STUDY OF TECHNOLOGY ACCEPTANCE OF COMPUTERIZED MAINTENANCE MANAGEMENT SYSTEM (CMMS) AS A TOOL FOR MEASURING CONTRACTOR'S PERFORMANCE: A CASE STUDY OF PUBLIC WORK DEPARTMENT, PUTRAJAYA.

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ABSTRACT

Knowing the level of user acceptance of the information system specialized in the management of government building facilities is needed to ensure a better level of service and management. One of the popular models used to know the level of acceptance of a system is Technology Acceptance Model 3 (TAM3). Model Acceptance Technology 3 (TAM3) is the latest TAM product enhanced by Viswanath Venkatesh and Hillol Bala in 2008 and the most widely used has proven forecasts in the use and use of information technology. This model describes users behavioural intention was influenced by their perceived usefulness and perceived ease of use of a system. The purpose for this research is to know level of eSPFB acceptance that lead to actual use of it among the supervisory team group in monitoring the performance of the facility management contractor who manages government building facilities in the Federal Territory of Putrajaya. Measurement of this acceptance stage is measured using TAM3. A total of 18 variables identified in this model will test which factor demonstrate the level of acceptance the most and identify the relationship of variables in TAM3 model. A list of barriers from 4 groups of barrier in eSPFB implementation were listed and respondents were asked to choose their level of agreement toward the barriers. Finally, a relationship between barriers and acceptance variable factors were identified. Research was conducted by distributing questionnaire to the target group of supervisory team at the Public Works Department, Putrajaya, and to Facility Managers and their engineers. Samples selected with random sampling are calculated 55. The data analysis method uses IBM SPSS 23. The result showed that, using eSPFB would enhance respondents job performance, the target system is applicable to their job and have the intention to continue using eSPFB. From 18 hypotheses designed, there are only 4 correlation significance relationship established. Output quality has negatively influence perceived usefulness. Computer playfulness has positively influence perceived ease of use but objective usability has

negative influence on perceived ease of use. Perceived usefulness is positively influence perceived ease of use. Top 6 eSPFB implementation barriers has been highlighted; lack of in-house expertise in using eSPFB, poor training in the use of the system, resulting in a reluctance to input data, poor training in understanding the need for data, lack of interaction and communication between departments which cause delay toward certain jobs, poor communications and alignment with, and mismanagement of, external resources such as consultants and vendors and inadequate resources assigned to the project were identified. In this study, the relationship between the barriers of eSPFB implementation with TAM3 variables were identified. There is a significance relationship between barriers in system usage with subjective norm, use, computer self-efficacy and perceived external control, barriers in vendor support with perceived usefulness perceived external control, subjective norm, job relevance, output quality, image, behavioral intention and use. While for category if people barriers, there is only one negative relationship found with computer playfulness. There is no relationship found between organization with behavioral intention and use variables.

ABSTRAK

Mengetahui tahap penerimaan pengguna sistem maklumat khusus dalam pengurusan fasiliti bangunan kerajaan adalah penting untuk memastikan tahap perkhidmatan dan pengurusan yang lebih baik. Salah satu model popular yang digunakan untuk mengetahui tahap penerimaan suatu sistem adalah Model Penerimaan Teknologi 3 (TAM3). Model Penerimaan Teknologi 3 (TAM3) adalah produk Model Penerimaan Teknologi (TAM) terkini yang dipertingkatkan oleh Viswanath Venkatesh dan Hillol Bala pada tahun 2008 dan yang paling banyak digunakan telah ramalan terbukti dalam penggunaan dan penggunaan teknologi maklumat. Model ini menggambarkan tingkah laku niat pengguna telah dipengaruhi oleh persepsi kesenangan penggunaan dan persepsi berguna. Tujuan kajian ini adalah untuk mengetahui tahap penerimaan eSPFB yang membawa kepada penggunaan sebenar di kalangan kumpulan pemantau dalam memantau prestasi kontraktor pengurusan fasiliti yang menguruskan fasiliti bangunan kerajaan di Wilayah Persekutuan Putrajaya. Pengukuran tahap penerimaan ini diukur menggunakan TAM3. Sejumlah 18 pembolehubah yang dikenal pasti dalam model ini akan menguji faktor mana yang menunjukkan tahap penerimaan oleh responden dan mengenal pasti hubungan pembolehubah dalam model TAM3. Satu senarai halangan dalam implementasi eSPFB sari empat (4) kumpulan halangan implementasi telah disenaraikan dan responden diminta untuk memilih tahap persetujuan mereka terhadap halangan yang dihadapi. Akhir sekali, hubungan antara halangan dan faktor pemboleh ubah penerimaan telah dikenalpasti. Penyelidikan dijalankan dengan mengagihkan borang soal selidik kepada kumpulan sasaran pasukan pemantau di Jabatan Kerja Raya, Putrajaya, dan kepada Pengurus Fasiliti dan jurutera mereka. Sampel yang dipilih dengan pensampelan secara rawak adalah sebanyak 55 orang. Kaedah analisis data menggunakan IBM SPSS 23. Hasilnya menunjukkan bahawa, dengan menggunakan eSPFB akan mempertingkatkan prestasi kerja responden, sistem yang digunakan menerapi sasaran pekerjaan responden

dan responden mempunyai niat untuk terus menggunakan eSPFB. Dari 18 hipotesis yang direka, hanya terdapat 4 hubungan hubungan korelasi yang dikesan. Kualiti output mempunyai pengaruh negatif terhadap persepsi berguna. *"Computer playfulness"* mempunyai pengaruh positif terhadap persepsi kesenangan penggunaan tetapi objektif kebolehgunaan mempunyai pengaruh negatif terhadap persepsi kesenangan penggunaan. Persepsi berguna secara positif mempengaruhi persepsi kesenangan penggunaan. Enam halangan teratas dalam implementasi eSPFB telah diketengahkan iaitu kekurangan kepakaran dalam menggunakan eSPFB, latihan yang lemah dalam penggunaan sistem, menyebabkan keengganan untuk memasukkan data, latihan yang lemah dalam memahami keperluan data, kekurangan interaksi dan komunikasi antara jabatan yang menyebabkan kelewatan terhadap pekerjaan tertentu, komunikasi dan penyelarasan yang lemah, dan salah urus, sumber luar seperti perunding dan vendor dan sumber yang tidak mencukupi terhadap kepada projek telah adalah halangan yang dikenalpasti. Dalam kajian ini, hubungan antara halangan implementasi eSPFB dengan pembolehubah TAM3 telah dikenalpasti. Terdapat hubungan yang signifikan antara halangan dalam penggunaan sistem dengan norma subjektif, penggunaan, efikasi kendiri, dan persepsi kawalan luaran. Halangan dalam sokongan vendor dengan persepsi berguna, persepsi kawalan luaran, norma subjektif, relevansi pekerjaan, kualiti output, imej, niat tingkah laku dan penggunaan. Bagi kategori halangan orang, terdapat hanya satu hubungan negatif yang ditemui dengan "*computer playfulness*". Tiada hubungan yang dikesan di antara halangan organisasi dengan mana-mana pemboleh ubah niat tingkah laku.

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CHAPTER 1: INTRODUCTION

1.1 Introduction

As we live in the information era, a massive measure of information is promptly accessible through computers, which are associated through rapid information communication systems, for example, the Internet, Wide Area Networks (WANs), and Local Area Networks (LANs). The fast rate of progress in the business world has constantly pushed the requirement for innovations and acknowledgment of these advancements at a quickening rate. The new innovation and technologies are empowering organizations to be uniformed, arranged, and more adaptable.

Organizations in the 21st century unavoidably make generous interests in Information Technology (IT) with a specific end goal to accomplish upper hand, by spending enormous wholes of cash on computer hardware, programming software, communication systems, databases and particular work force. Thus, Information Technology isn't just normally found in the working environment, however has likewise turned out to be unavoidable in the home and public spaces.

Twenty years prior, the use of information technology (IT) in business conditions was still in a development period. Therefore, the attention on expanding general acknowledgment and acceptance of IT was understandable and significant. Be that as it may, in the innovation and technology privileged conditions of today, this issue is generally old fashioned – managers and information technology laborers must use innovation and technology keeping in mind the end goal to improve their day by day business. Almost every business expert of today has, enthusiastically or not, embraced

IT. A basic part of Information Technology (IT) acceptance in general and Information Systems (IS) specifically, is to locate the vital fit between the way an organization carry out its business and the innovation chose to help in its implementation.

It is contend that the concern of the study ought not be whether they embrace innovation, but rather how they use it to take care of business.

1.2 Problem Statement

Throughout the duration of using Maintenance Information System and CMMS as a requirement stated in series Government Facility Management and Facility Contract by Jabatan Kerja Raya (PWD) of Malaysia there are issues was highlighted. In previous time of those contracts, before 2016, there are no specific unit to monitor CMMS used by outsourced Facility Management contractors and that caused many issues. For example, due to the existence of various functions and requirements of the building and its occupants, the performance of the building is also measured using different criteria although these buildings are bound to the same facility management contract. These criteria are set and processed by different supervisory teams, according to each monitoring zone (Sapari, 2016). This makes it difficult for contract administrators to monitor and supervise contracts to for example; for benchmarking purposes, controlling costs or determining the future direction of the contract. A vendor might be paid too much for work performed or paid for work never conducted. By the end of 2015, after years of using multiple brands of CMMS, the top management of PWD especially the contract administrator team has identified the key issues as below (Sapari, 2016) :

a) There are too many CMMS software used (eg; Archibus, Cworks, TOMs, Axicom, etc.)

b) Specifications and modules are not uniform

c) Inconsistent cost

d) Scattered CMMS server infrastructure

e) Data ownership and application are not clear

f) Government data security concern

g) Longer learning curve to the supervising team and to the contractors

In order to overcome these CMMS issues, *Bahagian Pengurusuan Aset Bersepadu*, PWD HQ decided to develop a new system where it is believed to become more robust, user friendly, effective, consistent data and cost it is standardize practices and formats across contractors who were enshrined in Goverment FM Contract. The system is called *"Sistem Pengurusan Fasiliti Bersepadu"* or eSPFB (Jabatan Kerja Raya Malaysia, 2017).

However, since it was introduced in late 2016, only twenty-four facility management contractors identified were using eSPFB throughout Malaysia from hundreds of government buildings managed and monitored by the PWDs. In Putrajaya alone, only twelve contractors use the eSPFB system (Sapari, 2016). PWD Putrajaya is a department that manages federally owned facilities at the national administrative center which makes them an individual government division with one of the world's huge asset under administration. The maintenance of these facility were outsourced to more than 50 isolate maintenance contractor (CWorks, n.d.).

Tuan Haji Sulaiman b Md Yusof, mentioned in his presentation at "Seminar Pengurusan Fasiliti Sektor Awam 2016", that any software, applications or systems developed, takes years to evolve" (Yusof, 2016). In the Information Systems field, a crucial field of research is focused on technology acceptance. Agarwal & Prasad, (1999) believes that "acquiring appropriate IT is a necessary but not sufficient condition for utilizing it effectively". In this way, it has been noticed that user's engagement

perspective toward and acceptance of another innovation or information system critically affect effective information system adoption (F. Davis, 1989; Succi & Walter, 1999; Venkatesh & Davis, 1996) as cited in (Ambali & Bakar, 2014).

Davis (1989) asserted that a technology that was observed to be less demanding to use than another will probably be acknowledged or accepted (Lee, Yu, & Jeong, 2015).

The use of this system is still in its early stages and many plans will be implemented to improve this system. Changes in technology that are constantly changing and growing rapidly even more so in the future, challenges in implementation will also increase. It is therefore crucial for PWD who developed and monitor the system execution process to comprehend the elements that prompted the effective usage and high utilization habits among supervisory teams in monitoring the performance of FM contractors involved.

1.3 Aim and Objectives

The aim of this study is to increase the behavioral intention to use eSPFB as a tool for measuring FM contractor's performance, adopted from TAM3 model.

The following are the **three (3) main objectives** are identified in this research:

a) To identify the effective factor that leads to behavioral intention of eSPFB usage; derived from TAM3 model.
b) To determine the barriers that influence the use of eSPFB in measuring FM contractor's performance.
c) To establish the relationship of barriers with variable factors of behavior intention and usage of eSPFB.

The study was aimed to answering these question;

a) What are the factor that influence user acceptance towards eSPFB application?

b) What are the barriers that user encountered in eSPFB implementation?

c) What are the relationship between the barriers encountered in eSPFB implementation with variable factor of technology acceptance based on TAM 3 model?

1.4 Scope and Limitations

In light of the research question and objectives, the extent of the research work is limited to;

a) The research is conducted on the usage of eSPFB by Putrajaya PWD only.

b) To focus on the use of eSPFB in measuring FM contractor's performance based on PWD performance requirement.

c) To conduct assortment and acquiring data from the team that supervised Facility Management contractors in Putrajaya's government building.

d) To execute research, analysis and evaluation of the particular supervising team derived from the appointed research methodology.

While the limitations of the research are;

1. The research area is focused to Malaysia and Malaysian Facility Mangament companies in Putrajaya only.
2. The FM contractors are using eSPFB and currently provide Facilities Management Services in government building in Putrajaya.
3. The organizations' identification should be kept secret all through the span of the research and report

1.5 Research Methodology

The study will be divided into 3 phases to identify the technology acceptance factor by the supervisory team at PWD Putrajaya on the eSPFB system.

Phase 1: literature review are conducted to gain greater understanding of the study and theories regarding the use of ICT in the management of facilities, performance measurement and the acceptance of technology. The results of this study will be used to design questionnaires.

Phase 2: selection of case studies. 55 respondents were selected from government agency offices in PWD Putrajaya, facility managers, engineers and contract administrators to answer questionnaire questions

Phase 3: confirmatory phase through questionnaire survey.

1.6 Chapter outlook

The report contains six chapters, where the first chapter covers the introduction of research topics, study backgrounds, problem statements, research questions, and research objectives. The second chapter contains topics related to the management of facilities in the public sector, the use of ICT in facility management, computerized maintenance management system, performance measurement, case study background and technology acceptance theory. Whereas, the methodology of the study is discussed in detail in the third chapter. Questionnaire analysis was further elaborated in four. The fifth chapter contains the entire discussion of the findings. Finally, conclusions and recommendations to the parties are also included in the fifth chapter. The conclusions of the study will be included in chapter six.

CHAPTER 2: LITERATURE REVIEW

2.1 Facility Management of Building in Public Sector in Malaysia

Facilities Management and Maintenance of government buildings is important to minimize disturbance or hindering the services of government agencies involved in operating in a government building. The administration of each government office is essential comprehend the significance, ideas and strategies of how best maintenance can be utilized as their very own part premises or building offices. With the learning and expertise of maintenance needs it will permit the leader of the offices to make accurate planning in terms of business operations, costs, finances, customer satisfaction requirements and achievement of objectives and better organizational performance.

Government buildings are all government-owned buildings used for many purposes such as office, Army camps, schools, centers, lodges, quarters, and others. Government structures are given by the Government and are given over to their separate Departments, for example, school structures and universities to the Ministry of Education, army camps to Ministry of Defense, hospital buildings, wellness centers to the Ministry of Health, police headquarters structures to the Ministry of Home Affairs, and others.

In Malaysia, the concept of internal sourcing for facility management is broadly carried out on privately or privately owned buildings, while outsourcing is carried out in most public-owned buildings or governments and is currently in almost all buildings. According to Mohanta & Das, (2015) around 70 % of the institution utilizes outsourcing approach for FM. Nonetheless, the rational motive for choose outsourcing are (1) cost saving;(2) adjust to inconsistency of work; (3) way to deal with enhanced great skills; (4) enables the organization to concentrate on the primary business; and lastly (5) the degree

of facilities can be secure, which can't be achieve if there should be an occurrence of in-house sourcing.

In the concept of outsourcing, the owner of the building will appoint a qualified company to implement the facility management. The process of outsourcing must be carried out professionally by competent contractor. It is important to understand the background in detail the facility management company, as it will affect the operation to be carried out. Short-term or long-term contracts will be awarded to qualified facility management companies. Often short term contracts offer less than contract 5 years while long term contracts exceed 5 years. In 1974, the Malaysian government has issued circulars in respect of the maintenance of public buildings, public roads, sewerage systems have been placed under the responsibility of Public Work Department (PWD) atau "Jabatan Kerja Raya or JKR" (Mahmud, 2016).

The government takes a serious view on the issue of management and maintenance of public assets that can jeopardize the government's reputation in serving the people. Therefore, the government has taken the initiative to overcome it in relation to establishing a government asset management committee or *"Jawatankuasa Pengurususan Asset Kerajaan"* (JPAK) at the central level. JPAK is committed to defining direction, policy and asset management guidelines for all government agencies

According to Mahmud (2016), the Malaysian government has launched Government Asset Management Policy or *"Dasar Pengurusan Aset Kerajaan"* (DPAK) where this policy explains the direction, principles and strategies of asset management that each government agency has to comply with. The rationale for this policy is that the government has spent a considerable amount of money in providing various facilities to improve the standard of living of the people. Assets are an important instrument for the

provision of services provided either directly or indirectly. Comprehensive and integrated asset management including planning, creation, utilization, maintenance, inspection, disposal and eradication should be undertaken to ensure that the assets are in a state of perfect, safe use, economical use and a longer life expectancy.

One strategy set out in the DPAK is the *"Pengurusan Aset Menyeluruh"* approach. It emphasizes on systematic and holistic management of government auspices to achieve optimal asset benefits. *Manual Pengurusan Aset Menyeluruh (MPAM)* provided for guidance by all Ministries or Departments in the implementation *"Pengurusan Aset Menyeluruh"*.

2.1.1 Roles and Responsibilities

In the management of government building facilities has established the policy that the duty of the maintenance of government buildings is under the leaders of their particular divisions as expressed in Government General Order *(Perintah Am Kerajaan - (P.A.))*. The responsibility of the PWD is to inspect Government buildings according to *Perintah Am Bab E Klausa 27* mentions:

> *"Adalah menjadi kewajipan JKR untuk memeriksa semua rumah dan bangunan Kerajaan dalam tiap-tiap daerah setahun sekali dan membaikinya sebagaimana yang diperlukan."*

While *Klausa 32* mentions;

> *"Tiap-tiap bangunan atau rumah kerajaan hendaklah diberi nombor oleh JKR."*

The Public Works Department is entrusted as a governing body to the implementation of DPAK and MPAM. MPAM clarifies specific responsibilities and practices in

accordance with asset liability such as land assets, infrastructure assets, buildings and special movable assets, movable assets and live assets. Enforcement of the implementation of MPAM is accountable to agencies in accordance with the respective asset specialization as follows;

a) Mobile Assets and Live Assets - Accounted to the Ministry of Finance.
b) Infrastructure and Building Assets - Assigned to the Public Works Department.
c) Land Assets - Assigned to the Director General of Land and Mines.
d) Infrastructure Assets (Sewerage) - Assigned to the Ministry of Energy, Water and Communications.
e) Infrastructure Assets (Irrigation and Irrigation - Responsible for the Department of Irrigation and Drainage.

2.2 Information System

A data framework (IS) is a composed framework for the gathering, arranging, stockpiling and transmission of data. It is the data and information and communication technology (ICT) that an association utilizes, and furthermore the manner by which individuals incorporate with this innovation in help of business operation.

Information system concept has three (3) main component named; data, information and information system. Data are usually raw, unprocessed facts, including text, number, image and sound. It is not organized and might or might not be important or beneficial to use. Information however is organized data and it is valuable and meaningful to a specific user (Kroenke, 2015).

There are six elements that must merge in order to make an information system. They are hardware, software, data, procedures, people, and feedback. These components are in collecting data, process them and provide information. Hardware can be describes

machinery or as the equipment that processes data to create information. It includes the computer itself and all it support devices. Software refers to computer program with series of instructions that tells a computer what to do (Kroenke, 2015). Computer programs are machine-intelligible command that direct the hardware inside the equipment parts of the system to work in ways that create helpful information from raw data. Information are actualities that are utilized by projects to deliver helpful information while procedures are the protocol that control the operation of a computer system. People is anyone who communicate with computer or utilizes the information generated. Each system needs individuals in the event that it is to be helpful. Frequently the most neglected component of the system are the users, presumably the segment that most impact the achievement or disappointment of an information system. This incorporates "the clients, as well as the individuals who work and repair the computer, the individuals who maintain the information, and the individuals who bolster the network of computer (Kroenke, 2015).

Pearlson & Saunders,(2010) defined Information system (IS) all the more comprehensively as the blend of innovation (the "what"), people (the "who"), and process (the "how") that an organization uses to produce and manage information. At the point when many people utilize the phrase information system, they really allude just to the technology component as characterized by the organisation structure. The term structure alludes to everything that support the stream and preparing of data in an organisation, including hardware, software, information, and system components, while engineering alludes to the procedure verifiable in these components.

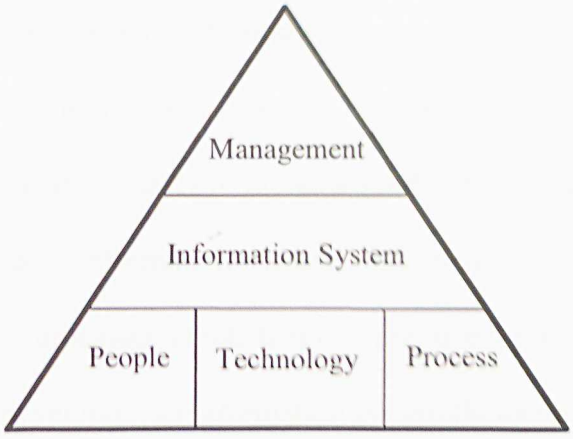

Figure 2.1 System hierarchy by Pearlson & Saunders, (2010)

In contrast, information technology (IT) concentre only on the technical equipment and tools used in the system. Supra the information system it is management, which administrate, create and form of the system and observe its general performance. Management create the operation need and the organization strategy that the information system is meant to fulfil.

2.2.1 Purpose of Information System

Any specific information system aims to support operations, management and decision-making. Reports, presentations, and reactions delivered by management information systems give data that these decision maker have indicated ahead of time as sufficiently meeting their data needs. Such predefined data items fulfill the data needs of decision makers at the operational and strategic levels of the organisation who encountered with more structured sorts of decision circumstances.Managers and other leaders utilize a MIS to ask for data at their arranged workstations that support their bdecision-making activities. This data appears as intermittent, exception, and demand reports and quick reactions to request. Web programs, application programs, and database management software give access to data in the intranet and other operational databases of the organisation. (Marakas & O'Brien, 2013).

2.2.2 Development of Information System

Quality information can be realized from the design of a good information system. Large companies even invest resources to increase productivity through the provision of sophisticated applications in information systems. Information systems themselves are formed from processed or processed inputs that will produce informational output. There is a process involved in developing an information system (Schneider & Sarker, 2006). It is a traditional process used to develop information systems named systems development life cycle (SDLC) is the. Numerous early projects met with tragedy, and organizations and system developers filtered through the fiery debris of those catastrophes to figure out what turned out badly. By the 1970s, most experienced project managers concur to the fundamental duty that should be performed to effectively built and maintain information system. These fundamental duty are consolidated into periods of system development (Kroenke, 2012). Below are the five stages process in developing an information system;

a) System definition
b) Requirements analysis
c) Component design
d) Implementation
e) Maintenance

Figure 2.2 shows how these stages are connected. Evolution starts when a business arranging process distinguishes a requirement for an information system.

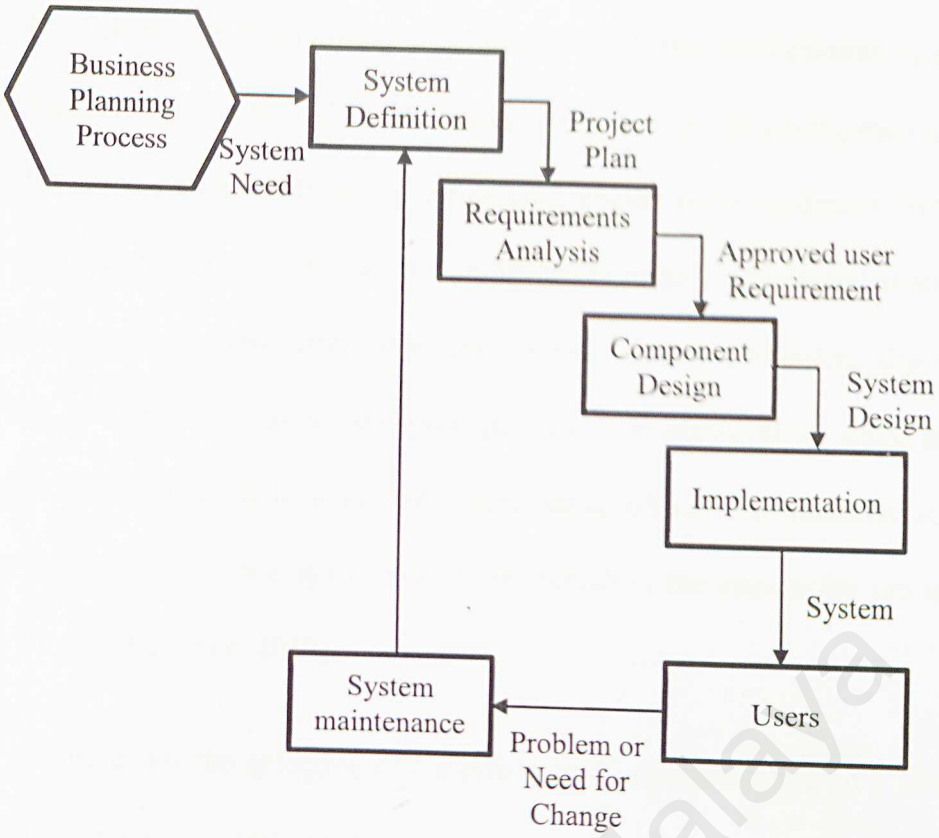

Figure 2.2 Phase in the SDLC by Kroenke, (2012)

Developers in the main SDLC phase, system definition—utilize management's point of views of the system needs, keeping in mind the end goal to start to describing the new system. This is where the organization will assign few employees to define the new system, to assess its feasibility, and to plan the project. Commonly, somebody from the IS division drives the initial group, yet the individuals from that inital group are the both clients and IS experts. The subsequent undertaking design is the contribution to the second stage—prerequisites examination. Here, developers distinguish the specific highlights and elements of the new system (Kroenke, 2012). The basic role of the prerequisites investigation stage is to decide and record the particular highlights and elements of the new system. For most development projects, this stage requires talking with many clients and recording possibly several prerequisites. In the event that the necessities are resolved totally and accurately, at that point design and implementation will be less demanding and more inclined to bring about results. (Kroenke, 2012).

The yield of that stage is an arrangement of endorsed user prerequisites, which turn into the essential information used to plan system parts. In this part configuration stage is the place the group decide hardware specifications, decide software details, outline the database, plan techniques and create work definitions. In stage 4, developers execute, test, and introduce the new system. After some time, user will discover blunders, slip-ups, and issues. They will likewise grow new prerequisites. The portrayal of fixes and new prerequisites is contribution to a system maintenance phase. The maintenance stage begins the procedure all once again once more, which is the reason the procedure is viewed as a cycle (Kroenke, 2012).

As for example, for the effective development and implementation of CMMS, the well-ordered improvement and execution is necessary, deciding carefully the decision of need subsystems as well as modules, together with coordinating activities amid the feasibility study as per the accessible financial resources, hardware and manpower, maintenance organization, information accumulation and other different elements. The system ought to be outlined sufficiently measured to render the continuous usage possible. (Krouzek, 1987).

2.3 Information and Communication Technology in Malaysia's Public Sector

Ages of individuals before this saw the advancement and revolution of numerous different innovation and technologies, automobiles, planes, radios, TVs, phones. The new age has been at the focal point of the digital revolution. Maybe more than any innovation before, computerized advancements, for example, PCs and the Internet have drastically changed the very texture of how individuals experience their lives. The range of computerized innovations is tremendous and wide. Innovation touches numerous individual life consistently. Similarly thus, advanced innovations have drastically adjusted the focused scene of business (MAMPU, 2001).

Innovation and technologies organizations are in no way, shape or form the main ones inspired by utilizing innovation successfully in the work environment. Each business grapples with management information systems once a day. Comprehensively, management information systems is both a business teach that deals with the utilization of data innovation (IT)— or computers, computer innovation, or essentially innovation— and a scholarly field of study. Innovation and technology is so vital to organizations since we are in the information age, a period when information is powerful. Today, like never before, organizations require information, information technology, and the overarching MIS function to massage, assimilate, and distribute information and knowledge to create and sustain a competitive advantage.. (Haag & Cummings, 2009). Many organisations implement information and communications technology (ICT) systems to improve their business processes and operations, as well as to provide better products and services (Amadi-Echendu & De Wit, 2014).

Information and communications technology (ICT) is a staple of present day living. Malaysia has been concentrating on ICT and keeps on including it as a component of the national motivation since 1996, and, with 20 years of accentuation on ICT, the exertion has kicked in, bringing about colossal achievement (Megat Tajuddin, 2017).

The Government of Malaysia is conferred towards modernizing its managerial apparatus and upgrading its enhancing its service delivery mechanisms. Apart from that, the Government is aiming to transform the quality of their services, improve organisation's productivity, and improve services to their client and also to motivate the workers.The way toward guaranteeing a proficient and powerful public sector is being driven by the empowering capacities of of information and communications technology (ICT).

The use of ICT extends towards the public-centric public service with the overall government approach. The resultant far reaching appropriation of ICT system by people in public sector has implied that more Government agencies are moving towards the paperless workplace where ICT system have turned out to be imperative for the arrangement of Government administrations to its citizens (MAMPU, 2001).

The government of Malaysia has been a strong advocate of ICT spearheading public service delivery. The Government increased its expenditure for ICT related programs and industry from year to year. But the essence, is not how leading edge and innovative the technology is, but more how the technology has enabled us to better serve the people (MAMPU, 2001).

Different computerisation programs have been attempted at the agency level. These incorporate IT infrastructure improvement and update, core business applications and also the computerisation of business operation functions. There are likewise various activities on creating customer facing systems to improve access to Government information and services by means of the Internet, with a couple being more intelligent, enabling citizen and organizations to lead exchanges with the Government. (MAMPU, 2003).

Some ICT key opportunities in the public sector has been identified. These opportunities involve people, processes and technologies. Opportunities against people can enhance the competence and expertise of ICT personnel in line with the advancement of technology and new ICT fields (MAMPU, 2003). It also enhances the efficiency of ICT personnel management including placement, career advancement and professionalism. Opportunities to process can improve the efficiency of managing ICT projects with emphasis on performance measurement and impact and improve ICT

planning and management efficiency at the central agency level as well as ministries or agencies. The emerging opportunities for technology will make it easier for people to access local government services over a variety of digital channels (MAMPU, 2003). Apart from that, it also promotes and enhances the people's involvement in improving government services. Government ICT infrastructure systems can be centralized to promote resource sharing and cost savings. Inter-agency data sharing can also be strengthened to facilitate data analysis.

ICT is perceived as a key empowering influence for the Public Sector to complete its part proficiently and successfully. The Government consequently needs to characterize approaches to use on ICT to change the Public Sector's internal operations and arrangement of Government administrations to the public. This change includes giving the services and information through electronic means on an "anyplace and whenever" basis. It additionally requires the making of a favorable environment, viable back-office forms and consistent front-end combination over the Public Sector to urge citizens and organizations to embrace the new practices (MAMPU, 2003).

In 2016, 10,369, or 77 per cent, of government services were available online. The Public Works Department has contributed to this success, particularly in equipping government buildings with ICT infrastructure. Since its establishment 140 years ago, PWD has progressed beyond being involved in building and infrastructure works to high-technology sectors, such as ICT. The decision to introduce ICT as one of PWD's technical fields of expertise 20 years ago was a commendable one. Transformasi Nasional (TN50) provides another platform for PWD to prove its relevance to accomplishing this national agenda, which aims to transform Malaysia into one of the top 20 nations in economic development, social advancement and innovation by 2050. It is anticipated that by 2050, virtual and augmented reality and the consumption of services via digital platforms, such

as education, healthcare and virtual tourism, will be the new normal (Megat Tajuddin, 2017).

The way people do business in the public service is being challenged today on various fronts, not for providing more and more services, but instead being challenged to making service delivery as accessible and painless as possible to the stakeholders or end-users. Further, stakeholders or end-users are also demanding that the service provided is cost-effective and its delivery seamless.

ICT on its bright side has the ubiquitous power to make time and distance irrelevant making the efficacy of public service delivery that much more befitting of the 21st Century needs. The optimization of the Internet and the World Wide Web has eliminated boundaries and allowed for integrated services to be available 24 by 7 promoting faster and efficient connection between agencies, processes and systems.

It is thus essential beyond measure that in whatever technology that may inspire and implement, must be led by the software parameters of sense and sensibility to the customers. That alone, must define the need for a technology innovation and enhancement. There is not much point in having a NASA equivalent of technology in a place where even literacy is a challenge. The technology must serve a purpose and that purpose must be in service delivery to the stakeholders.

2.4 Information and Communication Technology in Facilities Management

In the global world today, information and communication technology (ICT) is seen as increasingly impacting on competition in service providers industry such as facility management and maintenance. According to Pettit (1983) cited by Zakiyudin et al., (2013), facilities management has been supported by various techniques from manual report forms to computer support systems. Pettit states that, since the early 1970s,

computers have been utilized to assist the maintenance management process, and a generous number of maintenance organizations were using software developed for large centralized computer systems by the mid-1980s. The maintenance and repair information was regularly recorded using a focal computerized database product. The data was then used to produce work schedules and job requests. generators enabled work-in-advance to be checked and statistical management information to be delivered (Zakiyudin, Fathi, Rambat, & Tobi, n.d.).

As Muller, Crespo Marquez, & Iung, (2008) state that, role of information technologies in maintenance has expanded as a result of its part in keeping and enhancing system accessibility and security, and additionally product quality. They discuss an e-maintenance, speaking to the idea of e-maintenance that is across the board today in the industry and alludes to the integration of the data and information and communication technologies (ICT) inside the maintenance strategy and additionally plan to look with new needs rising up from innovate ways for supporting production. (Muller et al., 2008).

Information technology (IT) systems for maintenance management, in the future indicated as maintenance management IT (MMIT), have existed for a very long while. (Kans, 2012). The requests on MMIT has moved from being a device to robotize restorative and preventive maintenance management, such as task scheduling, plant inventory and stock control, to wind up help for prescient and proactive-prescient support by giving constant information handling, powerful correspondence channels and business work combination (Pintelon et al.,1999).

According to Karel, (2012) the key part in the execution of best practice in FM is played by current information systems. The critical and major condition for its most extreme effectiveness is the process-based management of the organization. Every one of

these processes cover a tremendous measure of information which should be filed and grouped by the distinctive criteria covering the necessities of strategic and tactical managerial decisions. The fundamental question for process efficiency management lies with an appropriate software application.

Mahmud, (2016) in her research, highlighted one of the FM contractors readiness element is technology besides people, system and process and governance. She explained that management information system (MIS) software was produced to dissect the building insufficiency information from the physical review, and incorporate it with a wide range of information, for example, spreadsheets, venture monetary models, expenses and computer-aided facilities management programs (CAFM) software. These powerful software, is seen as an essential apparatus for determining and forecasting strategic planning of FM activities for the management.

There are various types of software and systems that assist in the management of facilities and maintenance. These software and systems are either built-in or purchased from software or system developers or vendors. These systems are used at various levels of management within the organization, from levels of physical level, informational levels, to decisional levels.

Ideal FM software is an integrated system that permits the management and operations of all the activities in a complex facility. A single point access to coordinate all the activities needed for the smooth operation of the facility. The management of a building should be tightly integrated with the FM software so that operations of building systems are also possible through the FM interface. Perfect FM software is a united system that allow the management and operations of all the tasks in a complex facility. An individual point approach to organize all the tasks needed for the seamless operation of the facility.

The management of a building should be closely incorporate with the FM software so that operations of building systems are also accomplishable through the FM computer program.

An FM software is a Management Information System (MIS) for facilities managers. It is a repository of information that allows the control and maintenance of the facility. Information stored in the system includes building geometry and properties as well as equipment details. It is also a work flow automation system. It should permit smooth flow of information through various stages of performing tasks related to the management of the facility (Hamid et al., 2013). FM software is picked by the prerequisites of the association to cater the facilities based on the information about land, spaces, assets, services, procedures, expenses, and client necessities.

Among the systems used are Computerised Maintenance Management System (CMMS), Enterprise Resource Planning (ERP), Integrated Information Management System (IIMS) and Computer-Aided Facility Management (CAFM) (Ebbesen, 2015; Hipkint, 1997; Ismail & Kasim, n.d.; Kans, 2013; Levrat, Iung, & Crespo Marquez, 2008; Madritsch, May, & Madritsch, 2009; Platfoot, 2014a; Šlaichová & Maršíková, 2013).

According to Hamid et al., (2013), variation of ICT applications for FM can be categorized into strategic management, building and engineering services, environmental management, domestic services and support services. Basically these application can capture, store, manipulate and transmits data for many services and reports of each category as below;

a) Strategic management –property acquisition, exchange of use, building utilization, hire control, space usage planning, budgetary control, chance management, existence cycle cost appraisal, procurement method, supplier

management, human resource control, post-occupancy assessment, statutory requirement, facilities management strategic planning.

b) Building and engineering services management- data on building usage, premises management, asset management, property records, condition surveys, briefing, budgetary controls, QA plans and reports, service level agreements, specification, service scheduling, performance monitoring, flexible working, teleworking, day-to-day repairs, minor building works, planned preventive maintenance, equipment management, plant management and telecommunications

c) Environmental management - building energy management, health & safety, statutory requirements, utilities and fire safety.

d) Domestic services - security, cleaning, waste/refuse disposal, internal landscape, caretaking, portage, messengers/couriers, post, catering, functions and events, first aid, pest control, car parking, grounds maintenance and transport

e) Administration and service support – office management, legal and insurance affairs, financial management, procurement policies and procedures, contract management, service level agreements, benchmarking, customer feedback, training, reception, room bookings, help desk, ICT management, document record management, reprographics and transportation management.

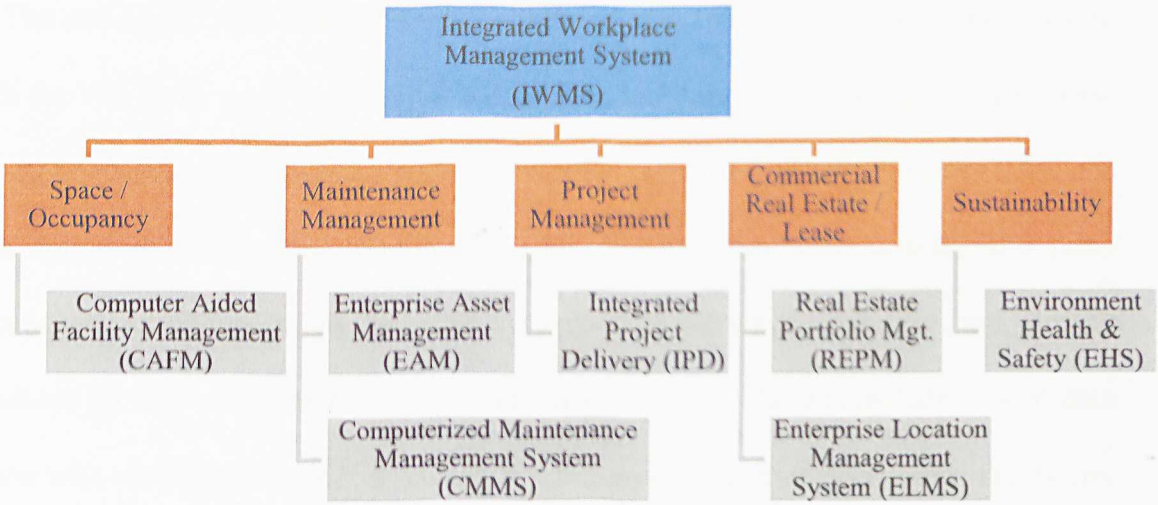

Figure 2.3 Different FM software according to facility management purposes by Mohanta & Das, (2015)

Figure 2.3 recommends the proper innovation according to the facilities management requirement. The FM instruments are valuable up and down the lifecycle of a building. In this study, the FM apparatuses just for maintenance management phase of buildings are considered. The most normally utilized option is computerized maintenance management system (CMMS).

2.4.1 Framework of Information and Communication Technology Utilization in Facilities Management

In 2012, Construction and Industrial Development Board (CIDB) Malaysia had organized a workshop named, *Leveraging ICT Strategy for Malaysian FM* to respond to the challenges of the new environment of fast emerged ICT. At the end of the workshop, the research team came out with a framework on strategic approach of ICT utilization in FM. The proposed framework organized around four entities namely, people, process, environment and infrastructure. In summary, for the most effective utilization of ICT; people should be trained adequately, processes should be defined correctly, infrastructure should support the needs of ICT usage and environment should be ready (Hamid et al., 2013).

The use of ICT involves capturing, storing, manipulating and transmitting relevant data for FM tasks such as property acquisition, building usage, change of use, lease management, space utilization planning, budgetary control, risk management, life cycle cost appraisal maintenance, monitoring and control of building systems and post-occupancy evaluation. Many software systems with varying capabilities are already available for these tasks. Barriers to the adoption of these solutions include lack of man power with adequate skills in ICT, current processes do not permit easy usage of software, lack of IT infrastructure and the non-acceptance of key stake holders. The framework aims to address how these barriers might be overcome (Hamid et al., 2013).

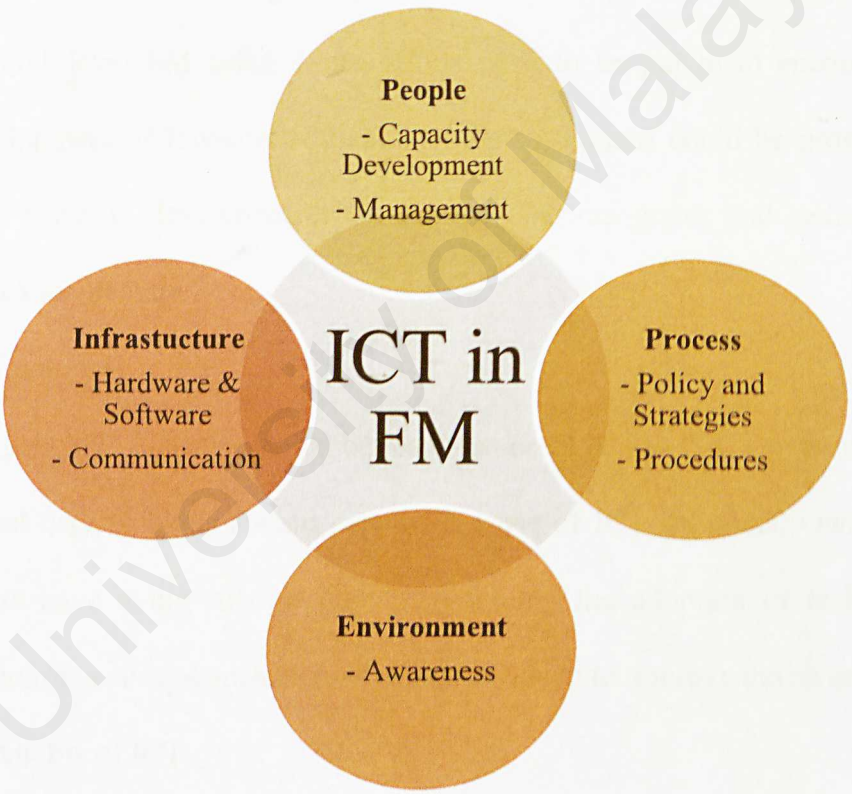

Figure 2.4 Framework of Information and Communication Technology Utilization by Hamid et al., (2013)

a) People

Capacity development through training is the key to developing a pool of personnel skilled in the use of ICT solutions. In addition, effective management

of skilled people is important. Skilled people should be motivated to remain in the industry and encouraged to apply innovative solutions

b) Process

Current FM processes should be critically reviewed in order to identify areas that do not support the application of IT. For example, paper-based tendering procedures restrict the scope of work flow automation. Electronic means of collaboration should be facilitated. Policies and strategies should be developed to encourage the use of ICT.

c) Infrastructure

While hardware is getting cheaper, the cost of software is still high, especially for high-level FM tasks. More efforts need to be put in to encourage the development of low-cost software solutions. Support could be provided for local software developers in the form of start-up grants and setting up of incubation centers.

d) Environment

Key people in industry should be ready to accept ICT in FM. Government and related organizations should support the use of ICT solutions. Owners and clients have a big role to play in enforcing the adoption of technology. Promotion activities such as road shows will help to improve the awareness of the benefits of ICT.

(Hamid et al., 2013)

2.4.2 Computerized Maintenance Management System

Currently, computerized maintenance management system (CMMS) has turned out to be exceptionally famous among management building maintenance in daily activities. CMMS is intended to store finish data and information for each action, system or building

equipment such as planned or unplanned maintenance; work orders; activity table; maintenance history, suppliers spare part; purchase orders and monetary streams. Moreover, information recorded will be connected in the observing and control of maintenance work; spending planning as well as the arrangement of money related reports and the maintenance of all the data put away in the CMMS is anything but difficult to allude back when required. CMMS is an essential system that is generally utilized all through industry.

The CMMS experienced a blast amid 1980s when mini computers wound up noticeably prominent and the age of the microcomputer started. Amid this decade, the CMMS was restricted principally to a single computer or later, a small network. There was little usefulness that bolstered anything besides a department or facility. CMMS vendors normally had some expertise in a given asset class such as plant equipment, facilities, fleet or mobile and infrastructure. In the 1990s, computers became smaller, faster and less expensive. Networks and telecommunication systems developed in size and modernity. CMMS vendors kept on improving their item offerings with a host of new features such as better security, notification and workflow, and more comprehensive planning, budgeting and scheduling.

Other than that, R. Fostiak (2001) explained that the advancements in computer software technology made it conceivable to financially incorporate significant relevant plant operations, equipment, planning, and systems information. At the point when those new advancements were mixed with new management processes relating to maintenance, outages, asset condition assessment, project justification and prioritization, unit dispatch, and reservoir management, the outcomes were enhanced proficiency and diminished expenses with high dependability.

Kumar & Tewari (2013) discussed the development of computerized maintenance management information system for a fertilizer plant which was versatile, less complicated, less costly and less time consuming computer software.

Marks, Rietsema, & AL-Ali (2015) reviewed landside airport information management systems, and their connections and interoperability with other systems and with the key airport users. A CMMS enabled an airport to provide the degree of comfort and convenience expected by its customers.

With the implementation of a contemporary CMMS it is customary to utilise a reporting strategy which may range from simple database extracts to a full business warehouse solution. The intent of these systems is to report statistics which provide valuable trend information on the quality of maintenance performance. The complexity of the reports can range from weekly lists of work to trends in order type, equipment covered, schedule compliance and other work order statistics (Platfoot, 2014b).

2.4.2.1 Determining the need of CMMS

In recent days, computerized maintenance management system (CMMS) becomes a necessity of every facility maintenance service provider to assist them in daily activities, where it eliminates printed material and manual tracking exercises, along these lines empowering the building staff to end up more productive. It is additionally intended to store information and complete data for each action. In addition, the recorded data will be grasped in the checking and control of maintenance work; budget planning and financial reporting and maintenance of all data set away in the CMMS it less requesting to imply back when required.

These basic modules can provide the foundation for an effective system of maintenance administration. If the details are incorrect the results also will be. There are numerous factors to consider in deciding if a CMMS can profit your operation. The most essential variables identify with diminished cost, but also think about such outcomes as better organizational methods, reduced paperwork, and enhanced communications (Lemma, 2012).

Manzini, Pham, Regattieri, & Ferrari (2010) featured an advanced way to deal with the maintenance problem requires an effective help worked by the information system. There are a ton of explained information to be contemplated. A system that gathers and arranges this data is an essential for any further elaboration

Therefore, the computer is currently being perceived as a capable instrument for support. Just a computer can store, recover, compute, sort out, and show boundless measures of information effectively and precisely (Cato & Keith Mobley, 2001). A computerized maintenance management system (CMMS) is a sort of management programming that performs capacities in backing of management and following of Operation & Maintenance exercises (G. P. Sullivan, Pugh, Melendez, & Hunt, 2010).

Labib (1998) has already watched that in a perfect world, a CMMS is a way to accomplishing world-class maintenance, by offering a stage for decision investigation and in this manner going about as a manual for management. CMMS package can furnish management with reports and insights, specifying execution in key zones and highlighting hazardous and problematic issues.

2.4.2.2 Benefits of CMMS

There are various benefits available when using the CMMS system. Many studies have also been conducted to identify the benefits gained from the use of CMMS.

In this study, based on the articles obtained and read, these benefits are divided into several categories. They are asset/ equipment management and control, plant management and control (purchasing cost, amortization plan, etc.), drawing and document management and control, planned and unplanned maintenance management, historical data analysis, cost and budgeting control, inventories management, labour productivity and environmental control (safety compliance). The list of citation of CMMS category of benefits is summarized in Table 2.1 below;

Table 2.1 Benefits of CMMS

Categories of CMMS Benefit	No. of Citations
Inventories management	9
Asset/ Equipment management and control	8
Historical data analysis	5
Labour productivity	5
Plant management and control (purchasing cost, amortization plan, etc.)	4
Drawing and document management and control	4
Planned and unplanned maintenance management	4
Cost and budgeting control	3
Environmental control (safety compliance)	1

a) Asset/ equipment management and control.

With the use of CMMS, it can help improved equipment, asset and plant availability and product quality improvement and efficiency (Bagadia, 2006; Braglia, Carmignani, Frosolini, & Grassi, 2006; Cato & Keith Mobley, 2001; Levitt, 2013). The efficiency can be achieved by effective maintenance

management of manufacturing facilities throughout their life cycle, emphasizing and enhancing the processes related to asset condition assessment, project justification and prioritization and unit dispatch (Kumar & Tewari, 2013). Bagadia (2006), Peters (2006) and Braglia et al., (2006) also believes that CMMS can increase and lengthen the life of asset and equipment while G. Sullivan, Pugh, Melendez, & Hunt (2010) pointed that it can be achieve by maintaining ideal equipment performance that diminishes downtime. Other than that, he said CMMS can detect approaching issues before a failure happens bringing about less failures and client protestations.

b) Plant management and control (purchasing cost, amortization plan, etc.).

With effective use of CMMS, can emphasizes and enhances the processes related to maintenance and conducts different maintenance activities of manufacturing units in a more synchronized and automated manner . This can reduce in total downtime, overall annual maintenance cost, frequency of failures of the machines (Kumar & Tewari, 2013) and increase in overall plant productivity (Bagadia, 2006). Kelly (2006) and Bagadia, (2006) also believes, in the aspect of contract compliance, it can assists in better management of service contracts, while Peters, (2006) said CMMS can improved work control, increase level of maintenance information, increase quality and service levels due to maintenance in order to achieve a good level of performance

c) Drawing and document management and control.

CMMS of storing information is able to provide greater efficiency in operating procedures (Marks et al., 2015). These stored information can improved reliability analysis and increased capability to measure performance and service (Peters, 2006). All levels of maintenance personnel, from director to craftsman, to have brisk access to to the maintenance information (drawings,

life plans, history, etc.) that is fundamental for financially savvy basic decision making and job execution (Kelly, 2006). Other benefits are also expected of a CMMS is accessibility to maintenance information is dramatically expanded. Controlling information and knowledge management in FM operations is important to ensure that no information is not taken into account to produce reports. This improved reporting and support for management control can contribute strongly to justifying a CMMS (Bagadia, 2006).

d) Planned and unplanned maintenance management.

Improved and control over maintenance planning and scheduling, enhance preventive and predictive maintenance (Braglia et al., 2006; Peters, 2006). With that, a maintenance operation can achieve reduction of corrective maintenance against preventive or even proactive (Braglia et al., 2006; Kelly, 2006). CMMS also helps in achieving a more elevated amount of planned maintenance exercises that empowers a more productive utilization of staff resources (G. Sullivan et al., 2010).

e) Historical data analysis.

CMMS contains a feature for accumulation of historical data about maintenance and makes tampering with this practically impossible so it is an invaluable and efficient tool for managing the heterogeneous information systems and database (Kumar & Tewari, 2013). It provides easier access to maintenance data and statistics (Braglia et al., 2006) to review the history of any significant asset requiring major repair (Levitt, 2013), extracting maintenance performance indicators and tracking them can be done much effective (Mohammadfam, Bahmani, & Mahmoudi, 2014). Perhaps the greatest benefit (or potential benefit) of all is the CMMS's ability to store, analyze and report on large quantities of control data. This includes the storing

investigation of history on costs, work usage, spares usage - giving an assortment of KPIs and control reports (Kelly, 2006).

f) Cost and budgeting control.

CMMSs cause important savings of maintenance costs especially in the realms of labor, parts, and downtime (Mohammadfam et al., 2014). Improved efficiency, reduced costs with high reliability (Kumar & Tewari, 2013), increased budget accountability, value of overall maintenance costs reductions with equal or greater service levels, value of facility availability or cost avoidance from being unavailable (Peters, 2006).

g) Inventories management.

The utilization of inventory modules affecting stock control empowering better spare parts forecasting to dispense with deficiencies and minimize existing stock. This can lead to improvement of Maintenance Repair Operation (MRO) materials management (Kumar & Tewari, 2013; G. Sullivan et al., 2010). It also can lower operating costs, mainly due to a better management of spares inventory and to the reduction of corrective actions (Bagadia, 2006; Braglia et al., 2006); improved inventory cost and management and improved parts and material availability (Kumar & Tewari, 2013; Marks et al., 2015; Peters, 2006). This benefits also provide opportunities where the enhancement of communication via e-mails between companies provided major advances in accessing the databases of equipment manufacturers, which allows them for setting up alliances for the holding of strategic spare parts and 'spares-finder' access to Internet companies specializing in spares management (Kelly, 2006).

h) Labor productivity.

CMMS can gained value from increase craft labor utilization and effectiveness via gains in wrench time, craft labor performance and efficiency (Peters, 2006).

This contributes to increased labor productivity (Bagadia, 2006; Cato & Keith Mobley, 2001) by improvement of labor scheduling (Levitt, 2013) and helps in reducing costs associated with maintenance labor and operations (Marks et al., 2015).

i) Environmental control (safety and compliance).

Preventing accidents and wounds because of appropriate techniques recorded by CMMS can spare you a lot of cash. A maintenance management function of an organization can contribute to safety and compliance with regulatory requirements (Bagadia, 2006). For example, in Malaysia, maintenance operation must comply with a few statutory requirements like Department of Occupational Safety and Health Malaysia (DOSH), Department of Environmental (DOE), Jabatan Keselamatan dan Kesihatan Pekerjaan (JKKP), and Fire and Rescue Department (BOMBA)

2.4.2.3 CMMS Implementation Barriers

Implementation is an important managerial responsibility. In one sense, implementation is an occasion that happens: the system has been actualized. In yet another sense, can be thought of as a procedure that is being connected to impact a result. In any case, implementation is simply doing what you wanted to do (Marakas & O'Brien, 2013).

When CMMS was introduced, most organisations have high expectation towards successfulness of the system. There is no doubt that the system can enhance the effectiveness of maintenance management in making decisions but it doesn't indicate that it can work its enchantment on its own. Most systems, as gained and introduced, are not management system and often as possible have compelled constrained management capacity. Human basic decision making based on what the system gave is the best

approach to awesome maintenance management. A system is simply in an indistinguishable class from the individual who utilizes it.

There are several factors that contribute to the barrier of CMMS implementation in an organization. Many researchers that conducted study in CMMS has found similarities. These similarities is group into categories. Most researchers who have conducted a study of CMMS have encountered the same problem that contributed to the barrier of CMMS implementation. Among the factors that have been identified from 19 literatures are;

Table 2.2 Barriers of CMMS Implementation

Categories	Barriers	Author
Organisation	Lack of leadership to show "lead by example"	(Cato & Keith Mobley, 2001)
	Lack of support from upper management	(Mather, 2002),(Jafarnejad A, 2014), (Berger, 2016), (Moballeghi et al., 2013)
	Lack or absence of follow up and monitoring	(Bagadia, 2006)
	Too high expectation and justification of the system	(Anderson & LeClair, 2004), (Jafarnejad A, 2014), (Berger, 2016), (Cato & Keith Mobley, 2001)
	Policies dictate hardware as well software requirements.	(Jafarnejad A, 2014), (Bagadia, 2006)
	Internal conflicts	(Cato & Keith Mobley, 2001)
	Poor project planning	(Cato & Keith Mobley, 2001), Berger (2016), (Berger, 2016), (Barratt, 2004)
	Not buying enough license	(Labib 2008), (Kelly, 2006), (Barratt, 2004)
People	Lack participation from both management and staff	(Atere-roberts & Bash, n.d.)
	Employee resistance.	(Jafarnejad A, 2014), (Bagadia, 2006)
	Not ready to change management	(Berger, 2016), (Cato & Keith Mobley, 2001), (Ashayeri, Teelen, & Selen, 1996)

Table 2.3 Barriers of CMMS Implementation (cont'd)

Categories	Barriers	Author
People	Lack of commitment	(Cato & Keith Mobley, 2001), (Sullivan et al., 2010)
	Lack of training or poorly trained	(Ramachandra & Srinivas, 2013), (Moore, 2004), (Bagadia, 2006), (Sullivan, Pugh, Melendez, & Hunt, 2010), (Kelly, 2006), (Moballeghi, Makvandi, Abadshapouri, Ghaseminejad, & Kalantari, 2013), (Atere-roberts & Bash, n.d.), (Mather, 2002), (Jafarnejad A, 2014), (Berger, 2016)
	Employee turnover	(Bagadia, 2006), (Kelly, 2006)
	Lack of expertise	(Cato & Keith Mobley, 2001)
System usage	Using a CMMS to solve the wrong problem.	(Bill D. Parker, 1998)
	Wrong selection of CMMS system	(Jafarnejad A, 2014), (Moballeghi et al., 2013)
	Poor data collection method lead to data deficiencies	(Kelly, 2006)
	Incomplete and inaccurate information register	(Barratt, 2004)
	System being underutilized	(Berger, 2007), (Carnero & Novés, 2006), (Mather, 2002)
Vendor support & reliance	Not having adequate supplier support for the CMMS	(Barratt, 2004), (Berger, 2009), (Cato & Keith Mobley, 2001), (Sullivan et al., 2010), (Bagadia, 2006)
	System not user-friendly	(Labib 2008), (Kelly, 2006), (Barratt, 2004)
	Unable to integrate with other systems	(Mather, 2002)

a) Organisation - an organization should play an important role in ensuring the implementation of the CMMS system in their organization is successful. Leadership and monitoring stance, and support should be demonstrated by

management and organizational members to ensure the CMMS system continues to be adopted (Bagadia, 2006; Berger, 2016; Cato & Keith Mobley, 2001; Jafarnejad A, 2014; Moballeghi, Makvandi, Abadshapouri, Ghaseminejad, & Kalantari, 2013; G. Sullivan et al., 2010). Less support and monitoring will lead to employee resistance. High expectations of CMMS systems are also one of the obstacles in implementing CMMS systems. CMMS is just one tool that helps facilitate the way in the facility trials and is not a solution to all the problems encountered. Each CMMS system is different. These systems are often flexible and configurable. Most major systems will meet the needs the client is aware of, as well as many needs the client is not (yet) aware of. CMMS systems are not 'Plug and Play' devices. The standard implementation elements; install, populate, configure, train, and support are necessary but not sufficient for success. The management should also not have a policy limiting the use of certain computer systems that limit the use of new systems that can be beneficial to the organization (Anderson & LeClair, 2004; Bagadia, 2006; Jafarnejad A, 2014).

b) People - Employees may find that the use of the system will eliminate their function as employees. Management may look at the CMMS as a tool to help employees in their work, and in turn improve the bottom-line. Employees, on the other hand, may view the CMMS as an intrusion, threatening their professional and personal security. The management should involve potential users of CMMS (technicians or data entry) since the process of system selection or development again (Bagadia, 2006; Berger, 2016; Cato & Keith Mobley, 2001). Training is an important factor in ensuring a successful implementation of CMMS (Bagadia, 2006; Berger, 2016; Cato & Keith Mobley, 2001; Jafarnejad A, 2014; Moore, 2004). According to Ramachandra

& Srinivas, (2013), training is very important in the implantation system and encourages employees to take on the challenge of working. The project should be trained using CMMS regarding input, function and maintenance of CMMS (Bagadia, 2006; Kelly, 2006; Moballeghi et al., 2013; Moore, 2004; Ramachandra & Srinivas, 2013; G. Sullivan et al., 2010). Lack of training in using CMMS system will cause the user not to be interested and afraid to use the system in turn causing a lack of input data into the system and decision making process by the superior. Sometimes, the training framework was conducted by the management, but did not get the employees' response (Kelly, 2006). In addition to relying on vendors, management must ensure that there is at least one expert or skilled staff in the use of the CMMS system (Cato & Keith Mobley, 2001).

c) System usage - Sometimes an organization chooses to use CMMS to solve the problems they face while the problem is not directly related to the use of CMMS system (Bill D. Parker, 1998). Sometimes the selected CMMS system does not conform to the situation faced by the organization, for example, the CMMS system used in the health sector is not appropriate to be used in the industrial sector. This is also due to the choice of the vendor and the wrong system (Bagadia, 2006; Jafarnejad A, 2014; G. Sullivan et al., 2010). The system that has been synthesized should be completed with the assets of the asset. Vendors only provide the system as a platform and users who should equip the system with appropriate information (Barratt, 2004; Berger, 2007; Kelly, 2006). Continuous use of CMMS will worsen a system user. Underutilized systems will not improve the organization's performance. According to Carnero (2006), a high percentage of CMMSs were poorly used or eliminated without providing benefits.

d) Vendor support & reliance - most CMMSs are purchased from the developer of the software. Support and dependency on vendors is important, as vendors are aware of the built-in system. Some CMMS vendors provide "after-sales" services that help users with installation and configuration (Bagadia, 2006; Barratt, 2004; Berger, 2009; Cato & Keith Mobley, 2001; B. Sullivan & GHD INC., 2013). The user should also choose the right before purchasing the CMMS software by ensuring the supplier provides long-term support. The purchased system is often not easy to use and not user-friendly will inconvenience users (Barratt, 2004; Kelly, 2006; Labib, 2008). There is also a system that cannot integrate with other systems in other settings that are used simultaneously as a financial system that is closely linked to asset management, human resource systems and other systems (Mather, 2002).

2.5 Performance Measurement as Part of Contract Monitoring

In the past, performance measurement was regarded as an important and effective management mechanism for controlling and ensuring organizational performance in line with the objectives set out. According to Gray, Micheli, & Pavlov (2015), performance measurement can be found all over the place: when we take a gander at organizations' money related articulations, read report details regarding normal waiting time in hospital, execution evaluations at work, or take a gander at schools' records when choosing where to send the kids. The act of gathering, examining and reporting data on the performance of people, groups, organisation, and countries has been around for quite a while.

Performance Measurement is the procedure whereby an organization builds up the parameters inside which programs, investments, and acquisitions are reaching the expected outcome. This procedure of estimating regularly requires the utilization of

factual confirmation to decide progress toward particular characterized organizational goals (Suleiman, 2011).

Diverse individuals have distinctive perspectives of what is meant by performance measurement. It can describe performance measurement as a formal procedure, which intends to retrieve, interpret, and pointed information about an aspect of a process, an activity or a person. For instance, if we are looking at "customers", we are taking a gander at "clients", we could quantify such viewpoints as fulfillment, dependability or advocacy.

Most associations have performance measurement in some shape or other, regularly connected to tools such as scorecards, dashboards, performance targets, indicators and information systems, and a supporting infrastructure that empowers information to be gained, ordered, arranged, analyzed, interpreted and spread. Imperatively, indicators and targets have to be considered not just as far as how hearty they are exclusively, yet additionally as a group, since they need to evaluate the organization as a whole. It would be unsophisticated to consider the measurement of performance as just a technical issue.

So, measurement is frequently utilised as a form of attempting to get understandability to difficult and unclear situations. From a technical point of view, performance information is collected, analyzed and pass on to exhibit outcome inside the organization or to its key stakeholders. For example, if performance information is correlated to the strategic target of the organization, it can be utilised to exhibit that advancement is being made against these objectives. In contrast, performance indicators are frequently used for representative or political purposes; in this case, their goal is to spike the relative power of a business unit or division within an organization, or to, apparently, fulfil the demands of external stakeholders. This is obvious if we consider how a function within an

organization can try to retrieve greater legitimacy and control by trusting on the measurement of their performance.

Performance reporting systems are based on performance numbers or indicators. These determine the performance focus on a precise aspect of operations or planning in a granted term. These produce numbers are then arranged on a "scale" in order to rate that performance. Most maintenance performance indicators (PIs) are ratios measuring effectiveness, efficiency or productivity (Pintelon & Puyvelde, 1997).

2.5.1 Contract Monitoring

Usually, in the process before entering a contract of management of the facility, the building owner (outsourcer) must compose a tender document to check relevant information including the level of work, the condition of the existing assets, the timing of the appropriate response and the working hours being issued and so forth. After tender returns, there will be a tender evaluation process, explanation of any information or submission of vague tender, and interviews with shortlisted tenderers prior to negotiating with prospective beneficiaries based on the number of agreed contracts. Having accepted the offer by the contractor, does not mean the outsourcer will get the expected service. Work performed by contractors should be monitored to ensure they comply with agreed contract requirements, and the work undertaken by the contractor requires measurement to determine the payment. Any disagreement during the contract period will involve time and financial resources to be resolve.

During the evaluation phase of contracting, public agencies require evaluation capacity to monitor and evaluate the contractor's performance to determine if its contract responsibilities are met (Smirnova, Yusuf, & Leland, 2016) .

Hinton, (2003) defined contract monitoring is the process of ensuring that vendors comply with sufficient contractual services. The government agency that manages the performance of the service is responsible for ensuring that the level of work performed is at a satisfactory level and the funds allocated by the government are utilized legitimately. At last, the state office is in charge of the outcomes of poor work execution whether the organization or a vendor gave the service. Well-driven contract performance more often than not prompts enhanced partnership with precious clients and vendors,

The growth of contracting out services has led many agencies to examine how they monitor their contracts in order to maximize their effectiveness. Scholars have emphasized that when public services are outsourced, their provision (and performance) needs to be monitored. Regular tracking and monitoring is a key characteristic of performance measurement. Public agencies contract out to pursue a variety of objectives, including achieving cost savings, realizing greater efficiency, managing risks, and improving service delivery. Milward (1994) noticed the incongruity of contracting in that it is elevated as the result for government wastefulness and bungle, yet can function admirably just if the administration organization deals with the procedure effectively.

Other researchers have similarly acknowledged the importance of contract management, and contract monitoring specifically. Gormley (1994) pointed to the need to monitor to "avoid unfettered discretion" and to evaluate performance to ensure that contracts provide the desired outputs and outcomes. Fossett et al. (2000) suggested that, to be prudent purchasers, government agencies must be able to specify performance measures, determine if and how contractors are meeting performance metrics, and hold contractors accountable for meeting the metrics by sanctioning them for failure to perform. Performance measurement is a critical element of effective contract

accountability, which Romzek and Johnston (2005) defined as when *"the state is able to design, implement, manage, and achieve accountability for its ... contract"*.

For effective contract accountability, monitoring mechanisms must be in place to provide data for contract evaluation. Strong monitoring capability contributes to achievement of outputs and outcomes by allowing the government agency to guarantee efficient control and guarantee contract obedience with service provision benchmark. Identifying performance measures and monitoring them allows for objective assessment of outcomes. Amirkhanyan (2011) found performance measurement to positively affect government's capacity to adequately manage contracts. Particularly, performance measures that included costs, client impact, service timeliness, service disruptions, and process- related service delivery measures were associated with accountability effectiveness. (Smirnova et al., 2016) .

Yang, Hsieh, & Li, (2009) defined evaluation capacity as: (1) having a formal observation system to assess whether temporary workers have accomplish the obligation specified in the contract; (2) using monitoring strategies such as filed inspections, intermittent assessments, and recipient interviews; (3) requiring normal, formal performance reporting; and (4) observing the contracted service consistently to guarantee execution.

2.5.2 Causes and Impact of Inadequate Monitoring

The assessment of contract limit stresses constructing a formal performance monitoring and reporting system so that the is compelled to complete its duties determined in the contract (Brown and Potoski 2003a; Kelman 2002; O'Leary 1996; Smirnova et al., 2016). Lacks in contract monitoring are related to infringement of good administration principles is frequently the aftereffect of the accompanying:

a) Poorly settled criteria for assessing vendor performance;

b) Perception of oversight as an obligation to build up an organization instead of impose rules, regulations, or contract provisions;

c) Focus on rules and orders rather than results

d) Failure to catch up audits to guarantee that remedial move was made; and

e) Failure to distinguish the risk and level of audit needed for each vendor

Viable contract observing is expert through the utilization of various checking techniques that are custom fitted to a specific contract. Some monitoring techniques might be proper for most contracts (i.e., performance measures, scheduled reports), while different strategies are suitable for fewer contracts (i.e., on location visits, consumer satisfaction studies). The segments used to screen a contract are subject to various components, particularly the complexity of the contracted service, the agreement sum, and the risk if the work isn't performed adequately (Hinton, 2003).

2.5.3 Performance Measurement System in Facilities Management

Real facility performance measurement practices are benchmarking, balanced scorecard approach, post occupancy evaluation and measurement through metrics of key performance indicators. Between the different successful performance models, as per a similar report displayed by Meng and Minogue, (2011), KPI is the most mainstream demonstrate for FM professionals and organisation. The reseach, in light , stress that the ten most significant performance indicators gathered from a poll: customer satisfaction, cost-effectiveness, reaction time, service dependability, health, safety, environmental compliance, staff dedication, client-service provider relationship and IT application (Talamo & Bonanomi, 2015).

Since an organization needs to suspect issues and openings and make the important changes at the most ideal time, great performance reporting is basic for each management work. Likewise, a proficient performance reporting system, bolsters a ceaseless upgrade program. They are stepping stone stones for quality control in each management function. It is obvious that performance reporting is likewise basic for support maintenance management, both operational and strategic. The present maintenance and restoration spending plan is substantial, costs related with maintenance at any rate as high as direct cost are incorporated into the financial plan, maintenance work costs are rising rapidly than total operating cost indexes, and others

Maintenance managers constantly have access to giant quantity of data, but seldom acquire the information they need: data frequently needs to be gathered from many different origin, and frequently unorganized and undocumented data as it supposed to be. This indicates, the process of data for profitable management information, e.g. few usual performance indicators, took a lot of time. Data quality and report timeliness are a the usual problem intersect in preparing maintenance performance reports. In addition, maintenance managers often do not have or depletion the equipment to ease of inquiry for computer systems or time to produced the required reports. Luckily, with the maintenance management information system, it can help resolve this problem..

Maintenance works as an valuable support role in business with remarkable investment in physical assets and plays an significant function in achieving organizational aim (Tsang, 2002). According to Parida & Kumar (2006),there are some of the significant factors behind demands on maintenance performance measures and one of them is technology where technology is ever ever-changing and is changing quicker in the new millennium. This has brought in new sensors and enclosed technology, information and communication technology (ICT).

2.5.4 Information and Communication Technology in Facilities Management's Performance Measurement System

PMSs are really IS that modify performance data into appraisal of organisational and individual performance (Burney and Matherly, 2007). As the goal of measurement is to navigate, assist, and upgrade performance, accommodate feedback to individuals in the way of performance measures is necessary. In so doing, no doubt that IS will act a leading role in a PMS in collecting, storing, processing performance-relevant data, and disseminating performance-relevant information. A best PMS should concentrate not only on the fiscal side of measures (e.g. profitability, return of investment return on assets, profit-per-share) but also on the non-fiscal side of measures such as consumer, quality, people, systems and processes. Prior studies on IS and organisational performance have concentrate on the IS strategically use and the relationship between IS investment and performance. Organisations that run in a competitive environment need inclusive IS to control the crucial parts of the organisation's activity in order to accomplish different strategic aim (Naranjo-Gil, 2009; Kaplan and Norton, 1996). Boynton et al. (1994) and Bakos and Treacy (1986) argue that IS invention has the possibility to amend a range of strategic and industry parameter such as expenditure positions, scale of economies, and power partnership with buyers and distributer, thereby providing competitive advantage. (Noor Akma Mohd Salleh, Ruzita Jusoh, & Che Ruhana Isa, 2010)

Facilities management and maintenance provides services such as repairs and maintenance, cleaning and waste disposal, asset management, energy and utility management, and so on. The complexity of this activity indicates the existence of various different information. To improve effectiveness and efficiency during operation, an information system is needed that can assist management, and to obtain and process information in the framework of decision making, in order to obtain accurate and accurate

information. Information systems that encourage managerial decision making are called management information systems (MIS) (Kroenke, 2012). Formally, management information systems can be defined as follows:

"Management information systems (MIS) deals with the planning for, development, management, and use of information technology tools to help people perform all tasks related to information processing and management"

So, MIS deals with the synchronization and utilize of three very significant organizational resources—information, people, and information technology. Expressed another way, user use information technology to work with information. And to do so they are engaged in MIS. Ideally, of course, people utilise technology to encourage the aim and target of the organization as motivated by aggressive force and determined by right business strategies (Haag & Cummings, 2009).

The accomplishment of maintenance practices is subject to the sstrict management of effective information management. This is identified to the management of all maintenance data, gathering, investigation, and trade information to information to provide reports and change feedback to appropriate functions. Overseeing key performance indicators measurements is an essential component of an information management system that provides linkages between status amid maintenance operations and maintenance objectives. This will give data and strategies to additionally enhance maintenance (Mat Deris, 2001).

2.6 Technology Acceptance

The emergence of a new technology, especially in the field of information communication technology will always produce a reaction on the user himself. User behavior of an information technology system has an important role to the successful

implementation. The development of technological behavior needs to get special attention in the context of the application of information technology. Technical, behavioral, and technological factors of technology users need to be considered before the technology is implemented.

Reaction can be either the acceptance of the new technology, or even the rejection of the new technology. The low adoption and utilization of IT in employees is a major obstacle for organizations to succeed in implementing IT. There are numerous cases of IT implementation failures in that prompt significant money related misfortunes, such as the failure of Hewlett-Packard (HP) in 2004 of $ 160 million.

Therefore, it is deemed necessary to know the model of acceptance of technology by users saying that user acceptance is defined as the user's willingness to use technology to support tasks that have been designed. According to (Louho, Kallioja, & Oittinen, 2006), technology acceptance is related to how one accepts and uses the technology. The main objective of most technology acceptance studies is to investigate how to advance the utilization and furthermore clarify what forestalls acceptance and use of technology (Kripanont, 2007).

Various theoretical frameworks were developed to support the process of adoption of information technology, including the Technology Acceptance Model (TAM). TAM is the most widely used model in the adoption and use of information technology that has proved highly predictive in the adoption and use of information technology. TAM is a model built to analyze and understand the factors that affect the acceptance of the use of technology.

The theory was developed in the late 1980s when we had technologies such as email and word processing systems and they could replace systems such as writing a letter by

hand. The technology acceptance model was developed in 1986 by (F. D. Davis, 1989) as part of his PhD program at Massachusetts Institute of Technology (MIT). The technology acceptance model was developed specifically for the information systems industry to improve understanding of user acceptance processes and to provide a theoretical basis for a user acceptance testing methodology. He contended that perceived ease of use will have a causal effect on perceived usefulness. There are two core beliefs that form the technology acceptance model. Perceived usefulness which is defined as the degree to which an individual believes that using a particular system will enhance his or her job performance and perceived ease of use which refers to the degree to which an individual believes that using a particular system will be free of physical and mental effort.

Knowing the level of user acceptance of an information systems required in the process of developing information systems is required in order to better service and management. Lina (2007) states that the success of the information system acceptance is not only determined by how the system can process information well, but is also determined by the level of individual acceptance of the application of the information system. The intent of receiving and using technology depends on how technology will benefit them, ease of use, and facilitate them to use. There are various technology acceptance models that can be used to evaluate the success of an information system.

Better measures for anticipating and clarifying system use would have would have extraordinary value, both for vendors who would like to assess user interest for new outline thoughts, and for information systems managers within user organizations who who might want to assess these vendor offering (F. D. Davis, 1989).

2.6.1 Technology Acceptance Model

TAM is a research model that can be used to predict the adoption of information technology introduced by Davis in 1989. TAM aims to explain and estimate user acceptance of an information system. TAM provides a theoretical basis for knowing the factors that affect the acceptance of a technology within an organization. TAM theorizes that an individual's behavioral intention to utilize a system is dictated by two convictions: perceived usefulness, characterized as the degree to which a man trusts that utilizing the system will improve his or her job performance, and perceived ease of use, characterized as the degree to which a man trusts that utilizing the framework will be free of exertion.

As per TAM, perceived usefulness is additionally affected by perceived ease of use because, different things being equivalent, the easier the system is to utilize the more useful it can be. Over the numerous experimental trial of TAM, perceived usefulness has reliably been a solid determinant of of usage intentions, with standardized regression coefficients typically around 0.6. Since perceived usefulness is such a fundamental driver of usage intentions, is such a crucial to understand the determinants of this construct and and how their impact changes after some time. In 2000, Venkatesh & Davis, (2000), include additional key determinants of TAM's perceived usefulness and usage intention constructs in terms of social influence (subjective norm, image and voluntariness) and cognitive instrumental processes (job relevance, output quality, result demonstrability) and to see how the impacts of these determinants change with expanding user experience after some time with the target system. This proposed extension is known as TAM2. Below are the definitions of the determinants of perceived usefulness.

a) Perceived Ease of Use (PEOU)- The degree to which a person believes that using an IT will be free of effort

b) Subjective Norm (SN) - The degree to which an individual perceives that most people who are important to him think he should or should not use the system.

c) Image (IMG) - The degree to which an individual perceives that use of an innovation will enhance his or her status in his or her social system.

d) Job Relevance (REL) - The degree to which an individual believes that the target system is applicable to his or her job.

e) Output Quality (OUT) - The degree to which an individual believes that the system performs his or her job tasks well.

f) Result Demonstrability (RES) - The degree to which an individual believes that the results of using a system are tangible, observable, and communicable.

(Venkatesh & Davis, 2000)

In the same year, Venkatesh (2000) also developed a model of the determinants of (Kans, 2008)perceived ease of use. A significant body of research in information systems (IS) and human-computer interaction (HCI) has aggregated supporting the significance of such perceived ease of use on initial user acceptance and sustained usage of systems. Venkatesh & Davis, (2000) contended that people will form early perceptions of perceived ease of use of a system based on several anchors related to individuals' general beliefs regarding computers and computer use (Venkatesh, 2000).

Computer self-efficacy, facilitating conditions, computer playfulness, and computer anxiety are system-independent, anchoring constructs that that assume a basic part in molding perceived ease of use about a new system, particularly in the early stages of user experience with a system. With expanding experience with the system, objective usability, perceptions of external control (facilitating conditions) in accordance with the particular system, and perceived enjoyment from system use are adjustments (resulting

from the user- system interaction) that will have an additional effect on system-specific perceived ease of use. The following are the determinants of perceived ease of use by Venkatesh (2000).

a) Computer Self-Efficacy (CSE) - The degree to which an individual believes that he or she has the ability to perform a specific task/job using the computer.
b) Perception of External Control (PEC) - The degree to which an individual believes that organizational and technical resources exist to support the use of the system.
c) Computer Anxiety (CANX) - The degree of "an individual's apprehension, or even fear, when she/he is faced with the possibility of using computers"
d) Computer Playfulness - (CPLAY) "...the degree of cognitive spontaneity in microcomputer interactions".
e) Perceived Enjoyment (ENJ) - The extent to which "the activity of using a specific system is perceived to be enjoyable in its own right, aside from any performance consequences resulting from system use".
f) Objective Usability (OU) - A "comparison of systems based on the actual level (rather than perceptions) of effort required to completing specific tasks".

(Viswanath & Bala, 2008)

Behavioral Intention (BI) relates to the degree to which a human being has formulated a plan to do or not to do a behavior in the future. Use (USE) behavior is the actual human behavior when using an information system.

2.6.2 Technology Acceptance Model 3

Further research on TAM2 (Venkatesh & Davis, 2000) and the determinants of perceived ease of use (Venkatesh, 2000), led to the development of TAM3. TAM3

presents a complete nomological network of the determinants of individuals' IT adoption and use. In Figure 2.5 , we can see the conceptual framework of TAM 3.

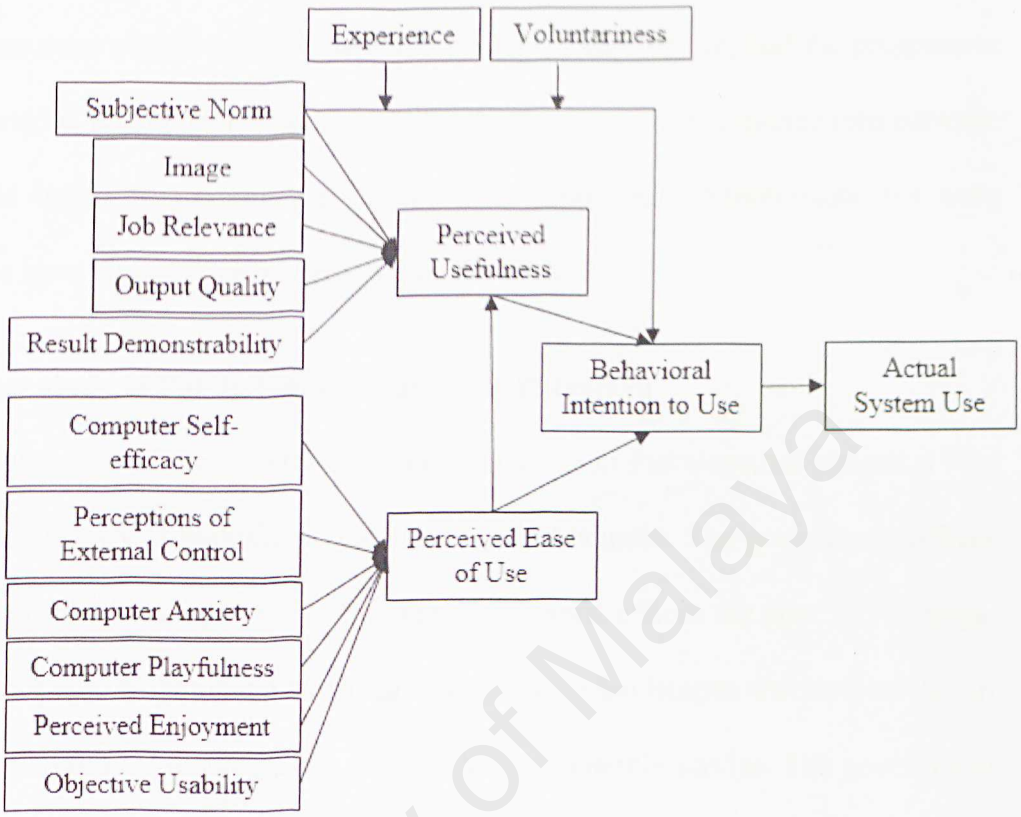

Figure 2.5 Technology acceptance model 3 (TAM3) by Viswanath & Bala, (2008)

TAM model is widely used in the literature, with more than 30,000 citations for the original articles introducing TAM and TAM 2 in Google Scholar. Its development after some time has been consistent and progressively helpful. The original model's determinants were perceived usefulness and perceived ease of use, and the progressive models started to build up the determinants for these factors and the interactions between them. TAM began as a compact core, and after some time, determinants that were exhibited to have impact were added to shape the TAM 3.

2.7 Case study of Public Work Department Putrajaya

The development of the Federal Government Center in Putrajaya has opened a new chapter in the history of building public buildings in Malaysia. The government offices that are beautiful and comparable to the world-renowned offices are now in Putrajaya. With a comfortable environment surroundings, beautiful landscapes and state-of-the-art equipment, government members can provide the best possible service. The government is always working to improve the level of maintenance, cleanliness and prosperity of its buildings in Putrajaya, in line with Putrajaya's position as Federal Government Administrative Center. The buildings, if not addressed in terms of maintenance and cleanliness, will be damaged and become obsolete quickly. Irreversible damage will involve extensive financial allocation in terms of operation.

The Public Works Department, Federal Territory of Putrajaya (PWD-WPP) was established in July 2002 officially with the enactment of the K74 / 2002 Establishment Warrants. Based on the letter of General Circular No. 1 Year 2003, PWD-WPP has been mandated to regulate the maintenance of a joint - office and government house building comprising the common house and official residence of the administrative and civil servant of the Government (JKR-WPP, 2015). Government Buildings in Putrjaya are divided into 3 categories (Prime Minister's Department of Malaysia, 2003):

a) Joint Office Buildings *(Bangunan Gunasama)* - Building complex shared by several ministries or departments or organizations

b) Non-Joint Offices Buildings *(Bangunan Bukan Gunasama)* - Building complexes dedicated specific to ministries, departments and organizations only. For example: Ministry of Finance Complex, Ministry of Foreign Affairs Comples, hospital, clinic, school, police station, mosque, etc.

c) Government House - Government houses include categories such as houses reserved for a department (e.g.: Police Quarters), houses reserved for a particular post (e.g.; the residence of the Head of State Secretary), formal residence of an administrative member or a high-ranking government official (minister, deputy minister, chief director of public sector Grade A and above) and a regular government house.

The party responsible for the maintenance of a joint building in Putrajaya is Public Work Department of the Federal Government of Putrajaya (PWD-WPP). This responsibility covers planning, control and supervision of all maintenance matters, maintenance contractor appointments, provision of expenditure and allocation controls. The specific role that the PWD-WPP needs to play is to ensure that the office and its equipment are well-operated and well-maintained including office space and shared space. Maintenance services include lighting systems, firefighting systems, air conditioning, lifts, telephones, cleaning and landscaping. PWD WPP is also responsible for maintaining the government house of the regular home category and the official residence of administrative or the Government high-ranking civil servants (Prime Minister's Department of Malaysia, 2003)

PWD as the largest technical department in Malaysia, PWD-WPP's members always work together and work together to ensure that national development can be implemented

with regard to relevant technical aspects and committed to maintaining government assets to meet the nation's development needs by providing quality professional services based on a set time frame, cost economics and quality and sustainable design. Their vision is to be a world class service provider and a center of excellence in asset management, project management and engineering for the development of state infrastructure based on creative human capital, innovation and latest technology (JKR-WPP, 2015).

2.7.1 FM ICT at PWD

These days,, information and communication technologies are generally use in the most government agencies and turn out to be essential in organization to enhance work performance, efficiency,, increase knowledge of workers, improve quality of job and improve collaboration and networking among employees by removing the barrier to real-time communication and effective information sharing. Through ICT, the organization can cross land and time zone community and ICT is contributing to environmental responsibility. By using ICT in an organization, it enables the organizations react quickly to their tasks and to their stakeholders by enhancing quality of service, responsibility and effectiveness.

In series of facilities management contracts that have been issued by PWD, have listed the scope of the contractor's duties and one of the scope that must be provided by the contractor is the scope of the Management Information System (MIS). This scope states where contractors are required to build an information system management; and plan management of information system (Jabatan Kerja Raya, 2015).

In the new Facilities Management and Maintenance Contract, listed under Item *22: Management Information System* sub item *22.1 Contractor's Obligation;*

"22.1.1 The Contractor shall, within three (3) months from the Commencement Date, develop, procure, manage and maintain the Management Information System which shall be compatible with and able to integrate with the Government's asset management information system;

22.1.2 If there is an Existing Management Information System, the Contractor shall manage, maintain, amend, upgrade and update the Existing Management Information System accordingly.

22.1.3 The Contractor shall integrate the Management Information System or the Existing Management Information System with the Government's asset management information system at its own cost and expense"- (Jabatan Kerja Raya, 2015)

In 2015, a study was conducted on the use of CMMS on Facility Management and Maintenance (FMM) contracts managed by PWD. There was inconsistency and some significant weaknesses to be given by the department. This incompatibility has resulted in governmental and other issues. Accordingly, a technical specification document for PWD's CMMS application has been developed to address these issues. The specification developed will be applied to all FMM contracts under the responsibility of PWD related to the provision of CMMS applications on the relevant contract (Bahagian Perundingan Pengurusan Aset JKR-HQ, 2017b).

The PWD has also taken the initiative to develop their own CMMS system known as the Sistem Pengurusan Fasiliti Bersepadu (eSPFB). However, the PWD has also given some flexibility where, should the Contractor would like to use CMMS software other than eSPFB, the Contractor must ensure that their alternatives proposed system is always

compliance, similar or equivalent to the requirements stated by the contract administrator (Jabatan Kerja Raya Malaysia, 2017).

2.7.1.1 Roles and Responsibilities

According to (Jabatan Kerja Raya, 2015)This MIS is being observe, monitor, verify and manage performance by *Facility Superintending Officer (FSO)*. FSO duties in MIS is also to make sure that contractor conducts activities as below:

a) Develop, utilize, manage and maintain MIS as stipulated in the contract (for premises that do not yet have a MIS system); or
b) Managing, updating, maintaining and coordinating inventory and data of assets using MIS developed / existing in compliance with Government's current instructions;
c) Ensure that all data management and asset inventory lists conform to the *Manual Pengurusan Aset Menyeluruh* (MPAM)
d) Manage, maintain and update all assets and labeled in accordance with the correct code and in accordance with the Government policy requirements;
e) Develop and streamline the inventory list of assets according to the appropriate method
f) Facilities and maintenance management records should be maintained through Computerized Maintenance Management Systems (CMMS), logs of maintenance activities, site daily logbooks, technical drawings, as built drawings and others.
g) Comply with the *Akta Rahsia Rasmi Kerajaan (Akta 88) Arahan Keselamatan Kerajaan* and other Government directives relating to official Government information in the form of data, records and others either in hard copy or / and soft copy

h) Ensuring the accuracy, authenticity and integrity of the data in MIS;

i) Protect the Government from any loss, damage or leakage to the data contained in the MIS

However, the FSO may from time to time appoint such number of FSO's Representative where he or she shall assist the FSO in carrying out the FSO's duties including overseeing, monitoring, supervising and regulating the FMM Services carried out by the contractor; have the powers and duties of the FSO that have been delegated to him in writing by the FSO, and be responsible to the FSO in all aspect pertaining to the contract.

2.7.2 *Sistem Pengurusan Fasiliti Bersepadu* (eSPFB) PWD

Sistem Pengurusan Fasiliti Bersepadu (eSPFB PWD) is an application of PWD CMMS that has been developed in line with the *Sistem Kod Aset Tak Alih* (SKATA) Kerajaan. eSPFB PWD is an innovation from the application of the *Sistem Pemantauan Pengurusan Fasiliti* (SPPF) used in Putrajaya.

eSPFB is a system based in Bahagian Teknologi Maklumat (BTM) which was developed by the *Cawangan Perancangan Aset Bersepadu,* Public Work Department, Headquarters (PWD HQ) with the appointed vendors. eSPFB is a more effective and organized management contract monitoring system that includes uniform operational management, monitoring of user-friendly complaint module modules and reporting modules that meet PWD's requirements (Sapari, 2016).

It is an application tool to enable the maintenance work of a facility to be easier, systematic and effective. Bahagian Perundingan Pengurusan Aset JKR-HQ (2017b) lists the following activities;

a) Generating work instructions, prioritization, and tracking of asset & component information

b) Historical tracking of all work instructions

c) Detects scheduled and unscheduled maintenance activities

d) Storage of technical documentation records or maintenance procedures

e) Detection of materials and labor costs; and

f) Report generation (dynamic / static) and analysis of maintenance activities.

This application contains four (4) main component as can be seen in Figure 2.6 below;

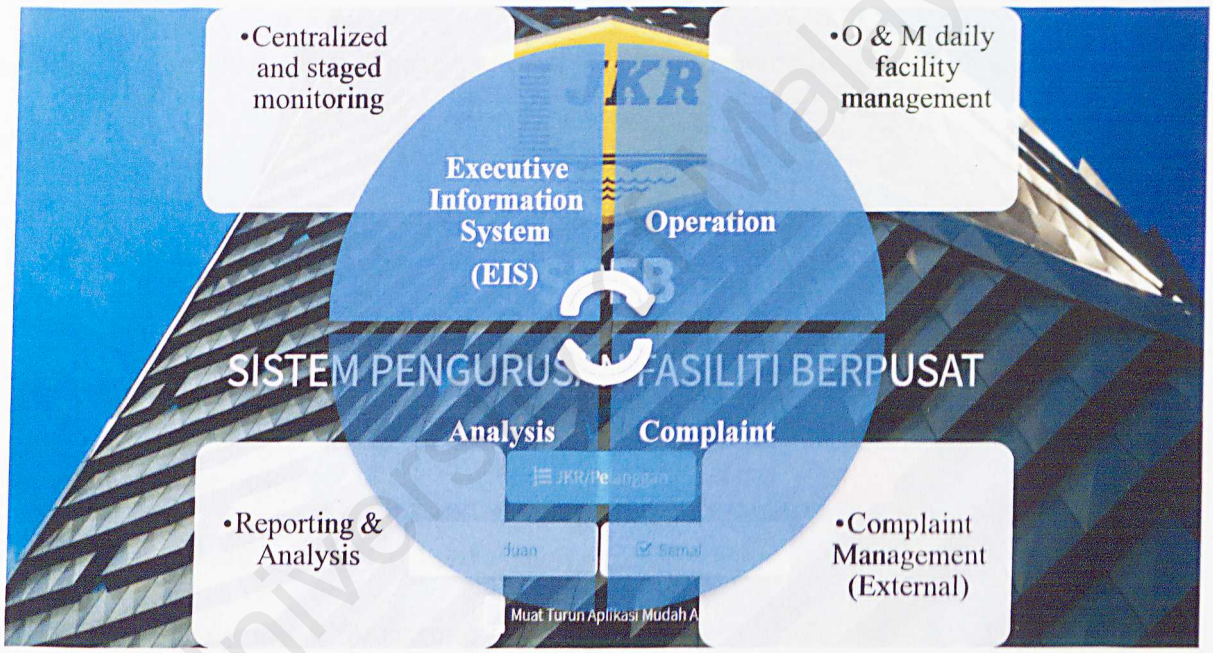

Figure 2.6 Main components of eSPFB PWD by Bahagian Perundingan Pengurusan Aset JKR-HQ (2017b)

This new developed application, eSPFB is an online based application believed to be uniformed with all data controlled by PWD HQ. It is a CMMS that is uniform and in line with PWD needs. All data of eSPFB application are controlled and placed in the PWD Data Center and with this, PWD owns and can fully use the eSPFB data. The application is fully using data from PWD and provide strategic and analytical reporting facility – where the data can be filtered from micro and macro level analysis (Premise-Regional-

State-Country) using single platform (Bahagian Perundingan Pengurusan Aset JKR-HQ, 2017a). For a correct implementation of CMMS, the whole process should be digital. The entire process within the CMMS should be in digital form to ensure the implementation is fully implemented. Facility managers should take this implementation with a logical approach to ensure that effective technology is effective. (Thomas, 2001)

In addition, the eSPFB system has a clear connection to the MySPATA system where all asset data used relates to the data used in the MySPATA system. Along with the government's mission and vision to empower government asset management, the eSPFB system is seen as one of the tools to realize the government's goals and expectations in managing government assets. The use of eSPFB has contributed to several advantages as below;

a) Centralized data center
b) Full Control of Data security & safety
c) Specification & price adjustment
d) Effective cost
e) Effectiveness of the Go-Live system period
f) Data analyzing & forecasting

2.7.2.1 Modules in eSPFB PWD

The PWD's eSPFB is not just focusing on the Facility Management operations, but also looks at the need for PWD to monitor online at Operation, Tactical and Strategic levels. eSPFB PWD is also based on the latest PWD CMMS Specifications that meet the basic requirements of the CMMS Specifications of the PWD as follows:

a) Contains 17 basic modules (Uniform);
b) Explain the roles and responsibilities of related parties;

c) Resolve data and application ownership issues;

d) Solve integrity and security data issues; and

e) Stabilize the CMMS price per FM contract / Maintenance for PWD supervision.

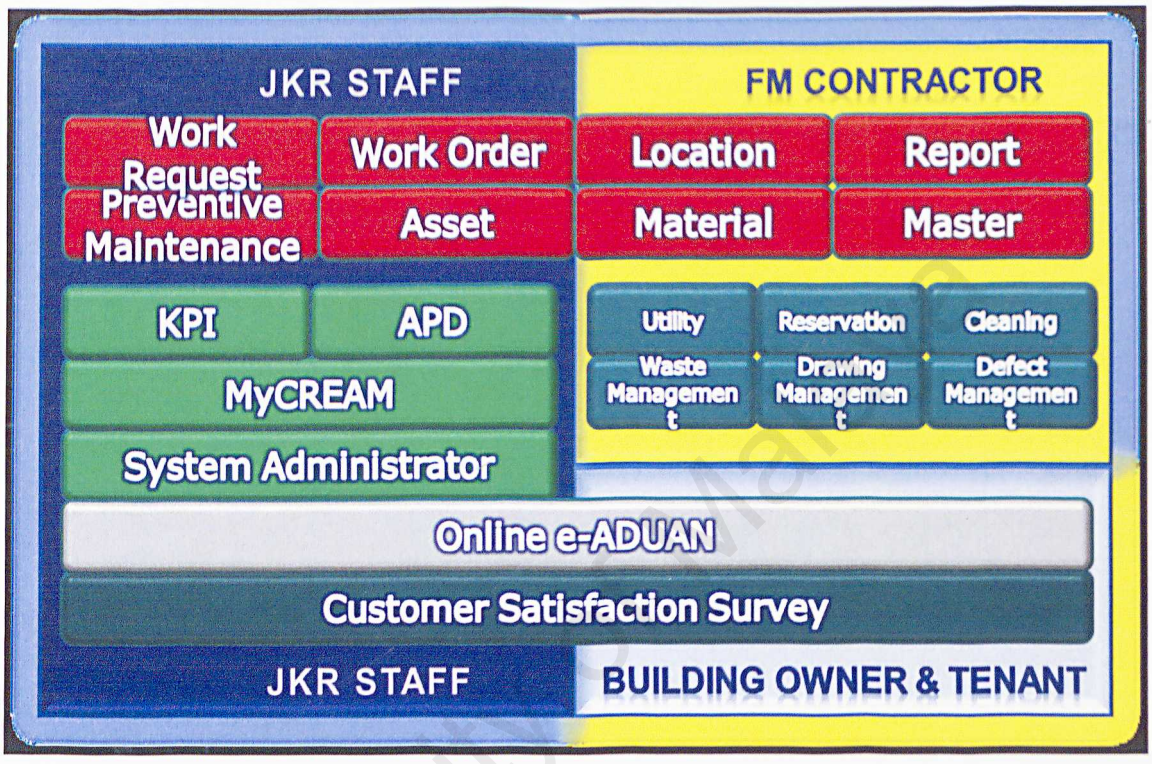

Figure 2.7 Main frame of eSPFB PWD by Bahagian Perundingan Pengurusan Aset JKR-HQ (2017b)

The complaint module makes it easy for all users to lodge complaints directly through the system using office computer or by using the android app on the mobile phone by visiting the *spfb.jkr.gov.my* website. This method is seen as more user-friendly, centralized across the country and more effective in line with today's technological advances. All users can lodge a complaint by entering the identity card number and personal information as well as complaints made online. The ability of the customer to enter service request electronically through the Internet opens the work management scope. No longer is there a reliance on the customer service desk. The internet extends the hours that operation and maintenance must support to entire hour of the week. (Thomas, 2001)

There are eight (8) main modules in this eSPFB system for the use of PWD which enables monitoring of facility management to be more organized, systematic and more effective. The modules are:

a) Call Centre,

b) Work Request,

c) Customer Satisfaction Survey (CSS)

d) Administration,

e) Key Performance Indicator (KPI)

f) Ascertained Performance Deduction (APD)

g) Master

h) Report.

Other than that, there are plenty of sub modules that completes the application. Those modules and functions are:

Figure 2.8 Functions and modules in eSPFB PWD application by Bahagian Perundingan Pengurusan Aset JKR-HQ (2017b)

Not all premises and FM contractors use this application, some of them still using different computerized system, be it built in house or on shelf product. eSPFB can be access by PWD HQ, FSO Offices, contractors, civil servants, the public or anyone who deals in premises registered with the eSPFB System. Public citizen or visitors of that related premises however can only use the complaint module to make complaint.

2.7.3 Contract Administration

Contractors selected to carry out tenders will be offered a contract to execute facilities and maintenance management activities. The Contract Document is a document which contains the terms of the contract to clarify the rights and obligations of the parties to the contract in writing. The contract documents are also documents describing the scope of work to be performed and the desired level of performance under contract with the agreed upon price.

Administration of Facility Management and Maintenance Contracts (FMMC) includes supervision, monitoring, verification and performance management. It is the responsibility of the Facilities Superintendent Offices (FSO) to supervise, monitor, verify the work and manage the performance of the contractor during the duration of the contract. FSO may delegate powers to carry out tasks in accordance with the Power of Representation Letter.

2.7.4 FM PMS at PWD

When work is performed, the performance of the contractor will be monitored to ensure that it is implemented according to the performance set out in the contract. Facility Site Meeting (MTF) shall be held to monitor performance and resolve problems arising from work execution.

In PWD, the performance measurement method system which is used to monitor contractors' achievements to ensure that the services provided meet the needs of the contract is balanced scorecard. There is an indicator list that this contractor needs to follow each month. The contractor shall perform work in accordance with the terms and conditions in the contract and meet the standards set by the government in accordance with performance requirement.

The performance management document for PWD FM Contract is comprised of KPI and APD Schedules. For Government buildings, KPIs are developed into three divisions; KPI based on Performance, KPI based on service availability and KPI based on Asset Availability. The terms of the contract to pay the contractor to the contractor are on a monthly basis (interim payment). Assessment of the value of FMM's work is paid based on the performance of the operation and maintenance, performance of the contractor's, the Schedule of Price and the Performance Management Measurement Schedule. The Ascertained Performance Deduction (APD) calculation will be applied to operations and maintenance that does not reach the specified performance level. APD is the amount of withholding amount already treated in Malaysian Ringgit (RM) is based on KPI listed (Jabatan Kerja Raya, 2015).

The contractors needs to report the specified report as in the Technical Specification and need to be sent on a monthly basis. The report will be part of the assessment base to make interim payments and APD calculations.

The imposition of the APD shall be based on the number of application / complaints / PPM records, records in MIS or CMMS and NCR reports comprising the three categories of KPI above which the contractor fails to meet in its obligations under the Contract.

Referring to (Jabatan Kerja Raya, 2015), supervisory teams of PWD shall go through the following process in making APD calculations;

a) Monthly collection of information from MIS CMMS
b) The cut-off date for the APD determination must be made on the date agreed by all related parties.
c) Establishing an agreed Parameter pertaining to APD Determination based on KPI (Based on Performance, Service Availability and Asset Availability).
d) Set the amount of maintenance data for the month in question.
e) Review non-compliance with respect to deductions for that particular month.
f) Provide justification and evidence for any disputed disobedience. On-site checks should be carried out upon request from any party as an extension to the verification process.
g) Monthly reports should be sent every 7 days of the month or at a fixed date each month

All information entered in the MIS or CMMS shall be validated and the information has been agreed upon by the facility superintending officer (FSO) and the contractor. All applications, complaints, Planned Preventive Maintenance (PPM) applications that have been made shall be authenticated by the FMM Contractor which will set the indication of the proper deduction.

Both parties (PWD and contractors) agree that the Government has the right to make a number of denials to the KPIs which are not met according to the predetermined formula. The Government reserves the right to deduct the monthly payment when it is found and that the contractor fails to achieve the performance set under the Contract. Performance measurement is made to the 3 Key Performance Indicator categories that

have been set. This study will look only into measurement using KPI based on contractor's performance only (Performance Based KPI). There are 11 indicator which FM contractors must adhere to for performance based assessments. Data of this KPI is mostly obtained from CMMS system, in this case, the eSPFB.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

This chapter contains a research methodology used in research. This chapter also describes in detail the study data, study methods, research instruments and data analysis.

3.2 Data Collection Technique

This study uses quantitative methods as the main approach of the study. There is an open-ended question question to give space to respondents to share their views unlimited. Questions about other challenges faced by respondents in the eSPFB system implementation are examples of the use of the open-ended method.

Some steps have been taken before going down the field. Firstly, a letter of permission for the purpose of applying for permission to conduct the study is sent to the *Cawangan Pengurusan Aset Bersepadu* (CPAB) at PWD Headquarters. Subsequently, after the delivery of the coloration, the CPAB provided a list of contractors using eSPFB and officers to contact at PWD Putrajaya for information. Facilities Engineer, PWD Putrajaya was contacted and provided a list of officers involved in monitoring FM contractor performance in Putrajaya. The questionnaire was distributed online, meaning that researcher created a survey online form and emailed to the respondent individually.

From the preliminary survey, 12 FM contractors in Putrajaya are currently using eSPFB in their facility management operations which means all the information of their operation such as work order, maintenance schedule, completed work orders, response time are currently stored in eSPFB server. The information is accessible to their individual supervisory team which PWD Putrajaya who will later use the information to monitor the

contractor's performance. Performance measurement in this context is contractor's monthly performance which is measured using the list of KPIs specified in the contract. This study will look only into measurement of Performance Based KPI only. These contractors provides facilities management services to several government buildings available in Putrajaya. The list of government buildings maintained by these contractors is as follows:

a) Parcel B
b) Parcel C
c) Parcel D
d) Bahagian Hal Ehwal Undang-Undang
e) Attorney General's Chamber
f) Immigration Department
g) Ministry of Domestic Trade, Co-Operatives and Consumerism
h) Youth and Sports Ministry
i) Department of Civil Aviation Malaysia
j) Natural Resources and Environment Ministry
k) Accountant General Department
l) Royal Customs Department of Malaysia
m) Ministry of Finance
n) 4G1 & 4G2 of Ministry of Agriculture and Agro-based Industry
o) Ministry of Transport

Each of the contactors are managed by a group comprised by Facility Superintending Officer (FSO) and is assisted by Facility Superintending Officer Representative (FSOR), engineer, verifier, assistant verifier and facility manager who are responsible in checking

and confirming work in progress, work done, assessments, records and reports put together by the FM Contractor.

3.3 Research Instrument

This study uses questionnaire to obtain primary data. The research instrument was constructed using a reference questionnaire based on the previous study. The study instrument is adaptation and refinement of the (Viswanath & Bala, 2008) study of in 2008. Whereas questionnaire for identifying barriers in eSPFB implementation was derived from literature review of barriers of CMMS implementation in facility management. The questionnaire consists of three sections where:

i. Section A: Contains study demographics including age variables, gender, level of education, years of services, classification of occupation, years of using eSPFB, assessment level of using eSPFB and system used before using eSPFB.
ii. Section B: Measuring respondents' perceptions of the variables found in the TAM3 model.
iii. Section C: Identify barriers faced by the respondents in eSPFB implementation.

Table 3.1 Questionnaire items across construct

Construct	Number of Item	Total
Demographics	1-8	8
Perceived Usefulness	9-12	4
Perceived Ease OF Use	13-16	4
Computer Self-Efficacy	17-20	4
Perception of External Control	21-24	4
Computer Playfulness	25-28	4
Computer Anxiety	29-32	4
Perceived Enjoyment	33-35	3
Objective Usability	36	1
Subjective Norm	37-40	4
Voluntariness	41-43	3
Image	44-46	3
Job Relevance	47-49	3
Output Quality	50-52	3
Result Demonstrability	53-56	4
Behavioral Intention	57-59	3
Use	60	1
Barriers in implementation	61-85	25

3.4 Constructing Questionnaire

This questionnaire uses various approaches and techniques including Likert Scale, open-ended, and multiple answers. Overall, the questionnaire using Likert Scale technique was used to measure the level of respondents' perceptions and to identify the barriers faced during eSPFB implementation. Views from respondents are about the other obstacles faced to get the job of applying open-ended techniques. Finally, respondents were also asked to comment on the eSPFB system using open-ended techniques. This is to give the respondents the widest space to share their sense of taste.

The questionnaire process begins with a reference to the previous study on the topic of the research. Subsequently, appropriate research instruments were adapted and combined to produce questionnaires. All the questions raised are tailored to respondents of the group who monitor the performance of FM contractors in Putrajaya. The questionnaire was formed based on the 5 points Likert Scale "1-Strongly Disagree to 5-Strongly Agree".

3.5 Population and Sampling

For this study the samples to be taken are from the respondents who are responsible for the duties of supervisory officers, engineers, and facility managers only as those involved in monitoring performance of contractors. Population of this research had been identified to 12 numbers of contractors that using eSPFB. These 12 contractors were monitored by a supervisory team of PWD who consisted of facility superintending officers or their representatives, engineers, verifiers and assistant verifiers. These team are the parties actively involved in monitoring contractor's monthly performance. On behalf of the contractor's side, facility managers and engineers were involved in making preparation and generate performance report every time.

The researcher contacted Facility Engineer in PWD Putrajaya and obtained the list of person in charge of every FM contractor. It has been found that some of the supervising team members are supervising more than 1 building. For this study it can be describe that, for these 12 contractors who are using eSPFB were supervised by 6 FSO/FSOR, 7 Engineers, 12 Facility Managers, and 12 Verifier/Assistant Verifier.

In this study however, the researcher also approached more respondents who were also involved in FM performance assessments and categorized them as "Others". These potential respondents approached are 6 respondents from PWD Contract Admin and

asked each FM to nominate 1 engineer that works with them to answer the questionnaire. In total, there are 55 respondents selected for this study.

3.6 Data Analysis

Statistical Packages for the Social Sciences (SPSS) Version 23.0 and Microsoft Excel are used for the purpose of analyzing research data. Several statistical methods are used to achieve the objectives of the study.

3.6.1 Descriptive Analysis

Descriptive method is used to analyze respondent's background. In addition, this method is also used to describe some variables. The descriptive approach used by frequency and percentage method. Descriptive analysis in this research is presented in the form of tables.

3.6.2 Reliability Test and Instrument Validity

Majid Konting (2000) states that the higher the value and the level of validity and the reliability of the instrument, the more accurate the data obtained. The value of Cronbach's Alpha, AVE (Average Variance Extracted), CR (Construct Reliability) is used to see the reliability of the study instrument. The AVE value is also used to see instrument validity. Cronbach's Alpha> = 0.7, AVE> = 0.5 and CR> 0.6 indicates reliability and validity data. Table 3.3 can be referred to determine the strength of a study instrument.

Table 3.2Conbarch Alpha Coefficient Size

Alpha Coefficient Range	Reliability Strength
<0.6	Weak
0.6-0.7	Moderate
0.7-0.8	Good
0.8-0.9	Very Good
>0.9	Excellent

3.7 Research Framework and Hypothesis

The main objective of this research is to conduct descriptive study to identify effective factor that leads to behavioral intention identify the factors based on TAM3 model. In Chapter 2, TAM 3 model has been introduced to the study. To broaden the study, the researcher had included demographic factors and personality background to know which character influence the acceptance factor the most. Based on the model, the researcher would also like to know the relationship of identified barriers with the model. The research framework for this study can be seen in figure below;

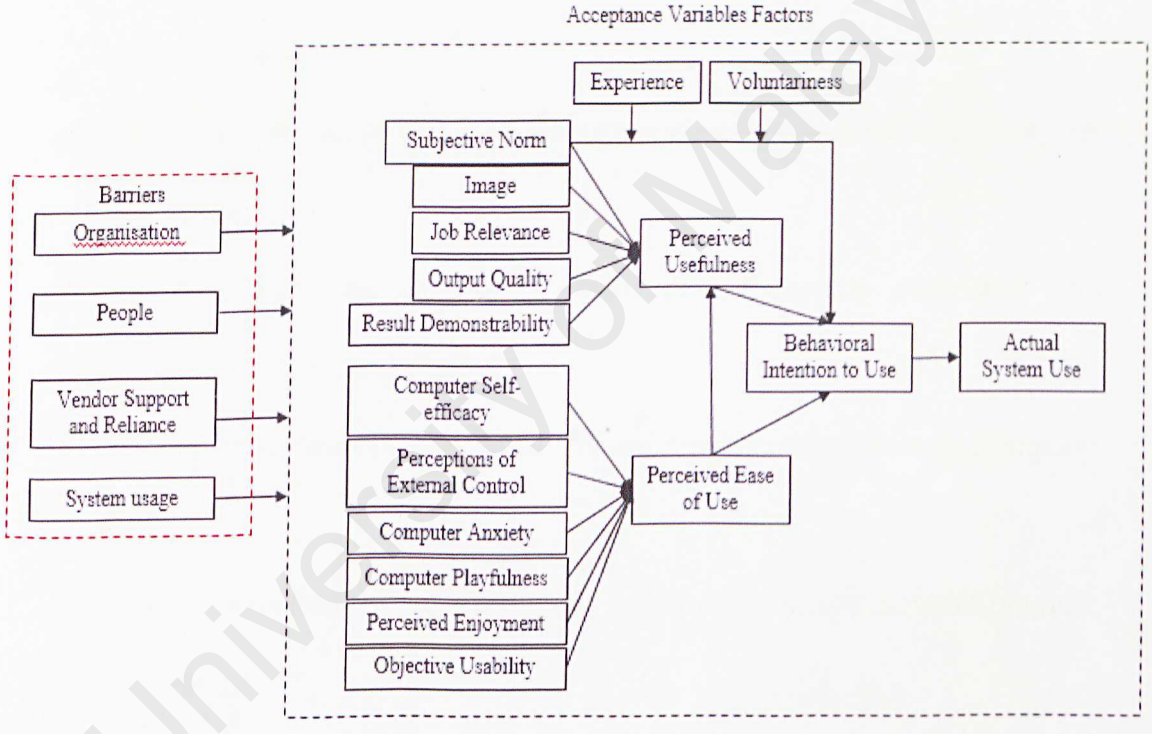

Figure 3.1 Research Framework by Author, (2017)

Based on TAM3 model, 18 hypothesis has been constructed in order to test the relationship of determinants of perceived usefulness and perceived ease of use with perceived usefulness, perceived ease of use, behavioral intention and use. The hypothesis are;

a) H1 Subjective Norm is positively and directly correlated with Image.

b) H2a Perceived Usefulness is positively and directly correlated with Subjective Norm

c) H2b Perceived Usefulness is positively and directly correlated with Image

d) H2c Perceived Usefulness is positively and directly correlated with Job Relevance

e) H2d Perceived Usefulness is positively and directly correlated with Output Quality

f) H2e Perceived Usefulness is positively and directly correlated with Result Demonstrability.

g) H3a Perceived Ease of Use is positively and directly correlated with Computer Self-Efficacy.

h) H3b Perceived Ease of Use is positively and directly correlated with Perceptions of External Control.

i) H3c Perceived Ease of Use is positively and directly correlated with Computer Anxiety

j) H3d Perceived Ease of Use is positively and directly correlated with Computer Playfulness.

k) H3e Perceived Ease of Use is positively and directly correlated with Perceived Enjoyment.

l) H3f Perceived Ease of Use is positively and directly correlated with Objective Usability.

m) H4 Perceived Usefulness is positively and directly correlated with Perceived Ease of Use.

n) H5 Behavioral Intention is positively and directly correlated with Perceived Ease of Use.

o) H6 Behavioral Intention is positively and directly correlated with Perceived Usefulness.

p) H7 Subjective Norm is positively and directly correlated with Behavioral Intention moderated by Experience.

q) H8 Use Behavior is positively and directly correlated with Behavioral Intention.

r) H9 Subjective Norm is positively and directly correlated with Behavioral Intention moderated by Voluntariness.

To identify the relationship of barriers with TAM 3 variables, the researcher has grouped determinants of perceived usefulness and perceived ease of use, perceived usefulness, perceived ease of use, behavioral intention and use as acceptance variables factors. The hypothesis of relationship of implementation barriers with acceptance variables factors are;

a) H10 There is negative relationship of system usage barriers with acceptance variables factors.

b) H11 There is negative relationship of vendor support and reliance barriers with acceptance variables factors.

c) H12 There is negative relationship of people barriers with acceptance variables factors.

d) H13 There is negative relationship of organisational barriers with acceptance variables factors.

CHAPTER 4: DATA ANALYSIS & FINDING

4.1 Data Collection

The questionnaire survey data was gathered through electronic medium (*Google Form*) between middle early November to early December 2017. Apart from that, no questionnaire was found to be incomplete received as respondents in online surveys, respondents were required to answer each question from each section to enable them to proceed to the next section. There are advantages in enforcing online surveys as it reduces the possibility for researchers to receive incomplete questionnaires.

This study has received a low response in the questionnaire where the respondent's target number is only 55 and as many as 35 responses are received. Therefore, a very important note to note that the target group for this research is comprised of professionals and executives who have many and many tasks. Hence, low response rates. According to Ketchen & Bergh, (2006), the low reactions of professionals and executives are due to their lack of time to carry out more critical tasks, especially to respond to academic studies.

The sufficient sampling size for appropriate statistical analysis received from the Putrajaya PWD's supervising team from the FM projects by Putrajaya PWD. The survey targeted to all supervising team whom monitors FM contractor and also FM contractors who are using eSPFB. The total sample size accounts for 55 respondents, 35 questionnaires were returned, representing 63% total response rate.

The composed data was analysed using the IBM SPSS package (Version 23). Descriptive statistics, such as frequencies, mean and percentages were used. In addition,

standard statistical analysis procedures were utilised by using Spearman correlation analysis and Kruskal-Wallis Test in order to analyse the data obtained from the questionnaire.

4.1.1 Reliability Test

A reliability test was completed to test the reliability of the output obtained for the questionnaire. The test of reliability is an important test of sound measurement where a measuring instrument is considered reliable if it provides consistent results (Kothari, 2004). The result of the reliability test is as shown in Table 4.39 below.

Table 4.1 Reliability Statistics for questionnaire construct

Cronbach's Alpha	N of Items
.862	85

Cronbach's alpha coefficient that exceeds 0.700 is considered to have acceptable reliability (Nunnally 1978 in Lance et al., 2006). Based on results in Table 4.1, the Cronbach's alpha coefficient for the 85 questionnaire construct is 0.862, which indicates that the responds for questionnaire have relatively high internal consistency.

4.2 Demographic Information

Tables below shows the frequency, distribution and percentage of the respondents' demographic information consisting gender, age, highest education background, grade of occupation, years of services, how long they have been using eSPFB and their assessment level of using eSPFB. There were 35 respondents who participated in this study.

Table 4.2 reveals that the 35 respondents in this study consisted of 77.1 percent male and the rest 22.9 percent were female.

Table 4.2 Frequency Distribution of Respondents by Gender

Gender	Frequency	Percent	Valid Percent
Male	27	77.1	77.1
Female	8	22.9	22.9
Total	35	100.0	100.0

As Table 4.3 shows, 42.9 percent of respondents are in age range of 30 to 34 years old, 40 percent of respondents are in age range of 35 to 39 years old, 11.4 percent of them are in the range of 25 to 29 years old and 2.9 percent representing the each range of age of 40 to 45 years old and 45 and older.

Table 4.3 Frequency Distribution of Respondents by Age

Levels	Frequency	Percent	Valid Percent
25-29 years	4	11.4	11.4
30-34 years	15	42.9	42.9
35-39 years	14	40.0	40.0
40-45 years	1	2.9	2.9
45 years and above	1	2.9	2.9
Total	35	100.0	100.0

Most of the respondents have the qualification of Bachelor Degree with the percentage of 80 percent, 14.3 percent of them have Master Degree qualification and the rest, 5.7 percent have the qualification of Diploma.

Table 4.4 Frequency Distribution of Respondents by Highest Education Qualification

Education Level	Frequency	Percent	Valid Percent
Master Degree	5	14.3	14.3
Bachelor Degree	28	80.0	80.0
Diploma	2	5.7	5.7
Total	35	100.0	100.0

In Table 4.5, Verifiers and Facility Managers have the same percentage of respondents which is 22.9 percent. 17.1 percent of the respondents are engineers and another 17.1 percent are from the other category where this group consists of engineer from FM contractor's office. 11.4 percent of the respondents are Facility Superintending Officers or their representative and 8.6 percent are Assistant Verifier.

Table 4.5 Frequency Distribution of Respondents by Grade of Occupation

Grade of Occupation	Frequency	Percent	Valid Percent
FSOR	4	11.4	11.4
Engineer	6	17.1	17.1
Verifier	8	22.9	22.9
Asst. Verifier	3	8.6	8.6
Facility Manager	8	22.9	22.9
Others	6	17.1	17.1
Total	35	100.0	100.0

Next is the frequency distribution of respondents by year of service, where 40 percent of the respondents has been working for the range of one to three years. 31.4 percent of them has been working for more than 5 years, 22.9 percent has been working for the range

of three to five years and only 5.7 percent of the respondent has been working for less than one year.

Table 4.6 Frequency Distribution of Respondents by Years of Services

Years of Services	Frequency	Percent	Valid Percent
less than 1 year	2	5.7	5.7
1-3 years	14	40.0	40.0
3-5 years	8	22.9	22.9
more than 5 years	11	31.4	31.4
Total	35	100.0	100.0

All of these respondent have experience in using eSPFB but with different level of experience. 62.9 percent of them have moderate experience in using eSPFB, 28.6 percent with low experience and 8.6 percent of respondent have high experience in using eSPFB.

Table 4.7 Frequency Distribution of Respondents by eSPFB Assessment Level

eSPFB Assessment Level	Frequency	Percent	Valid Percent
Low Experience	10	28.6	28.6
Moderate Experience	22	62.9	62.9
High Experience	3	8.6	8.6
Total	35	100.0	100.0

This section of questionnaire also asked on how long they have been using eSPFB.40 percent of the respondent have less than 1 year of experience of using eSPFB. 31.4 percent of them have been using eSPFB for a year and 28.6 percent of the respondent have been using eSPFB for more than 1 year.

Table 4.8 Frequency Distribution of Respondents by years of using eSPFB

Duration of eSPFB usage	Frequency	Percent	Valid Percent
Less than a year	14	40.0	40.0
1 year	11	31.4	31.4
More than 1 year	10	28.6	28.6
Total	35	100.0	100.0

Respondents of this study constituted a huge difference numbers of males and females. The average age of respondents are in the range of 35 to 39 years old. Most respondents had Bachelor Degree. Most of the works as a Facility Manager and Engineer and has been working for a range of 1 to 3 years. Majority of the respondents have moderate experience of using eSPFB and majority also has been using eSPFB for less than a year.

4.3 Factors Variables of Behavioral Intention and eSPFB Usage by Supervisory Team

Initially, means and standard deviations for each item and construct instrument were calculated and analysed for participant response, measuring their beliefs and opinions regarding the factors that affect behavioral intention to use eSPFB.

4.3.1 Subjective Norm

The data were calculated for valid percent, mean scores and standard deviations to determine respondents' rating of subjective norm. Table 4.9 shows that the mean values of subjective norm ranged from 3.20 to 3.89, indicating that respondents' ratings for their computer competence were between "disagree" to "neutral". The mean values of subjective norm for respondents of the 4 items was 3.64, indicating that overall, respondent's ratings for subjective norm was "neutral".

Table 4.9 Frequency Distribution for Subjective Norm

Subjective Norm	n	Mean	Sd.
People who influence my behavior think that I should use eSPFB	35	3.66	.591
People who are important to me think that I should use eSPFB .	35	3.20	.632
The senior management of this business has been helpful in the use of eSPFB	35	3.80	.584
In general, the organization has supported the use of eSPFB	35	3.89	.471

4.3.2 Image

In this study, respondents were asked to rate the factor of image in eSPFB usage. The mean and standard deviation of respondents for each item are presented in Table 4.10. The result show that the mean rating range from 2.86 and 2.91 indication that image rating in influencing use is "disagree". The overall mean for image was 2.89 indicating that overall respondents "disagree" that with the use of eSPFB, users will gain recognition and status in their organization.

Table 4.10 Frequency Distribution for Image

Image	n	Mean	Sd.
People in my organization who use eSPFB have more prestige than those who do not.	35	2.91	.781
People in my organization who use eSPFB have a high profile.	35	2.86	.692
Having eSPFB is a status symbol in my organization.	35	2.91	.887

4.3.3 Job Relevance

The respondents were also asked to rate their job relevance towards eSPFB through 3 items in the Lickert Scale. To identify the job relevance, it was calculated by frequency distribution. The mean ratings range from 3.80 and 4.11, indicating that respondents rating of their job relevance toward eSPFB ranged from "neutral" to "agree". The overall

mean for respondent's rating of job relevance in the scale was 4.03, indicating that respondents "agree" that the use of eSPFB is relevance in their job.

Table 4.11 Frequency Distribution for Job Relevance

Job Relevance	n	Mean	Sd.
In measuring FM contractor's performance, usage of eSPFB is important.	35	4.11	.530
In my job, usage of eSPFB is relevant.	35	4.21	.538
The use of eSPFB is pertinent to my various job-related tasks	35	3.80	.531

4.3.4 Output Quality

The respondents were also asked to rate their output quality that eSPFB produced through 3 items in the Lickert Scale. To identify the output quality it was calculated by frequency distribution. The mean ratings range from 3.49 and 3.94, indicating that respondents rating of output quality perceived from eSPFB is "neutral". The overall mean for respondent's rating of output quality in the scale was 3.76, indicating that respondent's perceived "neutral" toward outputs quality of eSPFB.

Table 4.12 Frequency Distribution for Output Quality

Output Quality	n	Mean	Sd.
The quality of the output I get from eSPFB is high.	35	3.86	.430
I have no problem with the quality of eSPFB's output.	35	3.94	.591
I rate the results from eSPFB to be excellent	35	3.49	.562

4.3.5 Result Demonstrability

The data were calculated for valid percent, mean scores and standard deviations to determine respondents' ratings of result demonstrability. Table 4.13 presents the frequency distribution of the respondents' self-rated rating for each result demonstrability

item. An examination of the mean of management support in the table shows that the mean values of result demonstrability ranged from 3.63 to 3.80, indicating that respondents are "neutral" on result demonstrability. The mean values result demonstrability for respondents of the 3 items was 3.51, indicating that, overall, respondent's ratings for result demonstrability was "neutral".

Table 4.13 Frequency Distribution for Result Demonstrability

Result Demonstrability	n	Mean	Sd.
I have no difficulty telling others about the results of using eSPFB.	35	3.63	.646
I believe I could communicate to others the consequences of using eSPFB.	35	3.66	.591
The results of using eSPFB are apparent to me.	35	3.80	.473

4.3.6 Perceived Usefulness

In this study, respondents were asked to rate the perceived usefulness of eSPFB. The mean and standard deviation of respondents for each item are presented in Table 4.14. The result show that the mean rating range 4.00 and 4.09 with overall mean is 4.05, gives indication that respondents perceived usefulness of using eSPFB.

Table 4.14 Frequency Distribution for Perceived Usefulness

Perceived Usefulness	n	Mean	Sd.
Using eSPFB improves my performance in my job, in measuring FM contractors performance	35	4.09	.284
Using eSPFB in my job increases my productivity, in measuring FM contractors performance	35	4.00	.343

Table 4.15 Table 4.16 Frequency Distribution for Perceived Usefulness (cont'd)

Perceived Usefulness	n	Mean	Sd.
Using eSPFB enhances my effectiveness in measuring FM contractors performance	35	4.09	.507
I find eSPFB to be useful in measuring FM contractors performance	35	4.06	.591

4.3.7 Computer Self-Efficacy

In this study, respondents were asked to rate their computer self-efficacy through 4 items in a Likert scale. The frequency distributions were calculated to identify the respondent's computer self -efficacy. The mean and standard deviations of respondent's computer self -efficacy for each item in the scale are presented in Table 4.14. An examination of the means show that the mean ratings range 3.60 to 4.00, indicating that respondent`s rating of their computer self- efficacy mentioned in the items ranged from "neutral" to "agree". The mean for respondents` ratings of computer self-efficacy in the scale was 3.85, indicating that overall respondents ratings of their computer self-efficacy was "neutral".

Table 4.17 Frequency Distribution for Computer Self-Efficacy

Computer Self-Efficacy I could measure contractor's performance using eSPFB	n	Mean	Sd.
..if there was no one around to tell me what to do as I go.	35	3.60	.651
..if I had just the built-in help facility for assistance.	35	4.00	.594
..if someone showed me how to do it first.	35	3.97	.785
..if I had used similar packages before this one to do the same job	35	3.86	.601

4.3.8 Computer Playfulness

The respondents were also asked on their computer playfulness. Results in Table 4.15 below, show that the mean ratings range 3.09 3.97, indicating that respondent`s rating of their computer playfulness mentioned in the items are "neutral". The mean for respondents` ratings of computer playfulness in the scale was 3.65, indicating that overall respondents ratings of their computer playfulness was "neutral".

Table 4.18 Frequency Distribution for Computer Playfulness

Computer Playfulness when I use computers…	n	Mean	Sd.
. . . I am spontaneous	35	3.97	.296
. . . I am creative	35	3.97	.514
. . . I am playful	35	3.60	.695
. . . I am unoriginal	35	3.09	.702

4.3.9 Computer Anxiety

For computer anxiety factor, the mean range from 1.60 to 4.00, indicating the respondents' rate of their computer anxiety form "strongly disagree" to "agree". However the overall mean score was only 2.30 indicating overall respondents rating to their computer anxiety as "disagree"

Table 4.19 Frequency Distribution for Computer Anxiety

Computer Anxiety	n	Mean	Sd.
Computers do not scare me at all.	35	4.34	.539
Working with a computer makes me nervous.	35	1.66	.591
Computers make me feel uncomfortable.	35	1.60	.553
Computers make me feel uneasy	35	1.60	.553

4.3.10 Perceived External Control

This factor is about a degree to which individual believes that they have support in using the system. The mean and standard deviation of respondents for each item are presented in Table 4.17. The result show that the mean rating range 3.26 and 4.43, indicating that the respondents rating on perceived of external control ranged from "neutral" to "agree". With overall mean 3.83, gives indication that respondents perceived external control is "neutral"

Table 4.20 Frequency Distribution for Perceived External Control

Perceived External Control	n	Mean	Sd.
I have control over using eSPFB	35	3.83	.618
I have the resources necessary to use eSPFB	35	3.83	.618
Given the resources, opportunities and knowledge it takes to use eSPFB, it would be easy for me to use eSPFB.	35	4.43	.558
eSPFB is not compatible with other systems I use	35	3.26	.817

4.3.11 Perceived Enjoyment

In this study, respondents were asked to rate the factor of perceived enjoyment in using eSPFB. The mean and standard deviation of respondents for each item are presented in Table 4.18. The result show that the mean rating range from 3.06 and 3.71 indication that image rating in influencing use is "neutral". The overall mean for image 3.34 indicating that overall respondents "neutral".

Table 4.21 Frequency Distribution for Perceived Enjoyment

Perceived Enjoyment	n	Mean	Sd.
I find using eSPFB to be enjoyable.	35	3.26	.817
The actual process of using eSPFB is pleasant.	35	3.71	.622
I have fun using eSPFB.	35	3.06	.684

4.3.12 Objective Usability

For objective usability, the result was measure using percentage. The result in Table 4.19 shows that 48.6 percent of respondents spent less than an hour to retrieve performance information each day. 17.1 percent of respondent spend 1-2 hours to retrieve performance information and 34.3 percent spent 3-4 hours to do the same task.

Table 4.22 Percentage of Time Spent to Retrieve Performance Information

Objective Usability		
On average, how much time do you usually spent to retrieve performance information each day?	n	%
Less than 1 hour	17	48.6
1-2 hours	6	17.1
3-4 hours	12	34.3

4.3.13 Perceived Ease of Use

In this study, respondents were asked to rate the perceived ease of Use of eSPFB. The mean and standard deviation of respondents for each item are presented in Table 4.20. The result show that the mean rating range 3.77 and 4.00 which indicates that respondent's rate range from "neutral" to "agree" with overall mean 3.87 gives indication that respondent's perceived ease of use of eSPFB as "neutral".

Table 4.23 Frequency Distribution for Perceived Ease of Use

Perceived Ease of Use	n	Mean	Sd.
My interaction with eSPFB is clear and understandable.	35	3.77	.426
Interacting with eSPFB does not require a lot of my mental effort.	35	3.80	.584
I find eSPFB to be easy to use.	35	3.91	.658
I find it easy to get eSPFB to do what I want it to do in measuring FM contractor performance	35	4.00	.542

4.3.14 Behavioral Intention

Despites all of the finding above, result for behavioral intention to use eSPFB show some positive result. With the mean rating ranges between 3.80 and 4.17, indicates that respondent's rate ranges from "neutral" to "agree". The overall mean for this factor is 4.00, which indicate that respondent "agree" to the intention of using eSPFB.

Table 4.24 Frequency Distribution for Behavioral Intention

Behavioral Intention	n	Mean	Sd.
Assuming I had access to eSPFB, I intend to use it.	35	4.03	.453
Given that I had access to eSPFB, I predict that I would use it.	35	4.17	.514
In the future, I intend to increase the use of the eSPFB	35	3.80	.406

Table 4.24 presents the mean and standard deviation of all factor stated previously.

Table 4.25 Mean and Standard Deviation of all Factor

Factor	N	Mean	Std. Deviation
Subjective Norm (SN)	35	3.63	.380
Image (IMG)	35	2.89	.694
Job Relevance (REL)	35	**4.03**	.448
Output Quality (OUT)	35	3.76	.392
Result Demonstrability (RES)	35	3.51	.415
Perceived Usefulness (PU)	35	**4.05**	.349
Computer Self-Efficacy (CSE)	35	3.85	.553
Computer Playfulness (CPLAY)	35	3.65	.416
Computer Anxiety (CANX)	35	2.30	.424
Perceived External Control (PEC)	35	3.83	.496
Perceived Enjoyment (ENJ)	35	3.34	.591

Table 4.26 Mean and Standard Deviation of all Factor (cont'd)

Factor	N	Mean	Std. Deviation
Objective Usability (OU)	35	3.17	.706
Perceived Ease of Use (PEOU)	35	3.87	.399
Behavioral Intention (BI)	35	4.00	.313
Use (USE)	35	1.85	.733

4.4 Test of Difference between Demographic Factor with Factors Variables of Behavioral Intention and eSPFB Usage

For this study, Man-Whitney U Test were used to measure the difference of the variables between genders. It was found that, there is no statistically significant difference in the variables (in IMG, REL, OUT, RES, PU, CSE, CPLAY, CANX, PEC, ENJ, OU, PEOU, BI, USE, and VOL) scores of males and females.

The researcher use Kruskal-Wallis test where this test allows researcher to compare the scores on some continuous variable for three or more groups. For example in this study, is there any difference in output quality across four work experience levels? For this study, Kruskal-Wallis Tests was used to compare scores on variables below.

4.4.1 Age

Difference in SN, IMG, REL, OUT, RES, PU, CSE, CPLAY, CANX, PEC, ENJ, OU, PEOU, BI, and USE across six age levels. In this study, Kruskal-Wallis test revealed a statistically significant difference as below:

i. Perceived Ease of Use (PEOU), x^2 (2,n = 35) = 9.66, p = 0.047. Group 1 (Gp1) and Group 2 (Gp2) recorded a highest median score (Md = 4.00) than the other three age groups, which recorded median value within the range of 3.00 and 3.75.

ii. Computer Playfulness (CPLAY), x^2 (2,n = 35) = 9.80, p = 0.4. Group 4 (Gp4) recorded a highest median score (Md = 4.25) than the other three age groups, which recorded median value within the range of 2.50 and 3.75.

iii. Image (IMG), x^2 (2,n = 35) = 11.71, p = 0.20. Group 4 (Gp4) and Group 5 (Gp5) recorded a highest median score (Md = 3.75) than the other three age groups, which recorded median value within the range of 2.67 and 3.12.

Table 4.27 Kruskal Wallis Test of Age with PEOU, CPLAY and IMG

	PEOU	CPLAY	IMG
Chi-Square	9.657	9.803	11.708
df	4	4	4
Asymp. Sig.	.047	.044	.020

Table 4.28 Mean Rank and Median of Age with PEOU, CPLAY and IMG

	Age	N	Mean Rank	Median
PEOU	25-29 years	4	21.00	4.0000
	30-34 years	15	22.13	4.0000
	35-39 years	14	14.89	3.7500
	40-45 years	1	3.50	3.2500
	45 years and above	1	2.00	3.0000
	Total	35		4.0000
CPLAY	25-29 years	4	8.38	3.5000
	30-34 years	15	19.43	3.7500
	35-39 years	14	19.32	3.7500
	40-45 years	1	33.50	4.2500
	45 years and above	1	1.00	2.5000
	Total	35		3.7500
IMG	25-29 years	4	6.88	2.0000
	30-34 years	15	14.83	2.6667
	35-39 years	14	23.36	3.1667
	40-45 years	1	26.50	3.3333
	45 years and above	1	26.50	3.3333
	Total	35		3.0000

4.4.2 Education

Difference in SN, IMG, REL, OUT, RES, PU, CSE, CPLAY, CANX, PEC, ENJ, OU, PEOU, BI, and USE across five education levels. Table 4.29 shows that there is a significant difference among different education level and Perceived External Control (PEC), x^2 (2,n = 35) = 7.26, p = 0.26. Group 3 (Gp3) recorded a highest median score (Md = 4.36) than the two education level groups, which recorded median value within the range 3.75 and 4.00.

Table 4.29 Kruskal Wallis Test of Education Level with PEC

Educ_Lvl	PEC
Chi-Square	7.263
df	2
Asymp. Sig.	.026

Table 4.30 Mean Rank and Median of Education Level with PEC

Education Level		N	Mean Rank	Median
PEC	Master Degree	5	9.20	3.7500
	Bachelor Degree	28	18.66	4.0000
	Diploma	2	30.75	4.3750
	Total	35		3.7500

4.4.3 Grade of Occupation

Difference in SN, IMG, REL, OUT, RES, PU, CSE, CPLAY, CANX, PEC, ENJ, OU, PEOU, BI and USE across seven occupation grades. Table 4.31 shows that there is a significant difference among different grade of occupation with Result Demonstrability (RES), x^2 (2,n = 35) = 16.12, p = 0.006. Group 1 (Gp1) Group 4 (Gp4) and Group 5 (Gp5) recorded a highest median score (Md = 3.75) than the three grade of occupation groups, which recorded median value within the range 3.00 and 3.50.

Table 4.31 Kruskal Wallis Test of Grade of Occupation with RES

Occu_Grade	RES
Chi-Square	16.158
df	5
Asymp. Sig.	.006

Table 4.32 Mean Rank and Median of Grade of Occupation Level with RES

	Occupation Grade	N	Mean Rank	Median
RES	FSOR	4	23.75	3.7500
	Engineer	6	15.08	3.5000
	Verifier	8	13.00	3.3750
	Asst. Verifier	3	23.67	3.7500
	Facility Manager	8	27.00	3.7500
	Others	6	8.92	3.0000
	Total	35		3.5000

4.4.4 Years of Services

Difference in SN, IMG, REL, OUT, RES, PU, CSE, CPLAY, CANX, PEC, ENJ, OU, PEOU, BI, USE, VOL across four years of services level. Table 4.31 shows that there is a significant difference among different years of services group with CPLAY and SN where;

i. Computer playfulness (CPLAY), x^2 (2,n = 35) = 10.86, p = 0.013. Group 4 (Gp4) recorded a highest median score (Md = 4.00) than the other three years of working groups, which recorded median value within the range of 3.25 and 3.75.

ii. Subjective norm (SN), x^2 (2,n = 35) = 9.58, p = 0.023. Group 3 (Gp3) and Group 4 (Gp4) recorded a highest median score (Md = 3.75) than the other two years of working groups, which recorded median value within the range of 3.50 and 3.25.

Table 4.33 Kruskal Wallis Test of Years of Services with CPLAY and SN

Years_Service	CPLAY	SN
Chi-Square	10.857	9.579
df	3	3
Asymp. Sig.	.013	.023

Table 4.34 Mean Rank and Median of Years of Service with CPLAY, SN and VOL

Years_Service		N	Mean Rank	Median
CPLAY	less than 1 year	2	6.75	3.25
	1-3 years	14	13	3.5
	3-5 years	8	22.31	3.75
	more than 5 years	11	23.27	4
	Total	35		3.75
SN	less than 1 year	2	5.5	3.25
	1-3 years	14	19.11	3.75
	3-5 years	8	25.13	3.75
	more than 5 years	11	13.68	3.5
	Total	35		3.75

4.4.5 Duration of eSPFB use

The is no difference found between IMG, REL, OUT, RES, PU, CSE, CPLAY, CANX, PEC, ENJ, OU, PEOU, BI, USE, VOL across three eSPFB duration from first start use.

4.4.6 eSPFB Assessment Level

Difference in SN, IMG, REL, OUT, RES, PU, CSE, CPLAY, CANX, PEC, ENJ, OU, PEOU, BI, USE, VOL across three eSPFB assessment level. Table 4.36 shows that there is a significant difference among different eSPFB assessment level with ENJ,SN and IMG where;

i. Perceived Enjoyment (ENJ) , x^2 (2,n = 35) = 6.75, p = 0.034. Group 3 (Gp3) recorded a highest median score (*Md* = 4.00) than the other two eSPFB assessment level group, which recorded median value within the range of 3.33.

ii. Subjective Norm (SN), x^2 (2,n = 35) = 8.25, p = 0.16. Group 3 (Gp3) recorded a highest median score (*Md* = 4.00) than the other two eSPFB assessment level group, which recorded median value within the range of 3.37 and 3.75.

iii. Image (IMG), x^2 (2,n = 35) = 9.33, p = 0.009. Group 3 (Gp3) recorded a highest median score (*Md* = 4.00) than the other two eSPFB assessment level group, which recorded median value within the range of 2.67 and 3.00.

Table 4.35 Kruskal Wallis Test of eSPFB Assessment Level with ENJ, SN and IMG

Assessment Level	ENJ	SN	IMG
Chi-Square	6.747	8.246	9.334
df	2	2	2
Asymp. Sig.	.034	.016	.009

Table 4.36 Mean Rank and Median of eSPFB Assessment Level with ENJ, SN and IMG

	Assmt_Lvl	N	Mean Rank	Median
ENJ	Low Experience	10	15.55	3.3333
	Moderate Experience	22	17.23	3.3333
	High Experience	3	31.83	4.0000
	Total	35		3.3333
SN	Low Experience	10	13.95	3.3750
	Moderate Experience	22	17.84	3.7500
	High Experience	3	32.67	4.0000
	Total	35		3.7500
IMG	Low Experience	10	12.30	2.6667
	Moderate Experience	22	18.64	3.0000
	High Experience	3	32.33	4.0000
	Total	35		3.0000

4.5 Relationship between Factor Variables based on TAM3 Model

The next step in the data analysis was to examine the significance and strength of hypothesized relationships in the study model using the Spearman correlation coefficient. The table below shows the hypothesis between each variables which represent the relationship of all variables. This test is also conducted in order to validate the model adopted in this study. The TAM can be isolated into a few segments. The principal part inspected was Perceived Usefulness and its derivative components. For tests of significance, the rule of thumb for using one-tailed or two-tailed significance is typically contingent on whether the direction of influence is known. In the present study, while the direction of influence was often anticipated, a two-tailed test was also more conservative providing greater confidence that results were valid. Thus, two-tailed tests were used throughout the study.

Table 4.37 Results of correlation and significance for all hypotheses

Hypothesis	Effects	Sig (2-tailed)	r
H1	Subjective Norm → Image.	0.673	0.074
H2a	Perceived Usefulness → Subjective Norm	0.647	0.080
H2b	Perceived Usefulness → Image	0.530	0.110
H2c	Perceived Usefulness → Job Relevance	0.329	0.170
H2d	Perceived Usefulness → Output Quality	0.025	-0.379*
H2e	Perceived Usefulness → Result Demonstrability	0.305	0.178
H3a	Perceived Ease of Use → Computer Self-Efficacy	0.226	0.210
H3b	Perceived Ease of Use → Perceptions of External Control	0.067	0.313
H3c	Perceived Ease of Use → Computer Anxiety	0.369	0.157
H3d	Perceived Ease of Use → Computer Playfulness	0.012	0.419*
H3e	Perceived Ease of Use → Perceived Enjoyment	0.150	0.248
H3f	Perceived Ease of Use → Objective Usability	0.029	-0.369*
H4	Perceived Usefulness → Perceived Ease of Use	0.000	0.581**

. Correlation is significant at the 0.01 level (2-tailed).

. Correlation is significant at the 0.05 level (2-tailed).

Table 4.38 Results of correlation and significance for all hypotheses (cont'd)

Hypothesis	Effects	Sig (2-tailed)	r
H5	Behavioral Intention → Perceived Ease of Use	0.651	-0.079
H6	Behavioral Intention → Perceived Usefulness	0.974	-0.006
H7	Subjective Norm → Behavioral Intention moderated by Experience	0.218	0.217
H8	Use Behavior → Behavioral Intention.	0.059	-0.322
H9	Subjective Norm Subjective Norm → Behavioral Intention moderated by Voluntariness	0.823	0.400

. Correlation is significant at the 0.01 level (2-tailed).

. Correlation is significant at the 0.05 level (2-tailed).

The correlation between Subjective Norm and Perceived Usefulness was 0.080 (ns); between Image and Perceived Usefulness was 0.110 (ns), between Job Relevance and Perceived Usefulness 0.170 (ns); between Output Quality and Perceived Usefulness -0.379 ($p < 0.05$), and between Result Demonstrability and Perceived Usefulness 0.178 (ns). One correlation was measured between component variables: the correlation between Subjective Norm and Image was 0.074 (ns).

The second component examined was Perceived Ease of Use and its derivative components. Once again, all p values were two-tailed. The correlation between Computer Self-Efficacy and Perceived Ease of Use was 0.210 (ns) between Perceptions of External Control and Perceived Ease of Use 0.313 (ns), between Computer Anxiety and Perceived Ease of Use 0.157 (ns); between Perceived Enjoyment and Perceived Ease of Use 0.248 (ns).

From the measurement of two variables, between computer playfulness and perceived ease of use, there was correlation between them, $r = 0.419$, $p<0.05$. Another correlation was also found between objective usability and perceived usefulness, with $r = -0.369$, $p <0.05$. It was also found that there is relationship between perceived ease of use and perceived usefulness with, $r = 0.58$, $p<0.01$.

There is no correlation between perceived ease of use and Behavioral Intention, r = -0.079 (ns) and also between perceived usefulness and behavior intention, r= 0.006 (ns), while subjective norm with behavioral intention 0.318 (ns). Lastly, between behavioral intentions with use behavior was -0.322 (ns).

An additional component in the theoretical model was Experience with the hypothesis that Experience may have had a mediating influence on the link between Subjective Norm and Behavioral Intention. It was found that there is no correlation between Behavioral Intention and Subjective Norm with Experience as moderator with the values were r = -0.322 (ns). Thus, in this study, it is identified that Experience does not played virtually role in the Subjective Norm and Behavioral Intention relationship. The same situation also applied to Voluntariness. Results found that the link between Behavioral Intention and Subjective Norm moderated by Voluntariness, the values were r = 0.400 (ns).

4.6 Identifying Barrier of eSPFB Implementation

Section C of the questionnaire survey aimed to investigate the barriers that the supervisory team member encounter in implementing eSPFB. This section contains a list of twenty-five (25) barriers that were identified through literature review and the respondents were asked to scale their level of agreement with each of the barriers using a Likert scale of 1 to 5.

A reliability test was carried out to test the reliability of the output obtained for the barriers in implementing eSPFB. The test of reliability is an important test of sound measurement where a measuring instrument is considered reliable if it provides consistent results (Kothari, 2004). The result of the reliability test is as shown in Table 4.39 below.

Table 4.39 Reliability Statistics for barriers in implementing eSPFB

Cronbach's Alpha	N of Items
.878	25

Cronbach's alpha coefficient that exceeds 0.700 is considered to have acceptable reliability (Nunnally 1978 in Lance et al., 2006). Based on results in Table 4.28, the Cronbach's alpha coefficient for the 25 barriers is 0.878, which indicates that the responds for barriers have relatively high internal consistency. The results of the questionnaire survey for this section are as shown in Table 4.39 below;

Table 4.40 Barriers in implementing eSPFB

Problem	N	Mean	Std. Deviation
Lack of in-house expertise in using eSPFB	35	4.31	.718
Poor training in the use of the system, resulting in a reluctance to input data;	35	4.29	.458
Poor training in understanding the need for data, e.g. To establish the root cause	35	4.20	.677
Lack of interaction and communication between department which cause delay toward certain jobs	35	4.20	.719
Poor communications and alignment with, and mismanagement of, external resources such as consultants and vendors	35	4.14	.772
Inadequate resources assigned to the project (people, material, equipment, funding)	35	3.63	.646
Lack of commitment to persist in eSPFB use and integration	35	3.60	.736
Internal politics that prevents effective coordination and cooperation among and within its function	35	3.57	.698
Lack of leadership to lead by example	35	3.54	.701
Lack of support from upper management	35	3.49	.702
Lack of commitment from both corporate and line management.	35	3.43	.778
Lack of support from contract administrator	35	3.34	.765
Lack of vendor support throughout the implementation period	35	3.31	.758
Hesitance to change traditional maintenance working culture	35	3.26	.950
Not fully understand the function of eSPFB and leads to underutilization	35	3.23	.973
Unskilled trainer	35	3.20	.868

Table 4.41 Table 4.42 Barriers in implementing eSPFB (cont'd)

Problem	N	Mean	Std. Deviation
Inaccurate and incomplete information in eSPFB	35	3.20	.901
Misinterpretation on the system capabilities	35	2.94	.873
Using a eSPFB to solve the wrong problem	35	2.77	.808
Being locked into restrictive hardware/software policy	35	2.69	.932
Wrong selection of eSPFB package	35	2.66	.873
Wrong selection of eSPFB vendor	35	2.60	.775
Employee refuse to use eSPFB	35	2.49	.919
Employee doesn't want to get involve in eSPFB	35	2.34	.968
Employee afraid that with the use of eSPFB will take over their job	35	2.20	.901

From table above, it can be observed that the top six (6) barriers in implementing eSPFB include:

a) Lack of in-house expertise in using eSPFB

b) Poor training in the use of the system, resulting in a reluctance to input data.

c) Poor training in understanding the need for data, e.g. to establish the root cause.

d) Lack of interaction and communication between departments which cause delay toward certain jobs.

e) Poor communications and alignment with, and mismanagement of, external resources such as consultants and vendors.

f) Inadequate resources assigned to the project (people, material, equipment, funding).

4.7 Relationship between barriers with Factors Variables of Behavioral Intention and eSPFB Usage

Given Table 4.41and Table 4.42 and emphasizing on the correlation between barriers and behavioral intention and use of eSPFB variables, it is observed that there is a negative relationship between system usage barriers with computer self-efficacy (CSE), r = -0.455,

p<0.01, perceived external control (PEC), r = -0.444, p = < 0.01, subjective norm (SN), r = -0.455, p < 0.01 and positive relationship with actual use (USE), r = 0.374, p<0.05.

There is also negative relationship between vendor supports with perceived usefulness (PU), r = -.0394, p<0.05, perceived external control (PEC), r = -0.360, p<0.05, subjective norm (SN), r = -0.407, p<0.05, job relevance (REL), r = -0.432, p<0.01 output quality (OUT), r = -.0500, p<0.01, behavioral intention (BI), r = -0.466, p<0.01 and Use, r = 0.359, p<0.05 but positive relationship with image (IMG), r = 0.383, p<0.05,

While for category if people barriers, there is only one negative relationship found with computer playfulness (CPLAY),), r = 0.376, p<0.05. There is no relationship found between organization with behavioral intention and use variables.

Table 4.43 Correlation matrix between behavior intention and eSPFB use variables with implementation barriers

			System Usage	Vendor Support	People	Orgnaisation
Spearman's rho	PU	Correlation Coefficient	-.162	-.394*	-.042	.024
		Sig. (2-tailed)	.351	.019	.811	.892
		N	35	35	35	35
	PEOU	Correlation Coefficient	-.198	-.134	-.081	-.117
		Sig. (2-tailed)	.253	.443	.645	.503
		N	35	35	35	35
	CSE	Correlation Coefficient	-.466**	-.288	.039	-.165
		Sig. (2-tailed)	.005	.093	.823	.343
		N	35	35	35	35
	PEC	Correlation Coefficient	-.444**	-.360*	.085	-.025
		Sig. (2-tailed)	.008	.034	.627	.885
		N	35	35	35	35

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table 4.44 Correlation matrix between behavior intention and eSPFB use variables with implementation barriers (cont'd)

			System Usage	Vendor Support	People	Orgnaisation
Spearman's rho	CPLAY	Correlation Coefficient	-.073	.167	.376*	.038
		Sig. (2-tailed)	.675	.338	.026	.830
		N	35	35	35	35
	CANX	Correlation Coefficient	-.025	.060	.254	.022
		Sig. (2-tailed)	.888	.730	.140	.899
		N	35	35	35	35
	ENJ	Correlation Coefficient	.004	.117	.216	.194
		Sig. (2-tailed)	.983	.505	.213	.265
		N	35	35	35	35
	OU	Correlation Coefficient	.221	.277	-.103	.247
		Sig. (2-tailed)	.202	.107	.554	.152
		N	35	35	35	35
	SN	Correlation Coefficient	-.455**	-.407*	-.025	-.126
		Sig. (2-tailed)	.006	.015	.885	.469
		N	35	35	35	35
	IMG	Correlation Coefficient	.204	.383*	.022	.180
		Sig. (2-tailed)	.239	.023	.898	.301
		N	35	35	35	35
	REL	Correlation Coefficient	-.284	-.432**	.067	-.068
		Sig. (2-tailed)	.099	.010	.701	.699
		N	35	35	35	35
	OUT	Correlation Coefficient	-.272	-.500**	-.035	-.110
		Sig. (2-tailed)	.114	.002	.842	.529
		N	35	35	35	35
	RES	Correlation Coefficient	.022	.031	.300	.079
		Sig. (2-tailed)	.902	.861	.080	.651
		N	35	35	35	35

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 4.45 Table 4.46 Correlation matrix between behavior intention and eSPFB use variables with implementation barriers (cont'd)

			System Usage	Vendor Support	People	Orgnaisation
Spearman's rho	BI	Correlation Coefficient	-.214	-.446**	.089	.070
		Sig. (2-tailed)	.217	.007	.611	.690
		N	35	35	35	35
	USE	Correlation Coefficient	.374*	.359*	-.064	.251
		Sig. (2-tailed)	.027	.034	.713	.146
		N	35	35	35	35

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

In this study, the researcher also determine the relationship between the barriers of eSPFB implementation with TAM3 variables and found some significance relationship between barriers in system usage with subjective norm and use and also barriers in vendor support with subjective norm, image, job relevance, output quality, behavioral intention and use.

There is also relationship between vendor supports with perceived usefulness perceived external control, subjective norm, job relevance, output quality, image, behavioral intention and Use. While for category if people barriers, there is only one negative relationship found with computer playfulness. There is no relationship found between organization with behavioral intention and use variables.

4.8 Comments from respondents

The questionnaire also included two open ended question, asking the respondents on other factors that can affect their use of eSPFB and other problems relating to eSPFB that needs attention. The answer of both questions are summarized in Table 4.47 below:

Table 4.47 Respondents comments in questionnaire

Question	Respondent ID	Comment/ Answer
Other factors that affect your use of eSPFB	009	Detailing the calculation
	004	eSPFB not so user friendly
	013	Link of pop-up (complain from client) with Gmail account
	005	Prediction asset in building for monitoring
	004	eSPFB must follow what the user needs, not the management need or what the vendor propose
What are the other problems relating to eSPFB that needs attention	011	Lack of after sales and service from vendor.
	003	Need more speed
	009	No detailing calculation formula for service availability and asset availability
	013	Pop-up notification (receive work request from client) link with Gmail account
	015	Slow
	007	Weightage in KPI & APD need to key in every month. Maybe to key-in just once per contract.

The first open ended question asked to respondents are "what are the other factors that affefcts your use of eSPFB"? 5 respondents answered the question with different answer. The second open ended question was "what are the other problem relating to eSPFB that needs attention?" There are 6 respondents answered this question with 5 different answer and Respondent 003 and 015 shared the same answer, stating that the system is slow or need more speed.

5.1 Factors affecting eSPFB user acceptance

In this study, by comparing the mean value of all factor variables in TAM3, there are 3 factor that respondent describes their acceptance of eSPFB. The respondents believed and perceived that using eSPFB; (1) would enhance his or her job performance, (2) the target system is applicable to his or her job and (3) have the intention to continue using eSPFB.

5.2 Differences between demographic factors with factor variables

The Kruskal-Wallis test also found that there is a difference in perceived external control across different education background group. Respondent with diploma qualification score the highest compared to respondents who has Bachelor Degree and Master's Degree qualification who scored the highest. This result indicated that, respondents with lower education background, believes that with sufficient support and resources, they can use eSPFB.

Result demonstrability shows a difference across grade of occupation group. Facility Manager have the highest scores across grade of occupation group while the group of "other" scored the lowest. This group is consisted of contract administrators and engineers from FM contractor's organization. This finding indicates that, facility managers found that, they get most of they have no difficulty in telling other about the result from using eSPFB and the system give the apparent result in their job. This happened maybe due to frequency of system utilization or time spent on the system. Facility contractors utilized more and spent more time on the system, to work on their part to fill in their job information, to control work order, work scheduling, to provide performance information,

to control work and labor costs, to maintain performance to obtain a user satisfaction rating rather than a monitoring group that is more focused on the task of monitoring the contractor in performing the work..

Respondents with longest year of services (more than 5 years) scored the highest in computer playfulness factor while respondents who have less than year of services scored the lowest. This indicates that respondents with this group of respondents have the most experience of using a computer. They can navigate through the computer and have clear interaction with it. This may be due to familiarization of how CMMS system works and experience on different CMMS brands and version previously. However, for subjective norm, respondents that have been in service for 3 to 5 years group scored the highest and respondents who have less than a year scores the lowest. This group use eSPFB because they were influence by others.

A difference was also found in perceived enjoyment, subjective norm and image across eSPFB assessment levels. Respondents who has a high experience in eSPFB use, scored the highest of those categories and as expected, respondents who has low experience of using eSPFB scored the lowest. This result indicate that, respondents with high experience of using eSPFB enjoys using eSPFB. They use the system because they have the support, influenced by people who is important to them and feel that image is important in using eSPFB.

5.3 Variables Relationship in TAM3

The study found that output quality has influence perceived usefulness. The influence of output quality on the users' perceived usefulness indicated the users believed the output quality of the system's output and result was high and satisfactory. While computer playfulness, and objective usability has influence perceived ease of use. The significance

influence of perceived usefulness on perceived ease of use indicating the users' perceived ease of use of the system indeed had a positive influence on their perceived usefulness of the system. This finding is consistent with that of the research by Venkatesh & Bala in 2008. The result in Section 4.5 shows, from 18 relationship hypothesis, only 4 significance correlation was found. In other word, the acceptance levels for eSPFB are still low.

Intervention after the implementation of a system is a set of organizational, management, and support activities that take place after the use of the system to increase the level of user acceptance of the system. Intervention after execution may be crucial to helping employees through early surprises and changes related to the new system.

When employees start using a new system, they tend to experience significant changes to their core work characteristics, work processes, routines, and habits (Millman & Hartwick, 1987). Perhaps some employees will give a good response to change and there is a possibility that workers who consider this change are one of the threats to their work (Boudreau & Robey, 2005; J. Orlikowski, 2000). In the post-implementation phase, workers will seek to understand this new system, assuming either the system is an opportunity or threat and whether they can control the system or not (Beaudry & Pinsonneault, 2005). For example, if employees find that the system is a threat and they have no control over the system, there is a possibility that they will refuse to use the system (Beaudry & Pinsonneault, 2005). In line with this, intervention after implementation should make the employees feel that the new system is an opportunity to improve their work performance and they have the capabilities and resources needed to use the new system easily. According to Venkatesh Viswanath ; Bala, (2008) the intervention for post-implementation of a system are training, organizational support and peer support.

Training is proposed as one of the most important innovations in bringing to consumer acceptance and greater system success (Sharma & Yetton, 2007). While training can be carried out before or during the implementation of the new system, Venkatch considers training as an intervention after implementation because, in most cases, training is conducted once the system is used and ready for use by potential users.

Organizational support can play an important role in determining the perceived usefulness and perceived ease of use. For example, experts can help employees customize the specific aspects of the new system, thereby enhancing job relevance, output quality, and the success of a system's results. TAM3 argues that external control perceptions are important and stable determinants of ease of use. Organizational support is a key source of external perception of external control. Furthermore, the presence of organizational support, especially in the context of complex systems, can reduce emergency related to system use (Viswanath & Bala, 2008).

Peer support refers to different activities and/or functions performed by coworkers that may help an employee effectively use a new system. Jasperson et al. (2005) suggested that coworkers from the same or different business units and workers in other organizations can be important sources of interventions leading to greater user acceptance of a system (Viswanath & Bala, 2008).

Venkatesh Viswanath ; Bala, (2008) believed that, these 3 post-implementation intervention can influence the determinant of perceived usefulness and perceived ease of use as Table below:

Table 5.1 Summary of Intervention (Adapted from Venkatesh Viswanath ; Bala, (2008))

	Post-Implementation Interventions		
	Training	Organisational Support	Peer Support
Determinant of Perceived Usefulness			
Subjective Norm			X
Image			X
Job Relevance	X	X	X
Output Quality	X	X	X
Result Demonstrability	X	X	X
Determinant of Perceived Ease of Use			
Computer Self-Efficacy	X		
Computer Anxiety		X	X
Computer Playfulness	X		
Perceived Enjoyment	X		
Objective Usability	X		

5.4 Barriers in eSPFB implementation

The study has listed 25 barriers in eSPFb implementation and questionnaire resust has highlighted top 6 barriers in eSPFB implementation. The first barrier identified was lack of in-house expertise in using eSPFB. Many plants address limited in-house knowledge by hiring a CMMS consultant to provide the expertise and experience needed to properly implement an effective maintenance management program and CMMS. While this approach is valid, extreme caution must be exercised in the selection process. Poor leadership by an outside expert can also generate CMMS failure. An organization may have at least one IT officer or an IT department. They may understand the characteristics of the system architecture and how the system works, but to what extent the individual understands the work process in the management of the facility and its relation to IT is a doubt. It is very important for everyone involved in the management of facilities to understand the work processes involved and not depend on vendors only. Dependence on vendors sometimes involves organizational side expenses.

Secondly, poor training in the use of the system, resulting in a reluctance to input data. If users do not know how to use the software effectively, you will not have a successful implementation. Training of users is very important. Poor training in the use of the system, resulting in a reluctance to input data (G. P. Sullivan et al., 2010). Ramachandra & Srinivas (2013) in their research, implemented a computerized maintenance management information system (CMMIS) according to the requirements of a medium scale industry. The intention was to assist the maintenance and other activities of the industry in an organized manner to assist management in controlling department like marketing, production, stores and purchase which are inter-linked for the better functioning of the organization. Further, it is stressed at this stage that, there is an utmost need to train the employees, instigate them to take up challenging jobs and to get involved totally for the success of the industry. However, sometimes, training courses had been set up, but had not been well attended and had not been followed through

The next barrier identified was poor training in understanding the need for data, e.g. to establish the root cause. The data entered should be sufficient and appropriate and meet the system requirements. The accuracy of this data is not only dependent on the person who performs the work but also the entry data that is in charge of data entry. The complainant is also no exception in making sure the information provided is correct. Incorrect information will give false diagnosis and incorrect results. This will cause either the same problem to repeat or cause the waste of financial resources, labor and time. The sort of data required by required by directors, executives, managers, and members of self-directed is specifically identified with the level of management decision making involved and the structure of decision situations they face. Information that is obsolete (or late), mistaken, or difficult to comprehend isn't exceptionally significant, helpful, or profitable to a decision maker. People require data of high caliber—that is, data items whose

attributes, traits, or qualities make the data more significant to them (Marakas & O'Brien, 2013).

Next is lack of interaction and communication between departments which cause delay toward certain jobs. Too many CMMS projects lack a master project plan and schedule that clearly identify all tasks and the sequence in which they must be performed to meet the implementation schedule and budget. The lack of this master plan leads to poor communication, adversarial relationships, and slippage of both timeline and budget.

Other than that, poor communications and alignment with, and mismanagement of, external resources such as consultants and vendors is also one of the implementation barrier. In any implementation process, user input is very important, starting from planning stage, vendor selection, system development, testing and subsequent implementation. Researchers such as Land (1982) have explained that taking into account consumer input is important in the selection of the system in which it will determine the success of business needs.

Finally, inadequate resources assigned to the project (people, material, equipment, funding). The major element necessary to the success of any large undertaking is commitment to the project and support by upper- level management. Lack of interest on the part of upper-level management will diminish the chances of success. If upper-level management approaches it from a rational, reasonable perspective, and provides necessary resources, success is almost assured. Poor planning or lack of management/labor commitment. Fail to estimate the level of manpower and financial resources that will be required to fully implement the CMMS and correct all of the limiting factors that preclude effective maintenance management.

5.5 Relationship between eSPFB implementation with factor variables.

In this study, it has been found that barrier in system usage will influence subjective norm, computer self-efficacy, perceived external control, and use. The negative relationship between system usage with subjective norm, computer self-efficacy and perceived external control can stated by barriers in system usage increased by decreasing subjective norm, computer self-efficacy and perceived external control. In other words, subjective norm, computer self-efficacy and perceived external control increased by decreasing barriers in system usage. This indicated that barriers in system usage can be overcome in an organization by increasing support to continue using the by peers and upper management. Respondents also feels that they doesn't have control and enough resources about the system hence the barriers in system usage. In this study, respondents prefer to have guidance, or demonstration in order to increase their self-efficacy and confidence to use the system. This is actually a positive attitude where user have interest in using the system and afraid that they will mess up.

Positive relationship with use stated that barriers in system usage increase with the use of the system. Respondents still does not understand the system fully but still using the system because it is relevant to them and they perceived usefulness of using the system. This barrier must be overcome by promoting a good practice of using the system to avoid misinterpretation and entering insufficient data that will effect decision making process in the future.

Barriers in vendor support and reliance increase by decreasing subjective norm, job relevance, output quality, behavior intention, perceived usefulness and perceived external control. Another words, vendor support and reliance barrier decrease by increasing subjective norm, job relevance, output quality, behavior intention, perceived usefulness and perceived external control. This result clearly shows the solution of vendor and

support and reliance barrier. By increasing support from peers and upper management, having a quality of eSPFB output and control of the system, the user will have positive intention to use the system and have the perception that the system is useful to them.

Besides system usage and vendor support, there is also a relationship between barriers in people with computer playfulness. Barriers in people increase if computer playfulness increase.

5.6 Recommendation

After reviewing and discussing the results of the current study in the researcher's attempt to interpret them, some recommendations have resulted from the current study that may help the system administrator apply and develop information system in facility management, especially through the use of eSPFB.

The perceptions amongst supervisory team of the concept of eSPFB must be enhanced through the contract administrator or vendor's official electronic site, by supporting it with recent concepts and terms related to eSPFB.

The use of eSPFB has a significant role to play in the measuring contractor's performance. It is therefore necessary for the supervisory team to master the use of this technology and for the contractor to use this technology to an optimum degree in all aspects of the managing facility management activities.

New users need to be educated about eSPFB and be enlightened about its objectives, importance, potential, the required skills, and how to take advantage of it. Training opportunities should be provided on how to search for the available information within the Internet and its various resources by conducting organised sessions or making guides

available to attract users render them more effective in using eSPFB. This should then lead to rapid adaptation and the acceptance of eSPFB as part of their tasks.

The eSPFB infrastructure at PWD must be continuously developed, in coordination with rapid developments in this field and the needs of both supervisory teams and contractors. This is attained through specialist technical personnel. The relevant modern techniques and tools must be expanded and programme updated, as well as access to eSPFB becoming quicker and easier, thus making it available for application at PWD, with various options and information.

More support from specialists at PWD and upper management, on an ongoing basis, must be provided for every users especially the supervisory team to ensure the success of the eSPFB process and also to enhance user's intentions to use eSPFB in the future and to facilitate their tasks. This may be fulfilled by activating and developing the Support Department within supervised building. The IT department must play role participate in this implementation. Diversity of support is required, with the availability of an active help desk.

The increase in the level of communication and interaction among all members of the organization is crucial to ensuring that an objective or target can be achieved. Communication elements need to be emphasized to ensure the use of eSPFB applications can be maximized in accordance with the potential and purpose they are being developed as facilitators in implementing and managing facilities management activities in government buildings in Putrajaya.

The use of any of these developed applications can be maximized with the availability of manuals or manual documents that guide users. This concept also applies to this eSPFB application.

CHAPTER 6: CONCLUSION

6.1 Research overview

This study is a quantitative study in which the data is carved through the measurement process and requires measuring tools such as distribution of questionnaires to respondents. A total of 55 sets of questionnaires were distributed to respondents and only 35 sets returned. This is due to the diverse range of researches. The results of the study are described by descriptive and descriptive study methods..

This study has discussed the level of acceptance of the supervisory team against the eSPFB application. The results showed that 35 respondents in this study consisted of 77.1 percent male and the rest 22.9 percent were female. Majority of the respondents are form the age range of 30 to 34 years old. Most of the respondents have Bachelor Degree. The most participated respondents works as Verifier and Assistant Verifier. 40 percent of the respondent has been working in their respective field in the range of 1 to 3 years. Although the system is relatively new, 3 of the respondents claimed that they have a high experience of using the system but majority of them have moderate experience and have been using eSPFB for less than a year.

In relation to research first objective*: To identify the effective factor that leads to behavioral intention of eSPFB usage; derived from TAM3 model.* Findings of the result found that, that using eSPFB would enhance respondent's job performance, the target system is applicable to their job and they have the intention to continue using eSPFB. The study has been extended by looking into the differences of respondent individual characterics (demographic) with factors variables of behavioral intention and eSPFB usage. Different demographic background has given different point of view on how they

see the application. From 18 hypothesized relationship, there are only 4 correlation significance relationship established. Output quality has negatively influence perceived usefulness. Computer playfulness has positively influence perceived ease of use but objective usability has negative influence on perceived ease of use. Perceived usefulness is positively influence perceived ease of use.

Matching up to the second research goal: *to determine the barriers that influence the use of eSPFB in measuring FM contractor's performance*. There are 25 barriers has been identified and top 6 barriers which have the mean score of 3.60 and above were highlighted. Respondents agree that they still lacking of training in using the system and lack of training in data input. They also an absence of in-house mastery of using the system. This causes them to rely heavily on vendors and admin systems that cater many users simultaneously. Absence of collaboration and communication between divisions which cause delay toward specific task was also an identified barrier. Besides communication between divisions, they also face difficulties in communicating with external resources such as consultant and vendors and have inadequate resources assigned to the project (people, material, equipment, funding)

The final research objective: *to establish the relationship of barriers with variable factors of behavior intention and usage of eSPFB*. From the result, the researcher also found relationship between groups of barriers with acceptance variable factors and discovered some significance connection between barriers in system use with subjective norm and use and additionally barriers in vendor support with subjective norm, image, job relevance, output quality, behavioral intention and use.

There is likewise connection between vendor supports with perceived usefulness perceived external control, subjective norm, job relevance, output quality, image, behavioral intention and Use. While for category if people barriers, there is just a single contrary relationship found with computer playfulness. There is no relationship found between organization with behavioral intention and use variables.

6.2 Conclusion

The model is being successfully used to evaluate systems likely adoption in use. In today's world technology changes rapidly and is being introduced and used in all aspects of our lives. Developers would be wise to use the technology acceptance model during development to increase user adoption and create technology that users will find easy to use while meeting their performance goals and objectives and accommodating social norms. Many end-users are more familiar with a variety of technology platforms likely reducing the importance of the perceived ease of use. Additionally this model may be helpful in developing acceptance of technology by audiences who are less comfortable with the rapid changes taking place.

Theoretically and practically TAM is a model that is considered most appropriate in explaining how users receive a system. TAM states that behavioral intension to use is determined by two beliefs: first, perceived usefulness defined as the extent to which a person believes that using the system will improve his performance. Secondly, perceived ease of use is defined as the extent to which one believes that system usage is easy. TAM also states that the impact of external variables on intension to use is mediated by perceived of usefulness and perceived ease of use (Viswanath & Bala, 2008).

In TAM3, the determinants of perceived usefulness are subjective norm, image, job relevance, and output quality and result demonstrability. While determinants for

perceived ease of use is computer self-efficacy, computer playfulness, computer anxiety, perceived external control, perceived enjoyment and objective usability. The concept of TAM also states that perceived usefulness is affected by perceived ease of use (Viswanath & Bala, 2008).

The earliest use of eSPFB is at the end of 2016 and its use is still new and the process of updating and completing the system is still ongoing. The number of its users throughout Malaysia is also very small compared to the number of buildings controlled by PWD. In Putrajaya alone, only 12 contractors use this eSPFB system. Therefore, the low level of acceptance of the system has been anticipated. However, the findings of this study had given other researcher new directions and areas to broaden the study in the future.

The purpose of this study is to contribute to a better understanding to the level of acceptance of supervisory team against eSPFB as a tool of measuring FM contractor's performance. This study also reveals other demographic factors and respondent's background personality that can influence the attitude of the direction towards eSPFB acceptance. Development of CMMS application in PWD at major transformation over several years until the application of eSPFB. eSPFB has provided a platform to enable it

All PWD staff, facility contractors under the PWD monitoring, building residents and building users to complain, handle, manage and maintain maintenance information and activities and to ensure that building functionality can be maximized. The development of the newly developed system will change the aspect of how current and future facility management with the development and enhancement of the application continues.

6.3 Research Limitation and suggestion for future research

There are some limitations that have been identified throughout the study. Firstly, this research has small population that leads to small numbers of respondents. Researchers

also face barriers in finding literature and articles specifically on technology acceptance in the field of facility management. The feedback from respondents to answer the questionnaire is also low. The time frame to conduct the research is too short, considering the time the researcher took to get response from parties involved. While some limitations have the potential to affect the generalizability of the results they were not found to significantly hinder the research or the interpretation of the results.

This study can be extended to produce greater result. TAM is a flexible model and most studies that use the TAM model included other external factors that can affect the level of system acceptance. Research results can be improved by gaining more response and conducting long-term studies by collecting data at specific intervals. This can indicate the change in acceptance rate either increasing or decreasing. Comparative studies on the acceptance of different CMMS systems adopted at PWD are also an interesting study for PWD understanding and identifying improvements that can be made to the existing system.

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APPENDIX

UNIVERSITI
MALAYA

UM.B/601
26 September 2017

Pengarah
Bahagian Perundingan Pengurusan Aset
Blok C (Lama) Ibu Pejabat JKR Malaysia
Jalan Sultan Salahuddin
50582 Kuala Lumpur

Dear Sir/Madam,

PERMISSION TO PURSUE RESEARCH AND SEEK INFORMATION

The above mentioned matter refers.

2. Please be informed that the candidate below is currently registered as a postgraduate student of the Faculty of Built Environment, University of Malaya:-

Name of Candidate	:	Noor Farisya binti Azahar
Matric No.	:	BGG150008
Programme of Study	:	Master of Facilities & Maintenance Management

3. She is conducting a research on "Evaluation of the Implementation of a Computerized Maintenance Management System of Governed FM Contract" under the supervision of Dr. Shirley Chua Jin Lin (03-79677952) is currently in the process of data collection.

4. The Faculty of Built Environment, University of Malaya believes that the knowledge and expertise that your organization / office holds would be suitable in assisting the research. Thus, we would appreciate if you could assist his research at your premise.

5. Research findings and results would be made available to your organization / office upon request to the Faculty. All information obtained pertaining to the research would be treated with the strictest confidentiality, kept anonymous and be used for academic purposes only.

Your kind cooperation towards this matter is highly appreciated.

Thank you.

Yours faithfully,

Sr. NORHAYATI MAHYUDDIN (PhD)
Head
Department of Building Surveying

JABATAN KERJA RAYA MALAYSIA
BAHAGIAN PERUNDINGAN PENGURUSAN ASET
CAWANGAN PERANCANGAN ASET BERSEPADU
ARAS 3, BLOK C (LAMA)
IBU PEJABAT JKR MALAYSIA,
JALAN SULTAN SALAHUDDIN,
50582 KUALA LUMPUR

Telefon (TO) : (03)26107500
Faksimili : (03)26926511
Laman Web : http://www.jkr..gov..my

Ruj. Tuan :
Ruj. Kami : (53) dlm.JKR. CPAB.800.01/1.04
Tarikh : 10 November 2017
(Sila nyatakan rujukan kami apabila menjawab surat ini)

Pn Noor Farisya binti Azahar (BGG150008)
Faculty of Built Environment,
University of Malaya
Master of Facilities & Maintenance Management

Puan,

KEBENARAN UNTUK MENJALANKAN KAJIAN AKADEMIK & SOAL SELIDIK BERKAITAN APLIKASI SISTEM PENGURUSAN FASILITI BERPUSAT (eSPFB)

Dengan segala hormatnya perkara di atas adalah dirujuk.

2. Sukacita dimaklumkan bahawa pejabat ini tiada halangan terhadap permohonan puan untuk menjalankan kajian bertajuk *"Evaluation of the Implementation of Computerized Maintenance Management System of Goverened FM Contract"* dengan menyentuh penggunaan aplikasi eSPFB yang sedang digunakan di JKR. Kelulusan ini adalah berdasarkan kepada hasil perbincangan yang telah diadakan bersama pegawai kami (En Dzulhadi Sapari) dan surat yang dikemukakan oleh pihak Fakulti Alam Bina, Universiti Malaya mengenai kajian tersebut.

3. Sehubungan dengan itu, puan dibenarkan untuk mendapatkan maklumat lanjut yang diperlukan oleh kajian dari pihak-pihak yang berkenaan. Walaubagaimanapun, puan dikehendaki mematuhi segala peraturan dan arahan dari jabatan/pihak yang berkenaan (pengguna eSPFB) tersebut semasa kajian dijalankan. Segala maklumat yang telah dikumpulkan adalah semata-mata bagi tujuan kajian akademik dan senaskah laporan akhir kajian dalam bentuk harcopy hendaklah diserahkan kepada pejabat ini.

Sekian untuk makluman. Terima Kasih

"Ke Arah Transformasi Pengurusan Aset Kerajaan"

"Aset Negara 1 Amanah Bersama"

Saya yang menurut perintah,

(Ir. AB HAMID BIN HJ MD DAUD)
Pengarah,
Bahagian Perundingan Pengurusan Aset

SURVEY ON THE USE OF eSPFB AS A TOOL FOR MEASURING FM CONTRACTOR'S PERFORMANCE

Dear Sir/Madam,

I am a postgraduate student at the Faculty of Built Environment, University Of Malaya. Currently, I am undertaking a field study and data gathering activities as part of the requirement for a degree of Master of Facilities Management and Maintenance.

This questionnaire is a part of study to determine the technology acceptance model of eSPFB as a tool of measuring FM Contractor performance in public buildings at Wilayah Persekutuan Putrajaya

I will be extremely grateful if you spare 15 minutes of your valuable time to complete the survey. All your responses will be kept strictly confidential and protected. Participants will not be individually indentified in any way. Your response is very valuable for the success of this research study.

I would greatly appreciate if you would share your views and thoughts in relation to your recent used of the eSPFB application. There is no known risk to participate of this study. If any part of the questionnaire is not clear, or there are any other questions regarding this study, please contact me at farisyazahar@gmail.com. I look forward to your encouraging response and help in making this academic research study a success.

* If you are having problem filling this survey form using a mobile phone, please kindly use a computer as some email domain sets several restriction of filling out Google Form from a mobile phone.

Thank you for filling in this questionnaire.

Your Sincerely,

Noor Farisya bte Azahar
University of Malaya
Tel: 0132491814
Email: farisyazahar@gmail.com

*Required

SECTION A: INFORMATION BACKGROUND

1. **Gender** *
Tick all that apply.

- [ ] Male
- [ ] Female

2. **Age** *
Tick all that apply.

- [ ] 25 yrs and less
- [ ] 25-29 years
- [ ] 30-34 years
- [ ] 35-39 years
- [ ] 40-45 years
- [ ] 45 y/o and above

3. **Education background** *

Tick all that apply.

- [ ] Doctorate (PhD)
- [ ] Master Degree
- [ ] Bachelor Degree
- [ ] Diploma
- [ ] SPM

4. **Classification/Grade of Occupation** *

Tick all that apply.

- [ ] Facility Superintending Officer (FSO)
- [ ] Facility Superintending Officer Representative (FSOR)
- [ ] Engineer
- [ ] Verifier
- [ ] Assistant Verifier
- [ ] Facility Manager
- [ ] Other: _____

5. **Years of Service** *

Tick all that apply.

- [ ] less than 1 year
- [ ] 1-3 years
- [ ] 3-5 years
- [ ] more than 5 years

6. **How long have you been using eSPFB?** *

Tick all that apply.

- [ ] Less than 1 year
- [ ] 1 Year
- [ ] More than 1 year

7. **What is your assessement about using eSPFB** *

Tick all that apply.

- [ ] Low Expereince
- [ ] Moderate Experience
- [ ] High Experience

SECTION B: DETERMINATION OF eSPFB ACCEPTANCE FACTOR TO MEASURE FM CONTRACTOR'S PERFORMANCE

Please rate the extent to which you agree with each statement below

8. **Perceived Usefulness & Perceived Ease OF Use in using eSPFB To Measure FM Contractor's Performance** *

Mark only one oval per row.

	1 Strongly Disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly Agree
Using the system improves my performance in my job, in measuring FM contractors performance					
Using the system in my job increases my productivity, in measuring FM contractors performance					
Using the system enhances my effectiveness in measuring FM contractors performance					
I find the system to be useful in measuring FM contractors performance					
My interaction with eSPFB is clear and understandable.					
Interacting with eSPFB does not require a lot of my mental effort.					
I find eSPFB to be easy to use.					
I find it easy to get eSPFB to do what I want it to do in measuring FM contractor performance					

9. **Computer Self-Efficacy** *

I could complete the job using a software package .....

Mark only one oval per row.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
. . . if there was no one around to tell me what to do as I go.					
. . . if I had just the built-in help facility for assistance.					
. . . if someone showed me how to do it first.					
. . . if I had used similar packages before this one to do the same job.					

10. **Perception of External Control** *

Mark only one oval per row.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I have control over using eSPFB					
I have the resources necessary to use eSPFB					
Given the resources, opportunities and knowledge it takes to use eSPFB it would be easy for me to use eSPFB.					
eSPFB is not compatible with other systems I use					

11. **Computer Playfulness** *

The following questions ask you how you would characterize yourself when you use computers:
Mark only one oval per row.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
. . . spontaneous	◯	◯	◯	◯	◯
. . . creative	◯	◯	◯	◯	◯
. . . playful	◯	◯	◯	◯	◯
. . . unoriginal	◯	◯	◯	◯	◯

12. **Computer Anxiety & Perceived Enjoyment using eSPFB To Measure FM Contractor's Performance** *

Mark only one oval per row.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Computers do not scare me at all.	◯	◯	◯	◯	◯
Working with a computer makes me nervous.	◯	◯	◯	◯	◯
Computers make me feel uncomfortable.	◯	◯	◯	◯	◯
Computers make me feel uneasy.	◯	◯	◯	◯	◯
I find using eSPFB to be enjoyable.	◯	◯	◯	◯	◯
The actual process of using eSPFB is pleasant.	◯	◯	◯	◯	◯
I have fun using eSPFB .	◯	◯	◯	◯	◯

13. **On average, how much time do you usually spent to retrieve performance information each day?** *

Tick all that apply.

- ☐ 3-4 hours
- ☐ 1-2 hours
- ☐ Less than 1 hour

14. **Subjective Norm, Voluntarism, Image & Job Relevance in using eSPFB To Measure FM Contractor's Performance** *

Mark only one oval per row.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
People who influence my behavior think that I should useeSPFB					
People who are important to me think that I should use eSPFB .					
The senior management of this business has been helpful in the use of eSPFB					
In general, the organization has supported the use of eSPFB					
My use of eSPFB is voluntary.					
My superior does not require me to use eSPFB.					
Although it might be helpful, using eSPFB is certainly not compulsory in my job.					
People in my organization who use eSPFB have more prestige than those who do not.					
People in my organization who use eSPFB have a high profile.					
Having eSPFB is a status symbol in my organization.					
In measuring FM contractor's performance, usage of eSPFB is important.					
In my job, usage of eSPFB is relevant.					
The use of eSPFB is pertinent to my various job-related tasks					

15. **Output Quality, Result Demonstrability and Behavioral Intention in using eSPFB To Measure FM Contractor's Performance** *

Mark only one oval per row.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The quality of the output I get from eSPFB is high.					
I have no problem with the quality of eSPFB's output.					
I rate the results from eSPFB to be excellen					
I have no difficulty telling others about the results of using eSPFB.					
I believe I could communicate to others the consequences of using eSPFB.					
The results of using eSPFB are apparent to me.					
I would have difficulty explaining why using eSPFB may or may not be beneficial					
Assuming I had access to eSPFB, I intend to use it.					
Given that I had access to eSPFB, I predict that I would use it.					

16. **I plan to continue using eSPFB in the future** *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

17. **On average, how much time do you spend on the system to retrieve performance information each month?** *

Tick all that apply.

- [ ] 1-2 Days
- [ ] 2-3 Days
- [ ] 3-4 Days
- [ ] 4-5 Days

18. **If you would like to add other factors that affect your use of eSPFB, please write them in the space below.** *

SECTION C: IDENTIFYING BARRIERS IN eSPFB IMPLEMENTATION

This section is to determine the challenges that you feel or currently facing in implementing eSPFB in your organisation

19. **Please rate the extent to which you agree with each statement below** *

Mark only one oval per row.

	1 Strongly Disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly Agree
Poor training in the use of the system, resulting in a reluctance to input data;	◯	◯	◯	◯	◯
Poor training in understanding the need for data, e.g. To establish the root cause	◯	◯	◯	◯	◯
Unskilled trainer	◯	◯	◯	◯	◯
Lack of interaction and communication between department which cause delay toward certain jobs	◯	◯	◯	◯	◯
Poor communications and alignment with, and mismanagement of, external resources such as consultants and vendors	◯	◯	◯	◯	◯
Lack of commitment to persist in eSPFB use and integration	◯	◯	◯	◯	◯
Lack of commitment from both corporate and line management.	◯	◯	◯	◯	◯
Internal politics that prevents effective coordination and cooperation among and within its function	◯	◯	◯	◯	◯
Not fully understand the function of eSPFB and leads to underutilization	◯	◯	◯	◯	◯
Using a eSPFB to solve the wrong problem	◯	◯	◯	◯	◯
Lack of leadership to lead by example	◯	◯	◯	◯	◯
Lack of support from upper management	◯	◯	◯	◯	◯
Lack of support from contract administrator	◯	◯	◯	◯	◯
Misinterpretation on the system capabilities	◯	◯	◯	◯	◯
Lack of vendor support throughout the implementation period	◯	◯	◯	◯	◯
Wrong selection of eSPFB vendor	◯	◯	◯	◯	◯
Wrong selection of eSPFB package	◯	◯	◯	◯	◯
Inaccurate and incomplete information in eSPFB	◯	◯	◯	◯	◯
Employee refuse to use eSPFB	◯	◯	◯	◯	◯
Employee doesn't want to get involve in eSPFB	◯	◯	◯	◯	◯
Hesitance to change traditional maintenance working culture	◯	◯	◯	◯	◯
Lack of in-house expertise in using eSPFB	◯	◯	◯	◯	◯
Inadequate resources assigned to the project (people, material, equipment, funding)	◯	◯	◯	◯	◯

	1 Strongly Disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly Agree
Employee afraid that with the use of eSPFB will take over their job	◯	◯	◯	◯	◯
Being locked into restrictive hardware/software policy	◯	◯	◯	◯	◯

20. **What are the other problems relating to eSPFB that needs attention** *

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