INFORMATION SYSTEM EFFECTIVENESS IN PROJECT MANAGEMENT: A STUDY OF PROJECT MONITORING SYSTEM II AT THE MINISTRY OF AGRICULTURE AND AGRO-BASED INDUSTRY.

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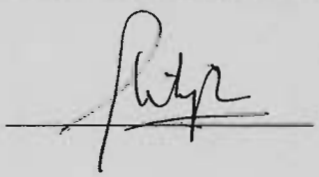

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ABSTRACT

In the context of public sector project management and monitoring in Malaysia, Project Monitoring System II (PMS II) is the primary Project Management Information System (PMIS) which is currently being used by all the ministries, departments and government agencies. Previous studies have suggested that the use of PMIS was considered to be advantageous towards successful project execution. Using the antecedents of system success as proposed by DeLone and McLean in the Updated Information System Success Model (ISSM), i.e. system quality, information quality and service quality, this study attempts to provide insight into the impacts of PMS II towards successful execution of public projects and ascertain the determinants that influence the system's effectiveness. The findings from this study showed that users at the ministry of Agriculture and Agro-Based Industry generally agreed that PMS II is an effective system to support project management and monitoring activities. The factors of system quality, information quality and service quality were found to have a significant relationship with the effectiveness of the system. Among these three factors, information quality was found to have the greatest effect of any variation in the effectiveness of PMS II.

Keywords: PMS II, system effectiveness, system quality, information quality and service quality.

ABSTRAK

Dalam konteks pengurusan dan pemantauan projek sektor awam di Malaysia, Sistem Pemantauan Projek II (SPP II) merupakan sistem maklumat pengurusan projek utama yang digunakan oleh semua kementerian, jabatan dan agensi kerajaan. Kajian-kajian lepas telah mencadangkan bahawa penggunaan sistem maklumat pengurusan projek mempunyai kesan positif keatas kejayaan pelaksanaan projek. Dengan menggunakan faktor-faktor penentu kejayaan sistem seperti yang dicadangkan oleh DeLone dan McLean dalam *Information System Success Model* (ISSM), iaitu kualiti sistem, kualiti maklumat dan kualiti perkhidmatan, kajian ini cuba memberikan pemahaman tentang kesan penggunaan SPP II keatas kejayaan pelaksanaan projek-projek awam dan juga faktor-faktor penentu yang mempengaruhi keberkesanan sistem tersebut. Hasil dapatan menunjukkan secara umumnya pengguna SPP II di Kementerian Pertanian dan Industri Asas Tani bersetuju sistem ini merupakan sistem yang berkesan dalam menyokong pengurusan dan pemantauan projek. Ketiga-tiga faktor kualiti sistem, kualiti maklumat dan kualiti perkhidmatan didapati mempunyai hubungan yang signifikan dengan keberkesanan sistem. Selanjutnya, faktor kualiti maklumat didapati sebagai faktor yang paling memberi kesan terhadap sebarang perubahan keatas keberkesanan sistem SPP II.

Katakunci: SPP II, keberkesanan sistem, kualiti sistem, kualiti maklumat dan kualiti perkhidmatan.

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LIST OF ABBREVIATIONS

DOI	:	Diffusion of Innovation
EPU, PMO	:	Economic Planning Unit, Prime Minister's Office
eGovernment	:	Electronic Government
ICT	:	Information and communication technology
ICU, PMO	:	Implementation and Coordination Unit, Prime Minister's Office
IS	:	Information System
ISSM	:	Information System Success Model
InfoQ	:	Information Quality
MoA	:	Ministry of Agriculture and Agro-Based Industry
MoF	:	Ministry of Finance
PMIS	:	Project Management Information System
PMS I	:	Project Monitoring System I
PMS II	:	Project Monitoring System II
SETIA	:	*Sistem Maklumat Agensi-agensi Pusat Yang Disatukan*
SIAP	:	*Sistem Penjadualan Yang Bersepadu*
SMBSS	:	*Sistem Maklumat Bersepadu* SETIA/SIAP
SPP II	:	*Sistem Pemantauan Projek II*
TAM	:	Technology Acceptance Model
TRA	:	Theory of Reasoned Action
UTAUT	:	Unified Theory of Acceptance and Use of Technology

SysE	:	System Effectiveness
SysQ	:	System Quality
ServQ	:	Service Quality

CHAPTER 1

INTRODUCTION

1.1 Background of study

The implementation process of public projects is the realization and translation of the various development policies formulated by the government. Public development projects were to be implemented by all ministries, departments and agencies with the aim to achieve the predetermined objectives of the overall policies. Successful project execution means a better chance for the policies to be realised. Therefore, the process of planning, monitoring and evaluation of projects must be carried out on a systematic and regular manner as they are important in ensuring the success of the projects (ICU PMO, 2012).

To assist the ministries, departments and agencies in project management and monitoring tasks, the government had introduced various versions of project management information system. Beginning with the highly manual Red Book (Buku Merah) until the information technology (IT) based Integrated Central Agencies Information System (*Sistem Maklumat Agensi-agensi Pusat Disatukan*-SETIA), steps had been continuously taken to ensure the effectiveness of public project management. The introduction of Project Monitoring System II (PMS II) in 2001 marked Malaysia's continued effort to utilise information, communication technology (ICT) in public sector project implementation and monitoring activities. The implementation of PMS II is

aimed at supporting and monitoring the entire lifecycle of Malaysia's 5-Year development programmes, producing quality projects, providing a platform for exchanging ideas and demonstrating best practices models in project implementation and providing the source for effective decision making based on analysis/ forecasting of project information and an auto-alert functions on problematic projects (Masrek, 2009). As of 2014, all the ministries, various departments and federal agencies have adopted PMS II as the main project management information system for public projects implementation throughout the country.

1.1.1 Malaysia Development Planning - An Overview

Through the formation of the first five-year development plan, namely the First Malaya Plan 1956-1960, development planning was established as a formal function of the Government since the 1950s (EPU, 2004). The creation of the Economic Planning Unit (EPU) in the Prime Minister's Department in 1961 had further enabled development planning to be carried out with authority and guaranteed the approach for inter-agency planning and monitoring mechanisms. Fundamentally, development planning for Malaysia is based on a three-tiered cascading planning horizon, which involves the long, medium and short term planning, as indicated in Table 1.1.

Table 1.1
Malaysia Development Planning Horizon

Long-Term Planning	Medium-Term Planning	Short-Term Planning
• First Outline Perspective Plan (OPP1), 1971 – 1990 • Second Outline Perspective Plan (OPP2), 1991 – 2000 • Third Outline Perspective Plan (OPP3), 2001 -2010 • Vision 2020, 1991 – 2020	• Five-year development plans • Mid-term review of the five-years plans	• Annual Budget • Yearly Rolling Plan

Source: EPU, PMO (2004)

The Outline Perspective Plan (OPP) is a long term planning instrument that sets the broad thrusts and strategies of the nation's development agenda. In other words, OPP is the macroeconomic framework of the nation, with specific long term targets set to enable the achievement of the society's vision. Malaysia had already undergone three OPP successfully and is currently on track to become a developed nation through the execution of the in progress long term planning, namely the Vision 2020.

The medium-term plan is designed for a phase of five years. The plan is formulated within the context and framework set by the respective OPP. In essence, the five-year plan is the key working guideline for the execution of government's development programs. It set the targets for macroeconomic growth of the country, and detail out the size and allocation for the public sector development programs. Additionally, it also asserts the roles of the private sector to cooperate and participate in the programs planned.

The third tier is the annual budget and yearly rolling plan. This annual planning exercise is undertaken by the Ministry of Finance (MoF) through its annual budget preparation. Views and feedbacks from the private sector are also taken into

consideration through budget dialogues held during the preparation stage. The Economic Planning Unit (EPU) under the Prime Minister's Department, also play the key role in determining the details of the annual development programs and rolling plans.

As a whole, it can be summarised that Malaysia's development planning mechanism are very specific with clear achievement period set. Plans formulated provide clear directions, with the intention to suit the socio-economic environment as well as the political scenario of the nation. It is notably evident that the most important purpose of the plans is to establish a clear and comprehensive national development policy for the nation to continue to progress.

1.1.2 Public Sector Project Management Information System in Malaysia

Malaysia has a long history of emphasizing a balanced approach of public project planning, implementation and evaluation process. As stated earlier, the EPU is the main planning agency for the government that draws up the various phases of development plans. The task of overseeing the coordination and implementation of every single projects or programs under these plans is the responsibility of the Implementation and Coordination Unit, Prime Minister's Office (ICU). ICU also reports back to the government on the progress and the problems that might occur. This is to ensure that realisation of development plans is well coordinated and any changes or adjustments can be made quickly when and where needed, in order to attain the desired results.

An effective and efficient project monitoring system is vital to support smooth and systematic project implementation. The fundamental of effective project monitoring, evaluation and control is a clear emphasise of the project objectives, goals and strategies

which will in turn results in a coherent performance standards. By having these standards in place, project progress can be measured consistently. This is to make sure all development projects can be carried out successfully at all levels and should any untoward problem occurs, immediate remedial actions can be undertaken promptly.

For the purpose of monitoring public projects in Malaysia, the government had introduced project monitoring system beginning with the Red Book system, Project Monitoring System I (PMS I), SETIA System, Integrated Scheduling System (SIAP), SETIA/SIAP Integrated Information System (SMBSS) and the current one being the Project Monitoring System II (PMS II). The change from earlier monitoring system to a new one had also witnessed the government embrace more the adoption of information system (IS) in public projects monitoring and management. As the case with any IS, the efficiency of a project monitoring system needs to be upgraded from time to time, thus explaining the eventual migration from a particular system to another.

1.1.2.1. The Red Book (Buku Merah)

The first monitoring system that was introduced by the government during the First Malaya Plan (1956 – 1960) was the Red Book. It was based on the British Army Operation Briefing where the main purpose was reporting the physical progress of projects and programs. This report would then be recorded and coordinated at a District Operation Centre. The Red Book monitoring and reporting model was largely applied on projects implemented in rural areas. It was not a centralized monitoring but a stand-alone system. In other words, every district had its own Red Book system. The Red Book would be inspected and verified regularly by the officer in charge and would be

made available to top management or ministerial officers who administer the progress of every ongoing project.

1.1.2.2. Project Monitoring System I (PMS I)

Beginning with the implementation of the New Economy Policy (NEP) which commenced in 1971, the government introduced a special directive mechanism known as the National Action Committee Instruction No.1. The previous year also witnessed the country's first computer-based public project implementation monitoring system that leveraged on the usage of ICT in project management. It was named as the Project Monitoring System I (PMS I). The main objective of PMS I was to process data on project implementation, monitoring and produce reports on projects status. The input to this system was based on the forms that had been circulated to the implementation agencies where the status of all projects must be reported every four months. ICU then will check and streamline all the data before it was keyed-in into the system. Consistency in term of checking and endorsements were applied at all time in order to avoid any mistakes and the need to re-entry the data. All the information was kept in database centre and the report can be produced at any time needed. The system had been credited for the successful implementation of development projects under NEP.

1.1.2.3. SETIA System

In 1980, a research was conducted by the Cabinet Committee to find ways to expedite the implementation of public development projects. As a result, the committee found out that PMS I had several weaknesses and need to be improved. Consequently, in 1984 a new system called Project Development Tracking System or also known as

SETIA was introduced. SETIA is the short form for *Sistem Maklumat Agensi-agensi Pusat Yang Disatukan* or Central Agencies Integrated Information System. This system which was officially launched on 1st of March 1984, basically consisted of four modules:

i. Planning and Approved Projects Module

This module is for the EPU to process the approved programs and projects in the Five Year Malaysia Plan.

ii. Estimated Budget Allocation Module

This module is for the Treasury to process yearly allocation for the approved projects.

iii. Project Status Tracking Module

This module is for the relevant ministries and ICU to analyze information of project's physical and financial progress.

iv. Payment Module

This module is for the Accountant General Department to process payments based on the progress of the projects.

SETIA system core function or main focus was on the financial status of projects. The financial information that it provides was in tandem with project progress. However, some quarters were concerned that the information on physical progress of projects may not be very accurate.

1.1.2.4. SIAP System

SIAP is the acronym for *Sistem Penjadualan Bersepadu* or Integrated Scheduling System and it was launched in 1991. The introduction of this system was to help head of departments and project managers to plan, implement and monitor the development of public projects more effectively. It is also aimed at avoiding any unforeseen circumstances that will have an effect on project progress and at the same time, ensured progress payment were always made on time, as per project schedule.

SIAP is actually part of SETIA. While SETIA was more focused on financial status, SIAP on the other hand, monitors the status of physical progress of the projects or sub-projects. It was a computer-based and standalone system. As a result, project information prepared by the respective departments and agencies had to be manually collected and coordinated at their respective ministry level before being sent to ICU on quarterly basis for monitoring purposes.

1.1.2.5. SETIA/SIAP Integrated Information System (SMBSS)

In 1996, the government introduced *Sistem Maklumat Bersepadu* SETIA/SIAP or SMBSS as the main public sector project monitoring system. SMBSS was not entirely new but it was actually the integrated and modified version of SIAP and SETIA. Both systems were merged and synchronised into a single platform to monitor the projects under the Seventh Malaysia Plan. All ministries involved in implementing the approved projects were required to use the SMBSS system. The objectives of SMBSS were as follow:

i. To enable ministries and State Development Offices (SDO) track the progress of federal development projects implemented by ministries in accordance with the National Development Policy;
ii. To enable ministries and SDO's prepare project implementation progress and analytical reports for top management;
iii. To assist secretariat to the ministry-level development committees;
iv. To provide information on project implementation details to ministries and ICU; and
v. To help identify problems during project implementation.

The implementation departments and agencies were made responsible to key-in the inputs and update all the data of the development projects which were undertaken by them. EPU approved projects were allocated a ten digit number for every project through SETIA system. This number was called SETIA project number. The ministry that was responsible for the projects then needs to break the program or project into subprojects and assigned them a fourteen digit number. The fourteen digit number was a continuation of the original ten digit number that had been assigned by EPU. In other words, each main project had a ten digit number and all subprojects under it will have a 14 digit number respectively, known as SIAP sub-project number. SMBSS used a dial-up connection system that link all ministries, departments and agencies.

1.1.2.6. Project Monitoring System II (PMS II)

PMS II is an online, end-to-end project management and monitoring system that utilises collaborative environment in order to provide better management of public development projects (Masrek, 2009). It is one of the Electronic Government (eGovernment) projects under the Multimedia Super Corridor (MSC) flagship program.

The vision of eGovernment is to restructure government management and delivery system by using multimedia and information communication technology. In line with the vision and to suit the ever changing public requirements and demands, the new project monitoring system had been identified as one of the pioneer project of eGovernment applications. It is the first project monitoring system that truly links all the ministries, departments and agencies online, where project information and data can be keyed-in at the source or at the user level.

Originally launched in 2001, PMS II adoption has been made mandatory on 23rd October 2010 through the directive of the National Action Council in Directive No. 1, 2010, National Action Council (ICU, 2010). To date, all the ministries, departments and government agencies are obligated to use the system. PMS II or *Sistem Pemantauan Projek II* (SPP II) in Malay language was developed to be one of the four key instruments for the implementation of the development programs and projects. Figure 1.1 shows the overall framework of the directive.

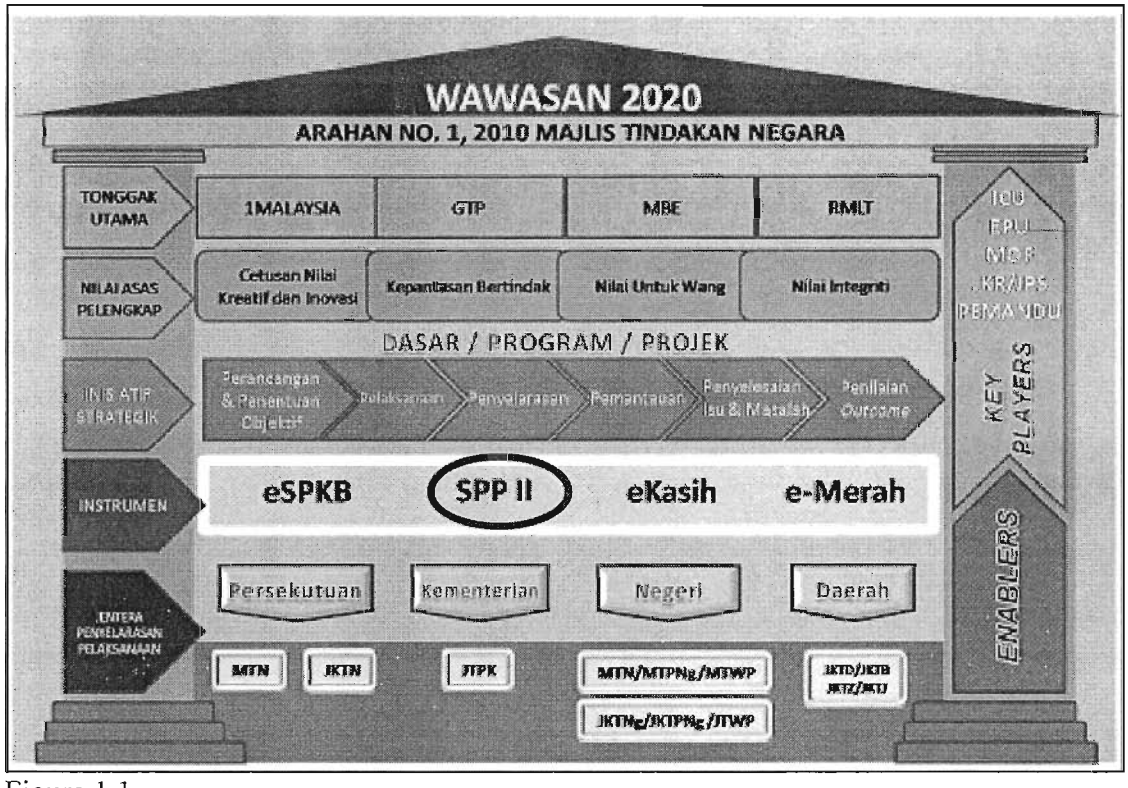

Figure 1.1
Directive No. 1, 2010 Framework, National Action Council
Source: Implementation and Coordination Unit, PMO. (2010).

There are three main modules in PMS II as follows:

i. Operational Functions Module

Operational Functions of PMS II includes the development and implementation of the operations function in order to facilitate the monitoring of daily operations of the project. This feature is targeted to users who implement and monitor the project in detail. Operational Functions Module of PMS II includes the functions of:

a. Project Application Module,

b. Rolling Plan Review Module,

c. Budget Application Module,

d. Request For Change Module

e. Project Monitoring Module; and

f. Financial Status Module.

ii. Managerial Functions Module

Managerial function is an extension of the monitoring features available in the operational function of PMS II. Objectively, it is aimed at providing a platform for the purpose of macro-monitoring of projects, analysis of project performance and the evaluation of a subproject/ project/ program and policy. It is made up of three modules, namely Executive Monitoring Module, Project Evaluation Module, and Web Application Module.

Executive Monitoring Module and Project Evaluation Module allow the management to make a more informed decision based on the ability of the system to generate a wide range of analysis, predictions and evaluations. On the other hand, Web Application Module is designed to enable the Project Management Teams to conduct project monitoring and update project activity information in the monitoring module via the world wide web.

iii. Knowledge Repository Module

Knowledge Repository Module aims to increase the efficiency of project teams in performing daily work particularly in terms of accelerating the rate of access to information and knowledge about the project. The module involves the accumulation

and management of information about projects conducted by various organizations. Apart from the usual project attributes, information gathered may also include the tacit or explicit knowledge of project managers or the project teams. By promoting information sharing through the repository, it is hoped that better situational assessment and method of implementation can be carried out to improve the accuracy of a project decision.

1.2 Problem Statement

The use of Project Management Information Systems (PMIS) is considered to be advantageous to project managers because of the perceived benefits such as timeliness in decision making and ensuring project success (Raymond & Bergeron, 2008). In the context of public sector project management and monitoring in Malaysia, PMS II is the primary PMIS which is currently mandated to be used by all the ministries, departments and agencies.

The main purpose of PMS II is to provide IS support to the full process of project development and implementation under the Malaysia Five-Year Plan (RMLT). Focusing primarily on the element to provide information mobility and enhance project monitoring effectiveness, the system was developed with the intention to overcome all the weaknesses of previous government project monitoring information systems.

Nonetheless, the annual Auditor General's Report from time to time still listed weaknesses in project monitoring capability among government bodies as the caused for delay or failure of public projects. For example, in 2011, it was specifically pointed

out that several weaknesses in the implementation of public programs, activities and projects were largely due to the lack of monitoring and supervision by the responsible parties (National Audit Department, 2011). The effects of project delays and failures if translated in terms of dollar and cents are colossal. Not to mention the denied benefits to the target groups of the projects, who had to wait longer or even being forced to accept substandard quality projects because of the failure to meet the specification required.

In the case of Ministry of Agriculture and Agro-Based Industry (MoA), for the 10th Malaysia Plan (2010-2015), there are already 580 projects and programs registered in PMS II with the financial allocation of almost RM 6.6 billion. Although most of these projects manage to adhere to their planned schedule, there are a few projects that had encountered long delays. A significant example of one of the delayed project that attracted observation and comment in the Auditor General's Report is the RM300 million Paya Peda Dam project in Besut Terengganu (National Audit Department, 2013).

Although there are various factors that can be attributed to project delay, absence of an effective monitoring system is likely to result in delayed information sharing, hamper communication between interested parties and affect the quality of decision made by the respective authorities (Caniels & Bakens, 2012). Therefore, an assessment of the current PMIS being used in the government sector will be beneficial to understand its effectiveness and the factors that can help to enhance future project management and monitoring system.

Currently, there are limited studies and information with regard to the contribution of PMS II towards successful project implementation. This echoes the observation by Liberatore et.al (2003) that there seems to be limited studies on PMIS effectiveness and most empirical studies conducted on PMIS have been largely limited to describing the demographics of project management users and usage. Hence, this study aims to contribute through the assessment of the effectiveness of PMS II.

Conducting assessment on information system effectiveness offers a chance to understand its strengths and weaknesses. Subsequently, through better understanding, strengthening actions and weaknesses elimination measures can be taken to ensure that the system objectives will continue to be fulfilled. This will also ensure that the system development cost is well justified by the benefits that the system could offer.

1.3 Research Questions

This study is aimed to find the answer to the following research questions:

i. Does PMS II contribute effectively towards successful project execution?
ii. What are the determinants for effective PMS II implementation?

1.4 Research Objectives

The objectives of this study are:

i. To assess the effectiveness of PMS II in terms of its impacts on project execution; and
ii. To identify the determinants that influence effectiveness of PMS II implementation.

1.5 Scope of Study

For the purpose of this research, PMS II is deemed to be a type of PMIS as it has all the necessary characteristics of any typical project management and monitoring systems. This research will examine the effectiveness of PMS II in the process of project management and monitoring at MoA, including its eleven departments and agencies.

1.6 Significance of Study

This study is significant in providing information on the effectiveness of PMS II in public sector projects implementation and the determinants that contribute to the system's effectiveness. It will also serve to contribute to literature on the impact of PMIS in public project management and monitoring.

1.7 Definition of Key Terms

1.7.1 PMIS

PMIS is the information system acquired by an organization to support project management processes. It can be in the form of generic type available in the market e.g. Microsoft Project, Primavera or custom developed for specific client such as the PMS II.

1.7.2 PMS II

PMS II is the project management information system used by the government ministries, departments and agencies in Malaysia to monitor the implementation of public sector development programs and projects.

1.7.3 System Success

System success is the perceived impact of PMIS usage on project success normally associated with conformity to deadlines, conformity to budgets, conformity to specifications (Olsen, RP, 1971), and the fulfilment of preset project objectives (Atkinsons, 1999, Munns and Bjermi, 1996).

1.7.4 System Quality

System quality is defined as the desirable characteristics of an information system (DeLone & McLean, 2003). Depending on the type and objective of an IS, the characteristic associated with system quality normally include accessibility, response time, flexibility, ease of use, querying and report generating ease, learning ease and also good system integration.

1.7.5 Information Quality

Information quality is described by DeLone & McLean (2003) as the desirable characteristics of the system output. Quality output is based on the availability, relevancy, accurateness, reliability and comprehensiveness of the information contained and generated from the system.

1.7.6 Service Quality

Service quality is mainly about of the support that system users receive from the IS department and IT support personnel (DeLone & McLean, 2003). The characteristics

that describe service quality include responsiveness, assurance, empathy and the availability of a proper guideline (Pitt et al., 1995).

1.8 Organization of Chapters in the Dissertation

The dissertation of this study is divided into five chapters which started with an introductory chapter that introduces the background of the study in terms of research background, problem statement, research questions, research objectives, research significance and scope of the study. In addition, this chapter also briefly describes the general information about project management information systems and eGovernment.

Chapter two provides the literature review which included descriptions of the independent variables and dependent variables, and the related information system theories that supported the development of the research framework. In addition, findings of previous studies conducted on PMIS were also discussed.

Chapter three which covers the research method, discussed about the research design and questionnaire preparation, research population, data collection method and data analysis technique.

Chapter four detailed the results of the data analysis conducted. The chapter presents the demographic characteristics of the respondents and the variables studied and also the results of the correlation and multiple regression analysis.

The fifth chapter presents the discussions, recommendations and conclusion of the study, based on the data analysis results. Limitations of the study and direction for future research were also discussed in this final chapter.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter explores the literature on project management practices and the introduction of IS as a tool to support and provide integrated information management system capability for project management. Discussion on previous literature with regard to IS diffusion theory, IS success model and system success are also presented.

2.2 Underlying Theories and Models

2.2.1 Information System Adoption Theories and Models

Originating from the field of psychology and social science, the issues of technology adoption and acceptance has been examined by applying a range of IS theories and models. Among them is the Diffusion of Innovation (DOI) Theory, developed by E.M. Rogers in 1962. DOI is one of the earliest diffusion theories and widely used to explore adoption of innovation. The concept of technology adoption was expanded into the IS literature by Davis (1986, 1989), in his Technology Acceptance Model (TAM). This model has since been used to develop new theories (Venkatesh and Davis, 2000). Theories that are based on TAM were used to explain technology usage behavior among individuals. The Unified Theory of Acceptance and Use of Technology

(UTAUT) were derived by Venkatesh and his colleague that unifies constructs from eight competing IS models, including TAM and DOI.

2.2.1.1 Diffusion of Innovations (DOI) Theory

Diffusion of Innovations (DOI) Theory (Rogers, 1962) originated in the effort to explain how, over time, an idea or product gains momentum and diffuses (or spreads) through a specific population or social system. The end result of this diffusion is that people, as part of a social system, adopt a new idea, behavior, or product. According to Rogers (1962), adoption means that a person does something differently than what they had previously did (i.e., purchase or use a new innovation, acquire and perform a new behavior, etc.). The key to adoption is that the person must perceive the idea, behavior, or innovation as new or innovative. It is through this that diffusion is possible.

Adoption of a new idea, behavior, or product does not happen simultaneously in a social system; rather it is a process whereby some people are more apt to adopt the innovation than others. Past studies have found that people who adopt an innovation early have different characteristics than people who adopt an innovation later. Thus, when promoting an innovation to a target population, it is important to understand the characteristics of the target population that will help or hinder adoption of the innovation. Five established adopter categories namely the innovators, early adopters, early majority, late majority and laggards (Rogers, 1962). While the majority of the general population tends to fall in the middle categories, it is still necessary to understand the characteristics of the target population so that different strategies can be used to appeal to the different adopter categories.

2.2.1.2 Technology Acceptance Model (TAM)

Technology Acceptance Model (TAM) is an information system theory that explains how users come to accept and use a technology. The model suggests that when users are presented with a new technology, a number of factors influence their decision about how and when they will use it. The core constructs consist of perceived usefulness, perceived ease-of-use, attitude towards using, behavioural intentions to use and actual system use.

The model was proposed by Davis, Bagozzi, and Warshaw (1989) based on a comparison study between two models namely Theory of Reasoned Behaviour (TRA) and what they term as Technology Acceptance Model (TAM). The study was done to evaluate how elements of perceived usefulness and perceived ease of use affected technology acceptance. TAM indicates that, people's computer use can be predicted reasonably well from their intentions and perceived usefulness. These two major constructs determine people's intention to use computer. It is also noted the study perceived ease of use is a significant secondary determinant of people's intention to use computer. Figure 2.1 illustrates TAM as proposed by Davis, Bagozzi, and Warshaw (1989).

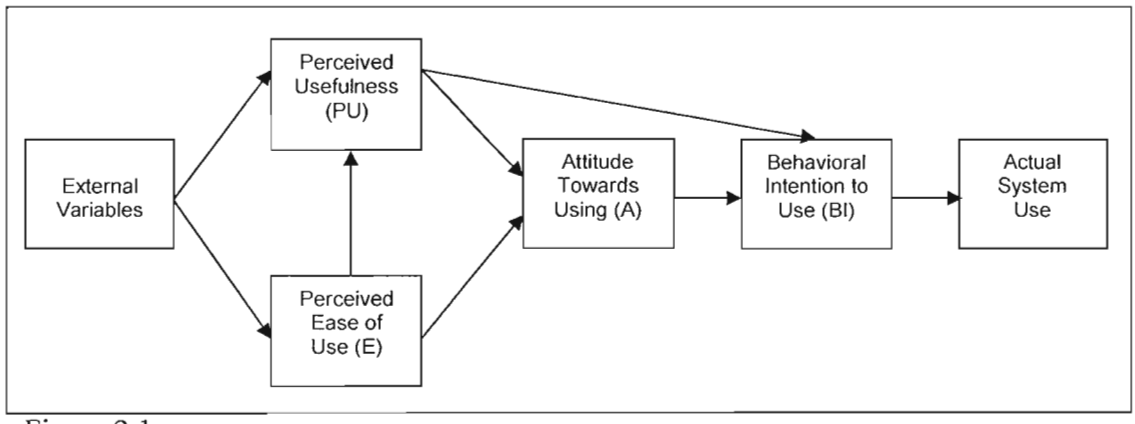

Figure 2.1
Technology Acceptance Model (TAM)
Source: Davis, Bagozzi, and Warshaw, (1989)

2.2.1.3 Unified Theory of Acceptance and Use of Technology (UTAUT)

UTAUT was developed in an attempt to unify eight distinct, but similar theories that explain technology acceptance. The authors included constructs from the theory of reasoned action, TRA (Fishbein, 1967; Fishbein and Ajzen, 1975), the TAM (Davis, 1989), TAM 2 (Venkatesh and Davis, 2000), the motivational model (Vallerand, 1997; Davis *et al*, 1992), the theory of planned behaviour (Ajzen, 1985, 1991), the combined TAM and theory of planned behaviour (Taylor & Todd, 1995), the model of personal computer (PC) utilisation (Thompson *et al*, 1991), DOI theory (Rogers, 1962) and social cognitive theory (Bandura, 1986). Venkatesh *et al* (2003) derived UTAUT based on all these theories.

Venkatesh *et al* (2003) use all of these constructs to create a unified model based on statistically sound procedures. According to UTAUT, the behavioral intention to use (BI) to accept and use a technology depends on both expected performance and effort as well as on social influences. Furthermore, the final use behaviour, in accordance with

prior research (e.g., Ajzen, 1985), depends on this behavioral intention. The existence of facilitating conditions is an additional predictor of use behaviour. The UTAUT model is as shown in Figure 2.2 and the definitions and origins of the core constructs is as explained in Table 2.1.

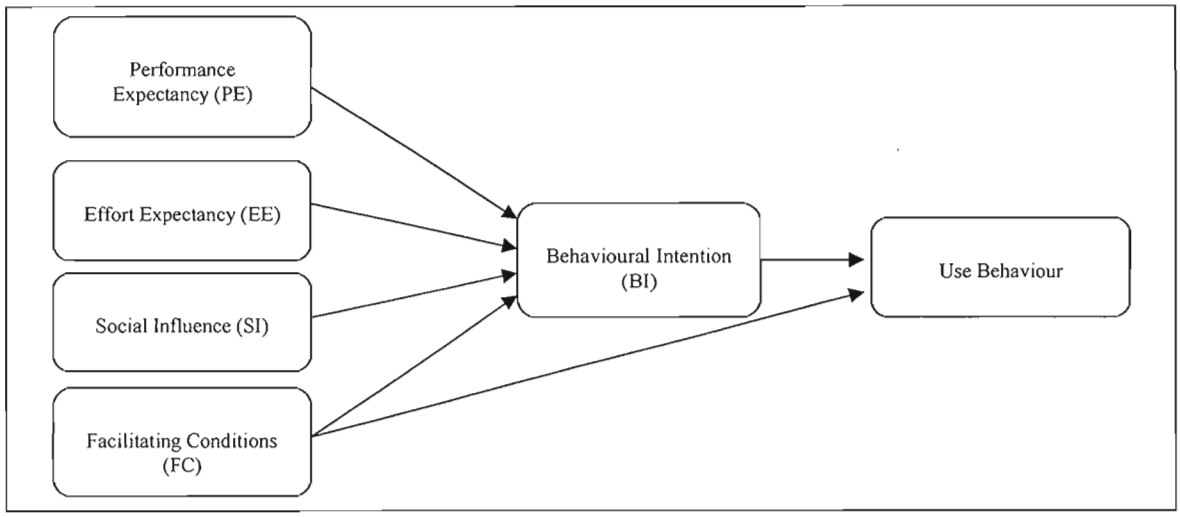

Figure 2.2
Unified Theory of Acceptance and Use of Technology (UTAUT)
Source: Venkatesh *et al* (2003)

Table 2.1
UTAUT Core Constructs

Core construct	Definition	References
Performance Expectancy (PE)	The degree to which an individual believes that using the technology will help him or her to improve personal performance.	Davis (1989), Moore &Benbasat (1991), Compeauet al (1999), Venkatesh*et al* (2003)
Effort Expectancy (EE)	The degree of ease associated with the use of a technology.	Davis (1989), Moore &Benbasat (1991), Venkateshet al (2003)
Social Influence (SI)	The degree to which an individual believes it to be important that others feel he or she should use a particular technology.	Davis (1989), Aijzen (1991), Thompson et al (1991), Venkateshet al (2003)
Facilitating Conditions (FC)	The degree of support available for adopting a specific technology.	Venkatesh*et al* (2003), Thompson *et al* (1991)

Core construct	Definition	References
Behavioural Intention (BI)	The degree to which an individual wishes to use a technology (here, the Internet) for personal activities.	Davis (1986), Davis (1989), Taylor & Todd (1995), Venkatesh et al (2003)

Source: Venkatesh *et. al.* (2003)

2.2.1.4 Updated Information System Success Model (ISSM)

William H. DeLone and Ephraim R. McLean (1993) were the proponents of the original Information System Success Model (ISSM). The model incorporates system quality and information quality as antecedents of IS use, leading to individual IS impacts, namely on users and their work (e.g., in regard to their effectiveness), and subsequently organizational impacts (e.g., in regard to business strategy and performance). Following the developments in the information and communication technology over the years, they reassessed ISSM in 2003 with the addition of "service quality" and the collapsing of "individual impacts" and "organizational impact" into "net benefit".

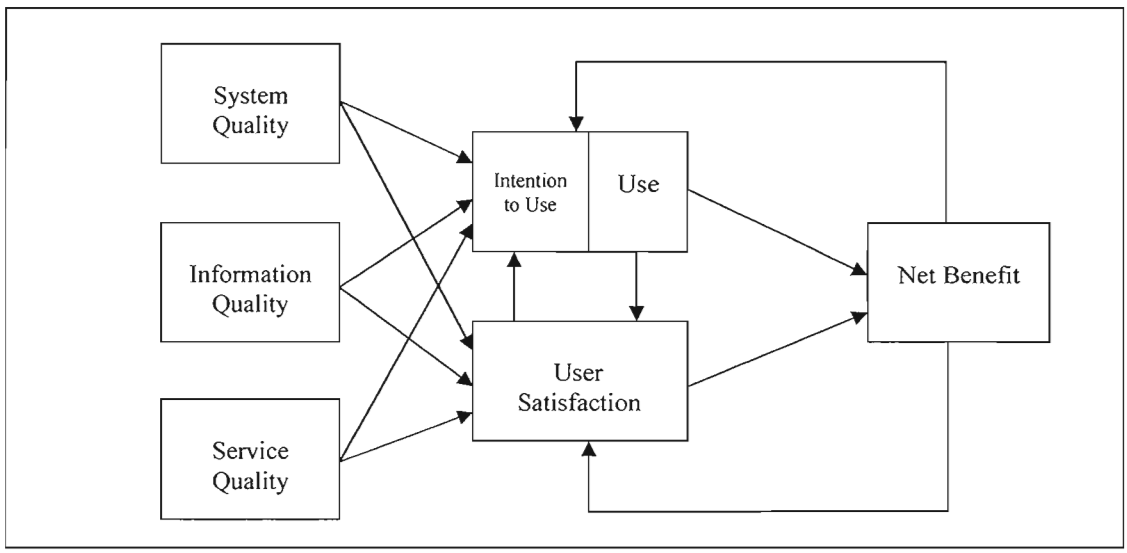

Figure 2.3
The Updated Information System Success Model (ISSM)
Source: DeLone and McLean (2003)

In the updated ISSM model, there are six criteria that are used to measure success of an information system. The criteria include system quality, information quality, service quality, system use, user satisfaction and net benefit. Explanation of the criteria is summarized in Table 2.2. The ISSM model were used by researchers to examine success and effectiveness of an IS by using benefits of IS adoption as surrogate measures.

Table 2.2
ISSM Core Constructs

Core Construct	Definition	Items	References
System quality	The desirable characteristics of an information system.	Adaptability, Availability, Reliability, Response time, ease of use, and ease of learning.	DeLone &McLean (2003)
Information quality	The desirable characteristics of the system outputs. that is, management reports and Web pages.	Usability, completeness, ease of understanding, personalization, relevance, accuracy, conciseness, completeness, currency and timeliness.	DeLone &McLean (2003)
Service Quality	The quality of the support that system users receive from the IS department and IT support personnel.	Assurance, empathy, responsiveness accuracy, reliability, technical competence, and empathy of the personnel staff, SERVQUAL.	Pitt *et al.* (1995), Kettinger & Lee (1995), Wilkin & Hewitt (1999), DeLone &McLean (2003)
System Use	The degree and manner in which staff and customers utilize the capabilities of an information system.	Amount of use, frequency of use, nature of use, appropriateness of use, extent of use, and purpose of use.	DeLone&McLean (2003)
User Satisfaction	Users' level of satisfaction with reports, Web sites, and support services.	Survey feedbacks, repeat usage	Ives *et al.* (1983), Doll and Torkzadeh (1988), Doll et. al (1994) DeLone &McLean (2003)
Nett benefit	The extent to which IS are contributing to the success of individuals,	Improved decision-making, improved productivity, increased	Seddon (1997), Seddon et. al. (1999), Chan (2000), Brynjolfsson*et*

Core Construct	Definition	Items	References
	groups, organizations, industries, and nations.	sales, cost reductions, improved profits, market efficiency, consumer welfare, creation of jobs, and economic development.	*al.* (2002)DeLone & McLean (2003)

Source: Petteret. al (2008)

2.3 Initial System Adoption by Government

The term eGoverment is commonly referred to as an initiative introduced by government in the effort to improve the relationship and communication process between the government and the public through the use of technology. In addition, eGovernment also refers to the use of information and communication technologies, particularly the Internet as a tool for improving the quality of public service delivery and government transformation efforts in improving relations with the community, businesses and government agencies. As a general statement, eGovernment is widely referred to as the use of information and communication technologies by the government to improve the process of governance and management (Wang & Liao, 2008).

eGovernment initiative is one of the innovations by the Malaysian government in order to ensure the success of the government projects and programs (Siddiquee, 2008). Government had use information technology, particularly the Internet as a medium for the delivery of services to all stakeholders involved in the chain of government relations. eGovernment provides benefits in terms of flexibility and accessibility of information communication to the public (Kaliannan et.al, 2007). In addition, eGovernment initiative is also aimed at enabling the Government to realize specific outcomes for each program

to a larger group of citizens. Apart from that, the element of speed had enabled the process of information gathering and dissemination to be conducted more quickly and easily via eGovernment application.

2.4 Project Management and Project Success

One of the most common definitions of project management cited by many studies is by Atkinson (1999). He defined project management as the application of a collection of tools and techniques (such as the Critical Path Method, (CPM), matrix organisation and Gantt Chart) in utilizing the resources to accomplish (from conception to completion) a unique, complex, one-time task within time, cost and quality constraints of a project. Atkinson (1999) also made famous the term "The Iron Triangle" of Cost, Time and Quality as key measurement criteria of project success. In coming with this definition, Atkinson cited Olsen (1971), who made observation on the views and developments of the project management field from the 1950's that were summarized in the following triangular model.

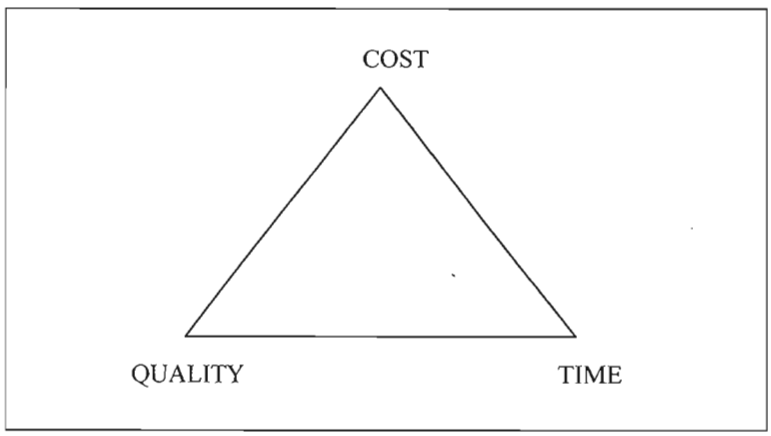

Figure 2.4
The Iron Triangle of Project Success Criteria
(Source: Atkinson R. 1999)

However, as the field of project management started to develop and more research were carried out in the area, there start to exist wide divergence of opinions in project management field. The only agreement seems to be the disagreement on what constitutes project success (Murphy, Baker & Fisher, 1974; Pinto & Slevin, 1988 and Shenhar, Levy, & Dvir, 1997).

A review of previous studies revealed that although most researchers accepted adherence to cost, time and specification as the basic project success criteria, many also suggested that additional elements should also be considered. A summary of the reviewed literature on project success criteria is as shown in Table 2.3.

Table 2.3
Summary of Literature on Project Success Criteria

Studies	Project Success Criteria			
	Cost	**Time**	**Quality/ specification**	**Others**
Olsen (1971)	√	√	√	Nil
Cleland (1986)	√	√	√	Contribution towards strategic mission
Baker, Murphy, and Fisher (1988)	√	√	√	Satisfaction among key people on the project team, and key users or clientele.
Pinto and Slevin (1988)	√	√	√	Client satisfaction with the final result
Freeman and Beale (1992)	√	√	√	Fulfillment of stakeholders' expectation. Acceptance by

Studies	Project Success Criteria			
	Cost	Time	Quality/ specification	Others
				interested parties upon completion of project
Munns and Bjeirmi(1996)	√	√	√	External relevant criteria, project goals
Atkinsons (1999)	√	√	√	Preset project objectives
Baccarini (1999)	√	√	√	Product success
Clarke (1999)	√	√	√	Fulfillment of project objectives
Crawford (2002)	√	√	√	Mission, outcome
Raymond & Bergeron (2008)	√	√	√	Nil

It is therefore evident that, an absolute number of project success criteria are impossible to be summed up with a single figure, or cannot even be justified by a single conceptual model. However, there seems to be some common criteria that were agreed upon by most of the researchers as prerequisites to measure success of project. The elements embodied in *The Iron Triangle* coupled with the ability to fulfill project objectives that offer customer's satisfaction mainly forms the basis of overall project success criteria.

However, additional elements are usually adapted to suit the nature and purpose of a project. Since project management is a science of application, the lack of a rigid concept that limit the number of project success criteria actually provides the possibility of more flexible measures of project success in wider and varied fields, not to mention the research opportunities that aim to examine project management and implementation.

2.5 Project Management Information System (PMIS)

PMIS is an information system acquired by an organization to support project management processes. It can be in generic form available in the market e.g. Microsoft Project, Primavera or customised for specific client such as the PMS II.

Around the early 1960s and 1970s, application of IS in project management using PMIS with the aim to support the project management process started to gain traction. This was possible due to the rapid expansion of information technology development during that era (Raymond & Bergeron, 2008). This development helped to promote a number of generic project management information software such as Microsoft Project, Primavera, RationalPlan, Multi Project and others. PMIS were normally used extensively by end users to monitor project implementation.

2.5.1 Previous Research on Project Management Information System (PMIS)

Lee and Yu (2012) applied the updated ISSM to investigate the success of construction project management information system. Seven factors were examined which included system quality, information quality, service quality, intention of PMIS use, user satisfaction, impact on efficient construction management and impact on

effective construction management. The research found that all the seven success measures are relevant in measuring information system success in construction projects.

Similarly, Wang and Liao (2008), adapted from DeLone and McLean's ISSM to examine a Government to Business (G2B) project implementation system. The results validated a comprehensive, multidimensional model of eGovernment PMIS success. The six success measures comprised of information quality, system quality, service quality, use, user satisfaction, and perceived net benefit. The findings of the research suggested that all the six success measures are relevant in measuring eGovernment information system success.

Among the more largely cited study that looked into PMIS effectiveness is by Raymond and Bergeron (2008). They had pursued empirical assessment of the quality of the generic PMIS used in organizations and examine their impact on project managers and project success. The PMIS success model is a combination from previous research on Technology Acceptance Model (TAM) and the updated ISSM. The main constructs are quality of the PMIS, information output quality, use of PMIS, individual impacts of the PMIS and organizational impact of PMIS. Based on a survey on 224 project managers and project management consultants in Canada, it was found that, PMIS is indeed advantageous to project managers by way of improvement in effectiveness and efficiency in managerial tasks and improvements in productivity of end users. PMIS also provided individual the ability to enhance project performance and have direct impacts on project success. PMIS also contributed to improving budget control and meeting deadlines as

well as fulfilling technical specifications (Raymond and Bergeron, 2008). Overall, they conclude that PMIS is indeed significant towards project success.

Caniels and Bakens (2012) highlighted the effects of the use of PMIS towards decision making process in a multi-project environment. They aimed to seek clarification whether the use of PMIS is beneficial in addressing the problems faced by project managers in a multi-project environments by examining the effects of the use of PMIS in the decision making process. The study used a model that was adapted from Raymond and Bergeron (2008) application of ISSM in evaluating PMIS. Six constructs were included namely; project overload, information overload, the PMIS information quality, project manager's satisfaction with PMIS, use of PMIS information and impact on decision making. The results showed that project overload is a weak predictor of PMIS information quality. On the other hand, information quality makes a significant contribution to the impact of making quality decision.

Factors that drive project managers to accept and use PMIS were also studied by Ali and Money (2005). Elements such as quality of the information, complexity of information and size of projects were deemed vital to acceptance of PMIS by project managers. The study also suggested that generated information from PMIS should be free of complexity, easy to understand and easy for project managers to communicate. A large and complex project setting tend to promote the use of PMIS, while less complex projects may not drive the usage of PMIS because of potentially high cost involved in order to keep the system up to date.

2.6 Overall Evaluation of Literature Review

Based on the literature available, the adoption of ISSM to evaluate the effectiveness of PMIS were widely accepted and proven to be able to provide a generalized framework in explaining IS success. ISSM generally had enabled researchers to select and define dimensions that are appropriate for a particular study condition. It is also noted that research interests were mostly focused on ascertaining the relationship between system success antecedent i.e system quality, information quality and service quality and the effectiveness of the system be it at the individual level, organisational level or the perceived overall net benefit. However, most of these researches were conducted in the more developed or western cultural work environment. Studies on effectiveness of PMIS in the context of public project monitoring and management proved to be limited, locally.

With regards to project success criteria, numerous studies that had been conducted largely agreed that the factors of adherence to cost, time and quality with the addition of the achievement of certain preset project objectives are relevant to measure project success. Researchers have also used the project success criteria to infer the effectiveness of PMIS via its impact on successful project execution.

2.7 Research Framework

The framework of this study is adapted from previous research based on one of the main model in IS literature, namely the updated ISSM (DeLone & McLean, 2003). Relationship between four variables which consisted of system quality, information quality, service quality, and system effectiveness was investigated. The rationale for referring to the three primary antecedents to system success as proposed in the ISSM model was due to the fact that the model itself was developed through the integration of elements that can examine the impact of information system towards individual and organizational benefit. Furthermore, as evident from the review done, ISSM had been widely adapted and proven to be generally suitable in evaluating the success of various IS, including PMIS.

The research framework in Figure 2.5 demonstrates the series of causal relationships of the constructs under study. Moving from left to right, the independent variables are system quality, information quality and service quality. The dependent variable is system effectiveness which for the purpose of this study, was measured in terms of benefits of PMS II adoption on successful project execution.

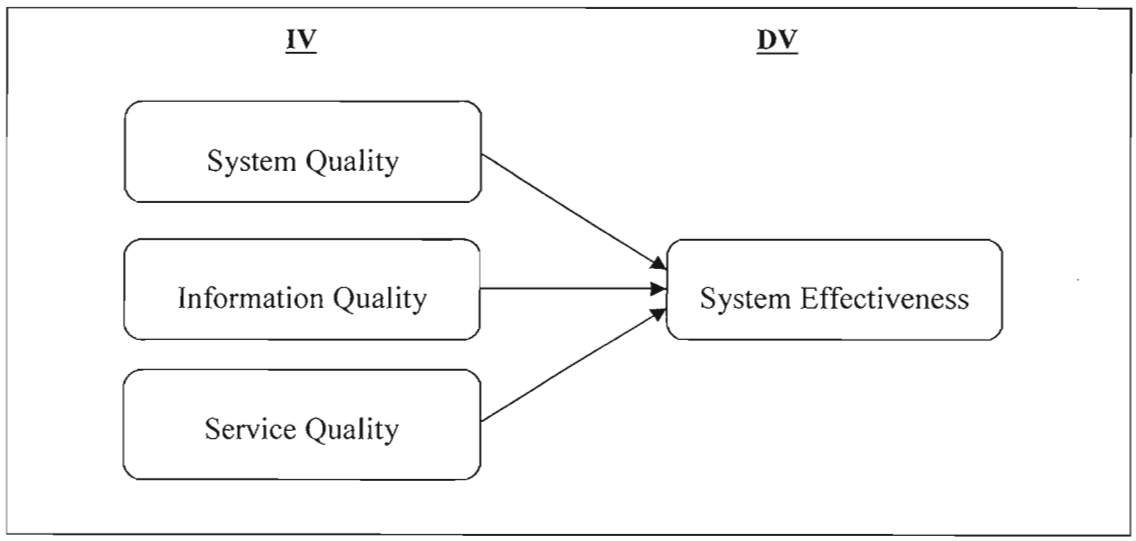

Figure 2.5
Research Framework

2.8 Development of Hypotheses

Based on the research questions and research framework in Figure 2.5, the hypotheses for this study are as follow:

H_1: There is a significant relationship between system quality and the effectiveness of PMS II.

H_2: There is a significant relationship between information quality and the effectiveness of PMS II.

H_3: There is a significant relationship between service quality and the effectiveness of PMS II.

2.9 Summary

From the literature, it is apparent that project management and monitoring practices have evolved over the decades. From the simple concept of utilising the right resources to accomplish a particular task, to the formation of manual project management tools, project management has now become more advance with the introduction of IS as an integrated information management supporting instrument. As PMIS continues to gain relevance and importance in project implementations, various studies had been conducted to assess PMIS effectiveness in different project types and settings. It is also apparent that elements adapted from ISSM were widely used in performing these assessments. With the increasing practice of adopting IS in project management and monitoring, the possibility for further assessment and investigation the effectiveness of these systems becomes more interesting and at the same time crucial towards better chances of project success.

CHAPTER 3

METHOD

3.1 Introduction

This chapter presents the method used for the study. Aspects of the research design, research population, development of research measurement, data collection procedure and analysis technique are discussed in detail in this section.

3.2 Research Design

This study was designed as a quantitative study using survey approach to test the hypotheses which were developed based on the research objectives and questions. Due to the limitations of resources and time, and for the benefit of a simple, inexpensive and quick data collection process, the study was carried out as a cross-sectional study, where data were only collected at one point of time.

Researcher interference was considered negligible as the study was conducted in the common environment of the organization. This permitted the respondents to complete the questionnaire freely without being influenced or feel pressured by the presence of the researcher (Sekaran, 2003).

Respondents' perception about PMS II system quality, information quality and service quality is important to understand the influence of the independent variables on PMS II effectiveness. Consequently, the unit of analysis for this study was at the

individual level (PMS II users) and the primary data was collected through distribution of questionnaire.

3.3 Research Population

In general, the determination of study sample size is a balance between resources capability and adequate statistical requirement. Roscoe's (1975) simple rule of thumb suggested that a sample that is larger than 30 and less than 500 is appropriate for most research. The target population of this research was the 180 registered users of PMS II in MoA. The users of PMS II comprised of project engineers, project coordinators, program coordinators, project managers and the management officers. They were the personnel responsible for the task of planning, implementation, monitoring and evaluation of the various projects. Referring to Krejcie and Morgan (1970), a sample size of 123 subjects would be adequate. However, in order to offset the possibility of a low response return, and after a discussion with the system administrator, a total of 180 questionnaires were distributed to all the registered users. In other words, this was a research done by mean of a population survey on the users of PMS II at MoA.

3.4 Operational Definitions and Measurements

3.4.1 System Effectiveness

In this study, system effectiveness was operationalised as the perceived impacts of PMS II usage on project success based on conformity to deadlines, conformity to budgets, conformity to specifications, fulfilment of preset project objectives,

contributions towards better monitoring and perceived importance of system. These were adaptations of the items as suggested by Raymond & Bergeron (2008) and Clarke (1999).

Table 3.1
System effectiveness: Operational definition and items

Variable	Operational Definition	Items	Authors
System Effectiveness	Perceived impact of PMS II usage on project success with regards to conformity to deadlines, conformity to budgets, conformity to specifications, fulfilment of preset project objectives, contribution towards better monitoring and perceived importance of system.	a. PMS II helps to ensure conformity to project deadlines. b. PMS II is useful in project financial control. c. PMS II is important for project management success. d. PMS II helps to ensure compliance to project scope/ specifications. e. PMS II is beneficial to ensure fulfillment of project objectives f. Use of PMS II has contributed to better project monitoring.	Raymond and Bergeron (2008), Clarke (1999).

3.4.2 System Quality

PMS II system quality was operationalised as the desirable characteristics of an information system with respects to its accessibility, response time, flexibility, ease of use, querying/ report generating ease, learning ease and integration with other systems. The items used to measure these characteristics was sourced and adapted from previous works by Caniels and Bakens (2012), Raymond and Bergeron (2008) and DeLone and McLean (2003).

Table 3.2
System quality: Operational definition and items

Variable	Operational Definition	Items	Authors
System Quality	The desirable characteristics of an information system with respects of accessibility, response time, flexibility, ease of use, querying/ report generating ease, learning ease, system integration.	a. PMS II is easy to learn. b. PMS II is easy to use. c. It is easy to access PMS II. d. PMS II offers flexibility in most of its modules. e. PMS II has good system response time. f. Query and Report can easily be generated from PMS II. g. PMS II can be easily integrated with other systems/ softwares.	Caniels and Bakens (2012), Raymond and Bergeron (2008), DeLone and McLean (2003).

3.4.3 Information Quality

In this study, PMS II information quality was operationalised as the desirable characteristics of an information system with respects to the availability, relevancy, accurateness, reliability and comprehensiveness of the information the system delivers. The items used to measure these characteristics was sourced and adapted from previous works by Raymond and Bergeron (2008) and DeLone and McLean (2003).

Table 3.3
Information quality: Operational definition and items

Variable	Operational Definition	Items	Authors
Information Quality	The desirable characteristics of the system output which include availability, relevancy, accurateness, reliability and comprehensiveness.	a. Information from PMS II is always available for users. b. Information provided in PMS II is up-to-date. c. Information provided in PMS II is reliable. d. Information provided in PMS II is precise. e. Information provided in PMS II is comprehensive.	Raymond and Bergeron (2008), DeLone and McLean (2003).

3.4.4 Service Quality

In this study, PMS II service quality was operationalised as the quality of the support that system users receive from the IS department and IT support personnel including rresponsiveness, assurance, empathy and the availability of a proper guideline. The items used to measure service quality was sourced and adapted from previous works by Pitt et al. (1995) and DeLone and McLean (2003).

Table 3.4
Service quality: Operational definition and items

Variable	Operational Definition	Items	Authors
Service Quality	The quality of the support that system users receive from the IS department and IT support personnel including responsiveness, assurance, empathy and the availability of a proper guideline.	a. PMS II users can depend on the support services provided by the system owner. b. Problems related to PMS II are quickly addressed by the system owner. c. PMS II system owner always try their best to understand the needs and requirements of the users. d. The instructions and guidelines provided by the system owner are easy to understand.	Pitt et al. (1995), DeLone and McLean (2003)

3.5 Layout of Questionnaire

Instrument used in this research is a questionnaire which was developed based on the proposed research framework and adaptation of existing questionnaire used in past studies. The questionnaire was divided into six (6) sections. Section A was for the demographic data of the respondents. Section B (seven items), covers the aspects of

system quality, section C (five items) covers the aspects of information quality and section D (four items) covers the aspects of service quality. Finally, section E (five items), asked about the participants perception on PMS II effectiveness towards successful project execution. Question/ statement for each item were adapted to specifically refer to PMS II. A multivariate scales (1–4), with anchors ranging from "1-Strongly Disagree" to "4-Strongly Agree," were used for all questions in section B, C, D and E.

3.6 Data Collection Procedure

The study acquired data from PMS II users i.e. project engineers, project coordinators, program coordinators, project managers and the management officers at MoA, including all the eleven departments and agencies under it. Application to request for the permission to conduct the study was sent to the Development Division of MoA, which was responsible to oversee the implementation of PMS II at the ministry. The letter conveyed that the research was strictly for academic purposes and the privacy and confidentiality of the respondents were assured.

After receiving permission, the questionnaires were distributed to the respondents by way of sending the address link of the Google online survey platform to the users through electronic mail (e-mail). A maximum duration of two weeks was given to the respondents to complete the questionnaires.

In order to ensure confidence on the confidentiality of the responses, each online questionnaire was enclosed with a statement that clearly explained the purpose of the

study and the assurance that the respondents were not needed to provide any kind of identification in the questionnaire. Responses accumulated in the online survey platform also did not have any characteristic that can be traced back to the respondents. Overall, the data collection for this research was done with very minimal interference from the researcher.

3.7 Technique of Data Analysis

The Statistical Package for the Social Sciences (SPSS) Version 16 for Windows was used to analyse the research data. Descriptive and inferential statistical analysis was conducted to provide answers to the research questions.

3.7.1 Descriptive Analysis

There are two objectives of conducting descriptive analysis for this research. The first one was to analyze the data of respondents's demography in order to get a clearer understanding about the backgrounds and characteristics of PMS II users. Secondly, via the measurement of mean, standard deviation and the minimum/ maximum value of the data, descriptive statistics also provided a cross sectional snapshot for every variable studied, thus giving the general idea of the overall perception among the users.

3.7.2 Correlation Analysis

This study investigates the relationship between the independent variables and the dependent variable. To ascertain the existence and strength of these relationships, Pearson correlation analysis was conducted on the data collected. For this purpose, the

strength of relationship criteria as proposed by Davis (1971) was used as reference. Table 3.5 shows the categorization of correlation value (r) and relationship strength.

Table 3.5
Strength of Correlation Value

Correlation value, r	Strength of relationship
± 0.70 or higher	Very High
± 0.50 to ± 0.69	High
± 0.30 to ± 0.49	Moderate
± 0.10 to ± 0.29	Low
± 0.01 to ± 0.09	Very Low

Source: Davis, 1971

3.7.3 Multiple Regression Analysis

Multiple regression analysis is an inferential analysis that can be used when there is more than one independent variable that can predict a particular dependent variable. For the purpose of this study, the dependent variable was PMS II system effectiveness (SysE) and the independent variables were system quality (SysQ), information quality (InfoQ) and service quality (ServQ). Regression analysis permits the understanding and explanation of the linear relationship between independent variables and the dependent variable studied. The regression coefficient (β) of each variable can be determined and being described as the amount of changes (Y) in the dependent variable given a unit of change (X) in the independent variable.

3.7.4 Testing the Research Instrument

3.7.4.1 Validity

Validity of an instrument is a central issue in the aspect of research measurement. It answers the question on how far an instrument can correctly measure the studied variables. Validity of instrument can be determined by three tests namely content, predictive and constructs validity (Nunnally& Bernstein, 1994). Content validity is to ensure the extent of the measurements used that represent the content of the instruments as valid and reliable. Predictive validity is quantified by the correlation coefficient between two sets of measurements obtained for the same target population. Construct validity is examined by performing factor analysis.

Nevertheless, due to the relatively small number of the population studied (180), a pilot test to ascertain content validity of the research instrument could not be carried out. Instead, an effort to acquire feedbacks on the face validity of the instrument was conducted. According to Sekaran (2003), face validity is considered by some researcher as a basic and a very minimum index of content validity. It indicates that the items that are intended to measure a particular concept do on the face of it look like they measure the concept. Gravetter and Forzano (2012), further described face validity as the extent to which a test is subjectively viewed as covering the concept it purports to measure. All this refers to the features of transparency or relevance of a test as it appears to test participants.

As for this research, in order to ascertain the face validity of the instrument used, the questionnaire was circulated to five (5) PMS II administrators and expert users at

MoA and two (2) lecturers who are expert in IS. Almost all the feedbacks received agree with the instrument's face validity. However, there was one suggestion from the system administrator that the word 'vendor' from the question related to support service quality be removed. This suggestion was based on the official practice at MoA, where PMS II users do not normally deal with the system vendors directly. Instead, the users will report any problem or request assistance from the system administrators at MoA, or if it is a more serious problem, the system owner, ICU, will be alerted. The suggestion was accepted and the necessary amendment was made in the final version of the questionnaire.

3.7.4.2 Reliability

The reliability of an item is often described as the probability that the item will adequately perform its intended purpose in a specified period of time under a particular surrounding conditions. Reliability of the data occurs when a test to measure the same thing is repeated and yields the same results (Salkind, 2006). If the measurement for the second time and subsequent measurements yield similar values with the original measurement, the study is said to have high reliability (Chua, 2012). According to Sekaran (2003), Cronbach's Alpha is a reliability coefficient that indicates how well the items in a data set are positively correlated to one another. In other words, Cronbach's Alpha is calculated to ensure the reliability of all the measurement scales. The closer the alpha value to 1, the higher the reliability is. Therefore, the reliability test was performed to test the consistency and stability of measurement used.

According to Nunnally (1978), the value of Cronbach's Alpha needs to be within the range of 0.7 to 0.9 to make the items acceptable and the correlation between items is good. However, if the value is moderate within the range of 0.5 to 0.6, it is still considered acceptable to be used for further research. In this research, interpretation of Cronbach's Alpha by Hair et al. (2007) was used as a reference to describe the reliability of the measurements. If the Cronbach's Alpha value of a particular variable exceeds 0.95, the particular item have to be reviewed to make sure that it measures different aspects for that particular concept. Table 3.6 shows the interpretation of Cronbach's Alpha value.

Table 3.6
Interpretation of Cronbach's Alpha Value

Cronbach's Alpha Value	Interpretation
< 0.6	Weak
0.6 to < 0.7	Moderate
0.7 to < 0.8	Good
0.8 to < 0.9	Very Good
> 0.9	Excellent

Hair et. al., 2007

3.8 Hypotheses testing

For the research hypotheses, they are to be tested by multiple regression analysis. Specifically, the statistical test is as summarized in Table 3.7.

Table.3.7
Hypotheses and Statistical Test

	Hypotheses	Statistical Test
H1	There is a significant relationship between system quality and the effectiveness of PMS II.	Regression
H2	There is a significant relationship between information quality and the effectiveness of PMS II.	Regression
H3	There is a significant relationship between service quality and the effectiveness of PMS II.	Regression

3.9 Summary

This chapter outlined the methodology used in this study, in trying to explore the relationship between system quality, information quality, service quality and PMS II system effectiveness. The measurement of construct, research questions and hypotheses, data collection method and analysis were also explained.

CHAPTER 4

RESULTS

4.1 Introduction

This chapter presents the analysis results on the responses obtained from the respondents who had participated in this study. Results of the analysis was divided into six parts i.e. the response rate of the survey, data screening, descriptive statistics about demographic information of the respondents, descriptive statistics on the variables examined, correlation and multiple regression analysis. The hypotheses testing results derived from multiple regression analysis are also presented.

4.2 Response Rate

From the 180 questionnaires circulated, 85 were returned back. All questionnaires returned contained no missing values and were usable for subsequent analysis. This constitutes to 47.2% response rate. Table 4.1 summarizes the response result for the survey.

Table 4.1
Response Rate (n = 85)

Questionnaire response	Frequency	Rate
Number of questionnaires distributed	180	100.0
Returned questionnaires	85	47.2
Usable questionnaire	85	47.2

4.3 Data Screening

4.3.1 Reliability Test

To test the reliability of the scales and internal consistency of the measurement used, reliability analysis was conducted on the obtained data. Reliability analysis is mainly about observing the value of Cronbach's alpha coefficient calculated for each variable studied. A reliability value of more than 0.6 is considered to be acceptable to be used in research (Sekaran, 2003) and a variable that has a Cronbach's alpha value that is nearer to 1 is considered to possess a higher reliability in its measurement.

Reliability analysis were conducted on all four variables namely system effectiveness (SysE), system quality (SysQ), information quality (InfoQ) and service quality (ServQ). Table 4.2 summarizes the results.

Table 4.2
Cronbach's Alphas of the Study Variables (n = 85)

No. of items	Variables	Alpha	Items dropped
6	SysE	.90	Nil
7	SysQ	.86	Nil
5	InfoQ	.88	Nil
4	ServQ	.87	Nil

Note: SysE = System Effectiveness, SysQ = System Quality, InfoQ = Information Quality, ServQ = Service Quality

The results showed that internal consistency of the scales ranged from .86 (SysQ) to .90 (SysE), and is acceptable based on Hair et.al (2007) interpretation

recommendation. The results provide confidence and are appropriate for the variables to be used for subsequent analysis (Hair et al., 2007; Sekaran, 2003).

4.3.2 Normality Test

Apart from reliability and validity testing, the basic conditions for statistical inference to be performed in the analysis of data obtained is by ensuring the distribution of the data is normal or close to normal. Normality tests can be conducted by using statistical test such as the Kolmogorov test, Shapira - Wilks test, Lilliefors statistics and skewness and kurtosis. In addition, normality can also be identified through the use of graphs such as histograms, stem and leaf plots, box plots and normal probability plots (Chua, 2012).

The normality test for this study was based on the skewness and kurtosis method. According to Chua (2012), the value of skewness and kurtosis should be within +/-1.96, for a data set to be normally distributed. The skewness and kurtosis value for system effectiveness, system quality, information quality and service quality was in the range of +/- 1.96, thus can be considered to be normally distributed. Table 4.3.shows the skewness and kurtosis values for all the variables.

Table 4.3
Skewness and Kurtosis Value

Variable	Mean	Skewness	Kurtosis
SysE	3.01	-.402	.802
SysQ	2.96	-.121	1.049
InfoQ	2.84	-.539	1.633
ServQ	3.02	.94	-.391

Note: SysE = System Effectiveness, SysQ = System Quality, InfoQ = Information Quality, ServQ = Service Quality

4.4 Descriptive Analysis Results

There are two objectives for conducting descriptive analysis. The first was to analyze the data of respondents's demography in order to get clearer understanding on the backgrounds and characteristics of the respondents who were PMS II users. Secondly, descriptive statistics is beneficial in giving the cross sectional snapshot for every variable studied, thus giving the general idea of how the variables studied were perceived by the respondents.

4.4.1 Demographic Characteristics of the Respondents

The main purpose of the study was to investigate the factors that influence the effectiveness of PMS II towards better project monitoring and management. The survey was conducted on respondents who were officers and staffs at MoA that utilise PMS II in their project monitoring and management activities. Table 4.4 shows the profile of the respondents studied which were categorized based on gender, education level, area of expertise, job function, membership in professional association, project management/ monitoring experience and also years of experience in using PMS II.

Table 4.4
Respondents' Demographic Profile (n = 85)

Item	Classification	Frequency	Percentage
Gender	Male	44	51.8
	Female	41	48.2
Education Level	SPM or lower	1	1.2
	Certificate	7	8.2
	Diploma (or equivalent)	17	20.0

	Bachelor's Degree	53	62.4
	Master's Degree	6	7.0
	Doctoral Degree	1	1.2
Profession Area	Management	32	37.6
	Engineering	15	17.7
	Agriculture	13	15.3
	Fisheries	11	12.9
	Veterinary Services	9	10.6
	Others	5	5.9
Function	Project Engineer	2	2.4
	Project Coordinator	21	24.7
	Program Coordinator	35	41.1
	Project Manager	8	9.4
	Others	19	22.4
Membership in professional association	Yes	8	9.4
	No	77	90.6
Project Management/ Monitoring Experience	3 years or less	36	42.4
	4-6 years	23	27.1
	7-9 years	20	23.5
	10 years or more	6	7.0
PMS II experience	3 years or less	44	51.8
	4-6 years	24	28.2
	7-9 years	13	15.3
	10 years or more	4	4.7

As can be observed from Table 4.4, from the gender and education level perspectives, both genders were quite evenly represented and the majority of the

respondents hold a bachelor's degree or higher qualification (70.9%). In terms of profession area, 37.6% of the respondents were from the management group while the remaining 62.4% was spread among other professional areas namely engineering (17.6%), agriculture (15.3%), fisheries (12.9%), veterinary services (10.6%) and others (5.9%). This indicates that the PMS II user's spectrum is varied with a near 40:60 ratio proportion represented between the management and other profession areas.

With regards to the user's function, less than half of the respondents (41.2%) assumed the responsibility as program coordinators. These program coordinators were normally officers who are in-charge of the macro level coordination of programs for each division, departments and agencies under MoA. In terms of affiliation with professional bodies, 9.4% of the respondents were members of professional association, particularly the Board of Engineers of Malaysia (BEM), Institute of Engineers Malaysia (IEM) and the Veterinary Association of Malaysia (VAM). Close to half of the participants had minimum project management/ monitoring experience of 3 years or less (42.4%) and slightly more than half (51.8%) had been using PMS II for 3 years or less.

In general, it can be concluded that the demographic data of the respondents suggest a wide ranging user background and characteristics. This provides an interesting opportunity to conduct further assessment on the effectiveness of the system usage.

4.4.2 Descriptive Statistics for the Variables Studied

The instrument for this research is survey questionnaires which used Likert Scale with scale ranging from "1" to "4" to measure the independent and dependent variables

studied. The use of a four-point Likert Scale was to eliminate 'uncertain' answers from the respondents. Furthermore, as the targeted population was actually the users PMS II themselves, which are deemed to be familiar with the system, coupled with the fact that the system usage is mandatory in nature, 'uncertain' option is thus considered less appropriate for this study. Table 4.5 summarizes the mean, standard deviation, minimum and maximum values of all the variables.

Table 4.5
Mean, Standard Deviation, Minimum, and Maximum of System Effectiveness, System Quality, Information Quality and Service Quality (n = 85)

Variables	Mean	SD	Minimum	Maximum
SysE	3.01	.58	1.00	4.00
SysQ	2.96	.54	1.29	4.00
InfoQ	2.84	.54	1.00	4.00
ServQ	3.02	.59	1.75	4.00

Note: SysE = System Effectiveness, SysQ = System Quality, InfoQ = Information Quality, ServQ = Service Quality
1 = Strongly Disagree, 2 = Disagree, 3 = Agree, 4 = Strongly Agree

The standard deviation describes the spread or variability of the sample distribution values from the mean, and is perhaps the most valuable index of dispersion (Hair et al., 2007). If the estimated standard deviation is large, the responses in a sample distribution of numbers do not fall very close to the mean of the distribution. On the opposite, if the estimated standard deviation is small, the distribution values are close to mean (Hair et al., 2007). In other words, if the estimated standard deviation is smaller than 1, it means the respondents were very consistent in their opinions, while if the estimated standard deviation is larger than 3, it means that there were a lot of variability in the opinions of the respondents (Hair et al., 2007).

In general, all the variables had moderate mean values between 2.84 (InfoQ) and 3.02 (ServQ). The mean for the dependent variable SysE (3.01) indicated that most of the respondents perceived PMS II to be effective in terms of its impact towards successful project execution. Also, the standard deviations for all variables were less than 1.00, which indicated that the variations on the participants' opinions were minimal.

4.5 Correlation Analysis Results

The Pearson correlation analysis was conducted to identify the relationship between the independent variables and the dependent variable. According to Sekaran and Bougie (2009), correlation analysis is the statistical analysis to measure the degree of the relationship between independent and dependent variables. The results of correlation analysis in Table 4.6 present the summary of relationships between the independent variables and dependent variables.

Table 4.6
Correlations between Variables System Quality, Information Quality, Service Quality and System Effectiveness

	SysE	**SysQ**	**InfoQ**	**ServQ**
SysE	*1.00*			
SysQ	0.454**	1.00		
InfoQ	0.657**	0.637**	1.00	
ServQ	0.576**	0.680**	0.529**	1.00

Note: SysE = System Effectiveness, SysQ = System Quality, InfoQ = Information Quality, servQ = Service Quality
***Correlation is significant at the 0.01 level (2-tailed)*

Generally the correlation analysis results indicated that all independent variables have significant relationship with the dependent variable. Both information quality and

service quality demonstrate high correlation with system effectiveness while system quality shows a moderate correlation level with the dependent variable. The highest correlation between all independent variables was r=.680 (p<.01) between system quality and service quality. In addition, the highest correlation in the correlation matrix between the independent variables and dependent variables was r=.657 (p<.01) between information quality and system effectiveness.

4.6 Multiple Regression Analysis Results

After ascertaining there were correlation between system quality, information quality and service quality with system effectiveness, it is beneficial to further investigate the factors that contributed and could explained variance in the dependent variable. In order to achieve this, multiple regression analysis was conducted. Results of the analysis are shown in Table 4.7, 4.8 and 4.9.

Table 4.7
Model Summary

	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.718[a]	.516	.498	.40766

a. Predictors: (Constant), ServQ, InfoQ, SysQ
b. Dependent Variable: SysE

Table 4.8
ANOVA Table

	Sum of Squares	df	Mean Square	F	Sig.
Regression	14.360	3	4.787	28.803	.000[a]
Residual	13.461	81	.166		
Total	27.822	84			

a. Predictors: (Constant), ServQ, InfoQ, SysQb. Dependent Variable: SysE

The results in Table 4.7 shows that the correlation value, R, between all the independent variables and the dependent variable is .718, which can be interpreted as having a very high relationship. The R Square value, which explained the variance among the studied variable is .516. In addition, Table 4.8 shows that the F value of 28.803 which is significant at 0.0001. The significant F-test result suggested that the relationship between the dependent variable and the independent variables was linear and the regression model could significantly predict the variances in the dependent variable. Therefore, it is suffice to conclude that 51.6% of the variance in system effectiveness could be significantly explained by the independent variables namely; system quality, information quality and service quality.

Identification of the most important predictors of system effectiveness was done through the assessment of the significant Standardized Beta Coefficient value of each independent variable. The coefficient value for each variable is indicated in Table 4.9.

Table 4.9
Coefficients Table

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	.700	.277		2.528	.013		
SysQ	-.181	.126	-.169	-1.433	.156	.431	2.318
InfoQ	.588	.108	.554	5.446	.000	.577	1.733
ServQ	.390	.105	.397	3.717	.000	.523	1.913

a. Dependent Variable: SysE

Table 4.9 shows that the independent variable that has the highest Standardized Beta Coefficient value is information quality (0.554) with a significant level of 0.0001. This suggests that among the three independent variables, information quality is the strongest predictor of system effectiveness and any changes in information quality will have the most impact on the variance of system effectiveness. It could also be observed from the table that the Tolerance value of all the variables were $p>0.10$ and VIF value of less than 10, thus suggesting that the studied variables did not have issues of multicollinearity.

4.7 Hypotheses Testing Results

As discussed in the previous chapter, three hypotheses had been developed for this research. The hypotheses were designed to answer the questions on PMS II effectiveness and the determinants that contributed to its success. Based on the regression analysis that had been conducted, the hypotheses testing results are summarised as follows:

Table 4.10
Summary of the Hypotheses Testing Results

No.	Hypotheses	Results
1.	There is a significant relationship between system quality and the effectiveness of PMS II.	Supported
2.	There is a significant relationship between information quality and the effectiveness of PMS II.	Supported
3.	There is a significant relationship between service quality and the effectiveness of PMS II.	Supported

4.8 Summary

This chapter had outlined the results of data analysis conducted on the 85 responses received from the survey. The results indicated that PMS II users at MoA generally agreed that the system is effective towards successful project implementation. The independent variables namely; system quality, information quality and service quality were shown to have significant relationships with system effectiveness. In addition, it was also found that information quality had the strongest influence that contributes to the variance in system effectiveness. Overall, 51.6% of the variance in the dependent variable could be attributed by the three independent variables in the regression model.

CHAPTER 5

DISCUSSION, RECOMMENDATIONS AND CONCLUSIONS

5.1 Introduction

This chapter presents the discussion on the findings of the research. Focus is given on answering whether the research questions, objectives and hypotheses developed earlier had been satisfactorily answered based on the results presented in Chapter 4.

5.2 Summary of the Research

The main purpose of this study is to investigate the relationship between system quality, information quality and service quality with system effectiveness. Multiple regression analysis was conducted to test the research hypotheses. Results of the analysis revealed that both information quality and service quality were positively related to system effectiveness. On the other hand, a less significant negative relationship was found between system quality and system effectiveness.

5.3 Relationship between Information Quality and System Effectiveness

As can be observed from the results of the multiple regression analysis, information quality had the strongest influence in the direction of the dependent variable, system effectiveness. The results supported earlier findings by Bakens and Caniels (2012), that information quality strongly influenced PMIS effectiveness by way of its

impacts at organizational and individual level. This is coherent with the reality, whereby the main reason for having a PMIS is to support the management and monitoring activities of projects and programs. PMIS offers a systematic way of information collection, management and distribution. Making quality information available to the respective PMIS users offers a better decision making capability which in turn can be translated to the success in project implementation (Bakens and Caniels, 2012).

From this finding, it is clear that future procurement of new system or upgrading legacy PMIS should focus on providing a platform that advocate better information gathering, validating and dissemination of information capabilities in PMIS.

5.4 Relationship between Service Quality and System Effectiveness

The study also found service quality to have a significant relationship in the direction of system effectiveness. This supported the findings by Lee and Yu (2012), whom postulated that service quality is one of the important determinant that influence the effectiveness of PMIS and its success. For the system owner/ operator, the result implied that users of PMS II perceived service quality as important factor towards the effectiveness of the system. This is logical given the mobility of PMS II users that frequently occur. As in many government ministries, departments and agencies, the changes of person-in-charge, staff or officers is a common occurrence. Some of these officers might not be very familiar with PMS II. Therefore, any steps to improve the effectiveness of the system should also take look into the ways of providing improved

service quality to the users especially in terms of responsiveness, assurance, empathy, and providing proper user's guideline.

5.5 Relationship between System Quality and System Effectiveness

Among the three independent variables, only system quality demonstrated a less significant relationship with system effectiveness. Moreover, the relationship is not in the direction of the dependent variable. The result concurred with previous research by Li and Yu (2012), suggesting that maintaining a certain level of system quality operation is desirable to ensure performance of basic system function. However, an upgrade on the aspects of system quality alone might not be sufficient in enhancing the overall effectiveness of PMS II.

5.6 Research Implications/ Contributions

The contribution of this research lies in the opportunity of understanding the suitability of the adaptation of the antecedents in the ISSM model in assessing system effectiveness. Consequently, the study also offers insights on the factors that are important for the effectiveness of PMIS implementation, especially in the context of public projects execution. The findings in this study suggested that information quality, service and system quality are important predictors towards system effectiveness.

This research helps to further understand what could transpired into effectiveness of PMS II and subsequently on successful project execution. The result demonstrated that PMS II have a significant impact on successful project implementation. This is in

tandem with findings by Raymond and Bergeron (2008), who suggested that PMIS is significant towards project manager performance and project success through the improvement of budget control and meeting project deadlines as well as fulfilling technical specifications.

5.7 Limitations and Direction for Future Research

Due to the limitations in terms of time, resources and accessibility, the researcher only managed to conduct the study on PMS II users in MoA. Ideally, a cross sectional study covering all the PMS II users in all the ministries would provide a more comprehensive representation on the success of the system and also the contributing factors that affect its effectiveness. Thus, future research should be designed to include all the ministries, with the main idea of broadening the sample base and coverage.

As stated earlier, PMS II is a project management information system that offers information mobility from the front liners i.e. project managers and program managers up to the highest respective decision-making authorities. Progress reports of projects and programs generated from PMS II are tabled monthly in high level meetings at all the ministries. However, it is not clear how far information generated from PMS II is really taken into consideration by the authoritative decision making parties. This is an interesting angle to be studied as it would provide some insights on the extent and influence of PMS II towards decision making process.

5.8 Conclusion

As the main project monitoring and management information system for public sector projects and programs in Malaysia, PMS II plays an important supporting role in ensuring the success of the development carried out by the government. The findings of this research suggested that PMS II is being perceived to be an effective system by its users. Effectiveness of a system could be attributed to a number of factors. The factor that had the most influence as highlighted in this research is the information quality input into the system itself. Hence, to further strengthen the effectiveness of PMS II, continuous assessment and improvement efforts should very much be focused on the enhancing the quality of information in terms of accuracy, timeliness, concise and up-to-date information to be input into PMIS. In similar vein, service and system quality should not be overlooked in new system development to enhanced overall effectiveness of PMIS.

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