THE CONTRIBUTIONS OF KNOWLEDGE MAPPING IN FACILITIES PERFORMANCE EVALUATION PRACTICE IN MALAYSIA

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...ONS OF KNOWLEDGE MAPPING ...PERFORMANCE EVALUATION PRACTICE IN MALAYSIA

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The following publications by the author of this Thesis have derived wholly or in part from this Thesis during its preparation:

1- Yasin, F and Egbu, C (2011) Critical steps to knowledge mapping in facilities management organisation. In: Egbu, C and Lou, E C W (Eds.), Proceedings 27th Annual ARCOM Conference, 5-7 September 2011, Bristol, UK. Association of Researchers in Construction Management, 603ó612, ISBN: 978-0-9552390-5-2.

2- Yasin, F and Egbu, C (2010) Exploitation of knowledge mapping benefits in the facilities performance evaluation process: a conceptual framework. In: Egbu, C (Ed.), Proceedings 26th Annual ARCOM Conference, 6-8 September 2010, Leeds, UK. Association of Researchers in Construction Management, Vol. 2, 799ó808. ISBN: 978-0- 9552390-4-5.

3- Yasin, M.F. and Egbu, C. (2010) õHarnessing Knowledge Management in the process of performance evaluation of facilities in Malaysia: A Critical Success Factorsö, W070 CIB World Building Congress 2010.

4- Mat Yasin, M.F and Egbu, C.O. (2009), Evaluating Building Performance Of Public Office Buildings Proceeding International Built Human Environment Research Week, 9th International Post Graduate Research Conference, 29-30 January, Salford Quays, Greater Manchester, UK, pp 309-319.

5- Yasin, M.F. and Egbu, C. (2009) õTrends and future direction of facilities management profession in Malaysiaö Proceedings of the Fourth Scottish Conference for Postgraduate Researchers of the Built & Natural Conference (PRoBE) - Glasgow Caledonian University. ISBN 9781905866410

I declare that this thesis was the result of my own work. No portion of the work covered in this thesis has been submitted in support of any application for another degree or qualification at this or any other university or institution of higher learning.

AEC   : Architecture, Engineering Construction

APQC   : American Productivity and Quality Center

BIFM   : British Institute of Facilities Management

BSI   : British Standard Institution

FM   : Facilities Management

FMC   : Facilities Management Classes

FPE   : Facilities Performance Evaluation

CIDC   : Computer Integrated Design and Construction

CIDB   : Construction Industry Development Board

CIFM   : Computer Integrated Facilities Management

IFMA   : International Facilities Management Association

ICT   : Information and Communication Technology

IT   : Information Technology

KM   : Knowledge Management

NAFAM   : National Asset and Facility Management

SLA   : Service Level Agreement

SME   : Small and Medium Enterprise

SPSS   : Statistical Package for Social Sciences

Performance evaluations of facilities are widely practiced within facilities organisations and it is generally accepted by Facilities Management practitioners that failure to obtain feedback on the building performance can expose facilities to serious consequences. The success of the evaluation is largely dependent on the breadth of issues being covered. These include financial matters, the physical condition of the building or the environment. As performance evaluation is a continuous process in the facilities management cycle, the factors that contribute to its success need to be identified. Issues such as accuracy, standardisation of practice, skill and knowledge remain open to debate among practitioners and academia in facilities management. There is also a view that facility users and owners are still in doubt as to how the performance evaluation will benefit them. On the knowledge management side, previous studies in various fields have identified numbers of knowledge mapping tools and techniques that are widely used. Knowledge mapping tools and techniques assist with information and knowledge flow throughout an organisation. However, for a knowledge map to be useful it must serve the purpose for which it is intended. This imposes some constraints upon which map forms are suitable and for what purpose. In the same vein, facilities performance practices are developing and evolving with changes in technology, business needs and usersø expectation. The present research identifies and explores the potential knowledge mapping tools and techniques that might be of benefit to facilities management organisations. In addition, a conceptual framework for the exploitation of benefits of knowledge mapping at various stages of performance evaluation is presented and discussed. The research methodology of the study employed both quantitative and qualitative approaches. Twenty-one (21) facilities managers from different facilities management organisation were interviewed using semi structured interview techniques in order to obtain in-depth information on the implementation of knowledge mapping in the organisations. The data obtained was analysed using content analysis techniques. To obtain a broader perspective of the key issues investigated in the research, one hundred and eighty-eight (188) usable questionnaires were obtained from facilities managers in Malaysia via e-mail survey. The Statistical Package for Social Science (SPSS 16.0) was used to analyse the quantitative data and various statistical methods. The present research concludes that majority of facilities management organisations are of the view that knowledge mapping is important and some have initiated and implemented tools and techniques of knowledge mapping in evaluating

also revealed that the main benefits of knowledge mapping

nce are: improvements in the decision making process,

m solving by providing quick access to critical information,

identifying knowledge gaps and islands of expertise. The guidance produced will be

beneficial to facilities management organisations in implementing knowledge mapping and

exploit the benefits in facilities management organisation.

...UCTION

This chapter introduces the overall focus of the present research. The chapter is organised as follows:

(1)   Background and review of research needs in the area.

(2)   Research aims and objectives.

(3)   Limitation of the research.

(4)   A synopsis and the proposed thesis outline.

(5)   Chapter Summary with link to Chapter 2.

1.2 Background and review of research needs in the area

A research problem is an issue or concern that needs to be addressed (Cresswell, 2009). The intent of a research problem is to provide a rationale or need for studying a particular issue or problem. This research problem can be derived from personal experience, job-related problem, research agenda or scholarly problem (Cresswell, 2009). Subsequently, this section discusses the research agenda and scholarly problem in the literatures that leads to the present research:

(1)   The issues that show the significance of facilities performance evaluation role in facilities management;

(2)   The issues that show the need for knowledge management in facilities management organisations;

(3)   The importance of knowledge mapping in knowledge management area; and

(4)   The significance of knowledge mapping approaches in facilities performance evaluation processes.

of research problems, interest and needs for research

Facilities Management
Area (FM)

Critical process in FM

Knowledge management

Evaluation of facilities performance

Knowledge mapping

Present research
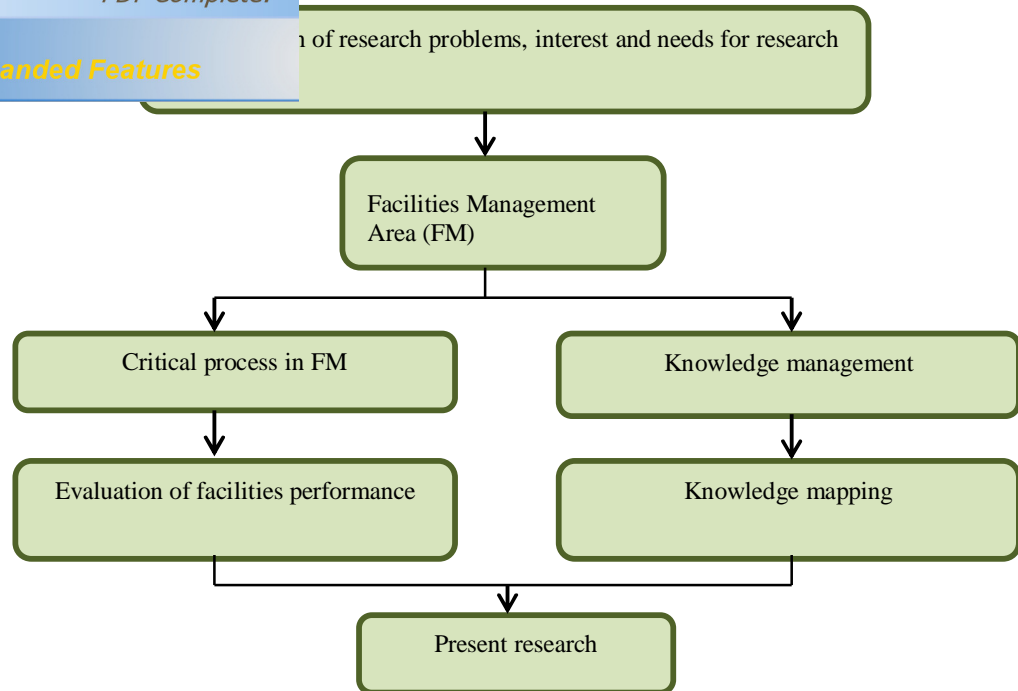
Figure 1.1: *Identification of research needs in facilities management (FM) area*

Apropos facilities management side, the importance of evaluating facilities performance has been emphasized by many authors (e.g Barret; 1992, Tranfield and Akhlaghi;1995, Alexander;1996, Fleming; 2005, Brackertz;2006, Fianchini;2007, Pati et. al.;2008, Abdulrahman et. al.;2008, Pitt and Tucker;2009). These authors emphasised the importance of facilities performance evaluation based on the following circumstances:

1)   The facilities performance evaluations provide information to the facilities management organisations on the current state of the physical condition and overall performance of the building and facilities;

2)   The evaluation exercise gathers the building occupantsø and facilities usersø feedback on the satisfaction and their perspectives on building environments and overall facilities management services;

3)   It enables the effective planning for future improvement, changes, and scheduling works while referring to the data and information gained through the evaluation;

formation, in providing options for problem solving and

5) In general, the evaluation could lead to cost saving and improvement of the overall service of facilities management.

The importance of facilities performance is also highlighted by Alexander (1996) who refers to the evaluation role as one of õthree essential issuesö for the effective implementation of a facilities strategy. This emphasised the importance of measuring facility performance in managing facilities and proved that the exercise could lead to improvement of the effectiveness and efficiency of facilities management organisation.

Hence, implementation of knowledge mapping could lead to improvement and added value to facilities performance evaluation, simultaneously to facilities management organisations in general. It is commonly accepted that facilities performance evaluation involves a group of multidisciplinary evaluators with different skills and knowledge (Then, 2005; McDougall et. al., 2002). The knowledge of facilities performance evaluation statically remains within an individualøs tacit and explicit barrier. Thus, it retards the innovation process within facilities management organisations and is expected to be generated from the evaluation process. A dynamic knowledge sharing and exchange within the internal staffing can occur through knowledge mapping.

A facilities management organisation is identified as a service-based organisation (Fitzsimmons, 1998, Atkin and Brooks, 2009, Barrett and Baldry, 2003). As a knowledge-based organisation, a facilities management organisation critically needs knowledge management benefits to be exploited. Thus, Nutt (1999) regarded knowledge management in facilities management field to be at a primitive stage of development and its terrain is largely unexplored. Facilities management-associated firms have limited understanding and less experience on how to identify what knowledge is important, capture it and promote its use throughout their own organisations and their project teams (Amaratunga, 2008).

Key sources, opportunities and constraints to knowledge creation and flows in the facilities performance process are not well exploited. This situation calls for knowledge mapping to increase visibility of knowledge sources and hence facilitate and accelerate the process of locating relevant expertise or experience. Apropos knowledge management field, Gupta et al (2000) infer that one of two major trends in knowledge management is to focus on knowledge mapping.

of knowledge mapping is another problem that needs to be organisations focus on the service they provide. In such lined to emphasise issues that are tangible, visible to be measured and are likely to resist process improvement activities that do not contribute to short term tangible results (Hinks and Mcnay, 1999) and provide returns on investment (Then, 2005) to the organisation. Consequently, as a process-related work, knowledge mapping has not been viewed as a high priority in the organisation. Immediate research area in knowledge mapping by Yun (2008) elicits the human resource, process and technological aspects in the context of knowledge mapping approach within construction project organisations suggested that further research is necessary to consolidate the theory of knowledge mapping approach within other areas.

As hypothesised in recent research and the above discussions, the present research would like to consolidate the theory of knowledge mapping in the facilities management spectrum. On the same premise, it has clearly emerged that there is a need for the knowledge mapping role in facilities management organisations to be identified. There is also a need to identify the related key factors, challenges and the processes in exploitation of knowledge mapping benefits which occur in facilities management organisations, notably in the facilities performance evaluation.

1.3 Facilities Management position in the Malaysian service industry

Facilities management is classified as a service-based industry which provides professional consultation and management of clients' building facilities including residential, commercial, industrial, airports terminals and offices. In the context of Malaysia, between the years 2003 to 2010 more than Ringgit Malaysia 60 billion worth of projects were awarded to independent facilities management providers (see **Figure 1.2**).

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Project Value (RM million)
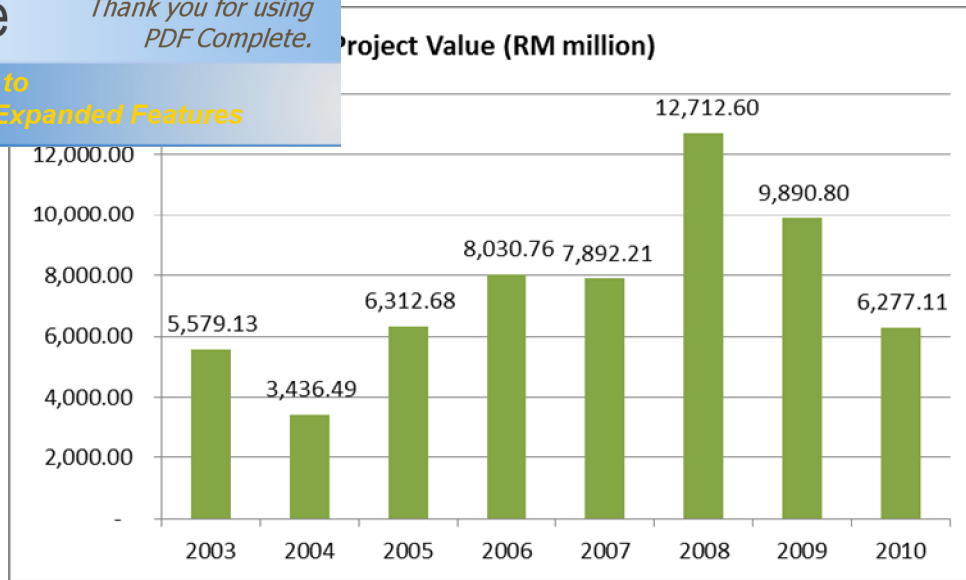
Figure 1.2: *Facilities management contract awarded to independent contractors in Malaysia between Year 2003 to Year 2010 (extracted from CIDB annual report statistics)*

The 10th Malaysia Plan which was published in late 2010 states that the country is now looking towards a more service-oriented economy with a reduction in the manufacturing sector. According to the Economic Planning Unit, the services sector possesses a 61% share of Malaysia's GDP against other sectors such as manufacturing, mining, construction and agriculture (see **Figure 1.4**). The 10th Malaysia Plan (2011-2015); a five year economic plan for the country exclusively focuses on this as a useful economic augmenter. The growth projected for the service sector from 2011 to 2015 as shown in **Figure 1.3** is 7.2 per cent per annum. This is the highest growth compared to other sectors such as manufacturing (5.7%), construction (3.7%), agriculture (3.3%) and mining (1.1). Interestingly, the service sector growth is higher than the country's projected GDP itself which is six per cent per annum; a surplus of 1.2 per cent.
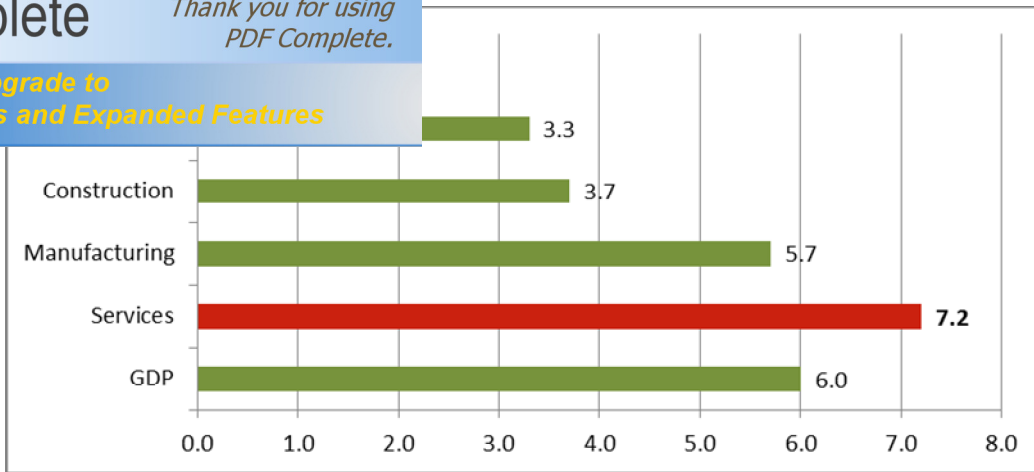
Figure 1.3: *Service sector expected annual growth rate (%) in 10th Malaysian Plan for 2011 to 2015*
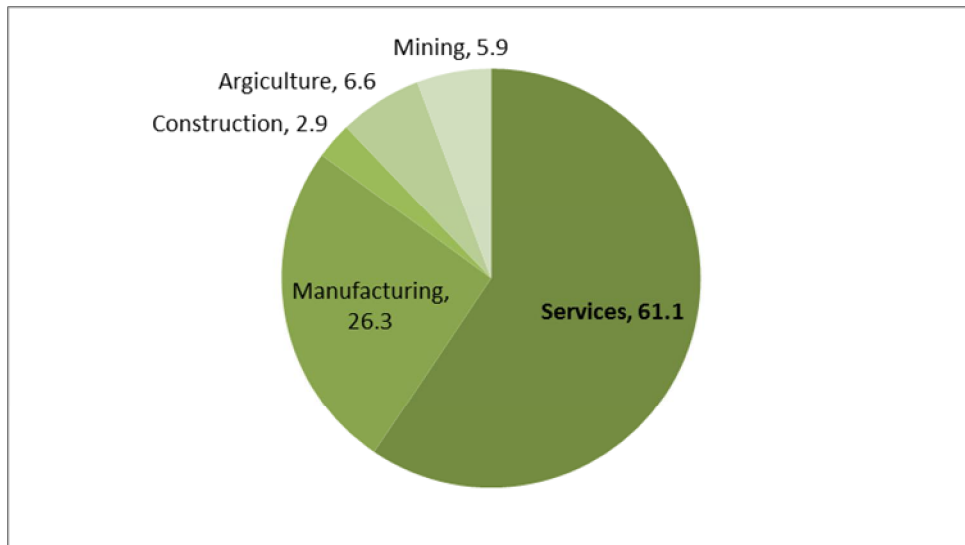
Figure 1.4: *Share of Service sector in Malaysia to GDP in 2015*

It can be deduced that facilities management is an important sector in the Malaysian economy as part of the bigger share of the service sector. This attracts attention and interest to research facilities management in the context of Malaysia from the perspective of knowledge management as discussed in Section 1.2.

ef ideas of the research scope and highlights that:

1) Facilities management is one of the components in the Malaysian service sector and plays an important role in the Malaysian economy;

2) Facilities management is a knowledge-based professional practice that provides consultation and management services to the customers; and

3) Facilities Performance Evaluation (FPE) is a vital process in facilities management and any improvement on the FPE practice can improve facilities management significantly.

The working hypotheses provide a direction for the research at an early stage and posed the following research questions:

(1)   How the facilities performance evaluation is being practiced in facilities management organisations in Malaysia and what factors constitute the challenge/s and critical for successful facilities performance evaluation?

(2)   What are the roles that knowledge mapping play in facilities management organisations especially in facilities performance evaluation and are the facilities management organisations really aware of those roles?

(3)   What constitutes the challenges in implementing knowledge mapping in facilities management organisations especially in facilities performance evaluation? AND

(4)   What are the processes employed in exploiting the knowledge mapping benefits and what factors are critical for the success of the exploitation?

...tions, a set of aims and objectives have been formulated for the present research in the next section.

1.5 Research Aims and Objectives

1.5.1 Research Aim

The aims of this research are:

❖ To establish the critical success factors for effective exploitation of knowledge mapping in performance evaluation of facilities; and

❖ To develop an appropriate guidance for improving awareness and exploitation of knowledge mapping in performance evaluation of facilities in Malaysia.

1.5.2 Research Objectives

In order to achieve the above aims, the following objectives have been formulated:

(1)   To investigate the extent to which performance evaluation of facilities is practiced in Malaysia, and document both challenges that confront facilities managers in this regard and the critical success factors in effective performance evaluation of facilities;

(2)   To explore the increasing role of knowledge mapping in the management of facilities in Malaysia and document factors that have given impetus to this;

(3)   To investigate the extent to which facilities management organisations are aware of the role and implications of knowledge mapping in performance evaluation of facilities;

(4)   To investigate and document the challenges associated with implementing a knowledge mapping initiative that could improve performance evaluation of facilities; and

...ses, if any, that are in place in facilities management ...xploit the benefits of knowledge mapping in performance ...lities, document critical success factors for effective exploitation of knowledge mapping and proffer guidance for improvements in this regard.

1.6 Significance/Benefits of the Study

This study will benefit fellow researchers, facilities management managers and personnel, and facilities management clients in the ways as listed below:

(1) Fellow researchers in facilities management will benefit from this study which is expected to spark new interest in the mapping of broad facilities management knowledge;

(2) Facilities management practitioners can be expected to be more aware of the importance of measuring facilities performance to fulfil structural, economical and functionalities of the facilities;

(3) Facilities management organisations can become more knowledgeable about facilities performance evaluation processes, and may become more familiar with usersø and clientøs needs;

(4) Facilities management organisations will be able to identify relevant skills and knowledge better, together with a more appropriate mix of multi-disciplinary skills in conducting facilities performance evaluations;

(5) For Malaysiaøs facilities management practitioners, create awareness to incorporate knowledge mapping in the facilities management process in general and specifically in facilities performance evaluation; and

(6) Identification of key success factors in both conducting facilities performance evaluation to the facilities and harnessing knowledge mapping approach in the facilities performance evaluation might assist in providing a õguided routeö for implementation.

There are very little attention and study with regard to the knowledge in FM processes. Most recent researches are focused on the general issues of implementing knowledge

...anagement discipline. The uniqueness of the research is its ...ad scope of knowledge management to one of its tools and ...ping in facilities performance evaluation.

1.7 Structure of the Thesis

The proposed thesis will consist of nine (9) chapters in full. Outlines of the overall thesis will be as follows:

Chapter 1 discusses the background of the research. The need for research in the area, posing a research question, formulation of research aims and objectives are highlighted in the chapter. Structure and flow of the thesis are as illustrated in Figure 2.

Chapter 2 discusses the literature review apropos knowledge management in the area of facilities management from the perspective of facilities performance evaluation practices and within the knowledge management implementation environment. It mainly deliberates the characters of facilities management organisation in worldwide view and local perspective (Malaysia). This chapter endeavours to underpin the analysis in Chapter 3 to Chapter 9 in the present research.

Chapter 3 outlines the research methodology and research methods adopted in the present research. Ontology, epistemology and axiology positions of the present research are also highlighted. Approaches in undertaking surveys and modes of data analysis used for the present research are also discussed in this chapter.

Chapter 4 presents analysis findings from the questionnaire survey data and interviews data on the extent of practice of facilities performance evaluation in Malaysian facilities management organisations. It then identifies the challenges that hinder the facilities manager in performing the evaluation exercise. The critical success factors for effective facilities performance evaluation are also analysed from questionnaire survey data and interview data available in this chapter. Overall, Chapter 6 addresses Objective 1 of the research study.

findings from the questionnaire survey and interview data
mapping in facilities management organisations in Malaysia.
The factors that give influence to the progress of knowledge mapping role in the
management of facilities in Malaysia are also analysed in this chapter. Overall, Chapter
5 addresses Objective 2 of the research study.

Chapter 6 presents analysis findings from the questionnaire survey and interview data
on the awareness of the facilities management organisations of the roles and
implications of knowledge mapping in performance evaluation of facilities. Overall,
Chapter 6 addresses Objective 3 of the research study.

Chapter 7 presents the findings from the questionnaire survey and interview data
analysis on the challenges associated with implementation of knowledge mapping
initiatives that could improve performance evaluation of facilities. Overall, Chapter 7
addresses Objective 4 of the research study.

Chapter 8 presents findings from the questionnaire survey analysis and interview data
analysis on the processes that takes place in the exploitation of knowledge mapping
benefits in the facilities performance evaluation. The critical success factors for
effective exploitation of knowledge mapping are also analysed. The proposed guidance
for exploitation of knowledge mapping in facilities performance evaluation is addressed
in this chapter. Overall, Chapter 8 addresses Objective 5 of the research study.

Chapter 9, finally, summarises the research process and provide key findings from the
analysis throughout the study. Furthermore, the limitations and contributions of the
study are discussed; and suggestions made for several directions of future research.

The diagrammatic flow of the research is as shown in **Figure 1.5**.

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Research empirical elements

Chapter 4: Practice of facilities performance (FPE) evaluation in Malaysia
Analysis of the FPE's extent of practice in Malaysian FM, challenges and the critical

Chapter 1: Introduction
Background of the research, justification to the research, research aims, objective and research question, Contribution to knowledge

Chapter 5: Role of K-mapping in Malaysian FM
Analysis of the increasing role of K-mapping in Malaysian FM and the related factors.

Chapter 2: Literature review and synthesis-Facilities management knowledge
Literature review on knowledge management in the area of facilities management.

Chapter 6: Awareness of the role of K-mapping in FPE
Analysis of the awareness in facilities management companies of the role and implications of knowledge mapping in FPE.

Chapter 9:
Summary of the research; fulfillment of the research aims, objectives and research questions; recommendations for further research.

Chapter 3: Research Methodology
Constitutes methodologies and methods of the research, strategies for data collection, and approaches in data analysis.

Chapter 7: Challenges in implementation of knowledge mapping
Analysis of the challenges associated with implementation of K-mapping initiative that could improve FPE.

Chapter 8: Process in exploitation of knowledge mapping benefits in Facilities Management organisation
Analysis of the process involved in exploitation of knowledge mapping, and its critical success factors.

Figure 1.5: *Flow of research based on thesis chapters' arrangement*

research background and the focus of the study. It provides

mance has a significant role in the management of facilities as a whole. This also indicates that effective facilities management service can be achieved by harnessing elements of knowledge management. To implement knowledge management in the organisation, there should be elements of tacit and explicit knowledge in the organisation. This is where the need for knowledge mapping exists in facilities management organisation as a whole and specifically in facilities performance evaluation process.

The aims and objectives of the present research have been formulated based on the issues and gaps that exist in the area. The next chapter will present a critical review of the relevant literature within the area of the research. Simultaneously, issues on facilities performance evaluation that are linked to knowledge mapping are expounded and debated. It also outlines the growing importance of knowledge mapping in the field of knowledge management.

VIEW OF LITERATURE ON EDGE MAPPING AND FACILITIES PERFORMANCE EVALUATION

2.1 Introduction

This chapter introduces the overall focus of the present research. The chapter is organised as follows:

(1)   Overview of facilities management practice: the literature discusses on the definitions, characteristics, local context in Malaysian practice and direction of research in the facilities management area;

(2)   Literature review on facilities performance evaluation: the literature discusses on the position of facilities performance evaluation in facilities management practice. The literature also discusses the scope and various perspectives of evaluation in the management of facilities;

(3)   Overview of knowledge mapping: the literature discusses and reviews on the definitions, the characteristics, the processes involved, tools and techniques as well as the potential benefits that could be explored;

(4)   Formulation of the conceptual framework of the present research based on the literature; and

(5)   A synopsis and the proposed thesis outline.

Finally, a summary of the chapter is provided with a link to Chapter 3.

2.2.1 Introduction

Facilities management is viewed differently according to different geographical locations, interests and schools of thought. Hence, it is difficult to have a standard definition for õfacilities managementö that is commonly accepted or agreed (CFM, 1996; Price, 2001; Grimshaw, 1999; Lord, et al., 2002). Geographically, the American-based International Facility Management Association (IFMA) defined facilities management as a õprofession that encompasses multiple disciplines to ensure functionality of the work environment by integrating people, place, processes and technologyö.

The British Institute of Facilities Management (BIFM) however defines facilities management as õthe integration of multi-disciplinary activities within the built environment and the management of their impact upon people and the workplaceö. Both the IFMA and the BIFM have worldwide memberships who practice facilities management in different countries. Another definition of facilities management made by the Australian based Facilities Management Association (FMA) defined FM as õa business practice that optimises people, processes, assets and the work environments to support the delivery of an organisationøs business objectivesö.

Individual authors, however, have proposed different definitions based on their interests, observation and schools of thought. Early definitions (Becker, 1995; Cotts and Lee, 1992) suggest that FM is only concerned with the ±hardwareø such as buildings, furniture and equipment at the workplace. Later definitions, however, included services and performance towards organisational improvement, such as people, process, environment, health and safety as the responsibilities of FM (Connors, 2003).

FM represents a field of activities beyond the design, procurement and furnishing of buildings that continue into the realm of management skills associated with the use of a facility and how that facility evolves and develops in response to the changing demands of the occupier (Park, 1998). Others (Nutt, 2002; Tay and Ooi, 2001), have taken the definition further by expanding the scope of FM to cover the entire property life-cycle of designing, building, financing and operating (Connors, 2003).

ective, FM is identified as one of the fastest growing Europe (Harris, 2003). It is increasingly gaining recognition ut its status as a profession or a market is still being debated (Green and Price, 2000). The traditionally defined practice of facility design and management as the co-ordination of the physical workplace with the people and work of an organisation has expanded so that it now interfaces with just about every element of the business; from human resources to information systems and accounting (Teicholz, 2001). Challenges facing facilities managers in the future are those of finding new ways of leading, of cultivating environments for performing, and of finding new conversations with clients, customers and staff (Price and Akhlaghi, 1999).

2.2.2 Characteristics of Facilities Management Organisations

The previous section highlights the current practice and development of facilities management as a profession. Facilities management organisations are emerging with the development and expansion of the built environment industry as a whole.

Facilities management can be identified as a service-based organisation which provides skill, labour and consultation to the clients. Schmenner (1986) as cited in Fitzsimmons and Fitzsimmons (1998) proposed the service process matrix in **Figure 2.1** where the services are classified across two dimensions that significantly affect the character of the service delivery process. The facilities management organisation falls in the professional category which provides highly trained specialists to deal with facilities management matters for the clients. The distinctions of the service organisations are in the following forms:

1)   The customer (client) as a participant in the service process;

2)   Simultaneous production and consumption of services;

3)   Time perishable capacity;

4)   Site selection dictated by location of customers;

5)   Labour intensity;

6)   Intangibility; and

...uring output.

Degree of interaction and customisation

		Low	High
Degree of labour intensity	Low	**Service factory:** ▪ *Airlines* ▪ *Trucking* ▪ *Hotels* ▪ *Resorts and recreations*	**Service shop:** ▪ *Hospitals* ▪ *Auto repair* ▪ *Other repair services*
	High	**Mass factory:** ▪ *Retailing* ▪ *Wholesaling* ▪ *Schools* ▪ *Retail aspects of commercial banking*	**Professional service:** ▪ *Doctors* ▪ *Lawyers* ▪ *Accountants* ▪ *Architect* ▪ *Facilities management*

Figure 2.1: *The service process matrix (adopted from Schmenner,1986, as cited in Fitzsimmons and Fitzsimmons, 1998)*

Schmenner (1986) also identified challenges in the professional-based organisational environments as shown in **Table 2.1**:

Table 2.1: *Challenges for professional service (adopted from Schmenner, 1986, as cited in Fitzsimmons and Fitzsimmons, 1998)*

Challenges apropos high interaction/ high customisation	**Challenges apropos high level intensity**
▪ *Fighting increasing cost.*	▪ *Hiring*
▪ *Maintaining quality*	▪ *Training*
▪ *Reacting to customer intervention in process*	▪ *Methods development and control*
▪ *Managing advancement of people delivering service*	▪ *Employees' welfare*
▪ *Managing flat hierarchy with loose subordinate-superior relationships*	▪ *Scheduling workforces*
▪ *Gaining employee loyalty*	▪ *Control of far-flung geographical locations*
	▪ *Start-up of new units*
	▪ *Managing growth*

employees come from diverse educational, cultural, and field
share and use their knowledge in order to achieve strategic
of FM may also be differentiated by their functions in the
organisation. Some organisations have their own facilities departments and others rely
fully on the appointed facilities management consultants to look after the buildings
and facilities on behalf of the organisation. The functions of FM are inter-related with
the businesses of all organisations, but FM departments vary considerably from one
organisation to another. These departments relate to people, the facilities themselves,
technologies, work processes and the core business of the organisations. The support
service functions in FM include: catering and vending services, cleaning, courier
services, furniture management, internal landscape, laundry, mail room, office support
services, on-site moves, porterage, reception and security. An example of FM supports
service types are as clustered by Chotipanich (2004) as shown in **Figure 2.2**.

...estate/Property portfolio strategy
...e Negotiation and management
...lord activities and Rent review
...ing and sub-letting services
...l outlets and space renting

...tion searching and selection
Acquisition and disposal of sites and buildings
Relocation
New building
Extending & Alteration
Demolition

Facility Project Management

Maintenance & Repairs

Facility Refurbishment
Building shell/fabric maintenance
Maintenance and repair plant

Landscaping and landscape maintenance
Cleaning and Housekeeping
M&E/Operations/Run plant
Energy distribution and management

Waste disposal & Environment management
Pest control
Disaster prevention and recovery
Health & Safety
Security

Building services & operations

Office services

Office move service
Post and mail distribution
Courier services
Telephones
Records management
Print and fax
Storage and distribution
Reprographics
Reception, and telephone operator
Public relations/Governmental affairs
Travel arrangements
Car fleet control
Transportation
Business hospitality

Long-term resource planning
Mid-term resource planning
Annual resource planning
Work programming
Development planning

Planning & Programming

Space Planning and Management

Facility planning/master planning
Space Planning:
Space configuration and reconfiguration
Space allocation, utilisation and relocation
Space use audit and monitoring
Chum planning
Office allocation

Operations Administration/ Management

Administration and management
Budget and cost control
Purchasing and Contract control and negotiation
Office furniture and stationary provision

Employee supports and Services

Child Nursery provision
Restroom
Workplace nurseries
Recreations
Catering
Residential accommodation
Community affairs
Employee special services

Figure 2.2: *Cluster of facilities management support service (source Chotipanich, 2004)*

...es strategy is a neglected area of concern in many ...cited in Nutt, 2002). And yet, it is critical that FM strategy ...y merge (Barrett and Baldry, 2003). A lack of strategic integration between FM and the core organisation could result in contradictory objectives and goals (Barrett, 2003). FM objectives must be seen to be in tandem with the strategic direction of the organisation and be in support of its business.

It is important for the FM department to play its role in enhancing the performance of the organisation. In order to convince the organisationøs top management of the FM departmentøs strength and priority, the staff in question should provide evidence in support of the service performance by measuring its activity.

2.2.3 Knowledge Management in Facilities Management Organisations

According to (Nutt 2000), the FM knowledge trail starts from a position that relies largely on borrowed management concept on one hand, and on imported technical expertise from other professional fields of activity on the other. The knowledge in facilities management has three main sources i.e. knowledge of property and construction, FM knowledge and knowledge of facilities design and use (Nutt 1999a) while Kincaid (1994) cited that FM emerged with the integration of three main strands of activities: property management, property operations and maintenance & office administration.

Nutt (2000) characterises FM as õinformation-saturatedö ödata-richö but õknowledge-poorö and Sink (1991) suggests that performance measurement is õa mysteryí .complex, frustrating, difficult, challenging, important, abused and misusedö function, the existence of KM in FM organisations becomes more essential.

The positive outcomes and benefits gained by various fields including Built Environment upstream activities (construction, professional consultation, industrial production etc.). By implementing KM in their organisations, they should encourage FM organisations and processes to gain benefit from it. McLennan (2000) contends that in the context of the commercial office sector, both in-house and outsourced facility managers are poorly placed and this prevents them from exploiting their knowledge base.

flow was obviously dedicated to the post occupancy building design improvement purpose and neglecting the tion for the existing building maintenance or facilities management theme. However, he stressed the importance of understanding the information flow in facilities management organisations that should have the feedback loop to enable the knowledge gain to be quickly dispersed to provide the opportunity for the organisation to exploit the knowledge through operating buildings as shown in **Figure 2.4**.
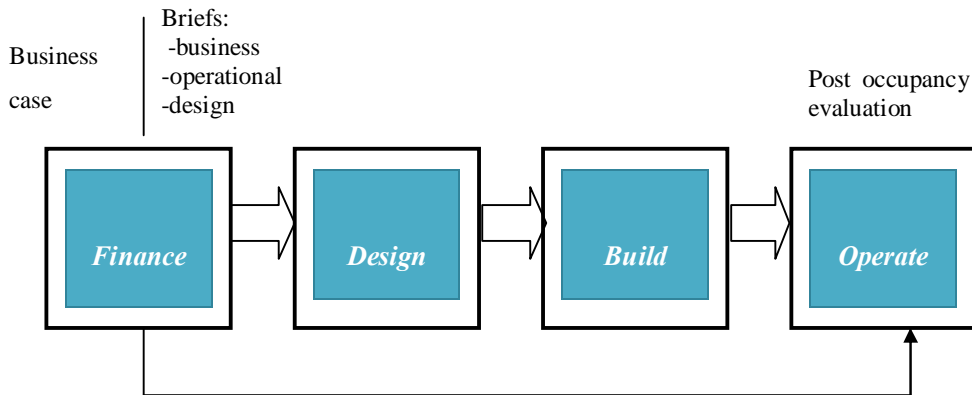
Figure 2.3: *Information flows for physical resources (McLennan, 2000)*

Knowledge Management (KM), like many other approaches in the built environment, is adapted from other fields of management i.e. business management and manufacturing. KM is of strategic concern for many organisations in todayøs business environment; hence, there has been a growing interest in KM within FM recently.

The London Times (Hoare, 1999 cited in Pathirage, et al, (2008a, 2008b and 2008c) calls KM the õfifth disciplineö after business strategy, accounting, marketing, and human resources and called upon British companies to harness it to improve their performance and profitability. Throughout the years, the researcher and academia has deliberately discussed the potential, challenge and critical success factors for knowledge management implementation in various types and categories of organisation. The context of discussion of the literature in this regards is as summarised in enclosed **APPENDIX A**. The challenges for organisation in harnessing KM in organisation are originated from three continuum i.e. information, management and technology as shown in **Table 2.2**(Alavi and Leidner, 1999).

...died in the context of FM despite a theoretical proposition ... 2000) of the discipline or perhaps the future (Price and ...pline. Indeed, the management of physical space may be the most under-utilised tool in contemporary knowledge management (Ward and Holtham, 2000) and a knowledge perspective may supply the conceptual framework with which occupier of property (facilities users) can understand and measure the business benefits they derive from occupation (Haynes et al., 2000).

Table 2.2: *Challenges or key concerns related to knowledge management in the organisation (adopted from Alavi and Leidner, 1999)*

Area	Main concerns
Information	• *Building vast amount of data into usable form* • *Avoiding overloading users with unnecessary data* • *Eliminating wrong/old data* • *Ensuring customer confidentiality* • *Keeping the information current*
Management	• *Change management implications* • *Getting individuals to volunteer knowledge* • *Getting business unit to share knowledge* • *Demonstrating business value* • *Bringing together the many people from various units* • *Determining responsibility for managing the knowledge*
Technology	• *Determining infrastructure requirements* • *Keeping up with new technologies* • *Security of data on internet*

According to Nutt (1999a), FM knowledge is of crucial importance and makes a proactive contribution to business, where FM still tends to be technically orientated and reactive. While the relevance and potential value of available technical and management expertise are recognised, their application to the specifics of facilities operations and management is poorly developed. As contended by Nutt and McLennan (2000), the FM knowledge trail is at an early stage of development in which:

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ver widening and ill-defined sphere of activity;

internal coherence for many working in the field;

herence to many corporate and business organisations, and

to educate public at large;

(4)   it has too few secure methods of its own to underpin good practice;

(5)   it has already begun to make its own distinctive contribution within the management field; and

(6)   it is insufficiently supported by an adequate knowledge base.

Then (2005) proposes a model for capturing knowledge from FM practice by linking between the identified problem areas in FM practice and taxonomy covering FM knowledge areas or functions as illustrated in **Figure 2.4.** It was further predicted that the outcomes from practice analysis will form the basis of key corporate learning and innovation.

Nutt and McLennan (2000) stress the two KM knowledge perspectives that need to be considered within FM are those of the corporate organisation and those of the individual employee. New strategic knowledge for FM could become a principal component of corporate knowledge value, as information begins to define market share for products and services around the world; with ICT providing the means for real time management globally.
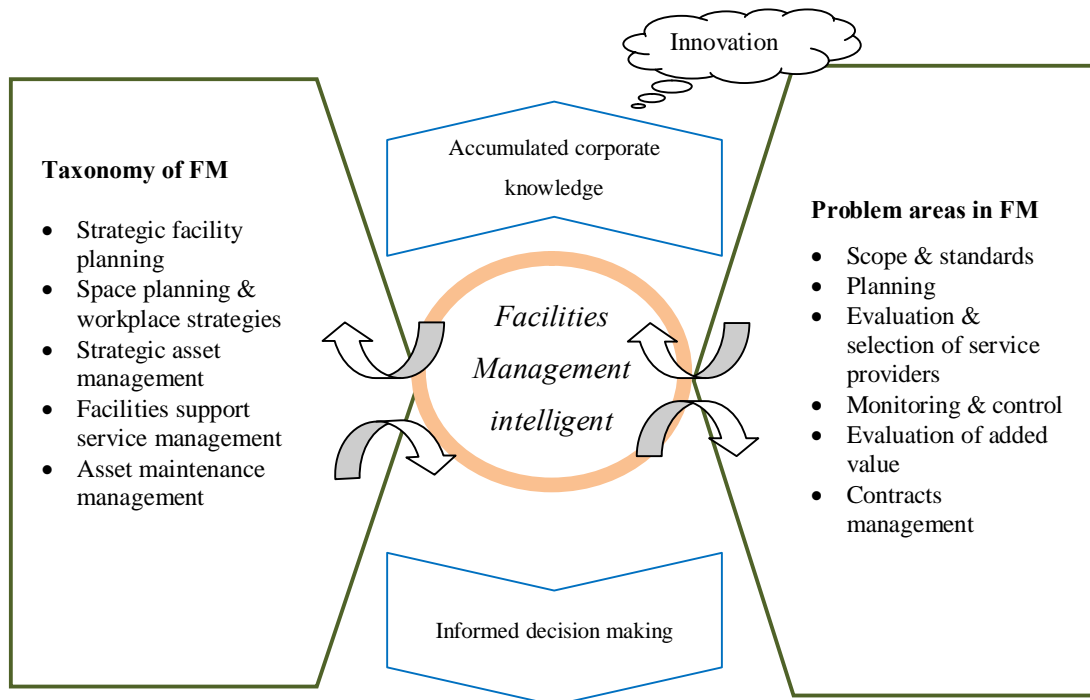
Figure 2.4: *Facilities Management Practice and Knowledge Capture (Then 2005)*

d explicit knowledge within the organisation, the sub-
s knowledge identification, capture, storage, mapping,
should be harnessed. Eley (2001) urges the facilities

manager to maintain good knowledge of what is possible to survive the future. This could be obtained if facilities managers really understand its õprofessional coreö and client expectations and needs. Then (2004) reviews the scope and competencies in three national institutions of facilities or facilities management in North America, Britain and Australia as follows:

(1)   Strategic Facilities management (governance and organisational capability)

(2)   Facility Planning (identification of business needs and response)

(3)   Facility Creation/Acquisition

(4)   Facility Operation

(5)   Facility Maintenance

(6)   Facility Replacement and Disposal

(7)   Facility Management Tools

(8)   Facility Management Systems

(9)   Business Management

(10)   Legislation, Codes, Regulations and Standards

For an effective KM exchange, both antecedents that govern knowledge (culture and technology) must be fully harnessed. An organisation must attract employees who can stimulate innovative behaviour or re-tool its employees in order to acquire the techniques and the principles of creativity. Therefore, FM organisations should always seek employees who think critically, plan strategically and adapt quickly to change (Oxer, 1998 as cited by Kululanga and McCaffer). Similarly, cultural and technological support services must be interwoven into their organisational processes.

In the context of Malaysian facilities management, Razali (2011) underlined nine criteria to be accentuated as strategies in implementing knowledge management in facilities management companies that is:

nisations;

hods;

4) Support from top management;

5) Knowledge culture in organisations;

6) Thoughtful;

7) Knowledge Creation;

8) Repository system in organisations; and

9) Innovation

FM cannot benefit effectively from KM without the existence of the two constructs of knowledge management. The two constructs act as a whole for effective KM. Thus, FM should intentionally and systematically cultivate knowledge and ensure a successful utilisation from the enabled cognitive capacity of their employees besides integrating the working environment with the services that support KM.

In cultivating the information and knowledge effectively, like other knowledge-based organisations, information technology is broadly exploited by facilities management firms in most of their operations (Barrett and Baldry, 2003). As an example, Yu et al. (2000) contend that in architecture, engineering and construction (AEC) activities, information is created by numerous computer applications throughout the entire life cycle of the project. The association of the information system between design and construction stage and operations stage in the management of facilities is shown in **Figure 2.5**. The concept shows on how the project information created during design and construction is later useful for facilities management activities during the building operation phase.
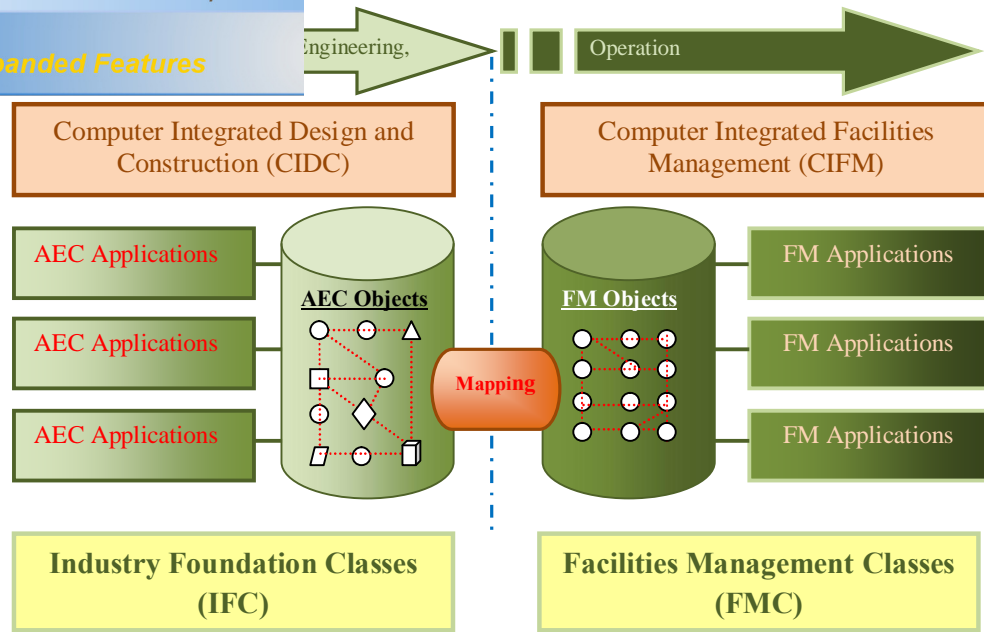
Figure 2.5: *AEC/FM information system supported by IFCs and FMCMs. (source: Yu et. al., 2000)*

Vischer (2001) suggests that an important reason to conduct a FPE is to develop knowledge about the design and construction decisions such as cost, occupant satisfaction, and physical building performance aspects. Therefore, in order to put into proper perspective the constructs for knowledge management specifically in knowledge mapping, Section 2.4 discusses the methodologies of acquiring, creating, sharing, storing and utilising intellectual assets.

2.2.4 Core competencies in facilities management

The competence in facilities management emerged from the õfore parentsö industries which draw on the body of knowledge that spans science, engineering, the humanities and social sciences. Despite many competencies required for managing facilities, Atkin and Brooks (2009) suggest that the core competence in facilities management is based on the knowledge in architecture, engineering, construction, technology, management, law and economics which covers:

ó building performance, environmental services and

...count, finance, purchasing and supply, and legal aspects;

iii- Organisational management ó organisational structure, behaviour, processes and systems;

iv- Innovation and change management ó technology, ICT and information management; and

v- Human resource management ó motivation, leadership, employment law, health and safety.

Williams (2003) suggests that the multiple skills needed in facilities management cannot all be reasonably brought in-house, so some outsourcing is virtually inevitable. The degree or level of competency varies depending on the nature and requirements of their services in the organisation. Intellix (2010) suggests amongst the competencies that are required in knowledge mapping is a fundamental knowledge of the industry and of the business area that is dealt with. To enable the facilities managers to participate actively in knowledge mapping implementation or act as a knowledge mapper, he/she should possess a more specific competence. Examples of specific competencies for facilities management personnel are as conceptualised by RICS in facilities managementøs associate assessment guide. Tissen et al., (2000) however suggest three most important types of competencies that facilities managers have to learn and trained in in the context of knowledge as a means of production:

- Competencies that help individual learn from information;
- Competencies that help individual improve their thinking; and
- Social competencies that help individual interact better with their colleagues and the world around them.

2.2.5 Facilities Management in Malaysia

Facilities management in Malaysia has been practiced for decades. The growth of its formal practice parallels the development of the built environment in the country. However, Pillay (2002) as cited in Kamaruzzaman and Zawawi (2010) contends that the obvious development of facilities management in Malaysia appears in the second half of the 1990s.

e facilities management function emerged apparently with
on industry and the escalating number of newly completed
policy introduced by the Federal government in 1984 gave
significant impact to the growth of the facilities management profession in Malaysia.
The earliest privatisation of facilities management services contracts took place in 1997
by the Ministry of Health for the provision, maintenance and management of hospital
support services of public hospitals throughout the country.

The trend of privatisation of the facilities management function continued and was
followed by other ministries, agencies, state governments and local governments; for
example in 2000, the Public Works Ministry outsourced the comprehensive facilities
and asset management of Federal Government Buildings throughout the country to the
facilities management provider.

From another perspective, Mustapha and Adnan (2008) identified that the increasing
awareness of the importance of a proper maintenance management system became the
main contributing factor to the development of facilities management in Malaysia.
Subsequent to this, the business management of various organisations has started to
promote the need for facilities management as part of the business organisation.

However, up to the present date, no specific facilities management professional body
has been established in Malaysia (Mustapha and Adnan, 2008, Noor and Pitt, 2010,
Kamaruzzaman and Zawawi, 2010). The responsibilities of facilities managers are often
being undertaken by various professionals, especially property valuers, mechanical and
electrical engineers and civil engineers. As noted, these professions are not specifically
designed to cover the required skills and knowledge of what is expected from facility
managers.

Mustapha and Adnan (2008) predict that within a few years, a positive call for FM
industry might emerge from the changes in the industry. This prediction is supported by
a number of research interests in various FM topics conducted in Malaysia in recent
years (e.g . Noor and Pitt, 2010 and Kamaruzzaman and Zawawi, 2010). Involvement of
the public and private sectors collaborating in organising the National Asset and
Facilities Management (NAFAM) in October 2007 shows the important synergy in the
facilities management sector in Malaysia. The Construction Industry Development
Board (CIDB), the government agency whose role is to overview the construction

Malaysia has actively organised facilities management-
seminars and workshops.

2.2.6 Process of Managing Facilities

The present research apply the agreed definition of facilities management as defined in EN15221: Part 1, 2006, ‗Facilities management: terms and definitions' as ‗*the integration of processes within an organisation to maintain and develop the agreed services which support and improve the effectiveness of its primary activities' (BSI, 2007).*

A process-based management system approach underlies this definition, as defined in the 1SO 9000 series. **Figure 2.6** shows the facilities management model together with the relation of its primary processes and support processes.

This facilities management model provides a framework which describes how facilities management supports the primary activities of an organisation. It deals with the demand and supply relationship and presents the different levels of possible facilities management interaction. An organisation should rely on its primary processes in order to achieve its strategic objectives. Facilities management acts as a support function (Alexander 1996) to the organisation, but its role in the maintenance of building facilities and property management are also critical and demanding (Barrett 1995; Sarshar, Betts et al. 2000; Underwood and Alshawi 2000).

The key facilities' issues for the future in all sectors of the economy are increasing adaptability to changing business needs, providing a healthy workplace for creative people, assimilating the potential of new technologies and ensuring full use of diminishing resources while minimising environmental impact (Alexander 2003b).

Even within the same business sector, each organisation is likely to have different needs in facilities and FM functions. The characteristics or nature of the organisation reflect its business objectives, organisational process and organisational culture. They influence the organisation's needs and the management methods of its facilities (Atkin and Brooks, 2000).
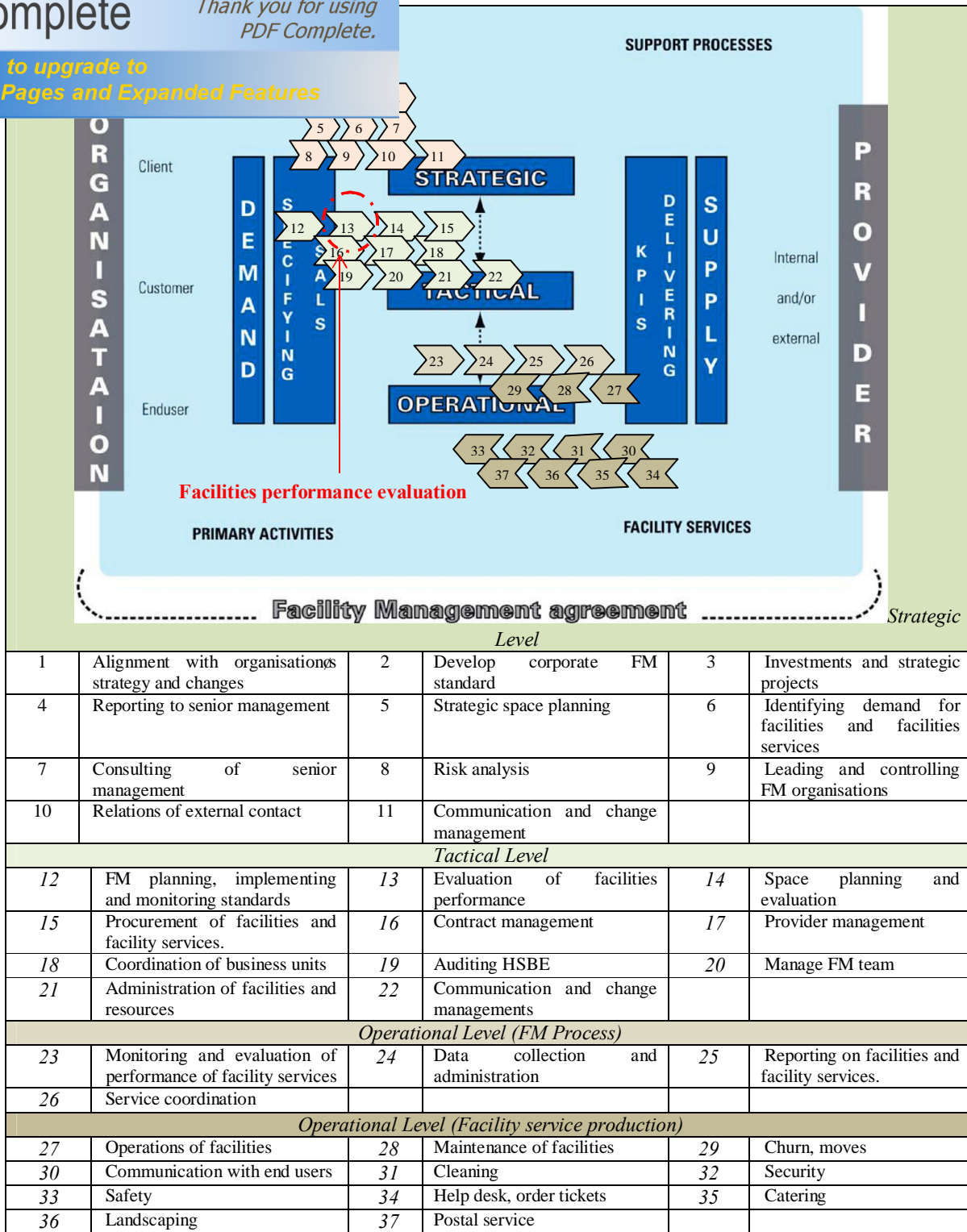
Figure 2.6: *Relationship of FM processes to the Facilities Management Model: Position of facilities performance evaluation at the tactical level (Source: BSI, 2007)*

	Strategic Level				
1	Alignment with organisation's strategy and changes	2	Develop corporate FM standard	3	Investments and strategic projects
4	Reporting to senior management	5	Strategic space planning	6	Identifying demand for facilities and facilities services
7	Consulting of senior management	8	Risk analysis	9	Leading and controlling FM organisations
10	Relations of external contact	11	Communication and change management		

	Tactical Level				
12	FM planning, implementing and monitoring standards	13	Evaluation of facilities performance	14	Space planning and evaluation
15	Procurement of facilities and facility services.	16	Contract management	17	Provider management
18	Coordination of business units	19	Auditing HSBE	20	Manage FM team
21	Administration of facilities and resources	22	Communication and change managements		

	Operational Level (FM Process)				
23	Monitoring and evaluation of performance of facility services	24	Data collection and administration	25	Reporting on facilities and facility services.
26	Service coordination				

	Operational Level (Facility service production)				
27	Operations of facilities	28	Maintenance of facilities	29	Churn, moves
30	Communication with end users	31	Cleaning	32	Security
33	Safety	34	Help desk, order tickets	35	Catering
36	Landscaping	37	Postal service		

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), the integration of facilities management as an effective

an be achieved by recognising three key characteristics:

(a)   FM is a support role within an organisation, or a support service to an organisation;

(b)   FM must link strategically, tactically and operationally to other support activities and primary activities to create value; and

(c)   Facilities managers must be equipped with knowledge of facilities and management to carry out their integrated support role.

Alexander (1996) points out that facilities management is the process by which an organisation ensures that its buildings, systems and services support core operation and processes as well as contribute to achieving its strategic objectives in changing conditions. He also stressed that FM should focus its resources on meeting user needs to support the key role of people in organisations, and strive to continuously improve quality, reduce risks and ensure value for money.

This view is supported by Nutt (2000), who addresses the strategic role that facilities management contributes in a business entity with a primary function to resource management at the strategic level and operational level of support. At the lowest level of support, a day-to-day support of operations is required to keep the business functioning whilst at the strategic level of FM, the facilities manager needs to play a role in planning for service provision based on organisational and business demands.

In addition, Heywood et al. (2004) also suggested that facilities should be strategically planned, aligned to business needs and demonstrate contribution to achieving business objectives. Alexander (2003b) claims that there are significant shifts in the public and corporate organisationsø acknowledgement towards FM contributions in the overall business performance.

The roles and responsibilities of facilities management in managing assets, managing occupancy, supporting the business, supporting the organisational transformation and enabling communities (as suggested by Alexander (2007)) are becoming more complex and changing widely (Lunn and Stephenson, 2000). Facilities management has to evolve to a higher strategic level if the client or business is to extract the best value from it (Grimshaw 1999; Nutt 1999; Price and Akhlagi 1999).

ls to see how it can fit in the overall business agenda
nfluences for change in the business environment and
nmodate it (Alexander, 2003b).

To influence and shape a contribution to an organisation, FM needs to be strategic and to broaden itself from merely being an operational maintenance management and management of the built assets to the management of the provision of business support needs (Hinks 2001). Finch (1998) explains that the role of facilities managers are managing change in buildings and its environments, and this function seemingly conflicts with the role of maintenance manager.

Maintenance managersø primary role is to combat the effects of physical deterioration of the building which contradictly strategic facilities management views on how the human react with the building deterioration from management perspective (Finch 1998). FM is evolving from an operational non-core business support services function to a strategic FM position in an organisation (Goyal, Pitt et al. 2006).

Furthermore Goyal et al. (2006) stress that the relationship between organisational strategic (core business) and operational (non-core business) activities is vital in facilities management. Therefore, the ability to link the operational activities and the strategic facilities management role is essential for the organisation (Goyal and Pitt 2007). This could happen if the FM discipline is recognised at the boardroom level or at the strategic level of an organisation.

Likewise, FM can also play a vital role in helping organisations manage change by enabling them to move from where it is today to where it has to be tomorrow to meet its business objectives (Atkin and Brooks 2000; Alexander 2003b). A facilities manager needs to prepare for change and ensure the success of the organisation. FM has to support dynamic business change and not simply to offer operational excellence, cost reductions or cost savings and time savings (Hinks 2007).

The aim of strategic facilities management is to achieve a strategic fit between core business needs and the provision of facilities management (Barrett and Baldry 2003). The strategic plan is a holistic and shared understanding of how the organisation should achieve the desired future position. The strategy can also be planned for a network of co-operative and otherwise independent organisations (Kettunen 2006).

r to achieve the objectives of the organisation in the long-

need to define the facilities management strategy in

sation's strategy. According to Barrett (2000), to improve the strategic context of FM organisation is through a clear process that links core business with FM strategies. This can ensure that the FM organisations continue to deliver high level operational support to the core business and will improve the strategic context of an organisation (Barrett 2000).

In addition, facilities managers have tended to measure performance from operational efficiency perspectives and this led to data which does not illuminate the potential competitive edge of tuning the facilities to the business process (Hinks, 2004). Hinks argues that difficulties arise for FM to use the data from the operational management of the facilities to inform the strategic business planning decisions of the organisation.

2.3 Facilities Performance Evaluation Processes

The activities, tools and detailed content of the evaluation process differ between one to another in terms of modus operandi; depending on the unique characteristics of the facilities, strategy deployed by the facilities management team, the purpose and specific level of evaluation. However, Preise and Schramm (2002) are of the view that in order to be able to evaluate buildings in their different settings, the need exists to develop state-of-the-art building performance evaluation. An initiative from HEFCE (2006) saw the production of a guide on how to conduct facilities performance evaluation for higher education to standardise the practice and outline the performance evaluation for universities in the UK. The Centre for Health Assets Australasia, University of New South Wales has developed a standard practice for health projects and assets performance evaluations in Australia. In the US the work for standard practice and procedures for conducting Post-occupancy Evaluation (POE) for correctional jail centres was initiated by Wener and Farbstein (1994) from Polytechnic University Brooklyn. For office buildings, guidelines were developed by the British Institute of Facilities Management in 2006 (as cited in Yasin and Egbu, 2009).

A Guide to Post Occupancy Evaluation (2006) was published by the Higher Education Funding Council for England (HEFCE) which suggests that in principles of conducting performance evaluation for building facilities, the evaluator should refine the existing

the needs of the particular facilities. There are many in the FM practices using different terms and on different suggested by Yasin and Egbu (2009), whatever method is applied, there are similar characteristics such as systematic and synchronized appraisals, computer-aided evaluation and analysis, combination of qualitative and quantitative data analyses and field observations by multi-disciplinary teams. The approach in evaluation should also define the limitations of the evaluation from several perspectives of facilities performance. Brackertz (2006) suggests six perspectives of facilities performance; 1) Service perspective; 2) Community perspective; 3) Financial perspective; 4) Physical perspective; 5) Utilisation perspective; and 6) Environmental perspective. In collecting those facilities performance-related data for the facilities performance evaluation, a physical and virtual tool is very important. Examples of physical tools that enable the collection of data have been listed by Chambers (2003) as follows:

(1)   visual inspection;

(2)   surveys;

(3)   interviews;

(4)   working observations;

(5)   maintenance records;

(6)   expert evaluations, testing, etc.;

(7)   check lists;

(8)   analysis tools;

(9)   digital photos

(10)   as-built (record drawings);

(11)   energy use records;

(12)   recording instruments; and

(13)   remote video cameras.

t enable the data collection and analysis of data are such as tranet; and specialist software.

To explain the variety of approaches in evaluating facilities performance, Barrett and Baldry (2003) have grouped the methods into two categories:

(1)   User-based system ó building occupants to evaluate the suitability of a building for their particular needs; and

(2)   Expert-based system ó relies on expert assessments and typically covers broad areas such as provision for information technology, organisational growth, changes in staff work style; and energy efficiency.

In practical innovative evaluation, it is an advantage if the evaluators can successfully triangulate both. Sole reliance on the userøs perspective does not represent an accurate position of facilities performance and is merely subjective in measuring individual satisfaction. In contrast, expert-based evaluations are merely focused on specific elements of a broad set of facilities, disregarding the userøs perspective. This is where the emergence of knowledge in the organisation must be systematically harnessed throughout the evaluation process.

Preiser et al. (1991) propose a common process in evaluating facility performance which involves the facility users and expert evaluators. Three levels of effort were proposed in the model. The process selected depends upon finances, time, manpower and the required outcome. However, each level contains the same procedures of planning, conducting and applying as shown in **Figure 2.7** below.
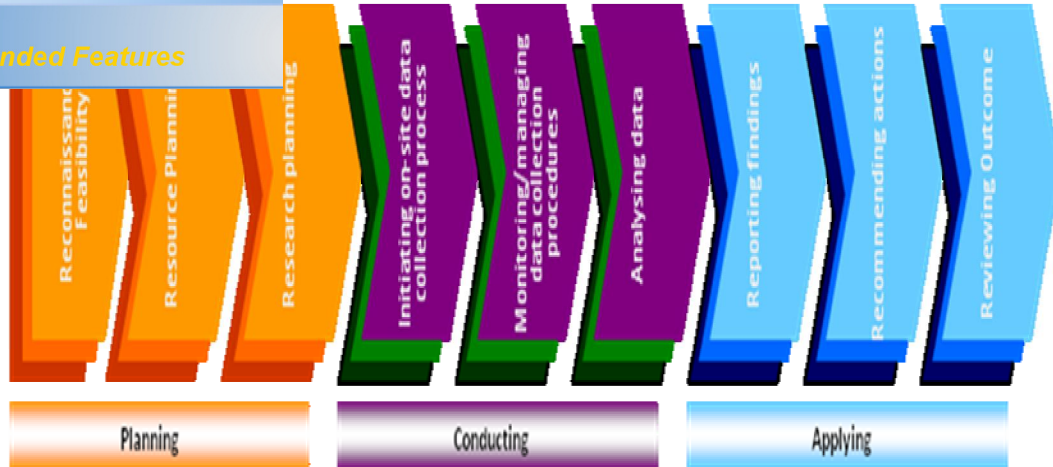
Figure 2.7: *Evaluating facilities performance process model (adopted from Preiser et. al , 1991 and Barrett and Baldry, 2003).*

The indicative level is where symptoms on an obvious criterion of the particular elements of the facilities is identified. In common practice, it is normally carried out by an experienced evaluator who is familiar with the building type being evaluated and as such is completed in a minimum time span. The findings are usually presented in a short report, outlining the purpose of the evaluation, the data collection method used, findings and recommendations. The result at the indicative level is often brought forward to an investigative level for more detailed investigation and evaluation. Barrett and Baldry (2003) suggest, at investigative level, evaluators should rely on more sophisticated data collection methods and benchmarking with similar buildings being assessed.

Finally at diagnostic level, a specific context of facilities element such as energy consumption efficiency, structural defects, space usability and thermal comfort are assessed. The diagnostic evaluation is likely to take several months at a minimum to complete depending on the breadth and depth of the evaluation.

As a project-based activity of the performance evaluation, managing the resources at the beginning is the most critical and challenging part. Identification of human and non-human resources in the organisation becomes challenging in a situation where knowledge in the organisation is not well managed. Therefore, the present research concentrates on the resource planning aspect in the facilities performance evaluation.

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Evaluation

...t role is to support the core business activities, it is always ...mportance and performance evaluations are frequently being abandoned. From a general management context and a classical point of view, Amaratunga and Baldry (2002) admitted that there is a need to assess performance in order to guide management decision making. Similarly, from a human relations angle, there is a need to assess performance to know whether an initiative is producing the benefit intended. Amaratunga and Baldry (1998) discussed the evaluations benefits in time-line context i.e. short, medium and long term benefits:

Short Term Benefits

- Identification of, and solutions to problems in facilities;
- Proactive facility management responsive to building performance;
- Improvement of space utilisation and feedback on building performance;
- Improvement on attitude of building occupants through active involvement in the evaluation process;
- Understanding of the performance implications of change dictated by budget cuts; and
- Informed decision making and better understanding of consequences of design.

Medium Term Benefits

- Built-in capability for facility adaption to organisational change and growth over time, including recycling of facilities into new uses;
- Significant cost saving in the building process and throughout the building life cycle; and
- Accountability for building performance by design professionals and owners.

Long Term Benefits

- Long-term improvements in building performance;
- Improvement of design databases, standards, criteria, and guidance literature; and
- Improved measurement of building performance through qualification.

evaluation parameters, the facilities management itself are

times beyond the building-related services as described

cites measurement of facilities as having three main

components namely physical, functional and financial. Evaluation of facilitiesø physical performance and service performance was also discussed by Brackertz (2006). Fleming (2006) suggests change of methodologies and methods in assessing building facilities performance which includes human factors that inhabit and use the building facilities. These emphasise the needs for functional performance to be included in the evaluation rather than technical aspects. Another purpose of facilities performance evaluation that was popularly discussed in literature is post occupancy evaluation techniques whereby the criteria of judgments are the fulfilment of the functional aspects of facilities as well as the occupantøs expectation towards the building facilities as highlighted by several authors such as Brooks and Viccars (2006), Bordass and Leaman (2005), Cooper (2001) Zimring et al. (2001), Zimmerman and Martin (2001) and Preiser (2001).

Financial performance arises from the physical and functional performances of the building and comprises capital and recurrent (life-cycle) expenditures, depreciation and efficiency of use, etc. The financial matter is a traditional approach in building facilities performance evaluation which is inclusive of tangible measures such as space efficiency and cost of occupation. Brooks and Viccars (2006) accentuate the benefits of the evaluation in terms of physical performance is to uncover problems which may label the building as õunder-performingö and thus reduce the value of the building. However, this trend of evaluation (Houvala, 2004) has gradually changed to include and consider the non-financial measures.

Secondly, **Physical performance** relates to the behaviour of the buildingøs fabric and embraces physical properties such as structural integrity, heating, lighting, energy efficiency, maintainability, durability etc.. The benefit of having to know about physical performance of building facilities is varied. In explaining the benefits of physical performance evaluation output, Ali and Mohamad (2009) suggest:

"...the result offers management the opportunity to appraise the overall progress being made and seek improvements for increased efficiency and more effective utilisation of available resources".

mance concerns the relationship of a building with its ...es such as space, layout, ergonomics, image, ambiance, ...safety, and flexibility etc. However, for the purpose of the present research, aspects of performance evaluation are concentrated on the usability and physical condition of the building facilities.

This inferred that the extent of the facilities performance evaluation practice in facilities management organisations could be measured from three main aspects:

1) The role and contribution played by facilities performance evaluation in the facilities management organisation;

2) The level of preparedness of one organisation to perform the evaluation; and

3) The approaches towards facilities performance evaluation that are presently being practised in the organisation.

2.3.2 Building and facilities-related evaluation techniques

There are many evaluation methods applied in the FM practices going by different names and some by different parameters. Previous research by Simpson (1998) classified the techniques for the assessment of performance in facilities management into three broad perspectives i.e. facilities side, external parties and core side perspectives.

Some of the techniques especially those related to technical standards are very narrow in their scope. Conversely, other techniques normally those for assessing management performance tend to be very broad in their scope. This research does not intend to review in-depth all aspects of available tools and techniques but will instead focus more on the tools broadly and commonly accepted in practice.

Brackertz and Kenley (2001) suggest that Kaplan and Norton's (1993) ‗balance score card' are the most influential of the ‗new' approach in evaluating facilities performance. Ironically, the perspective perceived by Kaplan and Norton views the facilities performance from the aspect of (1) financial aspect of facilities management organisation; (2) customer's response and satisfaction; (3) internal business; and (4) innovation and learning in facilities management organisation rather than the physical performance of the facilities.

is mainly reflected within the scope of managerial and he organisation rather than the vital aspect of building m. The physical performance of facilities is very important and is a fundamental issue in guiding the operation and maintenance of facilities management organisations.

At operational level, the outcomes on how effective the building facilities response to user requirements and its designated functions such as its efficiency and effective function, usability, level of comfort as well as its physical appearance is more useful during the occupation of a building facilities. However, the BSCøs technique is widely used in FM organisations for the contract monitoring purpose for out-sourced service provision. In this regard, Lai and Yik (2005, 2006) suggest that the financial, knowledge, motivation and information barriers are the challenges that the practitioner often encountered.

McDougall (2002) shortlists three facilities performance evaluation tools that portrayed the systemised post occupancy assessment and the tools that have established track records within the organisation; they are:

1.   Building Quality Assessment (BQA);

2.   Serviceability Tools and Methods (STM); and

3.   The Post-occupancy Review of Building Engineering (PROBE) occupant
        questionnaire.

He reiterated that these three techniques referred to and cited quite frequently in the literature, purposely for evaluating buildings in post occupancy use, comprehensively covered all aspects of facilities performance and has track record within an organisation. Based on the same grounds and besides the techniques listed in McDougalløs review, Yasin (2009) included three others which are Management-by-variance tools, Building Use Study and Balance Score Card.

Brooks and Viccars (2006) suggest, in broad facilities management practice, future direction of evaluation should consider the integration of the following:

• Analysis of organisational/business needs;

• Perception of building users;

• Comparative õscientificö data (e.g. environmental monitoring);

ts; and

ny productivity/environmental changes (including energy

2.3.3 Information technology in Facilities Management

Data and information are very important in the evaluation of facilities performance. The facilities management scope of work itself deals with massive amounts of data and information. Management of such a huge amount of data and complex information requires meticulous and systematic handling. The accuracy and reliability of data and information lead to the successfulness of the evaluation.

Glober et al. (2000) and Matasek (2000) as cited by Wang and Xie (2002) suggest that facility managers need a management system database to control building performance, manage distributed services, adapt rapidly changing requirements and provide important management information. Barrett and Baldry (2003) cite that the knowledge, information and data in facilities management organisations could be collected, stored, retrieved, communicated and used by adopting computer-based information system in the organisation:

> *"Good quality systems provide appropriate, accurate and timely information which could pull together a potentially disparate facilities management function into an integrated and organised one which is explicitly geared towards strategic corporate objectives"* (Barrett and Baldry, 2003)

They further contend, the effective and efficient information technology in facilities management organisations could promote:

i-More efficient use of information at all management levels;

ii-   Improve decision making;

iii-   Improve managerial responsiveness; and

iv-   Improve learning capacity and capability.

Rondeau et al (2006) suggest the hierarchy of facilities management decision system to reflect the importance of integrated and comprehensive information system in facilities management. The authors suggest that the facilities management team should first understand the strategic aims of the organisation and link them to the aims of the

Barrett and Baldry (2003) suggest that facility managers ty of the system in the aspect of technical, economical and system. Barret and Baldry further suggest that the main criteria of technical, economical and operational of the proposed software should consider:

i-   Ability to accommodate changes within the FM organisation. This means the software should be flexible and able to be adjusted accordingly to suit future changes;

ii-   Ability to accommodate changes in technology such as software and hardware. This means that the system or software should be able to upgrade to the latest version and be compatible to new hardware;

iii- Defining constraints such as cost, staff training and knowledge and skill of the staff to run the new system;

iv-   User friendly software that is easy to be operated by the user. The system or software should also be easy to maintain and operate;

v-   The functions and features offered match the organisational requirements; and

vi-   The system has sound support service from suppliers such as provide necessary training, demonstration, trouble shooting and after sales re-visit.

To find the gap to be bridged by the system, an inventory of the available information is vital. The inventory could be developed into a comprehensive database system by exploiting the available (information) technology. The outcomes of the process are improvements in the decision in terms of time taken and accuracy of the decision.
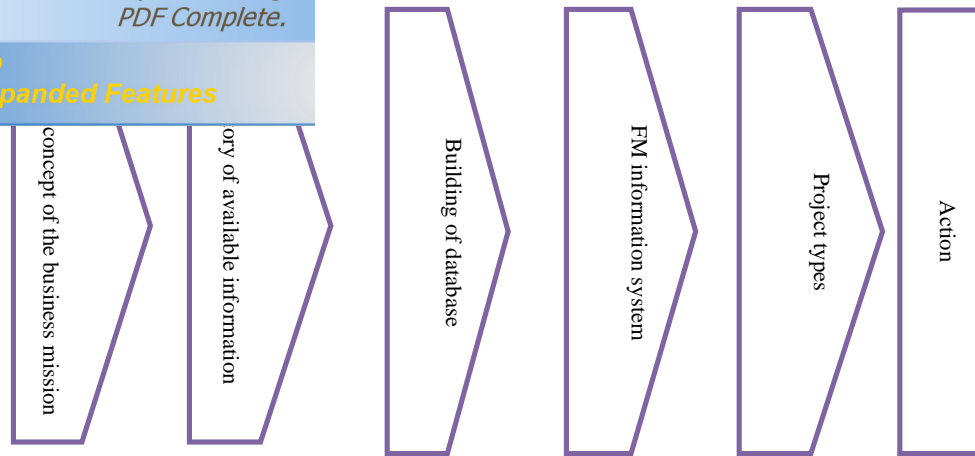
Figure 2.8: *Facilities management decision system (adopted from Rondeau et al., 2006)*

Rationally, those improvements could provide significant cost saving to the organisation in the long run and keep the organisation in a competitive advantage. The improvement in facilities management information system is parallel with the needs of knowledge mapping implementation in facilities management as discussed in the subsequent section.

2.4 Knowledge Mapping Implementation

Knowledge management holds the potential to identify, capture, codify, store, disseminate, use, evaluate and achieve up-to-date leverage of managing knowledge to maximise productivity and competitive advantage of the enterprise (Rollet, 2003, Sun and Scot, 2005, Halawi et at., 2006, Mohamed and Anumba, 2006) and to enhance exploitation, creation and use of intellectual assets of enterprise (Rowley, 1999, Marr et al., 2002, Hellstorm and Husted, 2004, Hoffman et al., 2005). However, it has been noted that knowledge management has many barriers and problems with respect to its development and operation, especially in codifying and transferring knowledge and integrating and applying the key components of project and business.

Knowledge mapping has been identified as a critical process, method and tool in knowledge management to effectively visualise the sources, flows, constraints and termination of tacit and explicit knowledge. The present section discusses and explores the specific principles and features of knowledge mapping.

apping

...fined as the processes, methods and tools for analysing ...discover features or meaning and to visualise them in a comprehensive, transparent form, such as clearly highlighted business-relevant features (Speel, 1999). Vail (1999) as cited in Berg and Popescu (2005) view knowledge mapping as techniques and tools for visualising knowledge and relationships in clear form in such a way that relevant features are clearly highlighted.

In the same vein, Renukappa and Egbu (2004) in defining the knowledge mapping also stress relationships but include the important element of maps referring also to tacit knowledge. They also highlight the important notion of knowledge dynamics, next to knowledge stores or repositories as they cited:

"A knowledge map is a navigation aid to both explicit and tacit knowledge, showing the importance and the relationships between knowledge "stores" and the dynamics."

The knowledge stores or repositories refer to the location where the knowledge accumulates. The dynamism in knowledge management could be obtained by effective knowledge mapping that generalises the knowledge to a wider group of people and provide means for new values adding to the existing knowledge. Vail III (1999) as cited in Folkes (2004) identifies knowledge mapping as the process of associating items of information or knowledge, preferably visually, in such a way that the mapping itself also creates additional knowledge. Therefore, the great potential of knowledge mapping benefits to be explored and exploited in various field is necessary.

Nevertheless knowledge mapping is still (considerably) a new field in knowledge management (Fisher cited in Folkes, 2004) and the right metaphors, algorithms, and conventions are continuously evolutionary. Over the years articles and papers have been written about knowledge mapping and its use; Grey (1999); Wexler (2001); Eppler (2001); Huijsen et al. (2004). In general, the literature shows the significant importance of knowledge mapping as one of the knowledge management approaches. Despite its newness, the role and benefits offered has long been exploited by individuals and organisations in various fields. The focus on knowledge mapping comes to the attention of organisations only when awareness towards knowledge management has taken place (Yasin and Egbu, 2010).

the sources, flows, constraints and sinks (losses or stopping ... wledge flow within an organisation (Egbu et. al, 2005b, ... lementing knowledge mapping, the organisation has an opportunity to identify the opportunities which exist for sharing knowledge within the organisation. Added value for the implementation of knowledge mapping is the identification of intellectual capital (Liebowitz, 2003), it can socialise new members, and enhance organisational learning (Vail, 2001 and Wexler, 2001).

Another advantage of implementing knowledge mapping is that it encourages the re-use of ideas and provides a database for best practice. Hence, it could prevent the re-invention of the wheel and capture new knowledge (Egbu et. al, 2005b). In addition, knowledge maps improve the ability for organisations to locate knowledge in process, finding critical information quickly, find islands of expertise, and forge relationships of knowledge domain and people, policies, repositories and context (Egbu et. al, 2005b). The systematic approach of mapping knowledge could simplify and speed the process being mapped by removing unnecessary actions, avoiding duplication of tasks and identifying best practice.

2.4.2 Character of Knowledge Mapping

Knowledge mapping maps the tacit and explicit knowledge residing in the organisation. Tandukar (2005) suggests that explicit knowledge maps the subject, purpose, location, format, ownership, users, and access rights. Tacit knowledge maps the expertise, skill, experience, location, accessibility, contact address and relationship/network. Tacit organisational process maps the people with the internal processing knowledge. Explicit organisational process maps codified organisational process knowledge. Egbu et al (2005b) pose an argument that it is not helpful to know the particular knowledge exists in the organisation without knowing where to find it. Hence, creating a database of the knowledge and skill of staff was not an easy initiative to pursue.

By identifying the object in knowledge mapping, the knowledge source, flows, constraints and knowledge sinks within the organisation will emerge. In other words, knowledge mapping highlights the (1) available knowledge resources; (2) knowledge cluster and communities; (3) individuals and/or groups who use types of knowledge

...owledge exchange; (5) knowledge life cycle; and (6)

In implementing knowledge mapping, it is crucial to comprehend its fundamental tenet. Through syntheses of the literature (Grey, 1999, Meso and Smith, 2000, White, 2002, Lui and Hsu, 2004 and Vestal, 2005) of knowledge management in the context of the present research, key principles of knowledge mapping can be summarised as follows:

(1)   Knowledge mapping is about inquiry, education and relationship building rather than about charting or documentation;

(2)   Knowledge mapping involves activities such as coaching, modelling and sharing the knowledge as well as identifying, finding, tracking, discovering, surfacing knowledge in all its forms;

(3)   Knowledge mapping recognises and jointly locates knowledge in a wide variety of forms for example tacit/implicit/explicit, formal & informal, codified & personalised, internal & external, individual & organisational, short life cycle & permanent;

(4)   Knowledge found in processes, relationships, policies, people and documents, conversations, links and contexts;

(5)   Knowledge mapping is concerned with organisational level aggregation, cultural issues and reward systems, timelines, sharing and value, legal process and protection such as patents, trade secrets, trademarks; and

(6)   Knowledge is transient and very closely tied to individual and group identities, it is needed to obtain and explain sanctions, establish boundaries and respect personal disclosures.

Two main focus of knowledge mapping role discussed in the present research are within the context of:

1)   Organisational setting ó implementation of knowledge management in the facilities management nature of business and operations including the type of services offered, human resources and specific requirements, challenges and the critical success factors; and

e role of knowledge mapping based on the nature of task

sources, specific requirements, challenges and the critical

2.4.3 Process of Knowledge Mapping

The knowledge mapping process discussed by various authors in the knowledge management literature include those by Yasin and Egbu (2011), Yang (2007), Egbu (2006), Ebner (2006) Ebner (2006), Jennings (2005), Kim et al. (2003) Grey (1999) and Rouse et al (1998). A comparison of the approaches is shown in Table 2.3. However, Vestal (2000) proposes an exceptionally comprehensive knowledge mapping process as shown in **Table 2.3**.

Authors such as Eppler (2001) and Egbu (2006) emphasise the importance of knowledge mapping project to focus on a pre-implementation stage. Prior to the implementation of the knowledge mapping project, the initiator should apprehend the objectives of knowledge mapping project in the organisations so that the process that is specially tailored to the organisation¢s need could be designed.

As a feed-forward process, knowledge mapping project should provide links upon completion of a one-process cycle. These links enable the organisation to retain the knowledge for the benefits of the organisation (Egbu, 2006). The process also provides means for updating the existing knowledge that could enrich the organisation¢s knowledge (Eppler, 2001). In the same vein, Kim et. al (2003) suggest that the links could also provide means for knowledge map validation that could be improved on the next cycle.

…pping (adopted from Vestal, 2000)

Author	Precedence	Approach to knowledge mapping				School of though
		Gather and Capture	**Analyse**	**Link**	*Beyond*	
Yang (2007)		1. knowledge framework establishment 2. knowledge sources determination 3. knowledge extraction 4. knowledge compilation		5. knowledge representation 6. Knowledge interpretation		Knowledge map for construction scheduling technique
Egbu, C. (2006)	*1. Set out goals to be achieved through K-mapping*	4. Capture/create appropriate knowledge	2. Identify knowledge needs 3. Identify knowledge gap	5. Leverage knowledge	*6. Retain knowledge*	Generic model for a sustainable urban environment : Sue-KM
Ebener et. Al. (2006)		1- Acquire Data 2- Manipulate data 3- Store data	4- Process data	5- Visualise data		General Adapted from Hujisen at al (2004)
Kim et. al. (2003)		1- Defining organisation knowledge 2- Knowledge extraction 3- Knowledge profiling	· Process map analysis	5. Knowledge linking,	*6. Knowledge map validation*	Industrial case study
Eppler (2001)	*1. Identify process*	2. Deduce relevant knowledge sources, assets or elements.	3. Codify the elements	4. Integrate the codified references	*5. Provide means of updating*	IT based
Grey (1999)		1. Survey	2. Audit	3. Synthesis		General
Rouse et. al. (1998) cited in Yang (2007)		1- Extraction of knowledge 2- Compilation of knowledge 3- Derivation of assertions	4- Sorting and labelling	5- Representation of relationships 7. Interpretation and iteration		R&D/technology management

...wledge mapping process discussed in this section and the ...ance evaluation in facilities management organisation as ...**ble 2.4** illustrates the proposed six basic steps in knowledge mapping for successful exploitation of knowledge mapping benefits in this regard.

Table 2.4 : *Six basic steps in knowledge mapping*

Steps/Stage		Task
Step 1	*Precedence*	Decide the scope for knowledge mapping. This could be a specific process, project or focus area. The present research focus specifically on facilities performance evaluation process in facilities management.
Step 2		Identify the objective and purpose of the mapping so that the real benefits could be gained at the end of the process. The literature review of the potential knowledge mapping benefits are discussed in **Section 2.4.8** and elaborated further on its important roles in **Chapter 5**.
Step 3	*Gather and capture*	Map the process including identifying the sources and beneficiaries of the knowledge, identify the stakeholders. The literature review on the purpose and setting of facilities performance evaluation processes are discussed in **Section 2.3** and elaborated further in **Chapter 4**.
Step 4		Identification of knowledge assets or available organisational knowledge involved in each of the steps in the process being mapped. The literature review which relates to the knowledge assets in the organisation is discussed in **Sections 2.4.4**, **2.4.5** and **2.4.6**.
Step 5	*Analyse*	Identification of knowledge gaps, connectivity drawbacks and information overloads. The literature review which relates to the identification of knowledge gaps and linking the knowledge is discussed in **Section 2.4.7**.
Step 6	*Beyond*	Exploiting the knowledge mapping advantages. Develop plans for collecting, reviewing, validating, storing and sharing the knowledge. The discussions on exploitation of knowledge mapping benefits are included in **Chapter 8**.

…ional Knowledge

…constitutes explicit knowledge and tacit knowledge. Even …entifies that there is õimplicit knowledgeö residing between tacit and explicit, the present research only looks into the tacit and explicit sides of the knowledge so as to enable clearer borderlines between the two. Tacit knowledge is the unarticulated knowledge that is in a personøs head that is often difficult to describe and transfer. It includes lessons learned, know-how, judgment, rules of thumb and intuition (Grayson and OøDell, 1998).

Knowledge itself is not tangible, but it is measurable (Bollinger and Smith, 2001). Knowledge is an asset to the organisation and is a non-physical resource and right that has a value to the organisation because they give the organisation some kind of advantage in the market place. Therefore frequently, organisational knowledge is also referred to as knowledge assets. Bollinger and Smith (2001) suggest that organisational knowledge is a strategic asset which possesses four characteristics; it is valuable, rare, inimitable and non-substitutable.

Identifying existing knowledge assets is the first key step to a knowledge management initiative. Therefore, any approach to a knowledge management initiative must first uncover what knowledge already resides in their organisation. Identifying the embedded knowledge in the organisation is perhaps not a one-off exercise for knowledge management. The dynamic character of the knowledge in the organisation requires organisational knowledge to be continuously identified.

For an organisation, effective exploitation of knowledge assets could be achieved by effectively identifying where knowledge resides. Williams (2003) suggests to exploit knowledge assets effectively, a systematic examination, verification and evaluation of knowledge are vital. The whole process of identification of origin, nature, ownership and characteristics of knowledge, measurement of quantity, dimensions and capacity of knowledge and evaluation of quality, value and significance of knowledge in organisations are called knowledge audit.

at the discussion on organisational knowledge normally

as follows:

i- Social/cultural knowledge;

ii- Historical knowledge;

iii- Human knowledge; and

iv- Functional knowledge.

Cultural knowledge is the context of knowledge which exists within the organisation's environment, norms, accumulation of standards of behaviour, hierarchical relationships that are conventionally accepted as part of the values in an organisation.

Historical knowledge is the 'time line' context of knowledge which is drawn from the history that is relevant to the organisation; such as past business deals, legacy systems and previous methods of management. Historical knowledge verifies changes, trends, experience and occurrences which occurred over time.

Human knowledge is the individual or people knowledge such as capabilities and skills that reside within the people in the organisation. The individual's capabilities, competencies, talents and skills could be stimulated through training, new roles and coaching.

Functional knowledge is the context of knowledge related to the processes in the organisation. It constitutes the flow of routine works or tasks such as project management, client response, problem solving and decision making.

Other typologies of organisational knowledge in the literature are by Sanchez and Heene (1997) about know-how (practical knowledge), know-why (theoretical knowledge) and know-what (strategic knowledge). Whitehill (1997) discusses encoded (know-what), habitual (know-how), and scientific (know-why) aspects as organisational knowledge. Bollinger and Smith, (2001) suggest that employee know-how is one of the components in organisational knowledge. Elements of 'know who' and 'know how' apply to individuals or groups of employees who know about customers, products, processes, mistakes and successes as contended by Grayson and O'Dell (1998) and possibly included in the human knowledge context by Vestal (2005). In the same vein, Pemberton and Stonehouse (2000) suggest that knowledge which is embodied into the

assets consists of its core competencies, technology, value-
systems, procedures, structures, product and services.

By referring to the model of learning progression in **Figure 2.9**, Bollinger and Smith (2001) argue that organisational knowledge resides in a database or through sharing of experiences and best practice, or through other sources both internal and external to the organisation. In addition, they suggested that organisational knowledge accumulates over time, and enables firms to attain deeper level of understanding and perception that lead to business astuteness and acumen, all characteristics of wisdom.
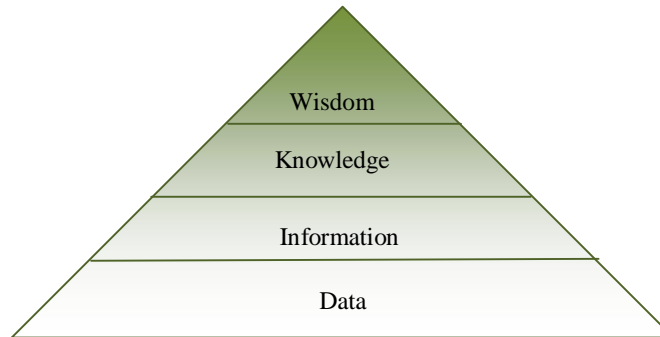
Figure 2.9: *Hierarchy of knowledge (adopted from Bollinger and Smith, 2001: Model of learning progression)*

Data is raw and does not have meaning by itself. Data requires explanations and relations between each other to add meaning to be classified as ‑informationø. Identification of knowledge in the form of data and information is easier than identifying understanding in an organisation. The identification of knowledge and wisdom requires understanding of complex relationships between knowledge repositories, people and processes within the organisation. Logically, the higher the ranking of knowledge understanding, the more challenging for the knowledge to be codified and its possibility to be mapped as knowledge. This complex õterrainö of knowledge in this environment requires an experienced knowledge mapper to identify the main attributes to be mapped as shown in **Figure 2.10**.
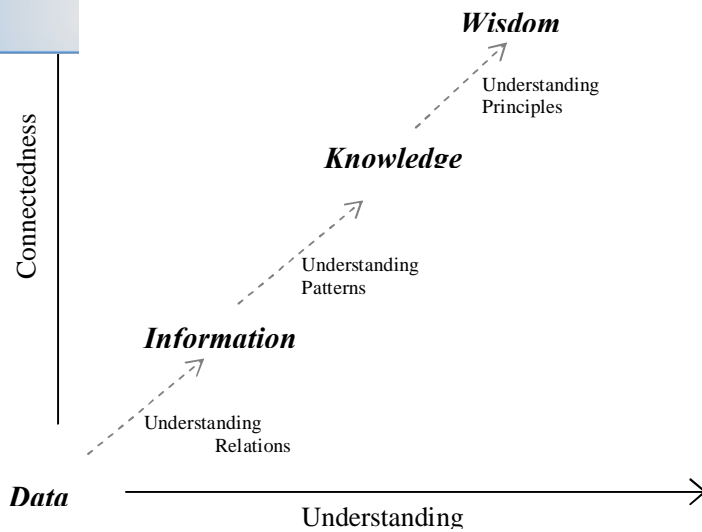
Figure 2.10: *Knowledge Transition (adopted from Bollinger and Smith, 2001)*

2.4.5 Knowledge Repository

A knowledge repository is the organisational memory or every so often referred to as institutional or corporate memory; an explicit component of organisational knowledge. Gray (2001), Hansen et al. (1999), Markus (2001) and Zack (1999) discuss a variety of ways that knowledge repositories can preserve and provide access to codified knowledge. Liebowitz and Beckman (1998) defined knowledge repository as a õ...on-line computer-based store house of expertise, knowledge, experience and documentation about a particular domain of expertise. In creating a knowledge repository, knowledge is collected, summarised, and integrated across sourcesö. In contrast, in the context of knowledge mapping, the knowledge repository does exist in conventional files, archives and õyellow pagesö directories.

2.4.6 Identifying the gaps and creating the links

The main reason for identifying the organisational knowledge as well as human competencies in the organisation is to enable the organisation to identify the gap and weakest point of link in the knowledge chain. Analysis of the knowledge gap is a critical path in the knowledge mapping process (Yasin and Egbu, 2011). Liebowitz et al. (2000) contend the analysis of knowledge needs in organisation is also referred to as

en and Militelo (2005) suggest that knowledge audits are different aspects of expertise required to perform the task. ed on their competencies and relationship of the individual to the process as discussed in **Section 2.4.6**. In practice, works by Driessen et al. (2007) for example, analysed the organisational knowledge based on practical entities and their relationships.

The entities are the general entity types that play a role in knowledge within the organisation such as activities, concepts, terms, groups, knowledge items and individuals. Therefore, the types of knowledge ranked and sorted into predetermined categories, types or domains could be effectively used and linked permanently as and when it is required by a specific user. At this stage, the human resource requirements such as staffing needs, training and re-training of employees, in-house specialist as well as organisational strength and advantages will be transpired. By identifying the gaps alone without finding the way to bridge it could not solve the problem in knowledge mapping exercise. Knowledge items should be linked to add meaning.

2.4.7 Types, Tools and Techniques of Knowledge Mapping

Knowledge mapping tools are referred to as information technology- (IT) related software and networking (Egbu and Suresh, 2008) which helps in conveying, sharing, linking, sourcing and manipulating data and information. An example of knowledge mapping tools are on-line databases, intranet and specialist software. On the other hand, knowledge mapping techniques are referred to as specific protocols or modus operandi to map the knowledge which ends up with the map as an output. It is learnt that knowledge mapping tools and techniques are interchangeable and the process of exploring and exploiting both the tools and techniques are the prime concerns in knowledge mapping.

Pragmatically, classification of knowledge mapping provides a taxonomy and context of knowledge mapping uses, functions and hence, more benefits of knowledge mapping could be explored. Thus, in a simple conjecture, successful exploration of knowledge mapping by classifying the tools, types and techniques provides better exploitation of knowledge mapping benefits. Eppler (2008) suggests by classifying the knowledge mapping could capitulate in the following ways:

...verview of the domain and can function as an inventory or ...red toolbox;

...stic that relates possible mapping solutions to knowledge management challenges;

3- Reduces complexity inherent in choosing a knowledge map format for a particular application context;

4- Helps to recognise the similarities and differences among different types of knowledge;

5- Helps to compare different types of knowledge maps along pertinent criteria; and

6- May reveal new form of knowledge maps that so far have not been applied.

In defining the classification of knowledge mapping, Jafari et al. (2009) suggest that in mapping organisational knowledge, various techniques or sets of tools such as approaches, objectives, and specific characteristics of business processes are used.

Vestal (2005) classifies knowledge maps into three categories:

(1)   Enterprise knowledge maps ó consist of strategic overviews and expertise overviews of knowledge maps;

(2)   Cross-functional knowledge maps ó consist of expertise in tacit knowledge maps and technical or functional knowledge maps; and

(3)   Process explicit knowledge maps ó consist of document-explicit knowledge maps, job role-based knowledge maps and competency or learning needs maps.

Earlier, Novins (1997) has distinguished the knowledge mapping into three main types: 1) pointer models; 2) linking models; and 3) solution models. The first is knowledge source maps that typically map experts and point the right individual or group. The second is the knowledge maps that provide more visual context on how the referenced knowledge can be used; for example by linking knowledge to a visual business process. Finally, the solution models provide more meta-information on the referenced knowledge by linking business problems to knowledge areas.

The majority of the literature (for example Gorseline, 1996, Bish, 1999, Caldwell, 2002, Kang et al., 2003, Liu and Hsu, 2004, Yun 2008) discerns knowledge maps as categories based on how knowledge has been sourced and the knowledge from within the people and process in the organisation. Folkes (2004) and Egbu et al. (2005) have

f knowledge mapping tools and techniques and its uses in

e of knowledge mapping types and its uses are as shown in

Jafari (2009) suggests the selection of tools and techniques of knowledge mapping could be compared from various perspectives and criteria:

(1)   Use tools for data gathering (Vestal, 2005);

(2)   Use tools for knowledge map evaluation (Vestal, 2005);

(3)   Mapping objectives (Lecocq, 2006);

(4)   Knowledge Maps characteristics and capabilities (Lecocq, 2006);

(5)   Determination of knowledge map elements (Lecocq, 2006);

(6)   Knowledge mapping approach (Jenning, 2006) such as process-based, relationship-based and project-based (Jafari, 2009);

(7)   Top-down or bottom-up approach; top-down map championing the process usually has those at the top of the hierarchy championing the map. Bottom up knowledge map processes are seen by the dominant coalition of the organisation as the most political (Wexler, 2001); and

(8)   Static or dynamic knowledge map.
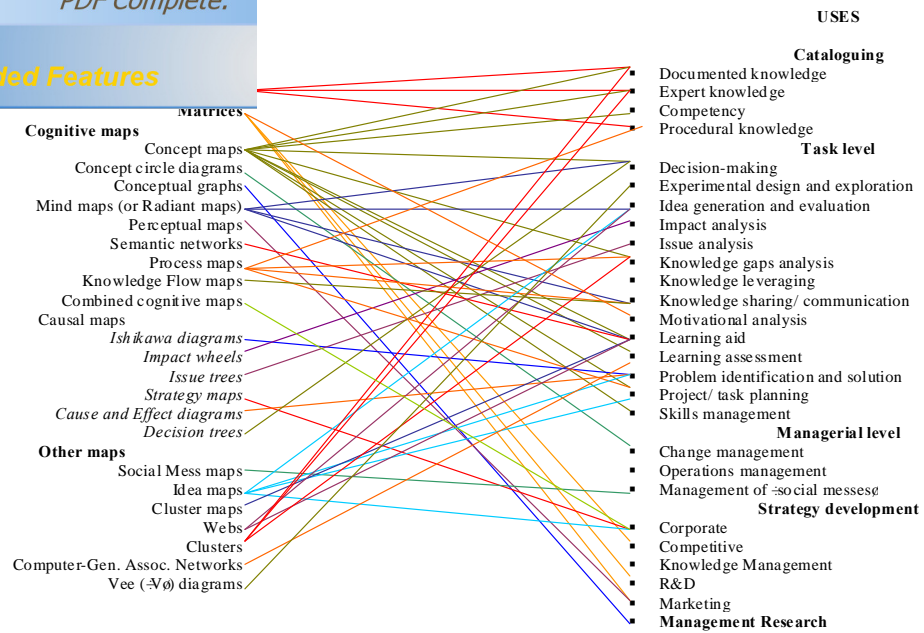
Figure 2.11: *Mapping techniques for the map context (source: Folkes, 2004)*

These discussions and classification of knowledge mapping types, tools and classifications might provide a significant distinction amongst different context areas and schools of thought. However the classification might also limit the broad potential of knowledge mapping uses into a few areas. Therefore, the classification of knowledge mapping should be equipped with the more flexible and adaptable knowledge maps that can be modified and upgraded according to the needs and changes of the times and redeveloped by people that include knowledge users, knowledge map developers, knowledge processors, knowledge innovators and managers in accordance with the needs and changes of industrial markets, sectors and others. (Wexler, 2001, Wang, 2002, White, 2002). To meet those requirements, Eppler (2008) suggests that the classification of knowledge mapping types should satisfy the ten (10) criteria as follows:

1-   It consists of mutually exclusive categories (groups that do not overlap);

2-   That are collectively exhaustive (i.e., together, the groups cover the entire classified domain);

3-   That is based on stable and objective grouping criteria (in order to unequivocally assign an item to a category in a classification);

4-   That has category names on a consistent level of abstraction (per hierarchic level);

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consistent and informative classification principle per level

...nd delineated topic area or domain;

7- Where the categories have self-explanatory, informative category names, or labels;

8- Contain typical, representative (prototype) members for each group in the classification;

9- Resulting in a well-organised system that does not overload the users as it contains an adequate amount of groups that can still be managed by short term memory (the granularity of the distinction does not exceed the level of detail necessary for the envisioned task that the classification supports); and

10- A system that is hence understandable and usable by the envisioned user groups.

Thus, as guidance, Eppler (2008) suggests a pragmatic taxonomy in classifying knowledge mapping thus: (1) by *purpose*; (2) by *content*; (3) by *application level*; (4) by *graphic form*; and (5) by *creation mode*. Formerly, Wexler (2001) proposes a number of questions and interrogatives in choosing a particular type of knowledge map which necessitates answering a number of key questions namely:

1- Which knowledge management *purpose* is it intended to achieve? (the õwhy?ö of the map)

2- Which kind of *content* about knowledge is it intended to represent in the map? (the õwhat?ö of the map)

3- Who should use the map in which context or situation and at what level? (the õfor whom?ö and õwhen?ö of the map)

4- Which graphic form should be used and who can create the map in that way? (the õhow?ö and õwho?ö of the map)

5- Which creation mode could be applied to represent the map? (the õhow?ö and õwho?ö of the map)

Based on these primary principles of knowledge mapping classification, the general ideas of knowledge mapping type are tabulated in **Table 2.5**. The items shown in the table are intended to serve as an illustrative guide and not a definite option of knowledge maps.

...tion (adapted from Eppler, 2008 and Wexler, 2001)

Classifying knowledge maps by intended purpose or KM process	...ation maps: illustrate the planned steps to develop a certain (organisational) competence or create new knowledge (i.e., a technology road map)
	2. Knowledge assessment or audit maps: illustrate the evaluation of certain knowledge assets graphically, for example, by a 2 x 2 matrix (axes: current ability and future importance)
	3. Knowledge identification maps: provide a graphic overview on knowledge assets (experts, patents, practices) and points to their locations/coordinates
	4. Knowledge development or acquisition maps/learning maps
	   (a) Learning overview and learning path maps
	   (b) Learning content structure maps
	   (c) Learning reviewing/repetition maps
	5. Knowledge transfer, sharing, or communication maps: show who transfers knowledge to whom
	6. Knowledge application maps: show which knowledge is necessary for carrying out certain processes or steps in a single process
	7. Knowledge marketing maps: can be used to signal competence to the public in a certain domain

"What?" Classifying maps by their content	I. By (digital and analogue) content formats: 1. websites (incl. blogs, portals, homepages), 2. documents (incl. books), 3. databases or repositories, 4. learning objects or online courses (or modules), 5. other file formats (e.g., sketches, drawings) II. By content types: 1. methods, 2. processes, 3. experts (incl. groups), 4. organisations/departments/institutions, 5. lessons learned/experiences, 6. skills and competencies, 7. concepts, 8. events, 9. patents, 10. knowledge or communication flows or relationships, 11. interests or knowledge needs
"Who?" Classifying maps by the application level	1. Personal knowledge maps (visualising one's own skills or expert contacts, see Eppler and Sukowksi, 2000 or Burnett et al., 2004) 2. Dyadic knowledge map (to support knowledge creation, transfer, or assessment between two people) 3. Team knowledge maps (visualize the skills present or needed in a project team, like the T-matrix, see Eppler and Sukowksi, 2000) 4. Departmental knowledge maps 5. Community knowledge maps 6. Organisational knowledge maps 7. Inter-organisational/network knowledge maps

"How?" Classifying maps by graphic form	I Table-based format (for an example see Heng, 2001)
	   1. Person by skills table
	   2. Skill area by people table
	   3. People by documents
	   4. Team by project experience table
	II. Diagrammatic format
	   1. Structure diagrams
	      (a) Venn diagram, (b) concentric circles (with or without segments), (c) matrix (i.e., 2 x 2), (d) network diagram, (e) mind map, (f) concept map (Tergan and Keller, 2005), (g) cognitive map (Huff and Jenkins, 2002), (h) strategy map, (i) fishbone
	   2. Process diagrams (Galloway, 1994)
	      (a) Timeline, (b) swim lane chart, (c) flow chart, (d) event chain, (e) critical path method, (f) Gantt chart, (g) cycle chart, (h) decision tree, (i) value chain, (j) flight plan (Eppler and Sukowksi, 2000)
	III. Cartographic format
	   1. Geographic map: globe/continent/land/island/region, 2. informational map: park, 3. tube/metro (Burkhard and Meier, 2005) map, 4. galaxy/stars, 5. sea/ocean, 6. building/architectural map
	IV. Metaphoric format
	(a) From the natural realm: 1. tree, 2. iceberg, 3. canyon, 4. mountain, 5. river, 6...
	(b) Man-made artefacts: 1. house, 2. temple structure, 3. radar screen, 4. bridge, 5. race track, 6...

"How?" and ***"Who?"*** Classifying maps by their creation method	1. Maps that are automatically and dynamically generated by the computer (such as self-organising maps, see Kohonen, 2001) 2. Maps that are semi-automatically generated (automatically assembled and then optimised by analysts) 3. Maps that are designed once by domain and mapping experts and then used in the same way by all users 4. Maps that are iteratively created, modified, or extended by the map user(s) themselves (community generated maps)

categorised the knowledge mapping based on their final

e **2.12**. The possible matching matrix for knowledge map

NDIX B.

2.4.8 Potential Benefits of Knowledge Mapping

The focus of the facilities performance evaluation in facing needs should be more agile, to anticipate threats and opportunities, to react faster, and to be more cost effective throughout the process. To meet these aims, the evaluation team is expected to be able to capture relevant knowledge that is continuously evolving, and to capture it in all forms such as text, picture, stories, archival data and models. The evaluation team must then be able to exploit this intellectual capital by making knowledge accessible to others in the organisation in the most appropriate forms of display.

Before knowledge mapping benefits can be exploited, it is important to understand the perspective knowledge mapping created. Ebner et al. (2006) suggest that it comprises the following visual framework:

(1)   The function of the map (including coordination, motivation and the elaboration);

(2)   The knowledge types (know what, know how, know why, know where, and know who);

(3)   The recipients (individual, group, organisation, network); and

(4)   The visualisation type (sketch, diagram, image or map).

It is also important to look into the form of the map (virtual or physical) as more comprehensive and large scale mapping exercises could benefit the most from computer software rather than physical maps.

In articulating the knowledge mapping benefits in an organisational setting, Wexler (2001) grouped them into four categories of returns such as economic returns, organisational cultural returns, structural returns and knowledge returns. Economic returns encompass financial benefits that may be gained by the organisation by harnessing knowledge mapping. The approach also acts as a catalyst in coordinating other knowledge management approach in organisations by creating additional values and culture.

that the concept of knowledge mapping is more usefully
rmal knowledge management. In the formal knowledge
3) proposed the categorisation of benefits that could be
exploited such as knowledge benefits, intermediate benefits and organisational benefits.
Egbu et al (2004) however suggests that the aim of knowledge mapping is to optimise
the efficient and effective use of the organisation's knowledge.

The knowledge benefits are the benefits derived from more efficient processing of
information and knowledge, for example by eliminating duplication of efforts or saving
valuable time. Intermediate benefits are the benefits that emerged in relation to the
improvement of efficiency or effectiveness by harnessing knowledge mapping. Finally,
organisational benefits are those that impact the organisation's key goals, such as
productivity and customer service. The relationship between the three categories is
shown in **Figure 2.12**.
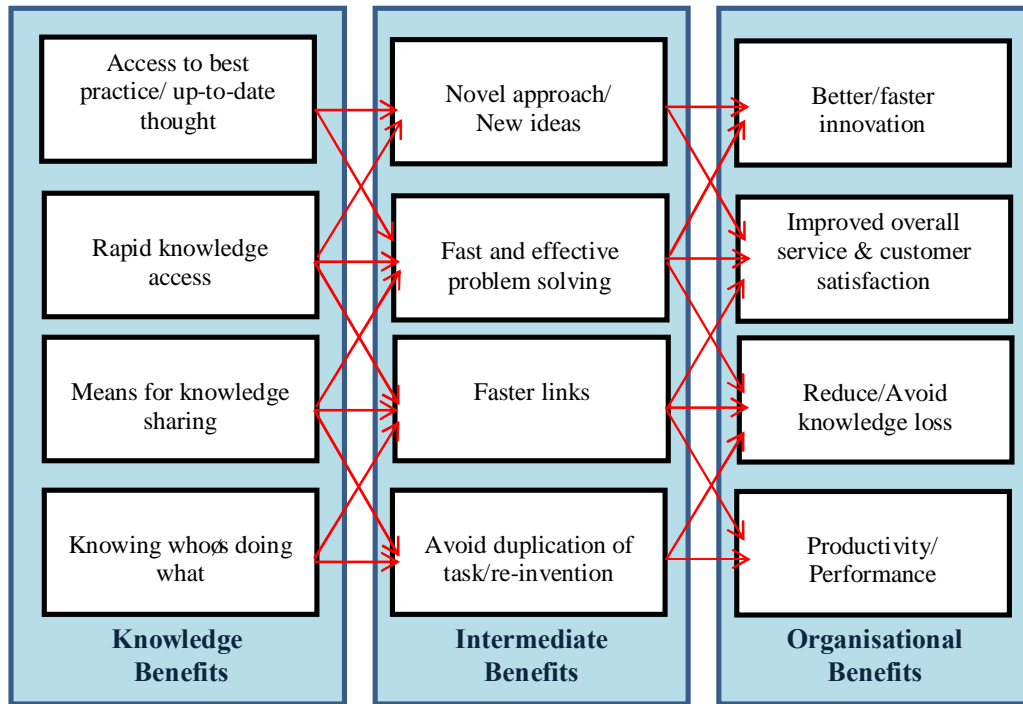
Figure 2.12: *Category of knowledge mapping benefits*

(adopted from: http://www.skyrme.com/tools/bentree.htm)

entially improved the problem solving and decision making ...es and effects as lessons learned from previous processes ...dentifying the knowledge assets, knowledge flow processes and the knowledge gaps within the organisation, they will simultaneously reflect the requirements for staff training in the organisation.

Knowledge maps also help in dealing with the greater complexity of inter-dependencies that arise from new structural arrangements such as joint ventures, outsourcing, sub-contracting and project management. Another significant benefit of knowledge mapping is to provide a knowledge return to the organisation in the form of an accelerating learning curve to the employee by helping to locate an effective route of the processes, prevent repetitive and overlapping activities and identify new knowledge and new focus of the emerging quest for actionable information. On the contrary, Yasin and Egbu (2010) discuss the benefit of knowledge mapping in five different themes i.e. process improvements, user satisfaction, cost saving, knowledge improvement and organisationsø value improvement theme.

In exploiting those benefits, a holistic view of the facilities performance evaluation process needs to consider:

(1) Re-use information and ideas throughout the evaluation process: As a recurring process, new knowledge captured during the process could be used for the next process for improvement, innovation and generating new ideas;

(2) Identification of knowledge location and flow: knowledge mapping enable the tacit and explicit knowledge being located and the flow of the knowledge being captured. It enables the evaluation team or individual evaluators to locate that knowledge and the path of its flows;

(3) Highlight and link the experts and island of expertise: Performance evaluation of facilities typically being carried out by a group of expertise teams with different areas of specialisation. Knowledge maps help in the form of providing õyellow pagesö while indicating their area of specialisation and providing a link between them;

(4) Rapid access to information: as it provides links to the tacit and explicit knowledge within an organisation or across an organisation, in the form of virtual maps and/or physical maps, thus providing quicker access to the information;

...entory: Provides inventory of the intellectual and intangible ... also helps in defining the gaps in the organisational

(6) Developing community of practice (COP): Developing a group of multi expertise in a common domain, with a genuine interest in each other's expertise based on their own practice. Involvement of a core group as experienced facilitators and junior evaluators sustaining the organisation knowledge structure;

(7) Improve decision making and problem solving: by providing applicable information comprehensively, quickly and accurately will lead to robust decision making, recommendations and in providing solutions for the problematic issues in evaluation;

(8) Provide access to knowledge: makes the various forms of knowledge accessible for exploitation within the organisation or across an organisation, except in classified areas; and

(9) Identify knowledge sharing and barriers: Acknowledges the knowledge-sharing opportunities and its possible barriers. On the other hand, knowledge mapping is only considered successful if the knowledge being mapped is effectively shared and exploited.

2.4.9 Conceptualisation of Knowledge Mapping Within Facilities Performance Evaluation

To simplify the complex and multi-faceted concepts of knowledge, the American Productivity and Quality Centre (APQC) and others have categorised knowledge into three categories i.e. explicit, tacit and implicit (Vestal, 2005). The categories are the extension of Polanyi's (1958) and Nonaka and Takeuchi's (1995) views of knowledge i.e. tacit and explicit categories.

There is general agreement that explicit knowledge is a type of knowledge in the formal and codified form for example knowledge that resides in books and documents, formulas, project reports, contracts, process diagrams, lists of lessons learned, case studies, white papers and policy manuals. Obviously, knowledge in this form is easier to document and share if provided in context.

...owledge is the knowledge in the informal and uncodified ...ding to uncover. Gupta et al. (2000), for example, argue that ...mains subjective, cognitive and experiential learning. Tacit knowledge includes know-how, individual skills and past experiences that lead to competency and a higher competitive advantage.

Vestal (2005) argues that in between the explicit and tacit knowledge, is a middle ground of knowledge that has not been codified. The implicit knowledge can be captured and written down once people explore the full depth of a vital process.

2.4.10 Selecting the Appropriate components in Knowledge Mapping

Vestal (2005) suggests four key components that must be considered in a knowledge mapping effort as people, process, content and technology which can be explained as follows:

(1) People ó people add the most dimensions to the process of knowledge management since verbal communication and paper is unable to convey perceptions, experience and personal experience interpretation. People embody expertise, competencies, cultural know-how, and specific roles.

(2) Process ó process designed to encourage collaboration, generate feedback, share standards, and engage metrics and reporting are technical but necessary to implement knowledge management practices. Likewise, linking knowledge to business processes will help make sense of the workflow of the organisation, helping business leaders to translate maps into action. However, in knowledge management perspective, the process that works well yesterday may or may not work tomorrow (Abdullah, 2007). Therefore, continuous reviewing of all processes embodied in the organisation is necessary.

(3) Content ó content arises from the overlap of the three components. People gather content in order to make decisions, to complete their work, or to fulfil a process. Information and knowledge can be extracted from artefacts, best practices, standard operating procedure documents, books, training classes, learning modules, expertise, and advice.

e programs are convenient tools to track and build upon nds certain business processes. Expertise databases, file- gement software, repositories and portals are accessible systems that compound knowledge-sharing and promote knowledge management.

Previous work on knowledge mapping in construction projects by Yun (2008) views knowledge mapping of the three components i.e construction actor (people), construction process (process) and knowledge transfer technology (technology) as key components of knowledge mapping models in his study. The work is based on Kaziøs (2005) proposal on the core components to study existing knowledge in construction organisations.

In the present study, three key components of knowledge: people, process and technology have been used for effective knowledge mapping in facilities management organisations in the context of evaluating facilities performance. The interaction between the three components is shown in **Figure 2.13**. Content was excluded in the component as it is embedded in the interrelation between the components.
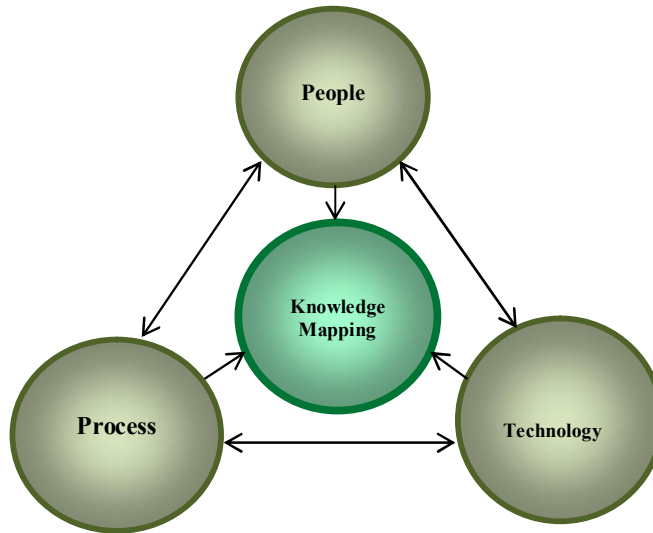
Figure 2.13: *Knowledge mappings' component interaction*

Firstly, the people in the present research context are from a diverse background of facilities management staff, facilities performance evaluators, clients, internal and external experts as well as facilities users that participate in the evaluation process.

...ent area, it has been agreed that people are at the heart of ...management, as knowledge owners and knowledge users ...arbrough, 2003, Thite, 2004).

Secondly, the process in the present research context is the facilities performance evaluation process. As will be discussed in the following chapter (Chapter 3), the facilities performance evaluation process consists of a number of phases and sub-processes. Therefore, it can be argued that the facilities performance evaluation processes are the necessary components for appropriate knowledge mapping in the present study.

Finally, technology in the present research context refers to the information and communication technology (ICT) in which a number of authors (e.g Kautz and Thaysen, 2001, Koch, 2003, Daghfous, 2004, Hustad, 2004, and Yu, 2008) espoused its function as enablers for effective knowledge transfer in the projects and organisations.

2.4.11 Barriers and challenges for knowledge mapping

Vestal (2005) suggests four main barriers in harnessing knowledge mapping in the organisation that is (i) lack of understanding of knowledge flow process inside the organisation, (ii) not having the right team members on a knowledge mapping team, (iii) the classical õknowledgeis powerö syndrome that prevents knowledge from being successfully shared; and (iv) failure to understand the business process.

Understanding the knowledge flow process is crucial in knowledge mapping process. Nissen and Levitt (2012) suggest that knowledge flow is critical to organisational efficacy and performance under a knowledge-based view of the firm. Although knowledge flow is an inherently dynamic concept, the understanding and awareness in this regard are the biggest challenges in organisation. Without knowing the steps, the flow and direction of the knowledge in the knowledge mapping project hardly attain the objective.

Understanding the knowledge flow relates closely with individual' ability to õplotö the types of knowledge as classified in **Table 2.5**. Dynamic characteristics of the people in the organisation, improvement or changes to the procedures and integration of the tools used for organisational database increase the challenge to the knowledge mapping project members in this task.

lated issue or challenge in knowledge mapping project is ssibly the process is not in place or the process is not in the mployees refuse to share their accumulated experience due to superior feeling that their knowledge and experience is a privilege that distances between senior and junior employees.

The human resource-related challenge in organisation could be overcome by providing necessary and sufficient training to the relevant staff in the organisation. These training cover the area of implementation, using the various tools for knowledge mapping and how to use knowledge maps to create solutions.

2.5 The Conceptual Framework

Terminologically, a framework is defined as a õbasic conceptual structureö, which would normally contain two or more domains (groups) as well as one or more dimensions (sub-groups). A framework is also identified as a valuable tool for conceptualising the ideas/issues to be considered under a particular area (Miriam-Webster dictionary, 1994).

Shields and Tajalli (2006) observed that the conceptual framework table is normally discussed at the end of the literature review chapter. The rationale for discussing the conceptual framework at this stage is to enable the structure of the research based on the context broadly discussed in the literature to be defined and refined. This view is supported by Marshall and Rossman (2010) who suggested the conceptual frameworksø role as a map that gives consistency to empirical enquiry and that it could take different forms depending on the research question or problem.

Therefore, all research needs an adequate conceptual framework (York University Research Partnership, 2000). They further suggested that the conceptual framework table is also used to structure much of the narrative of the chapter. It serves as a type of outline, with the literature already identified. Therefore, the present section should also relate to the methodological matters as discussed in Chapter 3. The linkages between micro-conceptual framework research purpose, research technique/methodology and data analysis techniques are as shown in **Table 2.6**.

) defined a conceptual framework as a visual or written either graphically or in narrative form, the main things to be ncepts, or variables and the presumed relationships among themö (p.18). They also suggest the conceptual framework to be similar to the term õtheoretical frameworkö or õidea contextö for the study.

Table 2.6: *Classifying micro-conceptual frameworks (adopted from Shields and Tajalli. 2006)*

Research Purpose	Research Question	Micro-conceptual Framework	Research Technique/ Methodology	Statistical techniques
Exploration	Anything goes: what, when, where, why, who, or any combination of the above	Working Hypotheses	Usually qualitative techniques: field research, structured interviews, focus groups, document/ archival record analysis as well as survey.	Qualitative evidence. Any type of statistical analysis possible
Description	What	Categories	Survey and content analysis.	Simple descriptive statistics.
Gauging	How close is process/policy to an ideal or standard? How can X be improved?	Practical Ideal Type	Case study, survey, content analysis, document analysis, structured interviews.	Simple descriptive statistics.
Decision Making	What is the best decision? Which approach?	Models of Operation Research	Cost benefit analysis, cost effectiveness analysis, linear programming, decision tree etc.	Quantitative techniques of operation research
Explanation /Prediction	Why	Formal Hypothesis	Usually quantitative, experimental and quasi experimental design, survey, existing data analysis	t-statistics, correlation, chi-square, analysis of variance, simple and multiple regression.

In explicating the conceptual frameworks, Shields and Tajalli (2006) suggest five types of micro-conceptual frameworks that are working hypothesis, categories, practical ideal type, model of operation research and formal hypothesis type. Therefore, conceptual frameworks are developed and designed to address a set of core questions developed through an extensive literature search and/or through an extensive interaction with users. The idea and context of the study for present research are represented by the

h aims, objectives and working hypothesis employed in the
.7.

In the context of the present study, the area and focus of the research are shown in

Figure 2.14
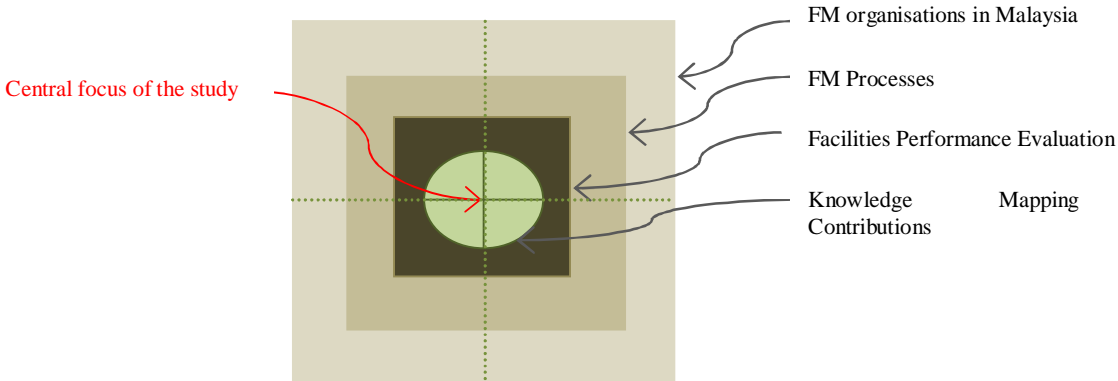
Figure 2.14: *Scope and focus areas of the study*

(N.B. The scale of the boxes and circle is not relevant)

Central focus of the research constitutes the aims, objective and research questions in
the present research.

...search aims, objectives and working hypotheses

...tion		Research Objectives	Working Hypotheses
To establish the critical success factors for effective exploitation of knowledge mapping in performance evaluation of facilities.	Current issues and challenges related to knowledge mapping benefits exploitation in facilities performance evaluation in facilities management organisations in Malaysia.	**RO 1**: To investigate the extent to which performance evaluation of facilities is practiced in Malaysia, and document both challenges that confront facilities managers in this regard and the critical success factors in effective performance evaluation of facilities.	**WH 1:** The purpose of facilities performance evaluation conducted differs according to the type of domestic service provision. **WH 2:** The purpose of facilities performance evaluation conducted differs according to the size of FM organisation. **WH 3:** The challenges differ between size of organisation **WH 4:** The challenges differ according to the type of domestic service provision **WH 5:** The CSF differ between sizes of organisation **WH 6:** The CSF differ according to the types of domestic service provision
		RO 2: To explore the increasing role of knowledge mapping in the management of facilities in Malaysia and document factors that have given impetus to this.	**WH 7:** The role differs between size of organisation **WH 8:** The role differs according to the types of domestic service provision
		RO 3: To investigate the extent to which facilities management organisations are aware of the role and implications of knowledge mapping in performance evaluation of facilities.	**WH 9:** The extent of awareness towards the role and implication of knowledge mapping differs according to the size of organisation. **WH 10:** The extent of awareness towards the role and implication of knowledge mapping differs according to the FM service provision.
		RO 4: To investigate and document the challenges associated with implementing a knowledge mapping initiative that could improve performance evaluation of facilities.	**WH 11:** The challenges differ between sizes of organisation **WH 12:** The challenges differ according to the types of domestic service provision
To develop an appropriate guidance for improving awareness and exploitation of knowledge mapping in performance evaluation of facilities in Malaysia.		**RO 5**: To identify processes, if any, that are in place in facilities management organisations, to exploit the benefits of knowledge mapping in performance evaluation of facilities, document critical success factors for effective exploitation of knowledge mapping and proffer guidance for improvements in this regard.	**WH 13:** The process in-place differ between sizes of organisation **WH 14:** The process in-place differ according to the types of FM service provision **WH 15:** The CSF differ between sizes of organisation **WH 16:** The CSF differ according to the types of FM service provision

extensive review of facilities performance evaluation of knowledge mapping in the area of knowledge management with affiliation between these two in the current practice. The discussion of the literature also realised the issues in the field of research and the gap that exists and needs further investigation. From the discussion drawn throughout the chapter, the following conclusions can be made:

1) The literature reviews informed that the facilities management organisations are aware of the facilities performance evaluation role in the management of facilities in Malaysia. However, the extent of practice including the relevant barriers as well as factors that is critical to the success of FPE needs to be investigated.

2) The literature reviews informed that knowledge mapping has played an important role in improving effectiveness and efficiency of the organisation. However the role of knowledge mapping in facilities management organisations and the factors that promotes this need to be explored.

3) The literature reviews informed that the element of knowledge mapping such as uses of IT in managing, storing and linking information and knowledge does exist in the facilities management organisations in Malaysia. However, the extent of practice and level of awareness are relatively low.

4) The literature reviews informed that exploitation of the knowledge mapping benefits is embedded as part of the process in knowledge mapping implementation.

The present chapter has confirmed the issues and problems in Chapter 3 has analysed and synthesised critical literature in the area of knowledge mapping. Knowledge mapping has a significant role in, and implication for improving processes in organisations that could be exploited by a facilities management organisation. The exploitation of knowledge mapping benefits could be effective by having insight into the environments such as the people involved in the process and those aided by technology. The next chapter explores and presents the research methodology adopted for the present research.

RCH METHODOLOGY

The preceding chapters review significant aspects of the literature within the area of the present research. This chapter describes the philosophical background that has been adopted and adapted as well as justifies the research methodology adopted for the present research study.

Research is a process of finding out something you don¢t know (Phillips & Pugh, 2005) whilst a research methodology is a systematic and orderly approach taken towards the collection and analysis of data (Collis & Hussy, 2003). It is also a process of how research questions are implemented and measured to achieve the overall research aim and objective (Brewerton & Milward, 2001). In this chapter, the structure is as follows:

(1)   Research methodology employed for the present research integrates research philosophy, research approach and research techniques;

(2)   The research philosophy underpinning the research is articulated and substantiated;

(3)   The research approach for this study is set out;

(4)   The data collection techniques in this study are discussed;

(5)   The data analysis techniques used in this research are debated;

(6)   In the validation, the generalisation, validity and reliability of this research are discussed; and

(7)   Finally a summary of this chapter is provided with links to potential future work.

3.2 Methodology: A Nested Research Approach

Understanding the research paradigm assumption is crucial in deciding the appropriate research methodology. This study adopts a nested research methodology approach that is integrated into three main themes: research philosophy, research approach and research technique (Kagioglou et at., 1998) as shown in **Figure 3.1**.

...ested approach ÷provides the researchers with a research ...fit from epistemological level direction and cohesionø This ...c, integrated research method and generates the framework. A chosen research philosophy guides the direction of the research approach and leads to the selection of the appropriate research techniques (Sexton 2007). Each of these elements is further described in the following sections.
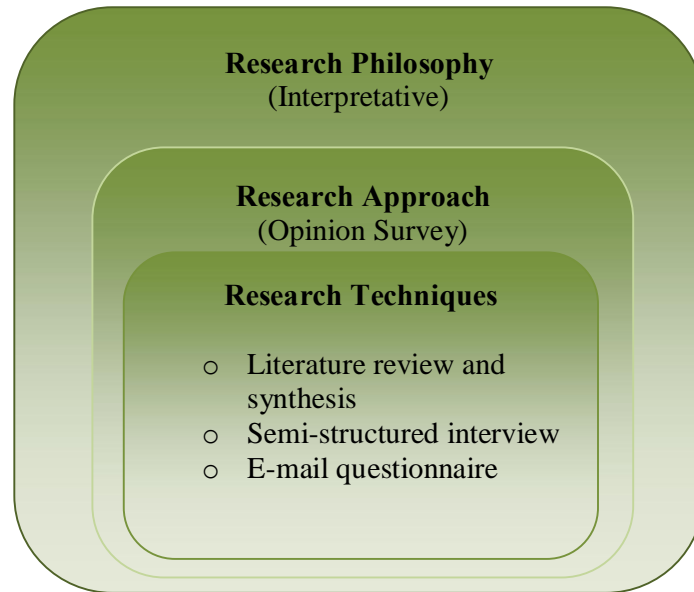
Figure 3.1: *A nested research methodology (adopted from: Kagioglou et.al., 1998)*

3.3 Research Philosophy

The research philosophy refers to assumptions about the world and the nature of knowledge (Collis & Hussey, 2003). Philosophically, researchers make claims about what is knowledge (ontology), how to know it (epistemology), what values go into the subject (axiology), how to write about it (rhetoric); and the process involved (methodology) (Creswell 1994). Miles and Huberman (1994) and Sexton and Barrett (2003) suggest that the philosophical approaches could be located in three dimensions namely ontology; epistemology and axiology. The possible position of the present research falls within the shaded area as illustrated in the diagram in **Figure 3.2** below and is further described in the following sections.

Ontology

Realism/Objectivis   Idealism/Constructivism
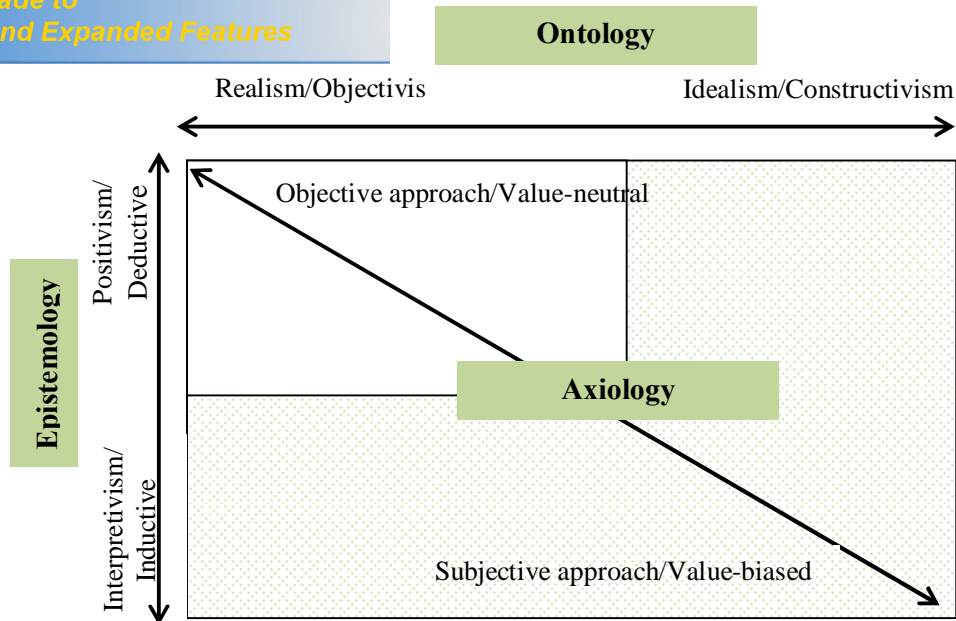
Figure 3.2: *Research on three dimensions (source: Sexton & Barrett, 2003)*

3.3.1 Ontological Consideration

The nature of this study is to seek an understanding of the role of knowledge mapping in the facilities performance evaluation process and exploitation of the benefits of the approach via people interaction in facilities management organisations. According to Sayer (2000) ontology is related to what is known in the world and also concerned with the nature of reality and phenomenon. This study adopts an ontological position which leans more towards **idealism** rather than realism.

3.3.2 Epistemological Consideration

There are two main research paradigms propounded in the literature. These are the positivism and interpretivism paradigms (Creswell 1994; Denzin and Lincoln 2000; Easterby-Smith, Mark et al. 2002). The term interpretivism has also been referred to as the phenomenological paradigm (Collis and Hussy 2003). In scientific and social inquiries, positivism is always associated with deductive reasoning and interpretivism with inductive reasoning.

Creswell (1994) identified that, in practice, these two paradigms involve an alternation between deduction where one tends to reason from observations and induction where one tends to reason from observations. Furthermore, Creswell (2003) drew attention to distinctive

...edge claim positions often observed in postpositivism, ...atory and pragmatism. Collis & Hussey (2003) identified ...and phenomenological philosophies as: (a) Positivist refers to quantitative, objectivist, scientific, experimentalist and traditionalist; (b) Phenomenological/ interpretivism refers to qualitative, subjectivist, humanistic, interpretivist.

The concept of interpretivisim/qualitative paradigms has been adopted as it attempts to understand human experience in the facilities management process. To justify which paradigm was more useful for this study, the following sections discuss the strength and weakness of both positivism and interpretivism paradigms.

3.3.3 Axiological Consideration

The axiological position can be located between value neutral/value free and value biased/value laden where positivists insist that researchers must maintain a value-free stance because the resultant knowledge is objective and generalised to the other contexts. On the other hand, interpretivists observe that research is value-laden and subjective (Sexton and Barrett 2003).

The axiological position employed in the present research leans more towards a value-laden approach and is subjective in nature. In a typical facilities management organisation, it has been recognized that knowledge is created, understood and used in different ways by each staff member, but it is vital that knowledge must be transferred when knowledge is commonly understood and can be used by others.

Therefore, it can be said that the value of knowledge can be subjectively interpreted in various different ways by the researcher, using owned and experienced knowledge within the area. As a consequence, the researchersø understanding is highly subjective and is filtered through his own understanding which modifies and evolves as more understanding is accumulated over time (Easterby- Cmith et al, 2002).

The research paradigm in this study is within the value-laden and subjective nature rather than positivist research paradigm that seeks objective knowledge. The next section justifies the choices of the research approach and the techniques in this study.

rvey Methods

survey research is most appropriate in certain situations as

(a) The central questions of interest about the phenomena are "what is happening?", and "how and why is it happening?" Survey research is especially well-suited for answering questions about what, how much and how many, and to a greater extent than is commonly understood, questions about how and why;

(b) Control of the independent and dependent variables is not possible or not desirable;

(c) The phenomena of interest must be studied in their natural setting; and

(d) The phenomena of interest occur in the current time or in the recent past.

On the other hand, surveys are less appropriate than other methods such as case studies and naturalistic observation when detailed understanding of context and history of given computing phenomena is desired. The same author indicates that case research is particularly appropriate in two situations: (a) where research and theory are at their early, formative stages; and (b) where the experiences of the actors are important and the context of action is critical. Yin (2009) infers three conditions to be considered in selecting the right method for research:

a)   The type of research question posed;

b)   The extent of control the investigator has over actual behavioural events; and

c)   The degree of focus on contemporary as opposed to historical events.

Research question of the present research as discussed in Section 1.4 built on the main quests on the state of affairs of knowledge mapping implementation in the facilities performance evaluation process within the facilities management organisation. Simultaneously, it enquires into how the implementation of knowledge mapping and exploitation of its benefits takes place. The situations highlighted by Yin (2009) as shown in **Error! Reference source not found.** prompt the present research towards survey research method.

erent research methods. (source; COSMOS as cited in Yin,

	m of research question	Requires control of behavioural events?	Focus on Contemporary Events
Experiments	How, why?	Yes	Yes
Survey	*Who, what, where, how many, how much?*	*No*	*Yes*
Archival Analysis	Who, what, where, how many, how much?	No	Yes/No
History	How, why?	No	No
Case Study	How, why?	No	Yes

In the current state of the present research, the control of the independent and dependent variables is not possible. The focus of the present research is on the current time and recent past occurrences.

Hence the survey research is appropriate in view of the fact that very little research in similar areas has been done and is therefore still at a formative stage. The experience and opinions of the actors are vital in investigating the problem to construct the theory in the area of research.

3.5 Identification of the population sample and selection of sample frame

One of the important challenges in the present research is to determine the population sample and selection of a sample frame. The present nature of facilities management practice in Malaysia with the absence of a regulatory body for facilities management practitioners which could provide members with directories; poses difficulties in obtaining a representative sample population.

Facilities management in the present research context centred on three domains in the post construction activities involving various built environment actors. The domains are property management, maintenance management and support services management. The actors in the facilities management are the facilities owners or clients, the contractors or facilities management service providers and professionals in built environment such as property valuers, quantity surveyors, architects and engineers. In explaining property management in Malaysia, Moore and Finch (2004) and Noor and Pitt (2010) suggest that the scope of

...uilding maintenance and management of support service. ...racticed by registered members of the Board of Valuers, ...)VAEA) under the "Property Management" trade.

Hence, an independent contractor and facilities management service provider extensively offers the service to manage private and government facilities. In certain circumstances, owners preferred to have the facilities management function to be in-housed. Quantity surveyors, architects and engineers in Malaysia are also significantly involved in the field of facilities management through post construction activities.

Snowballing through personal contacts and telephone calls, web searches are used to identify the organisations that practice facilities management and included in the respondent list for the questionnaire survey and interviews.

3.6 Data collection methods

There are several methodologies open to the researcher for the collection of data. Buckley et.al. (as cited by Egbu, 1994), have grouped these methodologies under four headings namely opinion research, empirical research, archival research and analytical research. Jobber, 1991 (as cited by Egbu, 1994) demonstrates that it is impossible to say which method is superior in abstract terms, and that each method has its own strength and limitation. He further added that:

"... the task facing researchers is to assess each of them in the light of the survey objective, the nature of the information required and resources available".

In this present study, this author has chosen the opinion research approach. The main data collection procedure under this research method is a combination of survey research – semi structured interviews and postal questionnaires. This combination provides more perspectives on the phenomena being studied.

3.6.1 Literature review and synthesis

The literature review provided the foundation of knowledge required by the researchers to familiarise themselves with the subject matter prior to data collection being conducted effectively (Fleming et al., 2005). Thus, the literature review and synthesis of the present study (as shown in **Table 3.2**) has a focus on a number of areas i.e. the broad scope of the knowledge management area with a narrowing down to knowledge mapping; the facilities

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...ng down to facilities performance evaluation and research

Table 3.2: *Literature search coverage*

Type of search	Scope of search
Year of references	Between 1990 - present
Sources	Book, Journal, Term paper, Post graduate dissertation, guidance, conference paper
Content and context of search	Facilities management:
	- *General practice*
	- *Research direction*
	- *FM practice in Malaysia*
	- *Facilities Performance Evaluation*
	- *Knowledge, skill and competencies in FM*
	Knowledge Management
	- *Knowledge Management Processes*
	- *Organisational knowledge*
	- *Knowledge mapping practices.*

3.6.2 Interviews

Even though the primary data source of the present research is from questionnaire survey, the interview data is very significant. Whitney (1972) suggests that questionnaire survey alone is unable to provide all the information required by the researcher. Consequently, he suggests that questionnaire should be complemented with other data sources. Perhaps the most obvious alternative is using a personal interview since the interview could provide advantages such as richness of response, ability to clear up misconceptions, opportunity to follow-up responses and by implication, better data in many situations.

In generic terminology, an interview is defined as a kind of conversation ó a conversation with a purpose (Newton and Ormerod, 2010). In respect of research approach, the conversation is aimed at obtaining relevant information on the specific topic of study. Interviews provide a depth of understanding on the subject being studied as it provides access to the respondentøs point of view, expression and feeling. A number of authors (e.g. Glaser and Strauss, 1967, Merriam, 1998, Wisker, 2001, Fontand and Frey, 2003) contend that data obtained through interviews provides a potentially effective method for capturing peopleøs opinions, feelings, practice, insight and experiences. There are three broad types of interview techniques namely structured, semi-structured and open ended or unstructured (Stewart and Cash, 1974, Wiskes, 2001, Robinson, 2002, Fontand and Frey, 2003).

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...plemented on a set of semi-structured interview questions ... e and they are conducted by the conversation between ... viewees can freely express their opinions on the topics and the data may be rich in gathering people's opinions, feelings and practice as well as their experiences. Easterby-Smith (1991; p. 74) recommended that semi-structured interviewing is appropriate when:

(1)   It is necessary to understand the constructs that the interviewee uses as a basis for his/her opinions and beliefs about a particular matter;

(2)   One aim of the interview is to develop an understanding of the respondent's 'world';

(3)   The step-by-step logical situation is not clear;

(4)   The subject matter is highly confidential or commercially sensitive; and

(5)   The interviewee may be reluctant to be truthful about the issue other than confidentially in a one-to-one situation.

The in-depth discussion in the areas of concern gives the researcher the flexibility of obtaining more information including new areas that are within the research but not thought of prior to the interview taking place. The great advantage of semi-structured interviews is that any ambiguity in questions or answers may be clarified instantaneously by both interviewer and interviewee.

The present research employs phone interviews that allow more flexibility of time to both, and are therefore logistically viable. Bouchard (1979) suggests that the length of interview could be between one to one and a half hours in length and if in some circumstances, more time is required, another appointment may be set. The estimated length of the proposed interview is in the region of fifty to sixty minutes for each respondent. Rationally, the average of five to six minutes allocated for each question is sufficient to answer two (2) general questions and eight (8) specific questions.

The interviews were conducted using 'Skype', software that allow calls over the internet to the respondents' office or mobile phone. These allow flexibility and convenience to the respondent and at the same time are reliable and cost effective for long distance conversations. The interviews were recorded with the recording tool software called 'Call Graph'. The software enabled the recording of the interview conversations for transcribing purposes.

...ities managers from different facilities management ... of thirty-four (34), only twenty-eight (28) managers agreed ...gers refused to participate due to heavy workloads and commitment to work. These managers were selected because they are likely to be familiar with multiple aspects of their organisations (Cowie, 2003; Enos et al., 2003; Becker, 2001) and the information they provide were deemed insightful and reliable (Hunt and Baruch, 2003).

The challenge however emerged to arrange the interviews with their busy schedules and urgent commitments. This has been addressed by adhering to their individual requirements especially the time for interview.

Table 3.3 : *Cross tabulation of interview respondents based on their organisations' size and their FM service provisions*

Organisation	Small	Medium	Large	Total	*(%)*
In-house	4	3	3	**10**	*48*
Out-sourced	5	4	2	**11**	*52*
TOTAL	**9**	**7**	**5**	**21**	*100*
(%)	*43*	*33*	*24*	*100*	

Appointment dates were fixed based on respondent's convenience taking place between February and March 2011. Several changes requested for the interview dates affected the overall completion date of the interviews. Seven (7) of the interview respondents withdrew as urgent commitments required immediate attention. Finally, twenty-one (21) managers from different Malaysian-based facilities management organisations participated in the interview. Only four (4) of those who took part in the interview were at director level because getting participants at the strategic organisational level to participate proved very difficult and challenging. All of the interviewees have more than 15 years' experience in facilities management field that gave insight into the facilities management industry in Malaysia.

To increase the generalisation of the survey, interviews were conducted on the two dimensions of facilities management organisations based on their service provision and another perspective is the sizes of their organisations. **Table 3.3** shows the respondents

provision (in-house and outsource) and organisational sizes

l large). Ten (10) or 48% of the interview respondents were

ervice provision and eleven (11) or 52% are out-sourced facilities managers.

According to the size of the organisations they represent; nine (9) or equivalent to 43% are from small organisations, seven (7) or equivalent to 33% are from medium size organisations and finally five (5) or equivalent to 24% represent large organisations.

Interview questions are as per enclosed in **APPENDIX C**.

3.6.3 Questionnaire method: The Design and The Content

A questionnaire was developed for the purpose of the present research to address the research questions and was based on the data required to satisfy the objectives of the research. Postal questionnaire administration will be deliberated later in this chapter.

The questions in the questionnaire were divided into six (6) sections based on the research objectives. According to Batchelor et al, (1994 as cited in Liyanage, 2006) attitudinal measures, in the form of Likert scales, can generate more valid data than single measures. The responses were encoded using the Likert scale for the convenience of respondents in determining relative measurements according to the scale.

In the present research, a scale of five (5) was seen as the most suitable method to choose phrases that are far enough apart from one another to be easily discriminated, while at the same time, keeping them close enough to ensure that the researcher does not lose potential information. In that sense, a scale of 4 is common practice; however, since it was necessary to include a õnot applicableö score, a scale of 5 was appropriate for this study. The scales were arranged orderly from 1 to 5 with 1 representing the highest value and 5 representing a null in value. For statistical data analysis purposes, five (5) scales were used consistently from Section B to Section F of the questionnaire.

A summary of the questionnaire is given as follows:

spondents such as job title and job experience was asked. Organisational background such as the organisationsø core role in providing facilities performance evaluation and current number of full time employees were asked. Respondents were required to give the response which best matched their position in the multiple choice answer provided.

Section B: the extent of facilities performance evaluation practice in Malaysia.

This section consists of three questions, namely question seven (7) to question nine (9). In question seven, the respondents were requested to rate and express their opinion on the perception of facilities performance evaluation practiced by their organisations. Question eight requires the respondent to rate the challenges in facilities performance evaluation. Question 9 requires the respondent to rate the challenges in conducting the facilities performance evaluation. The criteria for the facilities performance practice were listed for the respondents to rate their responses in the Likert scale form.

Section C: Role of knowledge mapping in managing facilities.

This section consists of two questions, namely questions ten (10) and eleven (11). In question ten, the respondents were requested to rate and express their opinions on the increasing role of knowledge mapping in the management of facilities in Malaysia. The criteria for the facilities performance practice were listed for the respondents to rate their responses in the Likert scale form.

Section D: Awareness about the role and implication of knowledge mapping.

This section consists of one question; question twelve (12). In question twelve, the respondents were requested to rate and express their opinions based on the levels of awareness about the role of knowledge mapping in the evaluation of facilities performance. The criteria for the facilities performance practice were listed for the respondents to rate their responses in the Likert scale form.

Section E: Challenges in implementing knowledge mapping initiatives in facilities performance evaluation process.

This section consists of one question; question thirteen (13). In question thirteen, the respondents were requested to rate and express their opinions on the challenges in implementing knowledge mapping in the facilities performance evaluation process. The

ance practice were listed for the respondents to rate their

Section F: Process of exploitation of knowledge mapping benefits

This section consists of two questions, namely question fourteen (14) and question fifteen (15). In question fourteen, the respondents were requested to rate and express their opinions on the exploitation of knowledge mapping benefits in the facilities performance evaluation process. Question fifteen requires the respondents to rate the critical success factors for effective exploitation of knowledge mapping in evaluating the facilities performance process. The criteria for the facilities performance practice were listed for the respondents to rate their responses in the Likert scale form.

Apart from the first section (Section A) which is in the multiple choice form, overall questions in the questionnaire are in the form of Likert scale questions. Four-point Likert scales are perhaps the most commonly used. It is interesting to consider different patterns of probabilities across a population of potential respondents. There could be consistency, inconsistency (without polarisation) or polarisation of response. Historically, the Likert scale is named after its originator, Rensis Likert. One of the benefits is that questions used are usually easy to understand and so lead to consistent answers. A disadvantage is that only a few options are offered, with which respondents may not fully agree.

The questionnaire was piloted to a group of academics and practitioners in the UK and Malaysia to validate the content, structure and language aspects of the questionnaire. The questionnaire sample is as enclosed in **APPENDIX D**.

3.6.4 Questionnaire method: The Administration Survey

The questionnaire was distributed in the 4th week of February 2011 to the 512 pre-identified individual facilities managers from 263 facilities management organisations in Malaysia, whose names and e-mail addresses were obtained from web searches and personal contact snowballing. The distribution of questionnaires was done about a week after the interviews took place.

The questionnaire was enclosed as an attachment in the e-mail. Respondents were only required to select the answer from a drop-down menu, click at the ÷check available boxø field

...ified text form field. Changes to the form content were ...eature in the Microsoft word form features.

The e-mail also includes the following:

a)   Introducing the researcher and background;

b)   Aims and objective of the research;

c)   Benefit of the study to the respondent;

d)   Protection of the respondent and their organisation's right to remain anonymous;

e)   Researcher contact detail;

f)   Instructions to fill in the questionnaire; and

g)   Last date to return the questionnaire.

The respondents have also been offered a free copy of the survey summary by completing the contact details in the questionnaire form. Total number of 21 emails bounced and unable to reach the recipients. The possible problems identified were invalid e-mail addresses and non-active e-mail accounts.

After the cut-off date at the 8th week the questionnaire was sent, there were 188 valid responses or 37 per cent response rates were obtained. This constitutes 122 responses (65 per cent) from clients organisation and the balance of 66 (35 per cent) are from FM specialists. This response constitutes 159 facilities management organisations in Malaysia as shown in **Table 3.4**.

Table 3.4 : *Response rate of the questionnaire survey*

Respondent	Questionnaire sent		Questionnaire received		Response rate
(Base on FM Service Provision)	(No.)	*%*	(No.)	*%*	*%*
In-house	392	*77*	122	*65*	31
Out-sourced	120	*23*	66	*35*	55
TOTAL	512	*100*	188	*100*	
			OVERALL RESPONSE RATE		**37**

sø organisations, the organisations are grouped into the Malaysian Small and Medium Enterprise Corporation le 3.5).

The definition of enterprise by SMECorp. distinguished the sectors in Malaysia to two main categories; the first is the industry related to manufacturing, retailing and agro-based activities and the second one is the industry based on service, information and communication technology and primary agriculture. Facilities management sector obviously belongs to the latter category which provides service to the client or user and reliance on a minimum number or multiple skill and knowledge of employees in the organisation.

The sizes of organisations are determined by two parameters or scales that are based on individual organisationøs financial turnover and its full time employees. It is difficult to classify based on financial turn-over especially for the in-house FM service providers as their role is as a support service arm and does not operate based on profit. Obviously, respondents are more comfortable providing information such as number of employees rather than information related to their organisationøs financial status. Hence, the present research classified the organisational size in the scale of current full time employees of the organisation.

Table 3.5 : *Categorisation of enterprise based on Malaysian SME Corporation definition*

Scale of enterprise	Industries/Sector	Manufacturing, manufacturing-related services and agro-based industries	Service, Primary agriculture and Information & Communication Technology (ICT)
Micro-enterprise	AST (RM)	Less than RM250K	Less than RM200K
	FTE (No of employees)	*Less than 5*	*Less than 5*
Small enterprise	AST (RM)	RM250K - RM10M	RM200K - RM1M
	FTE (No of employees)	*Between 5 to 50*	*Between 5 to 19*
Medium enterprise	*AST (RM)*	*RM10M - RM25M*	*Between RM250K - RM10M*
	FTE (No of employees)	*Between 51 to 150*	*Between 20 to 50*
Large enterprise	*AST (RM)*	More than 25M	More Than RM5M
	FTE(Noof employees)	*More than 150*	*More Than 50*

Note: AST –Annual Sales Turnover, FTE – Full Time Employee

...ation's definitions of Small, Medium Enterprise (SME) as ...ained were classified into the sizes of organisations and FM ... **Table 3.6** revealed that out of 188 responses obtained, 57 respondents or equivalent to 30 per cent belongs to small organisations, 101 respondents or 54 per cent are medium size organisations and 30 respondents or 16 per cent represents large organisations. The numbers of large organisations in facilities management services are relatively very rare compared to medium size organisations and these are reflected in the number of respondents in the survey.

Table 3.6 : *Cross tabulation of respondents based on their organisations' sizes and their FM service provisions*

Organisation	Small	Medium	Large	Total	(%)
In-house	29 *(29)*	71 *(58)*	22 *(15)*	**122** *(102)*	*65*
Outsource	28 *(28)*	30 (25)	8 *(4)*	**66** *(57)*	*35*
TOTAL	**57** *(57)*	**101** *(83)*	**30** *(19)*	**188** *(159)*	*100*
(%)	*30*	*54*	*16*	*100*	

(Number of organisations)

From facilities management service provision perspective, in-house facilities management organisations is represented by 122 respondents or equivalent to 65 per cent and 66 respondents or 35 per cent were outsource facilities management organisations. This supports the fact that the data collected is homogenous and represents the practice of facilities management organisations in Malaysia.

wo FM service provisions: outsource and in-house.

		FM Service Provision		
		Outsource	**In-house**	**Total**
CEO	Count	6.00	19.00	25.00
	% Within Job title	*24.00*	*76.00*	*100.00*
	% within Organisation	*9.09*	*15.57*	*24.66*
	% of Total	*3.19*	*10.11*	*13.30*
Facility Manager	Count	57.00	102.00	159.00
	% Within Job title	*35.85*	*64.15*	*100.00*
	% within Organisation	*86.36*	*83.61*	*169.97*
	% of Total	*30.32*	*54.26*	*84.57*
HR Manager	Count	3.00	1.00	4.00
	% Within Job title	*75.00*	*25.00*	*100.00*
	% within Organisation	*4.55*	*0.82*	*5.37*
	% of Total	*1.60*	*0.53*	*2.13*
Total	Count	66.00	122.00	188.00
	% Within Job title	*35.11*	*64.89*	*100.00*
	% within Organisation	*100.00*	*100.00*	*100.00*
	% of Total	*35.11*	*64.89*	*100.00*

Table 3.7 explicate the respondentøs experience in facilities management practice field including the length of service in the present organisation; both are based on the respondentøs organisation service provision. The purpose of differentiating the respondents based on the length of experience and service provision is to identify any significant differences and correlations between the groups at the analysis stage. Inspection to **Table 3.8** revealed that on average the respondents in the survey have more than 6 years of experience in the facilities management-related field. More experience in the FM practice could provide a contextual and accurate perspective to the subject under study.

according to FM service provision

(n)		Experience on the Current Organisation	Overall years of Experience
In-house	Mean	2.90	3.66
	N	122	122
	Std. Dev.	1.03	1.23
Outsource	Mean	2.76	3.50
	N	66	66
	Std. Dev.	0.58	0.86
Total	Mean	2.85	3.60
	N	188	188
	Std. Dev.	0.90	1.11

Meaning of scale (for mean value): 1- Less than 1 year, 2- 1to 5 years, 3- 6 to 10 years, 4- 11 to 15 years, 5- 16 to 20 years

The experience of individual respondent is crucial in this study as the individual respondent's response counts as an embedded unit of the analysis. On average, the respondent's experience in the field of facilities management is more than ten years (mean = 3.60) in the field of facilities management. Therefore, the individual respondent in this research has significantly sound experience and knowledge of the general practice of facilities management organisations. Further, the respondent's average lengths of time working in the current organisation are more than five years and this indicates that they have deep understanding of the processes involved in the current organisation.

3.6.5 Questionnaire method: Reasons for choosing the E-mail Survey Approach

The present study adopts a survey research design as a means of data collection by which the questionnaire survey was distributed to the pre-identified potential respondents. A survey is a quantitative research method that provides numeric description of trends, attitudes or opinions for a population by studying a sample of that population (Babbie, 1999). There was a number of options available for the author to distribute the questionnaire to the respondents, such as face-to face questionnaires, postal, e-mail and on-line. Face-to-face questionnaire surveys are not practical as they are time consuming and have high cost. Postal survey is impractical due to several constraints such as mailing to and from Malaysia is relatively time-consuming and involves higher costs.

...ealed that recent accessibility to the internet in Malaysia is ... statistics by the United Nation's Information Technology ...et usage in Malaysia has shown a sharp increase for the last 10 years from only 15 % of the total population to 64.6% of the total population in 2010. Respondents' organisations are located in major towns and cities in Malaysia; therefore accessibility to the internet is possible.

Table 3.9 : *Internet usage and population growth in Malaysia, Source – Internet World Stats (2011)*

YEAR	Users	Population	% Pen.	Usage Source
2000	3,700,000	24,645,600	15.0 %	ITU
2005	10,040,000	26,500,699	37.9 %	C.I.Almanac
2006	11,016,000	28,294,120	38.9 %	ITU
2007	13,528,200	28,294,120	47.8 %	MCMC
2008	15,868,000	25,274,133	62.8 %	MCMC
2009	16,902,600	25,715,819	65.7 %	ITU
2010	16,902,600	26,160,256	64.6 %	ITU

By using the internet as medium, surveys may be conducted via electronic mail (e-mail) or Web surveys (Schonlau et al., 2002). For the former, the survey instrument is contained either in the body of the e-mail message or as an attachment. Web surveys, on the other hand, are 'hosted' or reside on a website in which the respondent may enter the website by clicking on a hyperlink given in an e-mail by typing the URL (web address directly into the browser window) (Schonlau et al., 2002). The author has opted for attached e-mail survey due to it being less complicated for multiple levels of respondents' IT skills.

Moreover, at least three more reasons for the survey have been opted for the present survey as follows:

a) Firstly, absence of a comprehensive list of facilities management organisations in Malaysia and a regulatory body for facilities management practice;

b) Secondly, the characteristics of the entire population was able to be generalised, particularly when units of analysis are people or organisations (Babbie, 1999);

c) Finally, surveys can also be implemented in a timely fashion depending on one's budget and, most importantly, well-structured surveys may generate data that are amenable for quantification and consequently used in computerised statistical analysis (Rea and Parker, 1997)

...sed into two groups: (1) qualitative and (2) quantitative. ...through observations, interviews and documentation. In contrast, quantitative data is in numerical form and is analysed by specific statistical tests.

3.7.1 Qualitative Data Analysis

Qualitative data is important to understand the phenomenon in the area of research and social behaviour. The strength of quality data analysis is on how the rigours of the data being explained and understand. The qualitative data set for the present research was obtained via telephone interview. The interviews with the respondents were recorded using õCallGraphö applications that record the interview over the õSkypeö telephone conversation (see Section 3.6.2). The individual conversations were transcribed manually to extract the content and context of responses from respondents. The content and context is important for observing the pattern, themes and trends in supporting quantitative data inferences.

3.7.2 Quantitative Data Analysis

For the quantitative data, numerical data sets were analysed with certain statistical tests. Descriptive analysis, analysis of the reliability of variables being investigated, the correlation of the variables, differences of the variables and significance of the variables.

3.8 Reliability and Validity issues

Authors in the area of research methodology such as Yin (2003), Silverman (2007) and Creswell (2007) emphasised the issues of the findingsø data validity and reliability that influences the degree of õtruthö and authenticity in a research. In addition, Yin (2003) in describing case study research, suggests that a successful researcher has to justify by the four design tests; (1) construct validity, (2) internal validity, (3) external validity and (4) reliability.

3.8.1 Reliability analysis

Piaw (2006) contended three methods in checking the reliability of a scale for quantitative data; (1) test-retest reliability, (2) split-half, and (3) internal consistency approach. Test-retest approach has less significance to the present research data reliability test because it requires

provide similar responses twice. Reliability analysis is

inimise possible bias in the data collected. Reliability in the

ne study to obtain a similar value when a similar measure is

repeated. The similar value obtained in the subsequent measure indicates that the study has a

high reliability.

The homogeneity of quantitative data tested using Cronbach's Alpha ( ). Pallant (2007)

suggest the alpha value above .7 is considered acceptable and values above .8 are preferable.

Piaw (2006) suggests that alpha value lower than .65 is too low indicating that the ability of

instruments items is less reliable. The alpha value above .95 is too high and indicates that the

instruments items are similar or overlapping each other and it is not necessary. However, the

length of the scale also influenced the Cronbach's Alpha's values. For example, long scale

with more than ten items could reach higher Cornbach's values and vice-versa. All the data

sets from the questionnaire survey for the present research shows the Cornbach's Alpha value

of between .72 - .85, which means that the data were deemed reliable.

3.8.2 Validity of the research

1) *Construct validity*

   Construct validity is related with the ability of one research in generalizing the final
   outcomes or findings. The construct validity in the present research is achieved
   through creating and considering multiple sources of evidence: literature, documents,
   archival records, direct observation, participant observation, and interviews.

2) *Internal validity*

   Internal validity deals with the quality of the study and focuses on the accuracy of data
   obtained. The quality and accuracy of data could be achieved internally through
   certain research designs, operational definitions used, how variables were measured
   and research limitations.

3) *External validity*

   External validity referred to the extent to which a study's results can be generalized or
   applied to other people or broader social settings. In the present research, the

e from the population are clearly defined (section 3.5) to ty of the study.

3.9 Summary and link

Chapter three has presented a clear statement on how the on-going research is being strategized, positioned and planned to attain the aims and satisfy the objectives that have been set in earlier stages. In other words, the standpoint presented in chapter three imperatively steers the rest of the chapters in the present research.

Three aspects of philosophy as discussed in Section 3.3 evidently show that the present research is slanted towards idealism/constructivism (ontology), interpretism/inductive (epistemology) and subjective approach/value bias (axiology). Even though the main source of data in the present research (Section 3.7) is quantitative data via questionnaire survey and is complemented with interviews, the explanation of the issues, relationships and differences is extensively explicated in narrative approach. Therefore, instead of quantitative, the present research likely leans towards qualitative approach.

The next stage of the research is to implement the strategy and follow the trails outlined within the controlled methods. The primary data collected will be treated, analysed, synthesised and presented in subsequent chapters.

CE OF FACILITIES PERFORMANCE
TION

4.1 Introduction

The preceding chapter highlights the methodological aspects of the research including the stance and the processes in achieving the aims and objectives. The present chapter intends to satisfy the 1st (first) objective of the research that is:

> *"To investigate the extent to which performance evaluation of facilities is practiced in Malaysia, and document both challenges that confront facilities managers in this regard and the critical success factors in effective performance evaluation of facilities"*

In order to satisfy the objective, the qualitative and quantitative analysis in the present chapter will seek the answer for the first research question that is:

> *How the facilities performance evaluation being practiced in facilities management organisation in Malaysia and what factors constitutes the challenge/s and critical for successful facilities performance evaluation?*

Therefore, to satisfy the research objective and to seek the answer for the research question, the present chapter is laid in the following structure:

(1)   Discussions on the facilities performance evaluation practice in Malaysia;

(2)   Discussion on the issues and the challenges in conducting FPE;

(3)   Discussion on the factors that are critical in conducting FPE; and

(4)   Finally a summary of this chapter is provided with links to potential future work.

...lities Performance Evaluation Practice

...5), performance measurement is a topic which is often ...e, Sink (1991) suggests that performance measurement is a õmystery...complex, frustrating, difficult, challenging, important, abused and misusedö function. He further described measuring facility performance as a difficult activity, especially as performance measurement systems arouse suspicions of control associated with market station, managerialism and ÷new public managementø. Performance measurement can, however, be used as the means to improve communication and facilitate better service outcomes from the service and the building perspective, as well as respective governance. Preise and Schramm (2002) suggest that in order to be able to evaluate buildings in their different settings; the need exists to develop state-of-the-art building performance evaluation. Discussion of performance evaluation and assessment in facilities management led to the findings by Alexander (1996) that identifies measurement of the performance as one of õthree essential issues for the effective implementation of a facilities strategyö. Thus, performance measurement has become increasingly important both for reasons of justification to general management and to support management and practice within the FM organisation.

In the early 1990s, several authors such as Kincaid (1994) and Douglas (1996) observed that benchmarking has become one of the main exhortations in facilities management. In fact the word ÷benchmarkingø is often used to describe as evaluation of facilities performance. The concept of the benchmarking was originally adapted from business-related tools that are being increasingly adapted in construction and property. The benchmarking concept lingers within the functioning of the facilities, design, and project management of the existing building facilities. The outcomes from the evaluations and benchmarking are often used for guiding the designers for future developments of new building facilities. The common term referring to comprehensive evaluation of building facilities performance is õpost occupancy evaluationö (Zimring et al., 2001)

In almost ten years later, the performance evaluation practice in facilities management has expanded to incorporate the elements of efficiency and effectiveness in service (Neely, 2000). Hence, McDougall et. al. (2002) suggest that efficiency and effectiveness relate, as concepts, to best practice (efficiency) ó the pursuit of perfection of a given approach, and best value (effectiveness) ó the pursuit of the most economic (in the widest sense) approach. Facility managers are aware of the need to align facilities with the organisationøs overall aims and objectives, but lack access to the relevant information and communication process to do so

...t of information and communication technology sector also ...organisation simultaneously. This is made all the more ...abler of organisational process and outcomes, sits at the intersection of the building and service delivery, thereby straddling tangible and intangible performance aspects (Brackertz and Kenley, 2001) less complicated. The term facilities performance evaluation is used reflecting the broader scope of the evaluations and the aims of the evaluation. The scope of the evaluation includes userøs view of the building facilities and was aimed mainly at improving or maintaining building facilities performance to the standards set in the service level agreements (SLA) (BSI, 2007).

In the recent years, since the broad application of information technology-based facilities management, most of the building facilities performance information could be obtained and observed in electronic form. In this regard, Amaratunga and Baldry (2002) suggest that the term performance management is more suitable rather than facilities performance evaluation to reflect the high degree of accessibility to facilities performance evaluation.

4.3 Purpose of Facilities Performance Evaluation

As the facilities management role is to support the core business activities, it is always perceived as secondary in importance and performance evaluations are frequently being abandoned. From a general management context and classical points of view, Amaratunga and Baldry (2002) admit that there is a need to assess performance in order to guide management decision making. Similarly, from a human relations angle, there is a need to assess performance to know whether an initiative is producing the benefit intended.

The FM services themselves are relatively broad and sometimes beyond the building related services as described earlier. Williams (1993) cites measurement of facilities as having three main components namely physical, functional and financial.

Physical performance relates to the behaviour of the buildingøs fabric and embraces physical properties such as structural integrity, heating, lighting, energy efficiency, maintainability, durability etc. Functional performance concerns the relationship of building with its occupier and embraces issues such as space, layout, ergonomics, image, ambiance, communication, health and safety, and flexibility. Finally, financial performance arises from the physical and functional performance of the building and comprises capital and recurrent (life-cycle) expenditures, depreciation and efficiency of use etc.

facilities related more to tangible measures such as space ... . Yet, the trend of measuring facilities performance has ... e non-financial measures (Houvala, 2004). However, for the purpose of the present research, aspects of performance evaluation are concentrated on the usability and physical condition of the building facilities.

In the Malaysian context, generally, based on the majority of the literature (for example Ashaari, 2005, Mohammad et. al., 2008, Nawawi and Khalil, 2008), post occupancy evaluation is viewed as a generic terminology for evaluating facilities performance rather than a specific method and technique for that purpose. Ashaari (2005) asserts that a large number of personnel in facilities management organisations in Malaysia do not know the mechanism to use to measure facilities performance through user satisfaction. Despite the large amount of research that has been carried out in the context of building performance, the aspect of evaluating building performance has not been emphasised widely in Malaysia (Nawawi and Khalil, 2008).

It is an argument that the evaluation of facilities performance indeed does exist and is broadly practiced within facilities management organisations in Malaysia. Hence, the contexts of evaluations are too specific and are not in a comprehensive manner. Usersø views are merely taken into account based on context, for example, the physical condition survey, energy assessment, space audit, and structural analysis, as part of the broad facilities performance area.

Given the above discussion, ten key variables constitute the basis for FM organisations to perform the facilities performance evaluation. These are:

1. Facilities management organisation regularly conducting FPE according to predetermined schedule.
2. Facilities management organisations used and deployed specific techniques for evaluating facilities performance tailored to organisational requirements.
3. FPEs are consistently conducted by facilities management organisations internally.
4. Facilities management organisations always maintain sufficient number of staff with necessary skill and competencies in conducting FPE.
5. Staffs are provided with necessary training to improve and upkeep staff knowledge in the relevant areas of FPE.

occupants are constantly getting involved in providing performance in the evaluation.

contribute significantly to facilities and facilities service improvement.

8. Clients and users are well informed and aware of the benefits of having facilities performance being evaluated.

9. The outcome of FPE significantly contributes to guiding FM organisations in budget planning.

10. The outcomes of evaluation are significantly important to facilities management organisations for decision making and problem solving.
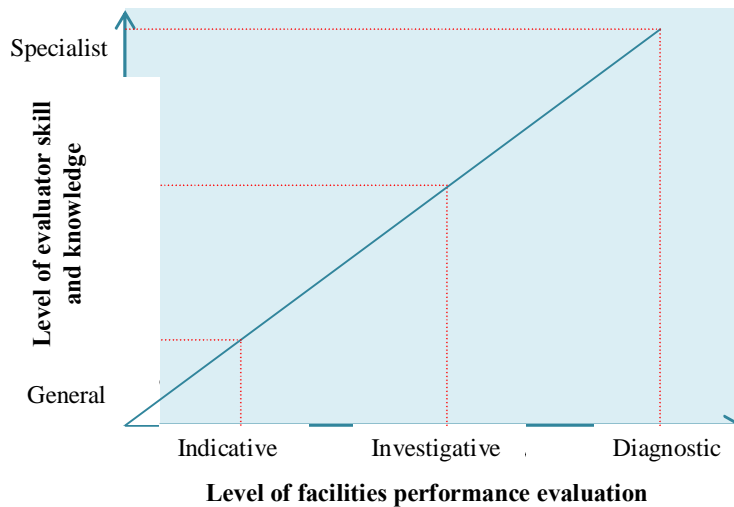
Figure 4.1: *Level of interaction between levels in facilities performance evaluation and skills and knowledge intensiveness*

The more specific the level of evaluation, the more skills and knowledge required. This relationship between evaluatorsø skill and knowledge and level of facilities performance evaluation is shown in **Figure 4.1**.

s Performance Evaluation

e extent of practice of facilities performance evaluation he role of facilities performance evaluation practice as discussed in Section 4.3. Three (3) themes of the main component in measuring extent of practice of FPE in the present research context are the measurement of the main contribution and role of FPE within FM context, approaches towards FPE practice in the organisation and level of preparedness or readiness of the organisation to conduct FPE as illustrated in **Figure 4.2**. Contribution and role of the FPE towards the client, facilities usersø and FM organisation itself are indicated as the use of FPE in budget planning, decision making and as a basis for facilities improvements.
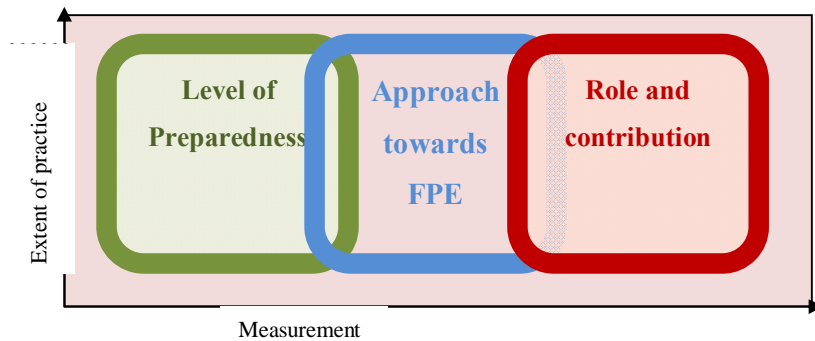
Figure 4.2: *Measurement of FPE practice*

Secondly, the level of practice measured based on the approach towards the FPE such as frequencies of FPE, involvement of occupants in the evaluation and the techniques used in the evaluation. Third consideration is the level of preparedness of the FM organisation in conducting FPE such as sufficient numbers of staff and training provided for the staff to conduct facilities performance evaluation effectively.

A questionnaire survey was conducted on 188 facilities managers from 97 facilities management organisation in Malaysia to measure the extent of facilities performance evaluation being practiced among the facilities management organisation in Malaysia by measuring the approach and basis in conducting facilities performance evaluation based on that three main variables derived from literature discussion on purpose and benefits of facilities performance evaluation as discussed in Section 2.3.1.

...uestionnaire reveals that the practice of FPE is centred on its ...antly focused on the approach in conducting FPE. In other ...cilities performance evaluation is associated with the level of preparedness, the expected role and approach towards the evaluation in an individual organisation.

Table 4.1: *Extent of practice of FPE in Malaysia*

Rank	Variables	Mean (N=188)
1	***For facilities improvement***	***1.30***
2	***For decision making***	***1.33***
3	***Have predetermined schedule***	***1.62***
4	***For budget planning***	***1.63***
5	***Have internal team for evaluation***	***1.88***
6	***Deploy specific techniques***	***1.97***
7	*Occupants feedback*	*2.07*
8	*User or client awareness*	*2.11*
9	*Training for staff*	*2.15*
10	*Number of staff*	*2.29*

Meaning of scale (for mean value): 1- Always, 2- Frequently, 3- Sometimes, 4- Never

Table 4.1shows the aggregate level mean score for extent of practice of facilities performance evaluation in facilities management organisation in Malaysia. The result of mean score indicates that as the mean score increases, the extent of practice decreases. In general, facilities performance evaluation conducted mainly focused on gaining advantage for facilities management operation. The evidence from the above mean score shows that the facilities performance evaluation was used as a basis for future facilities improvement (rank 1), decision making in facilities operation (rank 2), routine approach based on schedule (rank 3) and used for facilities budget planning (rank 4). Surprisingly, strategic approach of human resources such as providing relevant evaluation training for staff and having sufficient number of staff had second last and last position in the ranking list. By having provided facilities performance evaluation related training to the facilities managers, Barrett and Baldry (2009) suggest that they could also:

evaluations can contribute to organisational effectiveness;

e importance of building evaluations to other people within an organisation.

By ignoring the importance of training and maintaining sufficient number of competent staff in organisations, particularly for facilities performance evaluations, opportunities such as growth and innovation (Pitt and Tucker, 2008) could not be exploited.

Table 4.1 also revealed that the mean score leans towards 1 (mean range from 1.30 to 2.29) which suggests facilities performance evaluation currently played an important role and was harnessed as part of the routine in managing facilities. However, in identifying the most frequently practised approaches in facilities performance evaluation, a cut-off point of 2.00 do differentiate between the less practiced approaches. The meaning of mean score of 1.00 to 2.00 is between õalwaysö and õfrequentlyö which shows the most frequently practised approaches in facilities performance evaluation. Six variables were located in this region which means they were highly practiced in facilities performance evaluations in Malaysian facilities management (FM) organisations (arranged in orderly manner):

1) The outcomes of the facilities performance evaluation exercise are used for facilities performance optimisation and improvement;

2) Outcomes of the evaluation are used in decision making and problem solving;

3) Performance evaluation of facilities is conducted based on the pre-determined schedule;

4) The outcomes of performance evaluation are very significant for facilities management budget planning;

5) Relying entirely on internal evaluation team to conduct the facilities performance evaluation; and

6) A specific technique of inspection and data collection was used for facilities performance evaluation.

The results also suggest that facilities management organisation is more focused on the role and contribution of facilities performance evaluation rather than on the level of preparedness and the approach towards facilities performance evaluation itself. The assumption is based on the three elements of measurement of FPE practice as shown in the Figure 4.2 that is, 1) level of preparedness; 2) approach towards FPE; and 3) role and contribution of FPE itself.

twenty-one (21) respondents however, includes the uses of ...ware and database in exploring data and information for the ...elements of facilities performance evaluation listed in **Table 4.1**. An example of the advantage of IT software and database they explored for the evaluation is the ability of such software to generate õjob orderö, specific planned maintenance programme, õlife cardö for equipment etc. However, to operate those tools, highly skilled and well trained staffs are necessary which constitute a challenge in conducting FPE (discussed in Section 4.5).

It could be inferred that the possible reason for higher level of the role and contribution element in conducting facilities performance evaluation is because the FM organisation is expecting high quality facilities performance evaluation outcomes rather than providing input towards the quality facilities performance evaluation in the first place. A quote by Barrett and Baldry (2003) stressed the issues of ownerships and preparation for an evaluation:

> *"...it is important to ascertain why an evaluation is being conducted on whose authority. Evaluations obviously need to be directed towards an outcome, so check what results are expected. Check time and budget allowances, who will pay for reports, etc. try to ensure that some finances will be available on the completion of the evaluation, so that certain items can be dealt with immediately. If nothing changes as a result of an evaluation, both users and management will wonder why they agreed to participate."(Barrett and Baldry, 2003)*

The elements of õawarenessö and õownershipö of the evaluation are the main themes in describing the challenges that hinder an effective FPE as discussed in Section 4.5 in the present chapter.

The implication of providing the necessary input at earlier stage simultaneously could improve the level of preparedness and approach towards FPE and enhance the quality and the roles of FPE in management of facilities. A possible suggestion that could be made is; the organisation should also focus on the necessary inputs rather than outputs of the evaluation. Examples of the types of input that could be improved are providing the necessary tools for the evaluation, providing continuous training to the employees to use the relevant tools and new techniques in facilities performance evaluation that could improve the evaluation process and providing means for process improvement in the evaluation of facilities performance evaluation.

...rmance evaluation (FPE) practice based on facilities ...ion

...evaluation identified in Section 4.3 above, at times, differed according to the type of facilities management provision as well as the size of organisation. Comparisons were then made between different groups of respondents in order to identify any variations to the above. **Table 4.2** gives a mean value comparison based on the approach and basis for conducting facilities performance evaluation based on categories of respondentsø FM service provision.

Table 4.2: *Extent of practice of FPE according to FM service provision*

Variables	Outsource (N=66)		In-house(N=122)	
	Mean	Rank	Mean	Rank
For facilities improvement	*1.25*	*1*	*1.33*	*2*
For decision making	*1.36*	*2*	*1.31*	*1*
Have predetermined schedule	*1.61*	*3*	*1.63*	*4*
For budget planning	*1.85*	*4*	*1.52*	*3*
Have internal team for evaluation	*1.88*	*5*	*2.02*	*6*
Deploy specific techniques	*1.92*	*6*	*1.86*	*5*
Occupants' feedback	*1.98*	*7*	*2.11*	*7*
User or client awareness	*2.05*	*8*	*2.14*	*9*
Training for staff	*2.18*	*9*	*2.13*	*8*
Number of staff	*2.41*	*10*	*2.22*	*10*

Meaning of scale (for mean value): 1- Always, 2- Frequently, 3- Sometimes, 4- Never

Interestingly, outsourced FM service provision ranked significant contribution of facilities performance evaluation for facilities improvement as first in the rank in which in-house FM service provision ranked second. Rationally, in-house FM service provision has more authority to make decisions related to facilities management including for facilities improvement, expenditure and human resources compared to out-sourced FM organisations which are restricted to the service level agreements (SLA) with their clients. This denotes slightly different õweightagesö of the facilities performance evaluation role between two categories of FM service provision.

Extent of practice of facilities performance evaluation according to facilities management service provision could be observed by identifying the frequency and percentage of respondent rating either õalwaysö and õfrequentlyö or õsometimesö and õneverö. **Table 4.2** shows the frequency and percentage of respondent rating as õalwaysö and õfrequentlyö which indicated positively towards the individual variables.

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t service rated four (4) variables of more than 90% that is for facilities improvement, for decision making, have predetermined schedule and user and client awareness. This slightly differs with in-house FM service provision which has only three (3) variables of more than 90% that are for facilities improvement, for decision making and have internal team for evaluation. These hint that out-sourced FM have a better practice of facilities performance evaluation than in-house FM except for budget planning, training for staff and number of staff.

Budget planning for clientsø organisations is normally conducted in-house based on the maintenance proposal and building and facilities condition report from the evaluation by their service contractor (out-source). In contrast, in-house FM organisations are responsible to provide budget planning for works such as maintenance, repairing, upgrading, refurbishment and renovation internally.

Surprisingly, training of staff and maintaining a sufficient number of staff are less of a concern by out-sourced FM. As a business entity, these two variables are vital to maintain competitiveness in the service industry. The difference means the score does not reflect that the differences between FM service provisions are significant. To test the significant differences between those two groups of facilities management service provisions, a Mann-Whitney U statistical test was employed. It is now important to ascertain whether the size of organisation has an impact on the results discussed above. The null hypothesis (H_0) and alternative hypothesis (H_1) used in this statistical test are as follows:

> H_0 – *Extent of practice of facilities performance evaluation does not differ according to the type of FM service provision.*

> H_1 – *Extent of practice of facilities performance evaluation differs according to the type of FM service provision*

...test statistic extent of practice in conducting facilities ...rding to the facilities management service provision

	schedu	techniq	internal team	no. of staff	staff training	users feedback	performance improvement	awareness	budget planning	decision making
Mann-Whitney U	4004	3650	3761	3500	3845	3615	3841	3656	3278	3732
Wilcoxon W	11507	5861	11264	11002	11348	5826	6052	5867	10781	12135
Z	-.07	-1.12	-.90	-1.61	-.56	-1.41	-.66	-1.52	-2.41	-1.03
Asymp. Sig. (2 tailed)	.944	.263	.368	.107	.573	.160	.507	.129	.016*	.304

a- *Group of variables: organisation type*

* *results are statistically significant at p<0.05*

At five per cent level of significance, the Mann-Whitney U test result shown in **Table 4.3** revealed that there is only one variable with the *p* value less than 0.05. This could suggest that the null hypothesis is rejected, which means that the extent of practice is differs according to facilities service provision.

Thus it could be inferred that a significant differences on the extent of practice hint that regardless of whether in-house or out-sourced FM organisations, their roles, readiness and approaches towards FPE are almost disparate. The possible variables of FPE exist on other factors such as the scope of evaluation, types of facilities to be evaluated, availability of facilities information and accessibility to the space.

4.4.2 Extent of facilities performance evaluation (FPE) practice based on facilities management organisational size

Another aspect of facilities management perspective that is important to be examined is from the angle of organisational size. The norm of the organisational size could influence the extent of practice which is relevant to the extent of practice construct. The three categories of facilities management according to the size of facilities management organisations arranged as small, medium and large. The mean values given in **Table 4.4** are arranged according to the ranking order extracted from overall mean values given in **Table 4.1**.

in conducting FPE according to organisational size

	Small (N=56)		Medium(N=101)		Large (N=30)	
	Mean	Rank	Mean	Rank	Mean	Rank
For facilities improvement	1.18	1	1.20	1	1.83	3
For decision making	1.25	2	1.26	2	1.67	2
Have predetermined schedule	1.61	3	1.54	4	1.93	5
For budget planning	1.77	4	1.52	3	1.63	1
Have internal team for evaluation	2.00	5	2.11	8	2.30	10
Deploy specific techniques	2.07	6	1.70	5	2.13	8
Occupants feedback	2.13	7	2.11	9	1.83	4
User or client awareness	2.18	8	1.86	6	1.93	6
Training for staff	2.43	9	1.99	7	2.13	9
Number of staff	2.64	10	2.17	10	2.00	7

Meaning of scale (for mean value): 1- Always, 2- Frequently, 3- Sometimes, 4- Never
*rated as õalwaysö and õfrequentlyö

Table 4.4 revealed that the outcomes of a performance evaluation exercise contribute to facilities performance optimisation and improvement ranked 1st by small and medium organisations but ranked 3rd by large organisations. Whereas large organisations ranked the outcomes of performance evaluation practice as significant for facilities management budget planning whilst small and medium size organisations ranked it 3rd and 4th respectively. This is evident that large organisations perceived that facilities performance evaluation is vital for facilities management budget planning rather than for facilities improvement purpose.

Thus, it could be inferred that large organisations has much better operation systems such as operation procedures, more skilled staff and better knowledge sharing. Large organisations also rated user or client awareness as least priority (rank 6) as large organisations were largely represented from in-house FM service provision and were already aware of the important role of facilities performance evaluation in managing facilities.

Kruskal-Wallis test by deploying SPSS. Alternatively, the calculated manually using the following formula:

$$H = \frac{12}{n(n+1)} \sum_{i=1} R_i^2 - 3(n+1)$$

Where,

H = Kruskal- Wallis test

n = total number of samples

R_i = rank of the sample

In order to statistically test the significant differences between the three groups of organisational size (small medium and large) a null hypothesis (H_0) and alternative hypothesis (H_1) are set as follows:

> H_0 = *there is no significant difference between size of FM organisation to the extent of practice of facilities performance evaluation.*

> H_1 = *there is a significant difference between size of FM organisation to the extent of practice of facilities performance evaluation.*

Table 4.5: *Kruskal-Wallis test statistic for basis in conducting FPE according to the organisational size*

	schedule	techniques	internal team	no. of staff	staff training	users feedback	performance improvement	awareness	budget planning	decision making
Chi-Square	3.22	5.19	20.80	23.09	15.28	6.66	43.13	9.97	4.45	13.38
df	2	2	2	2	2	2	2	2	2	2
Asymp. Sig.	0.20	0.07	0.00*	0.00*	0.00*	0.04*	0.00*	0.01*	0.11	0.00*

a. Kruskal Wallis Test

b. Grouping Variable: number of employees

* results are statistically significant at p<0.05

As shown in **Table 4.5**, at five per cent level of significance, the *p* value is statistically significant in most instances. Seven out of ten variables has level of significance of less than five per cent. Thus, the null hypothesis is accepted for the above. This suggests that there are no differences in the approach towards FPE between different organisational sizes i.e. small, medium and large.

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eflect the number of staff in the organisation, most of the
e human resource-related factors such as õreliance on the
g sufficient number of staff with relevant knowledge and
skillö, õproviding relevant training for staffö, and õawareness towards the benefits of
knowledge mapping outcomesö.

4.5 Analysis of the Issues and Challenges in Conducting FPE

A õchallengeö is a noun that described a difficult task, an obstacle that confronts the effort. In
conducting facilities performance evaluation, the challenges are also the issues and problems
that hinder the facilities performance evaluation to achieve its objective. Balasty (2007)
pointed out that evaluation of facilities performance itself is one of the challenges faced by
facilities management in Malaysia.

In the context of conducting facilities performance evaluation, the literature discussion in
Section 2.3 inferred that challenges occurred in two forms:

1) **Ownership** to the evaluation task: the ownership of the task described the
   responsibility to conduct the evaluation mainly issues related to the question of who
   should conduct the evaluation in managing the facilities. This issue is followed by the
   question of õwhoö should bear the cost of the evaluation exercise. At this point, the
   issues of ownership are related to the second form of challenge; awareness.
2) **Awareness** towards the importance of the evaluation greatly linked with the
   knowledge of the evaluationsø benefits. This begs the question of what are the
   knowledge benefits and how the evaluation could contribute to the facilities
   management at large.

Ten variables derived from the ownership and awareness related issues were posed in the
questionnaire in order to identify how the respondent perceived the challenge in the research
context. The data analysis was carried out using Statistical Package for Social Sciences
(SPSS) as shown in **Table 4.6**. The analysis dealt mainly with the ranking of the issues and
challenges based on their mean values. This aspect of the analysis investigated facilities
managersø perception of the issues and challenges in conducting the FPE by ranking the mean
response. The critical cut off point was set to the overall mean score that is 2.00 to sort
between the most challenging and less challenging factors. A similar cut off point to
differentiate between most important point and less important point was also used in a

ree (3) variables with the means score equal or less than the ...terpreting evaluation data conclusion (M=1.32), obtaining ...of staff (M=1.96) (As marked bold in Table 4.6).

Table 4.6: *Ranking of the challenges in conducting facilities performance evaluation*

Rank	Challenge factors	Mean (N=188)
1	***Interpreting conclusion***	*1.32*
2	***Obtaining information & data***	*1.87*
3	***Lack of staff***	*1.96*
4	*Lack of awareness*	*2.02*
5	*Familiarity with facilities*	*2.03*
6	*Obtaining users' feedback*	*2.19*
7	*Define methods for evaluation*	*2.32*
8	*Determine responsibility*	*2.48*
9	*Allocating specific time*	*2.69*
10	*Organisation readiness*	*2.70*

Meaning of scale (challenge in conducting FPE):
1 (Very challenging), 2 (Challenging), 3 (Fairly challenging), 4 (Not challenging at all)

The result of mean score in **Table 4.6** indicated as mean score increases, the degree of challenge decreases. An inspection of Table 4.6 shows that facilities managersø ranked *"ability to interpret and draw conclusion from the data and information collected"* as most challenging in conducting facilities performance evaluation. The second highest ranked challenge based on mean rank is *"collecting and obtaining data and information about the building"*. *"Allocating specific time to conduct facilities performance evaluation to the building facilities"* and *"readiness and preparedness of organisation to perform the evaluation"* are ranked as 9th and 10th respectively. The least ranked challenges of allocating time and organisation readiness in conducting facilities performance evaluation indicate the positive move of FM organisation in Malaysia to seize opportunities from facilities performance evaluation. However, this contradicted with literature on facilities management practice in Malaysia (Khalil and Husin, 2009) even in more mature FM practice in countries like United Kingdom & Europe (Douglas, 1996, Usable Building, 2009, Riley et al, 2010), Europe (Cigolini et. al, 2011), and North America (Preiser, 2007) in which evaluation of facilities performance practice are not a standard and conventional practice by FM organisations. Therefore, the real potential of facilities performance evaluation is yet to be explored by FM organisations as Zimmerman and Martin suggest:

es part of the standard process of procurement then the *o enable a full realisation of the potential benefits......."*

The least ranked challenge of both in allocating specific time and readiness in conducting facilities performance evaluation may also be indicative of an absence of strong leadership in the organisation and/or absence of adequate training among staff in FM organisations in this regard. Perhaps there is a role for strong leadership to exploit this opportunity by engaging career development and training provider to suggest and provide necessary support to address the issue. The time they have allocated should be exploited in an affirmative manner by developing employer capability in work in order to equip the existing staff with an appropriate knowledge and skill related to building and facilities performance especially in relation to conducting facilities performance evaluation. The three most challenging factor in conducting facilities performance evaluation will be discussed in Sections 4.5.1, 4.5.2 and 4.5.3 later in this chapter.

In the same vein, twenty-one interview respondents also stressed the three challenges that are interpreting conclusion, obtaining information and data and lack of staff as most challenging in conducting facilities performance evaluation. The interview data is grouped into the predetermined themes of challenge factors as shown in **Table 4.7**.

Table 4.7: *Challenges and issues in conducting facilities performance evaluation highlighted by interview respondent.*

Coding	Challenge factors	Nos. of respondents	Score (%)	New issues brought up
C1	*Interpreting conclusion*	*14*	*67*	*Computer and software (ICT) application for evaluation.*
C2	*Obtaining information & data*	*15*	*71*	
C3	*Lack of staff*	*17*	*81*	
C4	*Lack of awareness*	*13*	*62*	*Dealing with vendors/contractors*
C5	*Familiarity with facilities*	*10*	*48*	
C6	*Obtaining users' feedback*	*3*	*14*	
C7	*Define methods for evaluation*	*8*	*38*	
C8	*Determine responsibility*	*5*	*24*	
C9	*Allocating specific time*	*3*	*38*	
C10	*Organisation readiness*	*9*	*43*	

*N = 21

of ranking order, interview respondents perceive that õobtaining information and dataö and õlack of staffö as the three õchallenges affecting FPE. In addition, lack of awareness of the importance of facilities performance evaluation and its potential benefits by top management and facility owners gain a considerably high score (62%) from the respondents. The summary of the interview findings in this regards is as enclosed **APPENDIX E**.

Table 4.8: *Challenges in conducting FPE according to FM service provision*

Challenge factors	Out-sourced (N=66)		In-house (N=122)	
	Mean	Rank	Mean	Rank
Interpreting conclusion	*1.33*	*1*	*1.31*	*1*
Obtaining information & data	*1.98*	*2*	*1.80*	*2*
Lack of staff	*2.14*	*6*	*1.87*	*3*
Lack of awareness	*2.50*	*8*	*2.01*	*5*
Familiarity with facilities	*2.39*	*7*	*1.99*	*4*
Obtaining users' feedback	*2.14*	*5*	*2.21*	*6*
Define methods for evaluation	*2.03*	*3*	*2.23*	*7*
Determine responsibility	*2.09*	*4*	*2.52*	*8*
Allocating specific time	*2.73*	*9*	*2.67*	*10*
Organisation readiness	*2.80*	*10*	*2.64*	*9*

Meaning of scale (challenge in conducting FPE):
1 (Very challenging), 2 (Challenging), 3 (Fairly challenging), 4 (Not challenging at all)

A comparison between two categories of facilities management service provision was then made in order to identify any variations between outsource and in-house service provisions. A closer look at **Table 4.8** shows that the mean value between two categories seems to be similar. However, lack of staff was perceived as less of a challenge for outsource FM service provision which ranked 6 compared to in-house FM service provision which ranked 3 as most challenging. This shows that staffing is less of a challenge for out-sourced FM organisations compared to in-house FM organisations. This will affect the decisions on staffing for contractors (outsourced FM) normally based on business needs reflecting the projects they have in hand (Atkin & Brooks, 2009) while for in-house FM organisation, the appointment of additional staff could be delayed as the main focus is on the core activities of the principal organisation.

the evaluation was ranked eighth by out-sourced FM and

...isations. The staff awareness is more of a challenge for out-

...acilities performance evaluation is conducted based on the requirements by the clients. Hence the potential benefits in conducting the facilities performance evaluation are viewed as imposing additional cost for the contractors. The out-sourced FM organisations are less aware of the role of facilities performance evaluation in improving effectiveness and efficiency in managing facilities against the cost they spent for the evaluation.

Surprisingly, the challenge which is related to familiarity with the facilities they manage ranked seventh by out-sourced FM organisations but fourth for in-house FM organisation. Plausibly, in-house FMs are more familiar with the building and facilities as they are continuously attached to the particular building facilities and involved in the facilities from the early stage compared with out-sourced FM organisations which are bound to the specific contractual terms in managing the facilities. This might well be one of the reasons out-sourced FM has more experience with different types and uses of building facilities giving advantage for them to quickly familiarise with the buildings they manage hence less challenging as compared to in-house FM organisations. The experience with various types of facilities pose less challenge in understanding the building characters, common defects, causes and early symptoms of structural or artificial defects as well as suggesting solutions in the evaluation as an added advantage.

Defining methods for evaluation ranked third most challenging by out-sourced FM organisations and ranked seventh by in-house FM organisations. Involvement with various building facilities exposed the out-sourced FM organisations with more firm methods and techniques in evaluating facilities performance to suit the requirements by their clients; hence less of a challenge in this regards. This hints that an element of difference exists between FM service provisions. Therefore, further statistical test is employed to identify if the differences are significant or insignificant. A Mann-Whitney U test was used to identify the significant differences in perceiving the challenges in conducting facilities performance evaluation (see **Table 4.9**). Null hypothesis and alternative hypothesis for the test are as follows:

...nducting facilities performance evaluation differ between ...nagement service provision.

II   the challenges in conducting facilities performance evaluation do not differ between type of facilities management service provision.

Table 4.9: *Mann-Whitney U test statistic challenge in conducting facilities performance evaluation according to the facilities management service provision*

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
Mann-Whitney U	3951	3344	3663	3967	3399	3853	3414	3879	3561	3703
Wilcoxon W	6162	10847	11166	11470	10902	6064	10917	11382	11154	5914
Z	-0.28	-2.39	-1.30	-0.20	-2.14	-0.56	-1.85	-0.45	-1.12	-1.01
Asymp. Sig. (2 tailed)	0.78	0.02*	0.19	0.84	0.03*	0.57	0.07	0.65	0.26	0.32

a- *Group of variables: organisation type*

* *results are statistically significant at p<0.05*

According to the results given in **Table 4.9**, there are only two variables with the *p* value less than 0.05. Therefore, at 5 per cent level of significance, the null hypothesis is rejected which means that the challenges do not differ according to facilities management service provision.

Despite the different roles of in-house and out-sourced facilities management organisations in managing facilities, the common challenges faced by both of those organisations are almost consistent.

Table 4.10 illustrates the mean comparison of the challenges in conducting facilities performance evaluation according to facilities management organisational sizes.

Table 4.10: *Challenges in conducting FPE according to organisational size*

Challenge factors	Small (N=56)		Medium(N=101)		Large (N=30)	
	Mean	Rank	Mean	Rank	Mean	Rank
Interpreting conclusion	1.20	1	1.22	1	1.87	2
Obtaining information & data	2.04	2	1.82	2	1.73	1
Familiarity with facilities	2.14	3	1.98	5	1.97	3
Lack of awareness	2.05	4	1.87	3	2.47	9
Define methods for evaluation	2.34	5	2.31	7	2.33	6
Obtaining users' feedback	2.29	6	2.12	6	2.20	4
Lack of staff	2.00	7	1.94	4	2.00	5
Allocating specific time	2.82	8	2.64	8	2.63	8
Organisation readiness	2.91	9	2.63	9	2.57	10
Determine responsibility	2.59	10	2.39	10	2.53	7

Meaning of scale (challenge in conducting FPE):
1 (Very challenging), 2 (Challenging), 3 (Fairly challenging), 4 (Not challenging at all)

hallenging"

0 do not show any significant differences in terms of mean values according to the size of organisation. However, a closer observation of **Table 4.10** suggests that small and medium FM organisations have comparatively lower mean values. This means that the level of challenges by small and medium FM organisations is higher compared to large FM organisations. However, it is vital to identify the statistical significant differences between three groups of FM organisation sizes (small, medium and large).

The Kruskal-Wallis test was used to identify the significant differences in perceiving the challenges in conducting facilities performance evaluation (see **Table 4.11**) according to three different sizes of FM organisations. Null hypothesis and alternative hypothesis for the test are as follows:

$H^0 =$ *the challenges in conducting facilities performance evaluation differ between sizes of facilities management organisation.*

$H^1 =$ *the challenges in conducting facilities performance evaluation do not differ between sizes of facilities management organisation.*

Table 4.11: Kruskal-Wallis test statistic challenge in conducting facilities performance evaluation according to the organisational size

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
Chi-Square	6.548	10.626	2.696	6.043	1.880	4.376	1.159	2.015	6.508	8.042
df	2	2	2	2	2	2	2	2	2	2
Asymp. Sig.	.038*	.005*	.260	.051	.391	.112	.560	.365	.039*	.018*

a. Kruskal Wallis Test
b. Grouping Variable: number of employees
* results are statistically significant at p<0.05

Table 4.11 shows, four out of ten variables indicate the significant value smaller than five per cent. This result informed that, at five per cent level of significance, the null hypothesis is rejected and alternative hypothesis is accepted. This denotes that there is no significant difference in perceiving challenges between the sizes of FM organisations.

The discussion and analysis of findings in the present section firmly inform that:

1) Ability to interpret and draw conclusions from the data and information collected;

2) Collecting and obtaining data and information about the building;

3) Lack of staff with relevant knowledge in facilities performance evaluation; and

in-house FM service provision) or facility owner (for out-
~~provision~~) are not really aware of the importance of facilities
~~n~~ and its potential benefits.

A statistical significance difference test reveals that the size of organisation and FM service provision does not impact the challenges in conducting facilities performance evaluation.

4.5.1 Challenges associated with interpreting and drawing conclusions from the facilities performance evaluation data and information

It is observed that all four most challenging factors are human-related factors. The first challenge occurred when all information and evaluation data required are already collected. The evaluators find it difficult in explaining the real issues of the facilities performance; and the relationship between issues and suggest the best solution for each issue to be found throughout the evaluation. Obviously the task requires highly skilled and experienced evaluators. The challenge becomes more severe in at least two situations:

- In the situation where the evaluators have lack of experience, skill and relevant knowledge for the facilities performance evaluation. The experience must not be limited to only building technical and ground data collection but analysis of data and preparing a good performance evaluation report (Hewitt et al, 2005).
- In the situation where the report is needed in a short time (Zimring and Rosenheck, 2001 and Hewitt et al, 2005)

This could be inferred that the task of preparing facilities performance evaluation reports require highly skilled, experienced and competent evaluators. Variation of the individual and group in terms of skill and experience makes interpreting the conclusion from evaluations difficult. Skills are the individual competency gained through training, formal and non-formal educations. Experience is the tacit knowledge gained by the individual through time and involvement in the process**.** Surprisingly, as **Table 4.12** indicates, more than half (51%) of the respondents in the survey have more than ten yearsø experience which means they are relatively experienced enough in defining facilities operation problems.

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...perience in the facilities management area

	Frequency	%	Cumulative %
	6	3.2	3.2
Between 1 to 5 years	18	9.6	12.8
Between 6 to 10 years	68	36.2	48.9
Between 10 to 15 years	58	30.9	79.8
Between 15 to 20 years	28	14.9	94.7
More than 20 years	10	5.3	100

In a different perspective, the challenge in interpreting conclusion from the data collected is not only relevant to the experience of the evaluators. This means, evaluators with more experience and skill also partake of the challenge related to this variable. Deru and Torcallini (2005) assert the problems related to standardisation of practice and subjectivity (Fianchini, 2006) is a setback in interpreting data from evaluation:

"One problem in evaluating building energy performance has been the inconsistency in approaches and terminology. If you ask ten energy professionals to give you the energy performance of a building, you will probably get ten different answers" Deru and Torcallini (2005).

The implication of poor interpretation of facilities performance evaluation would affect the follow-up action, decision made and planning aspects of the facilities management to the organisation. Therefore, it is strongly recommended that the facilities management organisations continuously improve evaluator's skill and knowledge via training and inculcate sharing of knowledge and coaching especially among senior and junior facilities managers.

4.5.2 Challenges associated with obtaining the information and data of the building facilities

Obtaining the information and data of the building facilities is ranked as second in ranking of challenges in conducting facilities performance evaluation (See **Table 4.6**). The challenge becomes severe when users refuse to cooperate and provide access to the space or/and information of the building facilities when required. In the same vein, Pitt and Tucker (2008) suggest that obtaining data and information for the building at a high level of security is more difficult for the purpose of evaluation. This challenge is associated with the level of awareness of the facilities users or building occupants towards the importance of facilities performance evaluation and knowledge of how the evaluation could benefit them.

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...rmance evaluation could affect organisation's effectiveness ...oted by Barrett and Baldry (2009):

"....organisations tend to have far more information on items such as photocopier than they do on their buildings. Organisations that are relatively good at managing the rest of their assets often have very little information concerning the performance of their buildings. Those that possess data on areas such as energy costs could well have no information on how energy performance relates to employee comfort. Even if organisations have such information, it is unlikely that they will have tried to relate their present needs to what they are likely to require in a few years' time." (Barrett and Baldry, 2009)

Amaratunga and Baldry (1998) suggest that involving building occupants in the evaluation could improve their attitude through active involvement in the evaluation process. To inculcate this, the occupants should be provided with appropriate training and information that is widely available to promote the benefits of conducting facilities performance evaluation (Brooks and Viccars, 2006).

Thus, it can be inferred that the challenge in obtaining information and data of the building facilities has a significant impact to the accuracy and quality of the facilities performance evaluation.

4.5.3 Challenges associated with insufficient number of staff

Insufficient number of staff ranked third as a challenge by survey respondents (see **Table 4.6**). Inspection on **Table 4.13** reveals that shortage of staff could affect the whole pace of facilities management operations. Recruitment of staff must correspond with the workloads in the organisation. A significant number of respondents agree that lack of staff is a challenge in conducting facilities performance evaluation in facilities management organisations with 117 respondents or 62 per cent rated this variable as very challenging and challenging. It could be inferred that respondents perceived that facilities performance evaluation as an eventful activity and required specially employed staff or more staff to handle the task. Four respondents or equivalent to two per cent rated lack of staff as not a challenge at all.

k of staff

	Frequency	Percentage	Cumulative (%)
	82	43.6	43.6
Challenging	35	18.6	62.2
Fairly challenging	67	35.6	97.7
Not challenging at all	4	2.1	100
Total	**188**	**100**	

4.5.4 Challenges associated with lack of awareness

The challenge variable in conducting facilities performance evaluation ranked fourth based on the mean score in the **Table 4.6** is clientøs awareness of the importance of facilities performance evaluation and its potential benefits. Close inspection to **Table 4.14** reveals that, 160 respondents or equivalent to eighty-five per cent of the respondent rated lack of awareness of the importance of facilities performance evaluation and its potential benefits as very challenging and challenging in conducting facilities performance evaluation.

Table 4.14: *Level of challenge for lack of awareness*

Level of Challenge	Frequency	Percentage	Cumulative (%)
Very challenging	30	16	16
Challenging	130	69.1	85.1
Fairly challenging	23	12.2	97.3
Not challenging at all	5	2.7	100
Total	**188**	**100**	

Awareness in conducting facilities performance evaluation in facilities management organisations is extremely important. This is to enable the facilities management organisations gain an advantage from its implementation as discussed in Section 2.3.1. Awareness relates closely with knowledge and culture of the individual and groups of people within the organisation. Hari (2005) for example suggests that õawarenessö involves comprehending the environment through the use of sense. In the present context, this challenge is likely to occur in the event that the managers are less concerned to be equipped with the knowledge about FPE. This could suggest that the facilities managers in the organisation are not well informed or lack understanding on õwhatö benefits FPE could offer and õhowö the benefits could be achieved by conducting FPE.

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4.6.1 The Critical Success Factors (CSFs)

Critical factors are a few numbers of the most important factors from the range of influence factors in which the absence of the factors could lead to failure to the organisation or its implementations.

Rockart (1979) as cited in Leidecker and Bruno (1984) observes critical success factors as:

"........thus are, for any business, the limited number of areas in which results, if they are satisfactory, will insure successful competitive performance for the organisation. They are the few key areas where 'things must go right' for the business to flourish. If results in these areas are not adequate, the organisation's efforts for the period will be less than defined."

In the context of conducting FPE, the focus is narrower and the factors are more specific. However, multiple factors that can influence the success of facilities performance evaluation have been discussed in the literature. Therefore, in order to determine the CSFs in this regard as perceived by the facilities managers in FM organisations in Malaysia, nine (9) most cited critical factors in FPE have been listed and the mean score of the perceived critical and priority of each factor was calculated. This measure eliminates the factors that facilities managers perceived as õless criticalö in conducting FPE. To represent the degree of criticality of each variable, four scales (1 to 4) are used where 1 denotes as õvery criticalö and the highest is 4 as õnot critical at allö. This means as mean score increases, the degree of criticality decreases.

Table 4.15 illustrates the ranking of the critical success factors based on the questionnaire survey data. The ranking is based on the mean score of each factor.

...actors in conducting FPE

	...cess Factors	Mean (N=188)
		1.12
2	Quality report	1.16
3	Accessibility to information and data	1.17
4	Available Database	1.19
5	Clear objective	1.29
6	Organisations' awareness	1.61
7	Clients' awareness	1.71
8	Tools and methods of evaluation	1.96
9	Accessibility to space	1.97

Meaning of scale (critical success factors in conducting FPE):
1 (Very critical), 2 (critical), 3 (Fairly critical), 4 (Not critical at all)

The survey result shows that õknowledge and skill of evaluatorsö ranked 1st as most critical factor and õaccessibility to space for data collection and observationö is ranked 9th as least critical success factor. The mean score of all factors range between 1.12 for the top ranking to 1.97 for the bottom ranking. The low mean score hints that the respondent perceived all the factors listed as very critical and critical. Factors such as õknowledge and skill of evaluatorsö, õaccessibility to the data and informationö and õavailability and adequacy of facilities information databaseö are evidences that the task of facilities performance evaluation involves highly knowledge-based activities and elements of knowledge management approach are strongly urged in the evaluation activities. The õquality of outputs/reports through evaluationö which ranked second as most critical factor could also be improved by harnessing knowledge management elements in the facilities performance evaluation activities. In the present research context, the element of knowledge management approach is through implementation of knowledge mapping approach in facilities management organisations and in the facilities performance evaluation approach.

The interview result shown in **Table 4.16** also shows a high frequency of citation of the critical success factors under the theme of evaluatorsø knowledge (100%) and availability of database (100%).

...ess Factors (CSFs) in conducting facilities performance ...rview respondent.

	tors	Nos. of respondents	Score (%)	Other factors perceived critical
CSF 1	Evaluators' knowledge	21	100	
CSF 2	Quality of report	12	57	
CSF 3	Accessibility to information and data	8	38	
CSF 4	Available Database	21	100	-Nil-
CSF 5	Clear objective	5	24	
CSF 6	Organisations' awareness	12	57	
CSF 7	Clients' awareness	10	48	
CSF 8	Tools and methods of evaluation	5	24	
CSF 9	Accessibility to space	4	19	

*N = 21

The results presented in **Table 4.16** also confirm that all factors are critical for successful FPE and at the same time no other critical factors were stressed by the interview respondents with regards to the successful FPE. The summary of the interview finding in this regards is as shown in **APPENDIX F.**

4.6.2 The critical success factors according to FM service provision

The quality of outputs/reports through evaluation or presentation techniques was ranked 1st by in-house FM organisation but ranked 5th by out-sourced FM organisations. The knowledge and skill of evaluators are most critical for out-sourced FM organisations for successful facilities performance evaluation hence they ranked 1st. The least critical success factor for out-sourced FM organisation is accessibility to space for data collection and observation. However, in-house FM organisations ranked tools and methods used for data collection and observation last which means it was least critical in conducting successful facilities performance evaluation.

factors in conducting FPE according to FM service provision

	Out-source (N=66)		In-house (N=122)	
	Mean	Rank	Mean	Rank
Presentation techniques	*1.23*	*5*	*1.12*	*1*
Evaluators' knowledge	*1.11*	*1*	*1.13*	*2*
Accessibility to information and data	*1.14*	*2*	*1.19*	*3*
Available database	*1.18*	*3*	*1.20*	*4*
Clear objective	*1.20*	*4*	*1.34*	*5*
Organisations' awareness	*1.48*	*6*	*1.68*	*6*
Clients' awareness	*1.73*	*7*	*1.70*	*7*
Accessibility to space	*2.12*	*9*	*1.89*	*8*
Tools and methods of evaluation	*1.95*	*8*	*1.96*	*9*

*Meaning of scale (critical success factors in conducting FPE):
1 (Very critical), 2 (critical), 3 (Fairly critical), 4 (Not critical at all)

Despite differences in perceiving CSFs based on the mean score shown in **Table 4.17**, it is important to discern whether the differences are significant or insignificant. Therefore, further statistical test need to be done to identify if the differences are significant or otherwise. A Mann-Whitney U test was used to identify the significant differences in perceiving the challenges in conducting facilities performance evaluation (see **Table 4.18**). Null hypothesis and alternative hypothesis for the test are as follows:

$H^0 =$ *the critical success factors (CSFs) in conducting facilities performance evaluation differ between types of facilities management service provision.*

$H^1 =$ *the critical success factors (CSFs) in conducting facilities performance evaluation do not differ between types of facilities management service provision.*

Table 4.18: *Mann-Whitney U test statistic for critical success factors of practice in conducting facilities performance evaluation according to the facilities management service provision*

	Presentation Techniques	Evaluators' Knowledge	Info. Accessibility	Database	Objective	Org. Awareness	Clients' Awareness	Space Accessibility	Tools and Methods
Mann-Whitney U	3955	3961	3824	3993	3426	3487	3861	3335	4024
Wilcoxon W	11458	6172	6035	6204	5637	5698	11364	10838	6235
Z	-.357	-352	-.908	-.137	-2.162	-1.678	-.515	-2.083	-.008
Asymp. Sig. (2 tailed)	.721	.725	.364	.891	.031*	.093	.607	.037*	.994

Grouping variable: Organisation
* results are statistically significant at p<0.05

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s shown in Table 4.18 revealed that there are only two

.05. This could suggest that the null hypothesis is rejected,

differ according to facilities service provision. The results in Table 4.18 also confirm that differences exist on how in-house and out-sourced facilities management organisations perceived the level of criticality of the factors in conducting FPE.

4.6.3 Critical success factors according to organisational size

A mean value comparison of the critical success factors according to size of organisation is shown in **Table 4.19**. Small sized FM organisations viewed the quality of outputs/reports through evaluation and accessibility to the data and information as the most critical factors (M=1.04) in conducting FPE followed by knowledge and skill of evaluators (M=1.05), availability and adequacy of facilities information database (M=1.09) and having clear statements about the evaluation objective (M=1.18).

Medium sized FM organisations viewed similarly as the small FM organisations on the most critical factor that is the quality of outputs/reports through evaluation. However, evaluatorsø knowledge and skill was rated as second in the rank (M=1.15); availability and adequacy of facilities information database rated third (M=1.20); followed by accessibility to the data and information (M=1.22) and having clear statements about the evaluation objectives (M=1.28).

Large FM organisations however, viewed knowledge and skill of evaluators as the most critical factor to the success in conducting FPE (M=1.17); followed by accessibility to data and information in the second position (M=1.27); availability of database in the third position (M=1.37); and fourth was having clear statements about the evaluation objectives (M=1.53). Obviously, the quality of outputs/reports was ranked the most important by small and medium sized FM organisations but was ranked fifth by large FM organisations (M=1.57).

factors in conducting FPE according to organisational size

	Small (N=56)		Medium(N=101)		Large (N=30)	
	Mean	Rank	Mean	Rank	Mean	Rank
Presentation techniques	1.04	1	1.11	1	1.57	5
Evaluators' knowledge	1.04	2	1.22	4	1.27	2
Accessibility to information and data	1.05	3	1.15	2	1.17	1
Available Database	1.09	4	1.20	3	1.37	3
Clear objective	1.18	5	1.28	5	1.53	4
Organisations' awareness	1.54	6	1.60	6	1.80	6
Clients' awareness	1.66	7	1.70	7	1.83	7
Accessibility to space	1.93	8	2.01	9	1.87	8
Tools and methods of evaluation	2.04	9	1.93	8	1.97	9

*Meaning of scale (critical success factors in conducting FPE):
1 (Very critical), 2 (critical), 3 (Fairly critical), 4 (Not critical at all)

The result from **Table 4.19** obviously shows existence of the differences in perceiving critical success factors for successful FPE. It is important to identify the significant difference in perception between sizes of organisation. Therefore, the Kruskal-Wallis test was used to identify the significant differences in perceiving the critical success factors in conducting facilities performance evaluation (see **Table 4.20**) according to three different sizes of FM organisations. Null hypothesis and alternative hypothesis for the test are as follows:

H^0 = *the critical success factors (CSFs) in conducting facilities performance evaluation differ between size of facilities management organisations*

H^1 = *the critical success factors (CSFs) in conducting facilities performance evaluation do not differ between size of facilities management organisation*

Table 4.20: *Kruskal-Wallis test statistic for critical success factors (CSFs) in conducting FPE according to the organisational size*

	Presentation Techniques	Evaluators' Knowledge	Info. Accessibility	Database	Objective	Org. Awareness	Clients' Awareness	Space Accessibility	Tools and Methods	Presentation Techniques
Chi-Square	4.132	3.076	9.860	2.939	2.786	1.322	1.684	.746	7.393	4.132
df	2	2	2	2	2	2	2	2	2	2
Asymp. Sig.	.127	.215	.007*	.230	.286	.516	.431	.689	.025*	.127

a. Kruskal Wallis Test

b. Grouping Variable: number of employees

* results are statistically significant at p<0.05

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factors which have p values of less than five per cent. [of significance], the null hypothesis (H^0) is rejected and [accepted]. The aforementioned result means that the critical success factors (CSFs) in conducting facilities performance evaluation are differ according to sizes of FM organisation.

4.6.4 Criticality related to evaluators' knowledge for successful facilities performance evaluation

The responses obtained from the questionnaire survey conducted demonstrate that facilities managers perceived the knowledge and skill of the evaluators as critical for the success of FPEs. **Table 4.21** indicates that 97.9 per cent (183 responses) rated the knowledge and skill of the evaluators as very critical and critical in successful FPEs. Level of criticality related to knowledge and skill of evaluators is very relevant as the quality of evaluation outcomes relies entirely on the critical observation by the evaluators of the facilities condition. The recommendations generated at the end of the evaluation process are subjected to the level of experience of the evaluators especially their knowledge and skill in conducting the evaluation.

Table 4.21: *Level of criticality with relation to knowledge and skill of the evaluators*

Level of Criticality	Frequency	Percentage	Cumulative (%)
Very critical	*169*	*89.9*	*89.9*
Critical	*14*	*8*	*97.9*
Fairly critical	*8*	*2.1*	*100*
Not critical at all	*0*	*0*	
Total	**188**	**100**	

A general theory of performance (Campbell el al, 1993, as cited in Russell, 2010) offers useful definitions of knowledge and skill. According to the theory, individual differences in performance are a function of three determinants: declarative knowledge, procedural knowledge and skill; and motivation. The first is knowledge about fact, such as knowledge of physiology or computer technology. The second refers to knowing of what to do and how to do it ó for example, knowing how to install a wireless network, how to plan and manage oneøs own time, and how to communicate with others. The latter (motivation) reflects choices about whether to expend effort engaging in the behaviour, how much effort to expend, and how long to persist with that level of effort. Campbell et. al. further suggest that, individual differences

...sonality traits, interest, education, training, experience, ...minants or predictors of declarative knowledge, procedural ...tion. One of the interview respondents mentioned about active involvement of senior facilities manager in the evaluation exercise.

"...it is vital for the evaluators to know and understand the "A to Z" of the processes in the management of facilities. The process somehow is too broad, for that the experience plays a very critical role for the successful of the evaluation. In our organisation, senior facilities manager is actively take part in the evaluation and guide the more junior staff"

This supports the determinants suggested by Campbell *et. al.*(1993), of the performance that is the knowledge about the facts such as building technical, maintenance; secondly knowledge about the process exists in managing facilities. Motivation differentiates the behavioural factors of individual and groups towards acquisition of knowledge and sharing of knowledge.

The factors suggested by Campbell et. al.(1993), support the requirement for evaluators involved in facilities performance evaluation hence it becomes very critical in effective facilities performance evaluations. The evaluators are required to be familiar with the processes in the management of facilities including building occupancy, and the surrounding environment besides the relevant technical and managerial knowledge for successful facilities performance evaluation. Tuveson (1998) as cited in Amaratunga (2000) in highlighting the importance of knowledge and competencies of facilities managers to be improved cited:

"For facilities professionals to be successful leaders in their organisations in the next millennium and beyond, they must have a broader knowledge of performance measurement than ever before..."

Tuveson's prophesy set the FM as a very competitive profession in built environment in the future. Good quality evaluators could be sustained in an organisation by offering competitive remuneration for skilled and knowledgeable staff besides inculcating training for existing staff. The experienced evaluator with knowledge and skill would also influence the success of the facilities performance evaluation.

quality of reports/outputs in determining facilities ccess

per cent of the questionnaire survey respondents perceived that the quality of report/output as õvery criticalö and õcriticalö factors for successful FPE. The factor also ranked second as most critical factor and this indicates that the quality of reports is very critical for successful FPE.

Table 4.22: *Level of criticality with relation to the quality of the report/outputs*

Level of Criticality	Frequency	Percentage	Cumulative (%)
Very critical	*166*	*88.3*	*88.3*
Critical	*14*	*7.4*	*95.7*
Fairly critical	*8*	*4.3*	*100*
Not critical at all	*0*	*0*	
Total	*188*	*100*	

The quality of facilities performance evaluation reports varies in terms of its format, contents and coverage of scope depending on differences in requirements of the output and individual creativity in interpreting the evaluation findings. The factor is simultaneously related with evaluatorsø knowledge and skill. The quality of recommendation provides suggestions and alternatives based on the field inspection and observation for the management or clients to make a decision on the facilities. Examples of alternatives include replacement, repairing, upgrading, and change of use of the elements of facilities depending on the objective of the evaluation by the users or clients (Pinder and Price, 2005, Brooks and Viccars, 2006, Zimmerman, 2006).

The implication of poor quality of reports and evaluation outputs could lead to flawed decisions being made and producing ineffective solutions and impacting on costs. In the absence of the quality of reports/output factors, the FPE would not be able to satisfy the organisationøs objective in conducting the evaluation.

Since the factor of quality of reports/outputs of FPE is closely linked with other factors such as knowledge and skill of evaluators, availability of database and accessibility to data and information, the same approach such as providing training for staff, staff coaching and employing suitable IT facilities in the evaluation process; are necessary to underpin the process to assure its success.

FPE findings were also suggested by several authors such
Bordass and Leaman (2005) and Higher Education Funding

4.6.6 Criticality related to accessibility to the data and information of the facilities

Accessibility to data and information of the facilities ranked third based on the mean score as shown in **Table 4.15**. As shown in **Table 4.23**, a majority of the facilities managers at 98.4 per cent rated this variable as õcriticalö and õvery criticalö.

Table 4.23: *Level of criticality with relation accessibility to the data and information of the facilities*

Level of Criticality	Frequency	Percentage	Cumulative (%)
Very critical	*159*	*84.6*	*84.6*
Critical	*26*	*13.8*	*98.4*
Fairly critical	*3*	*1.6*	*100*
Not critical at all	*0*	*0*	
Total	**188**	**100**	

The criticality of obtaining timely and up-to-date information enables the evaluators to make the most accurate observation on specific evaluation criteria. Access to the physical space enables the evaluators to assess and make visual observation on the building facilities component. An example of the situation where accessibility to the data and information to the facilities become severe was highlighted by one of the interview respondents:

"...information and data of the facilities component could be referred documents and databases in the office and secondly is trough field inspection and observation by the evaluator. You must ensure that the evaluators must always be accessible to those information for the evaluation to achieve its objective.......for example when assessing energy consumption, it might related to the application electrical appliances in the building, so evaluators need the appliances manuals and other relevant records for the evaluation"

The rapid development of ICT offers various features to be explored and exploited for effective and efficient FM service provision. A relevant database could be made accessible to the relevant personnel or group in FM organisations via online access.

...cilities performance evaluation based on the mean value ...s accessibility to space. The facilities managers perceived this variable as least critical as facilities management teams in normal practice are always allowed access to most of the space in the building. The facilities management team conducts routine inspection and maintenance of the facilities components based on scheduled and planned actions. Implicitly, this could be inferred that facilities performance evaluation is conducted according to fixed schedule. Facilities management organisations have alternative data and information of the facilities such as comprehensive facilities databases and facilities management information management as suggested by four out of twenty-one interview respondents.

4.7 Summary and Link

The present chapter discusses matters concerning the facilities performance evaluation in the following perspectives:

1- The extent of practice in the Malaysian facilities management organisational context;

2- The challenges faced by the organisations in performing facilities performance evaluation; and

3- The critical success factors in effective performance evaluation.

As discussed in Section 4.4 and **Figure 4.2**, the extent of practice of FPE could be presented in the following dimensions:

(D1)   Level of preparedness of the FM organisations to conduct FPE;

(D2)   Approach by FM organisations towards FPE;

(D3)   Role and contribution of FPE towards the management of facilities in FM organisations.

The finding of the analysis in Section 4.4 reveals the six elements that are most in place in facilities management organisations in Malaysia are as shown in **Table 4.24**:

ractice in FM organisations

			Dimension
		facilities performance evaluation exercise are used for facilities performance optimisation and improvement	D3
2		*Outcomes of the evaluation are used in decision making and problem solving*	D3
3		*Performance evaluation of facilities is conducted based on the pre-determined schedule*	D2
4		*The outcomes of performance evaluation are very significant for facilities management budget planning*	D3
5		*Relying entirely on internal evaluation team to conduct the facilities performance evaluation*	D1
6		*A specific technique of inspection and data collection was used for facilities performance evaluation*	D1,D2

The present focus of FM organisations is on the FPE role and contribution rather than the preparation for conducting FPE and approach towards conducting quality FPE. The extent of FPE practice is also linked with the challenges and critical success factors in conducting them.

The challenges in conducting FPE are relatively associated with:

1) Ownership of the facilities performance evaluation which includes the questions of who should conduct the FPE and who should bear the cost of conducting the FPE. However, the issues could be solved by incorporating the responsibility of conducting FPE in the SLA; both clients and FM top management are less aware of the important role played by FPE in management of facilities effectively.

2) Awareness of the roles and benefits of the FPE is relatively low amongst the FM stakeholders in Malaysia. The stakeholders include the FM organisations, the employees, the facilities owner, the facilities occupants/users and the public.

The questionnaire survey identifies the three most challenging factors in conducting FPE in Malaysian FM organisations as follows:

1) Interpreting and drawing conclusions from the data and information collected;
2) Collecting and obtaining data and information about the building; and
3) Lack of staff with relevant knowledge in conducting FPE.

The critical success factors determine the mandatory factors that organisations should have for successful FPE. From the analysis and discussion of the survey results in Section 4.6, it could be inferred that FM organisations strongly urge the element of knowledge management

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...k or process which requires highly skilled, knowledgeable ...e evaluation and make recommendation as an output of the ...that the critical factors for successful FPE is related to how the organisation dealt with management of knowledge.

Therefore, five most critical factors identified in the present research are listed in orderly sequence as follows:

1) Knowledge and skill of evaluators;
2) The quality of outputs/reports of the evaluation;
3) Accessibility to the data and information;
4) Availability and adequacy of facilities information database; and
5) Having a clear statement about the evaluation objectives.

The extent of practice, challenges and critical success factors discussed in the present chapter will be navigating the research towards the need for knowledge to be managed wisely and more formally in FM organisations in general and in FPE process itself specifically. Within the present research context, the knowledge mapping approach is the element to be employed to address the issues and satisfy the critical success factors in FPE.

To improve the practice of FPE practice so as to satisfy its intended objective, it could be suggested that the FM organisation should:

1) Develop and provide comprehensive guidance for conducting a FPE that could be used by the existing staff and referred to by new staff;
2) Develop a knowledge management framework so the organisation could identify its strengths and weaknesses. By having such frameworks, the organisation could always be sure that they are ready to conduct FPE task;
3) Employing an integrated facilities database which includes information such as building information, space management, tenant information, maintenance management information, past evaluation, vendors and staff directories. The database should be easily accessed by relevant staff from their desk. The online directories could assist in finding who does what and where they are;
4) Provide on-going learning so that existing staff could constantly update their knowledge;
5) Encourage staff within the organisation with a common interest to establish networking with each other so that the sharing of knowledge could be transpired;

ystems so that information could be searched in a number

asier to find;

taff can access all kinds of organisational information and

knowledge that might otherwise take a great deal of time and energy to find.

Hence, the following chapter explores the increasing role of knowledge mapping in FM organisations as well as factors that contribute to such developments.

OF KNOWLEDGE MAPPING IN NG FACILITIES

5.1 Introduction

The preceding chapter discussed the extent of facilities performance evaluation practice by facilities management organisations in Malaysia. The present chapter intends to satisfy the 2nd (second) objective of the research that is:

> *"To explore the increasing role of knowledge mapping in the management of facilities in Malaysia and document factors that has given impetus to this"*

In order to satisfy the objective, the qualitative and quantitative analyses in the present chapter will seek the answer to part of the second research question in the present research:

> *What are the roles that knowledge mapping play in facilities management organisations and what are the factors that foster those roles?*

Therefore, to satisfy the research objective and to seek the answer for the research question, the present chapter will be laid out in the following structure:

(1)   Discussions on the importance of knowledge mapping in FPE;

(2)   Discussion on the influence of ICT in FPE;

(3)   Discussion on the factors that are critical in conducting FPE; and

(4)   Finally a summary of this chapter is provided with links to potential future work.

5.2 The Role of Knowledge Mapping in Facilities Management Organisations in Malaysia

The questionnaire survey was used to seek the level of importance of the identified knowledge mapping roles. The analysis of data was carried out using the Statistical Package for Social Science (SPSS). The analysis dealt mainly with the ranking of the level of importance of the roles of knowledge mapping in facilities management organisation. This aspect of the analysis investigated facilities managersø perception towards the role of knowledge mapping by ranking the mean response as follows:

$+ (f_4 \times s_4)$

Where,

f= the frequencies for rating

s = the score

N = no of response

Table 5.1 shows the rank of knowledge mapping role in managing facilities perceived by the survey respondents. The rankings are based on the mean score of each identified role whereby as the mean score increases, the level of importance of the role decreases. Five most important roles of knowledge mapping in FM organisations as perceived by questionnaire survey respondents are:

Ro1:   Improving knowledge asset inventory by providing a comprehensive database of the building and facilities information;

Ro2:   Improving knowledge asset inventory by providing directories of people and information;

Ro3:   Avoiding duplication of tasks in managing facilities;

Ro4:   Identify the knowledge needs (gap between available knowledge and required knowledge) within the organisation; and

Ro5:   Improving process workflow involved in managing facilities.

Role of knowledge mapping in providing building database (Ro1) ranked first with a mean score of 1.05. The low mean score which is close to 1.00 indicates that the collective agreement or nearly one hundred per cent of the respondents rated the role as õvery importantö. The bottom rank is the role of knowledge mapping in identifying knowledge sharing opportunities (Ro16) with the mean score of 2.31. Second from the bottom in the ranking is the role of knowledge mapping in identifying barriers for knowledge sharing (Ro15).

...pping in facilities management organisations

		Identified Role	Mean (N=188)
1		*Building database*	*1.05*
2	Ro2	*Provide directories*	*1.09*
3	Ro3	*Avoid duplication of task*	*1.15*
4	Ro4	*Identify knowledge gap*	*1.18*
5	Ro5	*Improve process*	*1.41*
6	Ro6	*Simplifying process*	*1.48*
7	Ro7	*Compile resource*	*1.49*
8	Ro8	*Optimise reuse information*	*1.50*
9	Ro9	*Decision making*	*1.51*
10	Ro10	*Problem solving*	*1.52*
11	Ro11	*Optimise organisational knowledge*	*1.53*
12	Ro12	*Optimise best practice*	*1.55*
13	Ro13	*Time saving*	*1.78*
14	Ro14	*Minimise cost*	*1.97*
15	Ro15	*Identify KS barrier*	*2.27*
16	Ro16	*Identify KS opportunity*	*2.31*

Meaning of scale (extent of importance of Knowledge mapping in FM):
1 (Very important), 2 (Important), 3 (Moderately important), 4 (Not important at all)

A further inspection of **Table 5.1** reveals that the roles of improving knowledge asset inventory by providing a comprehensive database of the building and facilities information is the most important role of knowledge mapping in the management of facilities in Malaysia. This is based on the lowest mean score of 1.05 and 98.9 per cent of the respondent rated as ÷very importantø and ÷importantø roles.

Razali and Juaniløs (2011) study on knowledge management implementation strategy among property management-related organisations in Malaysia revealed that strategies related to repository systems in organisations such as personal searching, having an officer or team, companyøs information system, systematic archives, mobile repository systems and regular audits are still at ÷low levelø and ranked last in knowledge management strategy. This is evidence that facilities management-related organisations are likely to have a comprehensive database. Since the core activities of facilities management organisations are building related endeavours, the primary database for facilities management organisations that is important for the operation is building information database.

on the mean score as shown in **Table 5.1** is avoiding duplication of tasks in managing facilities (Ro3) with 1.15 mean score. In percentage, one hundred per cent (100%) of the respondents perceived that the role of knowledge mapping in facilities management organisations in avoiding duplication of tasks in managing facilities as õvery importantö and õimportantö.

It could also be inferred that both roles of providing building database and expert and information database rely on information technology especially information system. The implication of having a comprehensive, integrative and reliable information system could also improve efficiency and effectiveness by saving spaces for storage, minimising search time and improving accuracy of the data and information search.

Literature review (for example, Vail, 1999, Egbu et al.,Wexler, 2005, and Eppler,2008) stressed the role of knowledge mapping in providing the means for decision making and problem solving. Questionnaire survey results in **Table 5.1** shows that the role of knowledge mapping in improving decision making and problem solving within organisations are ranked ninth (mean score 1.51) and tenth respectively (mean score 1.52). Low mean score which is close to a minimum 1.00 and high percentage of respondents rated õvery importantö and õimportantö with 97.9 per cent for decision making role and 97.3 per cent for problem solving role; thus the low ranking indicates that both variables play important roles in facilities management organisation in Malaysia.

On the contrary, the role of knowledge mapping in identifying the barrier that eliminates knowledge sharing across organisations and identifying knowledge sharing opportunities across organisations are ranked last and second last in the list of sixteen identified roles of knowledge mapping in organisations with mean scores of 2.27 and 2.31 respectively. This implies that the roles of knowledge mapping in enhancing knowledge management specifically for knowledge sharing are yet to be explored. However, as discussed in the previous section, knowledge mapping is at the early stage for knowledge management implementation, and could be linked to other elements of knowledge management in the future. The oblivion towards the important role of knowledge mapping in identifying potential for knowledge sharing was highlighted by Woo *et al*. (2004):

at collecting and storing explicit knowledge in organisation ...od at tracking and sharing tacit knowledge" (Woo et al.,

An interview result as shown in **Table 5.2** which was based on the quotation by the respondent confirmed the highly important role of knowledge mapping in õImproving knowledge asset inventory by providing a comprehensive database of the building and facilities informationö (Ro1) and õImproving knowledge asset inventory by providing directories of people and information.ö (Ro2). In contrast, a close observation of **Table 5.2** reveals that the interview respondents perceived as significantly important the roles of knowledge mapping in õimproving decision making process within the organisationö (Ro9) and õimproving problem solving process within the organisationö (Ro10). Decision making and problem solving are closely related and it could be inferred that the FM organisations are aware of the roles and positively stepped forward to exploit its benefits. One of the interview respondents quoted that he is aware of the important role of knowledge mapping in problem solving, but post a query of the suitable tools and techniques so that the benefits could be gained successfully.

> *"..our routine here is dealing with problems….occupant (related) problem, building technical (related) problem ..and this issues must be address as fast as possible. Truly most of the problems solved with our past experience dealing with the same issues….no specific procedure or techniques for that (I think).."*

Another response of the interview respondents suggested the important role of knowledge mapping in managing facilities by giving a condition for effective implementation. The given condition denotes an assurance of the actual benefits that they could gain from the knowledge mapping initiative:

> *"In my opinion, I think that if facility managers have problems related to his/her task and role in managing building facilities, definitely they would need immediate source to knowledge, data and information in order to effectively solve the problems. So, if knowledge mapping could provide necessary access to that knowledge, the knowledge mapping is very useful and effective for effective problem solving in managing facilities"*

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suggested that the role of knowledge mapping is critical in projects in facilities management organisations especially organisation's performance:

> *"What we experienced here, I think knowledge mapping is a key and vary basic for effectively build knowledge management. Within this perspective, it can be guessed that knowledge mapping is effective and useful to search and find out right knowledge and knowledge owners. Furthermore, knowledge transfer and knowledge dissemination can be more effective. As a result, knowledge and capability of staff may be improved and facility serviced and its performance may be improved as well."*

Table 5.2: *Role of knowledge mapping in facilities management organisations highlighted by interview respondents*

Coding	Role	Nos. of respondents	Score (%)	New issues brought up
Ro1	Building database	21	100	
Ro2	Provide directories	21	100	
Ro3	Avoid duplication of task	9	43	
Ro4	Identify knowledge gap	10	47	
Ro5	Improve process	16	76	
Ro6	Simplifying process	7	33	
Ro7	Compile resource	1	5	
Ro8	Optimise reuse information	2	10	~ Nil ~
Ro9	Decision making	6	29	
Ro10	Problem solving	4	19	
Ro11	Optimise organisational knowledge	5	24	
Ro12	Optimise best practice	2	10	
Ro13	Time saving	8	38	
Ro14	Minimise cost	0	0	
Ro15	Identify KS barrier	0	0	
Ro16	Identify KS opportunity	0	0	

*N = 21

Surprisingly, **Table 5.2** shows that, many of the knowledge mapping roles which gained a significantly high score in the questionnaire survey are either rarely mentioned during the interview or not mentioned at all by the interview respondents. Hence it could be inferred that FM organisations are not really aware of the role and contribution of knowledge mapping. The respondents might realise those roles while rating the variables in the questionnaire. The knowledge mapping roles that had few citations or not cited at all are as follows:

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knowledge asset inventory by compiling internal and ...ources;

Ro8:   Optimising the opportunity to re-use information;

Ro12:   Optimising opportunity to update best practice databases;

Ro14:   Improving planning process by minimising overall operating cost;

Ro15:   Identifying the barrier that eliminates knowledge sharing across organisation; and

Ro16:   Identifying knowledge sharing opportunities across organisation.

Summary of interview finding in this regards is as shown in **APPENDIX G**.

From the interview and questionnaire results, it could be deduced that all FM organisations do not seem too aware of the knowledge mapping role with regard to improving facilities management operation and it could be inferred that the broader role of knowledge mapping is not fully explored and exploited by the facilities management organisations in Malaysia. The interview result also hints that the main possible cause for that is a very low or even absence of awareness of the benefits that knowledge mapping could offer for FM organisations in managing facilities effectively. The element of awareness is deliberated further in Chapter Seven in the present research. The awareness towards the importance of knowledge mapping could be achieved by several ways as suggested in knowledge management literature. For example Valaei and Aziz (2012) suggested that in a series of workshop it is essential to create interest and stimulate the practice of knowledge management approach. Knowledge management related training and workshops in FM organisations in Malaysia in general as observed by Ali and Mohamad (2009) are perceived as õrelatively inadequateö. Besides improving individual skills and knowledge in the day to day operation, the training and workshop could also introduce new possible approaches in facilities management operation.

The top five of most important roles of knowledge mapping based on mean score (Table 5.1) in facilities management organisations are discussed in Sections 5.2.3, 5.2.4, 5.2.5, 5.2.6 and 5.2.7 later in the present chapter. An attempt is now made to identify whether FM service provision (i.e. in-house and out-source FM organisation) and sizes of FM organisations (i.e. small, medium and large) have influenced the role of knowledge mapping. The results are given in the following Sections 5.2.1 and 5.2.2.

...ping vs. FM service provision

...mapping from the two FM provision (in-house and out-...section. A mean value comparison of the important roles of knowledge mapping according to respondentsø service provision organisations is shown in **Table 5.3**.

Table 5.3: *Role of knowledge mapping in FM organisations according to FM service provision*

	Identified role	Out-source (N=66)		In-house(N=122)	
		Mean	Rank	Mean	Rank
Ro1	Building database	1.05	1	1.06	1
Ro2	Avoid duplicate of tasks	1.06	2	1.20	4
Ro3	Provide directories	1.11	3	1.08	2
Ro4	Identify knowledge needs	1.17	4	1.19	3
Ro5	Compile resource	1.43	5	1.52	9
Ro6	Optimise reuse information	1.44	6	1.53	10
Ro7	Optimise organisational knowledge	1.45	7	1.54	11
Ro8	Improve process	1.48	8	1.37	5
Ro9	Decision making	1.50	9	1.50	8
Ro10	Simplifying process	1.54	10	1.44	6
Ro11	Optimise best practice	1.55	11	1.56	12
Ro12	Problem solving	1.56	12	1.48	7
Ro13	Time saving	1.76	13	1.79	13
Ro14	Minimise cost	2.02	14	1.94	14
Ro15	Identify KS barrier	2.32	15	2.25	15
Ro16	Identify KS opportunity	2.38	16	2.27	16

Meaning of scale (extent of importance of Knowledge mapping in FM):
1 (Very important), 2 (Important), 3 (Moderately important), 4 (Not important at all)

Initially, the result from **Table 5.3** indicates the following;

1) Mean value of 1.05 (minimum) to 2.38 (maximum) for outsourced FM service provision and 1.06 (minimum) to 2.27 (maximum) for in-house FM service provision indicates a similar perception of the knowledge mapping role in FM organisations.

2) The in-house FM perceived that the role of knowledge mapping (Ro3, Ro4, Ro8, Ro10 and Ro12) is obviously less important than their counterparts in out-sourced FM.

3) The out-sourced FM perceived that the role of knowledge mapping (Ro2, Ro5, Ro6 and Ro7) is obviously less important than their counterpart in in-house FM.

ng the level of importance based on the mean score shown

cern whether the differences are significant or insignificant

ervice provisions. Therefore, a Mann-Whitney U test was used to identify the significant differences in perceiving the level of importance of the knowledge mapping role in FM organisations (see **Table 5.4**). Null hypothesis and alternative hypothesis for the test are as follows:

$H^0 =$ *the level of importance of the knowledge mapping role in FM organisation differs between types of facilities management service provision.*

$H^1 =$ *the level of importance of the knowledge mapping role in FM do not differ between types of facilities management service provision*

Table 5.4: *Mann-Whitney U Test for differences between FM service provision (i.e. out-sourced and in-house) in gaining knowledge mapping benefits in FPE*

	(Ro1)	(Ro2)	(Ro3)	(Ro4)	(Ro5)	(Ro6)	(R7)	(Ro8)
Mann-Whitney U	4011	3445	3870	3999	3753	3747	3748	3559
Wilcoxon W	11514	5656	11373	6210	5964	5958	5959	11062
Z	-.120	-2.61	-.933	-.119	-.882	-.897	-.888	-1.540
Asymp. Sig. (2-tailed)	.904	.009*	.351	.906	.378	.370	.375	.124

	(Ro9)	(Ro10)	(Ro11)	(Ro12)	(Ro13)	(Ro14)	(Ro15)	(Ro16)
Mann-Whitney U	3960	3684	4023	3611	3936	3828	3792	3726
Wilcoxon W	11463	11187	6234	11114	6147	11331	11295	11229
Z	-.212	-1.103	-.009	-1.333	-.297	-.593	-.712	-.925
Asymp. Sig. (2-tailed)	.832	.270	.992	.182	.767	.553	.477	.355

a. Grouping Variable: FM service provision

* results are statistically significant at p<0.05

Table 5.8 shows that only one variable that is significant with *p* value of 0.009. The other variables have *p* values of more than five per cent. Therefore, at five per cent level of significance, the null hypothesis is rejected and the alternative hypothesis is accepted. This means that the level of importance of knowledge mapping is not significantly differing according to types of FM service provision.

Taking the findings presented in **Table 5.3** and **Table 5.4** into consideration, the following observations may be deduced;

nd out-sourced FM provisions had similar perception on the ...dge mapping role in managing facilities. One of the reasons ...eds for knowledge in the organisation to be managed. The increase of awareness towards knowledge management in managing the facilities in Malaysia was also discussed by various authors such as Kamaruzzaman and Zawawi (2009), Mustapa and Adnan (2008), Hassan and Mohammed (2003), Razali and Manaf (2003), and Sapri and Pitt (2005). This is a positive sign for the knowledge mapping progression in terms of management of facilities in Malaysia.

Despite the rejection of the null hypothesis which indicates that differences in mean score values are too marginal and not statistically significant for the variables, there are slight differences shown in the mean score ranking. For example, the in-house FM perceived that the roles of knowledge mapping (Ro3, Ro4, Ro8, Ro10 and Ro12) are obviously less important than those perceived by their counterpart in out-source FM. In contrast, out-sourced FM perceived that the roles of knowledge mapping (Ro2, Ro5, Ro6 and Ro7) are obviously less important than their counterpart in in-house FM.

Apparently, for both of in-house and out-sourced FM provisions, the most important role of knowledge mapping is in õimproving knowledge asset inventory by providing a comprehensive database of the building and facilitiesö (Ro1). The electronic database has been widely used to store data and information on buildings by the FM organisations. The electronic database applied in the FM is used to store comprehensive data and information in electronic formats. Types of data and information that extensively benefited FM organisations are such as various types of building plans and detail drawings, specifications of buildings and facilities installation or structure, facilities performance reports, user manuals of mechanical equipment and electronic yellow pages for vendors, tenants or building residents as well as authorities and their relevant persons in-charge. By virtue of having a database on the building facilities, regardless in which service provision they are, FM organisations in general are more likely and able to cope with difficulties in retrieving information on the building facilities whenever it is required.

Interestingly, the roles of knowledge mapping in õidentifying the barrier that eliminates knowledge sharing across organisationsö (Ro16) and õidentifying knowledge sharing opportunities in organisationsö (Ro15) are perceived the second least and least important by the survey respondents. The knowledge mapping-related literatures emphasised both roles as important contribution by knowledge mapping to be exploited by various tools and

ple stressed the potential benefits of knowledge mapping in ndividuals and groups. In the same vein, Vestal (2005) could foster identification of opportunities and threats in knowledge sharing via identification of organisational knowledge, identification of individual knowledge gaps and skills.

5.2.2 The role of knowledge mapping according to organisational size

Another possible difference that is significant to be examined is the role of knowledge mapping in FM organisations from the perspective of organisational size. **Table 5.5** compares the ranking of knowledge mapping roles according to organisational size. The ranking is based on the mean score of each identified role of small, medium and large organisations.

Table 5.5: *Role of knowledge mapping in FM organisations according to organisational size*

Identified role		Small (N=56)		Medium (N=101)		Large (N=30)	
		Mean	Rank	Mean	Rank	Mean	Rank
Ro1	*Building database*	*1.00*	*1*	*1.01*	*1*	*1.30*	*2*
Ro2	*Provide directories*	*1.01*	*2*	*1.02*	*2*	*1.53*	*8*
Ro3	*Avoid duplicate*	*1.02*	*3*	*1.13*	*3*	*1.50*	*6*
Ro4	*Identify knowledge needs*	*1.04*	*4*	*1.17*	*4*	*1.51*	*7*
Ro5	*Improve process*	*1.45*	*9*	*1.44*	*5*	*1.27*	*1*
Ro6	*Simplifying process*	*1.54*	*12*	*1.46*	*6*	*1.47*	*4*
Ro7	*Compile resources*	*1.43*	*8*	*1.53*	*10*	*1.48*	*5*
Ro8	*Optimise reuse information*	*1.34*	*5*	*1.51*	*8*	*1.73*	*13*
Ro9	*Decision making*	*1.46*	*10*	*1.58*	*11*	*1.31*	*3*
Ro10	*Problem solving*	*1.47*	*11*	*1.50*	*7*	*1.60*	*9*
Ro11	*Optimise organisational knowledge*	*1.36*	*6*	*1.52*	*9*	*1.80*	*14*
Ro12	*Optimise best practice*	*1.37*	*7*	*1.60*	*12*	*1.81*	*15*
Ro13	*Time saving*	*1.84*	*13*	*1.78*	*13*	*1.67*	*11*
Ro14	*Minimise cost*	*2.14*	*14*	*1.98*	*14*	*1.63*	*10*
Ro15	*Identify KS barrier*	*2.41*	*15*	*2.39*	*15*	*1.68*	*12*
Ro16	*Identify KS opportunity*	*2.43*	*16*	*2.40*	*16*	*1.87*	*16*

Meaning of scale (extent of importance of Knowledge mapping in FM):
1 (Very important), 2 (Important), 3 (Moderately important), 4 (Not important at all)

Providing building database is the greatest role for small and medium organisations but ranked second by large FM organisations. Databases of the building are very important for FM organisations for efficient maintenance operation, changes and upgrading of building facilities and general facilities management at large regardless the size of organisation. Strong reliance on the building database in management of facilities hints at the positive direction of

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organisations. Multiple types of data in various forms need ... on management to enable the data and information to be ... he use of data based on the question of õwhatö, õwhereö, õwhoö õwhenö and õhowö as suggested by Wexler (2001).

The result from **Table 5.5** obviously shows the existence of differences in perceiving levels of importance of the knowledge mapping roles in FM organisations. It is important to identify the significant differences between sizes of organisations. Therefore, the Kruskal-Wallis test was used to identify the significant differences in perceiving the level of importance of the knowledge mapping roles in FM organisation (see **Table 5.6**) according to three different sizes of FM organisations. Null hypothesis and alternative hypothesis for the test are as follows:

$H^0 =$ the level of importance of the knowledge mapping role differs between size of facilities management organisations.

$H^1 =$ the level of importance of the knowledge mapping role do not differ between sizes of facilities management organisations.

Table 5.6: *Kruskal-Wallis test statistic of the role of knowledge mapping in FM organisations according to organisational size*

	(Ro1)	(Ro2)	(Ro3)	(Ro4)	(Ro5)	(Ro6)	(Ro7)	(Ro8)
Chi-Square	31.911	35.970	72.505	22.344	2.882	7.775	8.138	3.805
df	3	3	3	3	3	3	3	3
Asymp. Sig.	.000*	.000*	.000*	.000*	.410	.051	.043*	.283

	(Ro9)	(Ro10)	(Ro11)	(Ro12)	(Ro13)	(Ro14)	(Ro15)	(Ro16)
Chi-Square	7.166	1.109	10.339	1.175	3.811	9.617	26.115	17.832
df	3	3	3	3	3	3	3	3
Asymp. Sig.	.067	.775	.016*	.759	.283	.022*	.000*	.000*

a. Kruskal Wallis Test
b. Grouping Variable: number of employees
* results are statistically significant at p<0.05

According to the results given in Table 5.10, nine (9) out of sixteen (16) variables has a *p* values of less than 0.05. This indicates that, at five per cent level of significance, the null hypothesis is accepted, which means that ‑the roles of knowledge mapping are different according to organisational sizeö. The aforementioned denotes that the roles of knowledge mapping for small, medium and large FM organisations are viewed differently.

ussed based on the five most important roles of knowledge
... interview respondents.

5.2.3 Role in improving knowledge asset inventory: Building and facilities information

Knowledge mapping promotes a systematic and comprehensive database for facilities management organisations to benefit from building maintenance and facilities management tools developed by the information technology organisations.

The result presented in **Table 5.1** indicates that õImproving knowledge asset inventory by providing a comprehensive database of the building and facilities informationö (Ro1) is the most important role for FM organisations in managing facilities. **Table 5.7** indicates that nearly 99 per cent of the respondents rated this variable as very important and important. This role could be achieved by having an appropriate information system that enables the building and facilities to be stored, retrieved and updated efficiently.

Table 5.7: *Level of importance of knowledge mapping in improving knowledge asset inventory by providing a comprehensive database of the building and facilities information in facilities management*

Level of Importance	Frequency	Percentage	Cumulative (%)
Very important	*180*	*95.7*	*95.7*
Important	*6*	*3.2*	*98.9*
Fairly important	*2*	*1.1*	*100*
Not important at all	*0*	*0*	
Total	**188**	**100**	

Table 5.6 shows that large organisations ranked Ro1 as second important, a slightly different ranking than small and medium organisations which perceived Ro1 as the most important role of knowledge mapping.

An interview with facilities managers reveals that all of them admitted that facilities management organisations employed specific information systems to help them manage the database of the building. However, the extent of application might differ based on the individual organisationøs requirements and priority. Some examples of information technology-integrated database for facilities management system in practice are Computer

(CIFM)(Yu et al.,2000), Building Management System
nt System (FMS) (Wang and Xie, 2002) and Computer
AFM) (Barrett and Baldry, 2003). Interview respondents highlighted the application of facilities managements-integrated information system that was comprehensively used to store and retrieve data and information.

> *"We are here working based on all building information and databases that we have. (the information system) save a lot of our time. Provide a timely and very broad range of building database, storage space instead of physical file and effectively accessible for most of the team members in our organisation…if (such information) not in the system, at least we know where to get them"*

> *"We benefits from CMMIS especially for planned maintenance for example by generating job orders for scheduled maintenance of components. The systems also simplified the procurements by providing the details and specification of components or even the vendors"*

In different aspects, the consequent of the successful facilities management information system could also improve the role of facilities management organisations in enhancing the quality and cost-effectiveness of the service provided in at least the following areas (Barrett and Baldry, 2003):

- More efficient use of information at all managerial levels;
- Improve decision making;
- Improve managerial responsiveness; and
- Improve learning capacity and capability

5.2.4 Role in improving knowledge asset inventory: People and information

Table 5.2 shows almost similar responses received from the questionnaire survey respondents on the role of knowledge mapping in õimproving knowledge asset inventory by providing directories of people and informationö (Ro2). This role is very important to answer the question of õwhoö are the experts and õwhatö is their area of expertise. Knowledge map in the form of expert directories or õyellow pagesö helps FM organisations in accomplishing a task in managing facilities such as building maintenance, diagnosing building defects, and performance evaluation which requires expertsøinvolvements.

d information to the task and vice versa, could improve
cilities and avoid duplication of tasks. In other words,
ortant role in providing an inventory of experts within and
across the organisation, linking and locating them.

Table 5.8: *Level of importance of knowledge mapping in improving knowledge asset inventory by providing directories of people and information in facilities management*

Level of Importance	Frequency	Percentage	Cumulative (%)
Very important	*173*	*92*	*92*
Important	*13*	*6.9*	*98.9*
Fairly important	*2*	*1.1*	*100*
Not important at all	*0*	*0*	
Total	**188**	**100**	

Even though the FM organisation is service-based and has minimum number of staff as discussed in the literature (see Section 2.5); for organisations that operate in multiple sites, the database of the people and their areas of expertise are vital to be mapped. In this case, the great potential that internet features is worth to be exploited.

In line with this, one respondent emphasised the potential role of internet facilities that could be of benefit to access and retrieve information and data quickly and accurately across the geographical boundaries. The directories of people and their expertise could also be made accessible on-line so that such information could be accessible at other places.

> õ*online technologies now give companies unprecedented power to know precisely what is happened in their facilities and to act on that knowledge effectively"*

This role is more significant to the FM organisations that manage the facilities at multiple locations. The same respondent also outlined the benefits of internet networking for facilities management organisation that manage the facilities in different geographical locations.

> *" ...that is just as true for companies that operate in multiple locations as those that own a single building (site)"*

In addition, as a powerful tool for knowledge mapping, the potential benefits of internet could be exploited by facilities management organisations for mapping the individual expertise roles and processes within the organisation.

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n of tasks

normally occurred in the event of poor coordination and n. The duplications of tasks leads to inefficient time spent for one task, waste of resources and affecting overall organisational performance. Even though ranked third important role in facilities management organisation as shown in **Table 5.1** based on mean score, **Table 5.9** however reveals that all questionnaire respondents rated the role of knowledge mapping in avoiding duplication of tasks in facilities management as õvery importantö and õimportantö. Egbu (2006) suggests that knowledge mapping would be able to reduce the barrier between individuals and groups in the organisation. By reducing such barriers, knowledge could be shared effectively and simultaneously prevents double tasking.

Table 5.9: *Level of importance of knowledge mapping in avoiding duplication of tasks in facilities management*

Level of Importance	Frequency	Percentage	Cumulative (%)
Very important	*159*	*84.6*	*84.6*
Important	*29*	*15.4*	*100*
Fairly important	*0*	*0*	
Not important at all	*0*	*0*	
Total	**188**	**100**	

Vestal (2003) suggests that top management should provide avenues for knowledge and information exchange to avoid repeating mistakes and clarify the individual roles to avoid duplication of actions. By having a clear statement of their roles, the individualøs or groupøs role in the organisation could be more focused on the specific area of the task with a certain limitation of their scope of work. One of the interview respondents suggested that by having a clear scope of work, every staff in the organisation could understand their role and other roles in one organisation.

> *"By having a clear scope of works and everyone have understand what others role in the task, I think one task could be done more efficient"*

In regulating the roles, the facility managers should ensure their subordinates also understand their roles individually.

to make sure from at all time, everyone in this company ...ope of work no matter it is generic or specific…routine or a

This suggests that duplication of tasks could be avoided by regulating the communication within the organisation. Therefore, in addressing the issues, the FM organisation should ensure that it:

1) Has a clear statement of the individual's or group's roles in the organisation;

2) Have regular meetings to organise activities and actions by individuals and groups in the organisation;

3) Shares the same terms of reference by all parties within the organisation; and

4) Exploits the benefits of information and communication technology available in the organisation.

5.2.6 Role in identifying knowledge gaps

Table 5.10 that derived the results of mean scores in **Table 5.1** reveals that almost ninety-seven per cent of the questionnaire survey respondents perceived the roles of knowledge mapping in identifying the knowledge needs (gap between available knowledge and required knowledge) (Ro4) as õvery importantö and õimportantö. Tacitly, this result hints that the elements of informal knowledge audit are in place or at least they are aware of the roles in managing facilities. The majority (14 citations) of the interview respondents perceived that Ro4 is important in managing facilities.

Table 5.10: *Level of importance of knowledge mapping in identifying the knowledge needs (knowledge gap) in facilities management.*

Level of Importance	Frequency	Percentage	Cumulative (%)
Very important	*156*	*83*	*83*
Important	*31*	*16.5*	*96.5*
Fairly important	*1*	*0.5*	*100*
Not important at all	*0*	*0*	
Total	**188**	**100**	

...ledge gap involves the task of ascertaining the available ...ge in the organisation. The task includes analysing what is ...in satisfying facilities management roles and what is the existing gap of knowledge. In this regards, Vestal (2005) suggests the knowledge management team to resolve four (4) enquiries:

1- What critical knowledge is missing?

2- What (or who) hinders the flow of knowledge within the process? Why?

3- What (or who) enhances the flow of knowledge? Why?

4- What are the next steps for the knowledge map? (What is it going to be used for?)

Analysis of the enquiries could guide the knowledge management team to choose the core content of the information and knowledge that could be compiled and linked in the knowledge mapping task. The analysis of core information needs and uses in organisations is also referred to as knowledge audit (Liebowitz et al., 2000). Hence, the available knowledge within the organisation is always too broad, insufficient, redundant, unstructured, overlapped and out of context. Yasin and Egbu (2011) suggest that top management should develop a framework of the organisationøs knowledge body to re-capture knowledge loss, capture new knowledge and retain existing knowledge within their organisations.

As the identification of organisational knowledge involves complex and time consuming processes (Yasin and Egbu, 2011), it could be suggested that top management:

1) Develop a framework of the organisationøs knowledge so as the knowledge gap is further visible;

2) Focus on the primary knowledge audit at the earlier stage and maintain the process which is less complex at the later stage; and

3) Explore and exploit the advantage of information and communication technologies available for gaps analysis, linkages of knowledge and knowledge mapping representations.

processes workflow

improved with wide understanding of processes involved ...is could happen in the event that all members in the organisation get familiar with their roles and other membersø roles, sequences in the task and identify the challenges and critical success factors involved. The response from the survey as shown in **Table 5.11**, is evidence of the significant role of knowledge mapping in õimproving overall process workflowö (Ro5) in facilities management. Nearly sixty per cent of the respondent rated this as õvery importantö and the rest rated this as õimportantö.

Table 5.11: *Level of importance of knowledge mapping in improving overall processes workflow involved in managing facilities.*

Level of Importance	Frequency	Percentage	Cumulative (%)
Very important	*111*	*59*	*59*
Important	*77*	*41*	*100*
Fairly important	*0*	*0*	
Not important at all	*0*	*0*	
Total	**188**	**100**	

As an improvement of process workflow could take place continuously after each of the completed work cycle, such improvement should consider:

1) Evaluating and analysing each measure in management of facilities in order to identify their strengths and weaknesses;

2) Eliminating unnecessary or lower implication processes that could impact on the efficiency and effectiveness of the task;

3) Introducing new approaches or necessary steps that could improve the efficiency and effectiveness in the task; and

4) From time to time, identifying best practices in the task to suit the organisational needs.

Knowledge mapping could effectively contribute to those improvements by visualising the relationships between the process and the people. Vistal (2005) suggests that the benefits that could be exploited by having a process map are:

1) All employees will understand the shared vision of a process

2) It provides an accurate snap-shot of the process

3) It aids in identifying non-value added tasks

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new employees

where in-process measures need to be used.

5.3 Factors influencing the increasing role of knowledge mapping in FM

Organisations are constantly looking for new, innovative ways to increase their competitive advantage. To find these areas of advantage, researchers need to examine what successful organisations are doing in todayøs world. These organisations are the high performers. High performance organisations have several key elements that enable them to grow. Bullinger (1999) listed them as:

- *Core competence*. High competitiveness, achieved through a process which concentrates itself on the actual competence and precedes the process of growth.

- *Networks and cooperation's.*. Demands on the company are becoming more and more complex. In order to be able to concentrate on core competence, the companies have to look for partners and cooperate with them industry wide.

- *Process orientation*. Decentralized process and product-oriented organisational structures are generally more suitable for growth than central, functional-oriented ones; it is easier to connect and disconnect profit centres and independent business areas in the form of a company organisation, than to inflate and reduce functional departments.

- *Free margins*. The creation of growth cells in the company, e.g. with creative teams, corresponding structural freedom and a variable schedule, so that every employee can think about processes, products, structures, problem fields and improvement potentials in general. In this case, it is required to reduce formalisms in workflow organisation and leadership.

- *Learning organisational structures*. The capacity of learning is becoming a core capacity in innovative, growth-oriented companies. Learning is necessary in order to improve oneself, to grow more productive and to gain the ability to adapt oneself to changes ó and this faster than the competition.

- *Knowledge management and information technology*. Knowledge and information are a basis for creativity and the capacity to learn. Management of knowledge does not only take place in the company, but is also accomplished in a comprehensive way. To

formation technology has to be created. Particularly, Internet would provide a good solution.

The progression and growth of the FM industry are discussed in Section 2.2.5. As a service provider, both in-house and out-sourced FM organisations have to progress concurrently with the country's economic growth (Hamid, 2005). The economic growth has resulted in a higher living standard of the public in general and facilities users in particular. Logically, the expectation of users is also increasing towards quality workplace, home or even common building facilities. The user demand drives facilities management organisations to a higher level. Mustapa (2006) for example, observed that two elements of changes are currently taking place in FM service in Malaysia. The first change is the positive user or client-oriented service rather than profit-oriented service; the second change is the high ICT dependency in FM operations. A number of authors (e.g. Razali and Juanil, 2011; Kamaruzzaman et. al., 2010; Noor and Pitt, 2010; Mustapa, 2006) suggest that elements of knowledge management are strategically important to boost such improvements in FM organisations in Malaysia. This is evidence that such elements are influential to the increasing role of knowledge mapping in Malaysian FM organisations.

Table 5.12 shows the result of the questionnaire survey on the factors that influence the growth of knowledge mapping needs for management of facilities in FM organisations. The ranking is based on the mean score of each factor. The lower mean score means the higher influence towards the needs for knowledge mapping.

Table 5.12: *Influential factors in the rise of knowledge mapping role in Malaysian FM*

Rank	Influence factor	Mean (N=188)
1	Higher user demand for better quality facilities management service	1.14
2	Rapid development of information and communication technology	1.15
3	Business competitiveness among facilities management providers	1.76
4	Increase of awareness towards knowledge management in facilities management organisation	1.77

Meaning of scale (factors that positively influenced the rise of the knowledge mapping role in FM in Malaysia):
1 (Very influential), 2 (Influential), 3 (Fairly influential), 4 (No influential at all)

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...ved by the respondents is õhigher user demand for better ...iceö with a mean score of 1.14. Besides the important factor ...ards harnessing knowledge mapping in their organisations, this result is also evident that FM is a customer or user-driven organisation and knowledge mapping approaches could help in improving effectiveness and efficiency in the management of facilities.

Second most influential is the factor of ICT development with which information and communication were made easier. Products related to database system, monitoring and internet facilities offer the facilities management organisation an alternative for advanced tools and technologies from the conventional way in managing facilities.

Third most influential factor is õbusiness competitiveness among facilities management providersö with the mean value 1.76. In ensuring the organisation provides the best service to the clients, the effectiveness and efficiency of service are possibly one of the approaches to attain them. Therefore, this is one of the most important factors for FM organisations to explore the potential benefits of knowledge mapping.

The least influential factor for FM organisations to implement knowledge mapping benefits as perceived by the respondents is õincrease of awareness towards knowledge management in FM organisationö. This means, the respondents perceived that the increasing role of knowledge mapping in FM organisations is less implicated by knowledge management awareness compared to factors such as ICT development, business competitiveness and user demand for better quality FM service. The result shown in Table 5.12 also reveals an obvious rift between factor one and two and three and four.

Thus it could be deduced that the FM organisation is more receptive towards the development of ICT in the management of facilities effectively. Elements of knowledge mapping have benefited from the ICT function to generate effective and efficient database, storage, retrieval, communication and use of information appropriately, accurately and timely (Barrett and Baldry, 2003). The application of ICT elements is also driven by user demand for better quality of FM service. The user demand for quality service includes a rapid response to their complaints and proactive maintenance measures besides satisfying the contents of SLA. Barrett and Baldry (2003) also suggest that the development of ICT mainly helps FM organisations in the following manner:

of information at all managerial levels;

making;

al responsiveness; and

iv-   Improves learning capacity and capability

Despite the high influence based on the mean score of the factors, an attempt is needed to examine the differences in the factors of FM service provision (in-house and out-sourced) and FM organisational sizes (small, medium and large) towards the increasing role of knowledge mapping in management of facilities in Malaysia.

Table 5.13 shows the comparison of mean score of the influential factor in the rise of knowledge mapping role between out-sourced and in-house FM organisations. The result shows that the mean values for each factor of out-sourced FM organisations are lower compared to in-house FM organisations. This indicates that out-sourced FM organisations have more influence on the factors compared to in-house FM. Out-sourced FM are more sensitive to the user demand and prioritised the factor as most influential compared to in-house which was more influenced by development of ICT.

Similar perception was found in õbusiness competitiveness among FM providersö which ranked third by the out-sourced FM but ranked fourth by in-house FM. The in-house FM perceived that õincrease of awareness towards knowledge management in FM organisationö is more influential than the business competitiveness.

Table 5.13: *Influential factors in the rise of knowledge mapping role in Malaysia according to FM service provision*

Impact factor	Out-source (N=66)		In-house(N=122)	
	Mean	Rank	Mean	Rank
Higher user demand for better quality facilities management service	1.02	1	1.22	2
Rapid development of information and communication technology	1.06	2	1.20	1
Business competitiveness among facilities management providers	1.08	3	2.15	4
Increase of awareness towards knowledge management in facilities management organisation	1.59	4	1.86	3

Meaning of scale (factors that positively influenced the rise of the knowledge mapping role in FM in Malaysia): 1 (Very influential), 2 (Influential), 3 (Fairly influential), 4 (No influential at all)

could be deduced so far that:

f knowledge mapping gained by out-sourced and in-house FM as discussed in Section 5.2 (see Table 5.3 and 5.4), the factors that influence the growth are different;

ii- The stronger influence on the out-sourced FM organisations not only hint that they are more positive towards the implementation of knowledge mapping, but also verified that out-sourced FM is more alert to the continuous improvement in FM practice;

iii- õBusiness competitivenessö disregarded by the in-house FM organisations possibly because of their exclusive role as a department or section in the organisation in-charge of the management of the facilities. The negative implication of neglecting the competitiveness issue could risk shrinking the organisationøs role in managing facilities as the organisation could consider other departments or sections to perform part of the FM organisationøs role. In severe situation, if the top management considered that the competitiveness of FM unit, section or department is insufficient, the management could also consider the FM role to be out-sourced.

Despite the differences, it is important to identify whether the differences are significant or otherwise insignificant. For that, a Mann-Whitney U test is used to identify the level of significance between the two FM service provisions. Consequently, a null hypothesis and alternative hypothesis are set as follows:

$H^0 =$ *the factors that influence the increasing demand for knowledge mapping in FM organisation differs between types of facilities management service provision.*

$H^1 =$ *the factors that influence the increasing demand for knowledge mapping in FM do not differ between types of facilities management service provision*

...tistic for Influential factor in the rise of knowledge mapping role ...provision

	User Demand	ICT Development	Business Competitiveness	Awareness
Mann-Whitney U	3326	3509	1489	3089
Wilcoxon W	5537	5720	3700	5300
Z	-3.396	-2.389	-7.933	-3.143
Asymp. Sig. (2 tailed)	.001*	.017	.000*	.002*

Grouping variable: Organisation

* results are statistically significant at p<0.05

Based on the Mann-Whitney U test for significance as shown in **Table 5.14**, at five per cent level of significance, three out of four variables show a significant result (below five per cent). Therefore, it could be suggested that the null hypothesis is accepted. This result confirmed that the factor influencing the increasing demand for knowledge mapping in FM organisations differs between types of facilities management service provision (i.e. out-sourced and in-house).

Another perspective of influence factor that positively influenced the rise of knowledge mapping role in the management of facilities is the sizes of organisations (i.e. small medium and large).

Table 5.15 shows a comparison of mean score and ranking between small, medium and large FM organisations in perceiving the influence factor in the rising knowledge mapping role in FM organisations.

An inspection to **Table 5.15** reveals that, in general, the mean score between the small, medium and large organisations are relatively similar. Medium and large FM organisations perceived that the most influential factor is õhigher user demand for better quality facilities management serviceö followed by õrapid development of information and communication technologiesö as second in the list. Small FM organisations however, perceived õrapid development of information and communication technologiesö as the most influential factor and õhigher user demand for better quality facilities management serviceö comes in second. The possible reason for the slight difference between small FM organisations and medium and large FM organisations is influenced by several factors such as number of employees they have, their clients or user preference and business objectives. Small organisations have smaller number of employees and are always coherently seeking for smarter ways of

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human resources; therefore the development of ICT offers as managing information, simplifying processes and ment systems. The tools offer a great range for the information and knowledge within the organisation to be mapped effectively. The medium and large organisations however, are driven by the user needs. Implementation of knowledge mapping is inspired by the users who expect effective and efficient service such as smarter ways of lodging complaints and requests, prompt response for repairing and rectification of facilities defects and proactive maintenance planned.

Large organisations perceived õbusiness competitiveness among facilities management providersö as the third most important factor that influences the rise of knowledge mapping roles in FM organisations. This is consistent with the large organisation as a user and business driven organisation which is more reactive to the demands and trends of the business and users that lead to the exploration of the knowledge mapping roles. For small and medium FM organisations õincrease of awareness towards knowledge management in FM organisationö factor was ranked third most important factor compared to large organisations which ranked it fourth. The knowledge management awareness factor is more influential to the small and a medium organisation is possible evidence that small and medium FM organisation is more dynamic and determined in improving organisational performance through innovation. The innovation in the present context is improving efficiency and effectiveness of processes in organisation through exploring knowledge mapping attributes.

Table 5.15: *Influential factors in the rise of knowledge mapping role in Malaysia according to size of organisation*

Influential Factor	Small (N=56)		Medium (N=101)		Large (N=30)	
	Mean	Rank	Mean	Rank	Mean	Rank
Higher user demand for better quality facilities management service	1.16	2	1.07	1	1.33	1
Rapid development of information and communication technology	1.05	1	1.14	2	1.37	2
Business competitiveness among facilities management providers	1.82	4	1.78	4	1.67	3
Increase of awareness towards knowledge management in facilities management organisation	1.77	3	1.76	3	1.73	4

Meaning of scale (factors that positively influenced the rise of the knowledge mapping role in FM in Malaysia): 1 (Very influential), 2 (Influential), 3 (Fairly influential), 4 (No influential at all)

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in **Table 5.15**, it is important to identify if the differences ...gnificant. Therefore, a Kruskal-Wallis statistical test was ...ults shown in Table 5.16. The null hypothesis (H^0) and alternative hypothesis (H^1) are set as follows:

$H^0 =$ *the factor that influences the increasing demand for knowledge mapping in FM organisations differ between size of organisation.*

$H^1 =$ *the factor that influences the increasing demand for knowledge mapping in FM organisations do not differ between size of organisation.*

Table 5.16: *Kruskal-Wallis test statistic for Influential factor in the rise of knowledge mapping role according to the organisational size*

	User Demand	ICT Development	Business Competitiveness	Awareness
Chi-Square	13.761	12.868	.496	.228
df	2	2	2	2
Asymp. Sig.	.001*	.002*	.781	.892

a. Kruskal Wallis Test

b. Grouping Variable: number of employees

* results are statistically significant at $p<0.05$

According to the results given in **Table 5.16**, two (2) factors show *p* values of less than five per cent (i.e. 1% and 2% respectively) and the other two show *p* values of more than five per cent (i.e. 78% and 89% respectively). Therefore, at five per cent level of significance, the null hypothesis failed and will be rejected. This confirmed the disparity between FM organisations on the factors that influence the increasing role of knowledge mapping in their organisations.

5.3.1 Influence of Information and Communication Technology (ICT)

A computer-based information system combines organisational, human and information-technology-based resources to generate the effective and efficient collection, storage, retrieval, communication and use of information. In this regard, Mustapa and Adnan (2008) contend that the advent of technology in facilities management is to accommodate the new innovations in building facilities:

...vices required computerised automation and this support ...in building management, and there have been constant ...ology sector. The progressive changes in technology has seen more and more new technologies being made available in Malaysia and the implementation or adoption of these new technologies often require advancement in management system and IT system" (Mustapa and Adnan, 2008)

Information system itself as the most important component in knowledge mapping and information system acts as a supporting tool to enable knowledge to be mapped effectively.

A good quality system provides appropriate, accurate and timely information which can pull together a potentially disparate facilities management function into an integrated and organised one which is explicitly geared towards strategic corporate objectives (Barrett and Baldry, 2009).

The integration of system is vital so that multiple databases could generate corresponding results and outcomes as required by the user. The uses of integrated system are as operational tools to store the data and information as well as to analyse and generate necessary information of many different types of operations. Typically, many different computer systems keep track of all information such as building-related information including utilities and energy consumption, technical specifications, spaces, safety and security, maintenance management and tenant management.

In the context of knowledge mapping as strategies to support the KM initiative, (Egbu et al., 2005) for example suggest that organisations should foster the exploitation of ICT to facilitate knowledge conversion process, and increase speed and ease of accessing the critical knowledge asset. Several tools such as ontologies, frame, petri net, cluster maps and webs, mind maps, computer generated associative networks, concept circle networks, concept circle diagrams, concept map, semantic networks, thesauri, conceptual graphs, visual thinking networking and topic maps are suggested to be explored and exploited in an organisational setting. General observation on the IT related literature reveals that FM software developers and vendors have included these mapping elements in their products and keep progressing to integrate more comprehensive elements to suit their clientsø needs.

e FM software must be more integrated to enable facilities

sive manner throughout the life cycle of the facilities.

s required to integrate data and achieve interoperability among software to support FM in practical ways. The growth of information technology application in facilities management organisations simultaneously increases the effectiveness of knowledge mapping in the organisation.

Table 5.17: *Influence of ICT development to the rise of knowledge mapping roles in facilities management*

Influence Level	Frequency	Percentage	Cumulative (%)
Very influential	161	85.6	85.6
Influential	26	13.8	99.5
Fairly influential	1	0.5	100
Not influential at all	0	0	
Total	**188**	**100**	

Table 5.17 summarises the various perspectives of knowledge mapping and its implications as discussed on knowledge management and knowledge management systems. The perspective relied upon most heavily as implied in the distinction of knowledge from data and information, is closely related to the perspective of knowledge as a state of mind**.**

The result also hints that the FM organisations are implementing or at least, are aware of the role of IT listed in the **Table 5.18** and therefore perceived that it has a very heavy influence towards the growing role of knowledge mapping itself in the FM organisation.

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...pectives and the role of information technology (adopted from

		Implication for knowledge mapping	Role of IT
Knowledge vis-a-vis data and information	*Data is facts, raw numbers. Information is processed/ interpreted data. Knowledge is personalized information.*	KM focuses on exposing individuals to potentially useful information and facilitating assimilation of information	KMS will not appear radically different from existing IS, but will be extended toward helping in user assimilation of information
State of mind	*Knowledge is the state of knowing and understanding.*	KM involves enhancing individual's learning and understanding through provision of information	Role of IT is to provide access to sources of knowledge rather than knowledge itself
Object	*Knowledge is an object to be stored and manipulated.*	Key KM issue is building and managing knowledge stocks	Role of IT involves gathering, storing, and transferring knowledge
Process	*Knowledge is a process of applying expertise.*	KM focus is on knowledge flows and the process of creation, sharing, and distributing knowledge	Role of IT is to provide link among sources of knowledge to create wider breadth and depth of knowledge flows
Access to information	*Knowledge is a condition of access to information.*	KM focus is organized access to and retrieval of content	Role of IT is to provide effective search and retrieval mechanisms for locating relevant information
Capability	*Knowledge is the potential to influence action.*	KM is about building core competencies and understanding strategic know-how	Role of IT is to enhance intellectual capital by supporting development of individual and organisational competencies

An example of current use of software relevant to facilities management work in FM organisations are Computer Aided Design (CAD) applications primarily developed for architecture or engineering design and drafting. Another category of software used extensively in FM is the database system. Interview respondents admitted that their organisations used Computerised Maintenance Management Information System (CMMIS) to support data querying, work scheduling and reporting for FM decision making. One of the interview respondents highlighted the role of the FM software in performing planned maintenance work.

air-conditioning need to be serviced by generating the job ...ance record of all equipment's....helps a lot to make

The growth of ICT product is continuous and this includes the information system and communication system that could impacted the management of knowledge and information. Many FM software products are available in the market claiming that their products are the most comprehensive and interoperable. However, as FM itself is differing in context and scope of coverage, a selective approach could be made by the FM organisation so that the software could be tailored to their unique requirements and FM objectives to make the tacit knowledge more visible and explicit knowledge more accessible in FM organisations.

The inference that could be made at this point is that the knowledge mapping appears to be misperceived by FM organisations to be IT as a whole. The possible cause of the misperception is the absence of universal and comprehensive definitions of knowledge mapping. Undeniably, knowledge mapping activities rely largely on IT as a tool in achieving the knowledge mapping objective such as storing and retrieving digital information, providing database and providing networking. The confusion of the role of IT also occurred in knowledge management at large (Champika, 2006) where their conceptual roles are always interchangeable. It could be deduced that IT has the most important component in knowledge mapping besides the people and the process (see **Figure 2.13** page 64).

5.3.2 Influence of User Demand for Better Quality Facilities Management

Table 5.19 shows the questionnaire survey results on the respondent feedback on the factors that influence the increasing role of knowledge mapping in facilities management organisations. Almost ninety eight per cent or one hundred and eighty respondent perceived that õuser demand for better quality facilities managementö is the most influential factor for increment of knowledge mapping role in facilities management organisations.

Table 5.19: *Influence of user demand for better quality FM on the rise of knowledge mapping role*

Influence Level	Frequency	Percentage	Cumulative (%)
Very influential	164	87.2	87.2
Influential	20	10.6	97.9
Fairly influential	4	2.1	100
Not influential at all	0	0	
Total	**188**	**100**	

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...cilities management organisations as a service-based entity ... This means that, the customer or user determines the level ... they required from facilities management organisations. British Standard (2006) for facilities management (Part 1 ó terms and definition) explains that the demand is:

> *"internal requirement of the primary activities for facility services (space & infrastructure and/or to people & organisation). Facilities Management demand is driven by primary activities. It is the responsibility of the client (at organisational level) to clearly define the facility Management strategy and requirements".*

The user demands are always translated into Service Level Agreements (SLAs). The British Standard (2006) also suggests that the supply and demand in facilities management depends largely on economic, organisational and strategic objective factors. In the same vein, Alexander (2003) extrapolates four (4) key issues that facilities management organisations should focus on to remain competitive in the future:

1) Increasing adaptability to changing business needs;
2) Providing a healthy workplace for creative people;
3) Assimilating the potential of new technologies; and
4) Ensuring full use of diminishing resources while minimising environmental impact.

As growth of knowledge mapping is positively driven by the demand for better quality facilities management, the element of user or customer satisfaction within the scope of knowledge mapping should be identified. Fitzsimmons and Fitzsimmons (1998) suggest that service management organisations should focus on innovation and understanding the social trends in achieving customer satisfaction. In the same vein, Ikram (2011) suggests that in service-based organisations, innovation could also introduce new technology. An example of the way knowledge mapping could expedite innovation in organisations is by having a best practice database map. The map could lead the user of the best practice processes or sub-processes to be involved in managing facilities innovatively. Understanding social trends could be explored by understanding the newness in social construct relevant to the building facilities such as usersø interest and technologies. This could be achieved by updating the new technologies related to building facilities.

...nagement Awareness in Facilities Management

...rived from mean score on **Table 5.12** indicate that almost ...ire respondents rated the awareness towards knowledge management as õvery influentialö. Almost sixty-five per cent however perceived the awareness towards knowledge management as only õinfluentialö towards the rise in the role of knowledge mapping in the management of facilities.

Table 5.20: *Influence of increase of awareness towards knowledge mapping to the rise of knowledge mapping role in facilities management*

Influence Level	Frequency	Percentage	Cumulative (%)
Very influential	55	29.3	29.3
Influential	122	64.9	94.1
Fairly influential	11	5.9	100
Not influential at all	0	0	
Total	**188**	**100**	

A significant number of authors (e.g Nutt. 2000; McLennan, 2000; Then, 2005; Rondeau 2006) suggest that awareness towards the important role of knowledge management amongst the facilities management organisations in general is increasing. In Malaysian FM context, the knowledge management content of implementation has also been discussed by several authors (eg. Kamaruzzaman and Zawawi, 2009; Hassan and Mohammed, 2005; Razali and Manaf, 2003). The awareness towards the implementation of knowledge management also indirectly impacted towards the important role of knowledge mapping elements to be exploited in the organisation (see Section 2.2.3). Knowledge mapping on the other hand, is very critical in initiating the knowledge management project especially to visualise the knowledge source, flows, and constraints and termination of tacit and explicit knowledge.

The aforementioned result inferred that the FM organisations are aware of knowledge mapping as part of knowledge management but not really sure the form of knowledge mapping component exists in their organisation specifically. This is evident by the response by the interview respondents that highlighted the influence factor as:

> *"....we do have knowledge management element in place but may be its not well structured. (can we call it knowledge management than?) Building information, database, directories….may be some of them are not or little integrates with each other's. Initially this is done to ensure that all information in this company is organised, fast and easy to access"*

that, awareness towards the implementation of knowledge ....d among FM organisations in the first place. The ....mapping complements a formal KM approach in an organisation. The awareness could be achieved by including KM content as part of the FM training or workshop in the future.

5.3.4 Influence of Competitiveness among Facilities Management Providers

Competitiveness denotes the willingness of the organisation to provide better FM service to the client or user in comparison with their competitors in the industry in general. The issue of competitiveness for in-house FM service emerged in the form of providing the best support service provider for the organisation. The in-house FM provider sought recognition that they also contribute significantly to the organisation's progress in their core business.

Table 5.21 clearly indicates that almost all of the respondents perceived that the factor of business competitive is õvery influentialö and õinfluentialö in the rise of knowledge mapping roles in FM organisations.

Table 5.21: *Influence of business competitiveness to the rise of knowledge mapping role in facilities management*

Influence Level	Frequency	Percentage	Cumulative (%)
Very influential	161	85.6	85.6
Influential	26	13.8	99.5
Fairly influential	1	0.5	100
Not influential at all	0	0	
Total	**188**	**100**	

In stressing the factor of business competitiveness, Vestal (2005) contends that knowledge mapping quickly gained favours among organisations due to three main reasons:

1- As a tool for identifying knowledge in the organisation;
2- As a tool for identifying gaps and skills; and
3- Identifies opportunities for improving organisational performance through knowledge sharing or reuse.

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e mapping initiatives have broadly benefited various types

gas industry, non-profit organisations, and military and

on with APQC.

5.4 Summary and Link

The discussion in the present chapter concerns the role of knowledge mapping in FM organisations at large and factors that influenced the growth of knowledge mapping roles in FM organisations.

Findings of the survey show five most important roles that FM organisations exploit from the knowledge mapping and ranked as follows:

1- Ro1:   *Improving knowledge asset inventory by providing comprehensive database of the building and facilities information*;

2- Ro2:   *Improving knowledge asset inventory by providing directories of people and information;*

3- Ro3:   *Avoiding duplication of tasks in managing facilities;*

4- Ro4:   *Identifying knowledge needs (gaps between available knowledge and required knowledge) within organisations; and*

5- Ro5:   *Improving process workflow involved in managing facilities.*

The roles of knowledge mapping that were exploited by FM organisations hint on the tools and techniques that are currently used by FM organisations in Malaysia. Most of the interview respondents however refused to reveal the specific software used in the management of facilities for unknown reasons. However, the guidelines by Barrett and Baldry (2003; pp 171-193) on the framework of information system in FM organisation could be useful for FM organisations to consider the software that is appropriate for their operation.

In this regard, as discussed in Section 5.4, factors that influence the rise of the role of knowledge mapping in FM organisations are driven by rapid development of ICT as the most influential factor and also driven by the user demand for better quality facilities service as the second most influential factor.

continuously increasing in FM organisations as more tools
...ve access to knowledge, better means for knowledge to be
...ng inferences and implications could be documented:

    i.   The role of knowledge mapping in FM organisations is significant and evolves through time, business direction, userøs expectation and availability of technology;

    ii.   Rapid developments in the ICT have significantly influenced the growth of knowledge mapping role in FM organisations. Simultaneously, facilities management software has also evolved and provided more advanced features (e.g. broadband internet, Wifi access and cloud computing) that could provide higher accessibility to information, faster retrieval of information and highly integrative database; and

    iii.   As FM organisations played a support function in the organisation, challenges to offer better service as expected by the clients always become a priority and emphasised. For that reason, improvements to maintain organisational competitiveness via implementing knowledge mapping in the organisation are vital.

Finally it could be deduced that two perspectives of FM organisations (organisational size and service provision) have much to gain from knowledge mapping initiatives. The indications are that, the initiatives are explored at some degrees, although a much more systematic approach is needed. The FM organisation would appear to need to develop understanding and awareness on the broad knowledge management trivia as an organisation enabler rather than as a resource-intensive additional initiative in inculcating knowledge mapping initiatives within their organisations.

Implicitly, based on the roles that are in place in FM organisations, the types of benefits appreciated by FM organisations are their links to the contribution of knowledge mapping in the context of speed and effectiveness in action (eg, Ro1, Ro2, Ro3, Ro4 and Ro5). The type of knowledge mapping benefits of being fast and effective in action or commonly cited as õeffectiveness and efficiencyö is investigated in one of the critical processes in FM - facilities performance evaluation, in the next chapter.

LE OF KNOWLEDGE MAPPING IN TIES PERFORMANCE EVALUATION

6.1 Introduction

The previous chapter discussed and explored the roles of knowledge mapping benefits in facilities management organisations illuminated in the organisational context in implementing knowledge mapping and its implications in the organisation. This chapter however, narrowed down the discussion into the process level in FM organisations; that is facilities performance evaluation. Hence, in explication the central focus of the present research, the present chapter intends to satisfy the 3rd (third) objective of the research that is:

> *"To investigate the extent to which facilities management organisations are aware of the role and implications of knowledge mapping in performance evaluation of facilities"*

In order to satisfy the aforementioned objective, the discussions in the present chapter intend to seek the answer to the research question of:

> *"What are the roles that knowledge mapping plays in facilities performance evaluation and are the facilities management organisation really aware of those roles?"*

Consequently, the chapter documents and compares the differences and similarities of knowledge mapping roles in the FPE process and in FM organisations.

...pproach in Improving Effectiveness and Efficiency in ...uation

...eering, Lon Roberts (1994) defines efficiency as "to the degree of economy with which the process consumes resources-especially time and money," while he distinguishes effectiveness as "how well the process actually accomplishes its intended purpose, here again from the customer's point of view."

The concept of efficiency is very relevant to the time taken in performing a task; it is influenced by the skill and knowledge of the people and the quality of the process. The words efficiency and effectiveness are often considered synonymous, along with terms like competency, productivity, and proficiency. However, in more formal management discussions, the words efficiency and effectiveness take on very different meanings. The differences between efficiency and effectiveness are as shown in **Table 6.1**.

Table 6.1 : *Comparison between "efficiency" and "effectiveness"*

Continuum	Efficiency	Effectiveness
What context of improvement	Improving Process Fast	Improving Product Value for money
How the things happened	Doing things right	Doing the right things Encourage innovation
Who	Encourage standard practice Operational centred	Management centred
Time scale	Restricted to the present state (status quo)	Involves thinking in long term

Since efficiency is about doing things right, it demands documentation and repetition of the same steps. Doing the same thing again and again in the same manner will certainly discourage innovation. On the other hand, effectiveness encourages innovation as it demands people to think of the different ways they can meet the desired goal.

Therefore, the differences between efficiency and effectiveness could be summarised as:

* Efficiency means doing the things right whereas effectiveness is about doing the right things;

...cess or ―means‖ whereas effectiveness focuses on the end;

...e present state whereas effectiveness involves thinking long term, and

- Organisations have to be both effective and efficient in order to be successful.

FPE is a process in FM organisations. Ould (1995), contended the essential features of the process in business organisations as follows:

Ω   A process involves activity. People or equipment do things.

Ω   A process also generally involves more than one person or piece of equipment. A process is about groups and concerns collaborative activity.

Ω   A process has a goal. It intends to achieve something and produce some results.

6.3 Role of Knowledge Mapping in Facilities Performance Evaluation Process

How FM managers perceive the role of knowledge mapping in their organisations is strongly related to the level of awareness of what knowledge mapping could offer. The awareness on the potential benefits perceived the important role that knowledge mapping plays in facilities performance evaluation process. Twenty variables of the knowledge mapping role in process setting listed in the questionnaire to be ranked by the respondents with representation of values of 1) Very high level of benefits; 2) High level of benefits; 3) Low level of benefits; and 4) No benefits at all. Low overall mean indicates that the respondents are aware of the knowledge mapping role in facilities performance evaluation.

...g in facilities performance evaluation process

		Identified Role	Mean (N=188)
1	RO1	*...vailable and required knowledge*	*1.15*
2	RO2	Simplified the process	1.16
3	RO3	Avoid duplication of tasks	1.21
4	RO4	Linking right people to the task	1.25
5	RO5	Provide building and facilities database	1.26
6	RO6	Provide knowledge asset inventory	1.27
7	RO7	Led to re-use of information	1.28
8	RO8	Avoided/reduced knowledge loss	1.31
9	RO9	Assisted in decision making	1.38
10	RO10	Saved overall time and cost for the evaluation	1.43
11	RO11	Provided process workflow	1.44
12	RO12	Provided directories of vendors	1.51
13	RO13	Provided directories of people and expertise	1.52
14	RO14	Linking right information to the task	1.56
15	RO15	Provide best practice database	1.56
16	RO16	Assisted in human resource planning	1.59
17	RO17	Easier access to information and knowledge	1.60
18	RO18	Assisted in problem solving	1.70
19	RO19	Assisted in innovation process	1.91
20	RO20	Assisted in identifying KS opportunities	2.21

Meaning of scale:
1 (Very high level of benefits), 2 (High level of benefits), 3 (Low level of benefits), 4 (No benefits at all)

Table 6.2 suggests that the five most important roles with very high level of benefits are:

1- RO1:   Assists in identifying available and required knowledge;

2- RO2:   Simplified the process;

3- RO3:   Avoid duplication of tasks;

4- RO4:   Linked right people to the task; and

5- RO5:   Provide building and facilities database.

Two least benefits perceived by the FM organisations are:

1- RO19: Assisted in innovation process; and

2- RO20: Assisted in identifying knowledge sharing opportunities.

The interview respondents were asked in Question 10 (c) in the semi structured questionnaire on the specific role of knowledge mapping in FPE.

responses by interview respondents perceived that RO1, the most important role in FPE. However, there was an ... the respondents on two roles of knowledge mapping; that is (RO5) õprovide building and facilities databaseö. Surprisingly, the role of knowledge mapping in õprovided directories of people and expertiseö (RO13) which has a low rating in questionnaire survey result has significantly higher frequency of citation by interview respondents which is equal with RO5.

Table 6.3: *Role of knowledge mapping in facilities performance evaluation process highlighted by interview respondent.*

Coding	Identified Roles	Nos. of respondents	Score (%)	New issues brought up
RO1	Identify available and required knowledge	10	48	
RO2	Simplified the process	9	43	
RO3	Avoid duplication of tasks	9	43	
RO4	Linking right people to the task	8	38	
RO5	Provide building and facilities database	19	90	
RO6	Provide knowledge asset inventory	5	24	
RO7	Led to re-use of information	1	5	
RO8	Avoided/reduced knowledge loss	2	10	~ Nil ~
RO9	Assisted in decision making	4	19	
RO10	Saved overall time and cost for the evaluation	3	14	
RO11	Provided process workflow	3	14	
RO12	Provided directories of vendors	2	10	
RO13	Provided directories of people and expertise	19	90	
RO14	Linking right information to the task	3	14	
RO15	Provide best practice database	1	5	
RO16	Assisted in human resource planning	1	5	
RO17	Easier access to information and knowledge	5	24	
RO18	Assisted in problem solving	5	24	
RO19	Assisted in innovation process	0	0	
RO20	Assisted in identifying KS opportunities	0	0	

The implication from the interview result indicated that building and facilities database and directories of people and expertise are the two most important elements of knowledge mapping that were highly appreciated by FM organisations in the FPE process. The summary of interview results in this regards is as enclosed **APPENDIX H**. In the FPE process as discussed in Section 2.3 (see **Figure 2.7**), at planning stage for example, the source of information for the evaluation as determined by the scope is very important to be identified.

...n the building is frequently made available in the form of ... database stores the building information including digital ... aided design (Barrett and Baldry, 2003), maintenance programmes, warranty cards for mechanical and electrical equipment, building materials and space information. This information is worthwhile for FPE and the knowledge mapping could link the information promptly and precisely.

At the planning stage as well, the resource planning could benefit from directories of people and expertise; for example from personal knowledge maps that visualised one's own skills or experts contacts (Burnett et. al, 2004) or team knowledge maps that visualised the skills present or needed in a project team (Eppler and Sukowksi, 2000).

Different nature and roles of FM service provision (e.g. in-house and out-sourced) also influence the type and level of knowledge mapping benefit that could be exploited by FM organisations. The differences of the benefits and roles between FM provisions at the task level are discussed in Section 5.2. The questionnaire survey also posed a question on how the respondent perceived the role of knowledge mapping at the task level (i.e. FPE process). The results as shown in **Table 6.4** identify the comparison of mean score between out-sourced and in-house FM organisations and their ranking.

The result shows that the mean score for both groups are mostly similar. Further investigation of Table 6.4 reveals that a few differences occurred, for example in-house FM organisations perceived that the role of knowledge mapping in õsimplified the processö (RO2) has a higher level of benefits than finding the knowledge gap through õidentify available and required knowledgeö (RO1). Another example is in-house FM organisations perceived that the role of knowledge mapping in providing building and facilities database (RO5) is more important (ranked fourth) compared to õlinking right people to the taskö (RO4) (ranked fifth).

...knowledge mapping in FPE perceived by facilities managers in ...tion service provision.

Coding	Identified Roles	Out-source (N=66)		In-house(N=122)	
		Mean	Rank	Mean	Rank
RO1	Identify available and required knowledge	1.08	1	1.20	2
RO2	Simplified the process	1.11	2	1.19	1
RO3	Avoid duplication of tasks	1.18	3	1.22	3
RO4	Linking right people to the task	1.20	4	1.28	5
RO5	Provide building and facilities database	1.23	5	1.26	4
RO6	Provide knowledge asset inventory	1.24	6	1.29	6
RO7	Led to re-use of information	1.14	7	1.36	8
RO8	Avoided/reduced knowledge loss	1.33	8	1.30	7
RO9	Assisted in decision making	1.35	9	1.39	9
RO10	Saved overall time and cost for the evaluation	1.42	10	1.43	10
RO11	Provided process workflow	1.43	11	1.44	11
RO12	Provided directories of vendors	1.45	12	1.53	13
RO13	Provided directories of people and expertise	1.55	13	1.50	12
RO14	Linking right information to the task	1.56	14	1.57	16
RO15	Provide best practice database	1.59	15	1.55	14
RO16	Assisted in human resource planning	1.65	16	1.56	15
RO17	Easier access to information and knowledge	1.59	17	1.61	17
RO18	Assisted in problem solving	1.82	18	1.64	18
RO19	Assisted in innovation process	1.94	19	1.89	19
RO20	Assisted in Identifying KS opportunities	2.35	20	2.14	20

Meaning of scale:
1 (Very high level of benefits), 2 (High level of benefits), 3 (Low level of benefits), 4 (No benefits at all)

For both differences, the inference that could be made is out-sourced FM is more positive towards identification of knowledge gap through identification of available and required knowledge due to the nature of business that requires them to explore new facilities every time they are engaged to manage new facilities. Identifying the knowledge gap could help the out-sourced FM in their roles for the new facilitiesø site for example to make a decision on human resource requirements and determine the strategy in managing facilities. The positive evidence of effective management of human resource was also shown by the out-sourced FM organisations by ranking RO4 (ranked fourth) higher than the ranking by in-house FM organisations (ranked fifth).

...that the role of knowledge mapping in FPE differs between ...ever, it is important to identify whether the differences is ...stical test to identify the significant difference between two groups i.e. Mann-Whitney U Test is employed in corroborating the differences (see **Table 6.5**). A null hypothesis and alternative hypothesis of the test are set as follows:

$H^0 =$ *the level of importance of the knowledge mapping role in FPE differs between types of facilities management service provision.*

$H^1 =$ *the level of importance of the knowledge mapping role in FPE does not differ between types of facilities management service provision.*

Table 6.5: *Mann-Whitney U Test for difference between FM service provision (i.e. out-sourced and in-house) in gaining knowledge mapping benefits in FPE*

	RO1	RO2	RO3	RO4	RO5	RO6	RO7	RO8	RO9	RO10
Mann-Whitney U	294	282	287	279	300	255	303	198	267	288
Wilcoxon W	372	360	1772	357	378	1740	381	276	345	366
Z	-1.09	-1.31	-0.95	-1.09	-0.55	-1.55	-0.59	-2.59	-1.18	-0.70
Asymp. Sig. (2-tailed)	0.28	0.19	0.34	0.28	0.58	0.12	0.56	0.01*	0.24	0.48

	RO11	RO12	RO13	RO14	RO15	RO16	RO17	RO18	RO19	RO20
Mann-Whitney U	228	262	309	288.5	261	198	261	297	312	307.5
Wilcoxon W	1713	340	1794	366.5	1746	276	1746	375	1797	385.5
Z	-1.86	-1.19	-0.29	-0.68	-1.23	-2.54	-1.23	-0.67	-0.21	-0.29
Asymp. Sig. (2-tailed)	0.06	0.23	0.77	0.50	0.22	0.01*	0.22	0.50	0.83	0.77

a. Grouping Variable: FM service provision

* results are statistically significant at p<0.05

In examining the differences between in-house and out-sourced FM provision in gaining knowledge mapping benefits in FPE, there is a significant difference between both groups in this regards. Further inspection to Table 6.5 discovered a probability value of between 1 to 83 per cent with 18 out of 20 variables having a probability value of more than 5 per cent. Therefore, at five per cent level of significance, the null hypothesis is rejected and alternative hypothesis is accepted. This means that the role of knowledge mapping in FPE is not significantly different between types of FM service provision.

Major inference that could be made based on the aforementioned result on the similarities of knowledge mapping role in FM organisations for the FPE process is that it could be suggested so far is that both FM service provisions (e.g. in-house and out-sourced) perform similar roles

suggested that, if the factor such as scope of FPE, level of
on to conduct FPE, type of facilities to be evaluated,
ility to facilities information are similar, the benefits of
knowledge mapping is likely to be similar regardless the type of FM provision of the organisation.

An attempt was also made to identify whether the size of FM organisations have an impact on the knowledge mapping role in conducting FPE.

Table 6.6 shows a comparison of mean score and ranking of the level of benefits of knowledge mapping in FPE based on the size of FM organisation (i.e. small, medium and large).

Table 6.6: *Potential benefits of knowledge mapping in FPE perceived by facilities managers in Malaysia according to their organisations' size.*

Coding	Identified Roles	Small (N=56)		Medium (N=101)		Large (N=30)	
		Mean	Rank	Mean	Rank	Mean	Rank
RO1	Identify available and required knowledge	1.02	1	1.12	2	1.53	8
RO2	Simplified the process	1.02	1	1.16	3	1.43	2
RO3	Avoid duplication of tasks	1.18	7	1.11	1	1.60	11
RO4	Linking right people to the task	1.07	3	1.29	7	1.47	5
RO5	Provide building and facilities database	1.13	5	1.27	6	1.43	2
RO6	Provide knowledge asset inventory	1.25	8	1.24	4	1.43	2
RO7	Lead to re-use of information	1.09	4	1.24	4	1.80	20
RO8	Avoided/reduced knowledge loss	1.13	5	1.31	8	1.67	15
RO9	Assisted in decision making	1.27	9	1.42	11	1.47	5
RO10	Saved overall time and cost for the evaluation	1.50	13	1.33	9	1.57	11
RO11	Provided process workflow	1.46	10	1.37	10	1.60	13
RO12	Provided directories of vendors	1.49	12	1.47	12	1.70	15
RO13	Provided directories of people and expertise	1.59	14	1.50	13	1.47	5
RO14	Linking right information to the task	1.46	10	1.60	17	1.63	14
RO15	Provide best practice database	1.66	16	1.52	15	1.53	8
RO16	Assisted in human resource planning	1.61	15	1.56	16	1.67	15
RO17	Easier access to information and knowledge	1.68	17	1.51	14	1.77	16
RO18	Assisted in problem solving	1.86	18	1.74	18	1.30	1
RO19	Assisted in innovation process	2.16	19	1.82	19	1.73	18
RO20	Assisted in Identifying KS opportunities	2.41	20	2.26	20	1.73	18

Meaning of scale (factors that positively influenced the rise of the knowledge mapping role in FM in Malaysia):
1 (Very high level of benefits), 2 (High level of benefits), 3 (Low level of benefits), 4 (No benefits at all)

...d between small, medium and large organisations in ... knowledge mapping in FPE mainly on the ranking of the ...xample, perceived equal level of benefits of RO1 and RO2 as the highest level of benefits with the mean score of 1.02. Medium sized organisations ranked RO3 as the highest level of benefits. In contrast, large FM organisations perceived õassisted in problem solvingö (RO18) as the highest level of benefits in which small and medium sized FM organisations ranked eighteenth.

The problem that occurs in this regards is related to the challenge in conducting FPE as per the findings of the discussion in Chapter Four (Section 4.5). The two most challenging issues that constitute the problem in FPE are:

C1:   Interpreting and drawing conclusion from FPE findings (ranked as the second challenge identified by large FM organisations); and

C2:   Obtaining information and data of the building facilities (ranked as the most challenging by large FM organisations).

Eppler (2008) suggests that the classification of knowledge maps by content formats and content types could show the links between the people to the required knowledge. The content of best practice and database of the previous FPE process could help in problem solving in the FPE. Interpreting conclusions from the evaluation requires skills and knowledgeable evaluators. The right evaluators need to be identified in the first place. The competency knowledge maps are useful to solve the issues. Secondly, the training required by the existing employees could be identified by comprehensive employee knowledge and skills database.

Obtaining information and data on the building facilities involve a question of who (own those information and data), where (the location of those information and data) and how (methods and techniques) to reach the information and data. The comprehensive directory of people in the organisation and their roles are certainly important to address the issues of obtaining information and data complete with the location of the people and how to get to the information.

Large organisations perceived RO5 and RO6 (equal mean score of 1.43) as the second highest level of benefits. This might hint that large organisations have a comprehensive database and knowledge asset inventory. In common, large FM organisations have a larger role and scope in managing facilities. Therefore, the management of facilities requires specific tools and techniques to aid the management of facilities such as advance information management and

ent and office infrastructure. This database and knowledge

PE task by directing to the information that are required at

Small and medium FM organisations perceived that õlead to re-use of informationö (RO7) as fourth highest level of benefits but ranked last by the large organisations. The re-use of information occurred where the lesson learned from the process could be beneficial in the future. The possible lessons learnt include good tips, things to avoid, challenges, opportunities and the success factors for the improvement of the FPE process.

At this point, it could be suggested that most of the roles are perceived differently between the different FM organisational sizes. Hence, a statistical test to ascertain whether the differences are significant or insignificant needs to be done. This was corroborated using a Kruskal-Wallis test as shown in **Table 6.7**. A null hypothesis (H^0) and alternative hypothesis (H^1) set fort the test are as follows:

$H^0 =$ *the level of importance of the knowledge mapping role in FPE differs between sizes of FM organisations.*

$H^1 =$ *the level of importance of the knowledge mapping role in FPE does not differ between sizes of FM organisations.*

Table 6.7: *Kruskal-Wallis statistical test on potential benefits of knowledge mapping in FPE according to the organisational size*

	RO1	RO2	RO3	RO4	RO5	RO6	RO7	RO8	RO9	RO10
Chi-Square	18.685	8.969	7.159	0.710	2.951	0.271	18.233	0.335	5.263	9.551
df	2	2	2	2	2	2	2	2	2	2
Asymp. Sig.	.000*	.011*	.028*	.701	.229	.873	.000*	.846	.072	.008*

	RO11	RO12	RO13	RO14	RO15	RO16	RO17	RO18	RO19	RO20
Chi-Square	25.042	6.011	16.011	8.042	14.052	6.566	11.404	13.086	15.245	20.460
df	2	2	2	2	2	2	2	2	2	2
Asymp. Sig.	.000*	.050	.000*	.018*	.001*	.038*	.003*	.001*	.000*	.000*

Grouping Variable: number of employees
*results are statistically significant at p<0.05

how that based on the significant value at five per cent, ave *p* values of less than five per cent. Therefore, the null ans there is evidence that the level of importance of the knowledge mapping role in FPE differs between sizes of organisation.

The differences based on the top five benefits are discussed in the following Section 6.3.1, Sections 6.3.2, 6.3.3, 6.3.4 and 6.3.5 respectively.

6.3.1 Role of knowledge mapping in identifying knowledge gaps for facilities performance evaluation

Table 6.2 shows õidentify available and required knowledgeö (RO1) as the highest level of benefits of knowledge mapping in conducting FPE. As previously discussed, the task of identifying available and required knowledge is also referred as identification of knowledge gap. In exploring further, **Table 6.8** shows that almost one hundred per cent (99.5 per cent) of the questionnaire survey respondents perceived that RO1 has a õvery high level of benefitsö and õhigh level of benefitsö. The questionnaire survey results obviously show that identification of knowledge gap through knowledge mapping has a very significant role for FPE.

Table 6.8: *Level of benefits of identification of knowledge gap*

Scale	Level of Benefits	Frequency	Percentage	Cumulative (%)
1	*Very high level of benefits*	*162*	*83*	*83*
2	*High level of benefits*	*23*	*16.5*	*99.5*
3	*Low level of benefits*	*0*	*0*	*99.5*
4	*Not benefits at all*	*1*	*0.5*	*100*
	Total	**188**	**100**	

In line with questionnaire results, three interview respondents (14 per cent) highlighted the identification of available and required knowledge or the knowledge gap as an important role of knowledge mapping in FPE. One of the interviewee contends that:

> *"When the knowledge audit take place, indirectly, its helps us to identify our strength and weaknesses and what should be rectified or upgraded. Indirectly we know what we really needed. Even though it is not a routine (knowledge audit), and also not in a formal way, but yet it is still very useful"*

, the RO1 as discussed in Section 5.2.6 and **Table 5.1** was s for FM organisations. It could be inferred at this point that nisational level and task level differed somewhat. The difference occurred as at organisational level, the role of knowledge mapping covers a broader scope of various areas such as organisational strategic planning, operation, human resource and business developments. However, at task level a smaller scope of knowledge mapping role only focused on the specific areas of FPE task.

A responsive facilities management organisation is always aware that the gap exists and will find the ways to fill them. In that sense, at the task level as is in FPE process, identification of knowledge gap could help in:

1- Identifying the movement of staff and their expertise, therefore new staff requirements such as their skill and knowledge of expertise for future evaluation could be identified;

2- Updating the organisational knowledge, the knowledge loss and discontinuity of the knowledge flow through the evaluation process;

3- Recognising opportunities and threats for capturing knowledge through FPE process; and

4- Identifying the requirements for staff training through identification of the areas of weaknesses.

It could be inferred that RO1 has a crucial role in FPE in which it would also impact the effectiveness and efficiency of knowledge mapping. Failure to recognise benefits from the knowledge gap identification may result in difficulties such as delay in the evaluation progress, lack of knowledge and skilled staff for the evaluation, and minimal impact of the evaluation could be accrued. It could be suggested that, in maximising the role of identification of knowledge gap, the evaluation team should be actively involved in the knowledge audit exercise at organisational level. With that, the gaps existing in the organisational level could be directly informed at the task level.

…g in simplifying the process for facilities performance

…e processö (RO2) as a second most important role of knowledge mapping for FPE by the survey respondents. Derived from the result, **Table 6.9** indicates that nearly one hundred per cent of the survey respondents perceived RO2 as õvery high level of benefitsö and õhigh level of benefitsö for FPE. In highlighting the importance of RO2, seven of the interview respondents (31 per cent) have cited this knowledge mapping role for FPE. In comparing with the role of knowledge mapping for õsimplifying the processö at organisational level, it was ranked sixth in the list.

Table 6.9: *Level of benefits of simplifying the process*

Scale	Level of Benefits	Frequency	Percentage	Cumulative (%)
1	*Very high level of benefits*	*159*	*84.6*	*84.6*
2	*High level of benefits*	*28*	*14.9*	*99.5*
3	*Low level of benefits*	*1*	*0.5*	*100*
4	*Not benefits at all*	*0*	*0*	*100*
	Total	**188**	**100**	

In this regards, the inference that could be made so far is the knowledge mapping role in õsimplifying the processö in FPE is much more important than in FM organisations at large. FPE is an important process in managing facilities; hence, a dynamic and effective process of FPE is essential. Various authors in knowledge management disciplines (e.g Eppler, 2008; Hansen and Kautz, 2004; Egbu et al., 2005 and Vail, 1999) stressed on the role of knowledge mapping in simplifying the process. Generally, the dynamism and effectiveness could be achieved by eliminating unnecessary and less impactful tasks in the process.

The FPE task is identified as a unique process from one to another. The sequence and flow of the process might vary depending on the scope and the depth of the evaluation itself. Therefore, identification of the unnecessary processes and their elimination is necessary to improve the overall process of FPE.

…n of tasks

…lication of tasksö (RO3) was perceived as the third most …ping in FPE by the survey respondents. Almost ninety-nine survey respondents as shown in **Table 6.10** rated RO3 as õvery high level of benefitsö and õhigh level of benefitsö. At organisational level, the role of knowledge mapping in avoiding duplication of tasks was also ranked third in the list shown in **Table 5.2**. The result alludes that the knowledge mapping role of avoiding duplication of tasks has a very important function for both FM organisations at large as well as at FPE task level. The result was supported by interview finding which indicates that nine respondents (43 per cent) emphasised that avoiding the duplication of tasks is among the role of knowledge mapping in FPE.

Table 6.10: *Level of benefits of avoiding duplication of tasks*

Scale	Level of Benefits	Frequency	Percentage	Cumulative (%)
1	*Very high level of benefits*	*151*	*80.3*	*80.3*
2	*High level of benefits*	*35*	*18.6*	*98.9*
3	*Low level of benefits*	*2*	*1.1*	*100*
4	*Not benefits at all*	*0*	*0*	*100*
	Total	**188**	**100**	

The inference that could be made from the analysis so far is that the RO3 is more serious in the event that the evaluation team involves a large number of evaluators, and the scope of work for every group or individual is not well established. The former normally occurs when the evaluation task involves a large scale of building facilities with detailed investigative evaluation. The possible risk of duplication of tasks is higher in organisations with higher number of employees (Vestal, 2003) and in the present research context; the large organisations are more exposed to the duplication of tasks. Eppler (2008) and Wexler (2001) suggest that several knowledge mapping techniques such as knowledge application maps could be used to avoid or at least minimise overlapping in carrying out the tasks. However, the FPE task relatively involves a minimum number of evaluators. The ideal number of evaluators in one team is not more than ten (Barrett and Baldry, 2003). The latter is also linked to the number of evaluators; increase in the number of evaluators means increase in the challenges specified to each individual task so as to avoid duplication.

...on of tasks in the organisation vary, such as time wasting, ...t management and financial implications. An example of ...plication of tasks is redundancy of the evaluation output. The negative implication of inappropriate time wasting is it could cause delay to the other tasks accumulated. This negative implication also reflects that the organisation has very poor task management. The problems of duplication of tasks could be addressed by establishing a clear relationship between the individual or groups of people as evaluators, and the task.

6.3.4 Role in linking the right people to the task

Table 6.2 shows that the questionnaire survey respondents have ranked õlinking right people to the taskö (RO4) as fourth in the list of the most important role of knowledge mapping for FPE. Ninety-seven per cent (97%) of the respondents perceived RO4 as õvery high level of benefitsö and õhigh level of benefitsö (see **Table 6.11**). To support the questionnaire survey, interviews with twenty one facilities managers in Malaysia reveal that the RO4 was also mentioned by five (5) interview respondents (24 per cent).

Table 6.11: *Level of benefits of linking the right people to the task*

Scale	Level of Benefits	Frequency	Percentage	Cumulative (%)
1	*Very high level of benefits*	*146*	*77.7*	*77.7*
2	*High level of benefits*	*37*	*19.7*	*97.3*
3	*Low level of benefits*	*5*	*2.7*	*100*
4	*Not benefits at all*	*0*	*0*	*100*
	Total	**188**	**100**	

The role in linking the right people to the task is a specific knowledge mapping role at task level. At organisational level, the role is embedded in avoiding duplication of tasks. The rationale in this is that at organisational level, there are several tasks and processes involved. Therefore, avoiding the duplication of tasks consequently hints that the right people in the organisation have been rightly linked to the specific task.

The right expertise of individuals and groups in FPE could be explained by way of the knowledge they are specialised in, the experience they have with relation to FPE and the skills (soft and hard) that are necessary for FPE. Failure to link the expertise to the task and vice versa could give a negative implication of the FPE work pace as well as its outcomes such as delay in FPE completion and false analysis and recommendations. Both implications also

ency of the overall FPE process. The role might be nominal

ations as the number of staff is relatively low and individual

g FPE can be identified with certainty. However, for large

organisations, the database of the employeesø background, qualifications, individual skills and

experience, history of training and workshops attended, their locations and positions are very

critical to be mapped. Commonly, in large organisations, information and database of the

employees are managed by the human resource departments. Therefore it could be suggested

that knowledge mapping exercises in FM organisations could involve human resource

department personnel so as to guide the FPE team leaders in identifying suitable evaluators

for the FPE.

6.3.5 Role in providing building facilities database

Table 6.2 shows knowledge mapping role in õproviding building and facilities databaseö

(RO5) for FPE as fifth in the list based on the mean value. At organisational level, the

knowledge mapping role in providing building and facilities database is ranked as the highest

level of benefits by the survey respondents. The derivation of the results in **Table 6.12** proved

that one hundred per cent of the survey respondents rated knowledge mapping role of RO5 in

FPE as õvery high level of benefitsö and õhigh level of benefitsö. This is proof that RO5 has a

significant role in FPE. The RO5 has also been cited by nineteen of the interview respondents

(90 per cent) as one of the role of knowledge mapping in FPE.

Table 6.12: *Level of benefits of having a building facilities database*

Scale	Level of Benefits	Frequency	Percentage	Cumulative (%)
1	Very high level of benefits	141	75	75
2	High level of benefits	47	25	100
3	Low level of benefits	0	0	100
4	Not benefits at all	0	0	100
	Total	**188**	**100**	

It could be inferred that knowledge mapping also helps organisations to compile the

organisational knowledge; which, in the present sectionøs context is explicit knowledge which

comprises data and information of the building facilities. A comprehensive building and

facilities database is very crucial for FPE. In FM organisations, building and facilities

nformation system framework. However, a compilation of

building facilities database have to have a link to its users

ledge of the information. The usersø tacit knowledge is also

a challenge for FM organisations to retrieve and compile as argued by Woo et al (2004):

*"some firms have been successful at collecting and storing explicit knowledge in organisational database, but are not always good at tracking and sharing tacit knowledge*ö (Woo et al, 2004)

6.4 Summary and Link

According to the questionnaire survey findings and supported by interview questionnaire findings, five most important roles of knowledge mapping in FPE process are as follows:

1- RO1: Assist in identifying available and required knowledge;
2- RO2: Simplifying the process;
3- RO3: Avoiding duplication of tasks;
4- RO4: Linking the right people to the task; and
5- RO5: Providing building and facilities database.

Another interview finding however emerged another important role of knowledge mapping in conducting FPE that is õprovided directories of people and expertiseö (RO13) which only ranked thirteen by the questionnaire survey respondent. The questionnaire survey findings also reveal that RO13 has less benefit for small and medium organisations compared to large FM organisations regardless they are in-house or out-sourced FM service provision.

The obvious disparity between the most important roles for knowledge mapping in the FM organisations and for FPE process are at least as shown in **Table 6.13**. The comparison of the findingsø discussion between Chapter 5 and the present chapter reveals that:

1- The role of knowledge mapping in compiling and linking organisational knowledge are the most important roles at the organisational level (i.e. FM organisations at large) as compared to that at task level (i.e. FPE process) which only ranked fourth and fifth respectively. The rationale of the findings is that the compilation of organisational knowledge is normally carried out for general management purpose rather than for specific process or task in the organisation. The user of each type of knowledge and information is also recognised for specific

organisation. Therefore, at task level, the role of knowledge

nd linking knowledge are relatively on the decline;

ganisations perceived that identification of knowledge gap is the most important role of knowledge mapping; while at organisational level, FM organisations perceived this role as fourth most important role. Even though at organisational level the organisational knowledge has been identified, for specific task or process the gap still exists. The absence of some specific information and specialist service could only emerge at task level. This is due to variances of task scope and distinctiveness of evaluation requirements;

3- Provide directories of people and information is ranked second most important role of knowledge mapping by FM organisations at the task level but only ranked thirteenth at task level. This indicates that the role of providing directories of people and information is less important for FPE task. The possible reason for this is that the group of people for FPE, their speciality and roles have already been identified as the task is repetitive and is frequently conducted. Hence, the FPE leader is already familiar with the group, source and type of information they required. Furthermore, the number of evaluators in the FPE team is relatively small and the task of identifying them is less critical;

4- The existence of an equal level of importance of the role of knowledge mapping to avoid duplication of tasks at organisational level and task level not only confirm that the knowledge mapping role is important, but at the same time it is evidence of effective classification of information and its users in the organisation with clear job specifications and individual roles;

5- The role of knowledge mapping in improving and simplifying the process was ranked second most important role by the respondents at task level (i.e. FPE process) but only ranked fifth and sixth at organisational level. This finding denotes that the knowledge mapping approach has significantly contributed to the improvement in the FPE process rather than in FM organisation in general.

…of having a building facilities database

	For FM organisation at large.	Code	For FPE process	Code
Identifying knowledge gap	*4*	*Ro4*	*1*	*RO1*
Compile and link organisational knowledge	*1*	*Ro1*	*4&5*	*RO4& RO5*
Provide directories of people and information	*2*	*Ro2*	*13*	*RO13*
Avoid Duplication of task	*3*	*Ro3*	*3*	*RO3*
Improve & Simplified the process	*5,6*	*Ro5&Ro6*	*2*	*RO2*

Considering what has been discussed above, the following inferences and implications can be made:

1. In general, the discussion reveals that FM organisations in Malaysia are aware of most of the knowledge mapping roles in FPE process. However, the training for effective use of knowledge mapping tools and techniques especially by exploiting technologies in ICT is necessary. The implication of lack of training includes less structured implementation of knowledge mapping as shown in the present research which was an impact from neglecting some of the knowledge mapping role and the limited extent of knowledge mapping benefit being exploited.

2. The role of knowledge mapping in FPE for in-house and out-sourced FM organisations is relatively similar. Therefore, regardless the FM provision the organisation belongs to, the FM organisation should focus on exploiting the benefits of the under-attention knowledge mapping role such as:

    i- Role of knowledge mapping in innovation process

    ii- Identification of knowledge sharing barriers and opportunities across organisations.

3. The implementation of knowledge mapping should begin at the organisational level and followed by the processes embedded in the organisation such as FPE. Most of the effort in implementation of knowledge mapping such as compiling organisational knowledge, providing training for the staff, inculcating the knowledge culture environment and providing the necessary ICT infrastructure are required inclusive of participation and support from the top management.

Therefore, this chapter addressed the third objective and research question posed at the beginning of the present chapter. The challenges for FM organisations in implementing knowledge mapping for FPE will be discussed in the next chapter of the present research.

...NGES ASSOCIATED WITH ...ENTING KNOWLEDGE MAPPING IN ...IES PERFORMANCE EVALUATION

7.1 Introduction

Roles of knowledge mapping in FM organisation at large and specifically for FPE process has been discussed, analysed and deduced in the previous Chapters 5 and 6 of the present research. The prime role of knowledge mapping aimed through its implementation in the FM organisation is to attain the improvement of the processes in FM organisation including FPE. The present chapter intend to identify the challenges that hinder FM organisation to exploit the knowledge mapping benefits. Hence, in explication the central focused of the present research, the present chapter intend to satisfy the 3rd (third) objective of the research that is:

"To investigate and document the challenges associated with implementing a knowledge mapping initiative that could improve performance evaluation of facilities"

This chapter discusses the findings from both questionnaire survey and semi structured interview on the key challenges associated with the implementation of knowledge mapping in facilities performance evaluation. This is to ascertain the question of õwhat are the main challengesö and õwhere the main challenges lieö for the FM organisations in implementing knowledge mapping initiative in FPE. In order to satisfy the aforementioned objective, the discussions in the present chapter intend to seek the answer for the research question of:

"What constitutes the challenge in implementing knowledge mapping in facilities management organisation especially in facilities performance evaluation?"

This chapter documents and concludes the factors that really challenge for facilities management organisation in implementing knowledge mapping initiative.

7.2 Common Issues and Challenges in Implementing Knowledge Mapping in Facilities Management Organisations

Amaratunga et. al (2002) argue that the FM has lacked specific management tools that meet its needs, instead borrowing many of its method and tools from manufacturing industries. Contradictory evidence shows that FM actually does have its specific management tools to tailor its operational needs. As a service-based organisation, FM organisations rely on the fundamental strength of their organisation in the business and employees skill and knowledge.

...wledge-based organisation. Thus, the real challenge in ...g in facilities performance evaluation are subject to the ...towards the importance of knowledge mapping. This is supported by Hinks and Mc Nay (1999) as facilities managers in FM are keen to focus on the service they provide. In such cultures people are naturally inclined to emphasise issues that are tangible, visible or measurable and are likely to resist process improvement activities that do not contribute to short term tangible result. Therefore, facilities managers often view process-related work as low priority and pose challenges to the existing task. This scenario is supported by APQC (2000) as the real challenge in implementing knowledge management is about creating a tangible picture and clear understanding of what KM means to the organisation while connecting at a personal level, with real problems, opportunities and values.

The word õchallengeö as discussed in Section 4.5 is described as a difficult task or obstacle that confronts the effort. In this section, the challenge could be explained as a difficulty and obstacle that confront knowledge mapping to be harnessed in facilities performance evaluation. Five categories of challenges could be inferred from the literature analysis on knowledge mapping implementation in Section 2.4 in relation to facilities performance evaluation as discussed in Section 2.3.

1) Challenges related to the culture and attitude of the people in the organisation from the senior and junior managers in the facilities management organisation towards the important role of knowledge mapping that could improve facilities performance evaluation process.

2) Challenges related to human resource in facilities management organisation including variables such as training provided to gain the benefits from knowledge mapping, recruitment of staff with relevant skill and knowledge as well as identification of the right team members and roles in mapping knowledge.

3) Challenges related to financial constraints that are interrelated with human resource and awareness towards the role of knowledge mapping in the evaluation.

4) Challenges related to data and information available in the facilities management organisations which are rich and complex to handle and required highly skilled and experienced individual or team to interpret, link and mapped for the purpose of knowledge mapping.

anisational setting that hinders the effective and practical e place. This includes the different expectation and different vledge of the different individuals and groups in the organisation.

The implication of issues and challenges at organisational level can also be linked to the task level. Therefore, it can be suggested that the issues and challenges that hinder the implementation of knowledge mapping at facilities management organisation can also influence the implementation of knowledge mapping in facilities performance evaluation even though at a different scale and mode.

7.3 The Issues and Challenges for Facilities Management Organisation in Implementing Knowledge Mapping Initiatives

There are ten variables derived from the category of challenges posed in the questionnaire in order to identify how the respondent perceived the challenge in the research context. The data analysis was carried out using SPSS (version 20) as shown in **Table 7.1**. The analysis dealt mainly with the ranking of the challenges based on their mean values. The aspect of the analysis investigates facilities managersø perception on the issues that they perceived as a challenge in implementing knowledge mapping based on their observation and experience in the context of facilities management organisation in Malaysia.

Table 7.1: *Challenges in implementation of knowledge mapping*

Rank	Coding	Challenge factors	Mean (N=188)
1	*CK1*	*Attitude and culture*	*1.16*
2	*CK2*	*Lack of training*	*1.37*
3	*CK3*	*Understand knowledge flow*	*1.89*
4	*CK4*	*Accuracy of info/data*	*1.97*
5	*CK5*	*Financial constrain*	*2.00*
6	CK6	*Readiness to share knowledge*	*2.01*
7	CK7	*Different users perspective*	*2.06*
8	CK8	*Dynamic org. environment*	*2.12*
9	CK9	*Complexity of data*	*2.14*
10	CK10	*Identify right team member*	*2.24*

Meaning of scale (challenge in implementing knowledge mapping in FPE):
1 (Very challenging), 2 (Challenging), 3 (Fairly challenging), 4 (Not challenging at all)

...vest mean value which is closest to one (1.00) as the most ...derly manner, the challenges decrease as the mean value ...sented in **Table 7.1** indicates that overall mean score is relatively low with the maximum of 2.24. The result confirmed that all factors are significantly challenged for the FM organisation to implement knowledge mapping in FPE. However, to identify the most prominent challenge factors, the factors with the mean score ranging between 1.00 and 2.00 means the very challenging factors are identified. Five factors out of ten are identified as the most prominent challenge factors as shown in bold in **Table 7.1**.

Table 7.2: *Most challenging factors perceived by the survey respondents.*

Coding	Challenge factors	Frequency N=188	(%)
CK1	*Attitude and culture*	**58**	**30.9**
CK2	*Lack of training*	**106**	**56.4**
CK3	*Understand knowledge flow*	**4**	**2.1**
CK4	*Accuracy of info/data*	**14**	**7.4**
CK5	*Financial constrain*	**5**	**2.7**
CK6	Readiness to share knowledge	1	0.5
CK7	Different users perspective	0	0.0
CK8	Dynamic org. environment	0	0.0
CK9	Complexity of data	0	0.0
CK10	Identify right team member	0	0.0
	TOTAL	188	100

Further inspection to the **Table 7.1** shows that õchange attitude and culture within organisations towards knowledgeö (CK1) is the most prominent challenge with a mean score of 1.16 and 96.8 per cent out of 188; showing that facilities managers perceived implementing knowledge mapping in facilities performance evaluation as very challenging. However, only thirty-one per cent of the interview respondents perceived CK1 as the most the challenging factor in implementing knowledge mapping. In comparison with õlack of training related to knowledge mapping provided to staffö (CK2) which is ranked second, fifty-six per cent of the survey respondents perceived CK2 as the most challenging factor. This is based on Question 14 of Section E in the questionnaire survey which requested the respondents to identify the most challenging factors based on the list. The result strongly indicates that lack of training is more challenging than attitude and culture factor. In supporting this result, the lack of training factor has been quoted by ten out of twenty-one (48 per cent) of the interview respondents (see **Table 7.2**) and two of them suggested that the lack of training factor is the most challenging in the implementation of knowledge mapping in FM organisation for FPE.

in the organisationö (CK3), õAccuracy of data and ...CK4) and õFinancial constraintsö (CK5) are the other factors ...llengingö based on the mean score in **Table 7.1**. All five factors were also identified as most challenging by the survey respondents. The interview result as shown in **Table 7.3** confirmed that the five factors are the most challenging in implementing knowledge mapping in FM organisations for FPE. The summary of interview result in this regards is as enclosed **APPENDIX I**.

Table 7.3: *Challenges and issues in implementing knowledge mapping for facilities performance evaluation highlighted by interview respondents.*

Coding	Challenge factor	Nos. of respondents	Score (%)	Most Challenge	Other challenge brought up
CK1	*Attitude and culture*	*13*	*62*	*1*	
CK2	*Lack of training*	*10*	*48*	*2*	
CK3	*Understand knowledge flow*	*5*	*24*	*1*	
CK4	*Accuracy of info/data*	*4*	*19*	*1*	*Data and information security*
CK5	*Financial constrain*	*3*	*14*	*1*	
CK6	Readiness to share knowledge	0	0	0	
CK7	Different users perspective	0	0	0	
CK8	Dynamic org. environment	0	0	0	
CK9	Complexity of data	1	5	0	
CK10	Identify right team member	1	5	0	

*N = 21

The inference that could be made based on the results is the most significant challenges such as CK1, CK2, CK3, CK4, and CK5 is close to the level of preparation or readiness of one organisation to implement knowledge mapping initiative. The reason for the lack of intention of the organisation towards the implementation is possibly because the organisation is mainly focused on managing the day-to-day operation.

An attempt is now made to identify whether the following factors have an impact towards the challenge in implementing knowledge mapping for FPE:

i- Sizes of organisation (i.e. small, medium and large FM organisation): and

ii- Type of FM service provision (i.e. in-house and out-sourced FM organisation).

The results are given in the following Sections 7.3.1 and 7.3.2 respectively.

e Size of Facilities Management Organisations

ories of FM organisationsø sizes is made in order to identify dium and large organisations. A closer look at **Table 7.4** reveals that the mean value between small and medium organisation seems to be similar. However, for large organisations a few differences are revealed such as factors associated with õaccuracy of information and dataö (CK4) is ranked as second most challenging factor compared to small and medium organisations which ranked the factor associated with õlack of trainingö (CK2) as second most significant challenge factor. The results hint that large FM organisations normally deal with higher volume of data and information compared to small and medium size organisations. Therefore, it is a great challenge for the organisation to ensure the accuracy of the existing data and information despite the information system that govern the organisationsø data and information are in place.

Factors of õlack of trainingö (CK2) and õunderstand knowledge flowö (CK3) which were ranked third by large organisations compared to second by small and medium organisations hint that better training is provided by large FM organisations compared to their counterpart in small and medium FM organisations. A good management system in large organisations such as individual job specification, clear process work flow and higher accessibility to the organisational information are amongst the possible basis for less challenge of CK3 to the large organisations in comparison with small and medium organisations.

Obvious differences also occurred with the factor associated with õidentifying right team members and roles in mapping knowledgeö (CK10) which ranked tenth as least significant challenge factor by both small- and medium-sized organisations and was ranked seventh by large organisations. This denotes, for small and medium FM organisations, CK10 is less challenging, as compared to large FM organisations in implementing knowledge mapping initiatives. The possible reason for this is that in smaller groups of employees, the individual employeeøs knowledge, experience and skill are easier to recognise compared with large FM organisations that has pools of employees with different levels of knowledge, experience and skills.

...tion of knowledge mapping according to organisational size

		Small			Medium			Large	
	N	Mean	Rank	N	Mean	Rank	N	Mean	Rank
Attitude and culture	56	1.07	1	101	1.12	1	30	1.50	1
Lack of training	56	1.30	2	101	1.28	2	30	1.80	3
Understand knowledge flow	56	2.04	3	101	1.83	3	30	1.80	3
Accuracy of info/data	56	2.09	5	101	2.00	6	30	1.67	2
Financial constrain	56	2.13	6	101	1.92	5	30	2.07	6
Readiness to share knowledge	56	2.14	7	101	1.87	4	30	2.20	8
Different users perspective	56	2.16	8	101	2.02	7	30	2.03	5
Dynamic org. environment	56	2.18	9	101	2.02	8	30	2.37	10
Complexity of data	56	2.04	4	101	2.17	9	30	2.30	9
Identify right team member	56	2.41	10	101	2.21	10	30	2.10	7

Meaning of scale (challenge in implementing knowledge mapping in FPE):
1 (Very challenging), 2 (Challenging), 3 (Fairly challenging), 4 (Not challenging at all)

The results from **Table 7.4** also evidenced that element of differences of challenge factor exist between the different sizes of FM organisation in implementing knowledge mapping for FPE. Therefore, further statistical test to identify if the differences are significant or insignificant is essential. A Kruskal-Wallis test was used to identify the significant differences in perceiving the challenge in implementing knowledge mapping (see **Table 7.5**). Null hypothesis and alternative hypothesis for the test are as follows:

$H^0 =$ *the challenge in implementing knowledge mapping in FM organisations for FPE differs between sizes of organisation.*

$H^1 =$ *the challenge in implementing knowledge mapping in FM organisations for FPE do not differ between sizes of organisation.*

Table 7.5: *Kruskal-Wallis test for significant differences on challenges in implementation of knowledge mapping according to the organisational size*

	CK1	CK2	CK3	CK4	CK5	CK6	CK7	CK8	CK9	CK10
Chi-Square	8.210	17.500	7.002	3.003	.355	9.326	4.470	9.309	14.486	17.319
df	2	2	2	2	2	2	2	2	2	2
Asymp. Sig	.016*	0.00*	.030*	.223	.837	.009*	.107	.010*	.001*	.000*

a. Grouping Variable: FM organisation's size

* results are statistically significant at p<0.05

Table 7.5, seven out of ten variables has p values of less ...at five per cent level of significance, the null hypothesis is ...vel of challenges differ between small, medium and large organisations in implementing knowledge mapping. The discussion and the difference of the top five challenges are discussed in Sections 7.3.3, 7.3.4, 7.3.5, 7.3.6 and 7.3.7 respectively.

7.3.2 Challenges According to the Facilities Management service provision

Table 7.6 shows a comparison of mean score between two FM service provisions i.e. out-sourced and in-house FM organisation. The lower overall mean score of out-sourced FM organisations hints that the listed variables are more challenging to the out-sourced FM organisations rather than in-house FM organisations.

Table 7.6: *Challenges in implementation of knowledge mapping according to service provision*

Construct	Out-source			In-house		
	N	Mean	Rank	N	Mean	Rank
Attitude and culture	*66*	*1.05*	*1*	*122*	*1.23*	*1*
Lack of training	*66*	*1.30*	*2*	*122*	*1.40*	*2*
Understand knowledge flow	*66*	*1.86*	*3*	*122*	*1.90*	*3*
Accuracy of info/data	*66*	*1.96*	*4*	*122*	*1.97*	*4*
Financial constrain	*66*	*1.97*	*5*	*122*	*2.01*	*5*
Readiness to share knowledge	*66*	*1.98*	*6*	*122*	*2.02*	*6*
Different users perspective	*66*	*2.03*	*7*	*122*	*2.08*	*7*
Dynamic org. environment	*66*	*2.11*	*9*	*122*	*2.13*	*8*
Complexity of data	*66*	*2.06*	*8*	*122*	*2.19*	*9*
Identify right team member	*66*	*2.15*	*10*	*122*	*2.30*	*10*
Overall Mean		**1.85**			**1.92**	

Meaning of scale (challenge in implementing knowledge mapping in FPE):

1 (Very challenging), 2 (Challenging), 3 (Fairly challenging), 4 (Not challenging at all)

Despite the similarities, it is important to verify if the element of differences exist and significant in comparing between in-house and out-source FM organisation. A Mann-Whitney U test was employed to identify if significant difference exists between the two groups. Therefore, a null hypothesis (H^0) and alternative hypothesis (H^1) are set as follows:

...e in implementing knowledge mapping in FM for the FPE ... facilities management service provision.

...the level of challenge in implementing knowledge mapping in FM for the FPE do not differ between type of facilities management service provision.

Table 7.7: *Mann-Whitney U test statistic for significance differences on challenges in implementation of knowledge mapping according to the facilities management service provision*

	CK1	CK2	CK3	CK4	CK5	CK6	CK7	CK8	CK9	CK10
Mann-Whitney U	3507	3694	3923	3979	4002	3897	3806	3906	3634	3670
Wilcoxon W	5718	5905	6134	11482	6213	6108	6017	6117	5845	5881
Z	-2.517	-1.155	-.404	-.232	-.083	-.512	-1.066	-.572	-1.608	-1.105
Asymp. Sig. (2-tailed)	.012*	.248	.686	.816	.934	.609	.286	.567	.108	.269

a. Grouping Variable: FM service provision

* results are statistically significant at $p<0.05$

The Mann-Whitney U Test result for significance as shown in **Table 7.7** shows that only one variable (CK1) has a *p* value of less than five per cent. This could suggest that at five per cent level of significance, the null hypothesis (H^0) is rejected and alternative hypothesis (H^1) is accepted. This means, the level of challenge in implementing knowledge mapping in FM for the FPE do not differ between in-house and out-sourced FM provisions.

7.3.3 Challenge associated with Attitudes and Cultures in The Organisation

Table 7.1 indicates õchange attitude and culture within organisations towards knowledgeö (CK1) as the most challenging factor in implementing knowledge mapping for facilities performance evaluation. As further derived from the results, **Table 7.8** firmly indicates that the majority of the respondents (96.8 per cent) perceived attitude and culture towards knowledge in facilities management organisations as challenging and very challenging issues to be addressed. Only six respondents or 3.2 per cent of the respondents perceived attitude and culture as a substantial issue to be addressed by rating it as õfairly challengingö or õnot challenging at allö. In addressing the same issue, thirteen of the interview respondents (62 per cent) out of twenty-one suggested that the attitude and culture within the organisational environment is the most challenging factor for FM organisations to implement knowledge mapping in FPE (**Table 7.3**). An example of the attitude and culture elements that prevent the implementation of new knowledge mapping is conserving organisational norms.

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...ast, that it's hard to change the way people think and the ...convenience get used with the current practice and work ...f the staff here has been with the company for more than eight and ten years. Same thing to the approach of managing knowledge systematically, company can invest some money for staff training and acquire new system for example....but to change values within staff, its consume time and effort" [R5]

Table 7.8: *Level of challenge for attitude and culture in implementing knowledge mapping initiative in facilities performance evaluation*

Scale	Level of Challenge	Frequency	Percentage	Cumulative (%)
1	Very challenging	164	87.2	87.2
2	Challenging	18	9.6	96.8
3	Fairly challenging	5	2.7	99.5
4	Not challenging at all	1	0.5	100
	Total	**188**	**100**	

The survey and interview result showed that attitude is related to individual human behaviours within the organisation and culture is the cumulative embedded values within the organisation. As suggested by McDermott and O∅Dell (2001), the culture concept has been borrowed from anthropology, where there is no consensus on its meaning. However, in the area of knowledge management, McDermott & O∅Dell (2001), Al-Ali (2003), Kulkarni (2006) and Hsieh et.al.(2008) for example, used the definition by Schein (1985) which defined culture as the shared values, beliefs and practices of the people in organisation. Therefore, culture is obviously qualitative in nature, implicit and difficult to observe without clearly defined by context.

Note: The thicker arrow denotes the predominant impact of values on behaviours

Figure 7.1: *Culture elements influence behaviours (adopted from Long and Fahey, 2000)*

Long and Fahey (2000) cited, culture is not only intangible and elusive, but it can also be observed at multiple levels in an organisation. **Figure 7.1** expounds the relationship between the elements of culture and human attitudes in creation, sharing and use of knowledge in an organisation. Culture is reflected in values, norms, and practices. At the deepest level, culture consists of values, which are embedded; tacit preferences about what the organisation should strive to attain and how it should do so. Values are often difficult to articulate and even more difficult to change.

Obviously, the attitude and cultural issues in the challenge of the implementation of knowledge mapping originated from organisational issues. The issues of attitude and culture in an organisation are linked to individuals and overall values of the organisation. Davenport et al. (1998) for example contend a õknowledge-friendlyö culture as one of the most important factors for a projectøs success and one of the most difficult to create if it does not already exist. They further anticipated that organisational culture should have several components with regards to knowledge:

- People have a positive orientation to knowledge; employees are bright, intellectually curious, willing and free to explore, and executives encourage their knowledge creation and use;
- People are not inhibited in sharing knowledge; they are not alienated or resentful of the company and donøt fear that sharing knowledge will cost them their jobs; and
- The knowledge management project fits with the existing culture.

...2009) revealed that attitude and culture of the individual in ...ns are led by the view of uncertainty in daily practice. The ...gained by individuals on the job as they õlearn by doingö. This attitude is a refusal to the exploration of the new knowledge and sharing the knowledge.

As knowledge mapping is a sub-component of the knowledge management area, the challenge in the implementation of knowledge mapping in the organisation is relatively similar. Challenges relevant to attitude of people and overall culture in facilities management organisations also lead to common failures in knowledge management approach even though it had well-designed tools and processes as exploitation of its benefits is not being done and absence of top management support. In the context of initiating knowledge mapping in the organisation, Egbu et al.(2005) suggest that individual and organisational efforts are the key barriers that incorporate their values and cultures:

> *"Key barriers are related to how the individual uses knowledge and how organisations manage the co-ordination of knowledge between individuals and other organisation"*

The question of whether the organisation needs to change the culture to fit the knowledge management approach or to tailor the knowledge management approach to fit the organisational culture depends largely on the values and style of the organisation. In implementing knowledge management projects, Davenport (1998) suggests that the organisation should have the culture with regards to knowledge, that is:

- People have a positive orientation to knowledge ó employees are bright, intellectually curious, willing and free to explore, and executives encourage their knowledge creation and use;
- People are not inhibited in sharing knowledge ó they are not alienated or resentful of the company and donøt fear that sharing knowledge will cost them their jobs; and
- The knowledge management project fits with the culture.

> *"A knowledge-friendly culture, one of the most important factors for project's success, is one of the most difficult to create if it does not already exist". (Davenport, 1998)*

...ral issues that challenge the implementation of knowledge ...nisation's issues. The issues of attitude and culture in an ...als and overall values of the organisation. Davenport et al. (1998) for example contend that a õknowledge-friendlyö culture as one of the most important factors for a project's success and one of the most difficult to create if it does not already exist. They further anticipated that organisational culture should have several components with regard to knowledge:

- People have a positive orientation to knowledge; employees are bright, intellectually curious, willing and free to explore, and executives encourage their knowledge creation and use;
- People are not inhibited in sharing knowledge; they are not alienated or resentful of the company and don't fear that sharing knowledge will cost them their jobs; and
- The knowledge management project fits with the existing culture.

In the same vein, Fong and Lee (2009) revealed that attitude and culture of the individual in facilities management organisation is led by the view of uncertainty in daily practice. The variations of knowledge only gained by individuals on the job as they õlearn by doingö. This attitude is a refusal to the exploration of the new knowledge and sharing the knowledge.

Therefore, the implication of attitude and culture of the employees is becoming severe to medium to large organisations which involve relatively bigger number of employees. As the knowledge mapping implementation requires high accessibility to information and knowledge for the inventory purpose, participation from all employees is highly indispensable. Tacit knowledge as Fong and Dettwiller (2009) described in facilities management as personal skill and experience in facilities-related activities critically requires employers to provide the domain or area of specific individual skill and experience. This situation creates difficulties for the evaluators to obtain the information especially on the building and facilities databases. A survey by Fong and Dettwiller (2009) also observed that the organisational culture of the staff is significantly dependent on the educational level of the staff and their interactional capabilities. They also identified that the innovativeness, risk-taking and proactiveness of the workers are managed differently depending on their education level.

raining for implementation

training related to knowledge mapping provided to staffö

ant challenge in implementing knowledge mapping in FPE. As derived from the table, **Table 7.9** shows that ninety-five per cent of the respondents perceived CK2 õvery challenging õand õchallengingö factor. Ten out of twenty-one (48 per cent) of the interview respondents (shown in **Table 7.3**) mentioned training-related factors as a challenge in implementing knowledge mapping for FPE. Two of them suggested that CK2 is the most challenging factor in this regard.

Table 7.9: *Level of challenge of lack of training in implementing knowledge mapping initiative in facilities performance evaluation*

Scale	Level of Challenge	Frequency	Percentage	Cumulative (%)
1	*Very challenging*	*130*	*69.1*	*69.1*
2	*Challenging*	*49*	*26.1*	*95.2*
3	*Fairly challenging*	*7*	*3.7*	*98.9*
4	*Not challenging at all*	*2*	*1.1*	*100*
	Total	**188**	**100**	

One of the interview respondents emphasised that the lack of training is due to the limited numbers of public training offered which is relevant to the formal implementation of knowledge mapping:

> *"Normally, software dealers come to our place and offer training to us on how their product could benefits us in managing facilities effectively……..other than that, it's hard to find the knowledge mapping related training offered or knowledge management instead. If there is a training especially to provide a guide on how knowledge mapping could be implemented formally, it's could be good"* [R13]

Another interview respondent highlighted the same reason of the challenge to provide the necessary training to the employees.

> *"Our staff are not trained in formal task to capture and map knowledge…we sent our staff for the training that we already know that the training is relevant to us and the staff development. As far as I'm concerned, training with relevant to knowledge management is very rare in this country (maybe)"* [R15]

...of training in organisation towards knowledge mapping or ...e strongly influenced by organisationsø awareness towards ...nd benefits that knowledge mapping and knowledge management in general could offer. From a different perspective, the related training to knowledge management itself is very limited even though a few organisations are actively promoting knowledge management awareness in Malaysia through series of workshop, seminars and conferences (Woods, 2005); although the coverage is mainly confined to academics and MSC status organisations (Gan, et al., 2006).

Training is always perceived as cost incurrence to the organisation. Short term implication of training in an organisation is negative including the loss of productivity during the time the specific employees were attending the training. The training for the employees also incurs cost. On the positive side, McNamara (2006) contends that the general benefits of providing necessary training for the employees are as follows:

i. Increased job satisfaction and morale among employees
ii. Increased employee motivation
iii. Increased efficiencies in processes, resulting in financial gain
iv. Increased capacity to adopt new technologies and methods
v. Increased innovation in strategies and products
vi. Reduced employee turnover
vii. Enhanced company image
viii. Risk management

The implication of lack of training or the challenges related to providing training to the employees could not be wisely addressed; the execution of knowledge mapping initiatives could be in the risk of failure. The training materials such as guidance on the implementation and exploiting the benefits out of the implementation are also advantageous to the FM organisations and facilities managers in Malaysia to guide the knowledge mapping implementation in the organisation.

understanding knowledge flow

ng the knowledge flow from facilities management process

ranked third based on the mean score. In comparison with

KC2, only thirty-one (16.5 per cent) respondents perceived KC3 as õvery challengingö (see **Table 7.10**). Four of the survey respondents perceived KC3 as the most challenging factor. Interview findings as shown in **Table 7.3** reveal that KC3 have been mentioned by five respondents as a challenge in implementing knowledge mapping for FPE and one of them perceived this as most challenging for the FM organisation.

Table 7.10: *Level of challenge of understanding knowledge flow in implementing knowledge mapping initiative in facilities performance evaluation*

Scale	Level of Challenge	Frequency	Percentage	Cumulative (%)
1	Very challenging	31	16.5	16.5
2	Challenging	148	78.7	95.2
3	Fairly challenging	8	4.3	99.5
4	Not challenging at all	1	0.5	100
	Total	**188**	**100**	

The results hint that understanding knowledge flow in the organisation has posed a significant challenge to FM organisations in implementing knowledge mapping initiatives especially for FPE. Denoting the form of knowledge flow in the FPE process could help in capturing new knowledge for re-use and identifying best practice.

The form of knowledge flow has been discussed profoundly by Nissen and Levitt (2012) who suggest that the knowledge flow could be through a few tributaries such as people, process, time, location and organisation. Knowledge flow through people in FPE is centred to the evaluators and those involved in the process. Hansen and Kautz (2004) suggest that knowledge flow through people can also occur via informal discussions between the people in the same process. For large organisations, the physical interaction between staff posed as more of a challenge compared to smaller organisations. However, with high accessibility to the internet in the organisation, the interaction could also occur through e-mail and social websites.

...n the FPE is the phases and sub-processes in the evaluation ... the FPE task. In this tributary, the understanding of the ... that the enclosed knowledge in the process flow will be identified and captured. Knowledge flow through time in FPE is the use and reuse of existing knowledge and new knowledge generated throughout FPE timeframe. For the purpose of knowledge mapping implementation, timeline and occurrence of the workflow of the process should be documented.

Knowledge flow through location and organisation is mainly applied to the knowledge flow in the existing building facilities and within the FM organisations involved in the evaluation. At this point, the question of õwhere?ö to find source of knowledge and õwho?ö are the individuals and groups who own the knowledge (Wexler, 2001) is appropriate to locate the knowledge in the flow. Vestal (2005) contends, without a clear sense of all of the knowledge flow components, knowledge mapping could lead to failure because it is possible that the knowledge mapper can miss important steps in the flow.

Through the flow in the FPE process, levels of involvement of every individual at every stage and phases of evaluation can be distinguished. Simultaneously, the type and source of knowledge can also be identified. Therefore, understanding the flow of the FPE process can enlighten the knowledge mapper on the brief idea of the tools and techniques to be used in each of the processes and sub-processes.

Advanced ICT system with special features is essential for knowledge mapping purpose, but, without understanding the knowledge flow throughout the processes involved in the organisation, such investment becomes insignificant.

> *"The use of information technologies, without the overarching direction of an information system, more often than not leads to the generation of voluminous, poorly focused and irrelevant information."* (Barrett and Baldry, 2003)

Therefore, it can be inferred that understanding the knowledge flow in FM organisations requires involvement of highly skilled and experienced staff that are familiar with the processes involved in the FM organisation. As Vestal (2005) suggests:

> *"Much like process mapping, effective knowledge mapping processes are best performed by people who intimately understand the business processes, knowledge assets, and expertise of the people in the organisation, such as business process owner, talent management group, and knowledge management practitioners".*

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…taffs in charge of conducting FPE are logically suitable for …nsideration for appropriate tools such as social network …l Vistal, 2003) to help the identification of the interaction between the people in the process can help in capturing knowledge through the process.

7.3.6 Challenge associated with data and information accuracy in the organisation

Table 7.1 shows that õaccuracy of data and information about facilitiesö (KC4) is ranked third as most challenging factor in implementing knowledge mapping initiatives. **Table 7.11** as derived from the **Table 7.1** shows that ninety-five per cent of the survey respondents rated KC4 as õvery challengingö and õchallengingö factor in this regard. The challenge was also cited by four out of twenty-one interview respondents in which one of them perceived CK4 as the most challenging factor in implementing knowledge mapping.

Table 7.11: *Level of challenge with regards to the accuracy of data and information of facilities*

Scale	Level of Challenge	Frequency	Percentage	Cumulative (%)
1	Very challenging	15	8.0	8.0
2	Challenging	165	87.8	95.7
3	Fairly challenging	7	3.7	99.5
4	Not challenging at all	1	0.5	100
	Total	**188**	**100**	

Accuracy of the existing data and information reflects the validity of the information and data that is in the organisationøs repository. The challenge occurred at an early stage of knowledge mapping particularly in compiling the organisationøs explicit knowledge. The challenge can decrease as the implementation of knowledge mapping are already in place as the updating and validating of data and information is occurring throughout knowledge mapping itself (Vail, 1999).

The inference at this point can be that FM organisations are hesitant with the existing information and data in their repository or database. One possible reason is the possibility of the information and data being invalid. The invalid data can be caused by the long period in updating and the approach in obtaining the data itself. Interview respondents highlighted the security issues of data and information as another challenge that could be linked to this. The

with the level of security of information and data that can

The implication of false or invalid data and information for knowledge mapping, the size of the gap can be too intricate to be identified. For newly assigned outsourced FM organisations, building facilities information and data relies entirely on the documents handed over by the clients from the previous FM providers. Hence, more time is needed for the facility manager to familiarise with and understand the content and relationships of the information and data.

7.3.7 Challenge associated with financial constrain

Table 7.1 shows that õFinancial constrain that prevents knowledge mapping initiative to take placeö (KC5) is ranked third based on the lowest mean score. Eighty-seven per cent of the survey respondent perceived KC5 as õvery challengingö and õchallengingö factors for FM organisations to implement knowledge mapping in FPE (see **Table 7.12**). The KC5 related factors were also cited by three interview respondents as challenges for FM organisations to implement knowledge mapping in FPE, in which one of them suggested KC5 as the most challenging factor.

Table 7.12: *Level of challenge with regards to the financial constrain that prevent knowledge mapping initiative to take place in FPE*

Scale	Level of Challenge	Frequency	Percentage	Cumulative (%)
1	Very challenging	33	17.6	17.6
2	Challenging	130	69.1	86.7
3	Fairly challenging	17	9.0	95.7
4	Not challenging at all	8	4.3	100
	Total	**188**	**100**	

The challenge related to the financial constraints of implementing any knowledge management approach in the organisation is closely related to the organisational awareness of the benefits they could gain via the implementation. The challenge also implicates the lack of management support for knowledge management initiatives (Fong and Lee, 2009 and Daghfous, 2004). In a recent study by Valaei and Aziz (2012) in the Malaysian context, the refusal factors for KM implementation in the organisation are one of the reasons that KM benefits are not significant, KM implementation is time consuming and too expensive.

implications on small and medium FM organisations and

small and medium FM organisations, which have limited

knowledge mapping initiative is likely less challenging if

implemented in stages. In contrast, their large organisation counterparts have only utilised the existing infrastructure in order to facilitate knowledge mapping initiatives to take place. The main cost incurred in the knowledge mapping initiative is acquisition of new tools such as facilities management software, database development and providing related training for staff. For FM contractors (outsourced), knowledge mapping could be an added advantage and could increase business goodwill which is an added opportunity for expanding businesses.

7.4 Summary and Link

Facilities performance evaluation is a highly skilled and knowledge-based process in the management of facilities. Despite slight differences in terms of the organisation (i.e. size of organisation), it was perceived that the most common challenges faced by facilities management organisations in implementing knowledge mapping are listed as follows:

1) *CK1*: Change attitude and culture within organisation towards knowledge;

2) *CK2*: Lack of training related to knowledge mapping provided to staff;

3) *CK3*: Understand knowledge flow from facilities management process within the organisation;

4) *CK4*: Accuracy of data and information about the facilities; and

5) *CK5*: Financial constraints that prevent knowledge mapping initiatives to take place.

The result findings in Section 7.3.1 show that there is no significant difference between FM service provisions (i.e. in-house and out-sourced) in perceiving the role of knowledge mapping in FPE. The findings in the present chapter found a consistent result that there is no significant difference in the challenges for implementing knowledge mapping in FPE. However, the size of organisation has shown a significant difference in perceiving the knowledge mapping role and the challenge in implementing knowledge mapping in FPE.

Considering the identified challenge as discussed in the previous sections, the following inference and implications can be made:

e culture could restrain knowledge mapping as discussed in ... ensive strategy can be employed to inculcate knowledge ... nisation such as encouraging senior facility managers to share their knowledge and coach junior managers, improving interaction between staff and improving transparency by making visible and accessible all common process to the employees.

2- Lack of training and exposure to the staff in implementing knowledge mapping can minimise the impact of knowledge mapping and severely hinder the implementation. For small and medium organisations, employing appropriate training strategy and programme for staff can prevent staff shortage during training. The appropriate training can be identified from the knowledge management and ICT training provider in the knowledge mapping related area. For large organisations, the training can be conducted in-house by inviting appropriate trainers to their workplace.

3- Failure to identify and understand the knowledge flow in the organisation can lead to the knowledge loss. Knowledge flow through people, process, time, location and organisation needs to be systematically recorded and documented. For tacit knowledge, it is sufficient to quote the source of knowledge.

4- The implication of inaccurate data and information being false judgements, inaccurate decisions, and delays in action can render knowledge mapping meaningless. Regardless of small and medium or large organisations, the group of identified employees or owner of the process should be allowed to update the database but appropriately, an individual is assigned to overlook the system especially when the owner of the process is numerous.

5- Challenges related to financial constraints occur relatively due to lack of awareness towards the benefits of knowledge mapping. Besides the cost of training, the primary expenditure expected for knowledge mapping initiative emerged from acquiring technologies (i.e ICT) for the tools. However, the finding in the previous chapter reveals that most of the FM organisations have a specific facilities management system such as CMMIS and CAFM which has features such as building and facilities database, preventive maintenance programming and groups of expertise directories. The program allows data and information of facilities to be generated, linking the expertise and information efficiently and effectively. Hence, in general, no further

required. The training and user creativity can enable the

effectively.

Therefore, this chapter has addressed the fourth objective and research question posed at the beginning of the present chapter. The next chapter discusses the process, challenges and the critical success factors in exploitation of knowledge mapping benefits.

required. The training and user creativity can enable the

effectively.

...ATION OF KNOWLEDGE MAPPING ...S IN FACILITIES PERFORMANCE ...TION

8.1 Introduction

The preceding chapters particularly Chapters 5, 6 and 7 prove the existence of knowledge mapping elements in facilities management organisation operations. The evidence in the discussions in those chapters revealed that knowledge mapping benefits are explored at various levels. At the stage of exploitation, logically, it could be presumed that individual organisations have already determined the different potential benefits to be achieved. Thus, the present chapter intends to identify whether the facilities management organisations have a specific process to get the best of the potential benefits of knowledge mapping. The critical success factors for the exploitation of the knowledge mapping benefits are also recorded in this chapter. This is to satisfy the 5th research objective of the present research as follows:

> *"To identify processes, if any, that are in place in facilities management organisations, to exploit the benefits of knowledge mapping in performance evaluation of facilities, document critical success factors for effective exploitation of knowledge mapping and proffer guidance for improvements in this regard"*

By identifying the process of exploitation of knowledge mapping in facilities performance evaluation, they could benefit the facilities stakeholders such as facilities managers (organisations and individuals), facilities management-related corporate bodies such as Construction Industry Development Board (CIDB) and Royal Institution of Surveyors Malaysia (RISM)), government agencies such as Public Works Department (PWD) and the Ministry of Housing and Local Government (MHLG) and academia in facilities management- and knowledge management-related fields in at least the following forms:

1) The important elements in exploitation of knowledge mapping benefits in general or in specific facilities management organisations. This also enhances the knowledge of individuals in the practice of knowledge mapping;

2) Generic ideas on the sequence of exploitation process taking place in the organisation. This also informs on what should be in place in an orderly manner to suit different organisationsø unique requirements for knowledge mapping; and

3) The critical factors that determine the successful exploitation of knowledge mapping benefits.

...ned objective, the discussions in the present chapter intend ... question of:

What are the processes employed in exploiting the knowledge mapping benefits and what factors that are critical for the success of the exploitation?

Therefore, the present chapter is laid out in the following structure:

i. This chapter begins with introducing the differences and relationships between exploration and exploitation processes in the exploitation of knowledge mapping benefits.

ii. Discussions on the interviews and questionnaire survey findings on processes involved in exploitation of knowledge mapping benefits.

iii. Discussions on the critical success factors that emerged from the interviews and questionnaire survey for successful exploitation of knowledge mapping benefits.

iv. Development of guidance for exploitation of knowledge mapping benefits in FPE.

v. Finally, a summary of this chapter is provided with links to potential future work.

8.2 The Exploitation of Knowledge Mapping Benefits

8.2.1 Exploration vs. Exploitation

The distinction between exploration and exploitation has been highlighted in a wide range of management literature. For example March (1991) described an õexplorationö as things captured by terms such as search, variation, risk-taking, experimentation, play, flexibility, discovery and innovation. On the contrary, õexploitationö includes such things as refinement, choice, production, efficiency, selection, implementation and execution. He then suggests that adaptive systems engaged from exploration to exploitation are likely to find that they suffer the cost of experimentation without gaining any of its benefits.

Baum *et al.* (2000) suggested that exploitation refers to learning gained via local search, experiential refinement, and selection and reuse of existing routines. From the innovationøs perspective, Benner and Tushman (2002) suggest that exploitative innovations involve improvements in existing components and build on the existing technological trajectory; whereas exploratory innovation involves a shift to a different technological trajectory. This is

...loration are frequently simultaneously discussed. In order to ...nd exploration, March (1991) cited that:

The essence of exploitation is the refinement and extension of existing competencies, technologies, and paradigms...The essence of exploration is experimentation with new alternatives".

Gupta et. al (2006) argued that the central ambiguity regarding the definitions and implications of exploration and exploitation lies in whether the two are distinguished by differences in the type of learning or by the presence versus the absence of learning. This indicates that the exploitation of knowledge can happen by integrating the resources that already exist in the organisation. Some authors (e.g. Baum et al., 2000; Benner and Tushman, 2002; He and Wong, 2004; and Gupta et al., 2006) reveal that the ideas of explicitly associating between exploration and exploitation with innovation and learning was initiated in management and administration literatures.

8.2.2 Exploitation of knowledge mapping in facilities performance evaluation

Gupta (2006) suggested that the unit of analysis and limitation of the exploitation have to be precisely elucidated. In the present research context, exploitation is focused on knowledge mapping benefits in facilities performance evaluation. As discussed in Section 2.2.1 on the meaning of exploitation in the context of current research, it is a refinement of knowledge mapping benefits that has been identified in the literature, selection of tools and techniques that can maximise the benefits for the facilities performance evaluation and the process of implementation and execution of those tools and techniques in facilities performance evaluation process.

The discussion of knowledge mapping benefits mainly centred on the organisational setting but in the present research context, the facilities performance evaluation is an embedded process in the organisation in order for such benefits to have correlation with the process. The literature review on facilities management as discussed earlier indicates that there is the need for knowledge in the facilities management area to be structurally synchronised and managed with the knowledge management approach. Knowledge mapping is identified as a key pre-requisite for effective knowledge management (Kautz and Thaysen, 2004; Speel et. al. 2000); therefore, as proposed by Gray, (1999), Eppler (2001) and Lui and Hsu (2004) the

...eas such as facilities management and its processes; ...mental resource for successful knowledge management.

As exploitation of knowledge mapping involves all resources that the organisation already have (Liu, 2006), the benefits can emerge by adopting, synthesizing and applying current knowledge for future benefits of the organisation in knowledge management.

In exploiting those benefits as discussed in the previous section, a holistic view on the facilities performance evaluation process (see Chapter 2, Figure 2.8**)** needs to consider:

   i.   Re-use information and ideas throughout the evaluation process: As a recurring process, new knowledge captured during the process could be used for the next process for improvement, innovation and generating new ideas.

   ii.   Identification of knowledge location and flow: knowledge mapping enables the tacit and explicit knowledge to be located and the flow of the knowledge to be captured. It enables the evaluation team or individual evaluators to locate that knowledge and the path of its flows.

   iii.   Highlight and link the experts and islands of expertise: Performance evaluation of facilities is typically carried out by a group of experts with different areas of specialisation. Knowledge map helps in the form of providing õyellow pagesö indicating their areas of specialisation and providing links between them.

   iv.   Rapid access to information: providing links to the tacit and explicit knowledge within organisations or across organisations in the form of virtual maps and/or physical maps, thus, quicker access to the information.

   v.   Knowledge assets inventory: Provides inventory of intellectual and intangible assets. The inventory also helps in defining the gaps that exist in the organisationøs knowledge.

   vi.   Developing community of practice (COP): Developing a group of multiple experts in a common domain, with a genuine interest in each otherøs expertise based on their own practice. Involvement of a core group with experienced facilitators and junior evaluators sustains the organisationøs knowledge structure.

   vii.   Improve decision making and problem solving: by providing applicable information comprehensively, quickly and accurately will lead to robust decision making, making recommendations and providing solutions for the problematic issues in evaluation.

...lge: making the various forms of knowledge accessible to ...ganisation or across organisations, exceptions on classified

    ix.   Identify knowledge sharing and barriers: Acknowledging the knowledge sharing opportunities and their possible barriers. On the other hand, the success of knowledge mapping is only if it can be shared and exploited.

Despite its benefits, Vestal (2005) suggested four main barriers in harnessing knowledge mapping in the organisation which are (i) lack of understanding of the knowledge flow process inside the organisation; (ii) not having the right team members on a knowledge mapping team; (iii) the classical õknowledge is powerö syndrome that prevents knowledge from being successfully shared; and (iv) failure to understand the business process.

8.3 The Processes in Exploiting Knowledge Mapping Benefits

As discussed in Section 8.2.1, the exploitation trajectory is positioned within the concept of learning and innovation. Ten constructs of the knowledge mapping exploitation process were developed based on the literature review in the area. To identify the process of exploitation of knowledge mapping benefits in facilities performance evaluation by the FM organisation, a survey questionnaire enquired on the readiness of the organisation to exploit knowledge mapping benefits based on common FPE processes as discussed in Section 2.3.2.

The study also sought the views of facilities managers on the processes involved in exploiting knowledge mapping benefits in FPE that exist in FM organisations. The respondents were asked to rate the variables that constitute the process in exploitation of knowledge mapping benefits. The range of categories were õvery much in placeö, õin placeö, õnot very much in placeö and õnot in place at allö and were coded as 1, 2, 3 and 4 respectively (see questionnaire in Appendix A). As the mean score increases, the related process in place in exploitation of knowledge mapping decreases.

...knowledge mapping benefits in FPE

		Variables	Mean (N=188)
		T ready	*1.66*
2	*P2*	*Accessible business process*	*1.96*
3	*P3*	*Identify organisational knowledge*	*1.99*
4	*P4*	*Evaluate effective map*	*2.06*
5	*P5*	*Review FPE processes*	*2.10*
6	*P6*	*Staff training*	*2.31*
7	*P7*	*Promote awareness*	*2.36*
8	*P8*	*Determine the purpose*	*2.47*
9	*P9*	*Identify and nominate staff*	*2.54*
10	*P10*	*Strategies for implementation*	*2.75*

Meaning of scale (process of exploitation of knowledge mapping benefits in FPE):
1 (Very much in place), 2 (In place), 3 (Not very much in place), 4 (Not in place at all)

An inspection of **Table 8.1** suggests that the most in place process is having an õinformation and communication technology ready for staff to access and retrieve information and knowledge fromö (P1). The interview survey findings (see Table 8.2) which show that the only process cited by all respondents (N=21) is the readiness of knowledge mapping in terms of providing necessary ICT as a tools for knowledge mapping.

Second most in-place process is õbusiness process recorded and accessible to staff in organisationö (P2) with the mean score of 1.96 and third most in-place process is to õhave organisational knowledge identification as a continuous processö (P3) with the mean score of 1.99. For both processes, there are equal citations of six each that the processes are in place in their organisation.

The two bottom mean scores are õnominate specific personnel and group of well trained staff as custodian for knowledge mapping of specific activitiesö (P9) with the mean score of 2.54 and õspecific strategy for implementation of knowledge mappingö (P10) with the mean score of 2.75. Correspondingly, there is no element of nomination of specific staff to oversee the knowledge mapping process and no element of specific strategies has been cited by interview respondents in this regard.

...ce for exploitation of knowledge mapping benefits in facilities ...ighted by interview respondent.

...ce		Nos. of respondents	Score (%)	Other process that are in-place
P1	ICT ready	21	100	
P2	Accessible business process	6	29	
P3	Identify organisational knowledge	6	29	
P4	Evaluate effective map	0	0	
P5	Review FPE processes	1	5	-Nil-
P6	Staff training	2	10	
P7	Promote awareness	3	14	
P8	Determine the purpose	2	10	
P9	Identify and nominate staff	0	0	
P10	Strategies for implementation	0	0	

*N = 21

Based on the questionnaire survey findings with highest mean score of between 1.00 and 2.00, and highly cited by interview respondents as shown in Table **Table 8.2**, it can be suggested that the most in place process in exploitation of knowledge mapping are:

    i- **P1**: Information technology and communication systems are ready for staff to access and retrieve information and knowledge for effective mapping;

    ii- **P2**: Specific and generic business processes are recorded and accessible to most staff in the organisation; and

    iii- **P3**: Identification of the organisational knowledge is a continuous process in the organisation.

Both questionnaire and interview findings (see **Table 8.1** and **Table 8.2**) confirmed that identifying and nominating staff (P9) and having a specific strategies for exploitation of knowledge mapping benefits (P10) has a least priorities in this regards. Summary of the interview findings are as enclosed in **APPENDIX J**.

Interestingly, despite a less structured exploration of knowledge mapping in the organisation as discussed in Chapter 6 and Chapter 7, fewer organisations are considering training for staff in order to get the best from knowledge mapping which ranked sixth in-place process. This could be related to several reasons such as lack of staff, and lack of support from organisation for staff attending training due to absence of awareness towards the benefits of knowledge mapping. In highlighting the important role of ICT for exploitation of knowledge mapping benefits, one of the interviewees expressed concern for the staff progression in acquiring ICT skill:

...ing which relevant to knowledge mapping for example IT
...ment management available.....above all, we unable to send
...vo at one session, so as not to affect our daily operation..."

Basic skill and knowledge of ICT is necessary for junior and senior FM managers, but despite the challenge, the opportunity for employees to develop understanding and acquire new skills in ICT is available in FM organisation. Another interviewee suggested that:

"....upon employment we have thoroughly sort the candidates for designated skill and knowledge, academic qualification, working experience in relevant field, for junior position we will ensure they might benefits from more senior staff trough coaching and sort of "on-job training"....we have a budget allocation for staff to attend training annually that are necessary to up-keep their knowledge with current technologies and best practice out there"

Despite the need for training and formal education significantly stressed in the review knowledge management related literature (Mentzas, 2001; Yahya and Goh, 2002; Wong and Aspinwall, 2005; Hung et al., 2005; Akhavan et. al., 2006; Chong, 2006; Akhavan and Jafari, 2006; Bozbura, 2007; du Plessis, 2007; Jafari et. al., 2007 and Valmohammadi, 2010), the facilities managers perceived training for staff to enable them to exploit the benefits of knowledge mapping as sixth in the list (M=2.31). The process of promoting understanding and awareness, determining the purpose of knowledge mapping, nominating specific personnel and groups and employing specific strategies for implementing knowledge mapping are ranked seventh to tenth respectively.

Based on the mean value (between 2.31 to 2.75) as shown in **Table 8.1** it was also revealed that the variables ranked six to ten in the list were positioned between õin placeö and õnot very much in-placeö. Apparently, strategies for implementation is ranked last in the list with a mean score of 2.75 which means that 75 per cent of the respondents perceived this important process as ÷not very much in placeø and ÷not in place at allø Absence of specific strategies for implementation of knowledge mapping prevents potential benefits of knowledge mapping to be achieved.

However, in the context of knowledge management implementation in Malaysia, a recent study of knowledge management implementation by property management-related organisations in Malaysia conducted by Razali and Juanil (2011) reveals that out of nine listed strategies for knowledge management, only three strategies are identified in a ÷good levelø The three strategies that are in place are (1st) the attitude of an individual in the organisation,

and (3rd) courteous and rewards. The remaining six that are

ful, knowledge creation, knowledge culture, support from

infrastructure, and repository system. On the contrary, the

findings by Baharum and Pitt (2009) in the research from the context of facilities management intellectual capital reveals the õawarenessö towards knowledge management which is logically linked with the attitude of an individual in the organisation is relatively at a low level. A possible improvement that could explain the differences is an increase in IT accessibility and higher IT dependency in FM organisations in Malaysia.

The comparison of the process in place for knowledge mapping exploitation between the facilities management provision (i.e. in-house and outsourced) and sizes of FM organisation (i.e. small, medium and large) are discussed in the following Sections 8.3.1 and 8.3.2 respectively.

8.3.1 Exploitation of knowledge mapping benefits based on the facilities management provision

Survey results as shown in **Table 8.3** reveal that the mean score for both in-house and out-sourced organisations are almost similar with overall score as shown in **Table 8.1**.

Table 8.3 : *Process in exploitation of knowledge mapping benefits in FPE according to FM service provision*

Variables	Out-source			In-house		
	N	Mean	Rank	N	Mean	Rank
ICT ready	66	1.68	1	122	1.66	1
Accessible business process	66	1.91	2	122	1.98	2
Identify organisational knowledge	66	1.94	3	122	2.02	3
Review FPE processes	66	2.08	4	122	2.11	5
Evaluate effective map	66	2.12	5	122	2.07	4
Staff training	66	2.35	6	122	2.29	6
Promote awareness	66	2.39	7	122	2.34	7
Determine the purpose	66	2.47	8	122	2.47	8
Identify and nominate staff	66	2.52	9	122	2.55	9
Strategies for implementation	66	2.74	10	122	2.75	10

Meaning of scale (process of exploitation of knowledge mapping benefits in FPE):

1 (Very much in place), 2 (In place), 3 (Not very much in place), 4 (Not in place at all)

FM service provisions i.e. outsourced and in-house as above; ed. To test the significant differences between the two FM d outsourced), a null hypothesis (H0) and alternative hypothesis were set as follows:

> **H^0**: *Processes in exploitation of knowledge mapping in place are different between FM service provisions.*
>
> **H^1**: *Processes of exploitation of knowledge mapping in place are not different between FM service provisions.*

Table 8.4: *Mann-Whitney U Test for difference between FM service provision i.e. out-source and in-house.*

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Mann-Whitney U	*4007*	*3897*	*4014*	*3773*	*3759*	*3756*	*3771*	*3967*	*3931*	*3780*
Wilcoxon W	*6218*	*6108*	*11517*	*5984*	*5970*	*11259*	*11274*	*6178*	*11434*	*11283*
Z	*-0.065*	*-0.404*	*-0.039*	*-1.025*	*-1.178*	*-0.902*	*-0.838*	*-0.322*	*-0.306*	*-0.987*
Asymp. Sig. (2-tailed)	*0.948*	*0.686*	*0.969*	*0.305*	*0.239*	*0.367*	*0.402*	*0.747*	*0.759*	*0.324*

a. Grouping Variable: FM service provision
results are statistically significant at $p<0.05$

Based on the probability value (*p*) of significance not less than or equal to .05 (five per cent), **Table 8.4** indicates the probability values are between .24 to .97. The result indicates that null hypothesis (H^0) is rejected and alternative hypothesis (H^1) is accepted. This means the processes of exploitation of knowledge mapping in place are not different between in-house and outsourced FM provisions.

8.3.2 Exploitation of knowledge mapping benefits based on the sizes of facilities management organisation

A comparison of mean score ranking between the FM organisations sizes (i.e. small, medium and large) as shown in **Table 8.5** indicates a difference especially with large FM organisations.

for example ranked second most in-place by small and
 third by the large organisations. Despite the slight
for large organisations, accessibility to the business process
is limited. This could be one of the reasons that large FM organisations have a specific
nominated staff for specific processes compared to small and medium organisations that have
higher accessibility to business processes by almost all staff in the organisation.

Table 8.5: *Process in exploitation of knowledge mapping benefits in FPE according to sizes of FM organisation*

The process	Small			Medium			Large		
	N	Mean	Rank	N	Mean	Rank	N	Mean	Rank
ICT ready	56	1.70	1	101	1.61	1	30	1.77	1
Accessible business process	56	1.93	2	101	1.97	2	30	2.00	3
Identify organisational knowledge	56	2.00	3	101	2.03	3	30	1.80	2
Review FPE processes	56	2.05	4	101	2.04	4	30	2.37	9
Evaluate effective map	56	2.07	5	101	2.08	5	30	2.10	4
Staff training	56	2.44	6	101	2.23	6	30	2.30	7
Promote awareness	56	2.59	9	101	2.24	7	30	2.33	8
Determine the purpose	56	2.50	7	101	2.25	8	30	2.47	10
Identify and nominate staff	56	2.52	8	101	2.66	9	30	2.13	5
Strategies for implementation	56	2.88	10	101	2.84	10	30	2.20	6

Meaning of scale (process of exploitation of knowledge mapping benefits in FPE):

1 (Very much in place), 2 (In place), 3 (Not very much in place), 4 (Not in place at all)

An obvious difference also occurred in reviewing the FPE process which was ranked fourth
by small and medium organisations but ninth by large organisations. The possible reason for
the difference is that large organisations have rigorous FPE processes compared to small and
medium organisations. Rigorous FPE processes can be obtained by having an in-house
specialist or expert and having well-trained and experienced evaluators.

Surprisingly, the large organisations which have ranked õstrategies for implementation of
knowledge mappingö as sixth in place compared to small and medium organisations which
ranked as least in-place process perceived that õdetermining the purpose of the knowledge
mappingö as least important. Key literatures in knowledge mapping such as Skryme, 2008;
Vestal, 2005 and Liebowitz, 2003, suggest that identification of the purpose of knowledge
mapping as a very critical first step in knowledge mapping.

Despite the differences, it is vital to identify whether the differences is significant or
insignificant.   Therefore, a Kruskall-Wallis test was used to identify the significant

...n and large organisations. A null hypothesis and alternative ...llows:

H⁰ *: Process in exploitation of knowledge mapping in place is different between sizes of FM organisation.*

H¹ *: Process of exploitation of knowledge mapping in place is not different between sizes of FM organisation.*

Table 8.6: *Kruskal-Wallis test for significance differences on processes in exploiting of knowledge mapping benefits according to the organisational size*

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Chi-Square	1.90	0.60	8.55	21.18	.002	7.25	12.73	8.77	20.45	35.65
df	2	2	2	2	2	2	2	2	2	2
Asymp. Sig	.388	.741	.014*	.000*	.999	.027*	.002*	.012*	.000*	.000*

a. Grouping Variable: FM organisation's size

* results are statistically significant at p<0.05

Based on the five per cent level of significance, seven out of ten variables show a *p* value of less than five per cent (see **Table 8.6**). Therefore, the null hypothesis is accepted which means the process in exploitation of knowledge mapping in place is different between sizes of FM organisation.

The implications and inferences of the results that could be made at this point are:

1- Small and medium organisations are similar in the perception of the in-place knowledge mapping exploitation process. The disparity as discussed earlier in this section occurred between small and medium and large organisations;

2- The process in-place does not reflect the sequence of knowledge mapping exploitation but shows that the elements of each sequence exist in FM organisations in Malaysia; and

3- The sequence of knowledge mapping exploitation can be developed based on the identified processes that are suggested in literature and found in place in the FM organisation and should be arranged in a logical order.

...vledge mapping benefits

...ion and communication technology are ready for staff to ...d knowledgeö for effective mappingö (P1) is ranked as most in-place by the questionnaire respondents. **Table 8.7** shows that nearly ninety-six per cent out of a hundred and eighty-eight respondents perceived that the use of ICT for staff to retrieve information and knowledge from is õvery much in placeö and õin placeö. Besides the most important process to exploit the knowledge mapping benefits, the results simultaneously hint that ICT is the most prevailing enabler for knowledge mapping. The influence of ICT in the increase of knowledge mapping role in the FPE is discussed in Section 5.3.1.

Table 8.7: *ICT readiness for knowledge mapping exploitation*

Value	Process in place	Frequency	Per cent	Cumulative (%)
1	Very much in place	71	37.77	37.77
2	In place	109	57.98	95.75
3	Not very much in place	8	4.26	100
4	Not in place at all	0	0	
	Total	**188**	**100**	

Therefore, it can be inferred that ICT is a powerful knowledge mapping tool and plays an important role in facilities performance evaluation. A few examples of the roles are:

1) *Providing an electronic information database*: in the facilities performance evaluation, the electronic database is crucial in most of the planning, conducting and applying phase. At the planning stage for example, the directories of expertise can be used for effective resource planning such as identifying the evaluators for the critical evaluation component;

2) *Synchronising facilities management information system*: the coordination of FM information is vital to enable the relevancy of the data in the evaluation context. For example, at conducting stage, data collectionö and observationö involve massive building facilities data to be analysed. Erroneous and faulty administration of data can lead to missed judgement or misinterpretation in the evaluation;

3) *Communication and sharing of information over internet and intranet networking*: the information on the evaluation process and sub-process such as the evaluation work flow, action plan, and initial findings for the evaluation can be shared within the FPEøs evaluators through internet and intranet access;

...mation through the database and information system: the
...ly on the building facilities information and electronic
...ired information besides the physical inspection on the
building facilities especially at conducting and applying phase of the evaluation;
and

5) *Effective and efficient decision making*: even though decisions are made
throughout the evaluation, the decision making is more critical during the
application phase. Reporting findings and recommending actions need wise and
accurate decisions to be made. Knowledge mapping can help evaluators to retrieve
information that is up-to-date and more accurate efficiently.

Obviously, the roles that knowledge mapping play can save the time and costs spent on
dealing with mass information and knowledge within and across organisations especially in
accomplishing the specific task of FPE.

In the context of rapid growth of internet and information system, Eppler (2001) extrapolates
that knowledge maps can become standard elements in the organisationøs knowledge
management repertoire. Table 8.4 shows that information and communication technology is
very common in facilities management organisations. Nearly thirty eight per cent of the
respondents perceived that the information and communication technology facilities are õvery
much in placeö in facilities management organisations and some other fifty eight perceived it
as õin placeö. At least the facilities management organisations in Malaysia are accessible to
basic internet facilities besides advanced high speed broadband and Wi-Fi features.

These show that facilities management organisations in Malaysia are aware and ready to
exploit the benefits of knowledge mapping in the perspective of tools and technologies. Some
facilities management organisations with outstanding business profiles are equipped with the
high end and up-to-date ICT features in the organisation. However, the rapid development of
ICT poses a challenge that the facilities managers should be aware of. The organisation
should provide room to accommodate the changes so that the exploitation of knowledge
mapping benefits is always cutting-edge.

> *"The changes in technology such as IT software and hardware and building and its
> content, techniques for evaluating facilities performance as few examples, imposed the
> challenge to the facilities management practice in harnessing knowledge mapping and
> tap benefits from it"* (Yasin and Egbu, 2010)

by Hari et al (2005) of small and medium organisations in ... related issues. The findings revealed that there is very ...ogy (ICT) due to the following factors:

1) Lack of investment;

2) Lack of time to learn; and

3) The lack of awareness of the benefits of transforming knowledge into explicit knowledge.

The earlier relates closely to the fifth most significant challenge in implementation of knowledge mapping in facilities performance evaluation as discussed in Section 7.3; financial constraints. This is linked closely with the last criterion which is related to lack of awareness of the benefits that the organisation can gain through the implementation of knowledge mapping. Therefore, there should be a specific focus on providing necessary training to the present staff in the organisation towards the benefits that knowledge mapping can offer.

As ICT is a very important component in knowledge mapping and its ability to address many of the challenges and issues in the implementation of knowledge mapping as discussed in Section 7.3, it can be suggested that:

Top management and decision makers in facilities management organisations should be informed of the benefits of knowledge mapping, criteria and guidance for implementation. This can be achieved by attending relevant seminars, workshops and training related to knowledge management and ICT. By providing workshops, seminars, and relevant training, the level of awareness for top management and decision makers in facilities management in this regard can be enhanced to enable the benefits of knowledge mapping to be exploited effectively.

The training, seminars and workshops relevant to ICT as a knowledge mapping tool can also be extended to managers and junior managers so that they can be aware of their roles in the knowledge mapping process. Added benefits to the organisation will also accrue if managers with experience and skilled in knowledge mapping are involved in guiding and coaching the junior managers, as well as acting as mentors to their subordinates.

process

generic processes are normally recorded and accessible to

önö (P2) is ranked as the second most in-place process for knowledge mapping. Further explaining the process, **Table 8.8** indicates that nineteen out of a hundred and eighty eight (10 per cent) respondents perceived that the process is very much in-place. In cumulative, ninety four per cent of the respondents perceived that P2 is in-place. Only eleven respondents (six per cent) perceived that the process is not very much in-place. This result confirms that P2 is an important process in knowledge mapping exploitation.

Table 8.8: *Process related to documentation of business process*

Scale	Process in place	Frequency	Per cent	Cumulative (%)
1	*Very much in place*	*19*	*10.11*	*10.11*
2	*In place*	*158*	*84.04*	*94.14*
3	*Not very much in place*	*11*	*5.85*	*100*
4	*Not in place at all*	*0*	*0*	
	Total	**188**	**100**	

Documentation of business process made accessible to all staff members is important so that every staff member can share the same values and understanding in conducting any single task. The documentation can be transformed into organisational database or integrated in the organisationøs information management system such as specific software that enables the process to be updated in the future. Another advantage that can be gained by systematic documentation is that the hurdle and the advantages of the specific process can be identified. In this way, the lessons learned and best practice of specific processes at organisational level can be identified.

8.3.5 Continuously identify organisational knowledge

Table 8.1 shows that õidentification of organisational knowledge is a continuous process in the organisationö (P2) as second most in-place knowledge mapping process. The questionnaire survey also reveals that ninety-one per cent of the respondents perceived P2 as õvery much in placeö and õin placeö (see **Table 8.9**).

...tional knowledge

	...lace	Frequency	Per cent	Cumulative (%)
1	*Very much in place*	*20*	*10.64*	*10.64*
2	*In place*	*151*	*80.32*	*90.96*
3	*Not very much in place*	*16*	*8.51*	*99.46*
4	*Not in place at all*	*1*	*0.53*	*100*
	Total	**188**	**100**	

Identification of organisational knowledge for organisational-wide settings has been discussed in the literature (Section 2.4.4). The FPE is intended to seek new information on partial or all elements of building facilities performance. The breadth and depth of the evaluation depend largely on the aims of one evaluation to be carried out. Three levels of FPE depths are indicative, investigative and diagnostic evaluations (Preiser et al., 1991; and Barrett and Baldry, 2003). The breadth of the evaluation is referring to the scope of FM itself.

Therefore, it can be inferred that FPE is also a parallel process of identifying organisational knowledge in the organisation. The information gained through the FPE process can benefit in-house FM organisations for future changes to the facilities and aid decision making process. Historical elements are part of the organisational knowledge besides social and cultural knowledge, human knowledge and functional knowledge as suggested by Vestal (2005). Identification of organisational knowledge is less severe for outsourced FM service as their role in managing particular facilities can expire upon completion of the term of contract.

8.3.6 Evaluate knowledge mapping outcomes

õContinuously evaluating the outcomes of effective knowledge mapping in the FPE processö (P5) is ranked as fifth in-place process in exploitation of knowledge mapping. **Table 8.10** shows that a cumulative of eighty six per cent questionnaire respondents perceived P5 as õvery much in placeö and õin placeö. Only two respondents perceived that the process is not in place at all. This hints that the process is highly important and does exist in their organisations in exploiting knowledge mapping benefits for FPE.

...ating knowledge mapping outcomes in FPE

Scale	Process in place	Frequency	Per cent	Cumulative (%)
1	Very much in place	12	6.40	6.40
2	In place	150	79.80	86.20
3	Not very much in place	24	12.80	98.90
4	Not in place at all	2	1.10	100
	Total	**188**	**100**	

For large organisations, the process is much in place (ranked fourth) compared to small and medium organisations (ranked fifth). The outcomes of knowledge mapping are development of knowledge nodes and their links which are represented by different types and forms of the knowledge maps. The quality of knowledge maps is measured based on the links it provides (Eppler, 2001). Therefore, the links that develop through knowledge mapping must always be up-to-date. Reviewing the knowledge mapping outcomes can be achieved by improving the nodes through updating the database or organisational knowledge and improve the links such as eliminating unnecessary links and providing new links. Evaluation of knowledge mapping outcomes by enriching and updating organisational knowledge such as database and improving the links can benefit the process by simplifying the process and saving time when retrieving the information.

8.3.7 Review the Facilities Performance Evaluation process

õReviewing the process of FPE and identifying best practiceö (P5) is ranked fifth as most in place process in exploitation of knowledge mapping for FPE. An inspection of **Table 8.11** reveals that less than one per cent (1 respondent) perceived P5 as õvery much in placeö, however, ninety per cent of the respondents viewed that P5 is õin placeö. This hints that P5 is a very important process to FM organisations in exploiting knowledge mapping benefits.

Table 8.11: *Process related to reviewing FPE process*

Scale	Process in place	Frequency	Per cent	Cumulative (%)
1	Very much in place	1	0.53	0.53
2	In place	170	90.43	91.06
3	Not very much in place	15	7.98	98.94
4	Not in place at all	02	1.06	100
	Total	**188**	**100**	

...mple of benefits that could be cultivated by reviewing the

...n benefits that could exploited by reviewing the process are

...ating unnecessary process or add new process that could

improve the quality of FPE.

8.4 The Critical Success Factors for exploiting knowledge mapping benefits

The circumstances of critical success factors (CSFs) are discussed in Section 4.6.1 narrowing the important factors to the few number of major factors that are really critical in which, the absence of the factor/s can lead to failure. The present section investigates the factors that are critical in effectively exploiting knowledge mapping benefits by facilities management organisations. The investigation of CSFs entails the facilities performance evaluation process by the facilities management organisation in Malaysia.

From a broad knowledge management context, eclectically, the successful knowledge management project in one organisation should be identified by hypothesizing the major factor as follows (Davenport et al., 1998);

a) Links to economic performance or industry value ó e.g. money saved and/or money earned

b) Technical and organisational infrastructure ó e.g. information and communication technology enabled

c) Standard, flexible knowledge structure ó e.g. dynamic knowledge mapping

d) Knowledge-friendly culture

e) Clear purpose and language

f) Change in motivational practices

g) Multiple channels for knowledge transfer

h) Senior management support

In addition, a study by Valmohammadi, (2010) suggests at least three more critical factors for successful knowledge management including human resources, knowledge management strategy and benchmarking (see **Appendix A**). Similarly, those critical factors play a vital role in providing a positive and constructive environment for exploitation of knowledge mapping benefits successfully. Considering the nature of facilities management organisation as well as knowledge mapping as a unit in knowledge management, leads by literature review in the area, the construct of critical success factors for exploitation are listed in **Table 8.12**.

...ys of facilities managers on the level of criticality for ...e mapping benefits in FPE that exist in FM organisations. ...criticalö, õfairly criticalö and õnot critical at allö were numbered as 1, 2, 3 and 4 respectively (see questionnaire in **Appendix D**). As the mean score increases, the level of criticality in exploitation of knowledge mapping decreases.

Table 8.12: *Overall critical success factors in exploitation of knowledge mapping benefits in facilities performance evaluation*

Rank	Coding	Critical Success Factors	Mean (N=188)
1	KCSF1	Understand flow	1.19
2	KCSF2	Capture new knowledge	1.23
3	KCSF3	Management support	1.44
3	KCSF4	Knowledge and skill	1.44
5	KCSF5	Organisational culture	1.51
6	KCSF6	Identify k-map. needs	1.58
7	KCSF7	IT accessibility	1.59
8	KCSF8	Sharing knowledge	2.00
9	KCSF9	Flexibility of technique	2.41

*Meaning of scale (critical success factors in conducting FPE):
1 (Very critical), 2 (critical), 3 (Fairly critical), 4 (Not critical at all)

Investigation of **Table 8.12** reveals that the most critical factor in exploiting knowledge mapping benefits is õunderstanding the process of FPE and knowledge flow in the processö (KCSF1). The second in the ranking is õability to capture new knowledge by implementing knowledge mapping in facilities performance evaluationö (KCSF2). The interview results as shown in **Table 8.13** also showed that KCSF 1 and KCSF2 were highly cited by the interview respondents with nine and four citations respectively. However, this does not mean that the two factors are the most critical factors in these regards. The results of higher ranking of questionnaire findings and high frequency in interview only confirm that the factors are critical.

ress Factors (CSFs) exploitation of knowledge mapping benefits
uation highlighted by interview respondent.

		Nos. of respondents	Score (%)	Most Critical (*n*)	Other factors that perceived critical
KCSF 1	*Understand flow*	9	43	0	
KCSF 2	*Capture new knowledge*	4	19	0	
KCSF 3	*Management support*	10	48	4	
KCSF 4	*Knowledge and skill*	10	48	5	
KCSF 5	*Organisational culture*	9	43	3	*-Nil-*
KCSF 6	*Identify k-map. needs*	8	38	1	
KCSF 7	*IT accessibility*	10	48	2	
KCSF 8	*Sharing knowledge*	3	14	0	
KCSF 9	*Flexibility of technique*	0	0	0	

*N = 21

Based on the most critical factors suggested by the interview respondent, the levels of criticality could be cascaded as follows:

1- KCSF 4: Knowledge and skill of the staff involve in knowledge mapping;

2- KCSF 3: Strong support from top management;

3- KCSF 5: Have an organisational culture that is positively towards knowledge mapping;

4- KCSF 7: accessibility and availability of information technology within organisation; and

5- KCSF 6: Identification of knowledge mapping needs with respect of knowledge capture, retrieval and analysis.

The summary of interview findings in this regards is as in **APPENDIX K**.

Table 8.12 also indicates that the least critical factor are õindividual willingness to share knowledgeö (KCSF8) and õflexibility of the mapping techniques usedö (KCSF9). The interview results as shown in **Table 8.13** confirm that those factors have least cited and not cited at all.

An attempt is now made to identify whether organisational size (i.e. small, medium and large) and FM service provisions (i.e. in-house and out-sourced) have an impact on the critical success factors.

(CSFs) according to size of organisation

nd large FM organisations ranked strong support from top skill of the staff involved in the knowledge mapping as the top two most critical factors for effective exploitation of knowledge mapping benefits in facilities performance evaluation. In contrast, small FM organisations ranked support from management as 4th but understanding the process of facilities performance evaluation and knowledge flow in the facilities performance evaluation as a most critical factor.

Table 8.14: *Critical success factors in conducting FPE according to organisational size*

	Small			Medium			Large		
Critical Success Factors	*N*	*Mean*	*Rank*	*N*	*Mean*	*Rank*	*N*	*Mean*	*Rank*
Management support	*56*	*1.16*	*4*	*101*	*1.08*	*1*	*30*	*1.33*	*1*
Knowledge and skill	*56*	*1.11*	*2*	*101*	*1.10*	*2*	*30*	*1.33*	*1*
Understand flow	*56*	*1.09*	*1*	*101*	*1.11*	*3*	*30*	*1.67*	*5*
Capture new knowledge	*56*	*1.13*	*3*	*101*	*1.13*	*4*	*30*	*1.77*	*6*
Organisational culture	*56*	*1.54*	*6*	*101*	*1.59*	*6*	*30*	*1.20*	*3*
Identify k-map. needs	*56*	*1.46*	*5*	*101*	*1.67*	*7*	*30*	*1.50*	*4*
IT accessibility	*56*	*1.59*	*7*	*101*	*1.53*	*5*	*30*	*1.77*	*6*
Sharing knowledge	*56*	*2.07*	*8*	*101*	*2.03*	*8*	*30*	*1.77*	*6*
Flexibility of technique	*56*	*2.34*	*9*	*101*	*2.62*	*9*	*30*	*1.87*	*9*

*Meaning of scale (critical success factors in conducting FPE):
1 (Very critical), 2 (critical), 3 (Fairly critical), 4 (Not critical at all)

An obvious difference occurred on õunderstanding the process of FPE and knowledge flow in the process (KCSF1) which was ranked first by small organisations, third by medium and fifth by large organisations. If the tributary by Nissen and Levitt (2012) which suggests that the knowledge flow could be through people, process, time, location and organisation is considered, the difference in terms of the tributary between the sizes of organisations can be the reason for the differences.

Ability to capture knowledge (KCSF2) was ranked second in overall mean score. The factor however, was only ranked sixth by large organisations and ranked third and fourth by small and large FM organisations respectively. The implication of the result that can be inferred is that the smaller the organisation, the higher the criticality to capture new knowledge is.

An obvious disparity also occurred on organisational culture KCSF5 which was ranked third by large FM organisations but only ranked sixth by both small and medium FM organisations. This result hints that organisational culture is less critical for small and medium FM organisations but more critical for large FM organisations. The number of staff in an

previous section has significant impact on organisational

ritical factors are in line with the aggregate ranking that is

wledge and flexibility of the mapping techniques used.

In view of the differences, it is important to confirm whether the difference is significant or in- significant. A Kruskal-Wallis statistical test was used to corroborate the differences between small, medium and large FM organisations which results are shown in **Table 8.15**. A null hypothesis (H^0) and alternative hypothesis (H^1) were set as follows:

H^0 = *the critical success factors (CSFs) in exploitation of knowledge mapping benefits for FPE are different between size of facilities management organisation.*

H^1 = *the critical success factors (CSFs) in exploitation of knowledge mapping benefits for FPE are not different between size of facilities management organisation.*

Table 8.15: *Kruskal-Wallis test for significance differences on exploitation of knowledge mapping benefits in FPE according to sizes of organisation*

	KCSF1	KCSF2	KCSF3	KCSF4	KCSF5	KCSF6	KCSF7	KCSF8	KCSF9
Chi-Square	.631	9.286	.084	8.769	6.446	1.096	1.821	.196	8.452
df	2	2	2	2	2	2	2	2	2
Asymp. Sig	.729	.010*	.959	.012*	.040*	.578	.402	.906	.015

Grouping Variable: FM organisational sizes
* results are statistically significant at p<0.05

The results shown in **Table 8.15** reveal that only three variables show a significance lower than five per cent. Therefore, at five per cent level of significance, the null hypothesis is accepted. The results confirmed that the critical success factors (CSFs) in exploitation of knowledge mapping benefits for FPE are different between sizes of facilities management organisations as discussed early in the present section.

8.4.2 The critical success factors (CSFs) according to facilities management service provision

There is a need to identify whether the CSFs differ according to FM service provisions, i.e. in-house and outsourced FM organisations. The results in **Table 8.16** shows a substantial difference between in-house and outsourced FM in perceiving CSF in exploitation of

FPE. In-house FM perceived that strong support from top

edge and skill of the staff involved in knowledge mapping

cal success factors but ranked second by outsourced FM

organisations. This clearly indicates that in-house FM organisations have a higher dependency of KCSF3 and KCSF 4 for success of knowledge mapping benefit exploitation compared to outsourced FM. For outsourced FM, understanding the process of FPE and knowledge flow in the process (KCFS1) and ability to capture new knowledge by implementing knowledge mapping in FPE (KCSF2) is equally perceived as most important.

The implication of the result is in the different nature of service as well as their different role in management of facilities. An example is when outsourced FM organisations are required to quickly capture their new client focus, processes involved, people involved and to be familiarised with new facilities setting when entering new facilities . In contrast, for in-house FM, the changes only occur for example when acquiring new facilities and changes in process.

Table 8.16: *Critical success factors in conducting FPE according to FM service provision*

	In-house			**Out source**		
Critical Success Factors	**N**	**Mean**	**Rank**	**N**	**Mean**	**Rank**
Management support	*122*	*1.11*	*1*	*66*	*1.20*	*2*
Knowledge and skill	*122*	*1.11*	*1*	*66*	*1.20*	*2*
Understand flow	*122*	*1.20*	*2*	*66*	*1.18*	*1*
Capture new knowledge	*122*	*1.26*	*3*	*66*	*1.18*	*1*
Organisational culture	*122*	*1.52*	*4*	*66*	*1.50*	*3*
Identify k-map. needs	*122*	*1.57*	*5*	*66*	*1.59*	*4*
IT accessibility	*122*	*1.59*	*6*	*66*	*1.64*	*5*
Sharing knowledge	*122*	*1.99*	*7*	*66*	*2.02*	*6*
Flexibility of technique	*122*	*2.43*	*8*	*66*	*2.39*	*7*

*Meaning of scale (critical success factors in conducting FPE):
1 (Very critical), 2 (critical), 3 (Fairly critical), 4 (Not critical at all)

The aforementioned results revealed that there are differences between the two FM service provisions (i.e. in-house and out-sourced) in perceiving the critical success factors in exploitation of knowledge mapping benefits. This was further examined using a Mann-Whitney U test as shown in **Table 8.17**. The null hypothesis (H^0) and alternative hypothesis (H^1) are set as follows:

...tors (CSFs) in exploitation of knowledge mapping benefits ...t between FM service provisions.

II   *the critical success factors (CSFs) in exploitation of knowledge mapping benefits for FPE are not different between FM service provisions.*

Table 8.17: *Mann-Whitney U Test for difference between FM service provision i.e. out-source and in-house.*

	KCSF1	KCSF2	KCSF3	KCSF4	KCSF5	KCSF6	KCSF7	KCSF8	KCSF9
Mann-Whitney U	3971	4008	3944	3749	3989	3719	3960	3915	3717
Wilcoxon W	6182	6219	11447	11252	6200	11222	6171	11418	5928
Z	-.234	-.059	-.419	-1.300	-.116	-.986	-.214	-.334	-1.312
Asymp. Sig. (2-tailed)	.815	.953	.675	.193	.908	.324	.831	.738	.189

Grouping Variable:
FM service provision

According to the results given in Table 8.16, all p values in **Table 8.17** are more than five per cent. Therefore, at five per cent level of significance, the null hypothesis fails to be rejected, which means that the critical success factors (CSFs) in exploitation of knowledge mapping benefits for FPE are different between FM service provisions. This confirms that differences exist between FM provisions in perceiving critical success factors in exploitation of knowledge mapping benefits for FPE as discussed earlier in the present section.

Taking findings in the previous section in the present chapter, the implications and inferences that can be made are that both organisational sizes and FM service provisions have influenced the differences in perceiving critical success factors in exploiting knowledge mapping benefits for FPE. The discussion of critical success factors also confirm that all the identified factors are critical in exploitation of knowledge mapping benefits.

The following Sections 8.4.3 to 8.4.10 discuss those factors that are proven as critical in successful exploitation of knowledge mapping benefits for FPE from the previous sections.

...ng knowledge flow in the process of FPE is ranked fist (1st) as most critical factor in exploitation of knowledge mapping benefits by the questionnaire respondents. Nearly half (43%) of the interview respondents highlighted the criticality of understanding the FPE process flow for a successful exploitation of knowledge mapping benefits. However, none of the interview respondents perceived KCSF1 as the most critical factor in exploitation of knowledge mapping benefits. The results hint that the interview respondents are aware of the criticality of KCSF1 in the exploitation of knowledge mapping benefits, yet the understanding of the tributary of the flow is required to be explored and identified. Besides the critical factor, understanding knowledge flow in FPE is also a challenge in implementing knowledge mapping for FPE as discussed in Section 7.3.5.

Understanding the process of facilities performance evaluation and knowledge flow within the process is very critical at the early stage in the exploitation of knowledge mapping benefits (Vistal, 2005). The form of knowledge flow has been discussed profoundly by Nissen and Levitt (2012) who suggest that the knowledge could flow through a few tributaries such as through people, process, time, location and organisation. Knowledge flow through people in FPE is centred on the evaluators involved in the process. Hansen and Kautz (2004) suggest that, knowledge flow through people could also occur via informal discussion between the people in the same process. Knowledge flow through process in the FPE are the phases and sub-processes in the evaluation from the beginning to the end of the FPE task.

Knowledge flow through time in FPE are the use and reuse of existing knowledge and new knowledge generated throughout FPE timeframe. Knowledge flow through location and organisation is mainly applied to the knowledge flow in the existing building facilities and within the FM organisation that are involved in the evaluation. Vestal (2005) contends, without a clear sense of all of the knowledge flow components, knowledge mapping can lead to failure because the knowledge mapper can miss important steps in the flow.

Through the flow in the FPE process, levels of involvement of every individual at every stage and phases of evaluation can be distinguished. Simultaneously, the types and sources of knowledge can also be identified. Therefore, understanding the flow of the FPE process can enlighten the knowledge mapper on the brief idea of the tools and techniques to be used in each of the processes and sub processes.

wledge (KCSF2)

reveals that KCSF2 is the second (2nd) most critical factor respondents. However, only nineteen per cent (19%) of the interview respondents highlighted KCFS2 as a critical factor in exploitation of knowledge mapping benefits in FPE.

Knowledge capture means capturing know-how in such a way that it can be reused (Collision and Parcel (2001). In organisational-wide context, Hari *et. al.* (2005) defined knowledge capture as a process through which knowledge is recognised from its source, examined and is in accordance with the organisation's strategy. They also suggest that there is a need to link between capturing knowledge before, during and after an event, project or task has been executed for effective knowledge. Obviously, the knowledge that has not been captured will then be simply dissolved. To avoid the loss of critical knowledge in the organisation, Power (2005) suggests that they must be identified in the first place.

Capturing new knowledge is critical for exploitation of knowledge mapping benefits as the new knowledge can prevent knowledge maps from being outdated and at the same time enrich the knowledge assets. The need for knowledge mapping to be up-to-date has been cited by Vestal (2005):

> *"..accurately collect and update knowledge maps. All knowledge maps become out-dated and need to be reviewed at least yearly. Some industries, such as the high-tech industry, may require updates every six months"* (Vestal, 2005)

In FPE process, Barrett and Baldry (2003) however suggest having "facilitators" to enable the issues and its solution throughout the evaluation to be recorded:

> *"..most evaluations should have at least two facilitators, one to guide the process and one to take notes. Decide beforehand who will do what"* (Barrett and Baldry, 2003)

Arguably, the use of separate roles of the facilitators can lead to conflict in FPE roles, yet the same authors suggest that the group of evaluators remain small which is between three to seven people. In the context of knowledge mapping, Vestal (2003) suggest that a team of five to ten people is reasonable, for manageability reason. However, the numbers suggested for FPE and knowledge mapping team is as a general guidance, therefore, the team can also consult with other experts to get the best from knowledge mapping. The leaders for the exercise, practically, the FPE leaders who are experienced and skilful in handling FPE tasks

g leaders to enable knowledge capture to be more effective o be successfully exploited.

Therefore, it can be suggested that in increasing ability for FM organisations to capture new knowledge through the FPE:

1- Document the FPE process work flow as well as the purpose and scope of the evaluation;

2- Document the log book of FPE for every evaluator to identify the problems throughout the evaluation process and how the evaluators solve them; and

3- Remove unnecessary and outdated knowledge from the FPE database nodes from the archive.

8.4.5 Top management support for knowledge mapping exploitation (KCSF3)

Table 8.12 shows that õstrong support from top managementö (KCSF3) ranked third based on the mean value of the questionnaire survey result. Interview results, however, revealed that the element of support from top management as the most cited factor critical for knowledge mapping exploitation with two other factors in which, four of the interview respondents stressed KCSF3 as the most critical factor.

Despite the criticality of the factors, top management support is also an obstacle for many organisations to implement knowledge management initiative (Daghfous, 2004). In a recent study by Valaei and Aziz (2012) in the Malaysian context, the refusal factors for KM implementation in the organisation are that KM benefits are not significant, and that KM implementation is time consuming and too expensive. In addition, authors such as Wong (2005), Davenport and Prusak (1998) and Skyrme and Amidon (1997) suggest a sort of support from top management in the form of reward and incentives. In the present research context, reward and incentives for employees that successfully exploit knowledge mapping benefits in FPE process and in the organisations at large should also be considered.

It can be deduced that knowledge mapping benefits cannot be exploited without the integration of KM implementation strategies which obviously need strong support from top management. In exploiting knowledge mapping benefits, top management support in providing necessary funds for training and acquiring or upgrading knowledge mapping tools in the organisation is a must.

gement for the exploitation of knowledge mapping benefits
led that top management should be equipped with sound
owledge mapping and the importance of its benefits. The awareness can be achieved and developed with relevant reading materials on knowledge mapping, and relevant training, workshop and seminars.

8.4.6 Knowledge and Skill of the staff involve in the knowledge mapping (KCSF4)

The fourth most critical factor as indicated in **Table 8.12** is õknowledge and skill of the staff involved in knowledge mappingö (KCSF4). The issues of criticality of evaluator knowledge and skills have been raised by all of the interview respondents where five of them perceived KCSF4 as the most critical in exploiting knowledge mapping benefits (see **Table 8.13**). The staff should be exposed to the benefits of knowledge mapping offered and the relevant tools and techniques for knowledge mapping. The staff should be trained on how the available tools and techniques should be used to exploit the benefits of knowledge mapping.

In this regard, Vestal (2005) contends:

> *"...these hurdles can be overcome by training people on how to knowledge map, when to use various tools, and how to use knowledge maps to create solutions"*

> *"Process improvement practitioners, found inside many organisations today, have many of the skills needed to successfully knowledge map. However, business managers and knowledge managers need to use these maps to effect change; after all, very few of us collect maps to then stick them on our shelves. Maps are tools that help us accomplish tasks more efficiently, so providing the skills and expertise to create them and use them is critical for success. (Vestal, 2005)*

However, training is perceived as a second most challenging factor in implementing knowledge mapping in FPE as discussed in Section 7.3.4. The implication of the result is that FM organisations cannot successfully exploit knowledge mapping benefits if the existing staffs are not being trained and re-trained on the techniques for knowledge mapping and to use the tools in the organisation for knowledge mapping.

...CSF5)

...onal culture that is positive towards knowledge mappingö ...cal factors perceived by the questionnaire respondents. Nine (43 per cent) interview respondents however highlighted KCSF5 as critical in exploitation of knowledge mapping benefits. Three of them perceived KCSF5 as most critical in the exploitation of knowledge mapping benefits. The interview and questionnaire results confirm that KCSF5 is a critical factor and absence of the factor can lead to the failure of the exploitation of knowledge mapping benefits in FPE.

The criticality of organisational culture in the knowledge management implementation has been raised by several authors such as Wong and Aspinwall (2005); Hasanali, (2002); McDermott and OøDell, (2001); Liebowitz, (1999); APQC, (1999); Davenport et al., (1998) and Skyrme and Amidon, (1997). The organisational culture can be described as a set of important understandings, such as norms, values, attitudes and beliefs shared by organizational members (Sun, 2008). Hofstede et al. (2010) emphasize the importance of understanding culture in the organisation as culture influence peopleøs behaviour and thoughts. In knowledge mapping initiative, support from all levels of employees in the organisation is very crucial.

Relatively, the challenge in controlling peopleøs behaviour and thoughts especially related to norms, values, attitudes and beliefs relies on the numbers of employees in the organisation. Small numbers of evaluation members in FPE decreases the challenge related to organisational culture, yet it is critical for exploiting knowledge mapping benefits.

8.4.8 Identification of the needs for knowledge mapping (KCSF6)

Table 8.12 shows that õidentification of the needs for knowledge mapping with respect to knowledge capture, retrieval, analysis and communicationö (KCSF6) is sixth most critical factor for successful exploitation of knowledge mapping benefits by questionnaire survey respondents. The results are supported by interview respondents of which thirty-eight per cent (38%) highlighted the identification of knowledge mapping needs as a critical factor for successful exploitation. In addition, one of the interview respondents suggested that the identification of the KCSF6 at the early stage of the FPE task as the most critical factor in exploitation of knowledge mapping benefits.

tent, the user and the form of knowledge mapping, the best the different knowledge mapping requirements for every in FPE can be identified. Wexler (2001) suggests that the needs for knowledge mapping can be identified by posing interrogative questions namely:

- Which knowledge management purpose do I want to achieve with the map? (The ÷whyø of the map.)

- What kind of content about knowledge do I want to represent in the map? (The ÷whatø of the map.)

- Who should use the map in which context or situation and at what level? (The ÷for whom?ø and ÷when?ø of the map.)

- Which graphic should be used and who can create the map in that way? (The ÷how?ø and ÷who?ø of the map)

In order to ensure all the questions have an answer, it can be suggested that those interrogative questions should be established at an early stage in the planning stage of the FPE. The implications of the absence of KCSF6 in knowledge mapping initiative that can be established at this point are:

1- Some of the knowledge mapping purposes or in severe cases all of them could not be achieved as the proper tools and techniques were not identified at an early enough stage;

2- The users of the maps could not benefit most from the knowledge mapping exercise as their specific needs are not justified; and

3- A possibility of missing the links between the processes and the people could occur as the knowledge maps needs could not be established.

8.4.9 Availability and accessibility to information and communication technology (ICT) (KCSF7)

An inspection of **Table 8.12** indicates that õaccessibility and availability of information technology within organisationö (KCSF7) is seventh (7th) in the critical success factor list based on the mean value of the questionnaire survey. The KCSF7 was also highlighted by ten (48 per cent) interview respondents as a critical factor in exploiting knowledge mapping benefits in which two (2) respondents perceived KCFS7 as the most critical factor for successful exploitation of knowledge mapping benefits. This result confirmed that the

...CT is a very critical factor for successful exploitation of ...e FPE process.

...T plays an important role in the exploitation of knowledge mapping benefits. The FPE practice also rely largely on ICT components such as building and facilities information system and various facilities databases as a source of information for the evaluation.

Literature shows that most of the knowledge management initiative benefited from ICT such as information system, social networking, and communication technology. ICT is a tool for knowledge mapping as discussed in Section 8.3.1. High dependency on ICT for the purpose of information management, database system and project management in the FM organisation indicates the criticality of KCSF7 for exploitation of knowledge mapping benefits.

With the high accessibility to information and knowledge in the organisation as a reflection of the rapid development of ICT, it can be inferred so far that obtaining information is not a real challenge for the organisation especially in the present research context. The real challenge lies in obtaining in the right context, accuracy, validity, reliability, and most recent and updated of the information. In short, it can be explained as quality information that can provide a means for the knowledge to be mapped and linked in the broader structures. The rapid changes and development in ICT also facilitate the development of a database system as a node in knowledge mapping.

8.4.10 Individual willingness to share knowledge (KCSF8)

Providing the opportunity and means for knowledge to be shared is the ultimate goal for knowledge mapping. If the knowledge is mapped but unable to be shared, the knowledge mapping project can be considered unsuccessful. Vestal (2005) argues that people are not hoarding the knowledge but their time and energy to enable sharing. The reason is that the people want to share what they know; they want to learn from others and not repeat the mistakes of the past. He contends the main barriers for sharing is the structural reason;

> *"..there is not enough time, the process is cumbersome, they do not know the source or the recipients and are not sure they can trust the information, and they know instinctively that tacit knowledge is richer than explicit knowledge."* (Vestal, 2005)

Knowledge sharing can occur through many different media such as conversation, meetings, processes, best practice, database and questioning (Smith and McKeen, 2002). The

to provide the medium for the staff to facilitate effective …nisational culture as discussed section 7.3.3 can hinder the …anagement projects. Therefore, it can be inferred that the issues related to knowledge sharing need to be addressed at organisational level to ensure successful exploitation of knowledge mapping benefits in FPE process.

8.4.11 Flexibility of the knowledge mapping techniques (KCSF9)

Table 8.12 shows that õflexibility of the mapping techniques usedö (KCSF9) as the least critical factor by the questionnaire survey respondents. Likewise, none of the twenty-one interview respondents mentioned KCSF9-related themes for successful exploitation of knowledge mapping. Both interview and questionnaire results however are not purporting that KCSF9 is not important for exploiting knowledge mapping benefits effectively. The results hint that the respondents are not aware of the implication of KCSF9 in exploitation of knowledge mapping benefits.

A flexible knowledge mapping allows room for changes and updating on how the õnodesö and õlinksö of knowledge are represented. Nodes are representing the type and source of knowledge while links is the relationships between the nodes. An example of the type or source of knowledge is the database and the people. The reliability of the links represents the quality of the knowledge maps. Eppler (2003) quoted:

> *"A knowledge map is only good as good as the links it provides. If the links are out dated or absolute, the map is useless. Therefore, a map needs to be continuously updated by the 'map maker' or the people who are represented in it."*

This clearly indicates that the improvement of the nodes and links to keep being updated is necessary to enable knowledge mapping benefits to be effectively exploited.

8.5 Proposed Exploitation for Knowledge mapping benefits in Facilities Performance Evaluation

Analysis of the literature in Chapter 2 (see **Table 2.3**) reveals that authors (Rouse et. al., 1998, Grey, 2009, Eppler, 2001, Kim et. Al., 2003, Egbu, 2006, Ebener et. al., 2006 and Yang, 2007) has proposed various stages in exploring knowledge mapping benefits. For the purpose of the present research, the process is summarised into three main stages which are

ge, analysing the knowledge and linking the knowledge. on requirements such as identification of process to be be achieved through knowledge mapping as suggested by Eppler (2001) and Egbu (2006) respectively. To complete the cycle of exploitation process, the action beyond the three stages recommended also need to be considered. Egbu (2006), proposed on how knowledge can be retained while Kim et. al. (2003) and Eppler (2001) emphasised on updating and validating the knowledge map as a õfeed forwardö process.

The role and contributions of knowledge mapping in facilities management organisations and in facilities performance evaluations in particular (see Sections 5.2, 5.3 and 6.3), hint of the existence of knowledge mapping benefits exploration process in facilities management organisations in Malaysia.

Discussions in Section 8.2.1 show that exploration and exploitation are linked together. The exploration process must be followed by exploitation to gain the best result for exploration while exploitation needs exploration to provide a contentment to be exploited. Otherwise, exploitation might take longer or fail to meets its objective.

The process proposed in this section integrates both exploration and exploitation in the form of infinitive shapes that link the two rings together. The first ring on the left explains the process of exploration of knowledge mapping benefits that can benefit facilities performance evaluation. The processes are summarised from the identified steps and stages of knowledge mapping in Table 2.3 in Chapter 2 of the present research. At this phase, potential benefits of knowledge mapping and issues in facilities performance evaluation that can be addressed by implementing knowledge mapping are identified.

The second ring on the right explains the exploitation of knowledge mapping benefits with the links to show the integration between both exploitation and exploration. The process is summarised and arranged based on findings in Section 8.3. The eight steps in the process are shown in **Figure 8.1**.

Search for K-mapping benefits that could benefits

Existence of K-mapping benefits that could make a full use in FPE
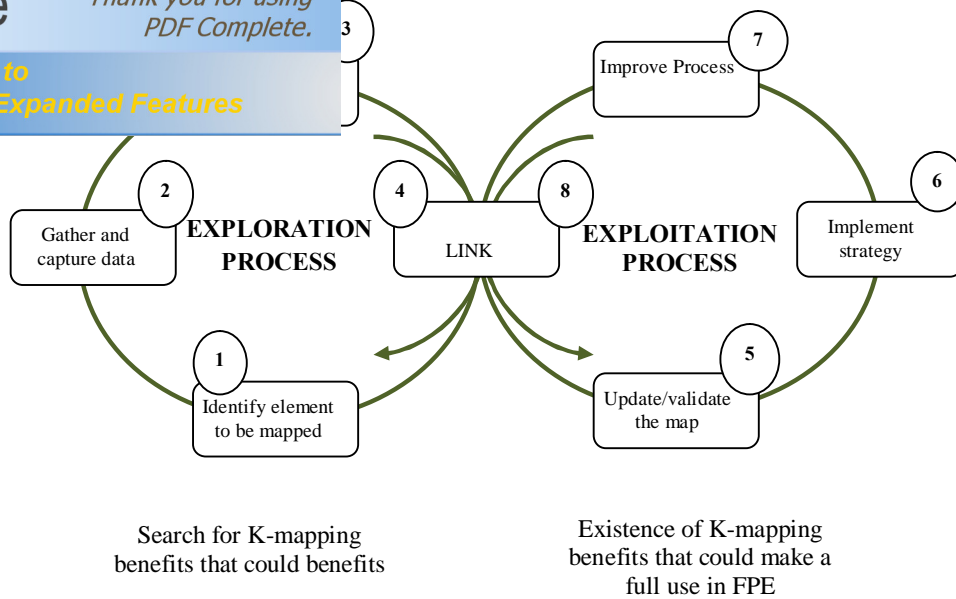
Figure 8.1: *Exploitation of knowledge mapping benefits process (Adopted from March and Barrett, 2010)*

1- Identifying elements to be mapped

Among the early process in exploring knowledge mapping is to identify the elements and process (Eppler, 2001) that will be focused on knowledge mapping. By identifying the elements, the scope and boundaries of the mapping process will be identified. This also allows for sub-processes and people or parties involved being determined. Beside those preparations, the teams for knowledge mapping should set out the goals to be achieved through knowledge mapping (Egbu, 2006). Vail (1999) proposes that the sponsor should determine what the knowledge map intends to do, and the scope of the map and specific knowledge map user requirements.

This is where the exploration of knowledge mapping benefits in facilities performance evaluation begins. Based on the analysis and discussion of critical success factors in Section 4.6 (see **Table 4.15**), the top four out of nine critical success factors for effective facilities performance evaluation are focused on:

(1) Evaluatorsø knowledge;

(2) Presentation techniques;

(3) Accessibility to data and information; and

(4) Availability of database.

...an on-going education on the benefits and requirements of ...the participating staff for (1) and (2) and exploiting ...) for managing information and knowledge effectively for (3) and (4).

The elements to be focused on in knowledge mapping in facilities performance evaluation exist in two forms; firstly the micro form of knowledge and secondly the macro side of knowledge. Micro forms are individual skills, experience and knowledge. In organisational context, micro forms of knowledge involve specialisation on a particular knowledge. Macro forms of knowledge are the commonly or explicitly shared knowledge within the organisation by the individuals and groups in the organisation or in the organisation repository.

2- Gathering and capturing data

Yang (2007) suggests that gathering and capturing data involves four rudiments that are knowledge framework establishment, knowledge source determination, knowledge extraction, knowledge compilation. Several other authors suggest that the process of gathering and capturing data within the organisation as providing an inventory for organisational knowledge; for example to capture and create appropriate knowledge (Egbu, 2006), acquire data, manipulate data, store data (Ebner et al., 2006), defining organisational knowledge, knowledge extraction, knowledge profiling (Kim et al., 2003), deduce relevant knowledge sources, assets or elements (Eppler, 2001), survey (Grey, 1999), extraction of knowledge, compilation of knowledge, derivation of assertions (Rouse et al, 1998).

In a broader knowledge management concept, Wiig et al., (1997) contends that inventory of knowledge is one of the most important elements for effective knowledge management in organisations. The purpose is to get a real picture of knowledge in the organisation and finding answers to the questions what knowledge is used , which knowledge is used, where is the knowledge used, when is the knowledge used and which organisational role provides the knowledge? Wiig et al., (1997) also suggest that the question of ÷whatø is answered by identifying business processes, the ÷whichø refers to the knowledge assets that contribute to the successful execution of business process, the ÷whereø and ÷whenø are captured by the time and location descriptors of a knowledge assets and the ÷which organisational roleø refers to abstract role in an

e in business processes. The rich concept of the locations as

eral other authors such as the knowledge profiles, owners

provides some form of knowledge mapping.

3- Analyse/sort data and information

Not all data and information are useful to the task. Conversely, data and information that constitutes organisational knowledge needs to be sorted out or analysed to add meaning to it. This will provide the means for identifying knowledge needs by means of identifying the knowledge gap (Egbu, 2006), processing data for map analysis (Ebner, 2006, Kim et al., 2003), codifying the knowledge elements (Epler, 2001), and sorting and labelling (Rouse et al., 1998). Grey (1999) perceives the process of identifying the knowledge needs and knowledge gap based on the available organisational knowledge as an audit of the existing knowledge.

4- Link: Providing content for exploitation

To get the best out of the knowledge mapping implementation, the content of the knowledge for specific processes need to be coded and established in the links. The process is cited by authors in knowledge management literature as knowledge representation and knowledge interpretation (Yang 2007), leverage knowledge (Egbu, 2006), visualisation of data (Ebner, 2006), knowledge linking (Kim et al., 2003), integration of codified references (Eppler, 2001), knowledge synthesis (Grey, 1999), and representation of relationships, interpretation and iteration (Rouse, 1997). At this point, all potential knowledge mapping benefits should be able to be identified and ready for exploitation. The information systems that enable the development of database, system integration and communication networking between the staff is very important.

5- Update and validate the map

Updating and validating the map are very important processes in exploiting the knowledge mapping benefits (Egbu, 2006; Kim et al., 2003; Eppler, 2001 and Vail, 1999). Emphasizing the issues of quality in knowledge mapping, Vail (1999) suggests the quality criteria that can satisfy the acceptable quality for knowledge map:

mapping team creates the map interactively and involve as
possible;

presents a truly shared model that all knowledge workers
can relate to;

iii. Synergistic: the experts all contribute their different expertise to the map, in order to generate one logical and comprehensive picture;

iv. Systemic: the map's elements can be combined logically to an integrated whole;

v. Simple; the map can be overlooked at one glance;

vi. Visual; the map uses a visual framework that is made up of iconic elements; and

vii. Information rich: the map is informative in the sense that it aggregates a great amount of noteworthy references that help in the problem solving processes

The quality domain suggested by Vail should be reviewed according to different dimensions of knowledge map such as functional map, cognitive map, technical map and aesthetic map. Eppler (2001) contends the knowledge quality criteria as shown in **Table 8.18**.

quality criteria

	Review question	Compliance
	Does the map serve an explicit purpose for a specific target user group?	YES/NO
	o Is there an implemented process to update and review the knowledge map periodically?	YES/NO
	o Is there a feedback mechanism through which users can suggest improvements to the map?	YES/NO
Cognitive map quality	o Can the map be grasped at one glance (not overloaded)?	YES/NO
	o Does it offer various levels of detail?	YES/NO
	o Does it allow comparing elements visually?	YES/NO
	o Are all elements clearly discernible?	YES/NO
Technical map quality	o Is the access time sufficient (no time lags)?	YES/NO
	o Can the map be used with a browser-interface?	YES/NO
	o Does the map appear legibly on various screen resolutions?	YES/NO
	o Is the map securely protected against unauthorised access?	YES/NO
Aesthetic map quality	o Is the map pleasing to the eye (adequate colour and geometric form combinations)?	YES/NO
	o Can the map's visual identity be kept when new elements are added (map scalability)?	YES/NO

Source: Eppler (2001)

for exploitation of knowledge mapping is very important of knowledge mapping benefits in facilities performance evaluations. Having a strategy means human resources, information technology, and sound management and financials are ready in order to exploit the potential benefits of knowledge mapping. Questionnaire survey results reveal that:

- FM organisations have information technology and communication system for staff to access and retrieve information and knowledge for effective knowledge mapping;
- At the same time, specific and generic business processes are normally recorded and staffs are able to access those information; and
- FM organisations are continuously identifying organisation knowledge.

Findings in Section 8.3 reveals that the process of having a specific strategy for implementation of knowledge mapping benefits has less attention from FM organisations. Only large FM organisations show that the process is very much in place. Therefore, in exploiting the knowledge mapping benefits effectively, a specific strategy is essential.

7- Improve Process

Findings in Section 8.3.6 and Section 8.3.7 evidenced that the process improvement for facilities performance evaluation can be achieved by continuously reviewing the process of evaluating facilities performance and identifying the best practice. At this point the organisation can measure the achievement of knowledge mapping exploitation by reviewing the benefits being cultivated via implementation of knowledge mapping as Skyrme (2007) perceived the process as organisational benefits exploitation.

8- Link: Provide lesson learned

Lesson learned in exploitation of knowledge mapping can suggest new areas to be explored in knowledge mapping that can benefits facilities performance evaluation and to tackle changes occurring over time. Time changes also transform perspectives of knowledge management in organisations with factors such as advances in technology, changes of business orientation, changes in environment and management approach.

...areness and Exploitation of Knowledge Mapping in

...uation

...er with the **Guidance Document - as per Appendix L**)

In the Oxford Dictionary (2011) õguidanceö is defined as *"advice or information aimed at resolving a problem or difficulty, especially as given by someone in authority"* different with guidelines which is defined as *"a general rule, principle, or piece of advice"*. Problems or difficulties in the context of present research are the issues pertaining to the challenges and critical success factors in the implementation of knowledge mapping in facilities performance evaluation.

The present study has provided insight and understanding of the exploitation of knowledge mapping in facilities performance evaluation. Chapter 2 provided the theory of knowledge mapping in general practice and the insight into the field of study were expounded in chapters 4, 5, 6, 7 and the previous sections of this chapter. Furthermore, a prescriptive guidance is developed to ensure that the benefits of knowledge mapping are fully exploited in facilities management organisation. Development of the guidance for knowledge mapping benefits in facilities performance evaluation can be exploited for other tasks in managing facilities. The guidance aims to help facilities management organisation to get the best of knowledge mapping implementation in facilities performance evaluation and at the same time improve the awareness of facilities managers in FM organisations of the benefits of knowledge mapping. The objectives of the guidance are:

- Providing insights on knowledge mapping.
- Providing the route to follow in implementation of knowledge mapping derived from industry best practice.
- Providing doøs and donøts in implementing knowledge mapping and important tips.
- Discovering the potential benefits of knowledge mapping that are being exploited in other fields and revealing the ways it can be exploited in FM organisations specifically in facilities performance evaluation processes.
- Highlighting the potential threats that challenge facilities managers in FM organisations and key factors for successful implementation of knowledge mapping.

Improving Awareness in Knowledge Mapping

One of the central tenets of the present research is the distinction between organisations that are aware of the roles and benefits of knowledge mapping implementation and those that are

...efined in the Oxford Dictionary (2011) as õknowledge or
...or õconcern about and well-informed interest in a particular

Awareness can be achieved in situations where facilities managers in the organisation are provided with the necessary knowledge and information of knowledge mapping benefits. To achieve this, an organisation should have a õknowledge-friendlyö culture. Davenport et al (1998) contend that having knowledge-friendly culture is the most important but the most difficult to create if it does not already exist.

8.6.1 Content and Design of the Guidance Documents

Guidance document is a document that demonstrates a series of action for implementation of an approach for individuals and groups of people. Very little in the literature discussed developing a perfect guidance (Spooner, 1998). This argument supported by Nursing and Midwifery (2006) confirms that there is little evidence available in the existing literature on how to produce a guidance document. The different audience or user requirements on the guidance might also diverse the structure and content of the guidance. Cox *et al*. (2003) suggest targeting guidance carefully towards its intended audience, and making information workplace- and context-relevant, and improving practitioner knowledge and understanding, and thus making the guidance more effective. Therivel *et al*. (2004) suggest in the writing of guidance documents, it is important to consult the intended audience of their special needs.

However, a õgoodö guidance might be obsolete when used over a period of time. Therefore, the guidance should also be able to accommodate changes. Bell and Morse (1999) contend that flexibility should be the main characteristic of guidance documents by making guidance documents so prescriptive, they become irrelevant and inappropriate for use in some circumstances.

Therefore the study on the userøs requirements and nature of the areas of guidance is necessary when designing or developing guidance. Scope of the guidance is also very important to provide boundaries and limitations of the areas covered in the guidance. Therivel *et al*. (2004) suggest that the guidance document should be written focused on the needs of planners; when writing guidance, an author should try to *"think like a planner in order to find out how (they) would like to see this new instrument fit in (their) day-to-day practice".* Therival also recommend that the guidance developer or author should aim to produce a

nce document that would be easy to apply in small local *and with little background knowledge or experience"* in e. This is in concordance with NHMRC (1998) suggestion which is the guidance should be presented as clearly and concisely as possible, bearing in mind that different formats may be appropriate for different types of guidelines or different types of users. Guidance may be presented as free text, as flow charts or in any other format that facilitates comprehension. Abbreviations and symbols should be consistent and easy to follow. Important terms and others that might be misinterpreted should be defined. Comprehensively, in health education sector, Davis (2006) underlined ten main values in developing guidance:

1) Process for developing and evaluating the guidance should focus on outcomes.

2) Guidelines should be based on the best available evidence and should include a statement about the strength of their recommendations. Evidence can be graded according to its level, quality, relevance and strength.

3) Taking the evidence - of whatever level, quality, relevance or strength - and turning it into housing useful recommendations depends upon the judgment, experience and good sense of the group developing the guidelines.

4) The process of guideline development should be multidisciplinary and include policymakers.

5) Involving a range of generalist and specialist will improve the quality and continuity of housing and will make it more likely that the guidelines will be adopted.

6) Guidelines should be flexible and adaptable taking into account context settings, costs and constraints. Provision should be made for accommodating the different values and preferences of managers and employees.

7) Guidelines should be developed with research constraints in mind.

8) Guidelines are developed to be disseminated and implemented taking into account their target audiences. They should also be disseminated in such a way that practitioners and consumers become aware of them and use them.

9) The implementation and impact of guidelines should be evaluated.

10) Guidelines should be revised regularly.

...ance

...posed guidance primarily covers the important aspects ...at constitutes the aim of the present research; the critical success factors for effective exploitation of knowledge mapping in facilities performance evaluation. The guidance also considered the nature of facilities management organisation and facilities performance evaluation practice in Malaysian context.

The variables that constitute challenges in implementation of knowledge mapping in facilities management organisation as discussed in Section 7.2 of the present research list the top two challenges in this regards in the following order:

1. Changing attitude and culture within organisations towards knowledge; and
2. Lack of training related to knowledge mapping provided to staff.

Therefore the guidance was designed to address the issues in providing training material for facilities managers and staff in facilities management organisation. Even though õknowledge-friendlyö culture is one of the most difficult to create if it does not already exist (Davenport et al., 1998), appropriate information and knowledge for knowledge management advantage can be shared with facilities managers. Indirectly, it can also change or improve the perception of the facilities managers and the organisation towards the knowledge.

The factors that influence the success of the exploitation of knowledge mapping as discussed in Section 8.4 also indicates the importance of knowledge and skill of the staff involved in knowledge mapping as well as organisational culture as critical factors in exploitation of knowledge mapping benefits. The elements such as understanding the process of facilities performance evaluation and knowledge flow in the process, ability to capture new knowledge by implementing knowledge mapping in facilities performance evaluation and support from top management are important to be considered and integrated in the proposed guidance.

8.6.3 Scope of the guidance

The aims of the guidance are to help facilities management organisations get the best of knowledge mapping implementation in facilities performance evaluation and at the same time improve awareness of the facilities managers in FM organisations of the benefits of knowledge mapping. However, some limitations are necessary to provide the right context and focus for the proposed guidance.

Although the guidance is developed by referring to international practice and multiple field of professions, the proposed guidance is targeted at the facilities management organisations in

...e content of the guidance is based on the interviews and ...ducted in Malaysia.

...red as the first attempt towards the implementation of knowledge mapping and exploitation of its benefits in facilities management organisations. This is referring to the exploratory stage of the research on how knowledge mapping plays a role in facilities management organisation. The guidance is attached to the facilities performance evaluation process in facilities management organisation. The guidance suggests and order methods and instruments which provide a general view of the relevant aspects but does not have to apply in every particular case. Hence, the proposed guidance is not self-thought; it is recommended that it should be used as a start to complement the systematic approach that needs the guidance of individual or groups of experts appropriately.

8.6.4 Proposed Guidance Documents

To develop a simple, concise and easy to follow guidance, the structure of guidance adopted by Transparency International (2004) which includes (1) Guidance background; (2) Implementation aspect, and (3) Questions and answers for some key topics; is a good example to be adopted in developing a guidance for the present research with a few adjustment to tailor to the needs of potential users of the proposed guidance.

The guidance proposed in the present research begins with the introduction of the purpose of the guidance, how to use the guidance, and the target user of the guidance. Three main components of the guidance as illustrated in **Figure 8.2** explained its main role in improving awareness towards knowledge mapping implementation by introducing three main components that is the implementation, the benefits and finally the issues.

GUIDANCE

Focused Area

The Implementation	The Benefits	The Issues
Best practice in implementation of knowledge mapping	*Exploitation of knowledge mapping based on the identified benefits of knowledge mapping*	• *Challenges* • *Critical Success Factors*
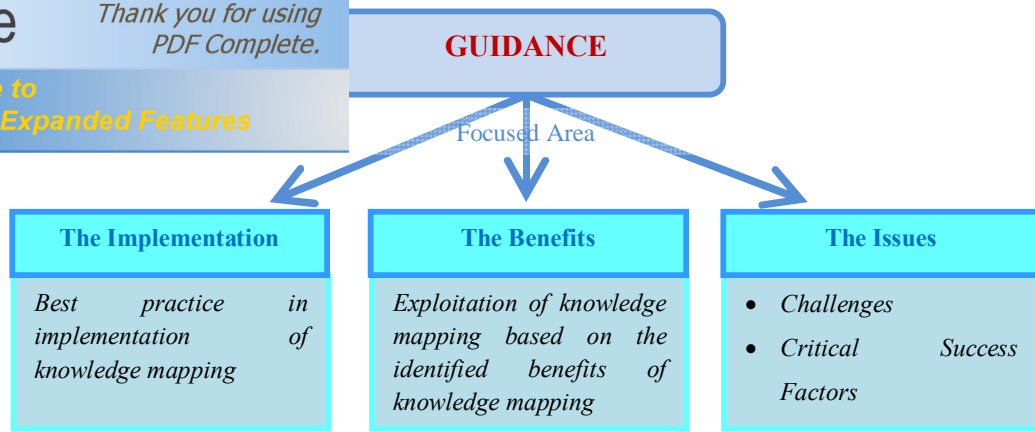
Figure 8.2: *Area of focused on the development of guidance*

a) *The Implementation*

The guidance suggests that the knowledge mapping implementation such as the process involved is based on the literature review in the subject of knowledge mapping implementation. The best practice in this subject is also derived from key findings in the data analysis in **Chapter 5**. This component guides the potential users to initiate knowledge mapping initiatives in FM organisations by introducing the common steps involved, general advice on do's and don'ts and the prerequisites prior to implementation. Potential users are also guided to various types, categories and uses of knowledge mapping that fit the context of usage.

b) *The Benefits*

Guidance to the potential benefits that can be gained through implementation in the organisation. Highlighting the benefits to potential users is very important so that potential users have an idea and are aware of the potential benefits that exist and can be exploited.

Outlines of the knowledge mapping benefits are extracted from the literature review and expanded in the practice theory by defining the key findings in **Chapter 6.**

...sues in knowledge mapping practice can guide potential users of the plain atmosphere of the implementation environment. Critical success factors in implementation of knowledge mapping in the organisation (Facilities Management) and process (facilities performance evaluation) are able to guide potential users of the key aspect that influences the success of implementation of knowledge mapping. Mainly, the issues highlighted and focused for the present guidance are on the implementation aspect of knowledge mapping.

8.6.5 Validation of the guidance

Validation is the process to maximise the accuracy, trustworthiness and authenticity of the findings as discussed in Section 3.8.2. In the case of the present research, to validate the proposed guidance, the draft have been sent to the top ten (10) managers in Malaysian facilities management and two (2) academia in the area of facilities management in Malaysian universities attached with a set of questionnaire. The distribution of FM practice as shown in **Table 8.19** indicates that the blend of practice-academia respondents to provide feedback on the proposed guidance can increase the reliability of the guidance.

Table 8.19: *Sample of the draft guidance validation from facilities management practice*

Participants	Small FM Organisation	Medium FM Organisation	Large FM Organisation	**Total**
In-house	*1*	*2*	*2*	5
Out-source	*1*	*2*	*2*	5
Total	2	4	4	**10**

The respondents are identified during data collection exercise and have been approached after the exercise. Therefore, one hundred per cent of the questionnaires sent were returned within the stipulated time. The questionnaires have been sent to twelve (12) respondents via e-mail attachments as preferred by the respondents.

The participants were asked about their perception towards the guidance in terms of (1) content and structure of the guidance; (2) appropriateness and relevancy; and (3) user friendliness of the guidance as well as their thoughts on how to improve the draft guidance documents.

ropriateness, 70% of the respondents are of the view that
idance information is high and very high in terms of clarity
both depth and breadth of coverage of key issues.

In terms of appropriateness and relevancy, 80% of the respondents are of the view that the level of appropriateness and relevancy of the guidance is high and very high logically and is easy to follow.

80% of the respondents are of the view that the guidance is high and very high in terms of relevance and usefulness for implementing quality of communication, 90% of the respondents are of the view that the guidance is high and very high in terms of user-friendliness and is hence easy to use and work within.

The results of analysis show that the content of the guidance is comprehensive, conveying both the depth and breadth of coverage of key issues, the structure is logical and easy to follow, the guidance relevant and useful, is user-friendly and hence easy to use work within, and the guidance is beneficial to both organisations and employees.

However, some areas of improvements on the guidance that can enhance the quality of the guidance are worthy of consideration. All of the respondentsø comments were on the level of user friendliness and the structure of the guidance. One of the respondents suggests separating the guidance according to the topics in the process to be more practical and for easy reference. Other comments from academia suggest including potential benefits of knowledge mapping at the beginning to attract users to the further contents. Consequently, the main comments are taken into consideration in the final guidance document as follows:

- Divide the guidance structure into topics;
- Point form rather than paragraph; and
- To include checklist for every phases in the process.

After taking these comments into consideration, the researcher decided to divide the guidance structure into three main topics; *meanings of issues, implementation issues and other salient issues for consideration*. Also, the researcher used figures to show the main ideas and the goals of these guidelines.

present chapter reveals that the most in-place processes of
re:

    i- ***P1***: Information technology and communication systems are ready for staff to access and retrieve information and knowledge for effective mapping;

    ii-   ***P2***: Specific and generic business processes are recorded and accessible to most staff in the organisation; and

    iii-   ***P3***: Identification of the organisational knowledge is a continuous process in the organisation.

However, the interview and questionnaire results also reveal that most FM organisations have disregarded the most important processes such as:

    i. **P9**: nominating a specific individual or group as knowledge mapping custodians of the process; and

    ii. **P10**: having a specific strategy for implementation of knowledge mapping.

The literature in the knowledge mapping area has suggested factors that are critical in exploitation of knowledge mapping. The survey and interview findings in the present research shows that five of the critical success factors in exploitation of knowledge mapping for FPE process can be documented as follows:

    i. **KCSF 4**: Knowledge and skill of the staff involved in knowledge mapping;

    ii. **KCSF 3**: Strong support from top management;

    iii. **KCSF 5**: Having an organisational culture that is positive towards knowledge mapping;

    iv. **KCSF 7**: Accessibility and availability of information technology within the organisation; and

    v. **KCSF 6**: Identification of knowledge mapping needs with respect to knowledge capture, retrieval and analysis.

As a summary, the following inferences and implications can be documented:

    1- The knowledge mapping benefits exploitation process does occur in FM organisations but an improvement can be achieved if a proper guidance for exploiting knowledge mapping benefits is available as a reference in an organisation that can be achieved through training and workshop in the area of knowledge mapping. There is no specific guidance available for knowledge mapping exploitation in Malaysia so far.

or knowledge management but a very powerful tool in the dge mapping. Besides being a very important component IT also becomes a basic skill and knowledge in the management of facilities. Therefore, in exploitation of knowledge mapping benefits, special focus and attention on IT development in FM organisations is crucial. The development of IT should also be parallel with staff development such as providing related training and workshop to maximise the consequences.

3- Besides providing the tools and training for staff, strong support from top management is a prerequisite in this regard. Through top management support, the specific strategy for knowledge mapping exploitation can be formulated, providing financial support and promoting knowledge culture within the organisation.

4- The guidance for exploitation of knowledge mapping benefits will not only be able to provide a guide but also promote awareness towards the practice of knowledge mapping in FM organisations.

Therefore, this chapter addressed the fifth objective and research question posed at the beginning of the present chapter. The next chapter concludes the research.

The present chapter is the final chapter of the present study that summarises the aims and objectives of the study, summarises the research process, presents key findings and proposed recommendations. It will also offer suggestions for the areas that need to be researched in the future:

> *"The aims of this research are to establish the critical success factors for effective exploitation of knowledge mapping in performance evaluation of facilities and to develop an appropriate guidance for improving awareness and exploitation of knowledge mapping in performance evaluation of facilities in Malaysia"*

9.2 The Research Process

Research direction of facilities management includes knowledge management subjects as an imperative domain to be focused on. Nevertheless, empirical evidence in implementation of knowledge management especially related to knowledge mapping is still intermittent. Evaluations of facilities performance have affirmed importance in facilities management organisations.

Consequently, the present research aims mainly to establish the critical success factors for effective exploitation of knowledge mapping in performance evaluation of facilities and to develop an appropriate guidance for improving awareness and exploitation of knowledge mapping in performance evaluation of facilities in Malaysia.

Overall, the research attempted to address the following objectives:

1. To investigate the extent to which performance evaluation of facilities is practiced in Malaysia, and to document both challenges that confront facilities managers in this regard and the critical success factors in effective performance evaluation of facilities;

2. To explore the increasing role of knowledge mapping in the management of facilities in Malaysia and to document factors that have given impetus to this;

3. To investigate the extent to which facilities management organisations are aware of the role and implications of knowledge mapping in performance evaluation of facilities;

ment the challenges associated with implementing a
ive that can improve performance evaluation of facilities;

5. To identify processes, if any, that are in place in facilities management organisations, to exploit the benefits of knowledge mapping in performance evaluation of facilities, document critical success factors for effective exploitation of knowledge mapping and proffer guidance for improvements in this regard.

Initially, the study covered a review of literature in the area of facilities management which focused on the relevant facilities performance evaluation domain. Identification of research problems in the area gives direction to the knowledge management subject matter. It was revealed that knowledge mapping is critically important but hardly ever discussed.

The second stage of the research focused on collecting primary data by conducting questionnaire surveys and semi-structured interviews. One hundred and eighty eight (188) valid questionnaire surveys executed via e-mail attachments were obtained from facilities management practices in Malaysia. Concurrently, twenty-two (22) interviews with senior facilities managers from different organisations were conducted. Due to distance and logistic matters, the interviews were conducted over telephone and recorded using the online dictation software õCallgraphö.

At this stage, the extent of practice, challenges and the critical success factors in conducting facilities performance evaluations were identified. The roles of knowledge mapping in FM organisations at large and in FPEs were identified as well as the challenges that hinder the implementations of knowledge mapping. The process of exploitation of knowledge mapping and its critical success factors were also identified at this stage.

Finally, in the third stage of the research, the guidance for exploitation of knowledge mapping benefits was developed based on the challenges, critical success factors and identified processes of knowledge mapping in the previous stage. Twelve (12) practitioners including two (2) members of academia were requested to review the developed guidance to seek feedback, ideas for improvement and suggestions for practical use of the guidance.

used to analyse the qualitative data collected (i.e semi-
tive data (i.e. questionnaire survey), the Statistical Package
n 20) was used.

9.3 Limitation and Self-Critical Analysis

In describing its scope and limitations, the present research has focused on knowledge mapping contributions with regards to the following aspects only:

1) This study focuses on the facilities management organisations practicing in Malaysia from the list obtained from CIDB as a main training provider related to facilities management development in Malaysia;

2) The data was collected from the respondents based on the available list and snowballing process by invitation to participate in the survey;

3) The results of the present research sought from respondents consist of senior managers in facilities management organisation. The justification for this is rationally the senior managers have bigger views, are more experienced; and understand the nature and processes involved in facilities management organisations better. Therefore, they can provide a timely, most accurate and true representation of the facilities management views on the questions posed in the interviews and questionnaire surveys;

4) The dimensions of knowledge mapping implementation discussed in the present research are focused mainly on: i) organisational setting; and ii) process setting. The former is intended to study the implementation issues such as the role of knowledge mapping, the challenges, and the critical success factors within facilities management practice in Malaysia. The latter mainly aims to explore the role of knowledge mapping, the challenges, and critical success factors in facilities performance evaluation task or process within facilities management organisation in Malaysia. The soft and hard FM perspective is not been discussed in the research as it could be conflicted with the FM service provisions; and

5) Since this is the first research to explore the role of knowledge mapping in facilities management organisations in Malaysia, a precedent research within this area is not available. However, similar researches in the area of knowledge mapping in other countries and contexts are compared.

has served as a training period for the researcher. The

knowledge such as process in research, research ethics,

ents and research methodology are attained throughout the

period.

9.4 Conclusion of the Study

The key findings of the research and conclusions drawn from the research study are presented in subsequent sections.

9.4.1 Practice of FPE in Malaysia

The extent of practice of facilities performance evaluation is viewed from three dimensions which are 1) level of preparedness of FM organisations to conduct FPE; 2) approaches by FM organisations towards FPE; and 3) the role and contribution of FPE in the management of facilities.

From the first dimension, FM organisations are likely to rely on highly internal resources and expertise to conduct FPE by employing specific techniques to suit their unique requirements and objectives of the evaluation.

From the second dimension, the FPE are the routine tasks that are conducted based on a predetermined schedule in most FM organisations. Therefore, FM organisations are always informed of their facilities performance.

From the third dimension, the outcomes of FPE are highly valuable for FM organisations to optimise and improve facilities performance. The outcomes of the evaluation are also used in decision making and problem solving. In preparing facilities management budget planning, the outcomes of the FPE can be used as a main reference.

The present focus of FM organisation is on the FPE role and contribution rather than preparation for conducting FPE and approach towards conducting quality FPE. The extent of FPE practice is also linked with the challenges and critical success factors in conducting them.

The challenges in conducting FPE are relatively associated with:

- Ownership of the facilities performance evaluation which includes the questions of who should conduct the FPE and who should bear the cost of conducting the FPE.

be solved by incorporating the responsibility of conducting ... ts and FM top management are less aware of the important ... of facilities effectively.

- <u>Awareness of the roles and benefits</u> of the FPE is relatively low amongst FM stakeholders in Malaysia. The stakeholders include FM organisations, the employees, the facilities owner, the facilities occupants/users and the public.

The questionnaire survey identifies three most challenging factors in conducting FPE in Malaysian FM organisations as follows:

- Interpreting and drawing conclusions from the data and information collected;
- Collecting and obtaining data and information about the building; and
- Lack of staff with relevant knowledge in conducting FPE.

The critical success factors determine the mandatory factors that organisations should have for successful FPE. From the analysis and discussion of the survey results in Section 4.6, it can be inferred that FM organisations strongly urge the elements of knowledge management in FPE. The nature of the FPE task or process which requires highly skilled, knowledgeable and experienced staff to conduct the evaluation and make recommendations as an output of the process is an imperative indication that the critical factors for successful FPE is related to how the organisation deals with management of knowledge.

Therefore, five most critical success factors identified in the present research are listed in the following order:

1) Knowledge and skill of evaluators;
2) The quality of outputs/reports of the evaluation;
3) Accessibility to the data and information;
4) Availability and adequacy of facilities information database; and
5) Having clear statements about the evaluation objectives.

The extent of practice, challenges and critical success factors discussed in the present chapter navigates the research towards the needs for knowledge to be managed wisely and formally in FM organisations in general and in the FPE process itself. Within the present research context, the knowledge mapping approach is the element to be employed to address the issues and satisfy the critical success factors in FPE.

To improve the practice of FPE implementation so as to satisfy its intended objectives, it can be suggested that FM organisations should:

nprehensive guideline for conducting FPE that can be used by the existing staff and referred by new staff;

- Develop a knowledge management framework so the organisation can identify its strengths and weaknesses. By having such frameworks, the organisation can always be sure that they are ready to conduct FPE tasks;

- Employ an integrated facilities database which includes information such as building information, space management, tenant information, maintenance management information, past evaluation, vendors, and staff directories. The database should be easily accessed by relevant staff from their desk. The online directories can assist in finding out who does what and where they are;

- Provide on-going learning so that existing staff can constantly update their knowledge;

- Encourage staff within the organisation with common interest to establish a network with each other so the sharing of knowledge can transpire;

- Creating electronic filing systems that can be searched in a number of ways, making the information much easier to find; and

- Creating intranets so that the staff can access all kinds of organisational information and knowledge that might otherwise take a great deal of time and energy to find.

9.4.2 Role of knowledge mapping in facilities management organisation

The most important role of knowledge mapping in FM organisations can be documented as follows:

- Elements of knowledge mapping exist for improving knowledge asset inventory in FM organisations by providing a comprehensive database of building and facilities information;

- Elements of knowledge mapping also exist in FM organisations such as providing directories of people and information;

- Knowledge mapping is also used for avoiding duplication of tasks in managing facilities;

- Knowledge mapping is important in identifying knowledge needs (the gap between available knowledge and required knowledge) within the organisation; and

...ed in improving process workflow involved in managing

...of the role of knowledge mapping in FM organisations are driven by rapid development of ICT as the most influential factor and also driven by user demands for better quality facilities services as the second most influential factor.

The role of knowledge mapping continuously arises in FM organisations as more tools and techniques to improve access to knowledge, and better means for knowledge to be linked. As a summary, the following inferences and implications can be documented:

- The role of knowledge mapping in FM organisations is significant and evolves through time, business direction, users' expectations and available technology;

- Rapid development in ICT has a significant influence on the growth of knowledge mapping roles in FM organisations. Simultaneously, facilities management software evolves and provides more advanced features (e.g. broadband internet, Wi-Fi access and cloud computing) that can provide higher accessibility to information, faster retrieval of information and highly integrated databases; and

- As FM organisations play a support function in the organisation, challenges to offer better services as expected by the clients always become a priority and is emphasised. For that reason, improvement to maintain organisation competitiveness via implementing knowledge mapping in the organisation is vital.

Finally, it can be deduced that two perspectives of FM organisations (organisational size and service provision) have much to gain from knowledge mapping initiatives. The indications are that the initiatives are explored at some degree, although a much more systematic approach is needed. The FM organisations would appear to need to develop understanding and awareness on the broad knowledge management trivia as an organisation enabler rather than as a resource intensive additional initiative in inculcating knowledge mapping initiative within their organisations.

...owledge mapping in FPE

Chapter six reveals that the six most important roles of ...process are as follows:

1- RO1:   Assisting in identifying available and required knowledge;

2- RO2:   Simplifying the process;

3- RO3:   Avoiding duplication of tasks;

4- RO4:   Linking the right people to the task;

5- RO5:   Providing building and facilities database; and

6- RO13:   Providing directories of people and expertise.

- RO13 has less benefit for small and medium organisations compared to large FM organisations regardless if they are in-house or outsourced FM service provisions.

- In general, the discussion reveals that FM organisations in Malaysia are aware of most of the knowledge mapping roles in FPE process. However, the training for effective use of knowledge mapping tools and techniques especially by exploiting technologies in ICT is necessary. The implication of lack of training includes less structured implementation of knowledge mapping as shown in the present research which leads to the negligence of some of the knowledge mapping role and limits the extent of knowledge mapping benefit being exploited.

- The role of knowledge mapping in FPE for in-house and outsourced FM organisations is relatively similar. Therefore, regardless of the FM provision the organisation belongs to, the FM organisation should focus on exploiting the benefits of the less prominent knowledge mapping role such as:

  - Role of knowledge mapping in innovation processes; and

  - Identifying knowledge sharing barriers and opportunities across the organisations.

- The implementation of knowledge mapping should begin at the organisational level and be followed by the processes embedded in the organisation such as FPE. Most of the effort in implementation of knowledge mapping such as compiling organisational knowledge, providing training for the staff, inculcating the knowledge culture environment, and providing necessary ICT infrastructure are required inclusive of participation and support from the top management.

implementation of knowledge mapping

...luation is a highly skilled and knowledge-based process in ...es. Despite a slight difference in terms of the organisation's (i.e. size of organisation) perceptions on the challenges in this regard, the most common challenges faced by facilities management organisations in implementing knowledge mapping are listed in the following order:

1) *CK1*: Changing attitudes and cultures within organisations towards knowledge;
2) *CK2*: Lack of training related to knowledge mapping provided to staff;
3) *CK3*: Understanding the knowledge flow from facilities management processes within the organisation;
4) *CK4*: Accuracy of data and information about the facilities; and
5) *CK5*: Financial constraints that prevent knowledge mapping initiatives from taking place.

- Large FM organisations appear to have higher levels of challenges than small and medium FM organisations.

- The inhibition of knowledge culture can restrain the implementation of knowledge mapping in FM organisations. A comprehensive strategy can be employed to inculcate knowledge awareness within the organisation such as encouraging senior facility managers to share their knowledge and coach junior managers, improving interaction between staff, and improving transparency by making visible and accessible all common processes to the employees.

- Lack of training and exposure to the staff in implementing knowledge mapping can lead to severe failure in the implementation of knowledge mapping. For small and medium organisations, employing appropriate training strategies and programmes for staff can prevent staff shortage during training. The appropriate training can be identified from the knowledge management and ICT training provider in the knowledge mapping-related area. For large organisations, the training can be conducted in-house by inviting appropriate trainers to their workplace.

- Failure to identify and understand the knowledge flow in the organisation can lead to knowledge loss. Knowledge flow through people, process, time, location, and

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e systematically recorded and documented. For tacit

o quote the source of knowledge.

ate data and information that is false, inaccurate decisions, and delays in action can render knowledge mapping meaningless. Regardless for small and medium or large organisations, the group of identified employees or owners of the process can be allowed to update the database but appropriately, an individual should be assigned to overlook the system especially when the owners of the process are numerous.

- Challenges related to financial constraints occur relatively due to lack of awareness towards knowledge mapping benefits. Besides the cost of training, the primary expenditure expected for knowledge mapping initiatives emerged from acquiring technologies (i.e ICT) for the tools. However, the findings in the previous chapters reveal that most FM organisations have specific facilities management systems such as CMMIS and CAFM which have features such as building and facilities database, preventive maintenance programming and groups of expertise directories. The programme allows data and information of facilities to be generated, linking the expertise and information efficiently and effectively. Hence, in general, no further investment on the tools is required. The training and user creativity can enable the advantages to be effectively exploited.

9.4.5 Exploitation of knowledge mapping benefits

- The analysis of the findings in **Chapter Eight** reveals that the key process of knowledge mapping benefits exploitation does exist but is less structured due to informal knowledge mapping practices in the organisation such as having no specific personnel or groups that oversee the process; and no specific strategy to exploit the knowledge mapping benefits.

- The literature in the knowledge mapping area has suggested factors that are critical in exploitation of knowledge mapping. The survey and interview findings in the present research show that five of the critical success factors in exploitation of knowledge mapping for FPE process can be documented as follows:

  i. **KCSF 4**: Knowledge and skill of the staff involved in knowledge mapping;

  ii. **KCSF 3**: Strong support from top management;

organisational culture that is positive towards knowledge

...ity and availability of information technology within the organisation; and

> v. **KCSF 6**: Identification of knowledge mapping needs with respect to knowledge capture, retrieval and analysis.

- Knowledge mapping benefits exploitation process does occur in FM organisations but an improvement can be achieved if proper guidance for exploiting knowledge mapping benefits are available as a reference in an organisation that can be achieved through training and workshops in the area of knowledge mapping. There is no specific guidance available for knowledge mapping exploitation in Malaysia so far.

- IT is not only an enabler for knowledge management but a very powerful tool in implementation of knowledge mapping. Besides being a very important component for knowledge mapping, IT also becomes a basic skill and knowledge in the management of facilities. Therefore, in exploitation of knowledge mapping benefits, special focus and attention on IT development in FM organisations is crucial. The development of IT should also be parallel with staff development such as providing related training and workshops to maximise the benefits.

- Besides providing the tools and training for staff, strong support from top management is a prerequisite in this regard. Through top management support, the specific strategy for knowledge mapping exploitation can be formulated, providing financial support and promoting knowledge culture within the organisation.

9.5 Recommendation and Future Work

Having considered the overall findings of the present research, some recommendations can be presented as follows. The recommendations are targeted to the two main related parties in this research; practitioners in the FM industry and members of the academia. This is to improve practices relating to the implementing of knowledge mapping in facilities management organisations and exploiting its benefits in facilities management operations:

titioners

lings and synthesis of the research, some recommendations

1.   Implementation of knowledge mapping is a continuous effort. Every individual in the organisation should be aware of their role in ensuring that knowledge mapping implementation can keep progressing and really work in the organisation.

2.   An attempt towards knowledge mapping can begin by exploiting existing tools and resources that are available in the organisation. Therefore, when the knowledge grows, the need for further tools and special training can be identified.

3.   An attempt to initiate knowledge mapping can be undertaken at the process level in FM organisations rather than initiating at the organisational level. It can be developed and expanded to the other processes or at the organisational level so the foundation of knowledge mapping implementation can be strengthened.

4.   Regardless of the size and type of FM provisions, the FM organisation should nominate an individual or a group for implementation and exploitation of knowledge mapping. The nominated individual or group should be equipped with the necessary skills and knowledge that can be achieved by attending seminars, training and workshops.

5.   The guidance proposed in the present research should be reviewed regularly to complement current best practices and trends in FM and accommodate future changes.

6.   In the case of outsourced FM service provision, a good relationship with the client should be established to enable smooth coordination of information and knowledge of the facilities so that the relevant processes of facilities management and evaluation of facilities performance can occur.

lemia

The recommendations to academia for future research are as follows:

1. In order to add value to the present research which adopts the organisation as a unit of analysis, it is strongly recommended for future research to explore the complex value of the phenomenon of knowledge management and knowledge mapping implementation in facilities management organisations from the individual facilities managersø perspective.

2. There is ample scope for more empirical study to explore and document the exploitation of knowledge mapping benefits in the specific sector such as government offices facilities, universities and hospitals. The case study approach may be appropriate to examine the depth of the study.

3. As knowledge mapping in facilities management is considerably underdeveloped, the same research methodology can be replicated in different industries and countries. The outcomes can lead to a generation of benchmarked data and best practices in exploitation of knowledge mapping as practiced in other industries of the country.

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APPENDIX A

Knowledge Management

Ranking		CSFs
1	Skyrme and Amidon (1997), Holsapple and Joshi (2000), Davenport et al. (2001), Liebowitz (1999), Hassanali (2002), American Productivity and Quality Center (APQC) (1999), Ribiere and Sitar (2003), Wong and Aspinwall (2005), Al-Busaidi and Olfman (2005), Chong (2006), Akhavan and Jafari (2006), Akhavan et al. (2006), Jafari et al. (2007), du Plessis (2007)	Management leadership and support
2	Skyrme and Amidon (1997), Davenport et al. (1998), Liebowitz (1999), (APQC) (1999), McDermott (2001), Hassanali (2002),), Wong and Aspinwall (2005), Al-Busaidi and Olfman (2005), Wong and Aspinwall (2005), hung et al. (2005), Akhavan et al. (2006), Chong(2006), Bozbura (2007),du Plessis (2007)	Organizational culture
3	Skyrme and Amidon (1997), Davenport et al. (1998), (APQC) (1999), Alavi and Leidner (2001), All-Buaidi and Olfman (2005), hung et al. (2005), Wong and Aspinwall (2005), Akhavan et al. (2006), Akhavan and Jafari (2006), Chong (2006),du Plessis (2007)	Information technology
4	Skyrme and Amidon (1997), Davenport et al. (1998), Liebowitz(1999), (APQC) (1999), Zack (1999), Wong and Aspinwall (2005), Akhavan et al. (2006),Bozbura (2007),du Plessis (2007)	KM strategy
5	Davenport et al. (1998), (APQC) (1999), Holsapple and Joshi (2000), Hassanali (2002), Hung et al. (2005), Wong and Aspinwall (2005), Chong (2006),du Plessis (2007)	Performance measurement
6	Davenport et al. (1998), Liebowitz (1999), Hassanali (2002), AllBuaidi and Olfman (2005), Wong and Aspinwall (2005), Akhavan et al. (2006), Akhavan and Jafari (2006), Jafari et al. (2007),du Plessis (2007)	Organizational infrastructure

	...n (1997), Davenport et al. (1998), ...i (2000), Bhatt (2000), Wong and ...Processes and activities Akhavan and Jafari (2006)	Processes and activities
8	Davenport et al. (1998), Liebowitz (1999), Yahya and Goh(2002), Al-Busaidi and Olfman (2005), Wong and Aspinwall Rewarding and motivation (2005), Akhavan and Jafari (2006),du Plessis (2007)	Rewarding and motivation
9	Mentzas (2001), Yahya and Goh (2002), Wong and Aspinwall (2005), Hung et al. (2005), Akhavan et al. (2006),Chong (2006), Akhavan and Jafari (2006), Bozbura (2007),du Plessis (2007), Jafari et al. (2007)	Training and education
10	Holsapple and Joshi (2000), Davenport and Volpel (2001),McDermott and O'Dell (2001), Wong and Aspinwall (2005), Chong (2006)	Removal or resource constraints
11	Brelade and Harman (2000), Yahya and Goh (2002), Wong and Aspinwall (2005)	Human resources management
12	Drew (1997), O'Dell and Grayson (1998), Day and Wendler (1998), Moffet et al. (2003), Hung et al. (2005), Chong (2006) Akhavan and Jafari (2006).	Benchmarking

(sources: Valmohammadi, 2010)

APPENDIX B

knowledge map parameters

K map format/knowledge management process/purpose		I Table format	II Diagrammatic format	III Cartographic format	IV Metaphoric format
1	Creation of knowledge		M, L, C 1́63	M, L, C 1́63	M, L, C 1́63
2	Assessment or audit of knowledge	E, F, S 1́65	E, F, S 1́65		
3	Identification of knowledge	M, E 1́64	M, E, F 1́67	M, E, F 1́67	M, E, F 1́67
4	Development of knowledge		M, S, C 1́67	M, S, C 1́67	M, S, C 1́67
5	Sharing, transferring, communication of knowledge	M 2́67	M, L, C, S, F 2́67	M, L, C, S 2́67	M, L, C, S 2́67
6	Application of knowledge	M, L, S 1́67	M, L, S 1́67	M, L, S 1́67	M, L, S 1́67
7	Marketing of knowledge		M, E, C, S 4́67	M, E, C, S 4́67	M, E, C, S 4́67

Knowledge map content types: M, methods (procedural knowledge, know-how); E, experts, organizations, groups, institutions etc. (know-who, knowledge carriers); L, lessons learned, and experiences (know-why); C, concepts (declarative knowledge, know-what); F, flows or relationships (i.e., communication flows, collaboration relations); S, skills and competencies (i.e., capability maturity levels, expertise levels, core competencies, etc.). Application Levels: 1, personal; 2, dyadic; 3, team; 4, dept.; 5, community; 6, org.; 7, network.

APPENDIX C

INTERVIEW QUESTIONS

Contribution of Knowledge Mapping in Evaluating Facilities Performance in Malaysia

BACKGROUND INFORMATION:

Section A: GENERAL INFORMATION

1- Please can you kindly tell me your working experience in facilities management field and in the present organisation?

2- Please can you kindly tell me your current job title in present organisation?

3- Approximately how many full time staff currently work, in your organisation?

4- Could you please tell me whether your organisation mainly provides in-house or an outsourced facilities management service?

õ ..

MAIN QUESTIONS:

Section B: THE EXTENT TO WHICH FACILITIES PERFORMANCE EVALUATION IS PRACTISED IN MALAYSIA

5- **Extent to which facilities performance evaluation is practiced in organisations.**
   a- Could you please explain the extent of facilities performance evaluation being conducted in your organisation?

   b- Which of these are the most important?

   c- Could you explain why facilities performance evaluation is becoming important?

6- **Challenges in facilities performance evaluation practice.**
   a- Could you please explain what the main challenges in conducting facilities performance evaluation in your organisation are?

   b- Based on these main challenges, in which circumstances does this challenge become severe?

   c- Could you please explain how your organisation addresses this main challenge?

7- **Critical success factors for effective facilities performance evaluation.**
   a- Giving your experience, could you enlighten me of the critical success factors in conducting facilities performance evaluation?

   b- How do you rank these?

...EDGE MAPPING

*...study is the process of identification of knowledge needs by
...ired knowledge, linking between peoples and their expertise and
...formation (e.g. linking "who" own the knowledge to "who" needs
...the knowledge, who know "what" in the organisation, where knowledge and information
resides, and how the knowledge flows and is shared)"*

8- Knowledge mapping tools and techniques
*In this stage, "tools" is defined as a information technology related that facilitate the knowledge
mapping process in your organisation while "techniques" are the methods that enable the
knowledge mapping to take place"*

Please can you kindly inform me of the tools and techniques for knowledge mapping
that are currently used in your organisation?

9- Role and benefits of knowledge mapping.
a- Could you please kindly explain the role that knowledge mapping plays in facilities
management provision in your organisation?

b- Could you please kindly explain the benefit of knowledge mapping in the provision
of facilities management services in your organisation?

c- To be more specific, could you please kindly explain the role that knowledge
mapping plays in *facilities performance evaluation* exercise?

Section E: CHALLENGES IN KNOWLEDGE MAPPING IMPLEMENTATION

10- Challenges in implementation of knowledge mapping to improve facilities performance evaluation.
a- What are the main challenges associated with implementing knowledge mapping
in the provision of facilities management services?

b- To be more specific, what are the main challenges associated with implementing
knowledge mapping in facilities performance evaluation exercise?

Section F: Knowledge Mapping Benefits Exploitation

11- Process in exploiting knowledge mapping benefits.
a- In your view, can you enlighten me exactly what is the process in place as to
exploit knowledge mapping benefits in facilities management provision?

b- What are the main benefits that accrue from the exploitation of knowledge
mapping in the provision of facilities management provision?

12- Critical Success Factors in effective exploitation of knowledge mapping benefits.

Finally, what are the critical success factors in the exploitation of knowledge mapping
so as to derive real benefits in facilities management service provision?

…iew session, please feel free to offer any comments or suggestions with regard to this research?

Note to interviewer: *Thank participant for their assistance in the research and for participating in the interview. Assure participant that all information obtained is confidential. If participant wishes to receive a summary of the findings of the survey, ask for their card or ask them to complete their personal detail below. Assure them that these details will be stored separately from the interview responses in order to maintain confidentiality.*

Name	:
Designation	:
Address	:
Phone	:
Fax	:
E-mail	:

APPENDIX D

(PLEASE REFER TO ORIGINAL DOCUMENTS)

APPENDIX E-K

APPENDIX E

Summary of the interview respondent distribution of the challenges factor in conducting facilities performance evaluation

Coding	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20	R21	Σ
C1	ç		ç	ç	ç	ç			ç	ç	ç	ç		ç	ç	ç	ç	ç				14
C2		ç	ç		ç	ç		ç	ç	ç	ç	ç	ç	ç	ç				ç	ç	ç	15
C3	ç	ç	ç	ç		ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç				17
C4		ç		ç			ç	ç		ç	ç	ç	ç	ç		ç	ç	ç			ç	13
C5					ç	ç		ç						ç	ç		ç	ç	ç	ç	ç	10
C6														ç				ç	ç			3
C7	ç			ç	ç				ç		ç	ç	ç	ç								8
C8		ç					ç						ç			ç		ç				5
C9																			ç	ç	ç	3
C10					ç			ç	ç					ç			ç	ç	ç	ç	ç	9

Note:

C1-Interpreting conclusion; **C2-**Obtaining information & data; **C3-**Lack of staff; **C4-**Lack of awareness; **C5-**Familiarity with facilities; **C6-**Obtaining users' feedback; **C7-**Define methods for evaluation; **C8-**Determine responsibility; **C9-**Allocating specific time; **C10-**Organisation readiness

*N = 21

Section in chapter: 4.5

APPENDIX F

Summary of the interview respondent distribution of the critical success factors (CSFs) factor in conducting facilities performance evaluation

Coding	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20	R21	Σ
CSF 1	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	21
CSF 2	ç			ç	ç		ç			ç		ç	ç		ç		ç	ç		ç	ç	12
CSF 3										ç		ç		ç	ç	ç		ç	ç		ç	8
CSF 4	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	21
CSF 5					ç		ç						ç	ç	ç							5
CSF 6	ç	ç				ç		ç	ç	ç	ç	ç		ç	ç	ç				ç		12
CSF 7					ç				ç	ç		ç	ç				ç	ç		ç	ç	10
CSF 8		ç			ç			ç			ç		ç									5
CSF 9						ç							ç					ç	ç			4

Note:

CSF 1- Evaluators' knowledge**; CSF 2**- Quality of report; **CSF 3**-Accessibility to information and data; **CSF 4**-Available Database; **CSF 5**-Clear objective; **CSF 6** -Organisations' awareness; **CSF 7**-Clients' awareness; **CSF 8**-Tools and methods of evaluation; **CSF 9**- Accessibility to space;

*N = 21

Section in chapter: 4.6.1

APPENDIX G

Summary of the interview respondent distribution of the identified role of knowledge mapping in facilities management organisation

Coding	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20	R21	Σ
Ro1	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	21
Ro2	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	21
Ro3	ç				ç	ç			ç	ç	ç	ç			ç	ç						9
Ro4			ç	ç		ç			ç		ç	ç		ç			ç	ç	ç			10
Ro5	ç	ç	ç	ç		ç	ç	ç		ç		ç	ç	ç	ç	ç	ç		ç	ç		16
Ro6		ç			ç				ç				ç			ç				ç	ç	7
Ro7			ç																			1
Ro8		ç					ç															2
Ro9	ç	ç			ç			ç								ç			ç			6
Ro10									ç					ç			ç				ç	4
Ro11			ç	ç				ç			ç		ç									5
Ro12						ç				ç												2
Ro13				ç		ç	ç	ç	ç				ç			ç	ç					8
Ro14																						0
Ro15																						0
Ro16																						0

Note:

Ro1-Building database; **Ro2**-Provide directories; **Ro3**-Avoid duplication of task; **Ro4**-Identify knowledge gap; **Ro5**-Improve process

Ro6-Simplifying process; **Ro7**-Compile resource; **Ro8**-Optimise reuse information; **Ro9**-Decision making; **R10**-Problem solving

Ro11-Optimise organisational knowledge; **Ro12**-Optimise best practice; **Ro13**-Time saving; **Ro14**-Minimise cost; **Ro15**-Identify KS barrier

Ro16-Identify KS opportunity

*N = 21

Section in chapter: 5.2, pg 148

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APPENDIX H

Summary of the interview respondent distribution of the identified role of knowledge mapping in FPE

Coding	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20	R21	Σ
RO1			ç			ç	ç	ç	ç			ç		ç			ç	ç	ç			10
RO2	ç	ç		ç				ç			ç		ç			ç				ç	ç	9
RO3	ç			ç	ç			ç	ç	ç	ç			ç	ç							9
RO4			ç	ç					ç			ç		ç			ç	ç	ç			8
RO5	ç	ç	ç		ç	ç	ç	ç		ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	19
RO6	ç								ç				ç			ç				ç		5
RO7			ç																			1
RO8		ç					ç															2
RO9							ç	ç			ç			ç								4
RO10						ç				ç											ç	3
RO11				ç									ç							ç		3
RO12		ç													ç							2
RO13	ç	ç	ç		ç	ç	ç		ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	19
RO14								ç									ç	ç				3
RO15																			ç			1
RO16												ç										1
RO17				ç			ç	ç						ç	ç							5
RO18		ç			ç				ç							ç					ç	5
RO19																						0
RO20																						0

Note:

RO1-Identify available and required knowledge; **RO2**-Simplified the process; **RO3**-Avoid duplication of task; **RO4**-Linking right people to the task; **RO5**-Provide building and facilities database; **RO6**-Provide knowledge asset inventory; **RO7**-Led to re-use of information; **RO8**-Avoided/reduced knowledge loss; **RO9**-Assisted in decision making; **RO10**-Saved overall time and cost for the evaluation; **RO11**-Provided process workflow; **RO12**-Provided directories of vendors; **RO13**-Provided directories of people and expertise; **RO14**-Linking right information to the task; **RO15**-Provide best practice database; **RO16**-Assisted in human resource planning;**RO17**-Easier access to information and knowledge; **RO18**-Assisted in problem solving; **RO19**-Assisted in innovation process; **RO20**-Assisted in Identifying KS opportunity

*N = 21

Section in chapter: 6.3, pg 180

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APPENDIX I

Summary of the interview respondent distribution of the Challenge and issues in implementation of knowledge mapping in facilities performance evaluation highlighted by interview respondent

Coding	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20	R21	Σ
CK1	ç		ç		ç*	ç			ç	ç	ç		ç	ç	ç		ç	ç	ç			*13*
CK2		ç					ç			ç	ç		ç*		ç*			ç	ç	ç	ç	*10*
CK3				ç	ç								ç	ç						ç		*5*
CK4	ç						ç		ç												ç*	*4*
CK5		ç	ç											ç								*3*
CK6																						*0*
CK7																						*0*
CK8																						*0*
CK9					ç																	*1*
CK10						ç																*1*

Note:

CK1-Attitude and culture; **CK2-**Lack of training; **CK3-**Understand knowledge flow; **CK4-**Accuracy of info/data; **CK5-**Financial constrain;

CK6-Readiness to share knowledge; **CK7-**Different user's perspective; **CK8-**Dynamic org. environment; **CK9-**Complexity of data;

CK10-Identify right team member;

*= most challenges

**N = 21

Section in chapter: 7.3, pg 196

APPENDIX J

Summary of the interview respondent distribution of the process in-place for exploitation of knowledge mapping benefits in facilities performance evaluation.

Coding	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20	R21	∑
P1	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	ç	21
P2	ç	ç	ç		ç					ç		ç										6
P3		ç		ç		ç	ç		ç		ç											6
P4																						0
P5							ç															1
P6	ç		ç																			2
P7	ç	ç			ç																	3
P8	ç		ç																			2
P9																						0
P10																						0

Note:

P1- ICT ready; **P2**- Accessible business process; **P3**-Identify organisational knowledge; **P4**- Evaluate effective map; **P5**- Review FPE processes

P6- Staff training; **P7**- Promote awareness; **P8**- Determine the purpose; **P9**-Identify and nominate staff; **P10**- Strategies for implementation

N = 21

Section in chapter: 8.3, pg 236

APPENDIX K

Summary of the interview respondent distribution of the critical success factors (CSFs) exploitation of knowledge mapping benefits in facilities performance evaluation.

Coding	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20	R21	∑
KCSF 1			ç		ç		ç	ç			ç				ç	ç	ç	ç				9
KCSF 2					ç	ç									ç			ç				4
KCSF 3	ç*		ç	ç				ç*		ç*	ç*	ç				ç				ç	ç	10
KCSF 4		ç	ç*			ç	ç*		ç*	ç	ç			ç*	ç						ç*	10
KCSF 5						ç*	ç	ç			ç		ç		ç*		ç			ç*	ç	9
KCSF 6	ç			ç*									ç	ç	ç	ç	ç		ç			8
KCSF 7	ç	ç*		ç					ç	ç		ç*			ç				ç	ç	ç	10
KCSF 8		ç			ç				ç													3
KCSF 9																						0

Note:

KCSF 1- Understand flow; **KCSF 2-** Capture new knowledge; **KCSF 3-** Management support**; KCSF 4-** Knowledge and skill;

KCSF 5- Organisational culture; **KCSF 6-** Identify k-map needs; **KCSF 7-** IT accessibility; **KCSF 8-** Sharing knowledge;

KCSF 9- Flexibility of technique

*= most critical factors

**N = 21

Section in chapter: 8.4, pg 248

APPENDIX L

EXPLOITATION OF KNOWLEDGE MAPPING BENEFITS GUIDANCE

FOR FACILITIES PERFORMANCE EVALUATION PROCESS

By:

Mohd Fadzil MAT YASIN

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The implementation of the proposed guidance primarily covers the important aspect discussed in the entire research that constitutes the aim of the present research; the critical success factors for effective exploitation of knowledge mapping in facilities performance evaluation. The guidance also considered the nature of facilities management organisations and facilities performance evaluation practice in Malaysian context.

The research findings in the exploitation of knowledge mapping benefits for facilities performance evaluation revealed that the two most challenging factors in this regard are:

3. Changing attitude and culture within organisation towards knowledge; and
4. Lack of training related to knowledge mapping provided to staff.

Therefore the guidance was designed to address the issues in providing training material for facilities managers and staff in facilities management organisations. Even though õknowledge - friendlyö culture is one of the most difficult to create if it does not already exist, appropriate information and knowledge for knowledge management advantage could be shared with facilities managers. Indirectly, it could also change or improve the perception of the facilities managers and the organisation towards the knowledge.

The critical success factors derived from the research indicate the important of knowledge and skill of the staff involved in the knowledge mapping as well as organisational culture as critical factors in the exploitation of knowledge mapping benefits. The elements such as understanding the process of facilities performance evaluation and knowledge flow in the process, ability to capture new knowledge by implementing knowledge mapping in facilities performance evaluation and support from top management are important to be considered and integrated in the proposed guidance.

facilities management organisations get the best of the knowledge performance evaluation and at the same time improve awareness of the facilities managers in FM organisations of the benefits of knowledge mapping. However, some limitation is necessary to provide the right context and focus of the proposed guidance.

Although the guidance is developed by referring to international practice and multiple fields of professions, the proposed guidance is targeting the facilities management organisation in Malaysia as potential users as the contents of the guidance are based on the interviews and questionnaire surveys output conducted in Malaysia.

The guidance would be considered as the first attempt towards the implementation of knowledge mapping and exploitation of its benefits in facilities management organisations. This is referring to the exploratory stage of the research on how knowledge mapping plays a role in facilities management organisations. The guidance is attached to the facilities performance evaluation process in facilities management organisations. The guidance suggests and orders, methods and instruments, which provide a general view of the relevant aspects but does not have to apply in each particular case. Hence, the proposed guidance is not self-thought; it is recommended that it should be appropriately used as a start to complement the systematic approach that needs the guidance of individuals or groups of experts.

Getting Started

a)   Prior implementation:

In the general implementation of knowledge mapping in organisations, it is important to identify the process to be mapped. However, the present guidance was set to focus specifically on facilities performance evaluation in facilities management. Therefore, it is important to identify the processes involved in evaluating facilities performance and the sequence of its processes. The facilities performance evaluation process introduced in this document is for generic purpose and potential user should adjust the content and sequence accordingly and adapt them to their unique requirements. Therefore, it is essential to identify and assess what type of knowledge map would be appropriate to be tailored with the organisation's needs. The needs for knowledge mapping in facilities performance evaluation could be identified at least as listed below:

...ping needs	
...ities performance evaluation	[√]
...sk goals	[ ]
Overall level of expertise or knowledge	[ ]
Gaps in knowledge or communication among units or groups	[ ]
Specific expertise of a business unit or process area	[ ]
Areas of the organisation that need lessons learned or after-action review processes	[ ]
Specific knowledge or content for community of practice	[ ]
Specific knowledge or content for a transfer of best practice initiative	[ ]

It is also vital to identify the challenges and the critical success factors at every stage of the implementation. The discussion on the challenges and critical success factors are presented in two dimensional view; facilities management service provision view and organisational size view. The approach will ensure a wide coverage of the facilities management organisations in Malaysia.

The purpose could be linked to the important role of knowledge mapping in facilities management organisations at least as listed below:

Benefits in general...	**...and benefits for FM organisation in conducting FPE**
Improve Quality	• *Improving knowledge asset inventory by providing a comprehensive database of the building and facilities information.* • *Improving knowledge asset inventory by providing directories of people and information. Improving knowledge asset inventory by compiling internal and external resources.* • *Optimising the opportunity to reuse information.* • *Identifying the barrier that eliminates knowledge sharing across organisations.* • *Identify knowledge sharing opportunities across organisations.* • *Optimising use of organisational knowledge.* • *Optimising opportunities to update best practice databases.* • *Improving decision making process within the organisation.* • *Improving problem solving process within the organisation* • *Optimising use of organisational knowledge.* • *Optimising opportunities to update best practice databases.*
Time saving	• *Improving process workflow involved in managing facilities.* • *Identifying the knowledge needs (gaps between available knowledge and required knowledge) within the organisation.* • *Avoiding duplication of tasks in managing facilities.* • *Simplifying the overall process involved in managing facilities.* • *Improving planning process by saving overall time consumed.*
Cost Saving	• *Improving planning process by minimising overall operating cost.*

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following hurdles or challenges that hinder organisations to enjoy ...ould be tackled and given special attention. Those challenges are as follows:

1) Change perspectives, attitudes and culture within the organisation towards the importance of knowledge management as a whole.
2) Lack of training related to knowledge mapping provided to staff.
3) Understand the knowledge flow from facilities management processes within the organisation.
4) Accuracy of data and information about the facilities.
5) Financial constrain that prevents knowledge mapping initiatives to take place.
6) Readiness to share knowledge among staff.
7) Mapping of knowledge between different users with different perspectives and purposes.
8) Handling the dynamic aspect of the organisation's environment and the dynamic character of the knowledge base itself.
9) Diversity and complexity of the data to be used.
10) Identification of the right team members and roles in mapping knowledge.

Therefore it is crucial to consider the critical success factors prior to exploitation of knowledge mapping benefits that could be gained in facilities performance evaluation. Those factors are:

Checklist for good Knowledge Mapping exploitation	√
The success factors are fundamental conditions in exploiting knowledge mapping in all FM service provision and organisational sizes.	
Does the team really understand the flow of the processes in conducting facilities performance evaluation?	
Is the team able to capture new knowledge from the series of facilities performance evaluation?	
Does the team have strong support from top management in respect of implementing knowledge mapping?	
Does the organisation have a sufficient number of staff with necessary knowledge and skill in implementing knowledge mapping?	
Does a culture that is friendly towards knowledge management exist in the organisation?	
Is the team able to identify the role of knowledge mapping with respect to knowledge capture, retrieval, analysis and communication?	
Is the information technology widely accessible to staff as a tool in undertaking facilities performance evaluation task?	
Are the individuals in the team willing to share their knowledge in the context of conducting facilities performance evaluation?	
Are the existing knowledge mapping techniques flexible enough for any changes?	

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ng Benefit Exploitation Process
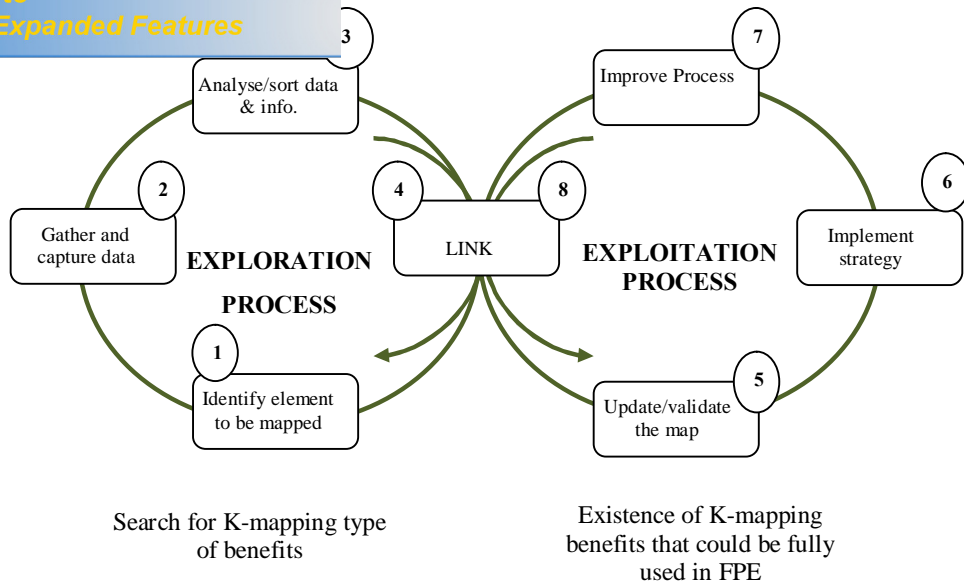
Process framework for knowledge mapping benefits exploitation for facilities performance evaluation.

9- **Identifying elements to be mapped**

Among the earliest process in exploring the knowledge mapping is to identify the elements and process that will focus on knowledge mapping. By identifying the elements, the scope and boundaries of the mapping process will be identified. This also allows sub processes and people or parties involved to be determined. Besides those preparations, the teams for knowledge mapping should have set out the goals to be achieved through knowledge mapping. Sponsors should determine what the knowledge map is intended to do, the scope of the map and specific knowledge map user requirements. This is where the exploration of knowledge mapping benefits in facilities performance evaluation begins. The research reveals that the four most critical success factors for effective facilities performance evaluation are focused on:

(1) Evaluator's knowledge,
(2) Presentation techniques,
(3) Accessibility to data and information; and
(4) Availability of database.

It is worth to provide on-going education on the benefits and requirements of knowledge mapping to the participating staff of the (1) and (2) and exploiting information technology (IT) for managing information and knowledge effectively on (3) and (4).

The elements to be focused on in knowledge mapping in facilities performance evaluation exist in two forms; firstly is the micro form of knowledge and secondly is the macro side of knowledge. Micro forms are the individual skills, experience and knowledge. In organisational context, micro forms of knowledge involved specialisation on a particular knowledge. Macro forms of knowledge are the commonly or explicitly shared knowledge within the organisation owned by individuals and groups in the organisation or in the organisation's repository.

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apped	
mapping process has been identified	☐
The expected outcomes of the knowledge mapping have been recognised	☐
The flow of the facilities performance evaluation process including the special techniques, tolls and people/parties involved are identified.	☐
Analyses of the strengths and weaknesses have been conducted and the results are established.	☐

10- Gathering and capturing data and information

Gathering and capturing data mainly involve four rudiments that are, knowledge framework establishment, knowledge source determination, knowledge extraction, and knowledge compilation. Literatures suggest that the process of gathering and capturing data within organisations as providing an inventory for organisational knowledge; for example to capture and create appropriate knowledge, acquire data, manipulate data, store data, define organisational knowledge, knowledge extraction, knowledge profiling, deduce relevant knowledge sources, assets or elements, survey, compilation of knowledge and derivation of assertions.

In broader knowledge management concept, inventory of knowledge is one of the most important elements for effective knowledge management in organisations. The purpose is to get a real picture of knowledge in organisations which amounts to finding answers to the questions of what are the uses of knowledge, which knowledge is used, where is the knowledge used, when is the knowledge used and which organisational role provides the knowledge? The question of ÷whatø is answered by identifying business processes, the ÷whichø refers to the knowledge assets that contribute to the successful execution of the business process, the ÷whereø and ÷whenø are captured by the time and location descriptors of knowledge assets and the ÷which organisational roleø refers to abstract roles in an organisation that participate in business processes.

The rich concept of the locations as suggested by literature such as the knowledge profiles, owners and the networks basically provides some forms of knowledge mapping. Once the purpose/s of knowledge mapping has been set; the relationship of the targeted aims could be drawn. Here, the benefits of knowledge mapping could be tapped on every steps of the processes involved in evaluating facilities performance. This could be achieved by:

c)   Identifying key decision points and cross-functional hand-offs.
d)   Locating owners and stakeholders of highly-valued processes to suit the organisational role in managing facilities as well as the different sizes of organisation.
e)   Identifying sources and recipients of knowledge within the organisation or intra organisation.

Therefore the following checklist could helps in gathering and capturing data and information

apturing data and information	√
nowledge captured? Decision on database system and	
capture new knowledge	
Strategy to capture new knowledge throughout processes in organisation	
Individual capabilities to capture new knowledge	

11- Analyse/sort information and knowledge

Not all data and information are useful for the task. Conversely, data and information that constitute organisational knowledge need to be sorted out or analysed to add meaning to it. This will provide means for identifying knowledge needs by means of identifying the knowledge gap , processing data for map analysis, codifying the knowledge elements, sorting and labelling. The process of identifying the knowledge needs and knowledge gap is based on the available organisational knowledge as an audit of the existing knowledge.

Checklist for sorting information and knowledge	√
Based on the key questions of *what, when, who, where and how*	
When will information be useful? Sorting information according to its potential uses.	
What type of information? Sorting information according to its type and form.	
Who are the individuals or groups of people that potentially benefit from the knowledge? Sorting information according to its potential users.	
Where the knowledge resides? Sorting information according to its location.	
How the information could be used? Sorting information according to hierarchy of use they belong to including in which stages it could be used.	

12- Link: Providing content for exploitation

The information from the facilities performance evaluation needs explanation and need to be contextualised. At this point, the õdirectional signageö at every junction is important. The location and format of the knowledge or content could hint at the appropriate approach of exploitation. At this point, the additional value to the existing information or knowledge could be achieved by linking them, visualising, integrating, synthesising and codifying them. Hence, all potential knowledge mapping benefits should be able to be identified and ready for exploitation.

Checklist for providing content for exploitation	√
Custodian and user of the maps are identified.	
Processes and relevant knowledge are linked.	
Context of the information and knowledge are being explained.	
Meanings of the relationship/link are understood by every people in the process.	
Expected knowledge benefits are clearly comprehended.	

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nowledge maps including the content and relationship structure are
ss. The users of the map are familiar with the map and could
retrieve the necessary information and data effectively. The literature shows that in exploiting
the benefits of knowledge mapping, a means for updating the knowledge and validation of the
maps or the relationship is essential. Indirectly, by updating and validating the knowledge
maps, the custodian of the map could be updated, the repository location, and maintenance
process could also be performed.

Checklist for validating and updating knowledge map	√
The existing knowledge could be retained within the organisation by means of:	
Feedback from the knowledge map users.	
Simulation of the map by the map developer/owner.	
Identifying problems and hiccups in the existing map.	
Existence of means for updating the map.	

14- Implement strategy

Having a specific strategy for exploitation of knowledge mapping is very important for
successful exploitation of knowledge mapping benefits in facilities performance evaluation.
Having a strategy means we have human resources, information technology, and management
and financially ready in order exploit the potential benefits of knowledge mapping.

Questionnaire survey result reveals that:
- The FM organisations have information technology and communication system for
  staff to access and retrieve information and knowledge for effective knowledge
  mapping.
- At the same time, specific and generic business processes are normally recorded and
  staffs have ready access to those information.
- FM organisations are continuously indentifying organisational knowledge.

Checklist for implementing strategy for exploiting K-mapping benefits	√
Identify the best information technology tools that suit the organisational needs.	
Identify the best methods or modus operandi in exploiting the knowledge mapping benefits.	
Identify and project training needed for the staff.	
Identify special criteria of knowledge and skill for future staff recruitment.	
Identify effective means for knowledge sharing .	
Identify specific areas for future improvement in knowledge mapping.	

major exploitable benefit that knowledge mapping offered from its
improvement for facilities performance evaluation could be
achieved by continuously reviewing the process of evaluating facilities performance and
identifying the best practice. Process improvement could be achieved by eliminating
unnecessary processes or/and adding new process that could add value to the existing process.

Checklist for improving process	√
Identify the sub processes that are unnecessary and need to be removed.	☐
Identify new sub processes that could provide added value.	☐
Identify new innovation in the existing process.	☐
Identify general and specific areas for improvement.	☐

16- Link: Provide lessons learned

Lessons learned in exploitation of knowledge mapping could suggest the new areas to be
explored in knowledge mapping that could benefit the facilities performance evaluation and
tackle changes occurring over time. Time changes also transform perspectives of knowledge
management in organisations with factors such as advances in technology, changes of
business orientation, changes in environment and management approaches.

Checklist for providing lessons learned	√
Conducting post-mortem and reflection sessions.	☐
Identifying new areas of knowledge in FPE to be explored.	☐
Providing specific database for future reference and opportunities to share knowledge especially in implementing knowledge mapping in facilities performance evaluation.	☐
Identification of best practice database from case studies and practice publications.	☐

f)   Conclusion

This guidance is a general document that guides the knowledge mapper in FM organisations in the
exploitation of knowledge mapping for facilities performance evaluation. A professional guide from
the expert is advisable for exploiting the knowledge mapping benefits to suit different requirements of
organisations, levels and types of intended tasks. The exploitation of knowledge mapping benefits
effectively is actually a very challenging and demanding task. The expectations of the organisation
and mapping teams need to be clearly formulated. Only clear aims and agreements on how knowledge
mapping benefits are being exploited can provide the necessary clarity to the parties / individuals
involved in the process. The type and extent of benefits to be explored are continuously extending
through times and organisational maturity in practising knowledge management culture in the
organisation.