging from the lowest to the highest level of measurement scale. The findings in this chapter are later used in the construction of ICTSQ ideas and research methods for developing the ICTSQ measurement framework.



Chapter	**Description**
Chapter 1 Introduction	Introduces readers to the research focus, scope and concern.
Chapter 2 Literature Review	Discusses the literature related to the ICTS concept, scope, quality and measurement.
Chapter 3 Research Methodology	Describes methodology used in the research.
Chapter 4 The Preliminary Study	Discusses the preliminary study and its findings.
Chapter 5 The Pilot and Case Study	Discusses the pilot and case study findings at selected MUs and the development of ICTSQ rubrics.
Chapter 6 The Survey and Analysis of the Framework	Describes the survey using quantitative analysis to describe and refine the framework structure.
Chapter 7 Hypothesis Testing of the Framework	Describes hypothesis findings on the relationships and differences towards ICTSQ components of the framework.
Chapter 8 Final Development and Validation of the Framework	Describes the final framework of ICTSQ measurement, synthesizes the performance level of ICTSQ validates the framework based on developed web-based survey system.
Chapter 9 Conclusions, Contributions and Recommendations	Describes the conclusions, contributions and recommendations of the research.

Figure 1.3: Organization of the Thesis

Chapter 6 describes the ICTSQ measurement survey and the application of quantitative analysis to describe and fine tune the framework structure. The questionnaire for the survey is based on the ICTSQ rubrics which encompass five ICTS categories and ICTS Governance. After the collection phase, the data represents 36 MUs consisting of 20 public universities and 16 private universities. The chapter discussion begins with the results of data exploration including normality, reliability and correlation analysis. Other analysis approaches such as multiple regression analysis and mean rank analysis towards components and elements of ICTSQ are also discussed in order to get the current performance of ICTSQ. The chapter concludes by presenting the reliable results of analysis and statistically-balanced framework structure.

Chapter 7 discusses the testing of hypotheses related to the relationships and differences between ICTSQ components in the framework. The chapter begins by answering the seven identified hypothesis statements. The chapter presents the findings on the influences of ICTS Governance towards ICT Operation services and ICT Community services. The discussion then proceeds with the explanation on the differences between ICT Operation services, ICT Community services, and ICTS Governance among ICTS stakeholders. This chapter explains in detail the hypotheses testing of actual survey using a variety of statistical methods. Based on the results, the chapter concludes that all seven hypotheses are successfully accepted.

Chapter 8 discusses the final components and elements of ICTSQ framework in detail based on the context of MUs. The chapter then synthesized the findings together with maturity of ICTS management process information to benchmark the ICTSQ for the current context of MUs. To provide a clear overall picture of the state of ICTSQ at the participating MUs, the chapter provides a detailed discussion towards ICTSQ maturity level. This chapter then describes the development of a web-based ICTSQ measurement survey tool for the purpose to validate the final developed framework. The survey tool was developed based on Microsoft Structured Query Language (SQL) Server for database. The system was developed based on

Hypertext Preprocessor (PHP) language for server side scripting besides Hypertext Markup Language (HTML) and Java Script for client side scripting. The chapter describes the features and advantages of the web-based system in measuring ICTSQ.

Chapter 9 concludes the thesis by describing the research outcomes in relation to the achievement of the research objectives. All three objectives in this study were achieved successfully by qualitative and quantitative approaches. The chapter then summarizes the research and provides the research contributions to the theory, practice and methodology. In conclusion, the chapter provides recommendations for future research.

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