OPTIMISING THE ROLE OF FACILITIES MANAGEMENT (FM) IN THE PROPERTY DEVELOPMENT PROCESS (DP): THE DEVELOPMENT OF AN FM-DP INTEGRATION FRAMEWORK

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Abstract

This thesis is a manifestation of efforts to integrate FM into the development process through a greater involvement of Facilities Managers in the property development industry. It also presents an original contribution to knowledge in a form of a validated best practice, which is identified as the facilities management-development process (FM-DP) integration framework. The framework potentially serves as a guide to Facilities Managers and other professionals in various organisations in the property development industry to optimise the value of Facilities Management (FM) in the development project and to achieve sustainable development. The study was conducted as an exploratory sequential mixed methods design in order to identify the issues that limit Facilities Managers from being involved in the property development industry, when they are known to be an appropriate professional to optimise the value of FM in the development process. Qualitative approach has been used as a core component of this research in order to obtain confirmation of the critical issues obtained from the literature review. To develop the framework, a survey questionnaire was used followed by relevant statistical procedure and analysis. To ensure validation, a member-checking approach was implemented through focus group interview. The validated framework reveals that there are 52 best practices to be considered by Facilities Managers or other professionals in the property development industry to optimise the role of FM in the development process for sustainable development. In addition, the framework discovers that best practices are required in all stages of the development process. Nevertheless, Stage 4: Technical Design is crucial, as it requires most of the best practices that drive the integration of FM into the development process. The framework demonstrates a 'killing two birds with one stone' strategy: (i) exploiting the framework is expected to increase the profile of FM among other professionals, (ii) encouraging a greater involvement of Facilities Managers in the property development industry, which (iii) leads the project to a sustainable development agenda.

Keywords: Facilities management, development process, integration, framework, property development industry.

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Chapter One

Introduction

This thesis offers a significant contribution to the body of knowledge in Facilities Management (FM) and the property development industry[1] in order to identify the professional best practices that are effective in optimising the role of FM in the development process, which can enhance the buildability and operability of the facilities[2].

This chapter contains the background of the research in Section 1.1, which leads to the formulation of research problems (Section 1.2) and research questions (Section 1.3). The 'modus operandi' on how to achieve the research aim (Section 1.4) is outlined through research objectives in Section 1.5. The value of this research is presented through its significant contribution to knowledge in Section 1.6. The final section of this chapter provides the research framework of this research and an overview of the chapters in this thesis.

1.1 Background of the research

The property development industry is a major contributor to the UK economy, contributing 6.0 percent of gross domestic product (GDP), equivalent to £90.0 billion (Construction Leadership Council, 2013). It creates 280,000 businesses that provide 3.0 million jobs around the UK (ibid.). The property development industry in the UK is categorised into five (5) sectors: new public and private works, new infrastructure, new housing, and repair and maintenance (R&M) works. R&M works contribute a significant amount to the whole industry, 36.0 per cent or £32.4 billion (Office for National Statistics, 2013). This fact indicates that the R&M works sector has a major influence on sustainable development, which sits on three (3) pillars: economy, social and environment. Although R&M works are often considered as supporting activities in the property development sector, they are often exploited to measure the performance of a facility and its services. The performance of R&M works during the operational stage of the facilities (particularly through complaint records) is a manifestation of the quality of work at the planning, design and construction stages. R&M is inevitably linked with the FM discipline, which informs the role of Facilities Manager as its professional representative.

[1] The term 'property development industry' refers to physical development projects that are going through the stages of work such as 'briefing', 'design', 'construction', and 'in use'. This is to distinguish it from the term 'construction industry', of which the construction itself is one stage in the development process.
[2] The term 'facilities' is used to include all the buildings, fittings, equipment and environment presented to the occupants while pursuing the organisation's business objectives.

FM is acknowledged as the fastest-growing profession despite being known as a relatively new discipline in the UK. The concept is vague as the remit is wide-ranging, covering various aspects of human wellbeing and physical infrastructure. The Facilities Manager has been perceived as a 'jack of all trades' (Tay and Ooi, 2001), the individual with spare bulbs, ladder and repairing tools moving around the office looking for the defects of existing facilities to be repaired while supervising the renovation works and monitoring the level of cleanliness. There is always a question of whether Facilities Managers are in charge of one (1) or all aspects of the facilities. According to Tay and Ooi (2001), the Facilities Manager should represent FM both in operational and strategic levels. From the property development industry, the Facilities Manager should be integrated at the early stages of the development process, such as planning and design stage, rather than being called upon at the commissioning and occupation stages. The role of FM has moved from 'the boiler room to the board room' (Rondeau *et al.*, 2006; p. 554), which has also positioned the Facilities Manager in a decision-making process in the development project set up. Although operational level is the Facilities Manager's 'bread and butter', it has become less important as Facilities Manager should 'spend their time in the classical roles of planning, controlling, etc.' (Kincaid, 1994; p. 22). Unfortunately, Facilities Managers are often neglected and misunderstood (Tay and Ooi, 2001).

High-quality facilities are essential in supporting the organisation that uses the facilities to achieve their business objectives. The owner/users who invest the upfront costs expect the provided facilities to be easier to commission and maintain, economical to operate, easy to control and manage, capable of enhancing their business, good quality, pleasant to look at and low in energy use (Latham, 1994). In the long run, the facilities would encourage a positive outcome in terms of meeting business needs, staff productivity, customer comfort, being responsive to the needs of the occupants and supporting a sustainability agenda. Chodasova (2004) asserts that the bottom line of a facility is that it has to be 'human', which covers ambience, organisation and flexibility. Unfortunately, it is argued that provided facilities that do not consider these ideas result in value deterioration and/or cause high-operating expenses to the owner due to extensive R&M work. For that, FM is considered as a strategic method of solution in rectifying the 'flaws' due to the deficiencies that took place at the early stages of the development process: planning, design and construction (Chodasova, 2004).

It has been argued that the incorporation of FM value at the early stage of the development process would enhance the performance of the property development industry. The Facilities Manager has been acknowledged as an appropriate professional to demonstrate FM value that significantly contributes to sustainable development (Wood, 2006). Moreover, the Facilities Manager is in a strategic position to view every activity in the development process (Hodges, 2005), as well as being the person in the middle to facilitate the coordination of various stakeholders in the development project (Macomber, 2001)).

Previous research on FM-DP integration is mostly associated with FM knowledge in the design stage (Damgaard and Erichsen, 2009; Jaunzens *et al.*, 2001; Jensen *et al.*, 2009). Despite knowing that the Facilities Manager is an ambassador of the FM discipline, insufficient effort has been made to identify the qualities[3] needed to enable the Facilities Manager to be regularly involved in the property development industry and consequently optimise the value of FM in all stages of the development process. Since this research attempts to define the qualities in each stage of the development process, it is crucial to identify an appropriate definition of 'development process' that suits this research. Development process is understood differently depending on type of contract, procurement routes, regulations, etc.

FM-DP integration is a strategic approach to enhance the performance of the organisation as well as improving the operation of the facilities. However, it is essential to identify the critical issues that restrain Facilities Managers from demonstrating FM value in the strategic level of the development process. This thesis presents the process of developing a FM-DP integration framework that will be advantageous in guiding Facilities Managers and other professionals such as engineers, architects and quantity surveyors in various types of organisations to optimise the role of FM in the development process.

1.2 Research problems

In the light of the brief introduction in the previous section, this research has identified problems pertaining to the optimisation of the role of FM in the development process and its contribution to sustainable development. The problems are:

i. Different views of the importance of FM in the development process.

ii. Various opinions on the role of FM in the development process and its ability to contribute to sustainable development.

iii. Barriers that limit the integration of FM into the development process.

[3] Qualities can be defined as best practices or success factors

1.3 Research questions

Based on the identified problems, the research questions that arise are:

i. What are the current perceptions of the property development community towards FM?

ii. What are the issues that hinder the integration of FM into the development process?

iii. What are the best practices needed to optimise the integration of FM into the development process?

1.4 Research aim

'To develop a facilities management (FM) - development process (DP) integration framework'

1.5 Research objectives

Through comprehensive synthesis of the literature review, the research is to develop a framework to optimise FM into the full development process. The objectives of the research are:

i. To explore the importance of FM and its relationship to the development process

ii. To identify a number of issues perceived to be barriers for the integration of FM into the development process

iii. To establish the best practices for the integration of FM into the development process

iv. To develop an FM-DP integration framework

v. To validate the concept of the FM-DP integration framework

1.6 Contribution to the body of knowledge

This thesis represents a significant contribution to the body of knowledge of the research field by enhancing the understanding of the critical issues that hinder the integration of FM in the development process. The research produces evidence of originality by firstly qualitatively confirming the issues grounded from an intensive literature review. Secondly, the research delivers its novelty by developing a framework, termed facilities management-development process (FM-DP) integration, which is potentially able to provide guidance to various professionals in different organisations to optimise the role of FM in the development process.

1.7 Research overview and framework

This sub-section discusses how this research was organised and conducted in a systematic way. The research framework depicted in Figure 1.1 describes eight (8) key articles and references which motivate this study. The synthesis of numerous literature sources led to the formulation of research aim, research objectives, research problems and research questions. The research framework presented in Figure 1.1 was designed with the aim of showing the process of this research on one (1) page.

1.8 Outline of the research

This thesis consists of eight (8) chapters, as follows:

Chapter One: Introduction

This chapter discusses the background of the study that lead to research problems, research questions, research aim, research objectives and the contribution to the body of knowledge. Interestingly, a research framework that presents the process of the research is presented on one (1) page. This would enable the readers to comprehend the whole research instantly.

Chapter Two: Development Process

This chapter presents a critical review of the literatures in search of a definition for and a concept of the development process. The chapter begins with the growth of the property development industry and its contribution to the UK's socio-economy. This includes a review of important documents related to government policies which are formulated to improve the performance of the property development industry in the UK. The review also covers the progress of professionals related to the property development industry and the emergence of FM in the 1990s. In exploring for the appropriate model of the development process, critical review was made of various sources of project life cycles. The critical part of this chapter is to decide the most reliable model of the development process as this will provide a solid foundation for this research to progress to data collection. An extensive critical literature review reveals the position of FM in the RIBA Plan of Work 2013 and its potential contribution to the development process.

Chapter Three: Facilities Management

This chapter demonstrates an intensive review of related literature in the field of research. This includes the definition of FM from the property development industry's point of view. The literature review covers the existing and potential role of Facilities Manager in the development process. In addition, the motivation that encourages the execution of this research is also presented. The review goes on looking for the gap by exploring and identifying critical issues that restrain FM from being optimised in the development process. It also covers the existing studies on the FM experience in the property development industry in other parts of the world. Finally, the review discusses the potential contribution of FM-DP integration to sustainable development. To conclude, the chapter demonstrates the ultimate purpose of the literature review by tabulating eight (8) main themes consisting of 33 sub-themes that provide the platform for the empirical aspects of this research endeavour. This chapter is a manifestation of Objective (i) and Objective (ii) of this research.

Chapter Four: Research Design and Methodology

This chapter describes the philosophical side as well as the scope of this study. The reader will find a critical review of the selected research methods, which leads to the justification for why those methods were employed. The chapter discusses the procedure of data collection for both qualitative and quantitative methods including sampling, administering the data, analysing and validating process.

Chapter Five: Qualitative Data Analysis

This chapter presents the results of qualitative data analysis. The findings are used to confirm qualities needed to enable Facilities Managers to be regularly involved in the property development industry, which consequently facilitates the optimisation of the value of FM in all stages of the development process including its impact on sustainable development. This chapter is a basis for the research to proceed with a quantitative strategy in order to develop an FM-DP integration framework. This includes summarising the individual interview participants' profiles and interpreting the meaning of the discussion. The critical issues were brought to the knowledge of professionals and academics in the property development industry. The purpose of individual interviews is to qualitatively confirm the issues that are grounded in the theory obtained from the intensive literature review. The analysis of the individual interviews and the amalgamation of the results with the literature produced nine (9) main themes consisting of 39 sub-themes. This chapter addresses Objective (ii) and Objective (iii) of the study.

Chapter Six: Quantitative Data Analysis

This chapter begins with descriptive analysis resulting from 156 questionnaires from a survey returned by the respondents. Execution of purification of the scale has led to the renaming and reorganising of the data. The subsequent statistical procedure and analysis were conducted to test the hypothesis. The results are presented in a way to satisfy the rationale to develop an FM-DP integration framework. Finally, the developed FM-DP integration framework outlines the best practices for the integration of FM into the development process. This chapter fulfils Objective (iv) of the study.

Chapter Seven: Validation

This chapter demonstrates the findings of focus group interview. This includes the summarising of the content and the interpretation of the interview. The focus group is conducted as a means to validate the developed FM-DP integration framework. 52 best practices were identified that were spread over all stages of the development process. The final section of the chapter reveals the strengths and weaknesses of the framework in terms of practicality and its contribution to the property development industry. This chapter satisfies Objective (v) of the study.

Chapter Eight: Discussion and Conclusion

This chapter provides the summary of the discussion of the study. This includes the performance of the research in achieving research aim and research objective. The answers to research questions are also presented. The chapter also demonstrates a range of limitations of the study. To conclude, the chapter presents the contribution to the body of knowledge and recommendations for future work.

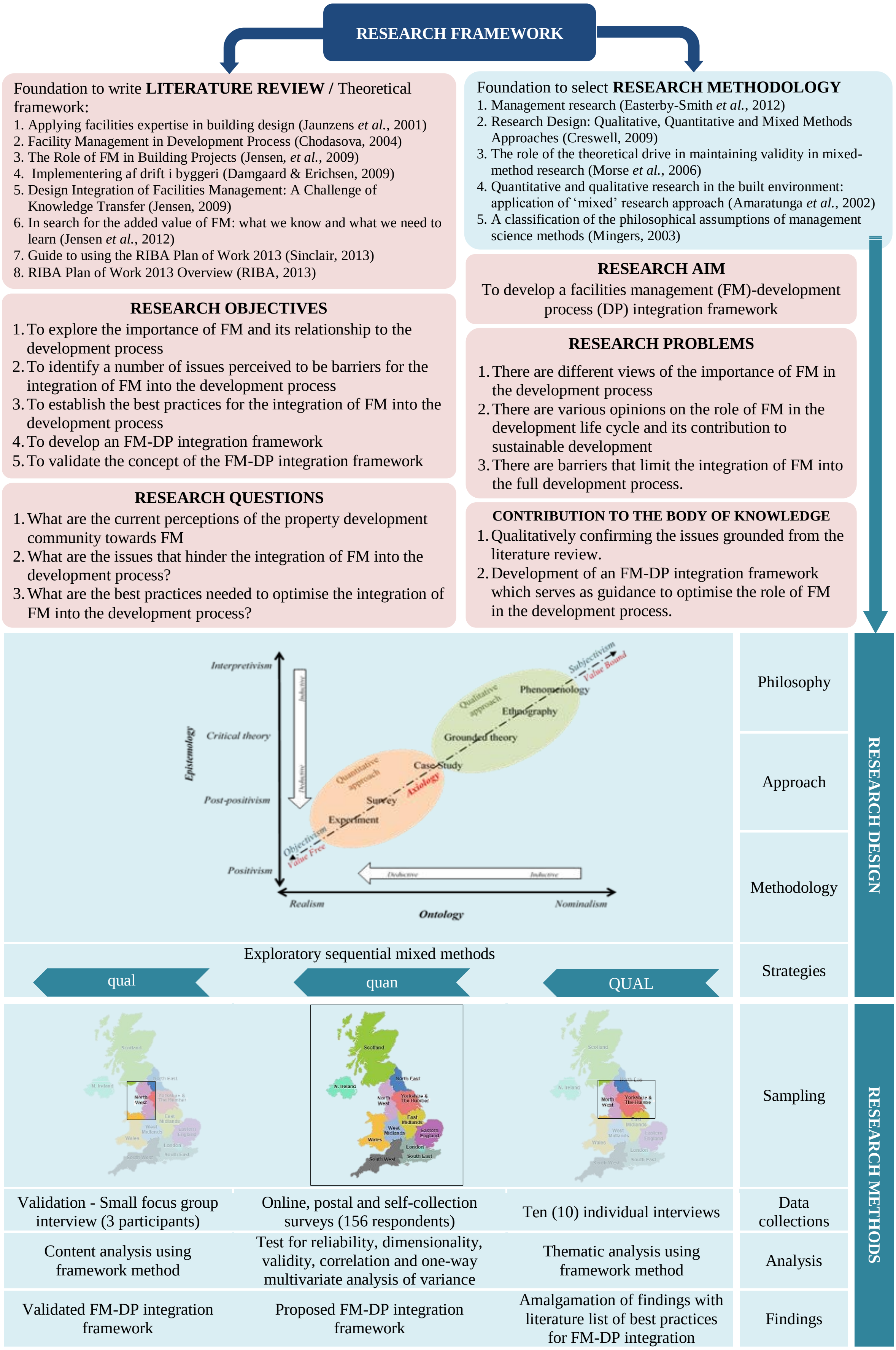


Figure 1.1 Research framework. Source: Inspired by http://drotspss.blogspot.co.uk

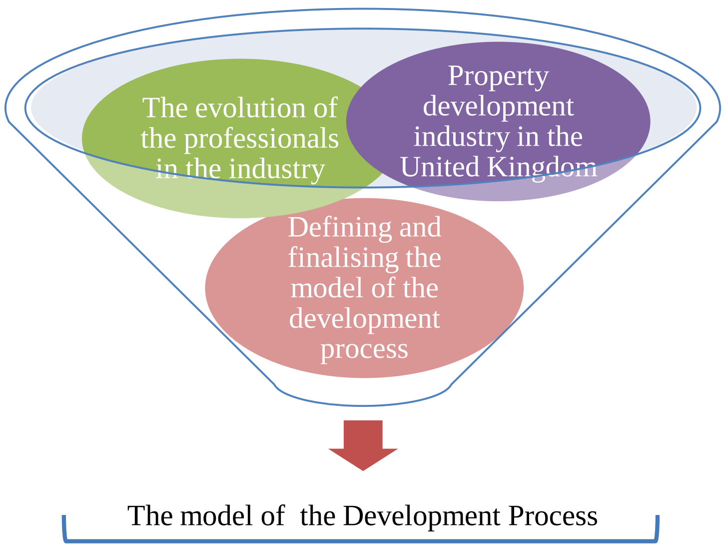
Chapter Two

Property Development Process

2.1 Introduction

Chapter Two discusses the whole spectrum of the property development industry in the United Kingdom (UK) and the process involved in it. The aim of this chapter is to identify an appropriate definition of the development process that can be used as a guide for this study. The literature review in this chapter begins by setting out the current scenario of the property development industry in the UK. It investigates the evolution of the property development industry in the UK including the brief historical trend and the UK Government's efforts to enhance the industry. Subsequently, this chapter examines the impact of the property development industry on the growth of the professionals including the emergence of the role of Facilities Manager. Here, the reader will be able to understand that there are opportunities for FM to contribute effectively to the development process. This chapter will also examine the model of the development process from various sources, prior to finalising the definition of the development process that will be used throughout this research. The outline of this chapter can be represented by a simple illustration, as shown in Figure 2.1. The results displayed on the plate under the funnel are the findings required from this chapter – the model of the Development Process that is fit to be used throughout this study.

Figure 2.1 The funnel of Chapter Two



Source: Self-study

2.2 The property development industry: UK setting

The property development industry is a catalyst to economic growth in the UK (Egan, 1998; National Audit Office, 2001). The output is exploited to measure economic performance through gross domestic product (GDP) based on two (2) elements: (i) the value of new works, and (ii) the value of repair and maintenance (R&M) works. Both are undertaken by public and private sectors for housing, office buildings and infrastructure works. The property development industry contributes approximately 6.0 per cent or £90.0 billion of total economic output (GDP) in the UK (Construction Leadership Council, 2013), in which the breakdown is as shown in Figure 2.2. It was recorded that the property development industry in the UK provides 280,000 businesses accounting for approximately 3.0 million jobs, which is equivalent to 10.0 per cent of total employment in the UK (ibid). With such broad involvement, the UK construction industry is recognised to be a key delivery mechanism to the improvement and enhancement of the economic and social infrastructure.

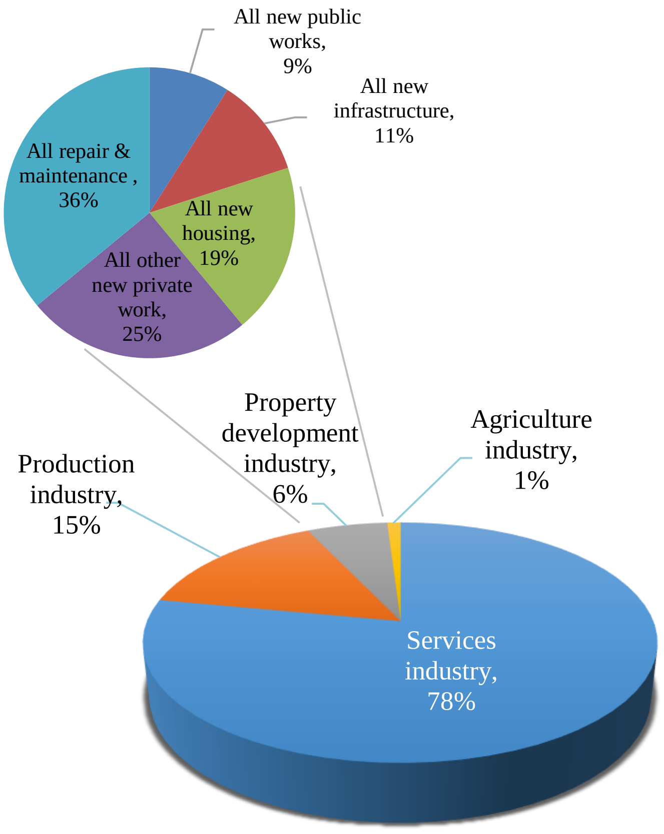


Figure 2.2 Property development industry as a proportion of GDP and its breakdown. Source: Office for National Statistics (2013)

Based on the above figure, there is evidence that R&M work contributes 36.0 per cent of the property development industry output, which indicates the level of support to this sector. Ball (1988) explained that new works and R&M works shall complement each other. The performance of R&M

works increases in direct proportion to the upsurge of construction of new works. This pattern was recorded from 1955 to 1985 (Ball, 1988, p. 99) and the data obtained from the Office for National Statistics (2014) showed that the trend continued until the third quarter (Q3) of 2014. R&M works are more sustainable compared to new works and this is proven by the following: in the first quarter of 2012, the new works dropped by 6.93 per cent, whilst there was only a minimum drop of less than 0.5 per cent in the R&M works. New work is irresistibly prominent in the property development industry; nevertheless, R&M works are more sustainable due to the need to maintain the condition of the facilities. Although R&M work is regarded as a support activity, it can provide a good or bad reflection on the performance of the developers (Ball, 1988). As R&M is prevalently associated with FM, there are opportunities for the Facilities Manager to play a better role in the development process.

The property development industry in the UK cannot escape from the issues associated with inefficiencies in the financial management, resulting in higher construction cost as well as weakness in handling the resources, which causes project delays and criticism of the final products. The number of complaints received after completion can be used as an indicator (Chan and Chan, 2004) of how the facilities fulfil the needs of end users and meet their operational requirements (Morton and Ross, 2008). The defects that upset the operation of the organisations that occupy the facilities can become a laughing stock throughout a facility’s existence, as stated by Morton and Ross (2008; p. 7): ‘the dozens of motorway bridges which function perfectly may be major feats of engineering – but the little footbridge that bounces is headline news for weeks’. Nowadays, the clients and users are more knowledgeable about the performance of the facilities in which the appraisal is dedicated to the ability of the facilities to fulfil the functions and requirements of the occupants. Owners and consultants often measure the success of property development projects based on three (3) common criteria: the project should be completed on time, on budget and free from any legal claims (Sanvido *et al.*, 1992). Nevertheless, the owner is extremely interested in knowing that the constructed facilities are functioning for their intended use and are free from long-term maintenance problems as well as having the ability to accommodate many functions. For the facilities to accommodate commercial activities, they need to be designed and constructed to the extent to which they are able to adapt to changes in order to support the occupants to remain competitive in their business.

2.3 UK Government intervention

The UK Government realises that the property development industry is a national economic backbone and needs to be monitored closely. However, the characteristic fragmentation of the industry has prevented it from improving its performance (Egan, 1998). The property development industry is commonly associated with delay in completion, exceeded costs and questionable quality. Complaints received after completion often indicate that the quality of the facilities in terms of their appearance and operational requirements has not been met (Morton and Ross, 2008). Mindful of this, the UK Government produces various reports to improve the performance of the industry as well as to enable the Government to perform its role as a major client and customer of the industry.

Since 1944, the UK Government and an authorised independent committee[4] have published 11 reports (refer to the Pre-Egan Report in Table 2.1) in which the intention is to enhance the property development industry.

Table 2.1 Reports' themes and issues

	Report	Years	Themes	Issue
Pre Egan Report	Simon	1944	Procurement and performance	Placing of public contract
	Phillips	1950	Procurement	Organisation and efficiency of building industry
	Emmerson	1962	Procurement and performance	Greater integration of the design and construction process
	Banwell	1964	Procurement and performance	Management of the building process
	What's Wrong on Site?	1970	Relationship and performance	Industrial relations on large sites
	Wood	1975	Procurement and performance	Placing of public contracts via package deals
	Faster Buildings for Industry	1983	Performance	Productivity in building factories
	Faster Buildings for Commerce	1988	Performance	Productivity in commercial construction
	Latham	*1994*	*Procurement and performance*	*Relationship between the parties to the construction process*
	Technology Foresight	1995	Performance	Return to an industry planning model not seen since the 1960s
	Egan	*1998*	*Procurement and performance*	*Performance of the industry since Latham Report*
Post-Egan Report	Achieving excellence, 1999			
	Modernising Construction, 2001			
	Accelerating Change, 2002			
	Improving Public Services Through Construction Better, 2005			
	Be Valuable, 2005			
	Callcutt Review of Housebuilding Delivery, 2007			
	Construction Commitments, 2008			
	The Strategy for Sustainable Construction, 2008			
	Construction Matters, 2008			
	Equal Partners, 2008			
	Never Waste a Good Crisis, 2009			
	Construction 2025, 2013			

Note: Italics indicate the reports that will be discussed in this thesis

Source: Adapted from Murray and Langford (2003) and Wolstenholme (2009)

Each report aims to encourage the community in the property development industry to act as a force without distinguishing their respective areas of expertise (Murray and Langford, 2003). Since the Simon report in 1944, the comments have been focused on the practice of construction management, particularly in the need to change for improvement. Nevertheless, recommendations made in the

[4] Authorised independent committee representing an independent review, commissioned jointly by the UK Government and the property development industry with the support of client bodies.

report have not been performed well for the success of the industry (Egan, 1998; Latham, 1994; National Audit Office, 2001).

Murray and Langford (2003) in their analysis found that the repetition of themes in the reports from 1944 to 1998 were evidence that the reports have changed the property development industry at a slow pace. Although the Government recognises the importance of the property development industry for economic growth, its intervention has been inadequate due to lack of effective comprehensive implementation. It is identified that the Philips Report was the only Government commissioned report that recognised the role of the labourers towards the performance of the industry (Murray and Langford, 2003). In 1968, there was the Phelps-Brown report that focused on labourers and sub-contractors level as a driver for change. Those two (2) reports were evidence that there were efforts to involve lower level workers to improve the performance of the industry (bottom-up approach). However, the Phelps-Brown Report was omitted from being commissioned by the Government, as the concerns were to look at the industry as a bigger picture (top-bottom approach) (ibid.).

2.3.1 Latham Report – Constructing the Team

The Latham Report entitled ‘Constructing the Team’ was published in 1994 and has been considered as a ‘landmark report’ for the UK property development industry (Murray and Langford, 2003). The report was prepared during three (3) different UK economic situations: economic performance during the boom period, the economic crisis and the critical economic downturn. Therefore, the Latham Report was regarded as ‘invincible and durable’. The main objective of the report was to reduce the construction and operation cost by enhancing the construction process, which would in turn increase the performance of the industry (Kagioglou *et al.*, 2000). There were 30 recommendations listed and the most prominent was the target to reduce the cost during the construction and operation stages by 30.0 per cent by year 2000. The report also suggested that the community in the industry needed to acknowledge the role of the building services engineering (Latham, 1994) and other new fields such as facilities management. Several recommendations in the Latham Report have been implemented by the UK Government and their impacts have been monitored closely. Although there is a view that the report has had little impact on the industry, Latham admitted that it has changed the landscape of the property development industry in the UK. The Latham Report has directly increased the awareness of issues related to the environment, thus introducing the concept of sustainable development as well as several important new regulations. According to Kagioglou *et al.* (2000), the report is beneficial to the industry in which the significant recommendation is to formulate effective tools or guidelines in undertaking activities at each stage of the development process.

2.3.2 Egan Report – Rethinking Construction

In October 1997, the UK Government set up The Construction Task Force (CTF) to revitalise the momentum of change that was initiated by Sir Michael Latham in 1994. It consisted of ten (10) individuals selected from the ten (10) prominent client organisations throughout the UK. As such, all views expressed are based on the clients' perspectives in line with the main task of this team as an advisor to the UK Government. The CTF was required to give its view in terms of efficiency in the development process. It covered all aspects of project management including planning, briefing, design, construction, occupancy, evaluation and operation. In addition, the quality of the construction system itself was also required be assessed so that the projects awarded by the Government could be implemented in conformity with the eight (8) objectives of the client as determined by Latham (1994), as tabulated in Figure 2.3. The Egan Report titled 'Rethinking Construction' published in 1998 was regarded as a continuation of the effort to strengthen the idea that was introduced by Latham. The ultimate suggestion of the report is the need to have clear procedures regarding integration with all stakeholders at each stage of the development process in order to improve the effectiveness of the projects.

Figure 2.3 Objectives of the clients in property development industry. Source: Inspired by Latham (1994)

Egan (1994) compares the property development industry with manufacturing and services industries, which have been improved in terms of efficiency due to their bounded process with inferior working conditions (Koskela, 1992). Five (5) main factors have been identified to bring the industry to a higher level, namely: (i) committed leadership, (ii) customer driven focus, (iii) <u>integrated processes and team around the product</u>, (iv) quality driven agenda and (v) commitment to people. However, this research focused on the third element, where the development process and the professionals in the industry are integrated, to improve the delivery of the projects and promote sustainability. According to Egan (1998, p. 16), the development process is often carried out in a fragmented manner, which needs to change for a better future in the industry.

> *'… the industry typically dealing with the project process as a series of sequential and largely separate operations undertaken by individual designers, constructors and suppliers who have no stake in the long term success of the product and no commitment to it. Changing this culture is fundamental to increasing efficiency and quality in construction.'*

The literature in this chapter will emphasise the possibility of FM being a one-stop solution (Wolstenholme, 2009, p. 31) or to position the Facilities Manager as an integrator (Hodges, 2005) at each stage as well as the team throughout the development process.

2.3.3 Modernising Construction

The Modernising Construction report was published by the National Audit Office in 2001, and has been regarded among the top ten (10) industry reports between 1998 and 2008, after the publication of the Egan Report (Wolstenholme, 2009). It aims to encourage all stakeholders including professionals representing the client and other organisation to implement all recommendations made in the Egan Report. The report emphasises the importance of the partnership concept that integrates all professionals in the team so that they have mutual objectives throughout the development projects. However, Sir Michael Latham in its foreword, expressing his concern with regard to the small changes that have occurred since the publication of Egan Report, wrote:

> *'The fastest growth has come… in some part of the public sector. The response from private commercial clients has been mixed. Some firms have led the way in best practices. Others have preferred traditional procurement routes. Many clients still do not understand that fiercely competitive tenders and accepting the lowest bid do not produce value for money in construction'.*

The report identified there are various factors in management aspects that need improvement in order to enhance the effectiveness of the projects, as shown in Figure 2.4. However, there is evidence that the lack of integration between all professionals that represent various organisations at all stages in the development process has predominantly contributed to ineffectiveness of the projects (National Audit Office, 2001).

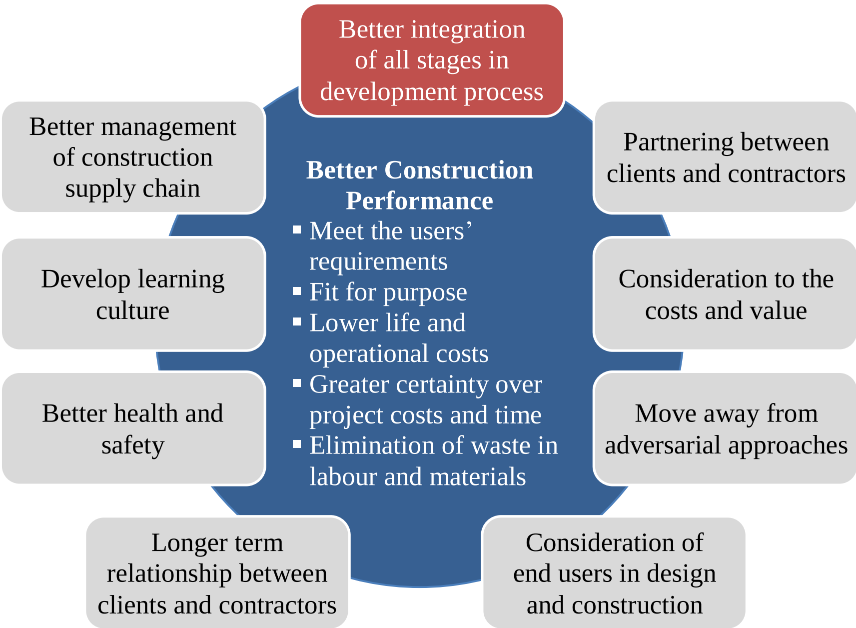


Figure 2.4 Management aspects that need for improvement for better construction performance. Source: Modernising Construction report by National Audit Office (2001)

Referring to Figure 2.4, it is apparent that FM has better opportunities to contribute significantly in improving the integration of all stages in the development process, in order to improve the performance of the property development industry in the UK. This research will focus on this aspect; however, the emphasis is given to the formulation of a framework that will guide Facilities Managers and other professionals in the property development industry such as engineers, architects and quantity surveyors to optimise the role of FM in the development process.

2.3.4 Never Waste a Good Crisis

This report was published in October 2009 as a result of an online survey that was conducted in summer 2008 with the aim of gathering feedback from various professionals in various sectors about the evolution of the property development industry in the UK since the Egan Report in 1998. The findings were exploited to support the survival of the industry. Committee meetings were conducted regularly in 2009 and they identified four (4) themes: (i) business and economic models, (ii) capability, (iii) delivery model and (iv) industry structure, which are the factors affecting the speed of change in the property development industry in the UK. The statement given by Sir John Egan is enough to provide a comprehensive image of the change performance in the property development industry in the UK between 1998 and 2008:

'We could have had a revolution and what we've achieved is bit of improvement. I would give the industry 4 out of 10'

Wolstenholme (2009, p. 8)

The online survey conducted asked about the importance of five (5) original drivers for change listed in the Egan Report. As mentioned in Section 2.3.2, this research is interested in supporting the integration of process and various professionals in the development process. Therefore, it is essential to acknowledge that about 56.0 per cent of the respondents agreed with the criticality to integrate the process and the team around the facilities.

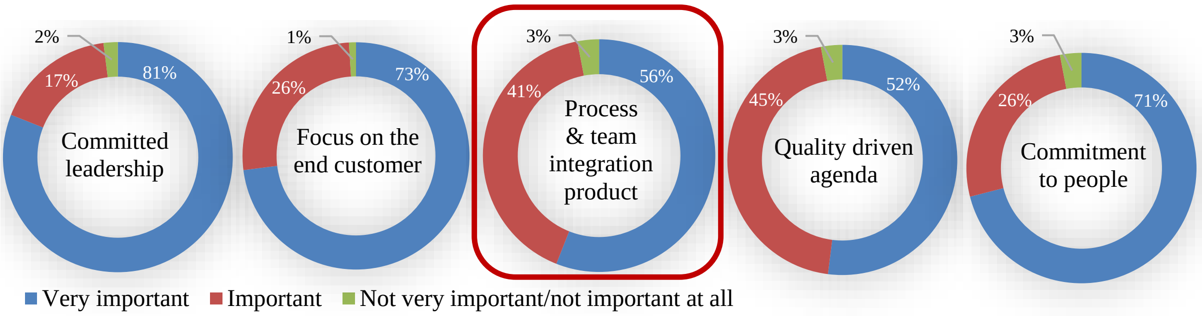


Figure 2.5 The findings of online survey conducted by Wolstenholme. Source: Never Waste a Good Crisis by Wolstenholme (2009, p. 9)

One of the factors in the theme of delivery model is the lack of understanding of the whole life cycle model and the impact of the facilities on the operating performance of the economy and the quality of life. Wolstenholme (2009) highlights that the value of the property development industry is far more significant during the use stage of the facilities, rather than in the construction stage. Therefore, it is critical to get it properly executed including the selection of the right individuals from the beginning of the development process. The report also suggests that it is important that the designers and the builders are involved with the completed facilities, so that they can continuously contribute to preserving the performance and the value of the facilities. However, this is not the case when the professionals involved in a project will leave immediately after completion. It was apparent that the property development industry needed a better-integrated process and to optimise the talent of the team. The isolation in every activity throughout the development process contributes to the slow changes in the property development industry. The appointment of consultant firms and contractors separately, coupled with the separation of the functions of FM in the early stages of the development process, has resulted in a failure to develop a comprehensive design (Wolstenholme, 2009). Therefore, there is a need to integrate FM into the development process in order to provide a positive effect on the whole life cycle of the facilities.

The report also emphasises the need to improve the line of communication in the development process. There is a suggestion for the players in the industry to create a one-stop point in the clients' set up. This is to encourage the project members consisting of various professionals to work in one (1) unit. The Facilities Manager could be the suitable professional to hold this responsibility.

2.3.5 Construction 2025

Construction 2025, published in 2013, summarises a long-term strategy of the property development industry in the UK to cope with the growth of the global industry market in 2025. The UK Government and the players in the industry have a vision to reduce the initial cost of the project and the operation of the facilities by 33.0 per cent. There is also a commitment to reduce the project duration by 50.0 per cent, from inception to handing over, both for new works and R&M works. The report identifies that one of the weaknesses in the industry is the lack of integration and limited information transfer. The continuation of information from one (1) project to another project was not common. As a result, the experience and information vanished when the team was disbanded and the facilities handed over to the client. Apart from that, the report also reiterates the concern of Latham and Egan that inadequate integration in the process and team have predominantly contributed to the waste of opportunities to innovate (Construction Leadership Council, 2013, p. 23).

Nevertheless, there are opportunities in the property development industry of which FM should be aware. Wide implementation of Building Information Modelling (BIM) in the industry could enhance the performance of the industry and cost reduction. BIM would encourage integration of various professionals in the industry as well as ensure the continuation of the information. The report has revealed that the implementation of BIM at the earlier stage of the development of Manchester Town Hall Building contributed to the efficiency of the project (p. 9). Furthermore, the project has demonstrated the potential of BIM for the future of FM in the property development industry. Therefore, the opportunities for FM to be integrated into and to contribute significantly in the development process are wide open.

2.4 The evolution of the professions

The future growth of professionals in the property development industry was debated as early as 1950 through the Working Party Report: Building document, better known as the Phillips Report (Ministry of Works, 1950). The report identifies that the professionals involved in the project were divided into two (2) groups, namely employers and operators, the latter of which is prevalently associated with architects, engineers and quantity surveyors (p. 3). However, the development of technological invention that supported the operation of the facilities created new professions that focused on ensuring smooth operations and comfort of the occupants. Although the term FM did not yet exist at this point, the awareness regarding the tasks and responsibilities did. The element of FM gained the attention of the client as even more customer care aspects emerged. The report concluded that there is an ambiguous boundary line between construction and operation stages as a result of qualitative and quantitative analysis of the data obtained in the UK, as well as case studies of neighbouring countries. This report can be considered as a trigger for the birth of the role of Facilities Manager.

A study by Harri (1992) found that the traditional British property development industry separates the design work and construction work while the responsibilities of the design team are divided between experts whose qualifications and duties are controlled and protected by professional bodies. Evolution in the property development industry has changed the principles of project management and the development process. The emergence of other professionals indicates the progress of modernisation of the property development industry in the UK. The expansion of the property development industry in the UK created opportunities in terms of the establishment of profession and employment. Architects have been the most recognised professionals in the industry. Architects play a major role in managing the overall development process encompassing planning, financial control, procurement, and monitoring the progress of construction activities as well as being the designer. Figure 2.6 shows the traditional project structures in the UK.

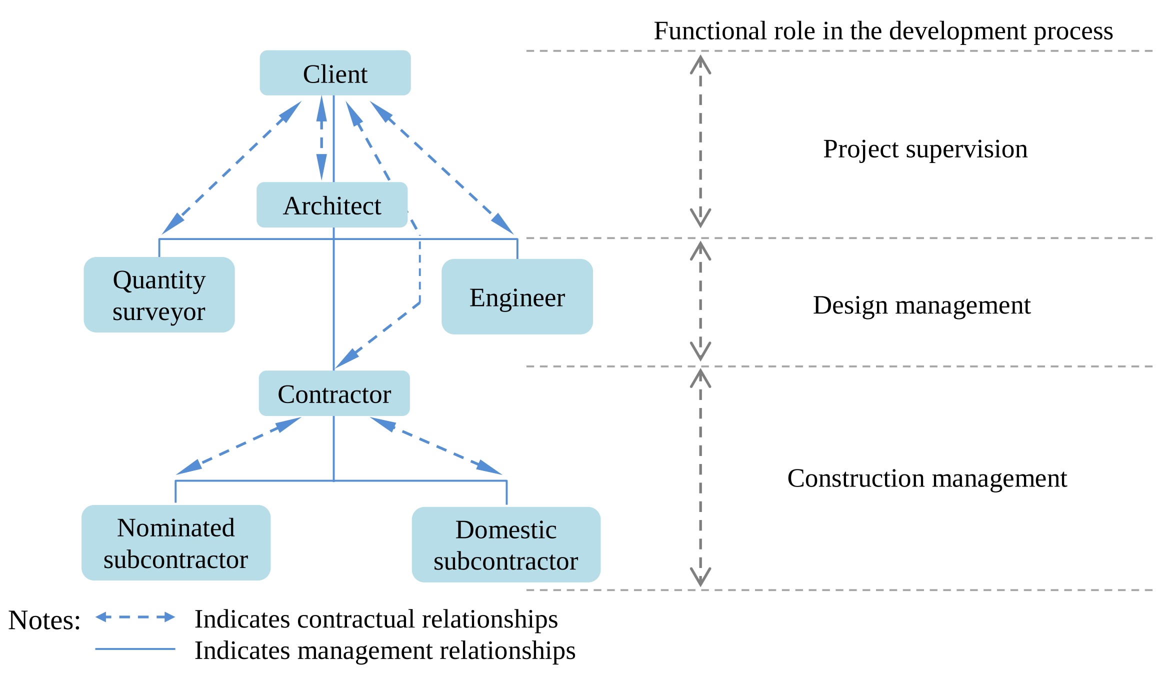


Figure 2.6 Traditional project structures. Source: Ball (1988)

The growth of complexity in development projects has changed the role of architects and increased the conflict within the community[5]. In the 1980s, the role of architects in the development process was criticised and questioned. The pressure for architects to work harmoniously with other professionals is always present. The most critical deficiencies that architects need to improve are the ability to cooperate and communicate with all members at any level throughout the development process as well as continuous learning about the design (Ball, 1988). This, coupled with the introduction of various forms of contract to fit the complicated environment in the industry, has lessened the renown of architects. A less respected architectural profession is mainly due to the incompetence of the average architectural practice (Ball, 1988). Architects alone could not manage the complexities and need to collaborate with other professionals in the development process. Uncertainties in the architectural profession have indirectly increased the profile of other professions such as engineers, quantity surveyors and workers involved in the R&M sector. In this respect, professionals engaged in R&M took the opportunity to enhance the profile of the field of facilities management.

The history and expansion of significant professional roles in the industry are briefly explained in the following sub-sections:

2.4.1 The Architects

The Institute of British Architects was founded in 1834 at a time when the architectural profession and community had a low level of respect due to a variety of ethical issues that surrounded it including corruption, fraud and abuse of power. Thus, the image of the architectural profession and its community needed to be enhanced and, as a result, the Royal Charter was awarded to the institution. Since 1937, the institution has been known as the Royal Institute of British Architects (RIBA), and has managed to uphold its reputation and to increase its professional membership. Since its initiation, RIBA has remained focused on '… general advancement of Civil Architecture, and for promoting and facilitating the acquirement of the knowledge of the various arts and sciences connected therewith…'(Royal Institute of British Architects, 2014).

There is another government authority to recognise and control the professionalism of architects, known as the Architects' Registration Council of the United Kingdom (ARCUK). The Architects (Registration) Act of 1931 allows ARCUK as a statutory body to register any architects who have passed the RIBA exams. ARCUK comprises representatives of all architectural organisations in the UK, government departments and other related professional institutions. The continuous reviews to the Act have strengthened its content and, with a view to enhancing the profile of architects, the

[5] Community refers to an organisation or individual other than Facilities Managers whose core business is to provide consultation services and construction activities particularly in the property development industry.

Architects Registration Board was formed through the Architects Act 1997. Currently, 40,000 architects are members of RIBA. RIBA is now based in London and there are 14 regional offices to support the affairs of architects all over the UK.

RIBA now is working hard to support sustainable development policies introduced by the UK Government. The establishment of a Sustainability Hub on its website is evidence that RIBA is serious in providing reliable resources in every aspect of sustainable design in architecture (Royal Institute of British Architects, 2014).

2.4.2 The Engineers

There are various fields of engineering in the UK. However, the most prominent fields in the twentieth century were civil, mechanical, electrical and structural engineering. In 1950, the traditional task of engineers was to advise architects in terms of engineering aspects of the building and concurrently take entire responsibility with regard to engineering characteristics of the facilities (Ministry of Works, 1950). The discovery and development of new engineering technology has placed engineers at the elite level in the public's mind. Their contribution to the property development industry of the UK has been recognised. The growth of five (5) engineering societies is explained in brief as follows:

- Institution of Civil Engineers (ICE)

ICE was established in 1818 and was known as the oldest professional society in the UK. In 1828, ICE was granted a Royal Charter implying recognition of the role of the institute to the nation. It allows ICE to draft its own by-laws, regulations and rules for its members as well as acts as authorisation to award a membership grade. ICE was formed to promote and develop civil engineers through its practical and academic programmes. Since its inception, ICE has believed that all civil engineers are 'at the heart of society, delivering sustainable development through knowledge, skills and professional expertise' (Institution of Civil Engineers, 2014). As of December 2014, ICE represents approximately 80,000 members around the world. It has been a partner in discussions with the Government built environment issues in which Lord Chidgey, a respected politician and a Member of Parliament (MP) for Eastleigh from 1994 to 2005, admitted the contribution of ICE to the nation:

> *'In the House of Lords we are reliant on external bodies providing us with timely authoritative research support our work. The ICE is always available to advise Members of both Houses – from all parties.'*

(Institution of Civil Engineers, 2014)

- Institution of Mechanical Engineers (IMechE)

IMechE was established in 1847 with the aim being to enhance mechanical engineering knowledge and to be a catalyst of innovations that are advantageous to humankind (Dolan, 1979). IMechE believes that the quality of life can be continuously improved through the harnessing of engineering technology. IMechE received a Royal Charter in 1930. As of December 2014, IMechE has over 110,000 members worldwide and operates from London.

- Institution of Electrical Engineers (IEE)

IEE was established in 1888 as an organisation that was originally known as the Society of Telegraph Engineers in 1871. IEE now no longer exists after its merger with the Institution of Incorporated Engineers (IIE) in 2006 to form the Institution of Engineering and Technology (IET), based in Stevenage, UK (The Institution of Engineering and Technology, 2014). IET represents more than 150,000 members worldwide. IET is a chartered professional body, which allows it to establish professional registration for its members.

- Institution of Structural Engineers (IStructE)

The need for durable and everlasting buildings enhanced the development of concrete technology and other related industries such as cement and steel. A standard for producing concrete was highly needed. In 1908, the Concrete Institute was born, which was officially renamed the Institution of Structural Engineers (IStructE) in 1923. In 1934, IStructE was granted a Royal Charter and was recognised for its contribution to the establishment of the London Building Act (The Institution of Structural Engineers, 2014). IStructE is an internationally recognised society comprised of 27,000 structural experts from more than 105 countries around the globe. Nowadays, IStructE is growing and incorporating the aspects of sustainable development as well as encouraging its members to safeguard the environment. The management and administration of IStructE is currently housed in London.

- The Chartered Institution of Building Services Engineers (CIBSE)

The Chartered Institution of Building Services Engineers (CIBSE) received its Royal Charter in 1976. CIBSE is an active organisation in promoting a sustainability agenda, particularly in energy efficiency initiatives, by awarding research grants to any CIBSE member around the world to develop their career and research as long as it meets the interests of CIBSE and related stakeholders (Chartered Institution of Building Services Engineers, 2011). CIBSE has set its role and core purpose, which is committed to promoting building services engineering for the benefit of through collaboration with the built environment and the industrial processes. CIBSE is also committed to enhancing education and research in the building services engineering and employing the research outputs for better outcomes (Chartered Institution of Building Services Engineers, 2010). As of December 2014, CIBSE had approximately 24,000 members around the world.

2.4.3 The Surveyors

In the early years, the surveying discipline was renowned as a multi-tasking profession including building survey, valuation and assessment, auction and property management (Royal Institution of Chartered Surveyors, 2014). Diversification of activities and expertise, and its uniqueness, are important features of the Royal Institution of Chartered Surveyors (RICS), which the name was adopted in 1946. In 1881, the institution received its Royal Charter followed by establishment of the objectives of the institution in promoting ‘the usefulness of the profession for the public advantage in the UK and in any other part of the world’ (Royal Institution of Chartered Surveyors, 2014). As of December 2014, RICS has around 118,000 qualified members, known as chartered surveyors, worldwide. Due to its wide range of specialism, 17 professional groups were formed apart from Property, Land and Construction groups. Facilities Management is one of the professional groups listed, of which a qualified individual who has passed the RICS Assessment of Professional Competence (APC) will be granted the title of Chartered Facilities Management Surveyor. RICS recognises FM as a discipline that contributes to the efficiency of the built environment. The role of Facilities Manager is needed in all sectors including the property development industry. RICS is known to be one of the professional bodies that are seeking to enhance the profile of FM.

2.4.4 The Facilities Managers

The British Institute of Facilities Management (BIFM) was founded in 1993. It is the largest professional body to promote the education, interest and professionalism of the FM community in the UK (British Institute of Facilities Management, 2014). As of December 2014, there were approximately 14,500 members of BIFM. BIFM had set up a clear strategy to develop a good relationship with all stakeholders including the Government and private sectors. BIFM emphasises continuous professional development through qualifications and training in line with its mission to enhance the profession. The interest of institutions of higher education to collaborate with BIFM indicates that the qualification of FM is recognised in the industry. Liverpool John Moores University (LJMU), for instance, created a unique programme embedded with professional FM qualifications. A successful individual will received a Master of Science (MSc) in Applied Facilities Management, equivalent to BIFM’s Level 7 portfolio. Since FM has been recognised as the fastest-expanding discipline in the UK (Noor and Pitt, 2009), the role of Facilities Manager has become significant in the built environment, which needs to be addressed in this thesis.

2.5 Defining the development process

A property development project is high in complexity (Williams, 1999) due to its interrelated activities (Baccarini, 1996) that have to be performed simultaneously and sequentially in each development stage. Furthermore, the involvement of numerous professionals from different disciplines that represent various organisations in the project set up further increase its complexity. Michael Kagioglou *et al.* (1998b) claim that traditional methods in managing property development projects resulted in repeating the same errors. According to Egan (1998), the property development industry in the UK kept repeating the development process that the industry community felt was unique whereas it resulted in repeating the same errors. Thus, there is a need for an organisation to establish good strategic planning, operation monitoring system and ability to anticipate difficulties in order to deal with the complexity in each activity in a project (Gidado, 1996). In addition, the establishment of a consistent model of the project life cycle requires a new paradigm and change of working system in the property development industry. However, Koskela (1992) affirms that the paradigm shift in the industry is very slow and difficult to measure.

The main purpose of the project life cycle model is to inform all parties involved in the development project to play their roles effectively and implement each project stage in a proper system (Pinto and Slevin, 1988). It allows all stakeholders to view the project from a broad and precise perspective. Monitoring and managing the development project throughout the project life cycle has been recognised as the proper approach to complete the project successfully (Yates *et al.*, 2009). The life cycle of the facilities involves various stakeholders and numerous changes to the requirements. The initial objectives of the facilities are often at stake and changes in policies can result in the alteration of physical layout, functions that lead to additional cost and delay in completion. Yates *et al.* (2009) stress the need to monitor the changes by using tools that completely rely on a clear model of the project life cycle. In addition, this model provides alternative ideas for tracking the achievement of the project in each stage (Slevin and Pinto, 1987). In short, the project life cycle will determine the sequence of the stage of the projects. Furthermore, the project life cycle allows the opportunity to encourage the assessment of FM in the development process, which leads to asking whether or not to integrate it into specific stages. An explicit model of the project life cycle will assist Facilities Managers and other professionals to prioritise the activities that encourage optimisation of the role of FM in each stage of the project life cycle.

In the literature review, it was identified that Morris (1988) was one of the pioneers who introduced the model of project life cycle. In fact, he stressed the need for professionals in the project management discipline to understand the model. Project life cycle, according to Morris (1988), is a process by which to achieve project objectives through various activities that involve formulation of project definition, project requirements, project execution, project segmentation and completion; in terms of physical and financial as well as contractual activities. He further separated the elements of the project life cycle into four (4) stages comprising feasibility, planning and design, construction, and turnover and start-up. The project life cycle was referred to by the Project Management Institute (2000) to describe the sum of knowledge within the profession of project management. Project life cycle as defined by Morris (1988) is illustrated in Figure 2.7.

For the purpose of this research, the term development process will be used since there is similarity in definition between Chodasova (2004) and Morris (1988). Furthermore, the term development process is used to indicate the presence of an FM element in the property development industry, as discussed in Chapter Three. Therefore, from this point onwards, the term development process will be used for the entire study instead of project life cycle.

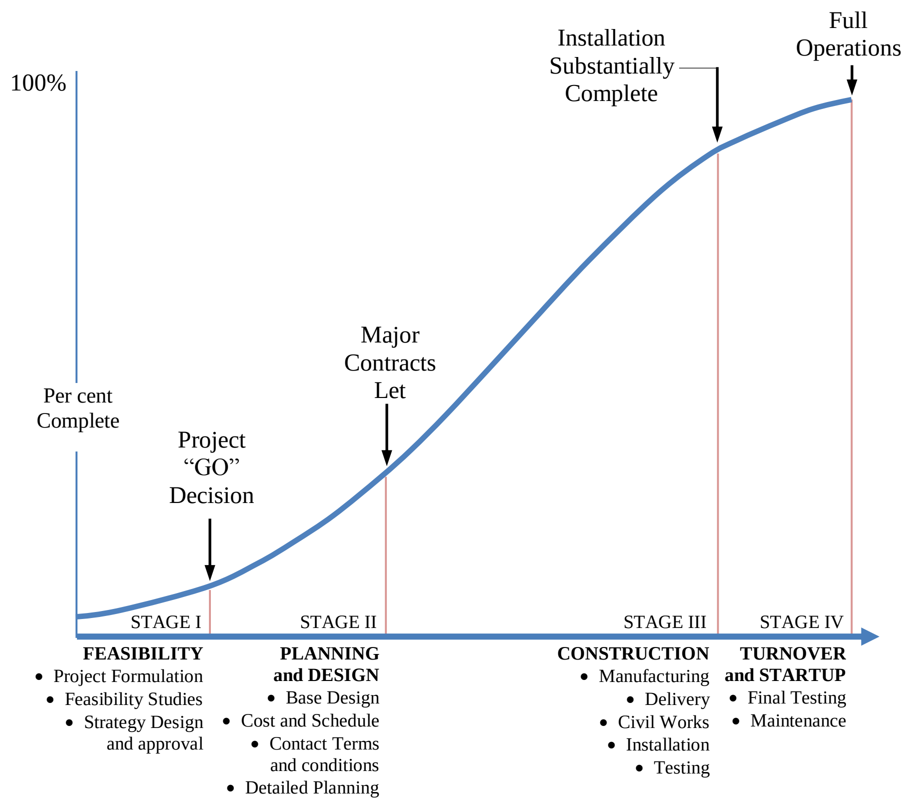


Figure 2.7 The definition of development process according to Morris (1988). Source: Morris (1988)

Stage I: Feasibility – At the preliminary stage, stakeholders' interests, economic viability, market trend and social changes are assessed. The project objectives are identified and the possibility to achieve them is measured. Elements of value and worth are gauged to conclude the phase. The feasibility stage is recognised as the institutional level involving 'go/no-go' (Morris, 1988) decision. At this level, the decision making is often related to financial and technical feasibility.

Stage II: Planning and design – The estimation and the work programme are scrutinised. Contract document, specification and working drawings are prepared, contracting strategy and funding are reappraised, authority permission is pursued and logistics systems are defined. The contract is awarded to a successful bidder followed by handing over of the site. The planning and design stage is classified as strategic in nature by making a firm decision while the construction stage is categorised as tactical.

Stage III: Construction – This stage comprises physical activities with the implementation of various construction techniques and technologies to achieve the specified project quality within the allocated timeframe, as well as procurement activities within the allocated budget. The performance and fitness are tested and the functions are certified by all professionals involved.

Stage IV: Turnover and start-up – Review of tasks and resources. The facilities management will lead the technical operation and support service system. The satisfaction of the users becomes the focus. The performance capabilities will be measured and monitored.

A clear definition of the development process is central for project success. The more processes that are identified, the bigger the possibility for the project to be implemented effectively, as complexity in each activity is isolated and easy to control. King and Cleland (1988) summarised that the development process was divided into nine (9) phases comprised of identification, formulation, evaluation, detailed planning, design and engineering, procurement, construction/execution, completion and post-completion activities. The Chartered Institute of Building (2010b) describes that there are 12 stages in the development project, consisting of appraisal, design brief, concept, design development, technical design, production information, tender documentation, tender action, mobilisation, and construction to practical completion and post-practical completion.

Barrett and Baldry (2003) argue that the model of development process was prevalently understood as a linear and sequential process as follows: planning → briefing → design → construction → occupancy. The process was repeated for every new project, despite there being evidence that the flow does not necessarily fit with other projects. Since there were weaknesses with the existing method, Barrett and Baldry (2003) introduce a cyclical process, as shown in Figure 2.8. The cyclical process encourages knowledge and data sharing between the stages, which is useful for the new design or to enhance the existing building performance. The incorporation of an evaluation element into the process complements the briefing and design process in investigating the users' feedback on the facilities provided.

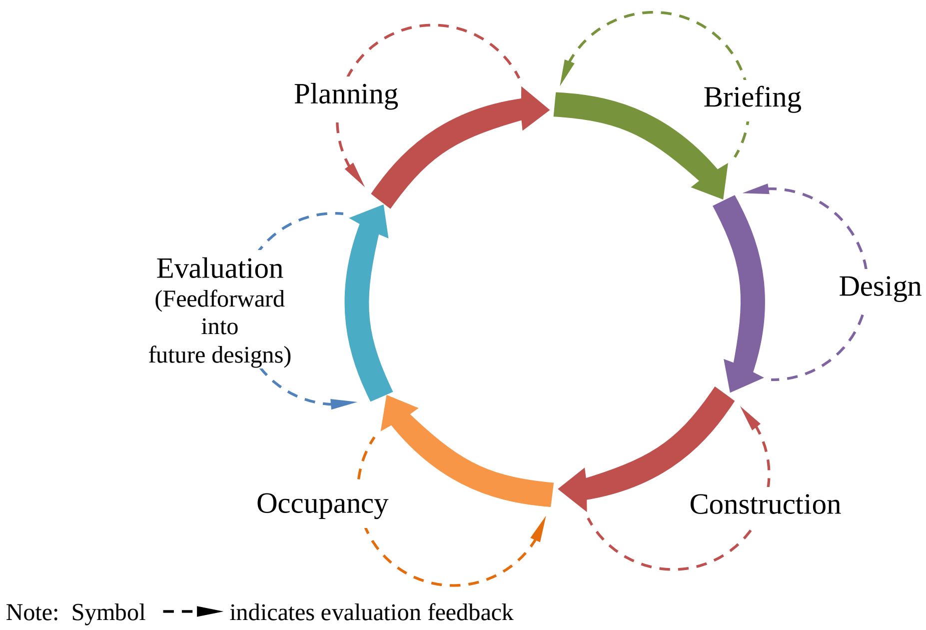


Figure 2.8 Cyclical development process. Source: Barrett and Baldry (2003)

The Project Management Institute Project Management Institute (2008) highlights that the overlapping phases could accelerate the progress of the project. However, it exposes the project to additional cost for rework as a result of insufficient collaboration in the project. According to Kerzner (2006), the overlapping of the activities in the development process is inevitable. The risk, however, can be controlled by increasing the effectiveness of the project and lowering the degree of uncertainty (Project Management Institute, 2008).

Michael Kagioglou *et al.* (1998b), Kagioglou *et al.* (1999), Kagioglou *et al.* (2000), Aouad *et al.* (1998) and Cooper *et al.* (1998) draw our attention to a different angle on the development process grounded in the 'process view' in the manufacturing sector. It is essential for the industry to review the development process to be more sustainable. Kagioglou *et al.* (1999) conclude that the property development industry needs these qualities in order to adapt to changes of environment. In addition, Kohler and Lützkendorf (2002) remind the property development industry to be aware of the increasing complexity of user requirements; having a good understanding of current working environment, and having the ability to anticipate future demands. The introduction of 'process protocol' was unique as all four (4) project phases (pre-project phase, pre-construction phase, construction phase and post-completion phase) have covered all critical activities in the property development project. Furthermore, FM responsibilities are properly indicated, as shown in Figure 2.9.

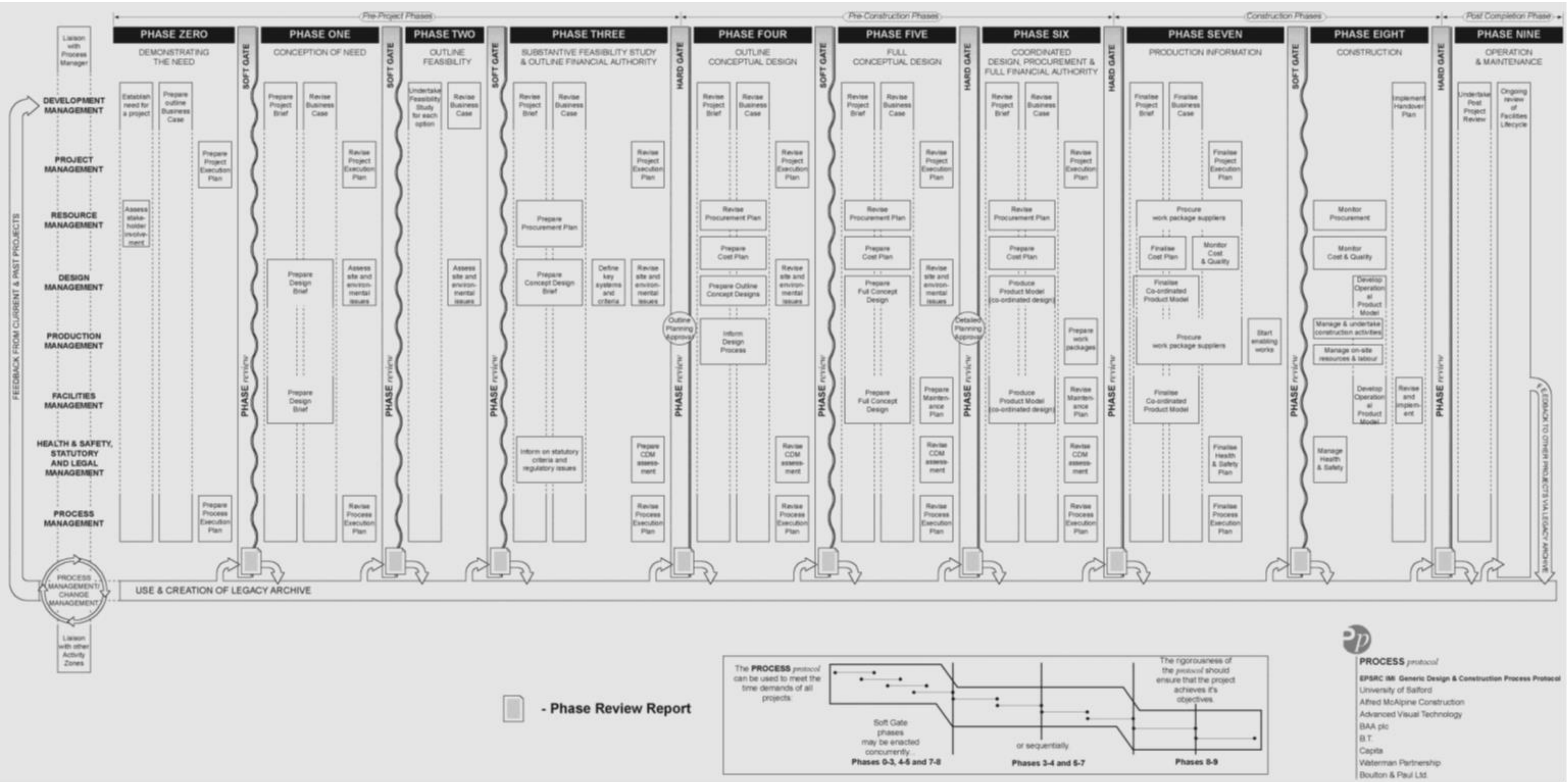


Figure 2.9 The generic design and construction process protocol. Source: Kagioglou *et al.* (2000)

Kagioglou *et al.* (1999) claim that the model of the development process has been viewed in a fragmented manner, which has limited the success of projects. The situation was different in the manufacturing industry, where the production process was treated as a unit. A proper model of production process in the manufacturing industry led to an excellent performance achievement in terms of the flow of the information. This view was supported by Winch and Carr (2001), who contend that it is vital to get the model correct as it will determine the continuation of the information throughout the development process, which is considered as a main success factor of the projects. Furthermore, the 'process protocol' introduced in Cooper *et al.* (1998) and Kagioglou *et al.* (2000) was referred to by Hamid *et al.* (2010) to develop and justify the need for FM process protocol in higher education institutions in the UK. It shows strong evidence that a clear model of development process is capable of contributing something new in the discipline of built environment. This idea became the motivation for the study and justifies why the development process model needs to be carefully determined.

It would be beneficial to examine why comparison is made between manufacturing and property development industries and what are the benefits to FM. 'Process protocol', which is formulated from the manufacturing industry, has similar characteristics in the property development industry in terms of activities for developing new products/facilities (see Table 2.2) (Kagioglou *et al.*, 1999). A 'stage gate' concept introduced by Michael Kagioglou *et al.* (1998b) encourages consistent planning and monitoring throughout the development process. It also allows the activities in the process to be carried out simultaneously while the products of the process are appreciated. There is similarity between the construction stage in the property development industry and new product development in the manufacturing industry. Both could begin after complying with the requirements set in the earlier stages of the process. In addition, the characteristics between the two (2) industries with regard to the construction stage are identical in terms of participation of professionals, optimisation of internal resources, commissioning of completed products and maintenance for the product/facilities. In line with this view is the work of Gann (1996), which claims that production and the property development industry shared the same critical issue in compromising between standardisation (facilitating the advantages of efficient utilisation of the production/development process) and flexibility (the marketability of the product/facilities and fit to user needs). Moreover, Sanvido and Medeiros (1990) claim that the similarity between the manufacturing and property development industries is in their basic processes and functions, challenges and innovative solutions. However, the manufacturing industry has managed to exploit all those aspects to achieve a better result.

The knowledge of information and communication technology (ICT) in the manufacturing sector is far more advanced compared to the property development industry. There have been efforts to apply the principles of ICT in the manufacturing sector to the construction industry (Koskela, 1992; Sanvido *et al.*, 1990; Sanvido and Medeiros, 1990; Sanvido and Norton, 1994). The idea of collaboration between ICT and the property development industry is to simplify the complexity of the construction industry: multiple-phases of development process, involvement of multidisciplinary professionals as well as usage of assorted software and hardware tools. However, there are problems for effective collaboration. The model of development process is unclear, resulting in poor planning and less priority being given to the operation stage including maintenance, environmental impact and sustainability (Sanvido *et al.*, 1990). The importance of having a clear model of the development process has been discussed by various researchers and most of them require a well-defined model of the development process to produce systems or models of integration and collaboration (Aouad *et al.*, 1998; Hagan, 2001; Hetrick and Khayyal, 1989; Michael Kagioglou *et al.*, 1998a; Razali and Manaf, 2005; Sanvido and Medeiros, 1990; Sanvido and Norton, 1994; Shohet and Lavy, 2004; Yu *et al.*, 2000). It has been anticipated that BIM would be able to be implemented smoothly and provide better opportunity for FM-DP integration as long as the project life cycle model is clearly defined.

Table 2.2 Similarity of characteristics between the manufacturing and property development industries

• The start of a project
• The production of the products/facilities
• Construction techniques
• Basic processes and function
• Challenges
• Innovative solutions

Source: Inspired from Gann (1996), Michael Kagioglou *et al.* (1998b) and Sanvido and Medeiros (1990)

Crowley (1998) justifies the reason why manufacturing is considered as the most appropriate sector to be compared with the property development industry. The manufacturing industry has been synonymous with lean production philosophy. It was suggested that the property development industry adopt the lean concept, which could definitely drive the industry towards sustainable economy and social life: ‘building can be seen as “facilities” that will generate income from its “servicing” for its entire life cycle’ (Crowley, 1998; p. 399). In line with Crowley, Koskela (1992) further supports that the property development industry should adopt the evolving set of principles, techniques and tools of the manufacturing sector. She concludes that there are three (3) values of new production philosophy in manufacturing that need to be learned by the property development industry (see Table 2.3).

Table 2.3 The definition of new production philosophy

• Conceived as material and information flow processes, which are
• Controlled for minimal variability and cycle time, and
• Improved continuously with respect to waste and value, and periodically with respect to efficiency by implementing new technology

Source : Koskela (1992)

Meanwhile, Kagioglou *et al.* (2000) conclude that there are two (2) main areas from which the property development industry could gain from the lean concept in the manufacturing sector (see Table 2.4). The lean concept could encourage the integration of the processes and enable concurrent engineering with low production cost. However, Crowley (1998) warns that the rise of the lean concept in the property development industry should be in line with the current trend of client requirements – provide the client with the complete service in one (1) package including planning, design, construction, operation and maintenance of the completed facility. For this, public private partnership (PPP) is the approach with which most property development organisations are interested in becoming involved. PPP is the contractual innovation, which is identified as one of the factors to encourage the growth of FM in the property development industry in the UK.

Table 2.4 Areas where the property development industry can benefit from the manufacturing industry

• The production process in term of nature and content, to the design and construction activities
• The production of the product, including resources planning, technology use and material selection

Source: Kagioglou *et al.* (2000)

The development process provides a useful framework for the client and professionals in the property development industry to monitor the progress of the projects by conceptualising the work stages and resources required at each project stage (Slevin and Pinto, 1987). In addition, it would assist in identifying the factors needed for effective project implementation. Slevin and Pinto (1987) formulate a factor model (see Figure 2.10) with the purpose of discovering the factors needed for project success. It was identified that 'monitoring and feedback' is the area that offers opportunity for FM to get significantly involved in the development process.

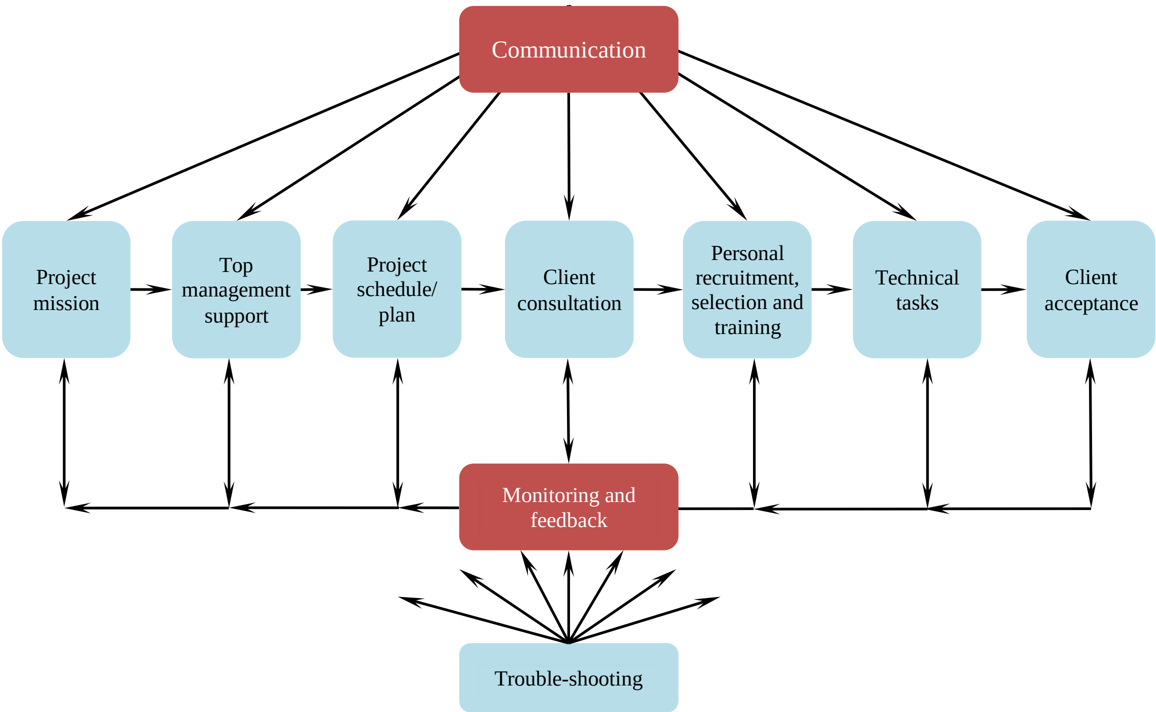


Figure 2.10 Ten (10) key factors of the project implementation profile. Source: Slevin and Pinto (1987)

The literature review has so far demonstrated that there is various understanding of the development process, some of which neglects the role of FM and the others which take it lightly. Table 2.5 summarises the elements of the development process obtained from 30 sources.

Table 2.5 Previous studies on the definition of the property development life cycle

No.	Title of articles/books	Author	Methodology	Development process
1.	Managing Project Interfaces-Key Points for project Success	Morris (1979) cited in Morris (1988)	Literature review	Stage I: Feasibility Stage II: Planning and design Stage III: Construction Stage IV: Handover and Start-up
2.	Life-cycle Management	Pandia (1985) cited by King	Literature review	i. Identification ii. Formulation iii. Evaluation

No.	Title of articles/books	Author	Methodology	Development process
		and Cleland (1988)		iv. Detailed planning v. Design and engineering vi. Procurement vii. Construction/execution viii. Completion and ix. Post-completion activities
3.	Behavioral Implications of the Project Life Cycle	Adams and Barndt (1988)	Questionnaire	Phase I: Conceptualisation Phase II: Planning Phase III: Execution Phase IV: Termination
4.	Processes, maps and protocols: understanding the shape of the construction process	Winch and Carr (2001)	Case study and interview	Define need Establish viability Conception Scheme design Detailed design Production planning Main trades Finishing trades Commissioning Facility management
5.	The Design And Construction Process	Macomber (2001)	Literature review	Formulation Design Construction Operations
6.	Facilities Management: Towards Best Practice	Barrett and Baldry (2003)	Case study and literature review	Linear Process: • Planning • Briefing • Design • Construction • Occupancy Cyclical Process: • Planning • Briefing • Design • Construction • Occupancy • Evaluation
7.	Facility Management in Development Process	Chodasova (2004)	Literature review	Initial idea Conception Feasibility study Preparation of contract Origination of contractual obligations Construction works Completion and occupation Facilities management
8.	A Guide to the Project Management Body of Knowledge (PMBOK Guide)	Project Management Institute (2004)	Literature review	Initial Phase: • Charter • Scope statement Intermediate Phase: • Plan • Baseline • Progress • Acceptance Final phase: • Approval • Handover
9.	Cost Management and Estimates in the Infrastructure Design Process	Savolainen *et al.* (2005)	Literature review	Project Planning Design Construction Use

No.	Title of articles/books	Author	Methodology	Development process
10.	Property Development	Wilkinson and Reed Havard (2008)	Literature review	Initiation Evaluation Acquisition Design and costing Permissions Commitment Implementation Let/manage/dispose
11.	Design Integration of Facilities Management: A Challenge of Knowledge Transfer	Jensen (2009)	Literature studies and knowledge sharing	Decision Briefing Design Construction Occupation
12.	Integration of Consideration of Facilities Management in Design	Jensen (2008)	Literature studies, knowledge / experience sharing	
13.	A Guide to the Project Management Body of Knowledge (PMBOK Guide)	Project Management Institute (2008)	Literature review	A. Design Phase • Initiating processes • Planning processes • Executing processes • Closing Processes B. Construction Phase • Initiating processes • Planning processes • Executing processes • Closing Processes
14.	FM dashboard: A facility management monitoring tool for planning, design and construction to optimise function and cost in operations	Felten *et al.* (2009)	Individual case study, connect analysis of literature review and qualitative research (empirical interviews)	Strategic planning Preliminary studies Project planning Innovation to tender Project execution Building operation
15.	Code of Practice for Project Management for Construction and Development	The Chartered Institute of Building (2010b)	Guideline	
15a	• CIOB Code of Practice for Project Management for Construction and Development			1. Inception 2. Feasibility 3. Strategy 4. Pre-construction 5. Construction 6. Engineering Services Commissioning 7. Completion, handover and occupation 8. Post-completion review / project close out report
15b	• Office Government Commerce			Gate 0: Strategic assessment Gate 1: Business justification Gate 2: Procurement strategy Gate 3: Investment decision Gate 4: Readiness for service Gate 5: Benefits evaluation
15c	• British Standards BS6079-1: 2000			1. Conception 2. Feasibility 3. Realisation

No.	Title of articles/books	Author	Methodology	Development process
				4. Operation 5. Termination
15d	• British Property Federation			1. Concept 2. Preparation of the brief 3. Design development 4. Tender documentation and tendering 5. Construction
15e	• Royal Institute of British Architects (RIBA) cited in Contemporary Property Development	Havard (2008)		A. Appraisal B. Design brief C. Concept D. Design development E. Technical design F. Production information G. Tender documentation H. Tender action I. Mobilisation J. Construction to practical completion K. Post-practical completion L. Letting and/or sale
16.	Facility Management	Rondeau *et al.* (2006)	Literature review	Step 1: Corporate policy, Strategic plan, revenue enhancement Step 2: Operation requirement, department criteria, graphic analysis Step 3: Concepts, schematic design, Costs and schedule Step 4: Working drawing, specifications Step 5: Bidding or pricing Step 6: Corporate status reports, interior design, construction observation Step 7: Beneficial occupancy, maintenance program, revenue production
17.	Re-Engineering The UK Construction Industry: The Process Protocol	Kagioglou *et al.* (1999)	Literature review	**Pre-Project Phases:** Phase Zero: Demonstrating the Need Phase One: Conception of Need Phase Two: Outline Feasibility Phase Three: Substantive Feasibility Study and Outline Financial Authority **Pre-Construction Phases:** Phase Four: Outline Conceptual Design Phase Five: Full Conceptual Design Phase Six: Coordinated Design. Procurement and Full Financial Authority **Construction Phases:** Phase Seven: Production Information Phase Eight: Construction **Post-Completion Phase:** Phase Nine: Operation and maintenance
18.	Cross-Industry Learning: The Development of a Generic Design and Construction Process Based on Stage/Gate New Product Development Processes Found in the Manufacturing Industry	Michael Kagioglou *et al.* (1998b)	Literature review	
19.	Rethinking construction: the Generic Design and Construction Process Protocol	Kagioglou *et al.* (2000)	Literature review	
20.	The development of a generic design and construction process	Cooper *et al.* (1998)	Literature review	
21.	An IT map for a generic design and construction process protocol	Aouad *et al.* (1998)	Literature review	
22.	A process for change-the development of a generic design and construction process protocol for the UK construction industry	Sheath *et al.* (1996)	Literature review	
23.	The Process Protocol: Process and IT modelling for the UK construction industry	Michael Kagioglou *et al.* (1998a)	Literature review	

No.	Title of articles/books	Author	Methodology	Development process
23.	CIBSE Introduction to Sustainability	CIBSE, 2007	Report	Pre-inception Strategic brief Project brief Strategy Design Construction Commissioning Building handover Operation Deconstruction
24.	The Evolution of the Systems Development Life Cycle: An Information Systems Perspective	King and Srivinasan (1988)	Literature review	**Prior phases:** i. Strategic planning ii. System planning **Classical systems development life cycle:** iii. Definition iv. Physical design v. Implementation **Post-phases:** vi. Evaluation vii. Divestment
25.	Intellectual Capital: Future competitive advantage for facility management	McLennan (2000)	Literature review	Finance Design Build Operate

26.	An Integrated Building Process Model	Sanvido *et al.* (1990)	Literature review	• Provide facility
				• Plan Facility
				• Design Facility
				• Construct Facility
				  • Acquire construction service
				  • Plan and control work
				  • Provide resources
				  • Build
				• Operate Facility

27.	Integrated facility construction process model	Hetrick and Khayyal (1989)	Literature review	
28.	Applying computer integrated manufacturing concepts to construction	Sanvido and Medeiros (1990)	Literature review	
29.	Integrated Design-Process Model	Sanvido and Norton (1994)	Literature review	
30.	RIBA Plan of Work 2013	Royal Institution of British Architects (2013)	Guideline	Stage 0: Strategic Definition Stage 1: Preparation and Brief Stage 2: Concept Design Stage 3: Developed Design Stage 4: Technical Design Stage 5: Construction Stage 6: Handover and Close Out Stage 7: In Use

Source: Self study

The above table shows that there is no standard definition in the model of the development process. The definition of the development process is based on the understanding of the author and context of discussion. However, for the purpose of this research, it is essential to hold an appropriate definition of the development process that is understandable to players in FM and the property development industry. As this study aims to develop a FM-DP integration framework, which emphasises the UK environment, it would beneficial to explore the definition of development process that is mostly used by the players.

2.6 RIBA Plan of Work 2013

The RIBA Plan of Work is a model of the development process in the UK. It has served as a main document to guide the development process in the property development industry around the world. This document has been used by various professionals in the industry; nevertheless, it is more synonymous with the profession of architects. It has gone through five (5) incremental amendments in line with the growth of the industry since its inception in 1963. The latest amendment was carried out in 2007.

2.6.1 The drivers and the process of amendment

The Royal Institute of British Architects (RIBA) launched a comprehensive review of the RIBA Plan of Work as a result of a number of weaknesses identified in the RIBA Plan of Work 2007. One of the factors that led to the revision of this document is the ambiguity of the definition of the development stages. In addition, the changes are required to reflect the increasing complexity in the landscape of the industry. The introduction of the UK Government Construction Strategy in May 2011 has changed the procurement process and approach to town planning. There has been increasing awareness of the need for proper integration of the process and the team at the earliest stage in the project. The growth of ICT in the industry has changed the method of design and information sharing. The RIBA Plan of Work has to reflect the 'Third Industrial Revolution' (Royal Institute of British Architects, 2013). For this, the Building Information Modelling (BIM) has to be considered when amending the RIBA Plan of Work. Moreover, the scope of post-occupancy evaluation (POE) has become crucial and its potential to contribute to enhancing the performance of the industry has been recognised.

A Work Review Group chaired by Dale Sinclair was established to perform the amendment process to the RIBA Plan of Work. The group consulted with other professional bodies such as the Construction Industry Council (CIC), Chartered Institute of Building (CIOB), Chartered Institution of Building Services Engineers (CIBSE), Institution of Civil Engineers (ICE) and Royal Institution of Chartered Surveyors (RICS). The process began with the mapping of process models published by those organisations (see Figure 2.11) followed by presentation of Green Overlay and BIM Overlay in 2012. An online survey and a series of dialogues have been carried out, to obtain feedback from RIBA members and other stakeholders about the proposals. The principle of the RIBA Plan of Work 2013 is describing the development process in a cyclical approach that is fit for all parties involved in the industry. In line with Barrett and Baldry (2003), the framework emphasises the element of feedback from completed stages to inform subsequent stages in other projects. In addition, the RIBA Plan of Work 2013 recognises the importance of data recording and dissemination of knowledge about completed stages in the projects.

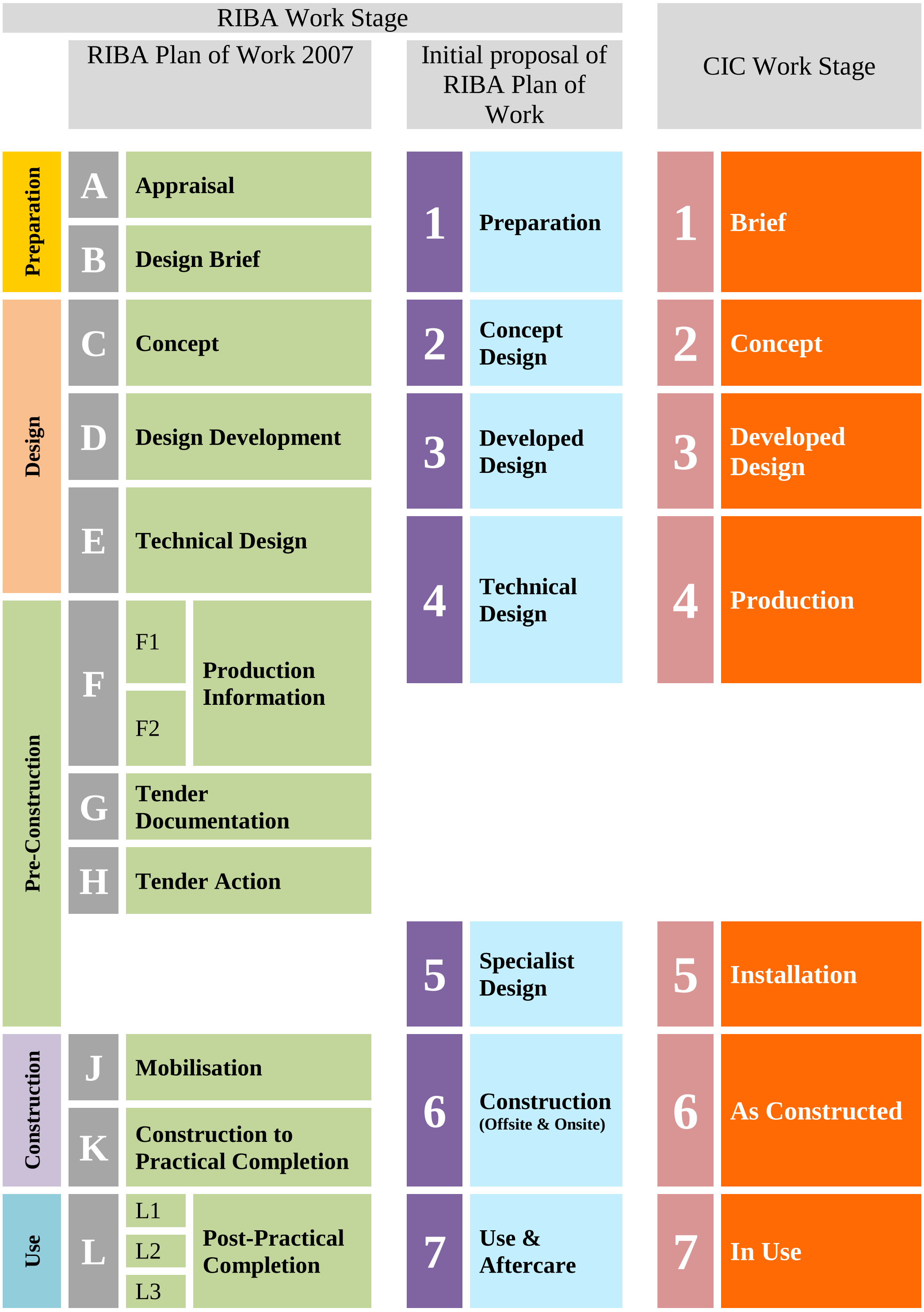


Figure 2.11 Mapping the new RIBA Plan of Work with the RIBA Plan of Work 2007 and CIC. Source: Royal Institute of British Architects (2013) and Sinclair (2013)

Figure 2.11 also demonstrated that there are different definitions of the development process between professional bodies. Hence, the RIBA Plan of Work 2013 endeavours to become the main reference in the property development industry in the UK.

2.6.2 The characteristics of the RIBA Plan of Work 2013

On 21st May 2013, RIBA published the RIBA Plan of Work 2013 Overview and Guide to Using the RIBA Plan of Work 2013 to mark that the framework had been finalised and was ready to be used by the public. It was anticipated that the RIBA Plan of Work 2013 would benefit the property development industry as it was designed:

- To be simple, as the process has been reduced from 11 to eight (8) stages.
- To fit all project sizes in various sectors.
- To accommodate various procurement methods.
- To be reachable and in line with the growth of ICT.
- To integrate the process and the team in the projects.
- To reflect the latest UK Government policy regarding town planning procedures.

The RIBA Plan of Work 2013 comprises eight (8) stages in the horizontal outline defined by numbers 0 to 7. The stages were identified as Stage 0: Strategic Definition, Stage 1: Preparation and Brief, Stage 2: Concept Design, Stage 3: Developed Design, Stage 4: Technical Design, Stage 5: Construction, Stage 6: Handover and Close Out and Stage 7: In Use. Meanwhile, the task bars illustrated in the vertical layout comprise eight (8) elements: core objectives, procurement, programme, town planning, suggested key support tasks, sustainability checkpoints, information exchanges and UK Government information exchanges. The final layout of the RIBA Plan of Work 2013 is shown in Figure 2.12:

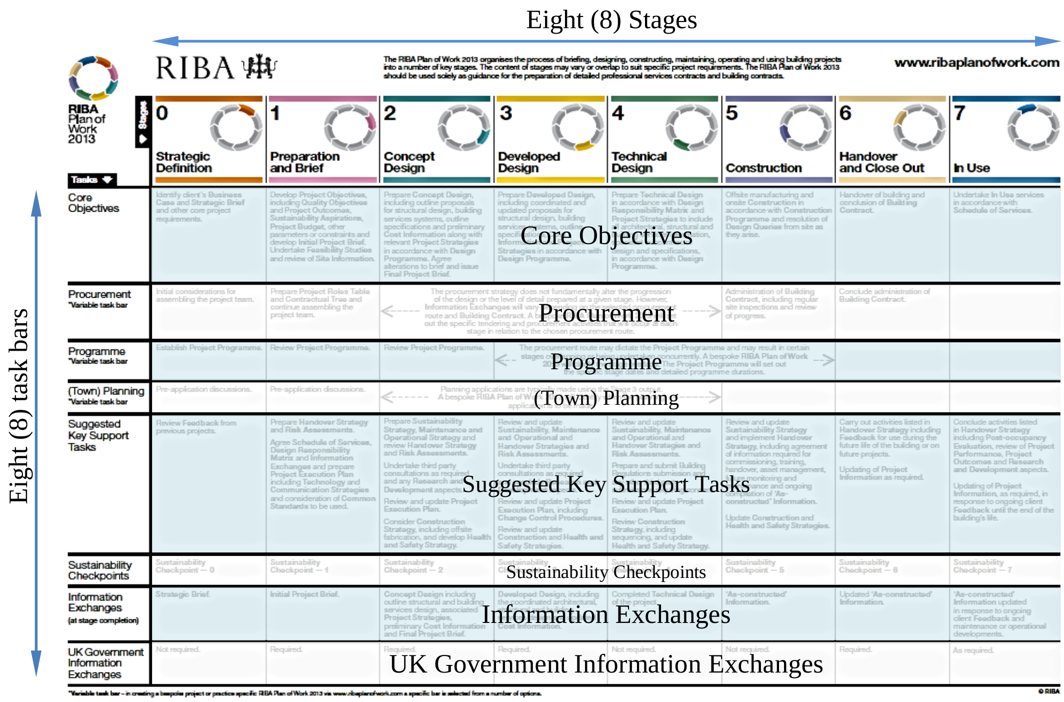


Figure 2.12 The layout of RIBA Plan of Work 2013. Source: Royal Institute of British Architects (2013)

The purpose of the task bar is to inform the degree of flexibility when using RIBA Plan of Work 2103 as follows:

Task Bar 1: Core Objectives: sets out the principle of each stage.

Task Bar 2: Procurement: explains a number of forms of procurement, which allows the users to personalise the process to suit their actual work.

Task Bar 3: Programme: sets out the duration of each stage and any supporting activities. The lead designer will have a bigger contribution to this task. This task is expected to produce a Project Programme that consists of Design Programme, Construction Programme and Schedule of Services:

Task Bar 4: (Town) Planning: emphasises the need to comply with planning conditions as well as submission of planning application to relevant authorities. The planning was often applied at the end of Stage 2, in which the lead designer has to play his/her role effectively. In addition, the project's Risk Assessment needs to be carried out.

Task Bar 5: Suggested Key Support Tasks: explains the endeavour required to achieve Sustainability Inspiration that meets environmental, social and economic needs. This task bar focuses on the implementation of BIM into the development process. Moreover, the regulation matters in terms of design, professional ethics, health and safety, logistics and other aspects in property development industry are considered.

Task Bar 6: Sustainability Check Points: needs to be read in conjunction with 2011 Green Overlay and the RIBA Outline Plan of Work 2007.

Task Bar 7: Information Exchanges: provides guidance on the information that would be delivered at the Information Exchanges at the end of each stage.

Task Bar 8: UK Government Information Exchanges: recognises the role of the UK Government as a main client in the property development industry. This task bar reminds the players in the industry of the need to information exchange at certain stages in the development process. The UK Government is interested in data-rich information, particularly post-occupancy evaluation/analysis. The knowledge would be useful to enhance the UK Government's property as well as to set benchmarking for the industry performance.

2.7 Determining the development process model

The aim of this research is to develop a framework that will guide professionals in the property development industry to optimise the role of FM in each stage of the development process. It is apparent that having numerous models of the development process has resulted in a difficulty to determine which one can be regarded as the standard model that can be consulted regularly in this study. Hence, it is crucial to determine the criteria prior to finalising the most appropriate model of the development process. As the model will be brought to the players of the property development industry in the UK during data collection, it has to be simple, user-friendly and self-explained. In addition, the model should provide opportunities for FM to significantly contribute to the property development industry, particularly in critical issues such as sustainability, BIM and post-occupancy evaluation. The model that incorporates the role of FM will be a priority in this study. There are also models that encourage early integration of the process and the team members of the projects that implicitly promote Facilities Managers to be included in the integration endeavour. However, it is paramount for this study to rely on a complete document that properly defines the development process.

The literature review reveals that some of the models take into account the element of FM; however, the majority ignore the potential that FM could contribute to the property development industry. Barrett and Baldry (2003) emphasise the element of feedback in the development process, though responsibility for carrying out the task remains unclear. Traditionally, the same project team that was already handling the design work and project monitoring was instructed to perform the feedback exercise. As a result, the team was unable to perform effectively, which affected the quality of the feedback data. Furthermore, members of the project team often disappear alongside their knowledge when the facilities are handed over to the client (Construction Leadership Council, 2013, p. 23). The RIBA Plan of Work 2013 has considered such circumstances in the model by introducing the Government Soft Landings (GSL) approach, which encourages early engagement of other professionals with the Facilities Manager who are also responsible for post-occupancy evaluation (POE) during the In Use stage (Sinclair, 2013; p. 84).

Kagioglou (1999) refers to the production process in the manufacturing industry to outline the role of FM in the development process. FM was identified in six (6) phases of the development process involving eight (8) tasks to be undertaken throughout the project. Alongside the Design Management and Production Management team, FM is to prepare the design brief and full concept design in Phase 1 (Conception of Need) and Phase 5 (Full Conceptual Design) respectively. It was also identified that FM is responsible for preparing and revising the maintenance plan in Phase 5 and Phase 6 (Coordinated Design, Procurement and Full Financial Authority). In Phase 7 (Production Information), FM is to finalise the coordinated product model followed by two (2) crucial tasks in Phase 8 (Construction): develop operational product model and implement handover plan. FM has a key role in documenting the data obtained from the feedback exercise in Phase 9 (Operation and Maintenance). The knowledge of the feedback exercise is to be exploited to encourage better performance of a new project. Despite the incorporation of FM in the development process by Kagioglou, some of the terms used in the ‘process protocol’ were unfamiliar in the property development industry. Furthermore, the ‘process protocol’ was influenced by the lean production process in the manufacturing industry. Unlike the ‘process protocol’, the RIBA Plan of Work 2013 has been formulated to adapt the complexity of the development project. On top of that, there was an effort to provide further clarity on what a bespoke RIBA Plan of Work 2013 would contain through an online tool (Sinclair, 2013; p. 36).

Chodasova (2004), Jensen (2008) and Jensen (2009) have raised awareness about integrating FM into the development process. However, there is a lack of defining the responsible of the Facilities Manager in each stage of the development process to support FM-DP integration. It was identified that the model they introduced tended to be theory-based without further effort to realise the integration. This can be understood as the effort to optimise the role of FM in the development process needs the comprehensive involvement of various parties in the property development industry. The RIBA Plan of Work 2013 was a product that resulted from close collaboration between RIBA, the UK Government and other professional bodies in the industry. Unlike other models, the RIBA Plan of Work 2013 was regarded as an ‘action-based’ document which provides opportunities for FM to be integrated into the development process.

Koskela (1992) claims that the growth of ICT in the manufacturing industry was encouraging. Coupled with the resolution to achieve lean objectives, the use of ICT has expedited the integration of process and the team. Razali and Manaf's (2005) discussions on the role of FM information system in the development project shows that FM could be the option to enhance the performance of the property development industry. Exploiting ICT in the property development industry provides an opportunity for FM to be better integrated into the development process (Shen *et al.*, 2010). The RIBA Plan of Work 2013 has considered this issue by promoting BIM as a catalyst for change of ICT aspects in the property development industry. The UK Government has supported the implementation of BIM, and even willing to provide incentives for cultivating BIM in the industry. A lot of research has been done in line with the growth of the internet, which is fundamentally changing the nature of activities in each stage of the development process (for example, the changes in the way buildings are designed and drawings are coordinated). The RIBA Plan of Work 2013 alone may not be able to push the industry to utilise ICT and implement BIM; however, one should realise that it has been designed to allow the property development industry to move from analogue to digital technology (Sinclair, 2013).

The RIBA Plan of Work 2013 has stated the tasks to be performed in the early stages of the development process to ensure the wellbeing of the occupants and the users of the facilities during the In Use stage, which was prevalently associated with the maintenance and operations of the facilities. This is important for all parties involved in the project, as understanding the purpose of the facilities and appreciating their contribution to the operations of the occupants will inspire a good design and high quality of workmanship. In addition, it encourages a successful project completion that is fit for the purpose of the operations of the occupants. To keep the occupants operating smoothly, the client often allocates a large amount of budget to carry out hard and soft FM services. The budget, which is commonly referred to as operating costs (Sinclair, 2013), is closely influenced by capital costs. Better-designed facilities may eliminate the problems in the use stage, which would reduce the operating costs for refurbishment works and FM services, for instance. Although it was not clearly mentioned, the RIBA Plan of Work 2013 has provided opportunities for FM to be integrated significantly in the development process, particularly in preparing capital cost at Stage 1: Preparation and Brief.

The RIBA Plan of Work 2013 emphasises the strategy by which to achieve the sustainability of the facilities. The sustainable facilities should 'deliver the good intentions that are embedded in its design once it is occupied, and then continue to do so throughout its life. In order to do this effectively, throughout the briefing, design construction and handover processes particular attention should be paid to how the building will be operated and maintained' (Sinclair, 2013; p. 86). In addition, the RIBA Plan of Work 2013 encourages the involvement of the client's FM team and the reviewing of past experience in a spirit of openness. This includes environmental, social and economical elements.

It is apparent that the RIBA Plan of Work 2013 is a reliable model to represent a comprehensive development process, which is capable of accommodating critical issues in the property development industry. The RIBA Plan of Work 2013 has considered critical issues in the industry such as whole life costing, sustainability, POE, BIM, ICT, GSL, lean philosophy and comprehensive integration of all aspects in the industry. In addition, the RIBA Plan of Work 2013 provides opportunities for FM to optimise its role in the development process. Therefore, it has been concluded that the RIBA Plan of Work 2013 will be used throughout this study.

2.8 Chapter summary

- Chapter Two reveals that the property development industry has been a catalyst for the growth of the UK economy. It contributes approximately 6.0 per cent of the GDP and provides enormous business opportunities to the whole nation. Hence, it is understandable why the UK Government and certain private organisations have fully supported the industry. A numbers of research papers and reports have been published to assess achievements and make recommendations to enhance the performance of the industry in the UK in the future.
- The growth of the property development industry in the UK has influenced the evolution of professions including Facilities Manager. There is evidence that the presence of Facilities Managers in the built environment has been acknowledged.
- There are a huge numbers of models of the development process. However, the role of FM in the development process has been addressed lightly in most of the models, although there was recognition that FM was the highest-growing discipline in the UK.
- A clear model of the development process is capable of contributing something new to the discipline of built environment. This idea became the motivation for the study and justification of why the model of the development process needs to be carefully determined in order to carry out this study successfully.
- The RIBA Plan of Work 2013 is a model of the development process in the UK. It has served as a main document to guide the professionals in the industry to carry out the project effectively. The establishment of the RIBA Plan of Work 2013 was to accommodate the increasing of complexity in the property development industry. The RIBA Plan of Work 2013 was expected to benefit the industry through its characteristics. It was designed to be user friendly and fit with any types of projects and procurements.
- The RIBA Plan of Work 2013 is an ideal model of development process as it has considered critical issues in the industry such as whole life costing, sustainability, POE, BIM, ICT, lean philosophy and comprehensive integration of all aspects in the property development industry.

- As illustrated in Figure 2.1 in the introduction of this chapter, what is required on the plate is an appropriate model of the development process that fits this study. It has been concluded that the RIBA Plan of Work 2013 will be used throughout this research work.

Chapter Three

The Facilities Management (FM)

3.1 Introduction

Chapter Three presents the core knowledge of this study. The aim of this chapter is to strengthen the understanding and build confidence in the existing knowledge in the area of FM-DP integration. The beginning of this chapter discusses the definition of FM from the perspective of the property development industry (Section 3.2). This includes the responsibility of the Facilities Manager (Section 3.3) within the development process, which potentially facilitates the users who use the facilities to achieve their business objectives (Kincaid, 1994). Section 3.4 discusses the importance and benefits of having FM in the development process as well as the challenges faced by FM to better integrate into the development process. Section 3.5 inspires the development of a theoretical framework of FM-DP integration that justifies the need for this study to be undertaken, resulting from the identification of the gap in the area of research. The findings in this section are essential to drive the study to achieve the objectives and the aim of this research. Sections 3.6, 3.7 and 3.8 present the issues that hinder the integration of FM into the development process, which will serve as the ground for the philosophical side and methodology of this research. Section 3.9 tabulates the themes emerging from the literature reviews. The outline of Chapter Three is represented in Figure 3.1, where obviously the aim is to identify the critical issues that hinder FM integration into the development process.

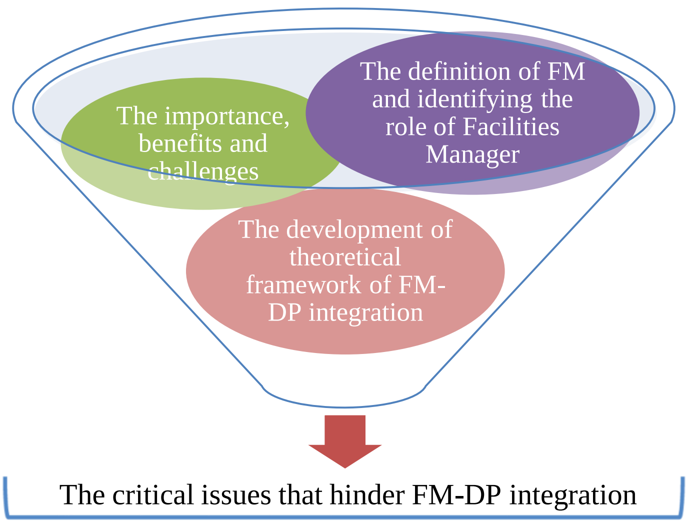


Figure 3.1 The funnel of Chapter Three

3.2 The definition of FM from the development process perspective

Various definitions of FM have been produced by individuals and organisations. The definition of FM has been amended several times along with the growth of its role and potential contribution to FM and the property development industry. According to Payne (2000), the formulation of an FM definition predominantly relies on the variation of themes and the interests of individuals and organisations in the business environment. From the organisation's point of view, the emergence of the definition of FM depends on the setting of the environment (Owen, 1994). A number of changes in the definitions of FM are a manifestation of problems in organisations, particularly in the culture of management, and the rapid growth of technologies. In other words, the changes in management and technologies affect physical facilities and people (Grimshaw, 1999). In addition, the views of employees and employers towards the workplace keep changing (Sutton, 2014), which also contributes to the continuous changes of the definition of FM. Although there are numerous definitions of FM, it is apparent that the gist are the same, regardless of whether they emanate from organisations and /or individuals (Owen, 1994). The following discusses the definition of FM from various organisations, as follows:

a. **International Facility Management Association (IFMA)**

The term FM became the focus of organisations in the 1970s when a lot of offices in the United States of America (US) applied freestanding separating screens known as cubicles and the computer terminal was introduced into the workstation (EuroFM, 2012). Those significant events set the evolution of FM in the world. In the 1980s, the International Facility Management Association (IFMA) introduced a new model of FM that emphasised the integration between 'people, process and place' within the organisation. However, the definition of FM has evolved and the addition of the element of technology has made the scope of FM wide-ranging. In the US, the definition for FM has been accepted as follows:

> *"Facility management is a profession that encompasses multiple disciplines to ensure functionality of the built environment by integrating people, place, process and technology"*

(International Facilities Management Association, 2014)

The concept of FM introduced by IFMA is illustrated in Figure 3.2, which clearly shows the integration of people, place, process and technology. Although the aspects of people, process, technology and place are nicely depicted to show the ideal concept of FM, putting them into practice is not always easy (Chodasova, 2004). It is too philosophical to explain the definition of FM, as the interrelationship of all four (4) elements is vague and inter-dictated.

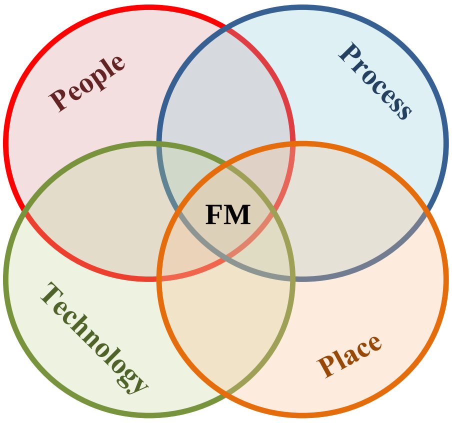


Figure 3.2 The definition of FM as People, Process, Place and Technology. Source: International Facilities Management Association (2014)

b. **American Library of Congress:**

In 1982, the American Library of Congress defined FM as:

> *"The practice of coordinating the physical workplace with the people and work of the organisation; it integrates the principles of business administration, <u>architecture</u> and the behavioural and <u>engineering sciences</u>"*

(Owen, 1994; p. 42)

The above definition was widely accepted among FM researchers as the character is more universal and flexible (Owen, 1994). Furthermore, the presence of architecture and engineering sciences indicates the relationship between development process and FM.

c. **British Institute of Facilities Management (BIFM)**

The British Institute of Facilities Management (BIFM) is a professional body to represent and promote the interest of the FM community in the UK. BIFM adopted the definition of FM provided by the European Committee for Standardisation (CEN) and ratified by BSI British Standards:

> *"Facilities management is the integration of processes within an organisation to maintain and develop the agreed services which support and improve the effectiveness of its primary activities"*

(CEN, 2006)

BIFM further explains that:

> *"Facilities management encompasses multi-disciplinary activities within the built environment and the management of their impact upon people and the workplace. Effective facilities management, combining resources and activities, is vital to the success of any organisation. At a corporate level, it contributes to the delivery of strategic and operational objectives. On a day-to-day level, effective facilities management provides a safe and efficient working environment, which is essential to the performance of any business – whatever its size and scope"*

(British Institute of Facilities Management, 2014)

The above explanation shows that BIFM recognises the presence and potential contribution of FM to the performance of the development process. From the perspective of the property development industry, optimisation of FM expertise would be beneficial in facilitating the management of the resources and enhancing the design of the facilities. Nevertheless, the bottom line of having FM in the development process is to ensure the completed facilities are able to support the organisations to achieve their core business objectives at both levels, strategic and operational.

d. **European Facility Management Association (EuroFM)**

The definition adopted by BIFM was originally used by the European Facility Management Association (EuroFM) in 2006. The definition was documented in EN15221-1: 2006 Facility Management – Part 1: Terms and definitions, as a result of general consensus among FM professional bodies around the European region. It was agreed that facility management was a multi-disciplinary field that covers a wide range of processes, services, activities and facilities as well as needing integration between 'People, Place, Process and Technology'. EuroFM simplifies the broad scope of FM into two (2) aspects: (i) space and infrastructure, and (ii) people and organisation. The former is associated with client demand on a strategic level, which includes the activities in the development process such as planning, design, construction, building operations and maintenance. The latter is related to operational level, which is the activities cover safety and health, hospitality, security, human resource management, accounting and marketing (EuroFM, 2012). The people who are using the facilities often perform activities in the operational level in order to achieve the organisation's business objectives. However, one must realise that without space and infrastructure the operational activities could not be performed. It was obvious that space and infrastructure as one (1) cluster supported people and organisations as another cluster. The definition of FM introduced by EuroFM is depicted in Figure 3.3, which shows the people and organisations on the left-hand side of the diagram, represented by client, customer and end users. These are the stakeholders in the primary process who are to perform primary activities to achieve the business objectives of the organisations.

On the right-hand side of the diagram, the support processes comprise space, infrastructure and facility services provided by internal and/or external resources.

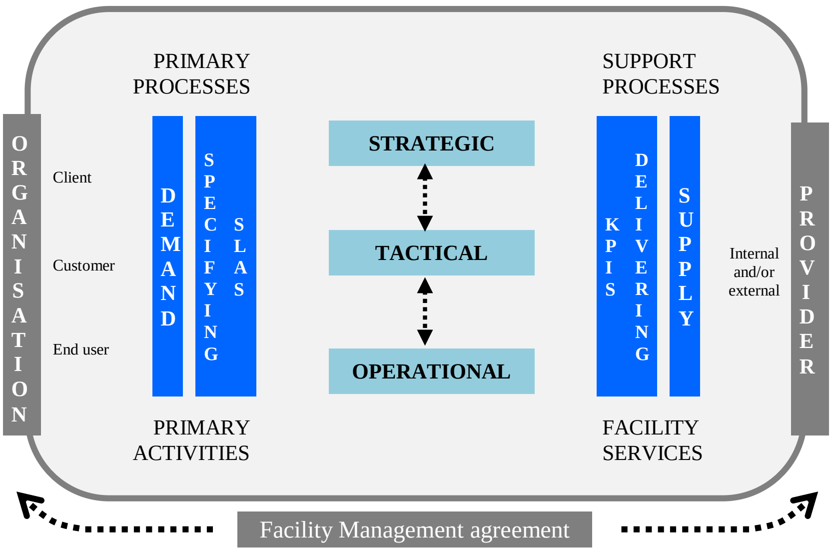


Figure 3.3 Definition of FM according to EuroFM. Source: EuroFM (2012)

e. **Royal Institute of Chartered Surveyors (RICS)**

The Royal Institute of Chartered Surveyors (RICS) is known to be one of the organisations actively enhancing the profile of FM and which recognise the contribution of FM to the development process. While establishing the Facilities Management Professional Group and publishing Pathway: Facilities Management Assessment of Professional Competence (FM APC) document, RICS consistently used this statement to explain FM:

> *"Facilities Management is the total management of all services that support the core business of an organisation"*

(Royal Institution of Chartered Surveyors, 2010; p. 6).

The statement has been used in various documents related to FM within the RICS perimeter, which indicates the level of acceptance by the members of RICS. RICS acknowledged that good FM would assist the organisation to minimise the usage of human resources, cost and time to maximise productivity. In other words, FM ensures the facility and its services are in a good condition so that the organisation can operate as efficiently as possible. RICS recognised that the role of FM could be found in all sectors including in the property development industry. Therefore, the establishment of the FM APC shows the determination of RICS to promote the worth of the Facilities Manager role. Facilities Management APC provides a pathway for an individual to be a professional advisor in FM, which is responsible from the operational level (day-to-day activities) to the strategic level (planning, designing and construction of facilities). The individuals who attain FM APC will be entitled to use the designation ‘Chartered Facilities Management Surveyor’ (Royal Institution of Chartered Surveyors, 2010). This recognition is believed to encourage the involvement of FM in the development process.

f. **Chartered Institute of Building (CIOB)**

The Chartered Institute of Building (CIOB) acknowledged that FM is one of the strong knowledge bases supporting CIOB to develop and disseminate construction management education. CIOB does not provide a clear definition of FM; however, it was obvious that there is a need for professionals to perform post-occupancy evaluation (POE) during operational stage of the facilities. The Chartered Institute of Building (2014) suggested that the data gathered from POE are analysed and the knowledge is fed back into planning, design and construction (strategic level). CIOB admitted that FM represented by Facilities Managers is the right discipline to perform these activities. Furthermore, the emergence of Government Soft Landings (GSL) and the differences between design and actual performance of the facilities has become the centre of discussion in the property development industry, which increases the demand on the FM discipline. In 2010, CIOB produced a report exploring managerial skills, training and the impact of the recession of the UK economy, as a result of an online survey that was conducted in 2009 and sent to 28,000 CIOB members. One of the questions that the respondents were asked was, what sectors are related to construction management (CM)? The responses show that FM was placed fourth out of 16 sectors. FM recorded 28.7 per cent behind architecture (43.6 per cent), education and training (33.5 per cent), and innovation and research (29.4 per cent) (The Chartered Institute of Building, 2010c; Fig. 12, p. 11). The report indicates an increasing awareness of the community in the property development industry about the existence of FM and its potential contributions to the industry. Following the previous research, CIOB commented that there is a need to review the existing definition of CM, so that it is more comprehensive and globally accepted. In its publication, CIOB’s Professionalism: An Inclusive Definition of Construction Management, CM was split into six (6) stages: (i) the CIOB’s footprint, (ii) a hierarchy of systems, (iii) the construction value system, (iv) specialist services, (v) our value system; and (vi) CM as an academic discipline. In the discussion of stage (v): our value system, Howard Shiplee, the Director of Construction for the Olympic Delivery Authority, who is known to be ‘the leading client project manager in the country, if not the world’ (The Chartered Institute of Building, 2010a; p. 14/15) advocated that CM should reflect the whole value stream throughout various disciplines including FM. He was optimistic that FM would be able to raise the awareness among professionals in the field of construction management for incorporating FM elements into the development process.

g. **Chartered Institute of Building Services Engineers (CIBSE)**

The Chartered Institute of Building Services Engineers (CIBSE) formed the FM Group in January 1996 with the purpose of catering for the increasing demand by CIBSE members, who were often associated with FM matters in their scope of works. A successful FM relies significantly on the effectiveness of the building services engineering discipline. CIBSE defines FM as:

> *"The management and optimisation of defined activities and resources in support of the overall corporate objectives"*

(Chartered Institution of Building Services Engineers, 2014)

Although the definition of FM according to CIBSE seems too general, they outline two (2) major issues in the field of FM that need to be considered seriously: (i) post-occupancy evaluation and (ii) education and training. On the first issue, CIBSE concentrated on getting feedback from occupants during the operational stage of the facilities. The feedback is analysed and the findings are interpreted in order to support the occupants to achieve the organisation's business objectives. On the second issue, CIBSE realised the importance of providing opportunities to the CIBSE members to enhance their career in FM through proper education and training. However, the curriculum should be related to building services engineering. On top of that, CIBSE expected that the FM issues such as energy efficiency, BIM, and sustainable construction would become dominant among CIBSE members in the future.

h. **Centre for Facilities Management (CFM)**

The Centre for Facilities Management (CFM) is a university-based research unit in Salford University headed by Professor Keith Alexander. CFM defines FM as:

> *"The process by which an organisation delivers and sustains support services in a quality environment to meet strategic needs"*

(Alexander, 2013; p. 1)

CFM characterised FM as an important element to reduce cost in the development project and at the same time that it needs to fulfil the rising demand of the users concerning the performance of the facilities. FM, according to CFM, is a wide-ranging discipline covering all aspects in the property development industry. Significant input from FM would facilitate the owner to identify the corporate value of the organisation and incorporate it into the design. CFM insists that FM is a universal discipline that suits all sectors. However, FM has to recognise the business philosophy of the organisation prior to integrating FM elements into the development process.

3.3 Identifying the role of Facilities Manager in the development process

A development project [6] involves various disciplines, which are represented by respective professionals whether in a group or individually. For instance, the engineering discipline is represented by a group of professionals called engineers from civil, electrical and mechanical backgrounds; while the built environment discipline is represented by architects. Facilities Managers, who are often disassociated from the development process, represent the FM discipline. As FM is regarded as a relatively new discipline (Pitt and Tucker, 2008), its role in the development process is vague except at the operational stage, which is concerned with maintenance and services. This section will scrutinise various literature to identify the possible responsibilities of Facilities Managers in the development process and what are their potential contributions to the property development industry.

In discussing the role of FM in the development process, Theriault (2011) advises that it should be discussed in terms of the function of Facilities Manager rather than the definition of FM, which is often used to cover a broad spectrum of the discipline. According to Rondeau *et al.* (2006), the term 'management' in FM itself has caused misperception, separating FM into two (2) different positions: (i) property management, which is related to the issue of human wellbeing, while (ii) asset management addresses non-human issues. In line with Theriault's advice, Rondeau *et al.* (2006) were happy to discuss the role of FM in the development process by describing the tasks and job responsibilities of the Facilities Manager. As an expert in almost all aspects of the internal background of the organisation, the Facilities Manager is considered as a generalist who understands the organisation's business objectives (Rondeau *et al.*, 2006; p. 5). Facilities Managers facilitate development project costing, finalising the design, monitoring the progression of the construction activities and ensuring the space is fully utilised. They are responsible for ensuring that the facilities are completed on time, within the allowed budget and to an acceptable quality. On top of that, Facilities Managers need to maintain the services in a good condition that is able to support the operation of the user of the facilities. Undoubtedly, Facilities Managers are the most suitable professionals to take up a development project and represent the client or owner. However, it is essential for the Facilities Manager to be integrated with various professionals in the development process, in order to ensure the success of the development project. Rondeau *et al.* (2006) list nine (9) responsibilities of Facilities Managers who are involved in the property development industry (see Table 3.1):

[6] Instead of construction project, the term development project is used to explain the projects that start from Strategic Definition and end at In Use stage, of which construction itself is one of the activities in the development process.

Table 3.1 Scope of responsibilities of Facilities Manager

1.	Long-range facility planning
2.	Annual facility planning (tactical planning)
3.	Facility financial forecasting and management
4.	Real estate acquisition and/or disposal
5.	Interior space planning, work specifications, and installation and space management
6.	Architectural and engineering planning and design
7.	New construction and/or renovation work
8.	Maintenance and operations of the physical plant
9.	Telecommunications integration, security and general administrative services

Source: Rondeau *et al.* (2006; p. 5)

Rondeau *et al.* (2006), however, express that there are additional responsibilities that need to be considered by Facilities Managers while fulfilling their role in the development process. Facilities Managers have the responsibility to identify, secure and work with a number of parties from various business sectors. Facilities Managers have to work with other professionals in the built environment discipline to achieve the objectives of the development project: value for money, pleasing to look at, free from defects, delivered on time, fit for the purpose, supported with worthwhile guarantees, having reasonable running costs and being satisfactorily durable (Latham, 1994). The black line in Figure 3.4 indicates the groups with which Facilities Managers have to work in order to achieve the definition of FM outlined by IFMA.

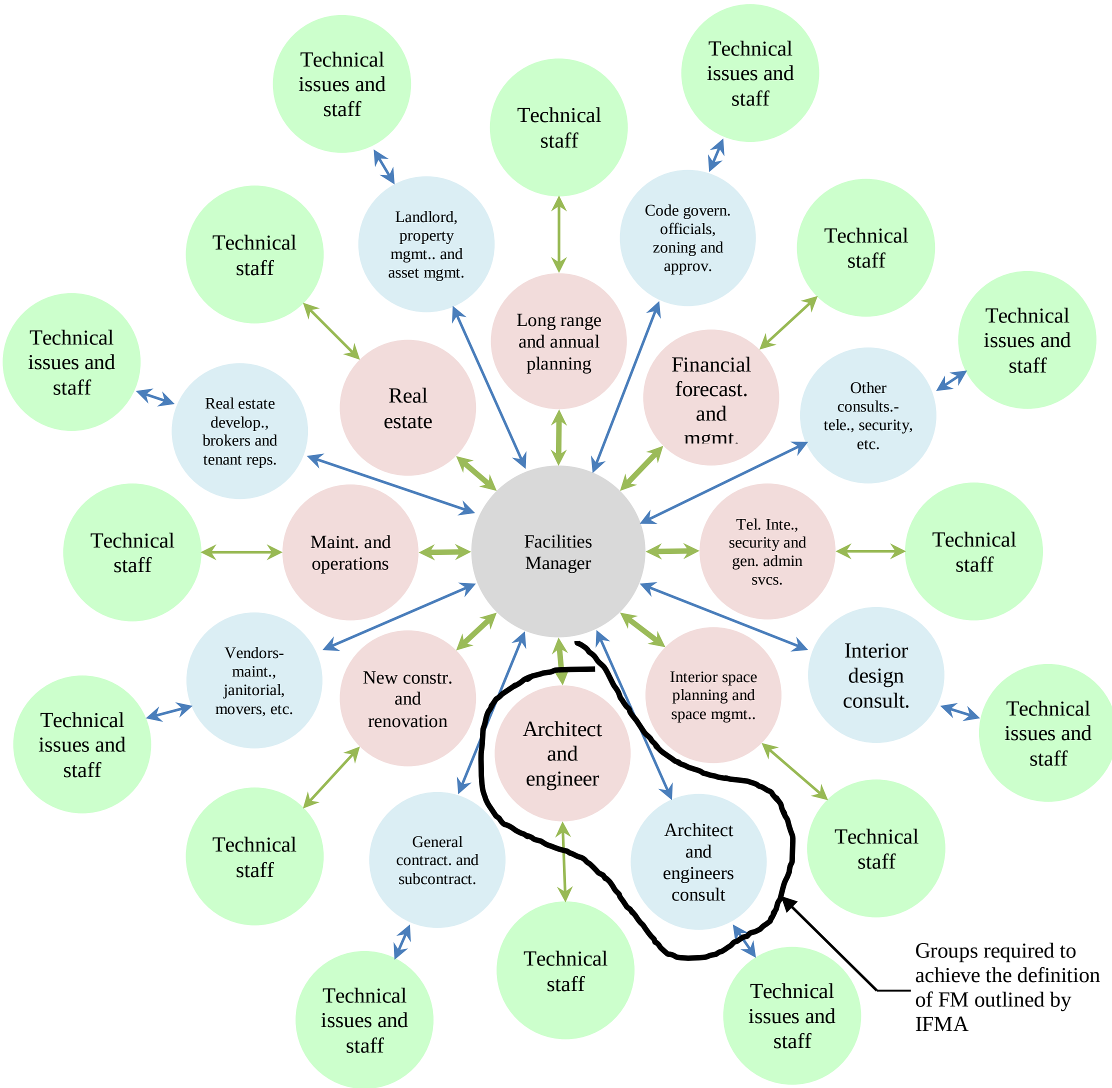


Figure 3.4 Responsibility of FM in the Development Process. Source: Rondeau *et al.* (2006)

Hodges (2005) highlights that the Facilities Manager is a key component in developing and operating green buildings and implementing sustainable development. It is essential for the Facilities Manager to contribute to the design and construction activities to ensure the success of implementing sustainable principles in a development project. In the US, Hodges (2005) claims that the involvement of Facilities Managers is up to the extent to which they have to evaluate the material and equipment that need to be installed in the building. Hodges affirms that sustainable development starts with the Facilities Manager by conducting a SWOT[7] analysis around social, economic and environmental aspects. However, understanding the business strategy of the project owner and the business objectives of the user are prerequisite to enable Facilities Managers to play their role in the development process effectively. Hodges (2005) emphasises that the Facilities Manager has a major

[7] SWOT is an acronym of strengths, weaknesses, opportunities and threats

role in building a relationship with the leadership of the organisation. As a 'key player and natural leader' (Hodges, 2005; p. 321) in the built environment discipline, the Facilities Manager should be able to influence the decision-making process at the earlier stage of the development process of the project. Nevertheless, it is essential for the Facilities Manager to understand the business philosophy and financial position of the owner prior to including them in the strategic planning process. Apart from that, the Facilities Manager is regarded as 'an integrator' (Hodges, 2005; p. 323) who is able to advise the owner on long-lasting functional facilities that serve the needs of the users today and tomorrow.

Besides the maintenance of the building fabric and services, the role of Facilities Manager has extended to include interior design and providing furniture and equipment to the user of the facilities. The presence of Facilities Managers in the property development industry, particularly in a new development project, space management and disposal of land and buildings, is new in the built environment discipline. Quah (1992) claims that the job scope of Facilities Manager has become complicated due to the rapid advancements in technology and the rising of user expectations. The modernisation process in the property development industry has increased the awareness of the importance of post-occupancy evaluation and its contribution to the improvement in the buildability and operability of the new facilities. This is a growing area which requires significant input from Facilities Managers.

Thomson (1990) draws our attention to the different approaches in determining the function of FM in the property development industry by taking into account the strategic and tactical dimension, as shown in Figure 3.5.

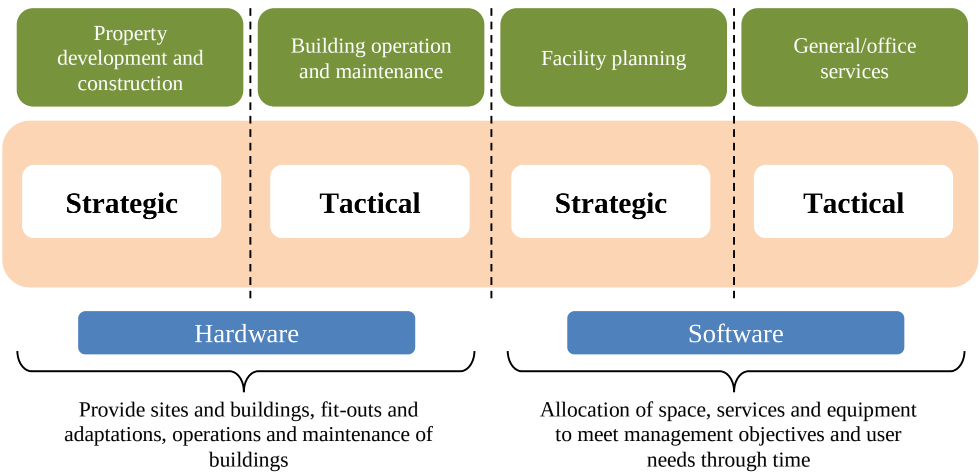


Figure 3.5 Primary functions of FM in strategic and operational emphasis. Source: Thomson (1990)

He asserts that FM is facility planning at the strategic dimension. In line with Thomson (1990) are Jensen (2008) and Kelly *et al.* (2005), who stress that FM should be considered in the strategic dimension to ensure the buildability and operability of the facilities. The justification is simple: facility planning is the strategies to relate the physical facilities to corporate objectives of the user (Thomson, 1990). The emphasis is to consider FM at strategic and tactical dimensions in both 'software' and 'hardware' of the facilities. Software means a provision of space, services and equipment to meet the organisation's business objectives and user needs while hardware relates to physical facilities and their supporting elements, operations and maintenance. According to Thomson (1990), the correct choice of software enables the hardware to function to the real benefit of the users. In other words, the software will determine the performance of the hardware. Based on Figure 3.5, it is apparent that facility planning cum FM is positioned in the software side, which is also viewed in a strategic dimension. Facility planning is the medium for the Facilities Manager to meet the top management of the project owner and to highlight the potential contribution of FM to the facilities in achieving their business objectives (Thomson, 1990). The typical functions of Facilities Manager in the facility planning, building operations and maintenance, property development and construction and general services are tabulated in Table 3.2.

Table 3.2 Typical function of Facilities Manager in facility planning, building operations and maintenance, property development and construction and general services

Facility planning	**Building operations and maintenance**
• Strategic space planning • Set corporate planning standards and guidelines • Identify user needs • Furniture layouts • Monitor space use • Select and control use of furniture • Define performance measures • Computer aided facility management (CAFM)	• Run and maintain plant • Maintain building fabric • Manage and undertake adaptation • Energy management • Security • Voice and data communication • Control operating budget • Monitor performance • Supervise cleaning and decoration • Waste management and recycling
Property development and construction	**General/office services**
• New building design and construction management • Acquisition and disposal of sites and buildings • Negotiation and management of leases • Advice on property investment • Control of capital budget	• Provide and manage support services • Office purchasing (stationery and equipment) • Non-building contract services (catering, travel, etc.) • Reprographic services • Housekeeping standards • Relocation • Health and safety

Source: Barrett and Baldry (2003; p. 48)

Chodasova (2004; p. 54) defines FM as a method to deal with unresolved issues in facilities that lack ‘human character’. She further explains that FM is also viewed as a strategic concept of management, administration and organisation of all material business resources (p. 54), which rests on three (3) values: complexity, life cycle and transparency. FM is regarded as a main element in supporting activities of the organisations including the usage of spaces, technical equipment, environment sustainability, and the purchase and provision of services. By applying FM in the development process, the supportive activities could play a significant role in assisting the organisations to achieve their business objectives. She also claims that the presence of an FM representative is crucial to facilitate the owner to prepare investment planning, which is positioned in the strategic dimension of the development process. The operational aspects during the In Use stage should be taken into consideration at the early stage of the development process in order to enable the owner to forecast the effectiveness and acceptable operation cost of the facilities in the future. This can be achieved by having a Facilities Manager in the development process to evaluate the design output (Chodasova, 2004). However, it is doubtful whether the established professionals such as engineers and architects could accept a Facilities Manager evaluating their works. Chodasova (2004) contends that Facilities Managers have a significant involvement at the conception, utilisation and evaluation stages of a new development project, while during the design and construction stages, Facilities Managers only play a supporting role (see Table 3.3).

Table 3.3 The domain of activities of the Facilities Manager in the development process.

Development process	Main activities	Supportive activities
Concept	✓	
Design		✓
Construction		✓
Utilisation	✓	
Evaluation	✓	

Source: Chodasova (2004)

Barrett and Baldry (2003; p. xi) define FM as ‘an integrated approach to maintaining, improving and adapting the buildings of an organisation in order to create an environment that strongly supports the primary objectives of that organisation’. They argue that the definition stresses the physical facilities rather than support services such as cleaning, catering and security. The above definition supports the doctrine introduced by Thomson (1990): give balance emphasise the software and the hardware elements of the facilities with a strategic dimension to them. Damgaard and Erichsen (2009) explain a comprehensive definition focuses on the whole environment surrounding the organisation. Barrett and Baldry (2003) contend that the strategic dimension in FM planning potentially affects the future of the core business and supporting activities. They describe the function of Facilities Managers to enable them to optimise their role in the development process (see Table 3.4).

Table 3.4: Function of the Facilities Manager in the strategic level of the development process

1.	Interactions with the core business to determine future changes that may occur to the business
2.	Identify possible developments within FM
3.	Involved in decision making at the strategic level to balance current operations with the needs of the future

Source: Adapted from Barrett and Baldry (2003)

FM is a continuous planning process through the changing needs of organisations. Since FM is a discipline responsible for anticipating changes in the affairs of the organisations, flexibility (Chodasova, 2004) is the key element in the design of the facilities. Planning for change involves identifying priorities and recognising the importance of delivering high-quality products and services that meet the client's perceived expectations. Anderson (2013) characterises the Facilities Manager as a 'changemaster' (p. 30) who is able to influence the decision making at the strategic level of the development process. From this research perspective, the term 'hybrid manager' introduced by Anderson (2013) would be similar to an 'integrator' established by Hodges (2005); the Facilities Manager is responsible for linking strategically, tactically and operationally the element of FM within the development process, which potentially facilitates the user to achieve their business objectives. One should realise that the effective changes of the operations of the organisations rely on the extent to which the facilities are designed to be as flexible as possible. However, the argument here is how Facilities Managers could be sure that the existing information during strategic planning would be able to meet the changing requirement of end users during operations.

To realise the success of the FM element in the development process, any activities which do not add value to the user's interest are a waste and should be eliminated (Payne, 2000). In other words, the user's requirements should always be the reference point in providing the facilities as this would influence all aspects in the development project (Egan, 1998). For that, Koskela (1992) advocates that the property development industry should adopt the lean concept from the manufacturing industry to reduce the share of non-value-adding activities. Facilities Managers should view the development process as a composed process flow (Koskela, 1992; p.38). There are areas that Facilities Managers should emphasise to enable better integration into the development process: (i) perform post-occupancy feedback for learning and continuous improvement, (ii) obtain user requirements as accurately as possible, (iii) understand owner's business objectives, (iv) proper documentation mechanism of design and construction activities, and (v) proper record of operation and maintenance of the facilities.

At the strategic level in an organisation, it is the responsibility of the Facilities Manager to examine the needs to provide the property/facilities to the users. At this stage, the Facilities Manager is involved in decision making to ensure the continuity of interaction between strategic, tactical and operational FM elements in the development process. McLennan (2000) affirms that the operational stage, which concerns the long-term use of the facilities, is the domain of FM and yet it is essential to link it with the business case and project brief containing business, operational and design strategies. Based on Figure 3.6, it is obvious that Facilities Managers play a significant role at financial (prepare business case and project brief) and operation (perform post-occupancy evaluation) stages. However, there is a need to identify what are the roles of Facilities Managers in the design and construction stages to enable FM to integrate effectively into the whole development process.

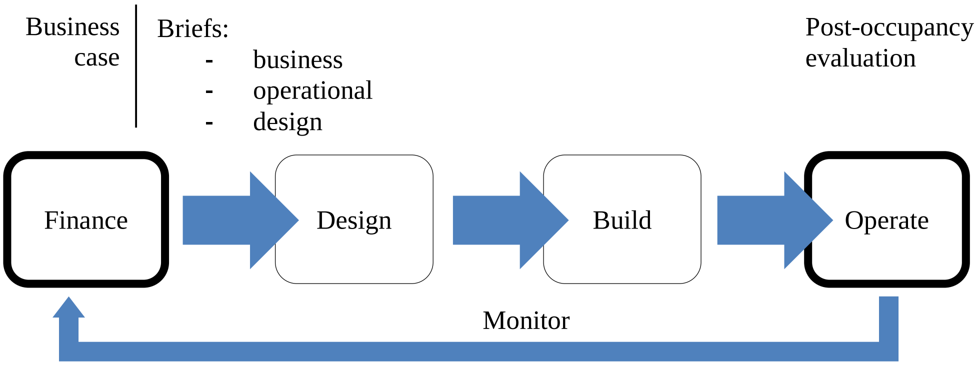


Figure 3.6 Role of FM in the development process. Source: McLennan (2000; p. 169)

Understanding user and owner's requirements is a critical element in the property development industry, failure of which would contribute to the interruption of the building services and affect the business of the users (Barrett and Stanley, 1999). Likewise, post-occupancy evaluation is important for continuous improvement of the design and performance of the facilities. The property development industry involves a significant amount of money, which is invested in advanced by the owner or by the users through tax (for public projects). Therefore, they expect the facilities to perform satisfactorily. Kenneth Plummer, as cited by Damgaard and Erichsen (2009; p. 2), reminds us that the situation in which facilities built at high cost are unable to function is a failure: '…we have got very expensive and beautiful facilities, but it is simply totally unacceptable that the facilities from the beginning have quite fundamental flaws'.

3.4 The need for integration of FM into the development process

Amaratunga and Baldry (2003) identify that the Facilities Manager play a supporting role for the core business (property development industry) to evaluate the possibility to be integrated with other stakeholders involved in the development process. Integration of FM in the development process is complex as it involves various parties and activities. The effort to improve the development process from different aspects has been the focus of the property development industry since Latham (1994) and Egan (1998), although there are different approaches among researchers and practitioners in the industry. However, they have a common target: for FM to be strategically positioned in the development process. Simultaneously, incorporation of FM elements in the development process would improve the buildability and operability of the facilities.

3.4.1 Decision-making process

Property management (human oriented) and asset management (non-human oriented) are subsets of FM. In a client organisation, FM is a key element for strategic decisions, particularly in determining the direction of their business objectives. It is the responsibility of the Facilities Manager to provide relevant facilities to support the organisation to operate effectively. Facilities Managers should be able to make the client aware that proper physical design of facilities has direct consequences for the operation of the organisation as Balch (1994; p. 22) stated: 'No organisation can operate without land or buildings'. Theriault (2011) advocates that Facilities Managers must take a leadership approach to enable their views to be considered in the decision-making process. In a number of organisations, Facilities Managers have been positioned at a senior management level. According to Rondeau *et al.* (2006; p. 554), 'FM has moved from the boiler room to the board room'. Facilities Managers who spend their time in the classical roles of monitoring of operations and maintenance activities (Kincaid, 1994) are no longer relevant.

3.4.2 Innovation

From the property development industry viewpoint, Barrett and Sexton (1998; p. 2) define innovation as 'the effective generation and implementation of a new idea which enhances overall organisational performance'. Innovation encourages the creation of knowledge and dissemination of knowledge that is able to add value to the operation of the organisations. Meanwhile, from the FM industry perspective, Pitt and Tucker (2008) describe innovation as a management process involving various activities performed by various professionals from the same or different organisations, of which the collaboration creates opportunities for a better achievement in the business. Innovation is a result of interplay between multiple parties in the business (Barrett and Sexton, 1998). The implementation of innovation in the property development industry aims to satisfy clients/owners by developing new facilities and services, and enhance the flexibility by creating new processes or concepts (ibid.). FM-DP integration should be seen as a new concept endeavouring to create synergy (ibid.; p. 3) to satisfy all stakeholders involved in the development project. Without FM-DP integration, the Facilities Manager and other professionals work separately due to fragmentation of the development process.

3.4.3 Value added

FM is often associated with operational services such as cleaning, catering and security. In fact, the role of FM is greater than that as FM is able to add value to the process of the business (Jensen *et al.*, 2012). Shah (2007) contends that integration of FM within the property development activities adds value to the facilities in terms of planning, design and construction. A systematic development process would lengthen the life of the facilities. Subsequently, FM-DP integration contributes to the efficiency of the occupants to run the business of organisations efficiently. de Vries *et al.* (2008) clearly illustrate that the consideration of FM elements at the early stage of the development process influences the performance of the facilities as well as supporting the operations of the organisations. If 'process' represents the construction stage, as defined by Koskela (1992), consideration of FM elements at the 'input' (planning and design stages) in real estate[8] have direct impact on 'output' (physical characteristics of the facilities) and the performance of the organisations who use the facilities.

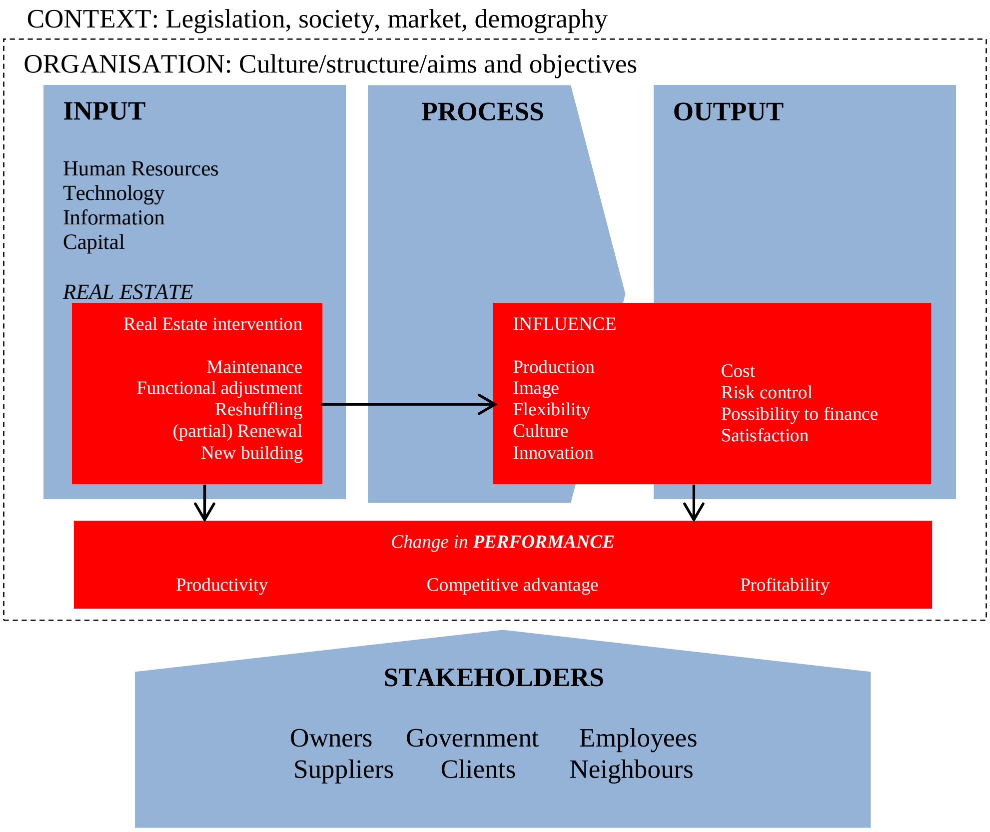


Figure 3.7 Model of added value for development project. Source: de Vries *et al.* (2008)
Note: The permission to reproduced the above diagram has been granted from de Vries et al. (2008)

[8] In this research, real estate is defined as the property development industry.

Since FM is a profession that encompasses multiple disciplines, it is also regarded as a relationship management discipline (Jensen *et al.*, 2012), which prevalently manages the relationship of the internal or external customer/client with the supplier. In the property development industry, FM is expected to have the same responsibility for managing the relationship of various stakeholders involved in the development project. However, to ensure the success of FM value added, the Facilities Manager should be capable of explaining the benefits and potential contribution of incorporating FM elements into the development process to all stakeholders.

3.4.4 Sustainable development

The Facilities Manager has a significant contribution to make to sustainable development (Wood, 2006), resulting from his/her strategic position to view all stages in the development process (Hodges, 2005). In addition, the Facilities Manager is identified as the right professional to take the lead in formulating strategies to optimise the facility in terms of utilisation and/or getting revenue from it (Wood, 2006). Therefore, Facilities Managers should take this opportunity to incorporate the value of FM in the early stages of the development process to encourage a smooth process of planning and design as well as sustainable use of the facility during its in use stage (Tucker, 2012). Incorporating the concept of sustainable development inevitably impacts the ‘triple bottom line’: economics, sociology and ecology (Ciegis *et al.*, 2009), which is broadly discussed in the property development industry (e.g.: Bourdeau (1999), Gandhi *et al.* (2006) and Sobotka and Wyatt (1998)). However, there is another bottom line that needs to be emphasised when implementing the sustainable development concept in the development project: design (Pitt *et al.*, 2009). Earlier stages of the development process including design stage have a key role in sustainable development (ibid.). The sustainable development concept covers all aspects in each stage of the development process. For instance, in the construction stage it covers health and safety; while in the In Use stage it focuses on reducing operating costs by using CAFM, enhanced corporate image and increased wellbeing of the occupants. In the design stage, sustainable development covers the application of information and communication technology (ICT) such as Building Information Modelling (BIM), which gives Facilities Managers ‘the opportunity to tell the designers what information they really need at the early stages of the project development [process], so it’s linking the project to the operation’ (British Institute of Facilities Management, 2012; p. 8). Besides that, incorporation of FM value into the development process encourages the property development industry to learn the principles, techniques and tools of the lean concept (Koskela, 1992).

3.4.4.1 The integration of BIM into FM for sustainable development

BIM has been a hot topic in built environment, which attracted FM to be in its circle. British Institute of Facilities Management (2012) has viewed BIM as a one way to create a sustainable facilities in the property development project. There is perception that the integration of BIM into FM could provide an encouraging environment for Facilities Managers to carry out their function (Gnanarednam and Jayasena, 2013). However, BIM need to play its role effectively in knowledge management, particularly in the whole life cycle of the facilities. The potential of BIM to facilitate architects and engineers in design works as well as construction of the facilities is inarguable. It was claimed that Stage 7 (In Use) will receive the biggest impact if BIM is implemented in the property development project (Pocock *et al.*, 2014). By the same token, BIM will also add value to the FM discipline by optimise the cost of operation and maintenance cost of the facilities. Hence, BIM is advantageous in fulfilling the economic dimension of sustainability. From the environmental dimension of sustainability point of view, BIM can support FM in identify the most effective opportunities for improving the implementation of green building and carbon reduction (Aaltonen *et al.*, 2013). More specific, the benefits that can be gained by FM from BIM according to Abdullah *et al.* (2014) is illustrated in Figure 3.8.

Figure 3.8 The benefits to FM from using BIM in the development process. Source: Abdullah *et al.* (2014)

Although BIM is often associated with new development projects, Volk *et al.* (2014; p. 123) pointed out that BIM can have significant contribution in existing facilities, particularly in sustainability assessments and ratings. There is also a need to expand BIM beyond design stage (Stage 2, Stage 3 and Stage 4) and to consider using BIM for FM activities at Stage 7 (Liu and Issa, 2013). Nevertheless, there are technical, informational, organisational and legal issues that need to be resolved. For this, Eastman *et al.* (2011) and Peglow (2010) suggest the relevant action that need to be considered to encourage the integration between FM and BIM.

To conclude, BIM is a new way of communication and collaboration between Facilities Managers and other professionals in the property development industry. As BIM created values to FM (Becerik-Gerber *et al.*, 2011), this research envisaged the presence of BIM as one of the best practices that could uphold the integration of FM in the development process.

3.5 Research gap: Developing an initial research framework

An extensive discussion in Chapter Two reveals that the property development industry is a cyclical and continuous process that is guided by the development process. The complexity increases with the movement of the stages of the development process. Meanwhile, earlier discussion in this chapter exposed the versatility of FM to be involved in multiple issues at strategic and operational levels (Lee and Scott, 2009). Lee and Scott (2009) identify that FM is an important factor in making strategic decisions on the performance of the facilities as well as the operations of the occupants (see Figure 3.9). Strategic and operational factors to be considered in the main aspects of the development process influence the output[9] and the outcome[10] of the development project. However, Lee and Scott (2009) advise that it is essential to rectify the problems of strategic and operational factors for improvement of the gaps between them.

Figure 3.9 Integration of influencing factors from the main aspects. Source: Lee and Scott (2009)

From this research's point of view, integration of a Facilities Manager who is capable of incorporating FM value into the strategic stage of the development process has a significant relationship to the performance of the building and the business of the organisation. In line with Lee and Scott (2009) recommendation, it is essential to identify and rectify the critical issues that hinder Facilities Managers integrating FM value into the main aspects of the development process. Adapting Figure 3.9 with the development process identified in Chapter Two, the following diagram is

[9] Related to the completion of the development project that meets the allocated budget, is timely and high quality.
[10] The impact of the project on the sustainable development 'triple bottom line': economic, social and environment.

obtained, which serves as an initial framework of this research. Figure 3.10 clearly shows the necessity to identify and rectify the critical issues embedded in Stage 0 to Stage 6 of the RIBA Plan of Work 2013 to contribute to the improvement of organisational misalignment and building maintenance operation efficiency at the In Use stage.

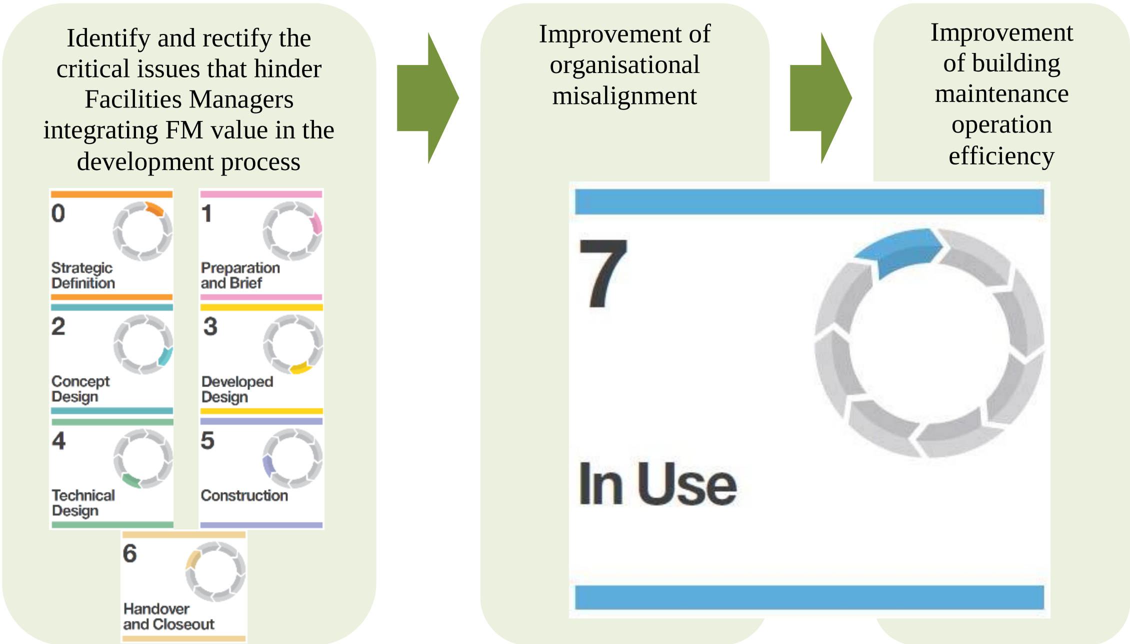


Figure 3.10 Initial framework of the research. Source: Adapted from Lee and Scott (2009) and the Royal Institute of British Architects (2013)

Pitt and Hinks (2001) emphasise the importance of selecting the most strategic mechanism to enable the interface between FM and the management of the development project. Discussing the impact of FM in the property development industry, Jensen *et al.* (2009; p. 1) acknowledge 'the role of Facilities Managers and FM knowledge in relation to building projects and propose possible improvements to the learning circle from experience of use and operation of existing building to the planning of new building projects'. Damgaard and Erichsen (2009) attempt to integrate the FM operational knowledge in the development process; however, they are unable to suggest any theoretical framework that shows the priority in determining the success factors of integration in a wider context. Chotipanich (2004) claims that there are a numbers of general frameworks that relate FM functions to the core business of organisations. However, most of the frameworks provide general concepts that need the gap to be filled (ibid.; p. 370). Furthermore, the existing framework needs to be tested against the validity (Amaratunga and Baldry, 2000) as well as its capability to be adopted in a real-life contexts (Amaratunga and Baldry, 2003). By referring to the above arguments, the development of an FM-DP integration framework has to address the following three (3) procedures:

- Exploring the critical issues that hinder the integration of FM into the development process
  This procedure will undertake the following aspects:
  - Identification of the critical issues from a literature review
  - Explore existing studies on this research field and identify the possible gaps
  - The discussions in Section 3.6, Section 3.7 and Section 3.8 are to satisfy Objective (ii) of this research
    (Note: Objective (i) has been satisfied by the discussion in Section 3.3 and Section 3.4)

- Adopting the most strategic mechanism such as a framework
  This procedure will undertake the following aspects:
  - Sharing of the themes drawn from the literature with relevant professionals in FM and the property development industry
  - Identification of the most relevant research methods that guide this research to develop an FM-DP integration framework (refer to Chapter Four)
    (Note: This procedure is expected to satisfy Objective (iii) and Objective (iv) of this research)

- Testing the selected mechanism for validity
  This procedure will undertake the following aspects:
  - Sharing of the FM-DP integration framework with relevant professionals for validation
    (Note: This procedure is expected to satisfy Objective (v) of this research)

Felten *et al.* (2009) contend that the contribution of FM towards the property development industry is unquestionable. However, it is surprising that FM has been given a low priority in the property development industry, resulting in Facilities Managers being inadequately integrated into the development process. There is currently no suitable generic mechanism that is practical in all stages of the development process to guide Facilities Managers and/or other professionals to optimise the value of FM in the property development industry.

The articles in Table 3.5 are the main references that shape the literature in identifying critical issues to integrate FM into the development process.

Table 3.5 Research methodology in construction management-FM related field

	Research title	Author	Methodology
i.	FM Dashboard: A facility management monitoring tool for planning, design and construction to optimize function and cost in operations	Felten *et al.* (2009)	Qualitative research
ii.	Implementering af drift i byggeri (*Implementation of service for construction*)	Damgaard and Erichsen (2009)	Qualitative research
iii.	Integration of considerations for facilities management	Jensen (2008)	Literature review
iv.	The role of facilities management in building projects	Jensen *et al.* (2009)	Literature review
v.	Construction contractors integrating into facilities management	Brochner (2008)	Quantitative research
vi.	Management for usability of the built environment	Jensen (2010)	Literature review
vii.	Towards an agenda for user oriented research in the built environment	Jensen *et al.* (2011)	Literature review
viii.	Integrated development of facilities design and services	Brochner (2003)	Literature review
ix.	A conceptual link among facilities management, strategic management and project management	Yiu (2008)	Literature review
x.	Applying facilities expertise in building design	Jaunzens *et al.* (2001)	Qualitative research and literature review

Source: Self-study

Since FM is a new field, the research and publication of this field is insignificant (Ventovuori *et al.*, 2007). Evaluation of academic research by Ventovuori *et al.* (2007) found that the research publications in the FM field can be divided into two (2) categories: empirical research (e.g. case studies, surveys and interviews) and non-empirical (e.g. literature review). The empirical research papers, however, can be grouped into exploratory studies, hypothesis testing and methodology review. When analysing empirical papers, it was discovered that 90.0 per cent were found to fall into exploratory studies: a study that makes observations of the research field with the purpose of developing theories but leaves the testing of the theories to other studies (ibid.). However, the analysis excluded the publications classified under construction and project management. Thus, it becomes apparent that research on FM-DP integration is very limited. The situation indicates that there is opportunity for this research to contribute to the body of knowledge.

3.6 Identify critical issues to integrate FM into the development process

Objective (ii) of this research is to identify a number of issues perceived to be barriers for the integration of FM into the development process. This section defines and explains barriers that limit the integration of FM into the development process and best practices applied in the industry. The issues are categorised into eight (8) themes, as follows:

3.6.1 Perceptions

FM has been around since humans invented buildings and facilities (Elmualim *et al.*, 2008). Only recently, the role of Facilities Manager, which represents the FM profession, was considered as the fastest-growing profession not only in the UK but also in most of the developed countries in Europe and America and in developing countries. de Lucy (1991) asserts that FM departments in corporate organisations have been recognised as increasing productivity and cost savings. There is awareness to position FM in a strategic level in the organisations. However, to obtain a collective agreement from other members in the organisation on the implementation of FM value in the organisation is a huge challenge for Facilities Managers. Integration of FM into the development process requires openness from both sectors, FM and the property development industry. Unfortunately, it is very difficult for a paradigm shift to happen in the property development industry (Koskela, 1992).

The perception of other professionals in the property development industry is one of the constraints to integrate FM into the development process. Adewunmi and Ogunba (2008), in their research studying the perception of estate surveyors towards FM in Nigeria, found that 60.0 per cent of them **disagree** that the Facilities Manager is a multi-disciplinary professional. This finding deviated from what had been reported earlier by John Hinks in 1999, where the role of Facilities Manager had been recognised with its versatility and flexibility among estate surveyors in the UK. Adewunmi and Ogunba's findings also conflict with Drion *et al.* (2012), who believe that Facilities Manager is a multi-disciplinary profession to cope with challenges to integrate the principles of other fields. This situation is evidenced by the fact that Facilities Managers are having a crisis of identity (Tay and Ooi, 2001; Yiu, 2008). They have to borrow other disciplines' images to enable them to be recognised in the property development industry (Yiu, 2008; p. 508). FM cannot continuously rely on the management concepts of other disciplines (Nutt, 1999). Besides, FM must establish a unique identity for Facilities Managers. In terms of job scope, Facilities Managers often get stuck at operational level, which restrains them from representing the FM discipline to demonstrate strategic value at a higher level in the owner/client organisations (Kaya *et al.*, 2004). Kaya *et al.* (2004) reveal that a weak relationship between senior management and Facilities Manager causes a misperception of FM's value in the organisation. According to Barrett and Baldry (2003), a good relationship between FM and senior management of the organisations is crucial as it would close the gap between expectations and perceptions as well as enhancing the perceived level of integration.

Despite the growth of the discipline, the concept of FM remains vague. The remit of FM is wide-ranging, which contributes to the difficulties in determining the qualities that should be regarded in the strategic and operational components of the development process (Elmualim *et al.*, 2009). Damgaard and Erichsen (2009) define operation in FM as all of the services that are prerequisite for building a system to function satisfactorily (in the use phase) including the supply, maintenance and cleaning, as shown in Figure 3.11. An operation that is viewed as a subset of FM is perceived as the most unattractive task (Damgaard and Erichsen, 2009; Wood, 2003). Therefore, this justifies why the operational aspects have a poor relationship and fail to integrate into a new development project (Spedding, 1994).

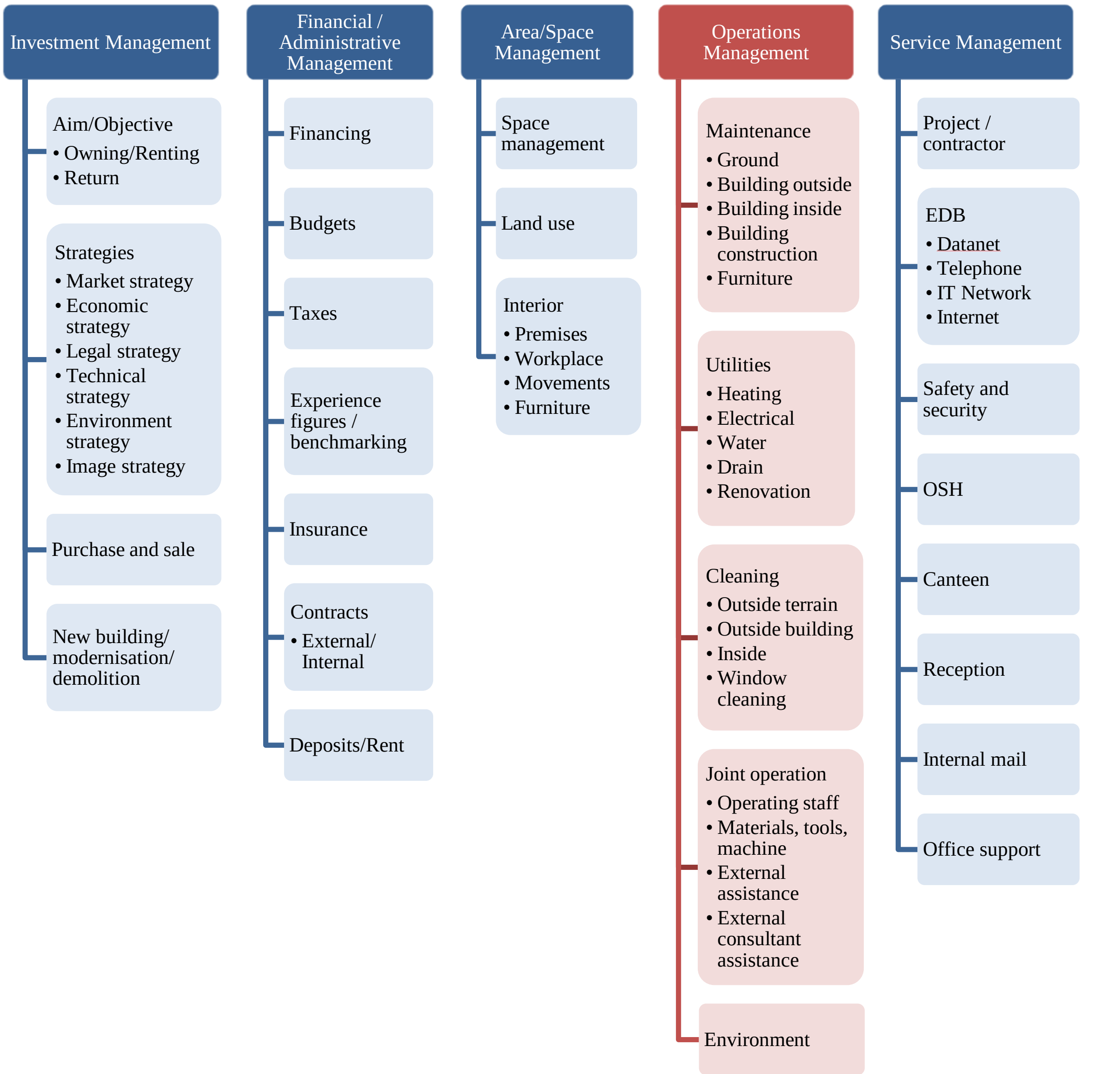


Figure 3.11 FM tasks. Source: Damgaard and Erichsen (2009)

3.6.2 Competence

Sullivan *et al.* (2010) claim that there are numerous professionals, regardless of whether they are technical or non-technical, entering the FM discipline through natural transition or on-the-job training process. This kind of transition does not provide FM with competent Facilities Managers. This situation is causing FM to have a shortage of 'pure' Facilities Managers in which the gap is filled through the additional hiring of individuals possessing irrelevant qualifications in FM (Badger and Garvin, 2007). Obviously, the situation creates threat to the growth of the FM discipline as well as to the clients who are concerned with the ability of Facilities Managers to take care of their properties. The ability of Facilities Managers to add value to the projects is in doubt. Sullivan *et al.* (2010) add that Facilities Managers are perceived to possess low levels of secondary education with very few of them willing to enhance their education due to lack of FM academic programmes. In terms of career development, the Facilities Manager is viewed as having an ill-defined career path that impedes the entrance of new talent to grow the field (ibid.). One (1) way to improve the situation is to provide continuous professional development to encourage the possession of multi-skills among Facilities Managers, as it influences their career progression (Badger and Garvin, 2007). Figure 3.12 shows that individual career is growing at the same rate of skills possession.

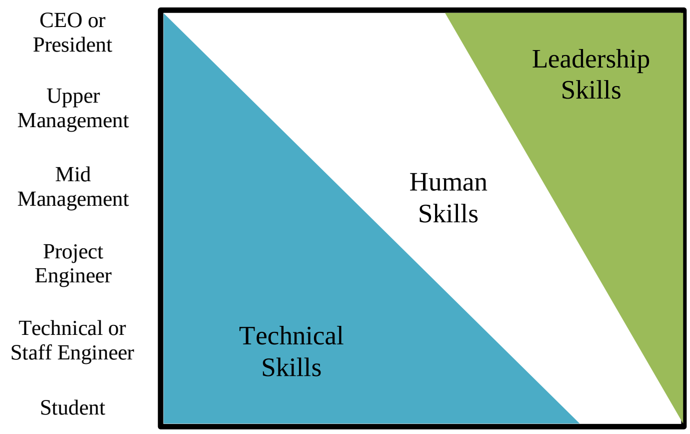


Figure 3.12 Evolution in skills for a successful engineer and Facilities Manager. Source: Farr *et al.* (1997)

Since Facilities Managers are often associated with operational aspects, they are rarely involved in the early stage of the development process. As a result, very few Facilities Managers possess sufficient knowledge and experience in the property development industry (Chodasova, 2004). Furthermore, the so-called Facilities Manager has usually emerged from a craft-trained professional who moved into a management position through specific 'on-the-job' training (Badger and Garvin, 2007). The Facilities Manager has an important role in sustainable development. To ensure the facilities support the business of the users, it is essential for FM to emphasise the life cycle of the facilities and its serviceability during the planning and design stage (Sobotka and Wyatt, 1998). However, those aspects are not at the top priority of the designer (Arditi and Nawakorawit, 1999); also, lack of sensitivity of the Facilities Manager to convince the designer has impeded FM-DP integration. Another factor that restrains FM-DP integration is a lack of communication skills among Facilities Managers. Insufficient knowledge and lack of prestige are identified to be the factors that limit Facilities Managers being equal dialogue partners in the development process (Jensen, 2008).

3.6.3 Regulations

FM in Public Private Partnership (PPP) projects is involved at all stages in the development process (Mustapa and Carrillo, 2007), from Strategic Definition to In Use stage. The success of the delivery of a PPP project relies significantly on the ability of senior management to highlight the issues of strategic and operational aspects at the earlier stage of the development process. Nutt (2000) advises that the risks and opportunities to FM in a PPP project should be identified as early as possible. The incorporation of FM value via the Facilities Manager would assist in this aspect. PPP is perceived as a platform to encourage the integration of FM in the development process (Baldwin, 2003). Despite the growth of PPP globally, the PPP performance in the UK is shrinking due to the political situation that influences the implementation of PPP (Adair *et al.*, 2011; p. 25). This circumstance has impeded FM from raising its profile and value.

Government Soft Landings (GSL) provide opportunities for the FM discipline to enhance the profile and prestige of Facilities Managers. From the FM perspective, BIFM (2012) identifies a number of benefits in the implementation of GSL. GSL ensures early engagement of FM in the development process as well as encouraging significant consideration of operation and maintenance elements in the design. Currently, there is limited collaboration and knowledge sharing among professionals in the property development industry. The design team and the constructor often leave the project after the Handover and Close Out stage. However, GSL policy has ensured the continuous commitment of those parties during the In Use stage. Apart from that, GSL encourages post-occupancy evaluation to be implemented by the design and construction team to ensure lessons learnt are captured for future projects (ibid.).

According to Felten *et al.* (2009), the contribution of FM to the property development industry is well known. However, initial costs and time investment to include Facilities Managers are identified as the main reasons why Facilities Managers have not been integrated more consistently into the development process (p. 116). There is conflict of interest among the stakeholder of the project. In this case, the investors and the users/operators have different aims towards the facilities.

3.6.4 Organisations

Damgaard and Erichsen (2009) identify that there are issues with organisational structure in the development project. Development projects are complex; the teams are interdisciplinary and vary significantly. The perception, goals and interest of each individual/organisation involved in the project are conflicting (p. 31). The consultants and constructor give too much focus to construction activities with short-term objectives. Meanwhile, the owner and the users perceive that the completed facilities provide a long-term business advantage to their organisation. However, it often happens that some of the owners focus on construction cost rather than operational costs (Damgaard and

Erichsen, 2009), resulting in inability of Facilities Managers to play their role effectively in the decision making at the strategic level (Elmualim *et al.*, 2010). It is a big challenge for the FM to satisfy various parties with different interests. Pitt and Hinks (2001) identify that there are structural barriers between professionals. For instance, without direct interface between Facilities Manager and project manager 'there is no opportunity for the joint consideration of strategic and operational matters … In such circumstances the level of strategic intelligence will differ between FM [Facilities Manager] and PM [project manager] too' (p. 306).

3.6.5 Knowledge management

Elmualim *et al.* (2008) assert that Facilities Managers are at the forefront for delivering sustainable development. There is an argument that the diversity of the FM role has left Facilities Managers in a difficult position to effectively contribute to FM-DP integration; however, there is a more important factor: lack of understanding about sustainable development among Facilities Managers. Part of this is due to conventional education and training, the separation of which in the curriculum creates a technical knowledge gap between Facilities Managers and other professionals (Elmualim *et al.*, 2009). These differences ultimately influence the design of the facilities, which does not meet the needs of the owner and/or users. As a result, there will be a lot of changes during the construction. Often, the knowledge on the change management process from design and construction stages is not effectively transferred to the Facilities Manager (Shah, 2007). Without this knowledge, the Facilities Manager is unable to play his/her role to demonstrate FM value at Handover and Close Out (Stage 6) and In Use (Stage 7) stages. By the same token, it is also crucial to transfer operational knowledge at the In Use stage (Stage 7) to earlier stages of the development process so that lessons can be learned from previous experience (Damgaard and Erichsen, 2009). It is obvious that there is a lack of knowledge transfer between FM and the property development industry. To improve the situation, it would be beneficial for all parties involved in the development project to go along with Sun and Scott (2005), who suggest five (5) approaches of effective knowledge transfer and learning process in the development project: (i) individual to team, (ii) team to individual, (iii) team to organisation, (iv) organisation to team, and (v) inter-organisation.

3.6.6 Definition

Chotipanich (2004) claims that there are many frameworks that relate FM functions to the core business of organisations; however, Shohet and Lavy (2004) argue that FM still lacks a suitable framework for decision making at the strategic and operational levels. This is not supposed to happen, since FM is a discipline that is responsible for holding unique information on the facilities and their use (McLennan, 2000). From a project management perspective, Pitt and Hinks (2001) view FM as management of cost efficiency. Since there is a motivation for FM-DP integration, interfacing between FM and project management discipline is inevitable. However, due to the different objectives between these disciplines, it creates a barrier to optimising the role of FM in the development process.

From a manufacturing industry point of view, Takata *et al.* (2004) argue there is a need to redefine the role of maintenance as a main approach for life cycle management (LCM). Westkamper *et al.* (2001) claim that the application of LCM systematises the interaction of the various stages of the manufacturing process that enhance the performance of the products. Moreover, LCM is to control the conditions of products so as to provide the functionality required by the users, minimise the environmental impact and maintain profits (Takata *et al.*, 2004). Westkamper *et al.* (2001) state that LCM is a precondition for sustainable development. By the same token, the role of FM needs to be reassessed as an essential method for the development process. A significant involvement of FM in the development process would benefit the property development industry.

Hodges (2005) points out that life cycle costing (LCC) has a significant impact on FM in terms of achieving sustainable development. LCC is often associated with facility costs. Sarja (2006) defines that LCC is the total cost of a structure throughout its life, including the costs of planning, design, acquisition, operations, maintenance and disposal. It is a technique for decision making for investment of the facilities, which is suitable to be implemented in the Strategic Definition stage. Meanwhile, in the Technical Design stage, Hodges (2005) advises 'Facilities Manager to be familiar with LCC analysis and to be inquisitive and demanding of designers when choosing construction and renovation materials and systems' (p. 319). Also, Brown *et al.* (2011) affirm that LCC is potentially exploited in the In Use stage. Case studies carried out by Shah (2007) reveal that application of LCC by Facilities Managers encourages environmental issues in the In Use stage such as climate change and pollution. Moreover, LCC can be used in making decisions to reduce energy and water consumption (The Federal Facilities Council Ad Hoc Task Group, 2001).

3.6.7 Operation

Feedback is a means of learning from experience by carrying out the processes of reflection and deduction involving analysing the experience, specifying the lessons learned and synthesising the findings to apply the learning to other conditions (Pearson, 2003). The cycle of feedback is illustrated in Figure 3.13.

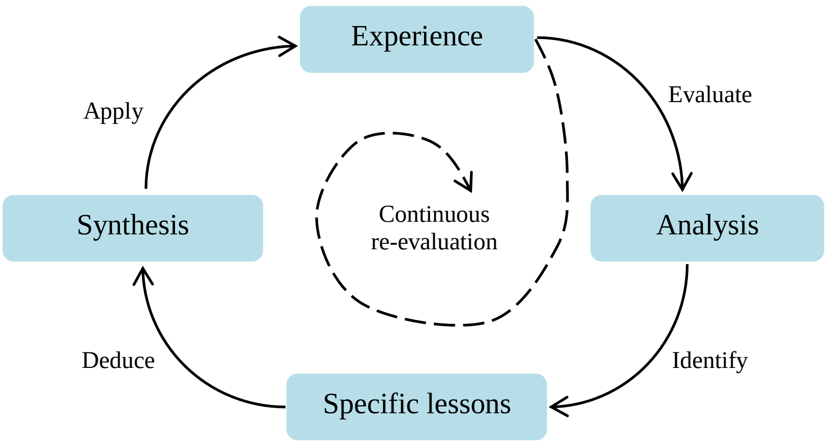


Figure 3.13 The feedback cycle. Source: Pearson (2003)

According to Pearson (2003), feedback from users in the In Use stage is crucial to sustainable development. In terms of fulfilling social and economic aspects, feedback helps designers to design the facilities that fit with users' needs as well as support the organisation, which uses it to achieve their business objectives. From an ecological point of view, feedback would encourage the improvement of environmental performance by introducing alternative means such as reduction of CO_2 emission and increased energy efficiency. A survey conducted by Bordass *et al.* (2001) found that users enjoy facilities that can respond positively to their life. Feedback is a means of evaluating the performance of the facilities, which is commonly known as post-occupancy evaluation (POE). However, the professionals required to carry out the tasks are not clearly defined. Moreover, most of the professionals as well as organisations in the property development industry perceive that POE is fragmented, semi-automated, partially systematic and weakly connected to the core business of the users (Pearson, 2003). The benefit of POE to the development process is undeniable, yet there are barriers to implementing it.

Section 3.3 clearly justifies that the Facilities Manager is the most suitable professional to carry out POE. Hadjri and Crozier (2009) claim that there are reasons why the implementation of POE is discouraging, which has also been discussed by various researchers (e.g. Bordass *et al.* (2001), Cooper (2001), Eley (2001) and Zimmerman and Martin (2001)). It is identified that 'the notion of professional liability is … the most significant contribution to the lack of POE work' (Hadjri and Crozier, 2009; p. 30). POE is not in favour with architects and engineers as negative findings may be harmful to their reputation. As a result, Facilities Managers may find that the data obtained from POE does not encourage their integration into the development process. A study carried out by Pitt and Hinks (2001) found that a poor interface between FM and project management in one of the airport projects in the UK has affected the business of the airport. The systems to deal with FM issues are not there during Handover and Close Out stage. This is one piece of evidence that the isolation of FM from being involved in the development project affects the business sustainability.

3.6.8 Communication

Development projects involve various stakeholders with different objectives, including FM as a new discipline. The presence of a Facilities Manager in the development process is a new initiative that possibly affects the existing working system. This situation potentially creates conflict among other professionals in the property development industry, which, according to Koskela (1992), finds it difficult to accept change. The community of the property development industry is often reluctant to invest in new initiatives or innovative approaches (Ruikar *et al.*, 2007). This, coupled with the insufficient clout (Eley, 2001) of Facilities Managers, means that they face challenges to get the knowledge to be shared with them. According to Barrett and Baldry (2003), it often happens that Facilities Managers are 'involved at every stage of the delivery process and know every last detail about what happening' (p. 49), but neglect their main role as a coordinator. This deficiency impedes Facilities Managers communicating effectively with other professionals as well as gathering knowledge within the project team. It is understood that FM is occasionally involved in the strategic level of the development process by referring back to the discussion of each issue in Section 3.6. However, a study conducted by Felten *et al.* (2009) to create an FM monitoring tool for the development process found that there is a flaw to be improved by FM in the strategic level: plausible explanation of operation costs for owners and users.

3.7 Existing studies on FM experience in property development industry

Previous sections have shown that there are eight (8) critical issues to integrate FM into the development process. The researcher also has identified that there is a gap, which has led to the execution of this research. To further clarify the contribution of this research to the area of research, this section discusses research endeavours that have been performed in three (3) countries: Denmark, Portugal and Malaysia.

3.7.1 Ignorance of operational experience in Denmark

The study undertaken by Damgaard and Erichsen (2009) consists of literature review and interviews with nine (9) selected key informants from FM-related practitioners. In general, they found that the players in FM and the property development industry in Denmark, including academicians, agreed that FM should be involved in all stages of the development process. Based on FM-specific functions produced by Jensen (2009), Damgaard and Erichsen (2009) identify the FM tasks that limit Facilities Managers' involvement in the property development process (see Table 3.6).

Table 3.6 FM-specific tasks in the development process

Project phase	Level of integration	
	Moderate	**Difficult**
Decision	• Information on space needs, etc.	• Addressing the concerns of property strategic business • Estimation of impacts on cost of FM • Preliminary discussion on new construction vs. modernisation
Briefing	- None -	• Organising user involvement • Operating and environmental concern • General requirements for documentation
Design	• Formulation of requirements for building automation system	• Incorporation of considerations for operation, sustainability and user needs • Establishment of operational concept
Construction	• Interior planning • Prepare commissioning	• Contracting out operational tasks
Occupation	• Moving • Handling former building	• Implementation of operational procedures

Source: Damgaard and Erichsen (2009) and Jensen (2009)

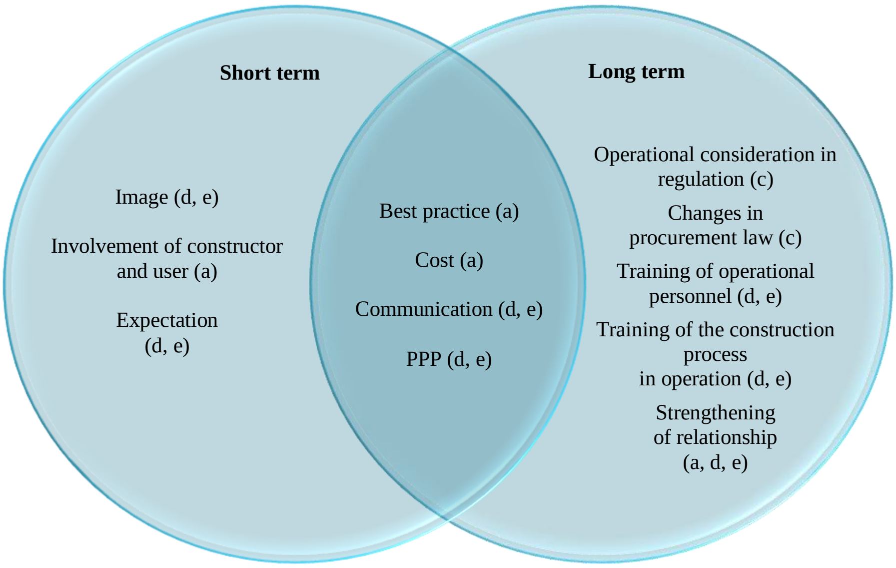
The research also revealed there are five (5) groups of barriers that hinder FM-DP integration, namely: (i) project-related, (ii) structural, (iii) regulatory, (iv) competence-related, and (v) sociological barriers. The detail of each group is presented in Table 3.7, below:

Table 3.7 Barriers to involvement of operation

Group of barriers	Barriers' description
a. Project-related barriers	• Temporary and project-based new entrants • Innovative construction gives more knowledge challenges than standard construction • The client is considered only as a principal, other players reluctant to take responsibility for operation • Hard to place responsibility for operation
b. Structural barriers	• Focus on the capital investment • Focus on costs in the construction process • Short-term thinking • Actors in the project have different focus areas of operation • Abandoned relationships partly due to competitive tender
c. Regulatory barriers	• Competition rules limit the recruitment of project participants • Lack of regulation
d. Competence-related barriers	• Lack of knowledge and communicative skills of operational staff • FM and operation is not regarded as a strategic discipline • Lack of expertise of advisors – output description backward • The end user's lack of understanding • Lack of competence of the builder • Ignorance of the literature on the operation of the parties in the construction process
e. Sociological barriers	• Power/power struggles between actors • The client's attitude to the operation • Operation status is low • Operational staff do not want to participate • Abandoned relationships partly due to competitive tender

Source: Adapted from Damgaard and Erichsen (2009) and Jensen *et al.* (2009)

At the end of the study, Damgaard and Erichsen (2009) suggest a long-term and short-term solution to integrate operational experience into the development process. The solution is illustrated in Figure 3.14, which shows enhancement of regulation, education and relationship are initiatives that would be advantageous in the long term. Meanwhile, improvement of practice in the development project, project costs, communication skills and proper implementation of PPP would likely benefit both long term and short term. Also, improvement of the Facilities Manager image, active involvement with the project team and users and fulfilling the expectations of colleagues and users would bring immediate effects for FM-DP integration.



Note: The letters in parentheses refer to the group of barriers: (a) Project related barriers, (b) Structural barriers, (c) Regulatory barriers, (d) Competence-related barriers, (e) Sociological barriers

Figure 3.14 Solution to integrate operational experience into the development process. Source: Damgaard and Erichsen (2009)

Damgaard and Erichsen (2009) anticipate that the solutions above are highly unlikely to be implemented by any individual or organisations and show immediate effect. However, it is expected that the awareness to integrate FM knowledge into the strategic level of the development process is increasing. This report further revealed that there is a need to develop a more detailed guideline to enable the property development industry to optimise the role of FM in the development process. Identifying best practice in the development project would be the area where this research could contribute.

3.7.2 Lack of FM competitiveness in Portugal

Flores-Colen and Carreira (2012) identify that lack of competitiveness in the Portuguese economy has significantly deterred the improvement of FM performance and the growth of the FM profession in Portugal. It is understood that providing facilities is increasingly complicated; they need to be built according to users' requirements and comply with sustainability agenda, for instance. The differing objectives among stakeholders in the development project require a competent Facilities Manager to coordinate effectively in order for the project to succeed. Flores-Colen and Carreira (2012) discover that the challenges that Portugal must resolve are improvement of the FM market, optimising the role of the FM department in the organisation and reinforcing educational training programmes for Facilities Managers (see Table 3.8).

Table 3.8 The Portuguese FM market situation and preferred solutions

Current situations	Preferred solutions
FM Market and FM situation	
Tactical level National focus Small FM market Low recognition of FM One (1) Portuguese association Uncertain future economic situation	Strategic level Internationalisation Increase market size Recognition of FM More FM association with contribution to FM affairs Stable economics
Organisation departments and FM implementation	
Difficulties in internal communication Technical issues (environment and processes) and workplace management (people) are separated Narrow-minded view of departments within organisations Resistance to change of ways of working No legislation and no implementation of EN 15521	Good communication Integrated structure Relationship with other departments Flexibility to implement new ways of working Practice EN 15521
Educational programme	
Different educational backgrounds within FM related department/no educational programmes specific to FM Specialisation in other areas (technical or managerial knowledge)	Several multi-level FM educational programmes Increases skills and competency

Source: Flores-Colen and Carreira (2012)

Despite a discouraging FM situation in Portugal, Flores-Colen and Carreira (2012) are optimistic that there are opportunities to increase the FM profile in the development process. They are promoting the implementation of POE, utilisation of LCC concept and ICT:

a. Assessment of buildings in operation and client satisfaction through feedback exercise – POE – aiming to improve the operational knowledge of buildings in use and the possibility of fulfilling user requirements.

b. Service integration and building management systems – concerned with enhancing interdisciplinary collaboration in property development and FM, improvement of building performance, utilisation of life cycle costing (LCC) methods for better design, construction, maintenance and operation and compliance with sustainability requirements.

c. Application of ICT – concentrate on finding low-cost and low-disruption IT solutions such as BIM and CAFM.

To conclude, Flores-Colen and Carreira (2012), however, state that having an FM educational programme in Portugal is the most crucial solution in 'helping to establish Facilities Manager as a profession and therefore increasing recognition' (p. 4) of FM in the property development industry.

3.7.3 FM challenges in the Malaysian property development industry

Mustapa *et al.* (2008) claim that FM in Malaysia is relatively new. The definition of FM is poorly understood. As a result, FM is not being implemented effectively. However, the revival of the Malaysia Association of Facilities Management (MAFM) in 2009 (Malaysia Association of Facilities Management, 2014) has promoted the benefits of integrating FM into the property development industry in Malaysia. Moreover, the increasing awareness of good practice in maintenance and operation of facilities has encouraged the importance of integrating FM into the strategic level of the development process. In general, there are a number of researchers discussing the challenge to implement FM in Malaysia. Most of the issues discussed, however, are around service quality (Kamaruzzaman and Zawawi, 2010), maintenance (Nik-Mat *et al.*, 2011) and organisation management (Abdul Mutalib *et al.*, 2015) during the In Use stage of the facilities. Mustapa *et al.* (2008) state that an investigation into the property development industry shows that no specific FM consultancy firm has been established in Malaysia. It also indicates that FM is not fully optimised in the development process. However, there has been an effort from the Malaysian Government to encourage architects and engineering consultancy firms to integrate FM expertise in the strategic stage of the development process to ensure the property development industry in Malaysia becomes much more competitive (ibid.; p. 82). Mustapa *et al.* (2008) identify that (i) establishing standards and regulations for FM professionals, (ii) promoting FM education and training programme to increase the number of FM experts and (iii) encouraging the use of ICT such as BIM and CAFM are prerequisites to enable Facilities Managers to demonstrate FM value in the development process.

Three (3) cases above confirm there was indication that FM is not regarded as a main element in the property development industry. ‘FM is still not wholly understood or appreciated by the other professions in the construction supply’ (British Institute of Facilities Management, 2012; p. 18). Although this research was performed based on RIBA Plan of Work 2013, which is fit with property development settings in the UK, there are opportunities to apply the results of this research internationally. For instance, the Malaysian Institute of Architects (PAM) that rooted from the Royal Institute of British Architects (RIBA) (Malaysian Institute of Architects, 2015) has the potential to exploit the FM-DP integration framework. Nevertheless, some modifications need to be made to fit with the environment of the property development industry in the local area.

3.8 Contribution of FM-DP integration to sustainable development

The concept of sustainable development is abstract and often interpreted differently depending on the context of usage. It sits on three (3) pillars: economic, social and environment. In general, the most well-known definition of sustainable development has been introduced by the Brundtland Commission, which described the ability of the development to fit the present needs without compromising the ability of future generations to satisfy their own needs (World Commission on Environment and Development (Brundtland Report), 1987). The definition obviously requires the property development industry to be considered when implementing sustainable development (Bourdeau, 1999). One of the challenges for the property development industry to implement sustainable development is to identify and implement new innovative working systems and technologies. Unfortunately, as reiterated by Koskela (1992), the property development industry is poor at accepting changes. ‘Why should I change? What are the area of risk and security? How can I get profit and what will it cost me?’ (Bourdeau, 1999; p. 364) are questions expected to arise from the industry. One must realise that the property development industry has a significant contribution to make to the various aspects of sustainability. To achieve sustainable development Bourdeau (1999) suggests there are FM elements that need to be considered by the owner and the users of the facilities: ‘They should set concrete environmental specifications to the parties involved in the design process. They should also assure the productivity of their own business by emphasising environmental issues, quality and preservation of property values’ (p. 361). This statement obviously encourages the presence of a Facilities Manager at senior management level in the owner’s organisation. It also recognises the role of Facilities Manager in advising the owner when preparing their business case and strategic brief at the Strategic Definition stage. Bourdeau (1999; p. 363) also advocates the professionals who are involved at the design stage to ‘adopt a more integrated approach to design… but also focus on the exploitation phase during functional [operational] design’. Again, FM knowledge during In Use stage of the facilities such as POE is required to assist the designers.

Facilities Managers have a significant contribution to make to sustainable development (Wood, 2006). Elmualim *et al.* (2009) admit that the main concerns are to meet the challenges of applying sustainable development criteria to the FM integrated within the development process. The challenges, however, need to be identified. An intensive review of the literature from various sources found that Elmualim *et al.* (2010), Häkkinen and Belloni (2011), Hodges (2005), Pitt *et al.* (2009) and Sobotka and Wyatt (1998) have discussed the challenges to FM's contribution in sustainable development. There are seven (7) potential issues that need to be considered by the Facilities Manager at operational, tactical and operational levels: namely: affordability, commitment, awareness, communication, briefing, regulations and flexibility. The following paragraphs discuss each issue and demonstrate the main points from the sources above.

Affordability: Costs are barriers for the implementation of sustainable development. One of the suggestions by Häkkinen and Belloni (2011) is the incorporation of energy-efficient elements into the design, which could bring down the operating costs. A proper application of LCC at the strategic level in the development process would ensure that those who pay the upfront costs would receive the benefits from the provided facilities.

Commitment: Successful implementation of sustainable development needs high commitment among various stakeholders including the Facilities Manager. The assembly of all expertise and knowledge in the very early stages of the development process is important (Häkkinen and Belloni, 2011). Pitt *et al.* (2009) claim that designers (architects and engineers) are often involved in the decision to shape the project to meet sustainable development criteria. However, the involvement of other stakeholders such as contractor and FM consultant seems to be a good practice that can reduce costs and improve corporate image as well as safety and health performance (ibid.). These are the areas for Facilities Managers to take into consideration when integrating into the development process.

Awareness – Pitt *et al.* (2009) identify that lack of client awareness is one of the factors that hinder the implementation of sustainable development in the property development industry. However, even if there is client has awareness, the design team still fail to produce alternative knowledge to convince the client to implement sustainable development. Therefore, it is an opportunity for Facilities Managers to be in a strategic position in the organisation or project set up to advise the clients about the potential of the implementation of sustainable development. On top of promoting the concept of sustainable development to the public, as suggested by Häkkinen and Belloni (2011), it is also the responsibility of the Facilities Manager to increase the awareness of sustainable development among project colleagues. Sobotka and Wyatt (1998) suggest that it would be beneficial for the Facilities Manager to highlight the environmental impact of the use of material and equipment at the strategic and tactical level, whilst stressing the importance of recycling and waste disposal at the operational level.

Communication – Häkkinen and Belloni (2011) assert that communication in the property development industry is crucial for the effective implementation of sustainable development. Communication is an important element in innovation. In their research, Elmualim *et al.* (2010) found that Facilities Managers often fail to communicate effectively with other stakeholders and investors. The situation evidenced that there is a need to produce a communication model (Häkkinen and Belloni, 2011) in the project, and Facilities Managers could lead this initiative.

Briefing – Häkkinen and Belloni (2011) identify that incomplete information as well as ambiguous strategies in a project brief are the factors that restrain the implementation of sustainable development in the property development industry. They go on to mention that the ability of the designers to integrate the principle of sustainable development into the design needs to be reassessed. From the FM point of view, the Facilities Manager would be able to improve the situation through intensive involvement at the early stage of the development process. Sobotka and Wyatt (1998), however, have a different view on this issue. They emphasise the importance of seeking to fulfil the client's brief on economic aspects, particularly business case and investment assessment, without neglecting social and environmental aspects. The following elements should be considered by Facilities Managers when presenting FM at the strategic level (Pitt *et al.*, 2009):

- Green buildings are good for environment
- Conducive facilities in which to live and to work
- Ability to attract high rents and prices
- Cost less to operate and maintain

Regulations – Facilities Managers have a significant impact on the implementation of sustainable development; thus, they should be knowledgeable about sustainable development regulations as they can be exploited to encourage sustainable development (Häkkinen and Belloni, 2011). Since the nature of the property development industry is fragmented, enforcement of regulations seems to be the only way to implement sustainable development (Pitt *et al.*, 2009). Elmualim *et al.* (2010) acknowledge that Facilities Managers will face a big challenge in implementing sustainable development in the development process, stating: 'much of the burden of [sustainable development] regulation will need to be picked up by Facilities Manager at every level; strategic, tactical and operational' (p. 59).

Flexibility – Sobotka and Wyatt (1998) identify that flexibility is one of the characteristics of the facilities that should comply with the indicators of sustainable development introduced by Roger Baldwin in 1996. It is clearly indicated that the element of flexibility is vital and needs to be emphasised in the tactical stage in order to implement sustainable development successfully. The incorporation of 'design serviceability culture… [in the design stage could provide flexible facilities that are] loose fit and functional [with high] quality' (ibid.; p. 320). From this research perspective, it would be beneficial for Facilities Managers to emphasise FM knowledge in the design stage. In designing office space, for instance, the introduction of innovations such as hot-desking office and flexible working concept would potentially encourage the integration of FM into the development process.

Table 3.9 maps out the development process and stakeholders (left and right column respectively) and the issues (bottom row) against sources of literature (in the centre of the table).

Table 3.9 Potential issues that need to be considered by Facilities Managers in the development process and interaction with stakeholders

Development process	Stakeholders	Affordability	Commitment	Awareness	Communication	Briefing	Regulations	Flexibility
Operational (Stage 7)	Users		H&B	H&B, S&W[a]				
Tactical (Stage 2, Stage 3, Stage 4, Stage 5 and Stage 6)	Authority						P	
	Designers	H&B		H&B, S&W[b]	H&B,	P		S&W[d]
	Suppliers			H&B				
	Manufacturers			S&W[b]	H&B,			
	Contractors			S&W[b]	H&B,			
Strategic (Stage 0 and Stage 1)	Clients		P, H&B	P, H&B, S&W[b]	E	P, S&W[c]		
	Investors	P, E	H&B, E	H&B	E	S&W[c]		

Potential issues

Legend 1: E = Elmualim *et al.* (2010), H&B = Häkkinen and Belloni (2011), H = Hodges (2005), P = Pitt *et al.* (2009), S&W = Sobotka and Wyatt (1998)

Legend 2:
Stage 0: Strategic Definition
Stage 1: Preparation and Brief
Stage 2: Concept Design
Stage 3: Developed Design
Stage 4: Technical Design
Stage 5: Construction
Stage 6: Handover and Close Out
Stage 7: In Use

Note:
Sobotka and Wyatt (1998) interpret differently for each variable:
a: Recycling and waste disposal
b: Environment impact of material production
c: Project briefing including business case understanding and investment assessment
d: Flexibility of design considering future operation and maintenance requirements

Source: Self-study

3.9 Themes emerging from the findings of the literature review

Through an extensive literature review in this chapter, the researcher has identified themes that support the continuation of this research to the next stage. Section 3.6 and Section 3.7 discuss the critical issues, explore the existing studies and identify the possible gaps in the research field. The findings from the literature review demonstrate that there is a need to integrate FM through the role of Facilities Manager in the development process. The benefit of having FM value in the development process for the performance of the facilities as well as sustainable development is unquestionable. However, there is no mechanism to guide Facilities Managers or other professionals to optimise the role of FM in the development process. Generally, there are eight (8) main themes that comprise 33 sub-themes, as follows:

Table 3.10 Critical issues of FM-DP integration

Variables		Description	Sources
V1: Perception	i.	Less recognition by other professionals due to no unique identity	Yiu (2008)
	ii.	Unclear professional boundaries, the vague way of defining FM	Pitt and Hinks (2001)
	iii.	Unable to demonstrate strategic value	Kaya *et al.* (2004)
	iv.	Profession stuck at operational level	Kaya *et al.* (2004)
	v.	Unclear responsibility makes FM less proactive and strategically focused	Damgaard and Erichsen (2009)
	vi.	Continues to be reliant on other professions	Nutt (1999)
	vii.	The concept of FM is vague	Elmualim *et al.* (2009)
V2: Competence	viii.	Absence of comprehensive FM academic programme	Sullivan *et al.* (2010)
	ix.	Scarcity of FM professional development in the organisations	Badger and Garvin (2007)
	x.	Lack of facility manager experience in property development industry	Chodasova (2004)
	xi.	Lack of serviceability and operational consideration in design	Sobotka and Wyatt (1998)
	xii.	Lack of communicative skill and prestige	Jensen (2008)
	xiii.	Less sensitivity of the designer to operational requirements	Arditi and Nawakorawit (1999)
V3: Regulations	xiv.	Unconvincing PPP implementation ability	Adair *et al.* (2011)
	xv.	Collision of professional interest between investors and operators	Felten *et al.* (2009)
	xvi.	Recently emergence of soft-landings concept	BIFM (2012)
V4: Organisations	xvii.	Huge complexity and temporary involvement with different interests	Damgaard and Erichsen (2009)
	xviii.	Offensive to individual professions	Pitt and Hinks (2001)
	xix.	Client's focus on capital investment neglects FM costs	Damgaard and Erichsen (2009)
	xx.	Inability to influence decision making at strategic management level	Pitt and Hinks (2001)

Variables	Description		Sources
V5: Knowledge Management	xxi.	Ineffective operational knowledge transfer	Shah (2007)
	xxii.	Technical knowledge gap between Facilities Managers and other professionals	Elmualim *et al.* (2009)
	xxiii.	Unclear operational concept and its impact on development process	Elmualim *et al.* (2008)
	xxiv.	Knowledge transfer and levels of learning in the organisation - *Individual to team* - *Team to individual* - *Team to organisational* - *Organisational to team* - *Organisational to inter-organisational*	Sun and Scott (2005)
V6: Definition	xxv.	Lack of conceptual and theoretical framework in FM field	McLennan (2004), Shohet and Lavy (2004)
	xxvi.	Difference of objectives between FM and project management field	Pitt and Hinks (2001)
	xxvii.	Under-utilisation of LCC and LCM methods	Takata *et al.* (2004)
V7: Operation	xxviii.	Poor feedback due to ineffective POE exercise	Pearson (2003)
	xxix.	Negative outcome from POE may be harmful to professional liability and reputation	Hadjri and Crozier (2009)
	xxx.	Absence of systems to deal with everything (with FM issue)	Pitt and Hinks (2001)
V8: Communication	xxxi.	Explanation of the costs between development planning and operation	Felten *et al.* (2009)
	xxxii.	Inability to coordinate and gather the knowledge within team	Barrett and Baldry (2003)
	xxxiii.	Unwillingness to share the knowledge	Ruikar *et al.* (2007)

Source: Self-study

3.10 Chapter Summary

- Chapter Three demonstrates that the researcher has conducted an intensive literature review to understand the definition of FM and identify the role of Facilities Manager in the development process. The involvement of FM in the development process would benefit the property development industry in four (4) elements: decision-making process, innovation, value added and sustainable development.
- Further discussion reveals that there is a gap in the research field. There are attempts from the industry and academia to integrate FM into the development process. It is discovered that FM has been given a low priority in the property development industry, resulting in Facilities Managers being inadequately integrated into the development process. There is currently no suitable generic mechanism that is practical in all stages of the development process to guide Facilities Managers and/or other professionals to optimise the value of FM in the property development industry.
- Eight (8) main themes have been identified, namely: perceptions, competence, regulations, organisations, knowledge management, definition, operation and communication, which consist of 33 sub-themes.

- FM has a significant contribution to make to the implementation and achievement of sustainable development. The development of an FM-DP integration framework could encourage Facilities Managers to demonstrate FM value in sustainable development.
- To conclude, the development of an FM-DP integration framework is a twofold strategy: to increase the profile of FM in the property development industry, which in turn encourages the integration between FM and the development process, and to improve the implementation and the achievement of sustainable development in FM and the property development industry.
- Chapter Three has satisfied Objective (i) and Objective (ii) of this research.

Chapter Four

Research Design and Methodology

4.1 Introduction

This chapter provides an extensive discussion on the philosophical side and the methodology that is relevant to this research. Philosophy in research has a major influence in shaping the research problems and research questions (Creswell, 2013). However, Mason and Dale (2011, p. 1) claim that occasionally researchers fail to make a clear connection between philosophy and research methods. This is also due to a failure to predict what kinds of data and knowledge in relation to research methods possibly emerge prior to the evaluation and selection of the proper research methods. To understand how this chapter is organised, the research onion introduced by Saunders (2012) is the best analogy to explain the whole content of the chapter. Assuming the onion was cut on the cutting board, as shown in Figure 4.1, the cutting board itself represents the research scope, the existing knowledge that explains the scenario of facilities management in the construction industry in the UK. This will be the first part of the chapter, which will provide some indication of what to expect from the existing knowledge and its connection to the selection of research design. This section will discuss the research philosophy in detail with the purpose of justifying the selection of research approach, methodological choice and strategies in order to answer the research questions.

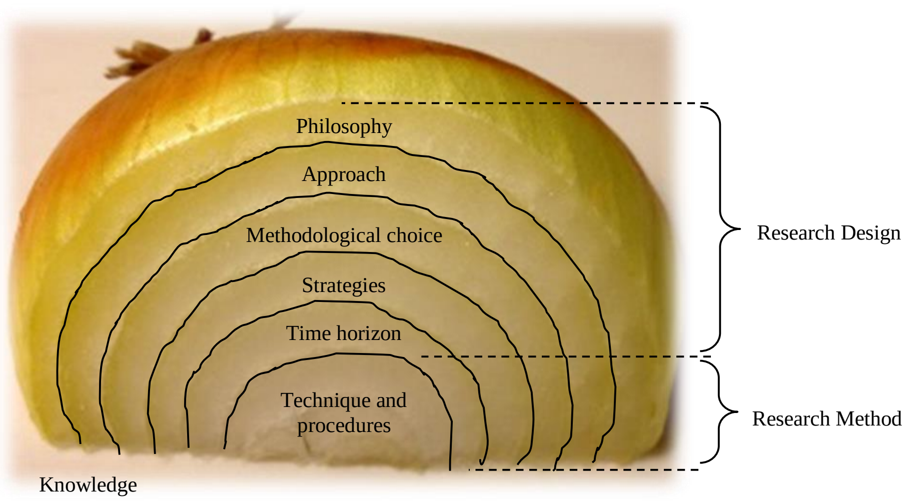


Figure 4.1 The research onion. Source: Permission to reproduce the diagram has been granted by Saunders *et al.* (2012). Photo courtesy: www.manitobamuseum.ca

The second part of this chapter discusses research methodology encompassing the technique and procedures employed in this study including sampling, data collection, organisation, analysis and validation. At the end of this chapter, the summary will provide the entire selection of each layer of the research onion.

4.2 The knowledge: Research scope

The goal of this study is to develop a framework of how to optimise the role of FM in the property development process in the UK and identify a number of issues perceived to be barriers for the integration of FM in the development process. The aim of this study is to establish best practices in a form of framework that works as a guideline for Facilities Managers and other property development professionals in the UK. In theory, the construction of a building should fit the purpose so that the users could optimise the space and supporting facilities provided. However, a poor start at the beginning of the development process will cause a domino effect. For instance, a poor project brief will cause a design fault, and thus will lead to defects in the building. The greater fear is that it might result in building operation disruption and continuous complaints from the users. Consequently, the building owner has to incur extra costs to overcome the problems that arise after the handover. As is customary, Facilities Managers are often called upon to solve the problems during the In Use stage.

FM has become widely discussed subject in the UK, and the scope has been extended from supporting role to the primary activities in the property development process. There is awareness that involvement of FM in the strategic activities in the development process could improve the construction and building performance. However, there are critical issues holding back the involvement of FM in the property development process. Therefore, the main aspect of this research is to identify the barriers prior to translating them into a list of best practices in every stages of the development process in the form of an FM-DP integration framework. In addition, it is important to validate the developed framework and to see what the feedback is, mainly from various professionals in the FM and property development industries.

Research was conducted to answer the research questions and to produce scientific knowledge. Reiterating Gibbons *et al.*'s (1994) ideas on how scientific knowledge is produced, Bryman and Bell (2011, p. 6) condense the process of knowledge production into two (2) categories, as follows:

- Mode 1: Production of knowledge is driven primarily by an academic agenda where the theoretical findings are translated into practice; however, the dissemination of knowledge is limited to the academic community.

- Mode 2: Production of knowledge is driven by a process where boundaries of knowledge of one (1) discipline are encroached by others; moreover, the knowledge is disseminated widely and applied promptly.

As this research was classified as management research, it is more suited to Mode 2 knowledge production. According to Nowotny *et al.* (2003), the knowledge emerging from the research is classified in Mode 2 knowledge production should the element of trans-disciplinarity be present. This explains that the FM discipline would exceed the knowledge boundary of project management or vice-versa. It is also justified that the research is to find ways of improving the performance of the property development process through increased effectiveness and efficiency. As a result, it would increase the understanding of how the development process works, and the impact on the FM community as well as on property development professionals. Mode 2 knowledge production has much greater diversity in terms of the sites and the types of knowledge produced. The research has to be dynamic in order to cope with physical and technical constraints. The former is related to the ability to meet the research subject while the latter is related to the tools used, such as online survey questionnaire and telephone. Nowotny *et al.* (2003) characterise that Mode 2 knowledge is also prone to a dialogic process in which the intensity of conversation between the researcher and the research subjects will be high. The researcher should be able to anticipate that he or she is to interact with the FM and property development professionals. It should be remembered that the discussion should be controlled in order to preserve the accountability of the collected data. Mode 2 knowledge is produced within the element of application. Nowotny *et al.* (2003; p. 186) define that the application is:

> *'... the total environment in which scientific problems arise, methodologies are developed, outcomes are disseminated, and uses are defined'.*

In line with the above definition, it is proven that Chapter Two and Chapter Three have identified the problems, which were translated into research questions. To answer the research questions, there is a need to develop a research design and methodologies. As the outcome of the research is a list of best practices to optimise the role of FM in the property development process in the form of an FM-DP integration framework, it will be disseminated to and applied by the professionals in FM and the property development industry.

The outcome of the research is apparent, where the validated framework could act as a best practice guideline in order to facilitate the property development community to optimise the role of FM in the development process. From the property development point of view, the identification of these qualities will benefit the property development project by supporting the delivery of a successful integration plan (Latham, 1994) and providing the comprehensive image of the future trends of the property development industry. From the FM perspective, this research will add value to FM and increase the awareness of FM in the property development process. Therefore, the assessment of the research philosophy that subsequently influences the decision to shape the research design and select the research methods is crucial. Furthermore, it is to ensure that the findings are more readily exploited in order to achieve practical advantage.

4.3 Research philosophy

Research philosophy is the highest level that inspires the whole process of the research which can be initiated with the assumptions about epistemology (what counts as knowledge) and ontology (the nature of reality) (Crotty, 1998). Those are the basic philosophical assumptions (Bryman and Bell, 2011) and the process (Saunders *et al.*, 2012) that need to be understood by the researcher in order to develop the research. From the built environment perspective, Amaratunga *et al.* (2002) insist that having a sound understanding of research philosophy is essential prior to commencing the research study. On top of that, Creswell (2013) and Mingers (2003) point out that when the researchers undertake a research work they need to be clear about the definition of ethics or axiology (the role of values in research or what is considered right) and research methodology (the process of research). Figure 4.2 demonstrates that epistemology, ontology, axiology and methodology form the subset of philosophical assumptions that illustrates the attributes of research philosophy.

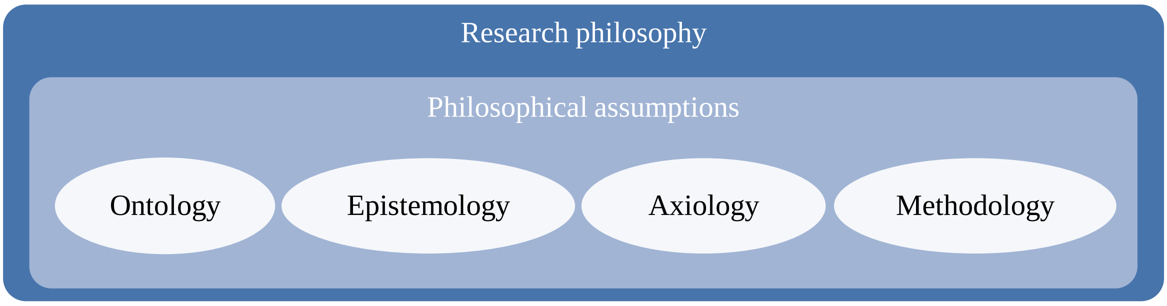


Figure 4.2 The attributes of research philosophy. Source: The diagram is inspired by Creswell (2013) and Mingers (2003)

Connecting those four (4) elements is a challenge for the researcher; however, Bryman and Bell (2011) suggest that it is essential to satisfy ontological and epistemological debate prior to deciding on what is the best process by which to conduct research (Easterby-Smith, 1991). The subsequent sections will discuss ontology, epistemology and axiology followed by the justification of method mixing.

4.3.1 Ontology

Ontology is related to the nature of reality, which Saunders *et al.* (2012) elaborate is associated with the assumptions of the researchers towards the world and their commitment to particular views. They further explain that there are two (2) aspects in ontology: objectivism and subjectivism. The question prevalently asked in relation to ontology is 'what is the nature of reality?' (Creswell, 2013; p. 21, see Table 2.2 Philosophical Assumptions With Implications for Practice). Holden and Lynch (2004) describe that ontology is the first element in the philosophical assumptions, which is consequential to epistemological view, human nature and the selection of research methodology. They argue that an objectivist approach encourages the involvement of the researcher whereas a subjectivist one is to understand a problem by looking at social phenomena. Burrell and Morgan (1979) developed an inclusive philosophical assumptions framework based on the subjective-objective dimension which consists of two (2) positions of ontology: nominalism and realism. The framework is shown in Figure 4.3.

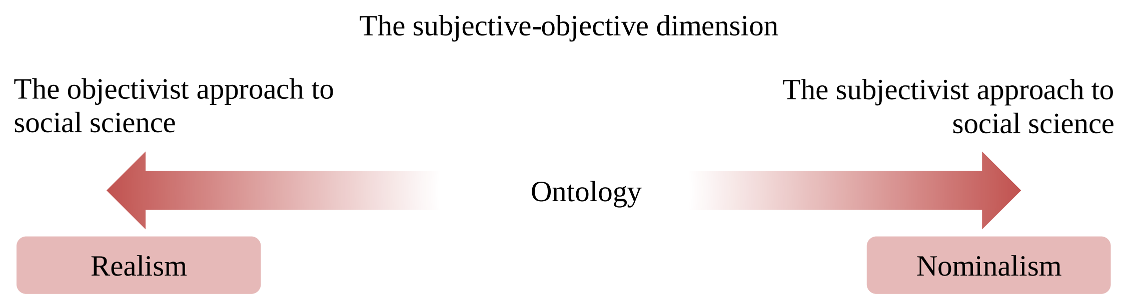


Figure 4.3 Ontological assumptions framework based on subjective-objective dimension. Source: Adapted from Burrell and Morgan (1979)

Easterby-Smith *et al.* (2012) describe that there is no truth in nominalism as the evidence is created by the human. Nominalism assumes that the interaction with the actors creates the social world in terms of experiences and events which are then identified. Unlike nominalism, realism emphasises that the world is external where the evidence can be discovered.

4.3.2 Epistemology

Epistemology is the second attribute of philosophical assumptions, which is concerned about another approach in inquiring into the nature of the social worlds (Saunders *et al.*, 2012). It discusses what kind of knowledge is considered valid in the research (Bryman, 2012; Mingers, 2003). In social science, researchers often assume that the reality is objective and the knowledge is already available in the world and is ready to be discovered (Holden and Lynch, 2004). However, Creswell (2013) highlights that the following question should be answered in order to understand the epistemological position of the research: 'what is the relationship between the researcher and that being researched?'(p.21). From the subjectivist-objectivist dimension, there are two (2) types of epistemology paradigms: antipositivism and positivism (Burrell and Morgan, 1979). Bryman (2012) uses interpretivism and positivism terminologies in arguing the epistemological paradigm. Lincoln *et al.* (2011) outline four (4) different paradigms of epistemology from the nature of knowledge point of view: (i) *positivism* (knowledge is established from a verified hypothesis), (ii) *post-positivism* (possible knowledge is created from reliable hypotheses), (iii) *critical theory* (knowledge is a logical outcome of human interest); and (iv) *constructivism* or *interpretivism* (knowledge is constructed from experience and interaction). Although the participatory or cooperative paradigm is listed as a fifth paradigm, the discussion in this section will focus on the four (4) existing epistemology paradigms which are widely debated, indicating the important of the subject (Lincoln *et al.*, 2011). In summary, the epistemological position is illustrated in Figure 4.4.

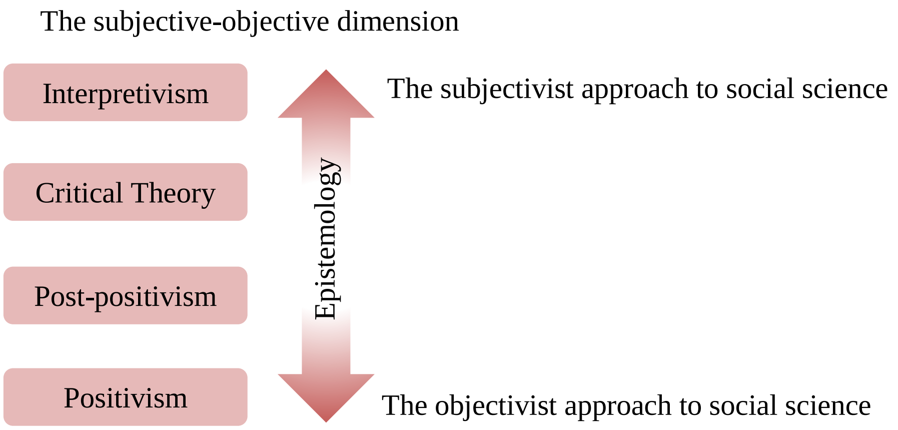


Figure 4.4 Epistemological assumption framework based on subjective-objective dimension.
Source: Adapted from Lincoln *et al.* (2011) and Burrell and Morgan (1979)

4.3.3 Axiology

Axiology is the third branch of philosophical assumptions that deal with ethics, aesthetics and religion (Lincoln *et al.*, 2011). It is all about recognising different values (Mingers, 2003). The question that is prevalently asked in relation to axiology is 'what is the role of values? (Creswell, 2013; p. 21) or, what value is considered right? (Mingers, 2003). Unlike the ontology and epistemology paradigms, which can be viewed from a subjectivist-objectivist dimension, axiology is intangible in the form of value-free and value-bound terminologies. Lincoln and Guba (1985; p. 161) describe that positivists believe inquiry is value-free as a result of the selection of the research methodology. On the other hand, interpretivists assert that inquiry is value-bound; that is, influenced by the values of the researcher, the philosophical assumptions employed and the research settings. However, Lincoln *et al.* (2011) insist that value should be embedded in each research process, beginning from choice of research problem right through to presenting the findings. The axiological assumption is illustrated in Figure 4.5.

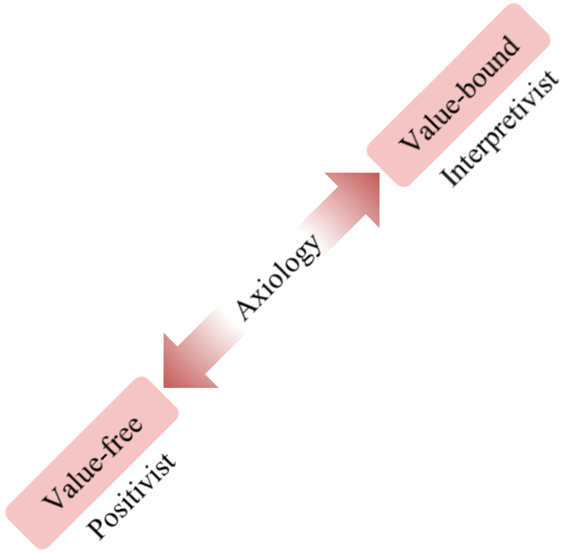


Figure 4.5 Axiological assumption framework based on value-bound and value-free dimensions.
Source: The diagram was inspired by Lincoln *et al.* (2011) and Plano Clark and Creswell (2008)

4.4 Research approach

The inductive-deductive logic process is a tool for social science researchers to determine the possible approach to be adopted in the research (Creswell, 2013; p. 45). Inductive and deductive approaches are often discussed individually as they have different characteristics and are incompatible with each other. However, the introduction of abductive terminology has allowed the amalgamation of inductive and deductive approaches, which encourages the research work to be carried out pragmatically (Saunders *et al.*, 2012). The following subsections will cover all three (3) types of research approach.

4.4.1 Inductive

Inductive is a term given to an opposing approach to deductive. According to Bryman and Bell (2011), the inductive approach leads the researcher to utilise the findings in forming a theory. In other words, it is a mechanism of theory generation. From the inductive approach point of view, the data obtained from the study of a phenomenon is analysed to identify themes and create a conceptual framework (Saunders *et al.*, 2012). Ketokivi and Mantere (2010) describe that inductive research is often associated with routine life and scientific practice that is committed to reaffirming the assumptions, whereas Danermark (2002) characterises that inductive is purely empirical generalisation often beginning with data collection from a small sample of subjects followed by analysis and interpretation of findings prior to building the theory, as illustrated in Figure 4.6.

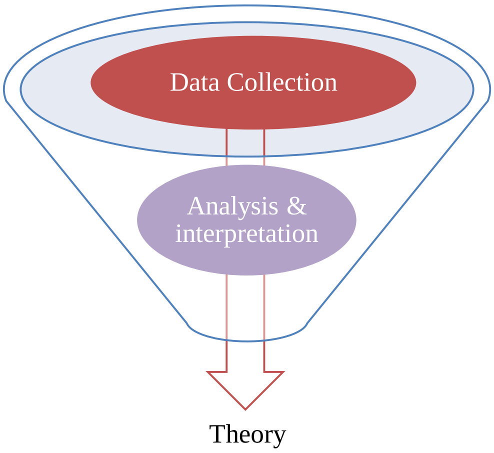


Figure 4.6 The process of inductive reasoning. Source: The diagram is inspired by Saunders *et al.* (2012)

4.4.2 Deductive

The deductive approach is interested in the relationship between theory and research strategy. Saunders *et al.* (2012) describe that the deductive approach begins with theory development, which is mainly coming from a literature review, followed by employment of a selected research strategy to investigate the theory. In the deductive approach, the presence of a hypothesis is inevitable, which the researcher then needs to translate into measurable research objects (Bryman, 2012; Bryman and Bell, 2011). Based on the logic point of view, the deductive approach is derived from a true hypothesis (Ketokivi and Mantere, 2010). The conclusion of the findings should be true and no new knowledge produced. The deductive approach is a mechanism in testing of a theory. Figure 4.7 illustrates the interaction between theory and findings.

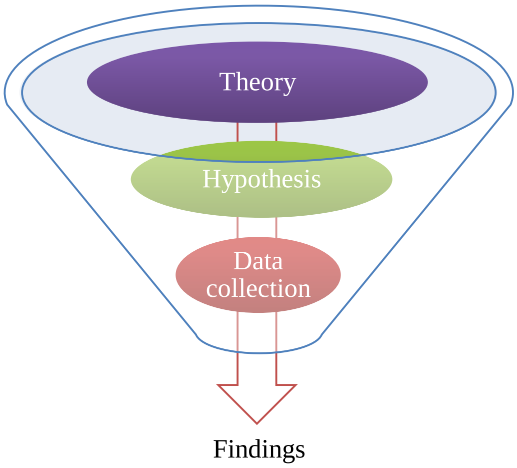


Figure 4.7 Interaction between theory and findings in deductive approach. Source: The diagram is inspired by Bryman (2012)

4.4.3 Abductive

The third research approach is abductive, which is advocated as appropriate for realism ontology (Danermark, 2002), showing that it is in line with positivism epistemology or objectivist position (refer to Figure 4.4). However, there is also evidence that the abductive approach is appropriate for constructivism or interpretivism epistemology (Järvensivu and Törnroos, 2010; Table 1 in p. 101). Suddaby (2006) reiterates that Charles Sanders Peirce, who was known as a logician and pragmatist, invented the terminology of abduction to express his concern regarding the lack of new ideas in deductive and inductive approaches. He later suggested the combination of both approaches, which he believed would encourage creativity or intuition in research to produce new knowledge and new conceptual views of the world. Saunders *et al.* (2012), however, opine that the abductive approach is flexible and allows 'back and forth' movement between deductive and inductive approaches (p. 147). Research in the abductive approach works at the outset by observing an unexpected phenomenon, but the ability of the researcher to exploit the relationship between findings and concept is imperative in order to create a reasonable theory or to extend the existing one (Andreewsky and Bourcier, 2000; Van Maanen *et al.*, 2007). On the other hand, a major concern in the abductive approach is the ability of the researcher to be present in the subject's worldview and to comprehend the settings of the subjects under investigation (Bryman, 2012).

Abduction is a difficult concept to embrace as a different philosophical view having a different interpretation to inductive and deductive approaches (Danermark, 2002). Furthermore, it is common to see the researcher going 'back and forth' between theory and empirical study to develop their understanding of the theory and the empirical phenomena (Dubois and Gadde, 2002). Bryman (2012) concludes that there is an ambiguous context between inductive-deductive and abductive, which has resulted in interchangeable use of the term.

4.5 Methodological choice

The decision in selecting qualitative, quantitative or a mixture of both in the research project relies significantly on the nature of the research and philosophical idea, ontology and epistemology (Saunders *et al.*, 2012). This section begins with a critical literature review on qualitative and quantitative research and their position in the research philosophy (ontology and epistemology) as well as their relationship to the research approach (inductive, deductive and abductive). At the end of this section, the reader will find the justification of whether or not the mixing of the two (2) methods is appropriate for this research.

4.5.1 Qualitative research

Qualitative research is a situated activity that requires the researcher to be present in the world of the participants under investigation (Denzin and Lincoln, 2011). Qualitative research is interested in investigating human action and expression. It involves various interpretive approaches to understand the world of the participants in its real-life settings. The knowledge obtained from qualitative research is prevalently in a subjective form which needs to be transformed into tangible evidence such as audio recording and interview or conversation transcription. Creswell (2013; p. 44) describes qualitative research in a more systematic way by emphasising the research approach and the process:

> *'Qualitative Research begins with assumptions and the use of theoretical frameworks that inform the study of research problems addressing the meaning individuals or groups ascribe to a social or human problem. To study this problem, qualitative researchers use an emerging qualitative approach to inquiry, the collection of data in a natural setting sensitive to the people and places under study, and data analysis that is both inductive and deductive and establishes patterns and themes. …'*

According to Denzin and Lincoln (2011), qualitative research is a complex research approach and it is difficult to define its position in terms of philosophical assumption. Qualitative research is not bounded by a certain research method; thus, it allows the researcher to employ multiple techniques in data collection. It is claimed as a highly creative act that requires researchers to be creative, flexible, and have intuitive skills as well as possess an encyclopaedic knowledge in the field of research (Morse, 1995). As stated by Amaratunga *et al.* (2002; p. 25), 'Qualitative research may be conducted in dozens of ways, many with long traditions behind them'.

Qualitative research is often associated with interpretivism in epistemological orientation, the purpose of which is to understand the social world of the subjects by emphasising the meaning of action and the expression of mind (Bryman, 2012). The content of the data collected in qualitative research is analysed by separating it into themes and patterns in an inductive approach while developing a theoretical framework and generalising specific findings (Saunders *et al.*, 2012). However, it is important to note that qualitative research is prone to misapplication, as it is not necessarily dedicated to generate theories. Depending on how the existing literature is treated, it can be used to test the theories (Bryman, 2012). Qualitative research is argued to be objective, which is it falls into positivism epistemology depending on how the subjects view their social world (Bryman, 2012). On top of that, there is evidence that qualitative research is compatible with the abductive approach, where inductive and deductive approaches are utilised (Saunders *et al.*, 2012).

Doing qualitative research is like an expedition to an unknown territory (Suddaby, 2006). The key element to know whether the results are complete is to realise that the data saturation point is achieved. Although there are no specific guidelines to determine the data adequacy, Morse (1995) has outlined the principles of data saturation in qualitative research. These are:

- Select subjects that share the characteristics related to the research topic to create great cohesiveness of the sample and to accelerate the saturation level;
- use a technique – whether theoretical, snowball or convenience sampling – to ensure the data saturation is achieved rapidly;
- when developing a theory, identify the negative statements and give them priority during the analysis;
- ensure that the theories are logic and reasonable; and
- be aware that one of the signs of data saturation is smoothness during the development of the theoretical framework.

Data in qualitative research is not straightforward to analyse as it is often recorded in non-numerical form. Bryman and Bell (2011) stress that the rules of how qualitative data analysis should be implemented are subjective and difficult to formulate. It is not a process that can be rigidly organised. Therefore, an insignificant amount of qualitative research conducted using a qualitative approach should be anticipated. This claim could be true when looking at Andrew Dainty's statistical records (quoted in Knight and Ruddock (2009)), which reveal that the number of research papers using a qualitative method in the built environment discipline is small compared to quantitative and mixed methods. The research also revealed that open-ended individual interview is the most favoured method followed by focus group interviews (p. 6). In contrary, similar research conducted by Ventovuori *et al.* (2007) shows that research employing an inductive approach using interview and field-based observation strategies is predominant in the FM discipline.

FM as a multi-disciplinary field is envisaged to enhance the business and social aspects of the end user's needs, where all of these activities are happening in the built environment. FM and built environment are interrelated and it is common for FM to employ project management principles in building performance research (Nutt, 1999). The presence of FM seems to be an alternative to improve the existing management concept in built environment research. It is understandable why FM is interested in qualitative research, as, according to Amaratunga *et al.* (2002), it provides six (6) benefits to the field of built environment: (i) qualitative research is influential for researching any process, (ii) flexibility characteristics in it build the confidence of the researchers in understanding the world of the participants, (iii) it is an appropriate method for discovering the meaning and relating it to the social world of the participants, (iv) it is reliable in exploring new topics in the field of FM, (v) it is robust in hypothesis testing and (vi) qualitative research is useful to further clarify numerical data.

Qualitative analysis should be executed in stages using appropriate strategy. According to Amaratunga *et al.* (2002), qualitative analysis must begin with data condensation, which involves managing the data using appropriate computer software. For this, the researcher might need to transform the data into material that is more tangible. The second step is data display, which, according to Creswell (2013), involves reading the transcriptions and jotting down the key points mentioned by the subjects, identifying the themes and interpreting the idea. The third step in qualitative analysis is verification, where the analysed data is written down in a report and should be able to be presented in a visual form.

4.5.1.1 Qualitative inquiry strategies

There are a numbers of inquiry strategies in the qualitative method, which is essential in guiding the researcher to answer research questions by taking elements of the philosophy and data collection techniques (Saunders *et al.*, 2012). Holden and Lynch (2004) were able to determine the position of inquiry strategies based on subjectivism-objectivism aspects and their relationship to epistemology. For novice researchers, it is crucial for them to be able to distinguish a variety of inquiry strategies and present them in a scholarly structure (Creswell, 2013). Creswell (2013) and Saunders *et al.* (2012) are writers who have been able to describe the key characteristics of various inquiry strategies. Although there are different types of inquiry strategies in qualitative research, this section will only focus on four (4) strategies: (i) phenomenology, (ii) ethnography, (iii) case study and (iv) grounded theory.

4.5.1.1.1 Phenomenology

Phenomenology lies at the extreme subjectivist point of the subjective-objective continuum in which it is positioned within antipositivism or interpretivism of epistemological paradigm (Morgan and Smircich, 1980). However, there are arguments that the characteristics of phenomenology are not able to be determined through the subjective-objective dimension; instead, phenomenology is located between the range of qualitative and quantitative study (Creswell, 2013).

Phenomenology, as defined by Creswell (2009), is an inquiry strategy that is interested in identifying human experiences about phenomena as expressed by the participants under investigation. This approach directs the phenomenological researcher to appreciate the different meanings of people’s experiences and the reasons for the differences (Amaratunga and Baldry, 2001). Therefore, phenomenology requires the researcher to make an interpretation of the meaning of the experiences holistically (Creswell, 2013). Since phenomenological researchers are ‘seeking the whole and not… the parts’ (Danermark, 2002; p. 161), this strategy uses a qualitative approach to understand and explain a phenomenon in order to develop a theory (Amaratunga *et al.*, 2002).

According to Danermark (2002), phenomenology is the central point of qualitative research that was originated by Alfred Schutz and Harold Garfinkel. It is advised that phenomenologists ignore their previous experience prior to carrying out phenomenological research in order to gain uncontaminated knowledge (p. 159). Creswell (2013; p. 79) terms this as bracketing, which he regards as ‘not letting past knowledge be engaged while determining experiences’. In one sense, the phenomenological researcher is trying to minimise the physical distance from the participants (Holden and Lynch, 2004) and, in another sense, the researcher has to isolate their experiences in their mind in order to gain knowledge about ‘causal power’ (Danermark, 2002; p. 159).

4.5.1.1.2 Ethnography

Ethnography is an inquiry strategy which focuses on investigating people in groups who work together and share the same culture. Based on the epistemological paradigm, ethnographic research adopts a more interpretivist approach (Holden and Lynch, 2004). Creswell (2009; p. 13) describes that the ethnographic researcher ‘studies an intact cultural group in a natural setting over a prolonged period of time’. Ethnographic researchers work closely with the participants. Therefore, it is crucial for the researcher to gain trust from the participants in order to acquire reliable data (Saunders *et al.*, 2012). Interview is common in ethnographic research; nevertheless, the researcher is allowed to discover other sources of data throughout the research period.

4.5.1.1.3 Case Study

Case study involves in-depth interviews and intensive analysis employing an encoding process (Holden and Lynch, 2004). Case study can be conducted with a single case or more cases for comparative purposes (Bryman, 2012). The factors that often influence the choice of case studies are observability and analysability of the case under investigation (Creswell, 2013). The data required in case study research is considerably detailed but collected over a short period of time, which is often regarded as a major constraint in case study research. However, the researcher has the freedom to use multiple techniques to gather the data (Creswell, 2009). Another advantage of conducting case study research is the use of a triangulation approach in which the quantitative elements such as statistical analysis are allowed to strengthen the case study results (Saunders *et al.*, 2012). In the event that the researcher has to incorporate more than one case, it is appropriate for the research to move ‘back and forth’ between inductive and deductive (p. 180).

In FM research, Amaratunga and Baldry (2001) identify using the case study method to measure performance in facilities management organisations where they clearly incorporate quantitative and qualitative approaches in the research strategy. They summarise that case study is an appropriate method to describe the process of theory building that accepts descriptive and prescriptive research.

4.5.1.1.4 Grounded Theory

According to Creswell (2013), grounded theory is a strategy by which to collect and analyse data in a systematic way in order to discover theory. Pathirage *et al.* (2008) claim that grounded theory is an iterative process to produce new data and reanalyse existing data, which involves the dynamic of inductive-deductive thinking. Saunders *et al.* (2012) acknowledge that grounded theory corresponds to the abduction approach. In grounded theory, restructuring data into themes (open coding) is essential, followed by recognising the relationship between the themes (axial coding) and integrating the themes (selective coding) as a final step to develop a theory (Saunders *et al.*, 2012). It involves multiple stages of data collection, improvement and correlation between the data. The data collection and analysis is repeated until theoretical saturation is reached (Saunders *et al.*, 2012). There are two (2) major features in grounded theory: (i) constant comparison – each item collected is compared with others, and (ii) theoretical sampling – the process of maximising the similarities and differences of the data.

4.5.2 Quantitative research

The Longman dictionary of contemporary English (2003) describes quantitative as 'relating to amounts rather than to the quality or standard of something' (p. 1341). Quantitative measurement is interested in numbers, where mathematical functions such as comparison, frequency and statistical analysis are common in order to confirm the reliability (Amaratunga *et al.*, 2002). From an ontological point of view, quantitative investigation is categorised as highly objective research (Long *et al.*, 2000) which requires the researcher to play a role as an outsider who is trying to understand the social world of the subjects under investigation (Jean, 1992). As quantitative research tends to be objectivist, the research is directed to positivism epistemologies that are concerned with the relationship between the variables. A statistical technique is prevalently used as a tool to help researchers to assess the relationship between variables (Saunders *et al.*, 2012). The results which appear in numbers need to be interpreted in order to explain the phenomena or to predict any changes in the future. It is also advocated that quantitative research is conducted using a deductive approach, which is the effective way to utilise the data for theory testing (Jean, 1992). Nevertheless, it is argued that the elements of the inductive approach are employed in quantitative research in order to generate theory (Saunders *et al.*, 2012).

According to Amaratunga *et al.* (2002), quantitative research is an appropriate approach in built environment research. This is not surprising when Andrew Dainty reveals that the majority of peer-reviewed papers and books in construction management research use a quantitative method (Knight and Ruddock, 2009). In general, survey research using self-administered questionnaires and structured interviews is the most popular technique used in quantitative data (Amaratunga *et al.*, 2002; Bryman, 2006; Easterby-Smith, 1991), and this can be true particularly in the topic about the responsibility of FM in business and its role in supporting the growth of the FM industry (Ventovuori *et al.*, 2007). Considering the benefit of qualitative research in the field of built environment, FM should be able to appreciate the following advantages (Amaratunga *et al.*, 2002):

- Comparison and repetition in quantitative research are permitted;
- researchers do not influence the participants (neutral);
- the source of data is treated objectively;
- reliability and validity is measured objectively;
- robust in measuring descriptive aspects;
- generating hypothesis is required prior to verification; and
- generalising from general to specific (deductive approach).

Despite the fact that quantitative data analysis is usually carried out at almost at the end of quantitative research, Bryman and Bell (2011) recommend that quantitative researchers when designing questionnaires should be able to predict the statistical techniques that will be used. It is important to ensure that the created variables have features that are consistent with the statistical techniques used. Furthermore, statistical analysis does not work in all circumstances. There are limitations in performing statistical analysis depending on the scope and characteristics of the sample.

4.5.2.1 Quantitative inquiry strategies

There are two (2) common strategies of inquiry in the quantitative method: experiment and survey. The former is often associated with natural science and laboratory works in engineering fields. In contrast, survey concentrates on quantitative data collection, which is able to be analysed quantitatively using a variety of statistical techniques (Saunders *et al.*, 2012). The following subsection will focused on the survey method, which is broadly used in social science.

4.5.2.1.1 Survey

The survey strategy is often associated with positivism of the epistemological paradigm. There are three (3) basic beliefs embedded under survey strategy: i) the world is external and objective[11], ii) the researcher is independent[12] and iii) the knowledge is value-free[13], in which human interaction is inevitable and ethics must be given attention (Amaratunga *et al.,* 2002). Survey is grounded by the deductive approach, where the process of deducing the hypothesis from existing theory is required; consequently, the data collected is to be tested using relevant statistical procedures (Bryman, 2012). In other words, survey is appropriate for descriptive and analytical research to discover the relationship between the variables (Saunders *et al.*, 2012). This strategy usually involves large samples; therefore, the data obtained has to be manageable. For that reason, structured inquiry, structured observation and self-administered questionnaire survey are commonly used as they can be fast and cost-effective. The data obtained in surveys is objective, quantifiable and based on numbers. Amaratunga *et al.* (2002) recognised it as 'hard generalisable data' where the characteristic is rigid and inappropriate to understand the participants contained in the world (p. 20).

The ultimate purpose of the discussion in Section 4.5 is to identify the most relevant research strategies for data collection with a sound understanding of philosophical assumption behind them. According to Gill and Johnson (2002), research methods can be positioned between realism and nominalism ontologies (refer to Figure 4.8). It is apparent that survey and experiment have a tendency to realism ontology, whilst phenomenology, ethnography and grounded theory tend to nominalism.

[11] The ontological paradigm in survey strategy is realism in which, according to Burrell, G. and Morgan, G. (1979) *Sociological Paradigms and Organisational Analysis: Elements of the Sociology of Corporate Life* the world is objective in nature and 'out there' in the world.
[12] The researcher is neutral, making inquiries from outside of the participant's world and leaves the data uncontaminated.
[13] The axiological paradigm in the survey is value-free (refer to Section 4.3.3 for the definition of value-free).

Case studies are more flexible, which means that the researcher is allowed to move 'back and forth' between deductive and inductive approaches.

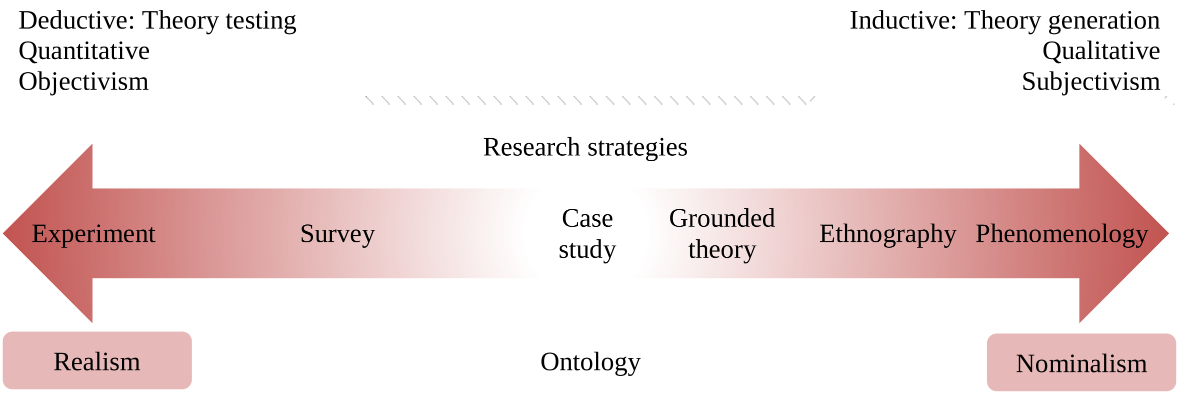


Figure 4.8 Research strategies along axiological trajectory. Source: Edited from Gill and Johnson (2002)

4.6 Justification for using mixed methods approach

The aim of this research is to develop a framework to assist better integration between FM and the development process. This research began with an extensive literature review to understand the overall scenario of FM and the property development industry in the UK. By understanding the phenomena and the problems, on the one hand, the researcher was able to identify the barriers that hinder the optimisation of FM in the development process. On the other hand, it helps the researcher to assimilate the social world and the philosophical assumption that comprises ontology, epistemology, axiology and methodology in a chronological manner, as these assumptions influence each other (Holden and Lynch, 2004).

From the research philosophy point of view, it is argued that the mixing of qualitative and quantitative research is not viable as there is conflict in terms of ontological and epistemological principles (Bryman, 2012). Furthermore, there is uncertainty regarding its technical ability (p. 631). However, Creswell and Clark (2011) contended that the pragmatism paradigm is best suited to mixed methods research. Mixed methods concentrate on the utilisation of various methods of data collection in sequence or in parallel to answer the research questions. The combination of both qualitative and quantitative research methods is capable of optimising the advantages and at the same time reducing the risk should they be implemented individually (Bahari, 2010). In the built environment discipline, mixed methods yield better understanding of the social world of the participants, effective data collection and data analysis (Knight and Ruddock, 2009; p. 11). In addition, the mixing of qualitative and quantitative research methods in the built environment discipline would contribute to the quality of the results (Amaratunga *et al.*, 2002). Considering the advantages and disadvantages of linking qualitative and quantitative data within the built environment, the following justification for using a mixed method approach should be considered:

- Enable confirmation between qualitative and quantitative methods via a triangulation approach;
- better explanation with complete supporting details obtained from analysis; and
- invention of new knowledge and fresh understanding.

Studies by Mingers (2003) explain how philosophical assumptions (ontology, epistemology and axiology) influence the combination of several research methods (qualitative and quantitative) in the management science practice. It begins with the 'do X by Y in order to achieve Z' (p. 562) principle. From the ontological, epistemological and axiological positions, Mingers demonstrated that this principle can be used to identify a root definition of a generalised management science methodology. Using the same principle, a root definition of this research was rewritten as:

> 'A research to **do** inquiry, **by** identifying the best practices in the form of FM-DP integration framework based on the subjects' experience and statistical analysis gained from social world, **in order** to encourage FM professionals to achieve a better integration in the development process'.

The above root definition makes clear the three (3) types of research philosophical assumptions. The keywords represented by different line patterns will provide the keyword for the answer to the questions often associated with ontology, epistemology and axiology:

- The single underlined text represents the keyword for the answer to the ontological question: What is assumed to exist?
- The wavy underlined text represents the keyword for the answer to the epistemological question: Where does the model come from and what character is represented?
- The dashed underlined text represents the keyword for the answer to the axiological question: What is the purpose of the framework?

From the literature, it can be understood that there are three (3) conditions that justify why this study should be conducted using mixed methods research. Firstly, past research efforts to integrate FM into the property development process are limited. Therefore, there are inadequate guiding theories related to this issue. Secondly, the barriers and the best practices for effective integration of FM in the development process are identified from a number of literature sources. This causes difficulty in determining the variables that need to be evaluated. Thus, the best way to verify the variables is to obtain the views of knowledgeable and experienced professionals in the FM property development industry. With this approach, the data collected is anticipated to be more subjective and prone to be qualitatively oriented. Thirdly, there are limited quantitative approaches in construction management-FM related research, which results in the unavailability of instruments to measure the variables of FM-DP integration. Consequently, it is essential to develop a reliable instrument such as survey questionnaire so that the numerical data obtained is able to be analysed using an appropriate statistical technique. Based on the above explanation, it is justified that the study is consistent with the purpose of conducting **exploratory sequential mixed methods**, as outlined by Creswell and Clark (2011; p. 86).

4.6.1.1 Exploratory sequential mixed methods design

In mixed methods design, quantitative and qualitative data collection can be done simultaneously or sequentially. The former is represented with + symbol, whereas the latter is represented with → symbol (Creswell, 2009). Mixed methods design considers the priority of the research work whether it is prone to qualitative or quantitative approach (p. 206). Morse *et al.* (2006) classify the decision to determine whether the research is qualitatively or quantitatively driven as theoretical drive, which is crucial to ensure the validity of the research work. In this light, the mixed method involves a core component (represented by ‘QUAL’ or ‘QUAN’) and a supplementary component (represented by ‘qual’ or ‘quan’).

As the data has to be collected sequentially, timing is crucial and the theoretical drive has to be determined precisely. In this research, the intention for the primary data collection is to obtain the opinions of various professionals in FM and the property development industry. This justifies why a qualitative approach is selected as a core component (Creswell, 2009; p. 206). On top of that, the qualitative data is exploited for in-depth quantitative study. A secondary data collection begins with a quantitative approach in which the previous qualitative data is used deductively. This approach allows the researcher to generalise the findings to a wider population and test the hypothesis in order to develop an FM-DP integration framework. An additional qualitative element is employed to provide a platform for in-depth discussion of the research results, disseminate the findings and examine the final product for validity (Stewart *et al.*, 2008). The process of mixed methods design of this research is illustrated in Figure 4.9.

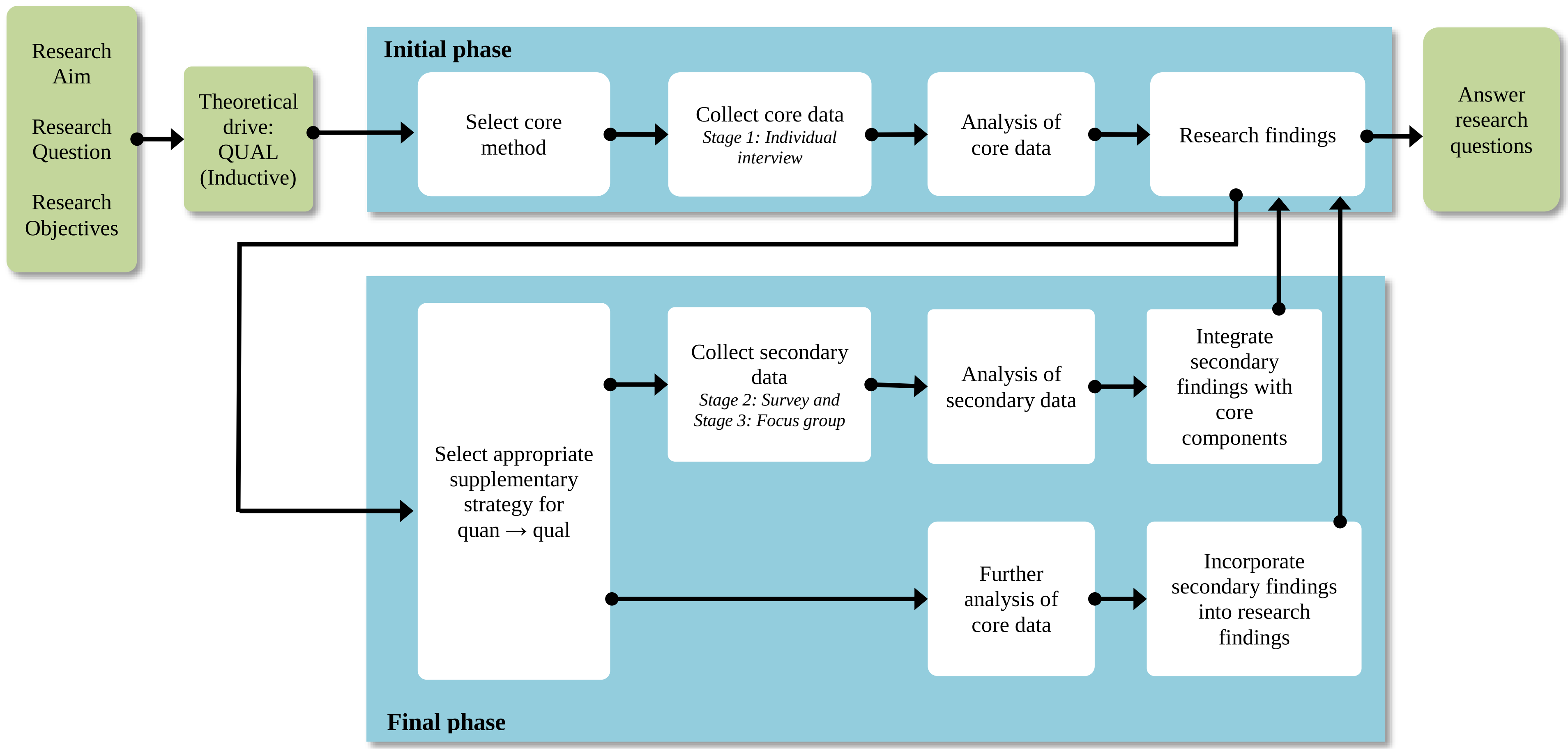


Figure 4.9 The process of exploratory sequential mixed methods design. Source: Edited from Morse *et al.* (2006) to correspond with the nature of this research

4.7 Research theoretical framework

In summary, the ontological paradigm of this research is moving back and forth between a realism and nominalism trajectory, which inspires the dynamic of epistemological paradigm involving positivism and interpretivism. In the light of this, an exploratory sequential mixed methods design is to be employed involving interviews, survey and additional focus group for validation. As qualitative and quantitative methods are to be utilised, the researcher is confined to an axiological paradigm between value-bound and value-free.

To recapitulate this research in the nomenclature of exploratory sequential mixed methods design, it can be represented as: QUAL $_{\text{individual interview}}$ → quan $_{\text{survey questionnaire}}$ → qual $_{\text{focus group}}$.

Combining all elements of research philosophy, research approach and methodological choice, the pragmatism paradigm of this research is illustrated in Figure 4.10.

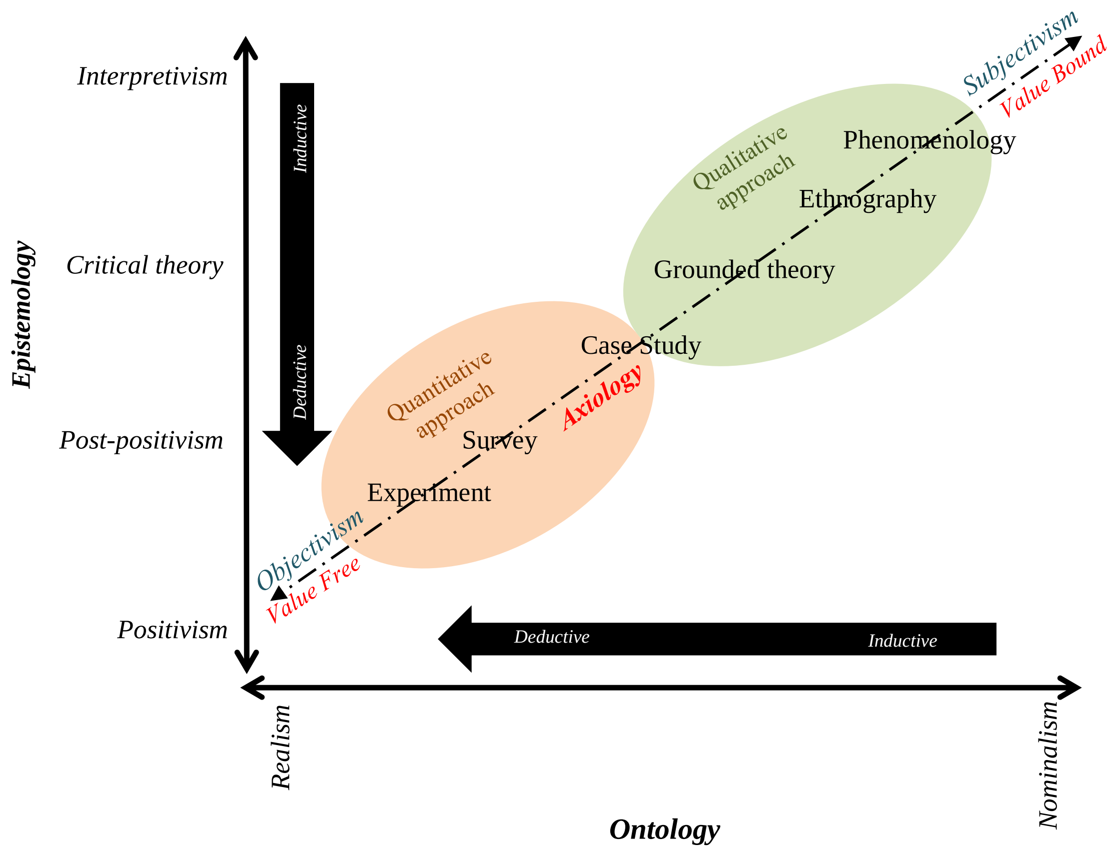


Figure 4.10 Positioning the pragmatism research paradigm. Source: Inspired by Dawood and Underwood (2010)

Table 4.1 Detail of research procedures, justifications and outcomes

Approach	Research Objectives	Procedures	Justifications	Outcomes	Strategy
	Phase 1 Objective (i): To explore the importance of FM and its relationship to the development process	Review of FM, development process, construction and project management literature	Establish research area in FM-DP integration	To date there are individual papers discussing the barriers for FM-DP integration There is limited research to combined all determinants and get them evaluated by the property development industry community	
Qualitative	Phase 2 Objective (ii): To identify a number of issues perceived to be barriers for the integration of FM in the development process	Identification of the most common barriers of FM-DP integration	Various literature on FM-DP integration – needed to focus on barriers that hinders FM-DP integration	Identification of eight (8) main themes containing 33 sub-themes that are perceived as barriers for effective FM-DP integration	Inductive strategy
		Stage 1 of Data collection: Semi-structured interviews with ten (10) FM and property development professionals	To confirm findings from Stage 1 of the research and allow for new variables that emerge in this phase	Confirmation of eight (8) key main themes with change of four (4) original main themes	
		Use of thematic analysis approach to analyse interview transcript	Typical methods of analysing qualitative interview data	Nine (9) main themes emerged 35 sub-themes were listed	
	Phase 3 Objective (iii): To establish the best practices for the integration of FM in the development process	Development of main themes and sub-themes	Preparation for effective amalgamation of findings in Phase 1 and Phase 2 in order to formulate the critical success variables of FM-DP integration	Nine (9) main themes were emerged 39 sub-themes were listed and to be considered in the survey instrument	
		Review of constructs derived from Phase 2	Consider all reviewed constructs in the survey instrument		
Quantitative	Phase 4 Objective (iv): To develop an FM-DP integration framework	Selection of survey tools	Launch pilot survey to test the validity and reliability of the instrument	No pre-validated survey instrument existed	Deductive strategy
		Development of survey instrument based on Stage 2 findings	Incorporation of finalised construct to survey instrument and selection of participants	Completed survey instrument Participants were identified	
		Stage 2 of Data collection On-line and off-line survey	Use of online and postal self-completed survey	156 respondents completed the survey	
		Data analysis using differential and inferential statistical methods	Rigorous and robust statistical analysis techniques	Five (5) constructs and 15 items emerged	
		Review of Phase 1, Phase 2 and Phase 3 findings in order to develop an FM-DP integration framework	Assessment of the results in order to formulate the framework in a most suitable form	Proposed FM-DP integration framework	
Qualitative	Phase 5 Objective (v): To validate the concept of the FM-DP integration framework	*Stage 3 of Data collection* Focus group	Disseminate the framework to participants for in-depth discussion	Three (3) participants were identified.	Inductive strategy
		Use of content analysis approach using framework method	Typical methods of analysing qualitative data	Analysis results defined the best practices of FM-DP integration	
		Finalise the framework based on the focus group findings	To confirm the results	Validated FM-DP integration framework	

Source: Self-study

4.8 Qualitative data collection methods

4.8.1 Stage 1 of data collection: Face-to-face interview

The interview is undoubtedly the most frequently used method in qualitative research. It is often claimed to be the best method of collecting data despite its complex characteristics (Easterby-Smith, 1991). It encourages the researcher to talk to those who have knowledge and experience in the property development process. As quoted by Chase (2011), 'narrative researchers work closely with individuals and their stories' (p. 423). Gillham (2005) points out that, unlike quantitative surveys, qualitative interviews are 'open', allowing the researcher to ask questions or raise current issues while the participant has the freedom to respond. This method develops an interactive environment between researcher and participant into a narrator and listener relationship, which permits the researcher to explore complex, contradictory or counterintuitive matters, particularly on the points raised. Also it allows the researcher to study the real-life world that could not be seen by reconstructing events the researcher has never experienced (Rubin and Rubin, 2012). Informal inquiring gives sufficient space for the researcher to harness unexpected answers that could arise from the interview session.

Kvale and Brinkmann (2009) cited by Creswell (2013) highlight that there are seven (7) logical sequences of stages to an interview inquiry starting from thematising, designing, interviewing, transcribing, analysing, verifying and finally reporting the study. These seven (7) stages are central for the researcher to proceed with the study, particularly in Phase 2. The next section discusses in detail the attribution of each stage in association with the action taken in this study.

4.8.1.1 Thematising

Kvale and Brinkmann (2009) define thematising as an action to prepare the purpose of a piece of research and the idea of a theme to be explored before the interview sessions take place. For this, the researcher needs to deeply understand the purpose of the research. As discussed in Section 4.6.1.1, this research deployed exploratory sequential mixed methods design in order to achieve the objectives and aim of the study. This was generated by undertaking an extensive literature review on the subject and identifying the barriers that prevent the optimisation of FM in the property development process.

Rubin and Rubin (2012) describe that qualitative researchers investigate complex situations using multiple techniques such as observations, document analysis and various interview methods. The researchers often combine several techniques in a single research project. Documentary analysis through critical reading of recent research papers or books in the field of FM-DP integration is an approach used in formulating the aim and objectives of the research. It is a strategy in obtaining pre-knowledge of the subject matter that needs to be investigated. Documentary analysis conducted as part of the qualitative interviewing part of the study improves the quality of the interview. The outputs of documentary analysis are most useful when combined with interviews, which allow thorough discussion within the developed theme. Table 4.1 justifies that qualitative research in Phase 2 and Phase 3 was to confirm findings obtained from Phase 1 and allow for the creation of new themes. On the other hand, qualitative research in Phase 5 was to validate the concept of the FM-DP integration framework.

4.8.1.2 Designing

This section discusses the procedures and techniques of how the data is collected qualitatively. It is essential to highlight that the selected techniques should satisfy the requirements of the study for which the aim is to look for rich and detailed information and maximise the value of openness (Gillham, 2005). Simultaneously, the technique employed should allow the participants to respond freely and acknowledge the researcher's intervention (Rubin and Rubin, 2012). An in-depth qualitative interview is categorised as the primary tool of research to explore complex situations and the most preferred approach by naturalistic researchers (Rubin and Rubin, 2012). Although this is the most advantageous qualitative interview approach, Gillham (2005) argues that an in-depth qualitative interview is costly and time consuming throughout the process - preparation, analysis, interpretation and reporting. Gillham (2005; p. 28) further acknowledges that the best data-gathering technique is 'what is adequate with the research task'. It would be beneficial for the researcher to stick with cheaper research options, and optimal aspects should be adapted as research is often restricted by the size and representativity of the participants (Kvale and Brinkmann, 2009). Therefore, the face-to-face method was selected in order to carry out in-depth individual qualitative interviews through semi-structured interview. Figure 4.11 shows the diagram of the design of interview technique for this research.

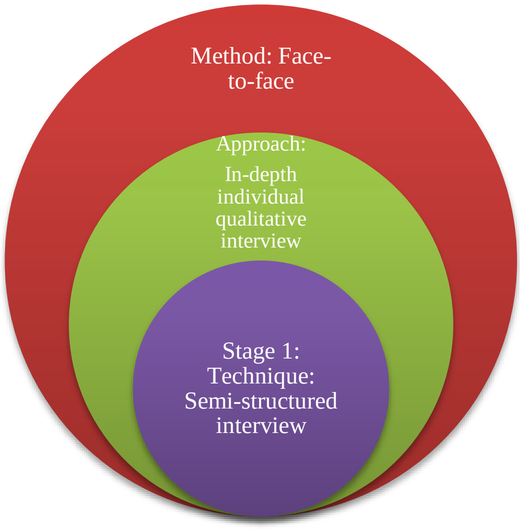


Figure 4.11 Design of interview technique. Source: Inspired by Rubin and Rubin (2012)

Qualitative data collection in Stage 1 is sought to identify a number of issues perceived to be barriers for the integration of FM into the development process. It is also used to gain feedback from the participants concerning the findings uncovered from the literature review. On top of that, the interview is essential to validate themes and their contents. This involved selection of participants who have vast experience and knowledge in the property development industry and FM industry in order to optimise the data required.

The criteria of qualitative research should be defined as balanced, thorough, credible, accurate and rich with ideas (Rubin and Rubin, 2012). The key to success in qualitative research is to collect data as much as possible until saturation happens (Morse, 1995); however, it would be risky to let the participants pour out their thoughts without limitations. Therefore, it is the responsibility of the researcher to control the participants in order to avoid misunderstanding and a false sense of saturation. Meanwhile, Corbin and Strauss (2008) define that data saturation is reached whenever new data no longer appears. In building theories, saturation is reached when the themes are well defined, which, according to Bryman (2012), means that the relationships among themes are well established and validated. Nevertheless, there are no specific guidelines regarding how the saturation of the data is reached. In human communication research, Myers and Oetzel (2003) notify that the interview should resume until the point of saturation is reached, which is indicated by repetition of the existing ideas resulting in the lessening of the enjoyment of the discussion. Saturation of data can also be determined by researcher’s judgement on the adequacy and the comprehensiveness of the results (Morse, 1995).

4.8.1.2.1 Sampling

According to Morse (2003), sampling is a continuous process until the level of saturation is reached. There is no specific formula for estimating the sample size in qualitative research (Morse, 1995) as the sample size cannot be predicted (Morse, 2003). Cost and time influence the sample size, as Morse (2003) advises: '… you must calculate some number as the requested dollar amount; experience has also taught me that it is folly to minimize, rather than maximize, the sample size' (p. 740). It is obvious that the amount of data that is ready to be analysed is much more important than the sample size and the quantity of raw data. Purposive sampling requires the researcher to assess the participants who are highly likely to answer the research questions and fulfil the research objectives.

4.8.1.2.2 Questions protocol

13 questions were designed in such a way as to help the participants think about their perceptions towards facilities management and its importance in the development process; and what other barriers lead to obstruct FM-DP integration. Most importantly at this stage, the 33 critical issues uncovered from the literature were shared with the participants in order to understand the phenomenon. The questions are theory-driven questions derived from themes through the combination of solid theoretical background in an area. According to Weitzman and Levkoff (2000), this type of question could enhance reliability of the data.

To guide the researcher before and during the data collection process, Merriam (2009) advocates that it is beneficial for the researcher to prepare an interview protocol containing instruction and script for the process of interview, the questions to be asked, and some space to write notes about the responses from the participants. Table 4.2 provides the matrix of the questions protocol. (See Appendix E for the detail of the interview questions protocol.)

Table 4.2 Matrix of the questions protocol

	Description	No. of questions
Part 1	General involvement in property development process	3
Part 2	Critical issues of integrating FM into property development process	8
Part 3	General opinions of FM in property development process	2
	Total	**13**

Source: Self-study

Within this study, qualitative data collection was undertaken twice. Firstly, semi-structured individual interviews were conducted to achieve Objective (ii) and Objective (iii), while focus group interview was performed to achieve Objective (v).

4.8.1.3 Interviewing

Selecting interview tools to be implemented in this research was a challenging task. A correct interview tool should correspond to the philosophical aspects of the research and should be able to satisfy the objective of the research. In their introduction to qualitative data-gathering methods and style, Rubin and Rubin (2012) emphasise in-depth interviewing techniques that are predominantly implemented in naturalistic research. The questions in this technique are open-ended, in which the participants can have flexibility in responding to the question in their own manner, elaborating upon the answer, disagreeing with the question or raising new issues. In addition, the questions are not fixed, meaning that the questions asked do not necessarily abide by the sequence and procedure. They can be flexible and tailored to the situation of the interview session. This provides advantages to the researcher to obtain rich and detailed information. In this section, semi-structured interview and focus group interview are discussed where both are conducted face-to-face in order to develop a professional relationship environment where trust is established and disclosure becomes possible (Gillham, 2005).

Gillham (2005) argues that the semi-structured interview is the most influential method of conducting a research interview because of its flexibility balanced by structure, and the quality of the acquired data. Semi-structured interview requires the researcher to prepare specific questions based on a specific topic. However, the questions prepared only serve as a guideline for the researcher to proceed with the interview. In this research, the questions were designed based on the findings gathered from the literature review conducted in advance and the concern was not to ‘pigeon hole’ (Bryman, 2012; p. 471) the responses of those interviewed. During the interview, the researcher had planned to ask follow-up questions based on the feedback given by the participants. The semi-structured interview process is flexible, giving the opportunity to gather additional information while the scope of the interviews remains definite. Another important factor to be concerned about during designing the questions is to approximate the way the collected data is to be analysed. In this case, the thematic analysis technique was taken into account so that the qualitative data gathered could be easily broken down into the designated themes.

The benefit of this approach is to give the researcher the opportunity to consider any matter that may be unknown prior to the interview. The interview questions were generated to reflect the information the research trying to find; that is, the research questions. The first step in constructing the interview questions is to specify the themes by name, as advocated by Tuckman (1999). Tuckman (1999) further insists that the researcher should construct questions that focus on selected themes. This should then be followed by restructuring the questions to enhance the flow of anticipated interview output and to ensure there is no topic overlap. Subsequently, each question needs to go through an improvement process, particularly in terms of clarity (Gillham, 2005). Finally, piloting the interview questions was carried out in order to analyse the content (p. 25).

Before the interview, the participants were asked to fill in and sign the consent form (refer to Appendix B) that allows the researcher to record the conversation. The interviews were recorded with an electronic digital voice recorder in a permanent and continuous form to which it is possible for the researcher to re-listen for transcribing. It is vital as well for the researcher to think in advance about the transcribing process that needs to be conducted and which solely depends on the recording material. Kvale and Brinkmann (2009) elaborate on this, discussing the recording requirements and the measures the researcher needs to take into account. The requirements are:

- Technical error: Unreliable appliances
- Human error: Painful memories and negligence in data handling
- Audible: Avoid background noise and encourage participants to speak clearly

Each of these measures is useful to this study and, for that, the researcher has prepared a checklist (refer to Appendix D) to ensure sufficient preparation which allows the researcher to optimise the interview session.

4.8.1.4 Transcribing

The face-to-face semi-structured interviews in Stage 1 of the data collection were recorded with the use of an electronic digital voice recorder. The interviews were recorded on the device and, for safety reasons, the voice data was self emailed to make the data transfer to computer easier. This was also to avoid losing the data due to device technical defects or human negligence. Kvale and Brinkmann (2009) describe transcribing interviews as a process of transforming an oral to a valid written mode structure in the form of an interview conversation, which agrees with closer analysis, and a preliminary analysis of the process itself. It is the first step in analysis that contains a word-for-word written rendition of the questions and answers (Rubin and Rubin, 2012). Eight (8) interviews were conducted in a meeting room while the other two (2) were carried out in an isolated area in the office. As a result, the background noise is minimal and the experienced audio typist hired by the researcher was able to transcribe the interviews within the range of three (3) hours to ten (10) hours. Cheek (2011) considers another resource associated with interviewing is the cost of transcribing the interviews. In her study, Cheek (2011) insists that the cost of transcribing the interviews is significant; therefore, there is a need for the researcher to allocate a budget for this purpose. The transcript's precision relies on the type of analysis the researcher requires. Since the purpose of the research analysis is not for speech mannerisms (Rubin and Rubin, 2012), the transcript is more formal where pronunciation, frequent repetition, pauses and grammatical errors are not included in the transcription, as they are not relevant.

The researcher sent the recorded interviews to an experienced audio typist for transcription. Therefore, it was a responsibility of the researcher to review the transcripts and standardise them in order to make analysis easier (Gillham, 2005). Reviewing the transcripts enables the researcher to comprehend the contents and anticipate analysis process planning. A sample of the interview transcriptions is provided in Appendix F.

4.8.1.5 Analysing

The qualitative findings were analysed based on the thematic analysis, in which the focus is given to a few significant passages (Creswell, 2013) in the interview transcription. Thematic analysis is an approach of data reduction which reduces the data into meaningful groups (Grbich, 2013). The purpose of this method is to improve the management of the data through systematic stages, as specified by Grbich (2013). Figure 4.12 demonstrates qualitative interview analysis stages adopted in this research.

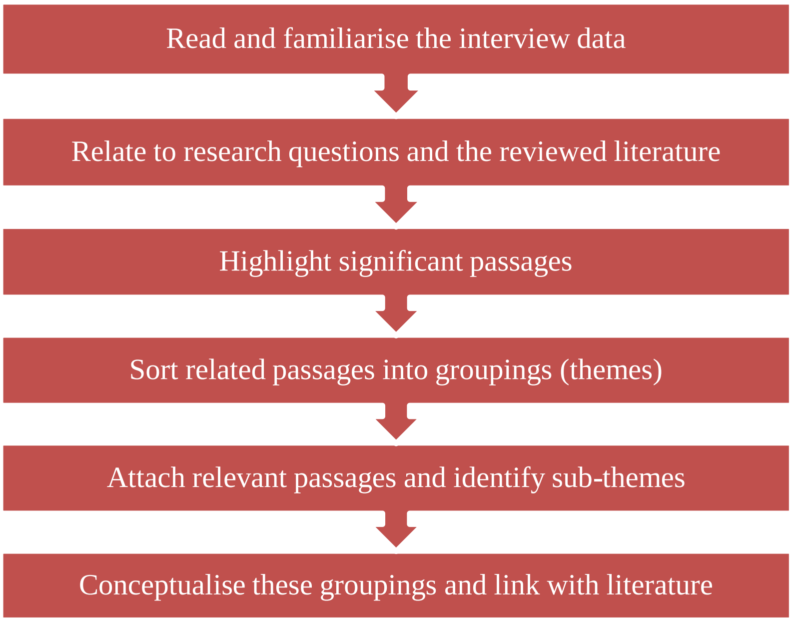


Figure 4.12 Qualitative interview analysis stages. Source: Adopted from Grbich (2013)

Grbich (2013) argues that thematic analysis is flexible, which allows the researcher to begin the analysis by deriving the data obtained from the relevant reviewed literature, from evidence within the area of study and from the researcher's own experience. Grbich (2013) asserts that it is challenging to distinguish the interview data and sort it out into existing themes or create new themes. However, there are three (3) options for the researcher to perform thematic analysis on the interview data as follows:

a. Block and file approach
b. Conceptual mapping

c. Segmentation

Block and file approach is a process of data recording based on the themes established. The same data may be interpreted differently; however, through this approach, the repetition and overlapping of quotes are allowed. However, the massive amount of processed data obtained could cause difficulties in management.

Conceptual mapping is a flexible visual-aided data analysis process. This approach helps the researcher to understand the overall issues that are arising in a well-ordered manner. Nevertheless, the use of keywords in this process can be confusing, which requires the researcher to keep tracking the history of the issue.

Segmentation approach emphasises detailed thematic analysis, requiring verbatim assessment from the interview transcription. Using this method, the key phrases in relevant passages forming a set of responses are highlighted and then tabulated in the analysis framework matrix display, as suggested by David and Sutton (2011). David and Sutton (2011) suggest that the use of matrix displays could improve the effectiveness of sorting and synthesising the data as well developing deeper-level themes in a more systematic manner. Ritchie and Spencer (2002) claim that this process is tedious and not a routine exercise as it requires careful judgement as to the meaning and significance of the data. Ritchie *et al.* (2003) have proved that the use of a thematic framework has increased the depth and rigorousness of the analysis. Using NVivo 10, the framework is already built into the software and the format can be exported to Microsoft Excel for further modification and analysis. In this research, the framework has been customised to adapt the data obtained from the interview, to harmonise with the analysis approach and to produce the thematic profile. The common thematic analysis framework matrix is shown in Figure 4.13.

	Theme 1	Sub-theme 1(a)	Theme 1(b)	Theme 2	Sub-theme 2(a)
Case 1	Passages	Passages	Passages	Passages	Passages
Case 2	Passages	Passages	Passages	Passages	Passages
Case 3	Passages	Passages	Passages	Passages	Passages
Case 4	Passages	Passages	Passages	Passages	Passages
Analysis profile	No. of passages	No. of passages	No. of passages	No. of passages	No. of passages

Figure 4.13 Common thematic analysis framework matrix. Source: Inspired by Ritchie *et al.* (2003)

During the analysis, it is essential to create a hierarchy of themes in order to organise the qualitative data obtained. Relevant passages are grouped into different existing themes that are established from literature review: perceptions, competence, regulations, organisation, knowledge management, definitions, operations and communications. One must remember that those themes were shared and discussed with participants to strengthen the reliability of the qualitative findings (Weitzman and Levkoff, 2000). The creation of new sub-themes helps to ensure the analysis did not omit any important points highlighted by the participants. Figure 4.14 illustrates how the hierarchy of themes was generated.

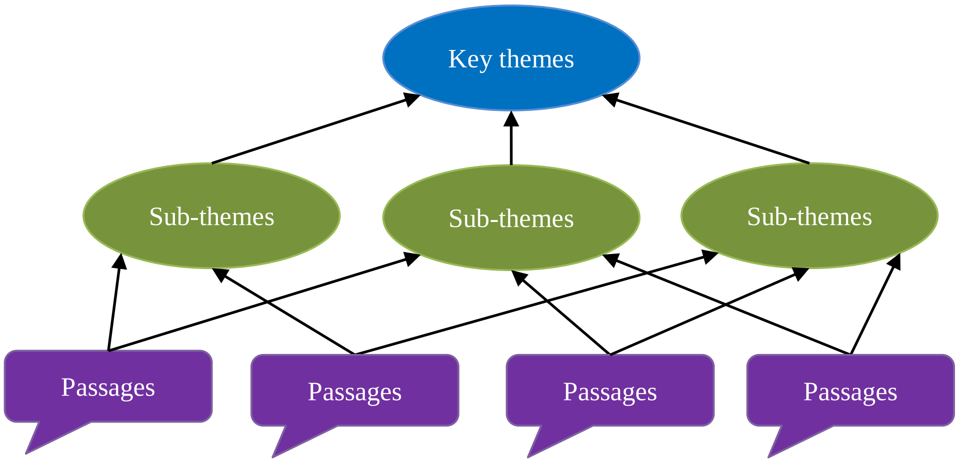


Figure 4.14 Hierarchy of themes. Source: Self-study

4.8.1.6 Verifying and reporting

The focus group interviews, as discussed in 4.8.2, are to take the proposed FM-DP integration framework to the research participants to see if the interpretation is confirmed. Ritchie and Lewis (2003; p. 276) refer to this as 'member or respondent validation'. Although this technique is considered critical in establishing credibility (Lincoln and Guba, 1984), the effectiveness of focus group interviews to critically scrutinise the framework and to discover what is missing is uncertain (Creswell, 2013). Nevertheless, the consent and confirmation from the professionals involved in this research are crucial before the proposed FM-DP framework can be finalised.

4.8.2 Stage 3 of data collection: Focus group interviews

Focus group interviews were conducted to meet Objective (v) of this research. Focus group interviews are used widely in consumer (Kvale and Brinkmann, 2009) and market research (Easterby-Smith, 1991). Kvale and Brinkmann (2009) contend that focus group interviews are well suited for exploratory studies in a new domain as the interaction during the interview may produce spontaneous responses and more cognitive views. This was also supported by Vaughn *et al.* (1996), who state that focus groups are particularly useful for exploratory research when little is known about the topic. According to Bryman and Bell (2011), focus group interview involves several participants in addition to the moderator. Morgan *et al.* (1998) assert that it is appropriate to have six (6) to eight (8) participants who come from similar backgrounds. Focus group interviews emphasise the questioning of a particular, fairly tightly defined topic. Member checking (Creswell, 2013) is the key value in focus group interviews. It has been recognised to be the most critical validation strategy of the research findings. Hence, the researcher found that focus group interviews are appropriate to measure the credibility of the research output: an FM-DP integration framework which consists of comprehensive analysis description, themes, critical factors and attributes.

Morgan *et al.* (1998) define focus group interviews as a research method for collecting qualitative data, they are focused efforts at data gathering, and they generate data through group discussions. The authors discussed several important point in the book series, including sampling. In focus groups, the researcher needs to use his/her judgement to select the participants who are able to contribute to meeting the research objectives. Morgan *et al.* (1998) further comment that focus group interviews allow considerable flexibility in how questions are asked. Although focus groups are perceived as loosely structured (Easterby-Smith, 1991), which is to encourage a variety of viewpoints on the topic (Kvale and Brinkmann, 2009), they should never be entirely without structure. The format should be controlled by a 'topic guide' (Easterby-Smith, 1991) and, most importantly, the researcher who acts as a moderator should be skilful in creating a permissive environment for the expression of personal and conflicting opinions.

According to Morgan *et al.* (1998), a successful focus groups inquiry should be executed based on four (4) stages, as shown in Figure 4.15.

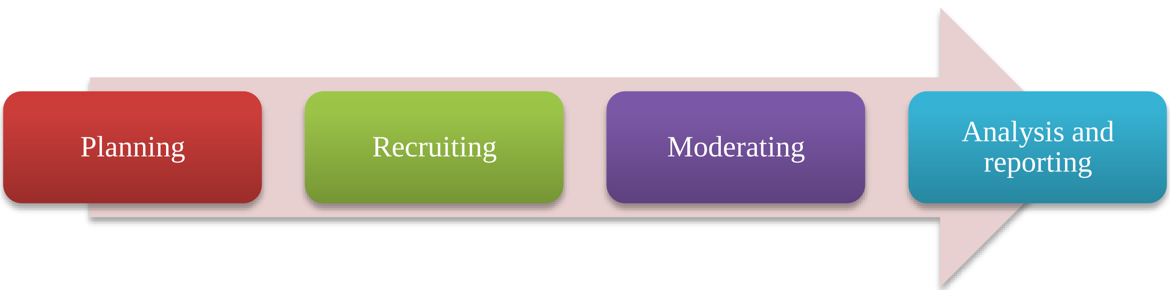


Figure 4.15 Focus group stages. Source: Morgan *et al.* (1998)

The steps identified above form the basic structure for undertaking the focus group interviews in Stage 3 of data collection in this study.

4.8.2.1 Planning

Successful planning in focus group interviews relies significantly on the lack of ambiguity of the research purpose and its outcome (Morgan *et al.*, 1998). The purpose of performing focus group interviews is to validate the concept of the FM-DP integration framework. The framework was developed in Phase 4, in which the researcher has to integrate the results obtained in Phase 2 and Phase 3. This was achieved by producing a report identifying the critical issues, which in turn produced a framework and a list of suggested recommendations that the study could make to improve the integration of FM and the development process. Another important element to be considered in focus group planning is to decide the suitability of topic guide and the development of the questions. Morgan *et al.* (1998) advise that the questions asked to the focus group participants should be direct, forthright, comfortable and simple. To obtain these qualities, it is essential for the researcher to allow ample time for thoughtful discussions between the participants and the researcher. Decisions about the participants' composition is crucial for successful focus group interviews. Therefore, the strategies for selecting the samples at this stage are instrumental. A purposive sampling strategy is appropriate for focus group interviews as the selection of the participants would be based on the purpose of the research. Specific criteria that relate to the target participants for the focus group are identified based on the extent to which they have a similar background and possibility to contribute to a successful focus group (Vaughn *et al.*, 1996).

4.8.2.2 Recruiting

Recruiting is a time-consuming task and is challenging as the researcher needs to locate the participants' availability and to assemble them in the same place at one time. Morgan *et al.* (1998) advocate that the researcher should have good contact with the participants, and it is a continuous process – even, in certain circumstances, recruitment is still going on during the focus group interview sessions. Making initial contact with potential participants is the first step to minimise no-show rates; however, it is only a part of the important recruiting process. Developing recruitment screening is an alternative element to find eligible participants. For this, the researcher decided to use the existing lists in which the participants were chosen based on the criteria listed in Table 4.3:

Table 4.3 Focus group participants' eligibility criteria

Eligibility requirements
Positioned in management level in organisation
More than 15 years' working experience in property development, and
More than 10 years' working experience in FM industries

Source: Self-study

All participants who had been previously involved in individual interviews were invited alongside five (5) new participants. An invitation letter was sent to participants in advance together with an information sheet, consent letter and questionnaire (refer to Appendices A, B and C). A thank-you letter was also sent as soon as each participant gave initial agreement to participate in the focus group session. Positive feedback from the participants is also recorded (refer to Appendix T).

4.8.2.3 Moderating

The moderator plays a significant role in ensuring a balance between ease and formality, which encourages interaction of the participants in a group discussion (Beck and Manuel, 2008). In this study, the researcher acted as a moderator, for which Morgan *et al.* (1998) advocate that they should be mentally prepared. Packer-Muti (2010; p. 1025) describe the moderator as an ‘interventionist’, raising topics directly, addressing specific participants, cutting-off ineffective discussions or challenging participants’ views. Moderating a focus group session requires concentration and careful listening (Gillham, 2005; Morgan *et al.*, 1998) skills. Vaughn *et al.* (1996) introduced a guideline for the moderator to chart the progress of the focus group interviews in terms of psychological approach and understanding human behaviour. There are three (3) main elements that the moderator needs to consider in performing focus group interviews, as listed in Table 4.4.

Table 4.4 Moderator's guide

Section	Purpose
Introduction	To provide an overview of the topic and set the environment of how the session will be conducted. This section should be conducted to provide comfort and get the participants familiarised with the environment.
Questions and discussions	General questions at the beginning of the session allow the participants to feel more comfortable expressing their opinions. More challenging questions are then asked that require participants to provide rationales of their views. Probe and follow-up questions are necessary to encourage in-depth discussion and obtain additional information.
Summary	To identify the major findings of the responses and organise them in a concise manner. In addition, it provides an opportunity for the moderator to recognise what was not covered during the session. In this section, the moderator would explain the future of the study and show appreciation to the participants.

Source: Adopted from Morgan *et al.* (1998) and Vaughn *et al.* (1996)

In terms of recording preparation, the researcher used an electronic digital voice recorder and video recording. Alternatively, an assistant moderator was asked to take written notes while the group was discussing topics. The assistant moderator will be the key person and reference point in the session. Flip charts were also provided to record valuable points highlighted by the participants which could then be discussed in more detail.

4.8.2.4 Analysis and reporting

Analysis begins with describing the focus group interviews, which includes the transcription, detail of participants' attendance, venue and time the session took place, and the procedures employed for the selection of participants. Smithson (2000) claims that the analysis is wide-ranging, involving what goes on in a focus group: participant-researcher interaction and interaction between participants. Acocella (2012; p. 1130) clearly identifies this point by characterising focus group analysis as:

> *"[an] analysis of the interaction among the group members can be aimed at investigating how conscience and ideas develop during the collective discussion…, as well as at evaluating the reliability of the information. This can be achieved by looking, for instance, at whether they have been invalidated by group dynamics… Secondly, analysing these dynamic can be useful to give a different value to the topics discussed, as not every topic will be discussed by participants with the same interest and intensity."*

Vaughn *et al.* (1996) claims that transcribing and coding is the most frequent method used in analysis. However, this analysis is more interested in verbatim responses, particularly in identifying the units of information that contribute to the development of themes or findings. Ho (2006) argues that the data for analysis would emerge from the interaction of the participants themselves, whereas it may be disorganised at the beginning. To overcome this setback, content analysis was selected as the coding of a text into categories means that the data will be quantified systematically (Kvale and Brinkmann, 2009). Moreover, using content analysis of focus group data on the topic would produce clearer understanding (Ho, 2006). On top of that, the developed coding systems could be entered in the computer programs as this would help in updating and modifying coded data (Morgan *et al.*, 1998). Rubin and Rubin (2012) specify the seven (7) steps in analysing the data, as follows:

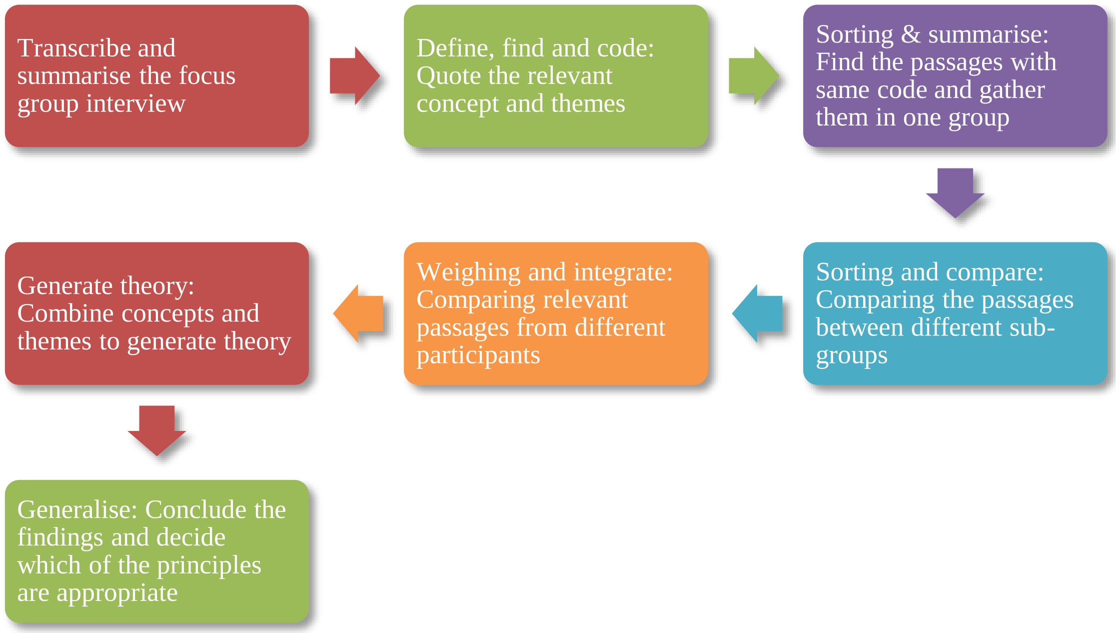


Figure 4.16 Seven (7) steps in focus group analysis. Source: Rubin and Rubin (2012)

Unlike the one-to-one interview analysis stages as shown in Figure 4.12, in which the literature review is always the reference point, this analysis is more complicated as the results obtained need to satisfy the research questions and the FM-DP integration framework concept which is developed in Stage 4. On the other hand, as NVivo10 software is used in the analysis, the thematic analysis framework matrix as shown in Figure 4.13 was employed.

4.8.2.5 The magnitude of the focus group

There are two (2) attributes in determining the magnitude of the focus group. Firstly, the size of the focus group and, secondly, the number of focus groups to be conducted. Based on the selection criteria of the candidates and the nature of this research, the researcher decided that small focus group interview is appropriate to validate the developed FM-DP integration framework. The reasons why a small group was chosen in this study are tabulated in Figure 4.17.

Figure 4.17 The reasons for using a small group in this study. Source: Creswell and Clark (2011)

In relation to the number of focus groups, Morgan *et al.* (1998) highlight that there is nothing wrong with conducting a single focus group provided the data obtained is analysed carefully. Also, the data collected from the focus group depends primarily on the resourcefulness of the participants. Having a few adequate multi-knowledge participants would be beneficial to keep the discussion progressing and lively. For that, the research endeavoured to satisfy both requirements.

4.9 Quantitative data collection methods

4.9.1 Defining the objectives

The objectives of the quantitative study determine what are the questions to be asked and who are the participants involved in the survey (Sue and Ritter, 2012). It is essential for the researcher to keep the questionnaire survey connected to Objective (iv) of this research, which subsequently enabled the researcher to perform an appropriate statistical analysis and procedure. In addition, it was designed to fit various groups of professionals in the property development industry. Its aim is to obtain quantitative data on the best practices that encourage optimising the role of FM in the development process. In line with the nature of this research, cross-sectional surveys are useful in assessing practices, knowledge and perception (Silva, 1999) of a population in relation to FM within the property development industry. Apart from that, this research is important in finding out the current FM practice in the property development process. This includes the types of FM services, the current consideration of FM expertise and existing decision-making tools. More generally, it also aims to investigate the perception of various professionals in the property development industry towards these identified factors. Subsequently, the factors could be deductively analysed with regard to which are the most critical factors that encourage the interaction between FM and the development process.

Table 4.5 Research hypotheses

	Hypothesis description
Hypothesis 1	To determine the relationships between perceived importance of FM to be considered and the extent to which FM could integrate effectively in the property development process
Hypothesis 2	To determine the differences between the level of involvement in the development stages in terms of perceived importance and perceived level of integration

Source: Self-study

4.9.2 Survey research

Survey is the most common technique employed for data collection. It is designed and conducted to produce numerical data about specific features of the population under study (Fowler, 2009). The numerical data obtained is to be measured in terms of variables. Survey research is interested in the relationships between the variables rather than in describing the features of each variable (Punch, 2003). It is essential for the researcher to be clear about the conceptual framework and to be able to visualise the meaningful interaction between the variables prior to proceeding with the operational level of the survey research. Hence, Fowler (2009) points out that there are correct procedures that need to be followed to conduct survey research in order to minimise the negative effects on the results. Punch (2003) highlights that effective survey research begins with the objectives. Meanwhile, Fowler (2009) emphasises that the combination of sampling, designing questions and data collection is essential to good survey design. Finally, it is crucial to put all the findings into a report and get it distributed (Sue and Ritter, 2012). The steps of quantitative survey in this study could be separated into three (3) levels: conceptual framework, survey design and operational, as shown in Figure 4.18.

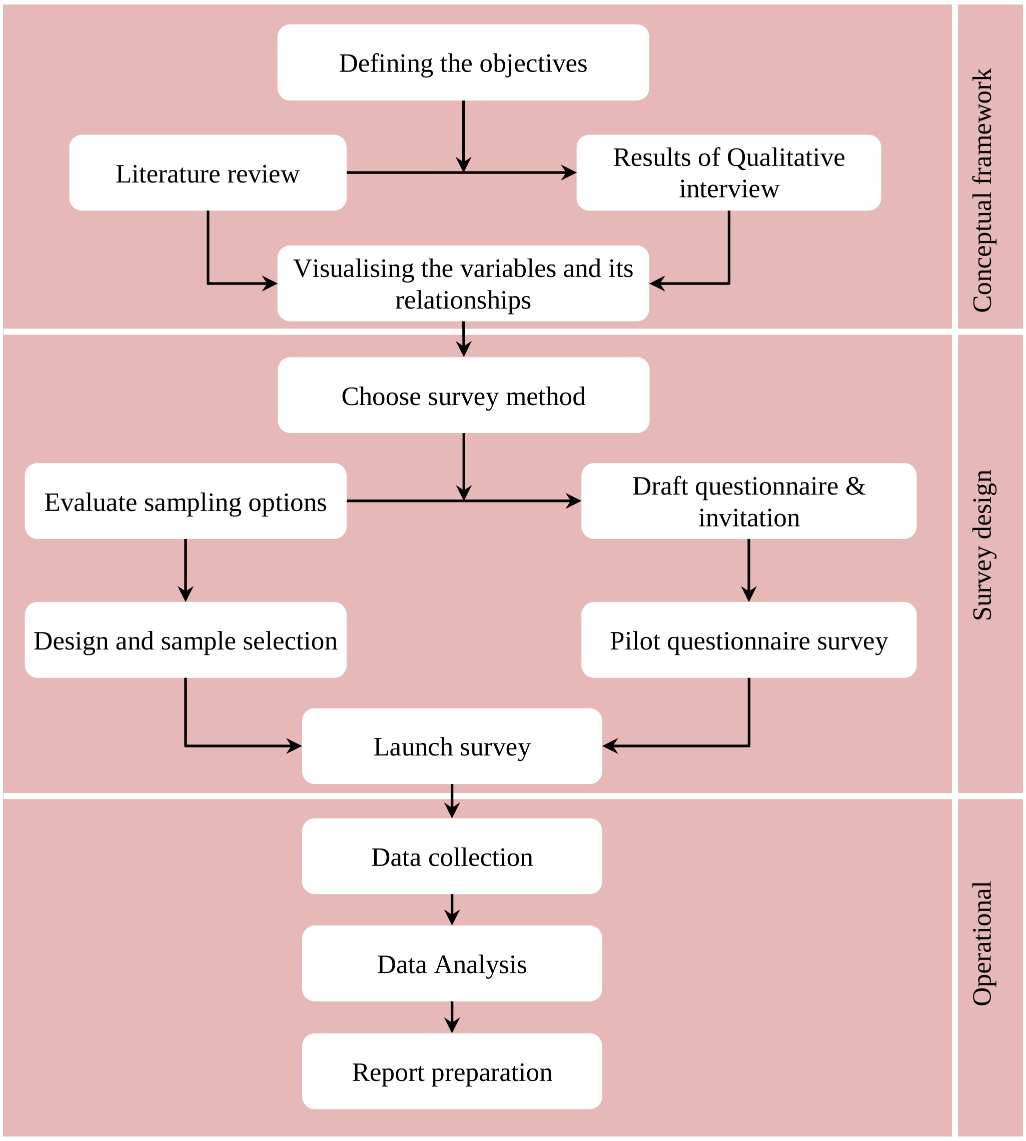


Figure 4.18 Survey research process flow. Source: Adapted from Sue and Ritter (2012)

4.9.3 Survey design

4.9.3.1 Sampling

Sampling 'consists of all units of the population that are drawn for inclusion in the survey' (Dillman *et al.*, 2009; p. 43). It is improbable that the researcher will be able to collect data from each person in the selected population due to cost restrictions, limitations of time and geographical constraints. Fowler (2009) suggests that good sampling in quantitative research can be achieved based on three (3) elements: a well-defined sample frame, sample size and the specific design of selection procedures. Hence, it is crucial for the researcher to be begin the sampling design with the correct process as sampling has a significant contribution in achieving the research objective (Saunders *et* *al.*, 2007). Wilson (2012) describes the process involved in developing a sampling process, as shown in Figure 4.19.

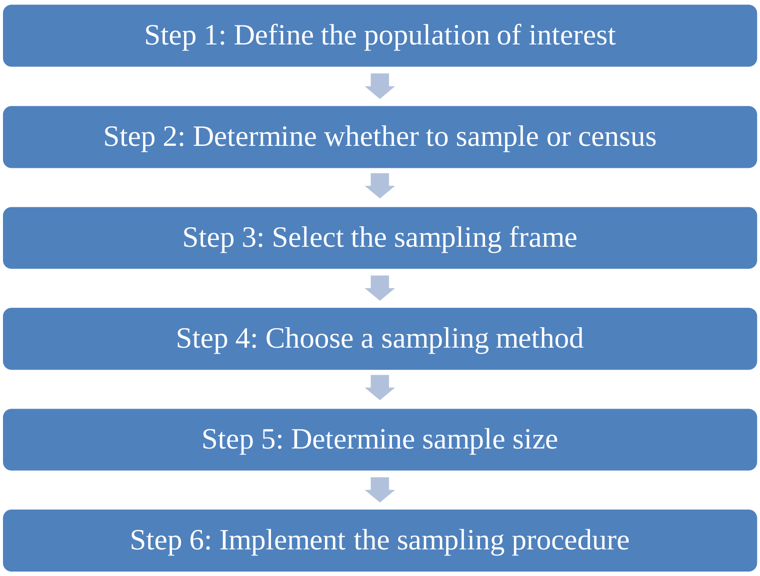


Figure 4.19 The sampling process. Source: Adapted from Wilson (2012)

In the UK, there are various professional bodies that patronise professionals in their respective disciplines. For example, Royal Institute of British Architects (RIBA), Royal Institution of Chartered Surveyor (RICS), Institution of Civil Engineers (ICE), Chartered Institution of Building Services Engineers (CIBSE), Chartered Institute of Building (CIOB) and British Institute of Facilities Management (BIFM). With regard to this view, the researcher believed that defining the population of interest based on the members of professional bodies related to the property development industry in the North West of England was appropriate. Fowler (2009) suggests a sample framing strategy would be useful, so six (6) professional bodies in the UK were selected. Table 4.6 shows the sample of this study: approximate members of six (6) professional bodies in the North West of England as of 31st December 2013, which totalled 23,200.

Table 4.6 Sample: Members of six (6) professional bodies in the North West of England

Professional bodies	**Approx. member**	**Region covered**
Royal Institute of British Architects (RIBA)	2,000	North West
Royal Institution of Chartered Surveyor (RICS)	9,000	North West
Institution of Civil Engineers (ICE)	6,000	North West
Chartered Institution of Building Services Engineers (CIBSE)	900	North West
British Institute of Facilities Management (BIFM)	1,600	North
Chartered Institute of Building (CIOB)	3,700	North West
Total	**23, 200**	

Note: North West region includes Cumbria, Greater Manchester, Lancashire, Isle of Man, Merseyside and Cheshire
North region includes Hull, Leeds, Sheffield, Tyne Tees, Merseyside, Lancashire and Greater Manchester

Source: Self-study

Sue and Ritter (2012) suggested that, with a comprehensive sampling frame such as a membership list, it is possible to employ a random sampling technique to select potential survey respondents. The use of this technique is another approach to minimise bias in sampling (Bryman and Bell, 2011). However, since this research employed a purposive sampling technique, the potential bias in sampling is reduced by designing the survey questionnaire to the construct-specific questions approach (Dillman *et al.*, 2009). To show how the respondents were selected, the sampling step-down process undertaken in this research is illustrated in Figure 4.20.

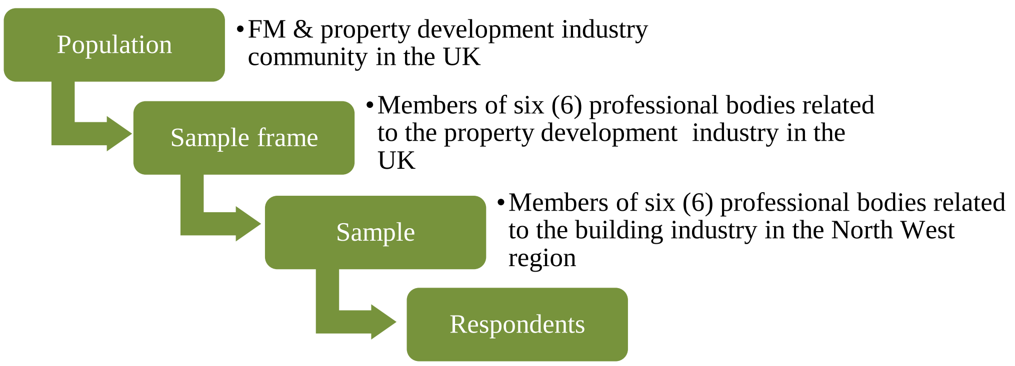


Figure 4.20 Sampling step-down process for this research. Source: Inspired by Fowler (2009)

4.9.3.2 Designing questionnaires

Good survey research cannot be built on poorly collected data (Gillham, 2000). To acquire good data, the questionnaire must provide consistent answers in similar settings and the responses should conform with what the researcher intended to measure. The questionnaire is used as a main instrument to assist the researcher to collect and record the data on specific subjects necessary to achieve the research objectives. It also provides a good communication vehicle between the researcher and respondents (Wilson, 2012). Hence, it should be designed in ways that could produce accurate responses. For this, Sue and Ritter (2012) suggest that the questionnaire should be professional in its appearance and motivating, made up of a list of simple questions, clear instructions,and comprehensible to the target respondents. Wilson (2012) advises that a good questionnaire should be designed properly based on the process as shown in Figure 4.21.

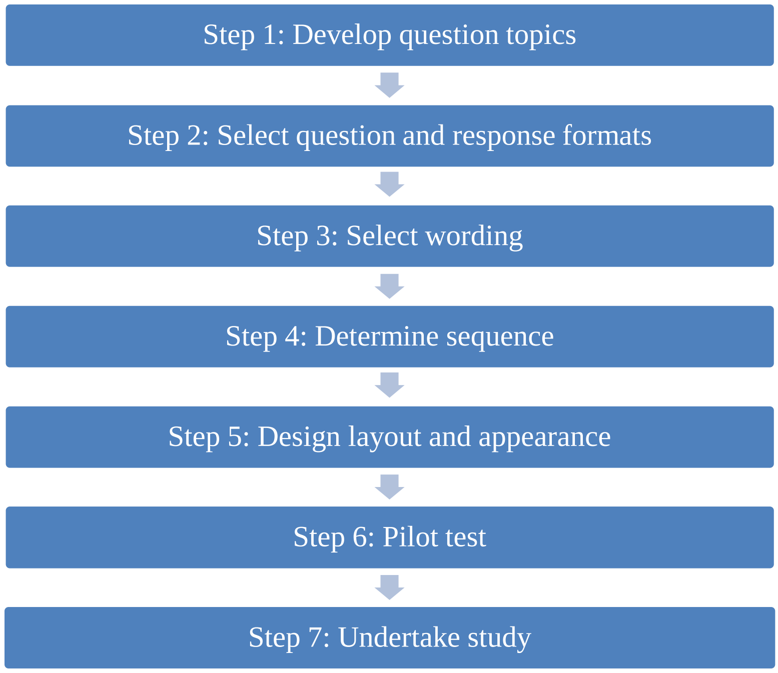


Figure 4.21 Questionnaire design process. Source: Adapted from Wilson (2012)

A cross-sectional survey was devised for this study in which the respondents are contacted at a fixed point in time and relevant information is obtained from them. The researcher should be able to classify the obtained information based on the level of the attribute of interest and the critical factors in optimising the role of FM in the development process. As noted, the survey is to measure the FM practices, knowledge, attributes and perceptions of the respondents (refer to Figure 4.22).

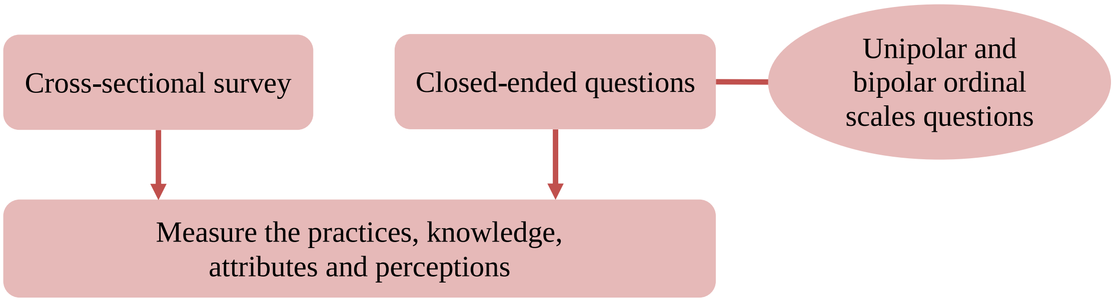


Figure 4.22 The relationship of cross-sectional study and closed-ended questions. Source: Inspired by Dillman *et al.* (2009)

Therefore, closed-ended ordinal question (Dillman *et al.*, 2009) is the most appropriate for this type of study. In addition, closed format questions provide other advantages: it is quick to respond to them, they give wider coverage within a sample population and less complicated procedures are involved in processing the data. To the same extent, the questionnaire could be designed to be as flexible as possible to fit with all respondents from different groups. To improve the questionnaire in terms of accessibility and level of response, the use of a variety of visual designs and configurations through an online survey would help in this aspect. Hence, the use of online multiple-choice questions (Wilson, 2012) would be the main preference followed by the conventional mail survey. Coupled with the employment of unipolar and bipolar ordinal scales, this would be beneficial in terms of performing the statistical analysis. To ensure this research produces stable results, the reliability of a five-point Likert scale is tested using test-retest reliability methods while the consistency of the scale is measured using split-half reliability (Cronbach's Alpha). In terms of validity, the content and the construct of the questions are to be measured as well (Wilson, 2012). In addition, Fowler (2009) suggested the wording of the questionnaire would have a significant influence on the reliability of the answers given by the respondents. Therefore, it is essential for the researcher to use construct-specific questions as this would encourage the respondents to make a sensible decision and 'reduce acquiescence response bias and cognitive burden' (Dillman *et al.*, 2009; p. 138. Refer to Guideline 5.21: Choose Direct or Construct-Specific Labels to Improve Cognition).

Once designing the questionnaire is completed, the next step is to conduct a pilot test. van Teijlingen and Hundley (2001) have produced a list of justifications for conducting pilot studies. The purpose of performing a pilot study at this stage is to establish the research protocol in terms of flow and its structure, to assess the respondents' understanding of the questions, and to evaluate whether the questionnaire is workable and realistic to collect data. De Vaus (2002) advocates that a newly designed questionnaire needs to be intensively pretested. Therefore, the questionnaire has gone through a pilot study on selected respondents, as shown in Table 4.7.

Table 4.7 The selected respondents for the pilot study

Position	No. of respondents
PhD students	3
Property development professionals	
- Engineers	5
- Quantity Surveyors	2
- Facilities Managers	8
Total	18

Source: Self-study

i. PhD students

Three (3) PhD students in built environment were selected for the pilot study. They were asked to answer the questionnaire online and give comments in terms of timing, content and overall design.

ii. Professionals in the property development industry

This is the target group of the study and therefore their feedback is crucial. 40 questionnaires were randomly distributed in BIFM North West region networking programme on 22nd January 2014 in Manchester, UK. Respondents were expected to give comment in terms of the questionnaire's content and appearance.

The findings of the pilot study were assessed and reported as this is important to inform the researcher about the probable outcomes and the best research process (van Teijlingen *et al.*, 2001).

The assessment was focused into three (3) main attributes, as recommended by Sue and Ritter (2012):

a. Appearance: This includes the design of the welcome screen, formatting, colour, font type, and size and paging.
b. Cognition: The assessment includes the quality of the opening question, wording and language, instructions and formats for response options.
c. Time of completion: The evaluation will be focused on the length of the questions.

The findings of the pilot study were reported as shown in Table 4.8.

Table 4.8 Summary of pilot study results

	Online	Paper
Average Timing	15 to 20 minutes	12 minutes
Appearance	Variables need to be answered twice for different scales of measurement	Neat and clean The scale provided easy to choose
Wording & cognition	Less information for non-FM professionals The terms used are vague, which could lead to different meanings Grammar errors	

Source: Self-study

4.9.3.3 Data collection

Survey research can be conducted through telephone and face-to-face interviewing, self-administered postal questionnaires and online survey. The target group of this research consists of professionals in the property development industry who have internet access and possesses a moderate computer skill. For this particular group, an online survey can be designed and implemented and the results could be obtained immediately. In terms of cost savings, the charges related to postage, printing, travelling and keypunching wages are effectively eliminated (Dillman *et al.*, 2009). In addition, the ability of online surveys to reach a wider range of target respondents is also regarded as the determining factor in the selection of the survey research methods. For this, Nair and Adams (2009) conclude that online surveys provide advantages particularly in cost savings, time savings in data management, processing, storage and readability, ability to avoid external influence in judgement, and help to produce reports faster. In addition, online surveys give respondents an opportunity to view their feedback and, simultaneously, the reports can be disseminated. In choosing survey research methods, the ability of research to maximise the response rate is often given significant attention by the researcher (Nair and Adams, 2009). For this, several techniques for improving the response rate in the online survey for this research were adopted, as suggested by Sue and Ritter (2012) and Kaplowitz *et al.* (2004):

a. Send a pre-notification to the respondents.
b. Write an appealing and attractive invitation.
c. Keep questionnaire short and simple.
d. Choose the most appropriate time to deliver the invitations and reminders.
e. Establish reminder email notification.
f. Convince respondents that confidentiality and anonymity are protected.

To start with the online survey, the researcher asked for permission to distribute the survey URL link in various professional bodies such as the Royal Institute of British Architects (RIBA), Royal Institution of Chartered Surveyors (RICS), Institution of Civil Engineers (ICE), Chartered Institution of Building Services Engineers (CIBSE), Chartered Institute of Building (CIOB) and British Institute of Facilities Management (BIFM). In addition, the URL link was also distributed in various professional group discussions in LinkedIn.

There is an abundance of free commercial software programs for survey research on the market, such as Survey Monkey, KwikSurveys, Soorvey and Google Docs. However, ethical and legal issues are the main elements in choosing the appropriate survey application. For that reason, Bristol Online Survey (BOS) was preferred as LJMU has purchased access from the University of Bristol in which the legal aspects regarding licensing and copyright would be not an issue. Besides, the researcher is interested in an application that is easy to use, provides free technical support through email and telephone, and where there are no hidden charges involved. BOS is used to design, collect and manage the data through an online application package. One of the main features of BOS is the survey data and the individual questions can be downloaded and transferred into another statistical application software package such as Microsoft Excel and Statistical Package for Social Sciences (SPSS). In addition, BOS could generate inbuilt reports, allowing the researcher to cross-tabulate results, filter surveys by specific answers, compare results across multiple surveys, view statistical information, step-through results and classify questions.

4.9.4 Statistical data analysis

This section provides an overview of the statistical concepts applied in this study. Execution of various statistical tests depends significantly on the type and number of variables investigated and the depth of data analysis required. Therefore, it is essential for the researcher to be certain regarding the variables involved that fit the statistical procedure. The statistical concepts employed for data analysis in this study include descriptive analysis and a wide range of inferential analysis. The data was analysed using Statistical Package for Social Sciences (SPSS) version 21. The process of data analysis in this stage is summarised as illustrated in Figure 4.23. The detail of each stage is explained in Sections 4.9.4.1 and 4.9.4.2.

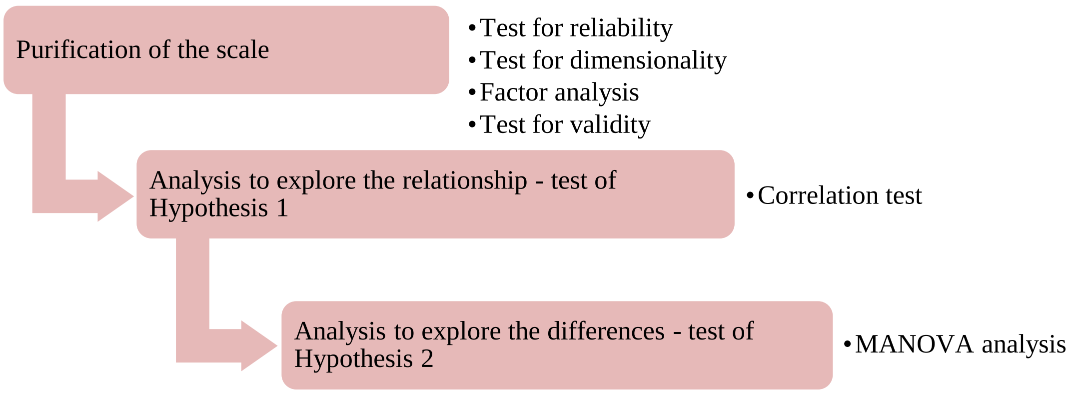


Figure 4.23 Process of data analysis. Source: Self-study

4.9.4.1 Purification of the scale

4.9.4.1.1 Test for reliability

The analysis of this study began with refining the instrument scale. It is essential at first to calculate the reliability coefficient (Cronbach's Alpha), as recommended by Churchill Jr (1979). It is the most frequent method (Cortina, 1993; Yurdugul, 2008) used in measuring the reliability of the scale to inform the meaning of the items in the questionnaires. In other words, reliability coefficients are calculated to measure the probability of the respondents answering the questions and giving the same results on repeated occasions. As a rule of thumb, an item with Cronbach's Alpha value greater than 0.7 is considered acceptable (Gaur and Gaur, 2009; Pallant, 2010); otherwise, it should be deleted (De Vaus, 2002). Subsequently, an iterative calculation of Cronbach's Alpha to a new set of data should be employed until a satisfactory Cronbach's Alpha is achieved. In order to obtain a stable value of alpha, Yurdugul (2008) advocates that the sample size should be sufficient. Consistent with the recommendation of Nunnally and Bernstein (1994), it is decided that a minimum size of 300 respondents is adequate; nevertheless, a smaller number of usable surveys would be accepted (Fleiss, 1986).

4.9.4.1.2 Test for dimensionality

In the next task, this research is to assess the dimensionality of the overall scale by factor analysing the perceived importance and perceived level of integration scores on the 39 items. Hair Jr *et al.* (2009) classify that factor analysis is an interdependence technique in which the basic aim is to define the underlying structure among the variables in the analysis. An orthogonal rotation analysis was employed under the assumption that the underlying factors are uncorrelated with each other; otherwise, oblique rotation analysis is used. Factor analysis helps in identifying the answer patterns, which enables the researcher to merge some variables together. In other words, factor analysis is a process to reduce the number of variables (Bryman and Bell, 2011). In a situation where the variables consist of fewer than three (3) items and/or the item-to-variable correlations is low, the deletion, reassignment and restructuring of variables and items is to be applied where necessary, in order to produce a higher alpha value (Peterson, 1994). This is an iterative process of analysis (refer to Figure 4.24) to a new set of data until a satisfactory subsequent Cronbach's Alpha value and factor loading of higher than 0.4 (Gaur and Gaur, 2009) is reached.

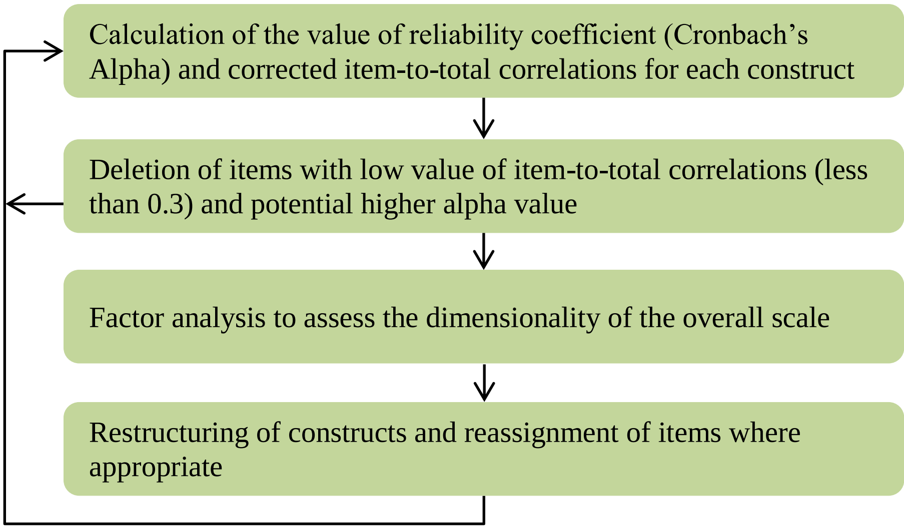


Figure 4.24 Iterative process of analysis. Source: Adapted from Parasuraman *et al.* (1988)

4.9.4.1.3 Test for validity

In terms of validity, two (2) tests were carried out in this study. First, the assessment on content validity was performed by endorsing the instrument against the literature review and the interviews. In addition, the instrument was also shown to individuals with decent knowledge in research work and the built environment to gauge the extent to which the instrument is likely to be measuring correct characteristics. Second, construct validity usually attempts to establish an agreement between the measuring instrument and the theoretical concepts. For this, correlation analysis was applied to determine convergent validity and discriminant validity (Churchill Jr, 1979).

4.9.4.2 Respondent data statistical analysis

In this stage, the analysis focused on the analysis of relationships of the constructs and differences of the groups in terms of the constructs as well as the items in order to satisfy both of the hypotheses.

4.9.4.2.1 Analysis to explore the relationships of the constructs

4.9.4.2.1.1 Correlation analysis

After reassigning the items and restructuring the dimensions, the next step is to determine the relationship between perceived importance and perceived level of integration. For this, correlation analysis will be used. Pearson's correlation coefficient, r, is to be applied if the assumption of normality is satisfied. In case the assumption of normality is violated, a non-parametric alternative (Spearman's correlation coefficient, ρ) is to be employed. In interpreting the ρ value, there are two (2) important aspects to be considered: the direction and the strength of the relationship. If a negative sign is present, it shows that there is negative correlation between the variables. In defining the strength of the relationship, Pallant (2010) suggests that researchers refer to Cohen (1988) guidelines in which he suggests the value of 0.10 to 0.29 as a small correlation, 0.30 to 0.49 as a medium correlation and 0.50 to 1.0 as a large correlation. Another aspect to be considered is the level of statistical significance (p-value) where the rationale is to understand the level of confidence of the results obtained from the correlation analysis. The preferred p-value should be less than 0.05.

4.9.4.2.2 Analysis to explore the differences in perceived level of integration between the groups of independent variables

4.9.4.2.2.1 One-way multivariate analysis of variance (MANOVA)

One-way MANOVA analysis is used to assess the differences between groups on two (2) or more dependent variables. Statistically, MANOVA can be characterised as a linear model. It compares the groups and explains whether the mean differences between the groups on the combination of dependent variables are likely to have occurred inadvertently. In addition, MANOVA analysis also provides the univariate results for each of the dependent variables separately (Pallant, 2010). In spite of this, Tabachnick and Fidell (2013) clarify that there are a number of criteria to be fulfilled before MANOVA analysis can be performed:

a. The data should be normally distributed
b. There is an absence of outliers
c. The variance-covariance matrices should be equal
d. There is a linear relationship between dependent variables
e. There is an absence of multicollinearity

On top of that, Hair Jr *et al.* (2009) advocate that there are three (3) most critical assumptions to be checked in MANOVA. They are the independence of observations, homogeneity across the groups and normality. On top of that, Field (2013) adds that the data should be randomly sampled and measured at interval scales. To check whether or not the data violates the assumptions, multiple tests can be carried out such as descriptive statistics, Box's test of equality of covariance matrices, multivariate tests, and test of homogeneity of variances as well as the assessment of the maximum value of Mahalanobis distance in residual statistics. The results of the multivariate test will determine whether the null hypothesis (H_0) is accepted or rejected. In the case of the null hypothesis (H_0) being rejected, tests of between-subjects effects will take place. The intention to perform this procedure is to separately assess the differences between the groups of dependent variables (Pallant, 2010).

Although the smoothness of MANOVA analysis is subject to the fulfilment of the above assumptions, there are justifications that MANOVA could compromise violations. In terms of normality, MANOVA is claimed to be robust (Maxwell and Delaney, 2004) if the sample size is large enough and the data is analysed in a two-tailed condition (Sawilowsky and Blair, 1992). On top of that, MANOVA is robust to non-normal distributed data if the sample size of each group is equal or nearly equal (Lix *et al.*, 1996).

In the event that the assumption of linearity is not met yet MANOVA analysis is resumed, the researcher is agreed to accept the loss of power of a test (Tabachnick and Fidell, 2013, p. 83). This measure is supported by Stevens (2009, p. 164), who emphasises that the power is not a concern in MANOVA analysis on condition that the sample sizes of the study is large (more than 100).

To satisfy the multicollinearity assumption, the researcher needs to be aware that the accepted bivariate correlation that appears in the correlation matrix should not be greater than 0.9 (Tabachnick and Fidell, 2013), otherwise multicollinearity is assumed to exist. If this happens, Pallant (2010) suggests that the presence of the affected variable should be reassessed.

In order to decide whether there are multivariate outliers, the study applied the Mahalanobis distance procedure. If the maximum value of Mahalanobis distance exceeds the critical value of 13.82 (for two (2) dependent variables), it shows that multivariate outliers are present. Nevertheless, MANOVA analysis is considerably robust to the violation of the multivariate outliers, provided the number of participants who exceeded the critical value is few. In case that situation happened, retain all of the participants or, otherwise, remove them before proceeding with further analysis.

The assumption of homogeneity of variance-covariance matrices needs to be satisfied. The *p*-value of the Box's Test of Equality of Covariance Matrices should be greater than 0.001 or, otherwise, run non-parametric Kruskal-Wallis (Lix *et al.*, 1996). To investigate the difference of the dependent measures separately, the analysis continues with assessment of *p*-value in the tests of between-subjects effects output box. In order to minimise the possibility of rejecting a correct null hypothesis (Type 1 error), Tabachnick and Fidell (2013) suggest the study should apply Bonferroni adjustment based on the following formula:

$$\alpha_i = \alpha_{fw}/p$$

where α_i is approximately alpha, α_{fw} is the family wise error rate (0.05) and p is the number of tests.

In this study, the number of tests on the dependent variables is two (2). Therefore, the valid value of α_i is 0.025. If the p-value in the tests of between-subject effects output box is greater than α_i, it shows that the null hypothesis is true.

Figure 4.25 shows the flowchart of one-way MANOVA analysis in order to explore the differences in perceived importance and perceived level of integration between the two (2) groups of independent variables.

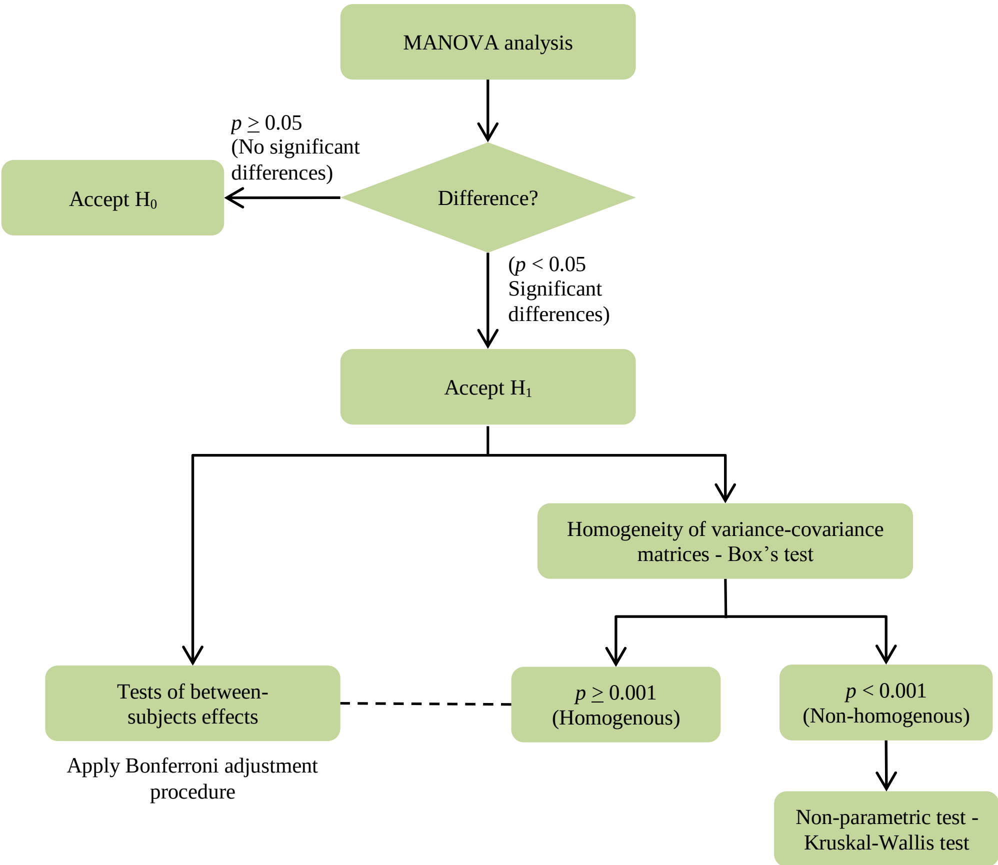


Figure 4.25 Testing of Hypothesis 3 using MANOVA analysis. Source: Inspired by Pallant (2013)

4.10 Chapter summary

Chapter 4 has provided a comprehensive overview of this research in terms of research design and research methods. The former discusses research philosophy, approach, methodological choice and strategy used. The knowledge in FM and the property development industry 'out there' has been connected with philosophical assumptions in terms of ontology, epistemology and axiology. It was identified that this research is flexible, which means that it allows 'back and forth' movement between deductive and inductive approaches. In addition, movement is also allowed between theory and empirical study in order to strengthen the understanding of the world of FM-DP integration in the property development industry. This chapter has justified that a exploratory sequential mixed methods approach is appropriate, which led to the combination of qualitative and quantitative research methods. This decision influenced how the analysis of data collected is conducted and subsequently interpreted to meet the objectives of this research. In the final research strategy, the chapter has described unique validation techniques and justified that small focus group interview is appropriate to ensure the validity of the FM-DP integration framework.

Chapter Five

Qualitative Data Analysis

5.1 Introduction of qualitative data analysis: Phase 2 – Semi-structured interview

The discussion in Chapter Two and Chapter Three presented an extensive literature review into barriers that hinder the integration of FM within the development process. It can be concluded that the factors can be classified into eight (8) groups of main themes, namely perception, competence, regulations, organisations, knowledge management, definition, operation and communication. The main themes contain 33 sub-themes for the measurement of FM-DP integration. The literature provides motivation for establishing the best practices for FM-DP integration. It is obvious that the availability of the information is limited and if there is information, it is hard to identify it as the contents are too general. In order to assess whether the data obtained is true and could be effectively implemented into the property development industry, it is essential to acquire views from professionals within the industry regarding the effectiveness of FM-DP integration. For that, the interview participants were selected among professionals who have at least five (5) years working experience and positioned in a senior management level in FM and property development organisation. Another criteria to select the participants is by examine their involvement in various stages of the development process. As a result, balance professional experiences are obtained, which enhancing the reliability of the data.

The aim of this chapter is to present the process of qualitative data analysis and the results. This chapter will also discuss the problems that prevent effective FM-DP integration. A detailed interpretation and discussion of the problems is illustrated with themes and sub-themes with relevant passages. The important points are indicated with specific keywords, which subsequently lead to the development of the constructs and items in the survey instrument.

5.1.1 Participants' profiles

This research requires the interview participants to have experience and knowledge in FM and the property development industry. This is crucial, as the data needed must come from participants who are able to express their real-life experiences. Ten (10) participants were selected based on a purposive sampling method. The justification of the selection of this method was discussed in Section 4.8.1.2. The selection criteria for the participants are as shown in Table 5.1.

Table 5.1 Selection criteria for interview participants

Selection criteria for interview participants
Experience in a senior management position in property development or FM organisation
At least five (5) years' working experience in property development or FM industry
Extensive involvement in any stages of development process in accordance to RIBA Plan of Work 2013: Stage 1: Strategic Definition, Stage 2: Preparation and Brief, Stage 3: Concept Design, Stage 4: Technical Design, Stage 5: Construction, Stage 6: Handover and Close Out, Stage 7: In Use
Location: North West and North of England, which covers Cumbria, Isle of Man, Cheshire, Hull, Leeds, Sheffield, Tyne Tees, Merseyside, Lancashire and Greater Manchester

Source: Self-study

With the experience and knowledge possessed by the participants, it was anticipated that they would be able to respond to the questions effectively and initiate deeper discussion throughout the interview process. As tabulated in Table 5.2, ten (10) interview sessions were conducted between 21st January 2013 and 25th April 2013. It took a long time due to several reasons, including the availability of the participants and geographical constraints.

To comply with ethical requirements, the participants were first contacted via telephone and followed up by email. The Cover Letter explaining the purpose of the interview (see Appendix A), and the Consent Form (see Appendix B) and Participant Information Sheet (see Appendix C) were attached to the email. Subsequently, the communication with the participants continued for arrangement of a suitable time and venue for the meeting. The questions and the list of themes were given on the day of the meeting.

It was found that the participants have decent knowledge and sufficient experience, based on in-depth answers they gave to each prompt question. There was only one (1) participant, Interviewee 6, who asked for the list of questions before the meeting. During the interview session, it was identified that Interviewee 6 had prepared the answer for each question. This proved advantageous for Interviewee 6 to respond quickly with accurate information.

Table 5.2 Profile of interview participants in Stage 2 of data collection

Name	Location	Working experience	Gender	Role	Education background	Type of Organisations	Date of Interview
Interviewee 1	Liverpool	25 years	Male	Facility Manager	Electrical Engineering	Owner/Client	21st Jan. 2013
Interviewee 2	Liverpool	22 years	Male	Head of FM Consultant	Building Survey	Consultant	24th Jan. 2013
Interviewee 3	Manchester	18 years	Male	Head of Facilities Manager	Quantity Survey	Owner/Client	25th Jan. 2013
Interviewee 4	Manchester	15 years	Male	Business Management Manager	Economy	Contractor/ Developer	07th Feb. 2013
Interviewee 5	Manchester	6 years	Female	Project Manager	Construction Management	Contractor/ Developer	29th Jan. 2013
Interviewee 6	Liverpool	12 years	Female	Construction Manager	Project Management	Contractor/ Developer	05th Feb. 2013
Interviewee 7	Liverpool	30 years	Male	Project Manager	Mechanical Engineering	Contractor/ Developer	27th Feb. 2013
Interviewee 8	Liverpool	15 years	Male	Design Architects	Architectural	Consultant	03rd Apr. 2013
Interviewee 9	Sheffield	43 years	Male	Professor in FM	Geology	Owner/Client	25th Apr. 2013
Interviewee 10	Liverpool	18 years	Male	Senior Quantity Surveyor	Quantity Survey	Contractor/ Developer	23rd Jan. 2013

Source: Self-study

It is obvious from the table above that participants are mainly at middle-high management level of their respective organisation as well as in property development project set up. All of the participants are responsible for physical development within their organisation.

Three (3) participants are positioned at senior level in owner/client organisation. It is believed that they have significant influence in the decision making associated with the development work in their estate, such as building new facilities, renovation, refurbishment, repair and maintenance works. This group has an important role of bringing about a significant transformation for better integration between FM and the development process. Something interesting about this group is the presence of Interviewee 9 who had a total of 43 years of work experience, of which 23 years were served formally in FM education. Interviewee 9 is a prominent figure in the FM industry and was listed as one of the UK's 20 most influential pioneers of Facilities Management by the British Institute of Facilities Management (BIFM).

In contractor or developer set up, five (5) participants held a management position in their organisation. Some of them were previously involved in Private Finance Initiative (PFI) and Design & Build (D&B) project schemes in the UK and other parts of the world, which has given attention to incorporating FM elements in the projects. For example, to explain how extensive is the involvement of FM in the property development industry, Interviewee 10 shared his working experience in the United Kingdom (UK), United States of America (USA) and Canada. Meanwhile, Interviewee 4, who had an economic background, a non-technical education, shared his involvement in FM, particularly in maintenance and aftercare. The views given by Interviewee 4 are important as the information gathered is from a non-technical individual.

As an architect, Interviewee 8 had 15 years' working experience involved extensively in all stages of the development process (see Table 5.3). Interviewee 8 provides valuable insights with respect to the role of FM in the development process. Meanwhile, Interviewee 2, who had 27 years in the property development industry of which nine (9) years were in the FM industry, expressed his confidence that FM is important in contributing to the property development industry, provided that FM is given the opportunity to play a greater role in the development process.

From the interview findings, the researcher found that the experience and level of involvement of each participant can be represented against the RIBA Plan of Work 2013, as shown in Table 5.3.

Table 5.3 Participant level of involvement against the RIBA Plan of Work 2013

RIBA Plan of Work 2013	Interviewees									
	1	2	3	4	5	6	7	8	9	10
Stage 0: Strategic Definition	✓	✓	✓					✓	✓	
Stage 1: Preparation and Brief	✓	✓	✓					✓	✓	
Stage 2: Concept Design	✓	✓	✓					✓	✓	
Stage 3: Developed Design	✓	✓	✓		✓	✓		✓	✓	✓
Stage 4: Technical Design	✓		✓		✓	✓		✓		✓
Stage 5: Construction	✓		✓	✓	✓	✓	✓	✓		✓
Stage 6: Handover and Close Out	✓		✓	✓	✓	✓	✓	✓		✓
Stage 7: In Use	✓		✓	✓			✓	✓	✓	

Source: Self-study

From the table above, it was identified that Interviewee 1 and Interviewee 3 from owner/client organisation and Interviewee 8 from architect consultation firm have been involved at all stages in the development process. Meanwhile, the involvement of Interviewee 4 and Interviewee 7, who are from contractor/developer type of organisation of which the nature of the business is in building services engineering, is predominantly in Construction, Handover and Close Out, and In Use stage. This is the opposite of Interviewee 5, Interviewee 6 and Interviewee 10, whose involvements are primarily in Stage 3 to Stage 6. As an FM consultant, Interviewee 2 has extensive involvement at Strategic Definition, Preparation of Brief, Concept and Developed Design stage. Despite being a senior academician in public higher education, Interviewee 9 had experience in the first four stages as well as having continuously contributed to the FM industry at Stage 7 through a number of outstanding research works.

5.1.2 Transcribing analysis

The analysis of qualitative interviews can only be carried out through completed transcription. The interviews were transcribed verbatim. The procedure of transcribing was discussed in detail in Section 4.8.1.4. Hence, in this section, the discussion is more focused on more straightforward results, in numerical form.

The total number of words recorded in interview transcriptions was 84,319. The output of interview transcription analysis is as illustrated in Figure 5.1, which explains that 75.0 per cent of the words were contributed by the participants and another 25.0 per cent were produced by the researcher. The comparison of word count between researcher and the participants is illustrated in Figure 5.2. Figure 5.3 depicts the word count produced by the participants for each question. A sample of the interview transcripts can be found in Appendix F.

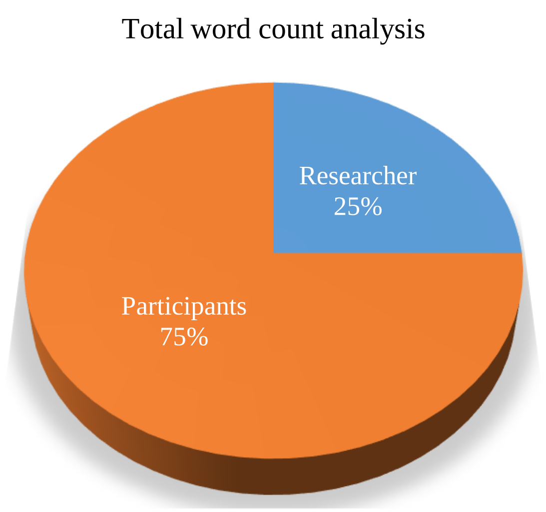


Figure 5.1 Comparison of overall word count between researcher and participants. Source: Self-study

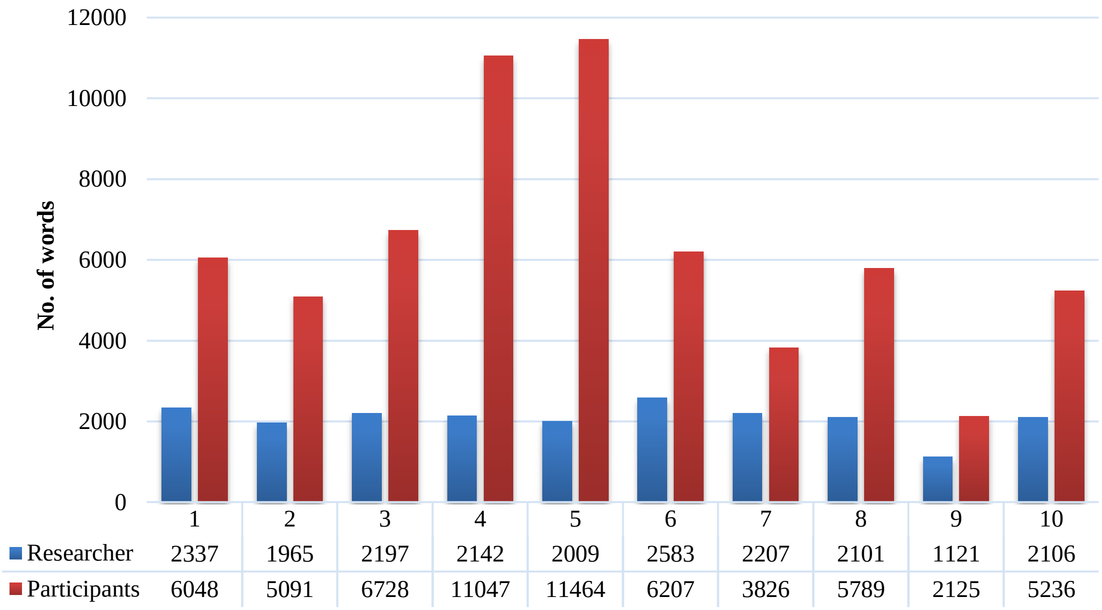


Figure 5.2 Comparison of word count between researcher and the participants. Source: Self-study

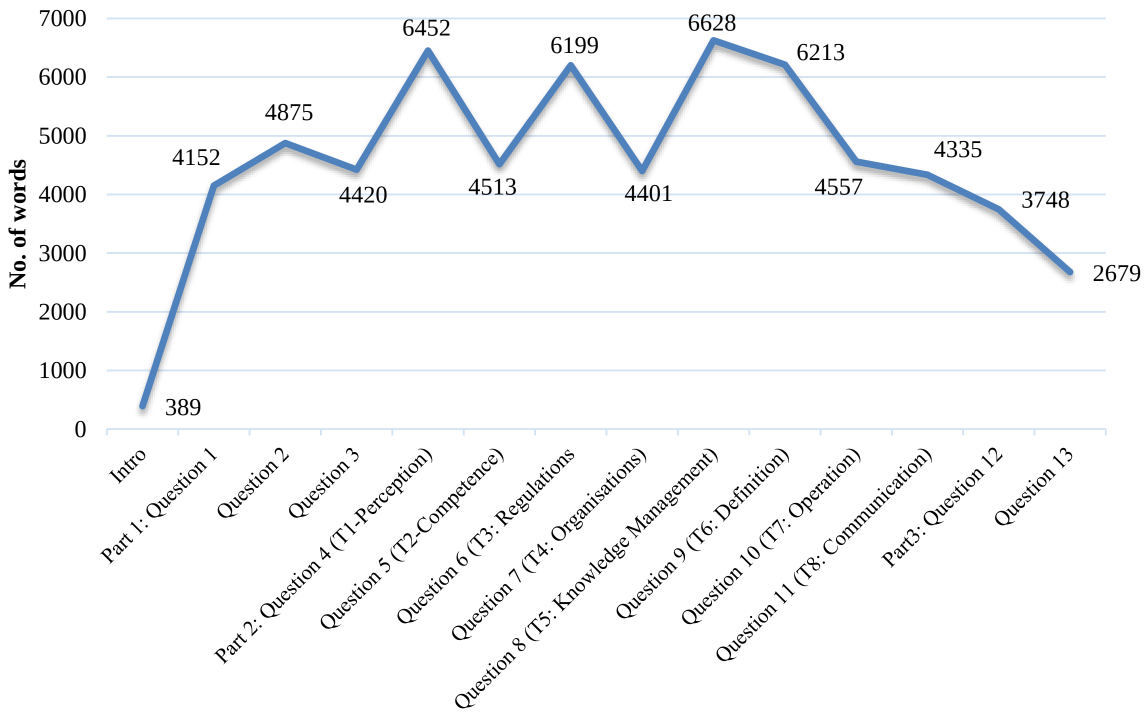


Figure 5.3 Overall number of words by all interview participants for each question. Source: Self-study

Despite the high word quantity in interview sessions, the researcher understands that this situation does not reflect the quality of the content. This can happen due to a repetition of the existing information, which Morse (1995) calls data saturation. Thematic analysis carried out would determine the quality of the information.

5.1.2.1 Tuckman's team development model

Passages that were assigned to an individual theme were counted in order to establish a thematic analysis profile. This can be easily achieved by extracting the number of passages from the framework matrix, as shown in Figure 4.13.

A total of 266 passages were produced in which the responses provided at the early stage of the interview were significantly high and became less so towards the end. At the beginning of the interview sessions, the participants are fresh and have many points to talk about the issues. This is proven by the high number of passages for the first three themes, TI: Perception, T2: Competence and T3: Regulations that represents 47 per cent of the overall passages (refer to Table 5.4).

To understand why this happens, Tuckman (1965) explains that the participants in natural science research need to perform a social function where the researcher has limited control. The participants are to retell previous experience and share their knowledge based on the given queries that they need to answer. This creates conflict between interpersonal relationships (behaviour) and the need to complete the tasks. At the beginning of the interview session, the participants are concerned with orientation, which serves to identify the limitations in answering the questions, as well as in building the relationship with the interviewer. It is natural human behaviour for the participants to show their hesitation, anxiety, guardedness, dependency, and a mixture of curiosity and confusion (Tuckman and Jensen, 1977) in the adaptation process. According to Tuckman (1965), the process of orientation and adaptation is the process of *forming*. During the interview sessions, the participants could not escape from being emotionally responsive to the questions. Tuckman (1965) encourages this behaviour as it avoids the participants using useless experience to influence their answers. This is called a process of *storming,* where the participants begin to purify their minds and attempt to express the differences of the ideas, feelings and opinions. In the next stage, the interaction becomes smooth as the trust and cohesiveness has been developed between the participants and the researcher. This situation is called the *norming* stage, where the participants voiced their suggestions for a better FM-DP integration. There is also agreement on several issues raised by the researcher. The final stage is regarded as *performing*, which is concerned with disengagement and termination of the interview session. Therefore, the ending questions were designed to be general, which allows for flexibility and keeps the momentum to complete the interview session. Tuckman's group development model is adapted in this research to demonstrate the tasks and behavioural characteristics of the model during data collection in this stage.

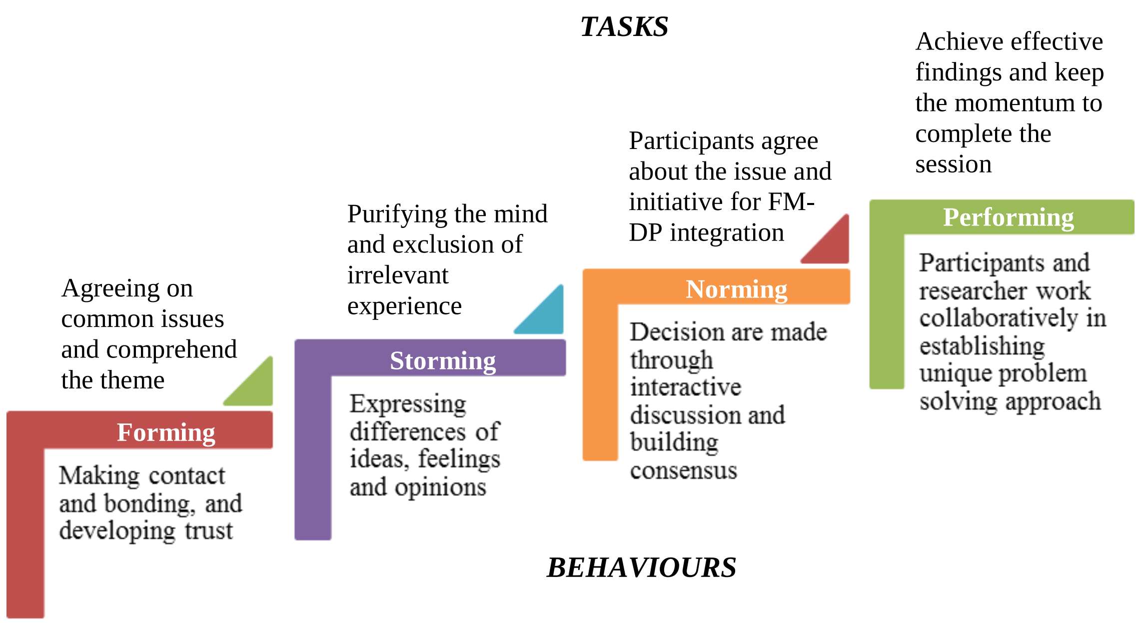


Figure 5.4 Application of Tuckman's team development model in the qualitative data collection. Source: Adapted from Crotty (1998); Tuckman (1965) and Tuckman and Jensen (1977)

5.2 Analysis of the themes

This section focuses on the analysis strategy adopted by the researcher. The aim of this section is to prove that the participants have scrutinised the themes and a consensus to validate the themes has been achieved. Using NVivo 10, the analysis carried out was controlled by the research questions and the themes that were formed from the literature review. The interview data was coded according to the themes that have been created at the literature stage; however, a detailed analysis was carried out based on four (4) approaches to produce new themes or retain, remove and revise existing themes. These approaches will finally establish the final list of variables that will be used in Phase 4 of this research. The analysis of this research can be divided into three (3) steps, as illustrated in Figure 5.5.

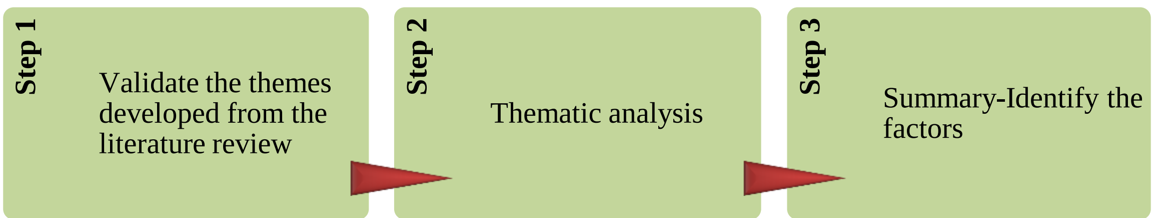


Figure 5.5 Analysis of problems for effective FM-DP integrations. Source: Self-study

5.2.1 Validation of Objective (i): The importance of FM in the development process

In the interviews, the participants discussed their general involvement in FM and the development process. They were also willing to share their thoughts on the importance of FM and its relationship to the development process, producing 17 related passages, which come from ten (10) participants. The passages were grouped into four (4) sub-themes, namely 'the importance of FM in the development process', 'FM as a supporting element to core business', 'contribution of FM to sustainability' and various 'different perspectives of the role of FM in the development process'. For easy understanding, the analysis is visualised in a form of brainstorming, as shown in Figure 5.6.

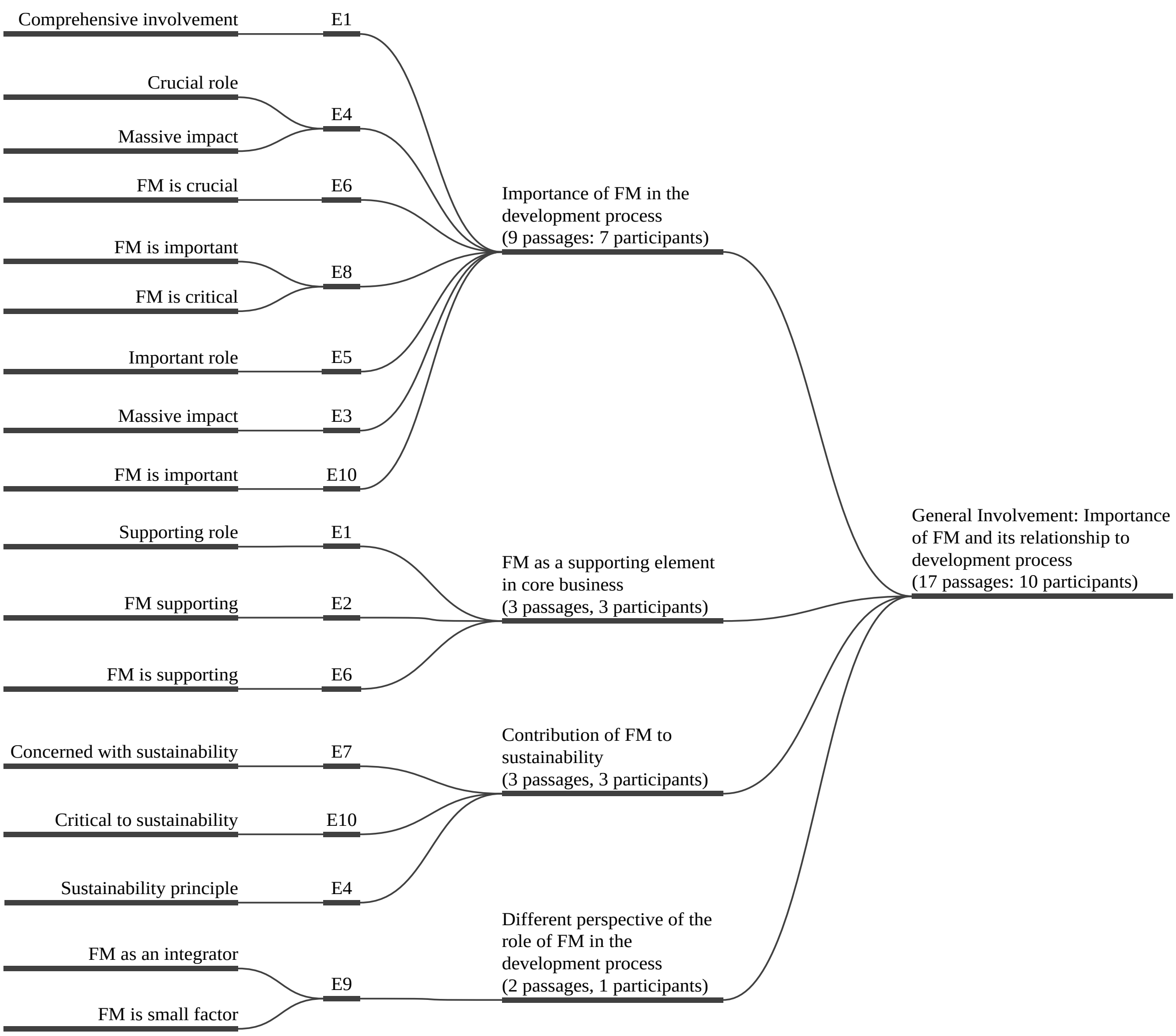


Figure 5.6 Key points of importance of FM and its relationship to the development process. Source: Self-study

The importance of FM in the development process was the most frequent theme identified with regard to how massive was the impact of FM in the development process to the operations of the occupants or clients. For this sub-theme, nine (9) passages were identified from seven (7) participants. In general, the participants agreed that the FM role is important in the development process, particularly at the early stage of the property development project, to ensure effective operations of the organisation. This was mainly emphasised by Interviewee 3, stating that *"FM can potentially have a massive impact on overarching project in its life cycle; therefore, it is very important that role is adopted as soon as possible within the design process"*. This was further reinforced by Interviewee 8, who said that *"from [the] architect's point of view, it is critical to get FM involved in the early stage of the development process in order to ensure the smooth handing over process and assisting the end user and owner to fully utilise the building"*. In more critical thought, Interviewee 1 stressed the consistent contribution of the Facilities Manager to the whole development process, stating that *"we [Facilities Manager] should have been part of the design [and] construction right through the whole project"*. Interviewee 1 resumed with a critical statement regarding common practice in the property development industry, stating that *"[what] I found going in to both of these projects [two previous projects] right at the end with an eye to looking at maintaining the building is that I found things that weren't right".* Interviewee 6 further explained that the end user or the building operators may be distracted from performing the core business activities perfectly, unless *"the building element or the designer of the facility get the FM input right at the beginning, it will have a knock-on effect to achieve the aim of the core business"*. It is obvious that the role of FM is crucial at the beginning of the development process in order to provide an effective supporting function at the use stage, particularly in keeping the core businesses of the tenants running smoothly. Although FM is important in the early stage of the development process, it is not necessarily going to be the core business of the construction activities, as mentioned by Interviewee 6: *"FM is supporting the core business of the tenants in the building not the core business of the construction".* Interviewee 6 added that, in buildings with high human service interaction such as schools and hospitals, *"... FM input is crucial. It is essential in reviewing the design decision as early as possible".*

Three different participants mentioned that **FM is a supporting element in core business**. Interviewee 1 commented on this aspect in a disappointed manner, stating that other professionals in the property development industry tend to look at FM *"as a supporting role that comes after the construction rather than during or before"* construction activities. This can be understood as the FM team often have to deal with problems that are due to error in the design. Interviewee 2, however, looked at it in a positive way and took it as an opportunity for the FM team to realise their important contribution to the core business. Interviewee 2 stated that *"FM team are faced with trying to resolve those problems and that's how they really get their understanding of how that facility is functioning and how it is supporting the original [core business] objectives"*. Interviewee 6 reinforced the supporting role of FM by noted that FM *"is to support the core business and if that support is taken away, the core business won't be able to achieve its aims and objectives"*. Interviewee 4 made a good point of this sub-theme in which the participant summarised the issue, stating that *"at a high management level, retail and education organisations are well aware [of] the role of FM and how important it is to keep their business running. FM [has] clearly got a massive impact to play in their core business"*.

The participants again gave their opinions with regard to the **contribution of FM to the sustainability** of the core business. Interviewee 10 noted that *"I understand Facilities Management and I understand how critical an issue it is in terms of sustainability"*. Interviewee 4 elaborated that FM has a crucial role to play in ensuring the principle of sustainability and value for money is achieved. Interviewee 4 resumed that *"it includes the idea of energy efficiency, space utilisation and mobile flexible working patterns"*. From the energy efficiency point of view, Interviewee 7 stated that *"FM is a lot more concerned with sustainability [of a] building during its working life and should be involved in the preparation stage and consult on the energy efficiency",* hence emphasising that it is essential to value FM involvement in the development process and its contribution to the achievement of the sustainability principle.

Finally, two (2) distinctive passages on **the role of FM in the development process** were given by one (1) participant. Interviewee 9 commented that *"in the business-led situation, FM was very much an integrator or a translator between the technology providers, the building providers and the architects or other designers and the users"*. Interviewee 9 further elaborated on the fact that FM was not very much involved in the construction phase as in the pre-construction phase and post-occupancy phase; hence stressing that the FM team could play their role effectively with the property being developed for a known user rather than the property being built with a view to leasing for unknown tenants.

5.2.2 Step 1: Validate the themes developed from the literature review

This section seeks the overall view of the participants whether or not they agree with the themes developed from the literature review.

During the interviews, the key themes and the sub-themes obtained from the literature review were shared with the participants. Adequate time was given for the participants to review them. At the beginning of the interview sessions, the researcher explained the progress achieved and the importance of the research to the participants. A brief introduction to the current situation in the FM industry and property development industry in the UK helped the researcher to focus the participants' minds into their world as well as guide them to the right track of the discussion. The explanation of the purpose of the interview inspired the participants to share their experiences and, most importantly, to validate the themes and their contents.

In different parts of the interview, several participants stated clearly that they agreed with the themes and their contents. For example, in question no. 3 with regard to theme one, Perception, Interviewee 9 mentioned that *"all the seven (7) points that you've got down there hold true and other people including me at various times have said the same thing"*. As an experienced academician, Interviewee 9 shows that the quality of the details gathered from the literature review is reliable. The answers given by Interviewee 9 for the next themes are also encouraging and convincing, which indicates that the key themes and the sub-themes are valid. In the same question, Interviewee 1 expressed his confidence with the points obtained from the literature review, stating that *"I agree actually with a lot of your findings in that"*.

During the discussion on the theme of Operation, Interviewee 6 agreed with statement no. 29: Negative outcome from POE may be harmful to professional liability and reputation, saying *"I would agree with the statement"*. It shows that the points gathered from the literature review are acceptable. Interviewee 10 made a clear statement that the researcher was trying to address the key issues in FM-DP integration and had successfully shown the gap in the research. Furthermore, by reviewing the list of the themes and brief introduction, Interviewee 10 could anticipate the direction of the literature review and its interest, saying that *"I don't have a great understanding of Facilities Management and I guess that's one of the key issues that you're trying to address so I can definitely see the gap in it and I can definitely [see] where your literature review is taking you to this part hopefully"*.

Although some of the sub-themes are questionable, they encouraged in-depth discussion towards the key themes and other sub-themes. For example, Interviewee 1 does not agree with statement no. 3: Unable to demonstrate strategic value; however, his further explanation has added weight to the points by saying *"I don't agree 100% with that. I think it is difficult to demonstrate the strategic value of the FM but it is measurable in some instances"*. The statement demonstrates that Interviewee 1 expressed his experience and emphasised the importance of FM to support the core business of the organisation with further explanation: *"if I took my department and shut it down for a day, I would come back the next day with loads of problems; it is a very pro-active type of job…"*. Another example is when Interviewee 1 did not agree with the perception that FM is prevalently considered in the operational level. Interviewee 1 elaborated in detail the points and highlighted the substantial role of FM in the strategic level by stating *"to say everything [in FM] is operational is not 100% correct and you have to have certain human resources skills because you [are] managing people, and you have to have negotiation skills because you have to negotiate contracts. So, yes, it is operational but there are other facets to the job as well. I think to purely say it is operational is very short-sighted"*. Therefore, it was evident that participants appreciated the key themes and the sub-themes shared to encourage critical thinking and meaningful discussion.

Another good example was when Interviewee 2 expressed his view with regard to the implementation of the Post-Occupational Evaluation (POE) exercise in the property development industry.

Interviewee 2 did not agree with statement no. 28: Poor feedback due to ineffective POE exercise, as he spontaneously replied: *"I think I would probably substitute 'ineffective' for 'none at all', really"*. The following explanation justifies his earlier statement by sharing his experience: *"The majority of new buildings are occupied and there's no formal assessment of how they're operating afterwards"*. He later urged the POE exercise to be implemented more regularly by emphasising that *"again making post-occupation evaluation much more recognised, valued and something that's carried out much more often would have a great impact on the perception of FM as a profession but also its value in terms of feeding back in to that development process"*. From the above situation, although there is hesitation regarding the key themes and the sub-themes, the participants benefit from it because it inspires deeper discussion from different perspectives.

From the above discussion, it can be concluded that the participants are pleased with the developed themes and sub-themes. Subsequently, detailed analysis of each theme is to be performed, as discussed in Section 4.8.1.5.

5.2.3 Step 2: Analysis of results of Objective (ii)

5.2.3.1 T1: Perception

The most prominent theme with regard to the barriers to FM-DP integration noted by participants was regarding **perception** of the property development community towards FM, producing 53 passages from all participants. This theme was broken down into six (6) sub-themes, as illustrated in Figure 5.7.

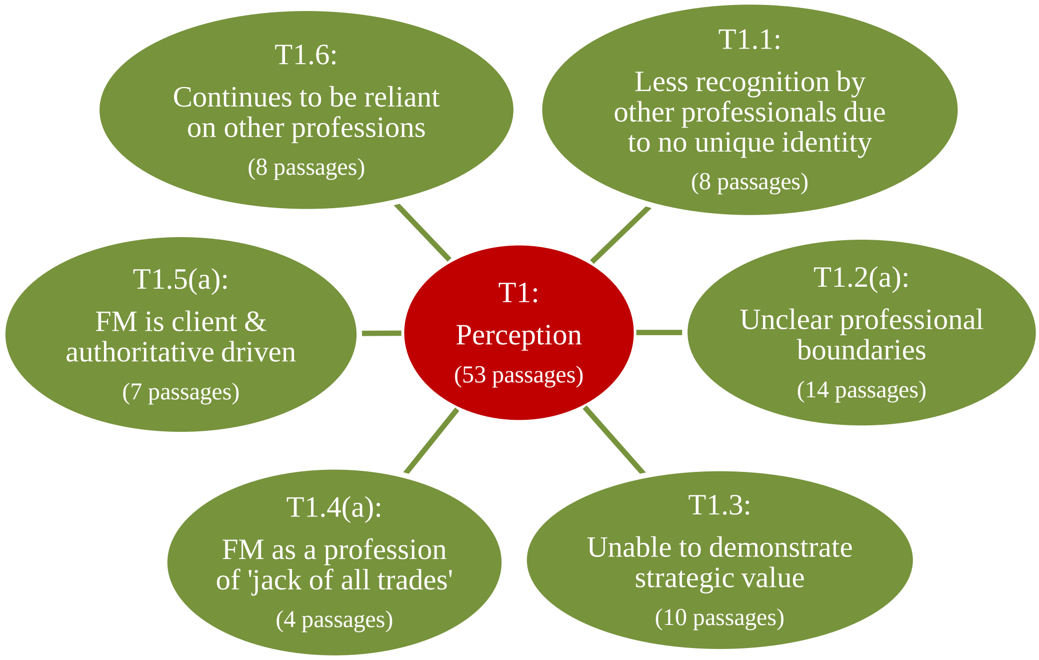


Figure 5.7 Thematic diagram of T1: Perception. Source: Self-study

Less recognition by other professionals due to **no unique identity** produced eight (8) passages. The responses could be separated into two (2) aspects: encouraging (two (2) passages) and discouraging (six (6) passages). Two (2) passages were identified as providing positive perception of the recognition of other professionals towards FM. The increased recognition of FM professions was also noticed by Interviewee 8, who disagreed with the ambiguity of the concept of FM, emphasising that *"There are so many parties who are interested in this process [managing the facilities] of the wellbeing of the building after it was constructed"*. It shows that the task of Facilities Managers is highly demanding. On the negative responses, Interviewee 10 acknowledged that the engagement of Facilities Managers in the feasibility stage in the development process was discouraging. Interviewee 10 comprehended that *"the costs that the developer was going to be spending on construction would balance between his operation costs (FM) as well"*; nevertheless, *"at no stage during the [development] process of that project did we engage a Facilities Management consultant"*. To sum up the recognition of FM in the development process, Interviewee 9 stated that *"on many projects perhaps it [FM] should be positioned strategically but the FM as it has developed over the last twenty years does not position itself strategically very often"*. Unfortunately, the function of FM had decayed into either building services engineering and/or the service management sector.

Unclear professional boundaries provides 14 passages. Interviewee 2 stated that the definition of FM is subjective and Interviewee 7 felt that the concept itself is vague. These views seemed to be reiterated several times by the participants, with Interviewee 3 emphasising that *"If people talk about*

Facilities Managers they imagine somebody with screwdrivers in a bag repairing a light fitting. The Facilities Management definition is so wide ranging, it can range from operating, delivering, managing the building right through to a strategic consultancy". Another participant (Interviewee 1) commented that *"unclear professional boundaries is quite correct because if I take my role today it covers everything from managing projects to negotiating wage contract to employing electricians, so it is a very vast role, it is not particularly specified, it is not a speciality"*.

Unable to demonstrate strategic value received ten (10) responses that could be divided into positive and negative criticism. On the positive side, predominantly this was highlighted by Interviewee 1, who stated that the strategic value of FM is measureable. Moreover, according to Interviewee 4 this should not be an issue as the FM field has grown and been recognised at the higher level of organisations. On the other hand, five (5) participants commented on this matter in a negative manner, with one (1) participant stating that the community in the property development industry was interested in winning the tender bidding by reducing the contract price as low as possible. For this, the cost-cutting exercise will not consider FM elements that are affected by the operations of the organisations.

Jack of all trades was a term used by Tay and Ooi (2001) to explain the crisis of identity faced by the FM industry. Interviewee 5 commented that there is nothing wrong with connecting that term to Facilities Managers, as they are often associated with maintenance and repair works, which disregards their technical background and specialties. One (1) comment was made under this sub-theme, concerning the career path of the Facilities Managers as some of the other participants suggested that academic qualifications would provide more opportunity for Facilities Managers to further their career. Four (4) passages were captured for this sub-theme.

Another factor believed to be a barrier for FM-DP integration was the characteristic of FM itself, on which Interviewee 6 commented that "**FM is client driven**". Most private developers are driven by profit and they would not realise the benefits of incorporating FM into the development process, as they might think it would increase the project cost (additional fees) and be time consuming. Moreover, providing operational criteria to satisfy the users at the early stage might be a waste of effort as the function of the space might change. Therefore, to overcome this situation Interviewee 7 suggested that the relevant authorities should take appropriate action to revise the contents of the contract, taking into account the needs of FM elements in all stages of the development process.

Inability for FM to be independent was also considered as a barrier for FM-DP integration that made FM **continuously reliant on other professions**. Although FM was claimed by Interviewee 1 as a technical profession on its own, two (2) participants argued against this, in which Interviewee 4 commented that management skill is more important than technical knowledge. Meanwhile, Interviewee 5 argued that the ability to interact with "other reliable" technical professions is more critical for Facilities Managers who come from non-technical backgrounds. Therefore, Interviewee 3 reminded us that *"Facilities Managers have got to be really careful that their role doesn't get diluted into other disciplines"*.

5.2.3.2 T2: Competence

The theme of **competence** produced the second-highest number of related passages (40) from the interviews undertaken. Within this key theme, a series of sub-themes were identified, as shown in Figure 5.8 .

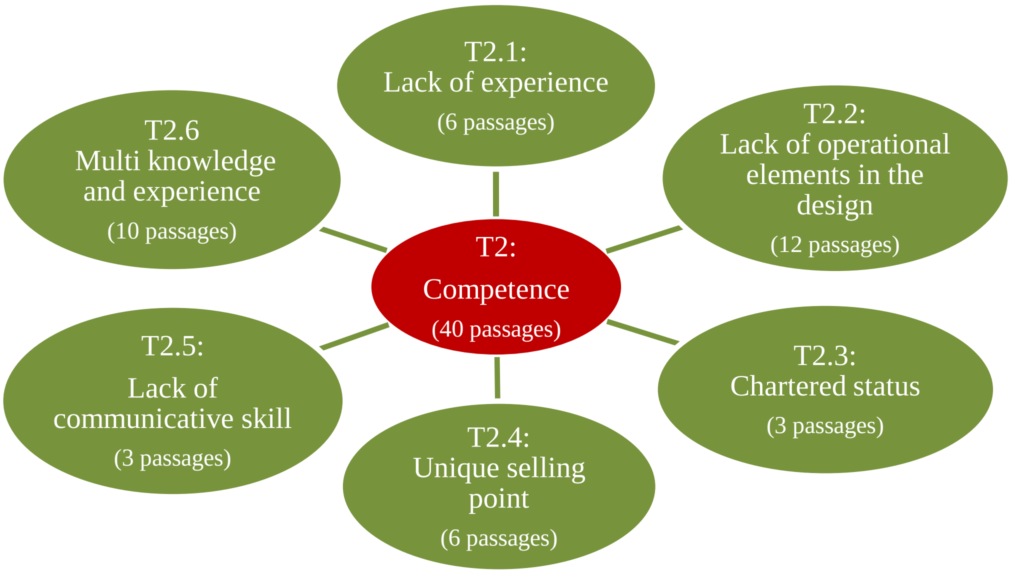


Figure 5.8 Thematic diagram of T2: Competence. Source: Self-study

Lack of experience in the development process is expected to have an impact on the FM-DP integration for both FM and non-FM professionals (Facilities Managers). This factor was viewed as important to ensure that elements of FM are included at all stages of the development process. Out of ten (10) participants, four (4) commented on this sub-theme, producing six (6) passages. The terms experience, knowledge and understanding were used interchangeably by the participants. There are several reasons for FM and non-FM professionals to enhance its competencies in order to get involved in the development process. Interviewee 4 revealed that *"FM has been regarded as a career of chance rather than choice. A lot of Facility Managers started their career as an office manager and end up looking after technical aspects of the building"*. Participants felt that most Facilities Managers do not understand the performance of the building and its function due to insufficient experience and knowledge in the property development industry. This was viewed as very important as continuous training is necessary for them to enhance their competence and skills. Moreover, two

(2) participants (Interviewee 2 and Interviewee 7) conveyed their concerns regarding the ability of Facilities Managers to survive within the environment and the behaviour of the property development industry.

The most prominent sub-theme regarding the competence of Facilities Managers noted by participants concerned the **scarcity of operational elements in the design**, producing 12 related passages. One (1) participant (Interviewee 1) commented on this matter, stating his disagreement with the idea that Facilities Managers were less concerned with operational features in the building design. For him, it is the designers (architects and engineers) who are less concerned with considering operational elements in their design. Interviewee 1 further elaborated that *"FM is more sensitive to the building designs that are easy to maintain and economical to operate. FM is reliable in balancing the design concepts and the functionality of the buildings"*. Another supporting comment to this matter came from Interviewee 2, who claimed that FM had the ability to advise the design team in terms of building operations and supporting the business of the tenants. To optimise the ability of FM in the development process and contribute economic value to the building design, Interviewee 8 insisted that the *"involvement of FM in the design stage together with designer's help takes advantage of something that has been existing in the organisation"*. Despite positive comments on how FM would benefit the property development project, Interviewee 6 emphasised two (2) points that could hinder FM involvement in the development process: (i) lack of Facilities Managers' understanding of the design process and its relationship with building operations; and (ii) lack of awareness of FM capability in contributing to business management that supports the organisation's core activities.

To encourage the involvement of FM in the development process, three (3) participants emphasised the need for Facilities Managers to achieve **chartered status**. Despite the existence of the British Institute of Facility Management (BIFM), which is the professional body that protects the interests of Facilities Managers, Interviewee 3 claimed that it seems inadequate without the chartered status enjoyed by other professional bodies such as Royal Institute of Chartered Surveyor (RICS), Chartered Institute of Building Services Engineers (CIBSE), Royal Institute of British Architects (RIBA) and Institute of Civil Engineers (ICE). Meanwhile, Interviewee 8 commented that it is crucial for the FM community to apply the professional code of conduct established by their professional body on top of any other professional qualifications they might have. Interviewee 9, however, questioned the need for FM to achieve chartered status, stating that *"FM should not be trying to replicate what either of those groupings do because I'm not sure that will actually make that much difference"*. This sub-theme received three (3) related passages from three (3) participants.

The majority of the participants agreed that FM has a big impact on the development process. However, one (1) participant (Interviewee 8) insisted that FM has to disseminate its **unique selling point** within the property development industry. Most of the comments in this sub-theme tend to provide recommendations and advice on the need to improve the competence of FM in some subjects, as emphasised by Interviewee 9, who highlighted *"FM's ability to insist on decent procurement"* and *"the competencies that FM professionals [Facilities Managers] should be having, exhibiting"*. Another participant (Interviewee 3) added the element of saving through an FM approach for: *"better ways of working"*, *"adopting the most appropriate maintenance strategies for your assets"* and *"ability to sell services outside of your own portfolio"*, for example, should be highlighted rather than emphasising that *"FM generally is a cost to a business – it will always be"*. Four (4) participants produced six (6) related passages for this sub-theme.

Lack of interpersonal skill attracted two (2) participants to discuss this sub-theme, which produced three (3) related passages. Interviewee 4 emphasised that good organisational and interpersonal skills are essential for facilities professionals. Interviewee 1 added that *"I think the reality is that most FM managers whether they realise it or not are probably very good communicators and probably quite skilled communicators but I do feel that for the future perhaps some kind of communication skills and management skills [need to be] part of the overall FM qualifications"*. This is a prerequisite, as Facilities Managers need to communicate effectively with operational staff as well as convey valuable strategic information to the boardroom level.

Ten (10) related passages were identified discussing the **multi-knowledge and experience** Facilities Managers have. In this sub-theme, most of the participants agreed that Facilities Managers are often burdened with the need to have a wealth of knowledge relating to the operations of the organisation as well as detailed knowledge of various building engineering and FM. More positively, Interviewee 4 acknowledged the ability of Facilities Managers to have various knowledge that makes them become *"expert in soft and hard FM, and at the same time deal with day-to-day issues"*. He further elaborated the need for Facilities Managers to manipulate other expertise to understand the building operations. Related to this belief, Interviewee 6 emphasised the necessity of Facilities Managers possessing *"coordination skill to gather different knowledge from various disciplines"*. One (1) participant (Interviewee 2) noted that Facilities Managers have a role to support an organisation's business in the building it occupied; however, Facilities Managers have to be *"knowledgeable in the physical and environmental side of the building"* (Interviewee 8) and have *"a certain amount of technical engineering ability to understand engineering processes"* (Interviewee 1).

5.2.3.3 T3: Regulations

The noticeable theme regarding the barriers for integration of FM and the development process was regarding **regulations** and legal impact within the development industry, producing 33 passages. This theme was broken down into four (4) sub-themes, as illustrated in Figure 5.9.

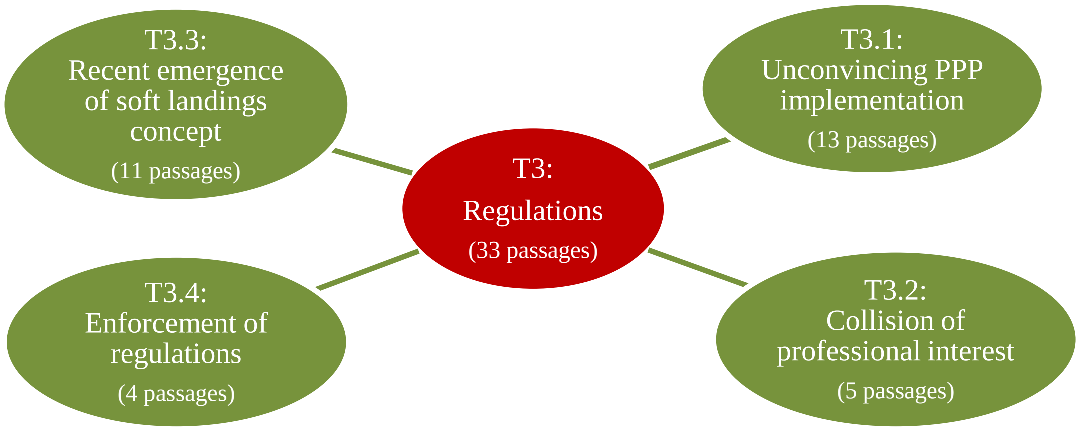


Figure 5.9 Thematic diagram of T3: Regulations. Source: Self-study

A number of comments (13 passages) regarding the barriers for effective FM-DP integration were related to **unconvincing Public Private Partnership (PPP) implementation**. Interviewee 10 commented that "*PPP theoretically should be a champion to incorporating FM into projects"*; however, the community in the development industry thought that PPP is still in the infancy stage and unable to help in producing buildings that are *"FM friendly"*. Using the term *"FM friendly"*, Interviewee 10 insisted that there is a need for legal enforcement or sharing of best practice, which would obviously save money. Linked to the perspective of value for money, a number of participants discussed this matter comprehensively. Interviewees 1, 2 and 8 had a consensus that PPP is not financially effective due to unreliable data for the developers and designers in predicting the long-term FM operational costs. To overcome this problem, Interviewee 4 insisted on the need for Building Information Modelling (BIM) in order to resolve inefficient mechanisms in defining the best practice of knowledge continuity.

Some participants also talked about the **collision of professional interest**, producing five (5) related passages. Participants commented that the FM job scope was in the interests of other professionals although each professional has their own professional agenda. Interviewee 8, for example, emphasised that the tasks of Facilities Managers are often questioned, as other professionals felt they could also perform FM duties. Using the term *"unique selling point"*, Interviewee 8 enforced the view that FM should promote its uniqueness in terms of competency and its professionalism. Conversely, Interviewee 2 suggested that other professionals such as *"architect[s are] not interested to take over FM role as it is more operational and practical. However, the designer's FM professional [Facilities Manager] development could benefit from [being] part of the FM professional [Facilities Manager] development"*. Academicians in the FM field have been known to be the prime movers in boosting the status of the Facilities Manager. However, Interviewee 9, in a more decisive tone, stressed the focus of the Facilties Managers as being on *"winning business"*, rather than academics who are trying to *"beef up"* the FM profession.

Recently emergence of soft landings concept in the property development industry was addressed by eight (8) participants, producing 11 related passages. A number of participants said that they had never heard of the concept of soft landings and had different understanding regarding this concept. One (1) of the participants (Interviewee 10) admitted that soft landings is a new concept in the UK, while Interviewee 5 had a different understanding of the soft landing concept which is more towards the involvement of FM at the end of the construction process.

5.2.3.4 T4: Organisations

The theme **organisations** produced 26 passages and it was broken down into two (2) sub-themes. The thematic diagram of T4: Organisations is shown in Figure 5.10.

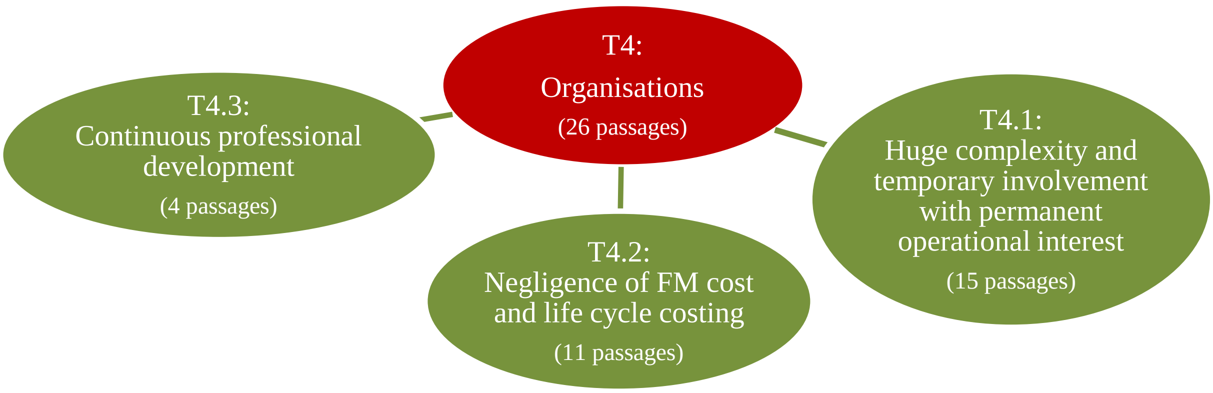


Figure 5.10 Thematic diagram of T4: Organisations. Source: Self-study

The **huge complexity and temporary involvement with operational interest** produced 15 passages. Six (6) participants agreed that FM is usually positioned in operations; meanwhile, recognition is increasing and has a significant impact at the early stage of the development process. This is enforced by Interviewee 1, who claimed full involvement of Facilities Managers in *"future planning and future proofing"* in the development process. He further elaborated their role in *"looking all the time at ways of reducing costs and saving money"* as well as *"ongoing commitment to gathering knowledge"* to be utilised in future development for sustainable planning. All of these are changes in the role of Facilities Manager, which is becoming more strategic in the development process. On the other hand, in a disappointed tone, Interviewee 9 claimed that *"On many projects perhaps it should be positioned strategically but the FM as it has developed over the last twenty years does not position itself strategically very often"*. One (1) participant agreed that FM sits across all stages in the development process. Based on the airport management point of view, Interviewee 3 emphasised his role is *"looking at how the [FM] operations can be linked into the strategy"* of the core business. For this, Facilities Managers need to utilise comprehensive data of FM operational performance and the operational requirements. Those two (2) elements pull through a strategy that is delivered back to the business as part of the (core) business plan.

The **negligence of FM cost and life cycle costing** recorded 11 passages, gathered from five (5) participants. One (1) participant claimed that in the construction projects most *"clients focus more towards capital costs"* although they know that the FM operational cost is also important. This was highlighted by Interviewee 2, who asserted that *"FM probably costs organisation the second-highest drain after staffing"* and is *"extremely significant in supporting the core business"* of the occupants. This situation may happen in an organisation where the management board has less knowledge and awareness about FM in the development process. Interviewee 2 and Interviewee 3 recommended a solution to this unfavourable circumstance by saying that Facilities Managers need a higher education level such as postgraduate programme (Master's courses) or other **FM executive and professional academic programmes**. Interviewee 3 continued that the introduction of Applied Facilities Management at MSc level by LJMU is a good step to promote FM to higher management in an organisation. Interviewee 1 also participated in professional courses, studied and read literature about FM and was even seriously considering doing a doctorate degree in FM. Interviewee 4, who possesses a non-technical academic qualification working in the FM field, advised that individuals should open their minds to learn other knowledge from different disciplines. However, a continuous professional development programme would encourage greater engagement and understanding about FM and other integration opportunities. Interviewee 8 encouraged Facilities Managers to learn and train by experience in order to enhance their competency.

5.2.3.5 T5: Knowledge Management

The participants also discussed **knowledge management,** producing 25 related passages. This theme was broken down into four (4) sub-areas, as identified in the thematic diagram in Figure 5.11.

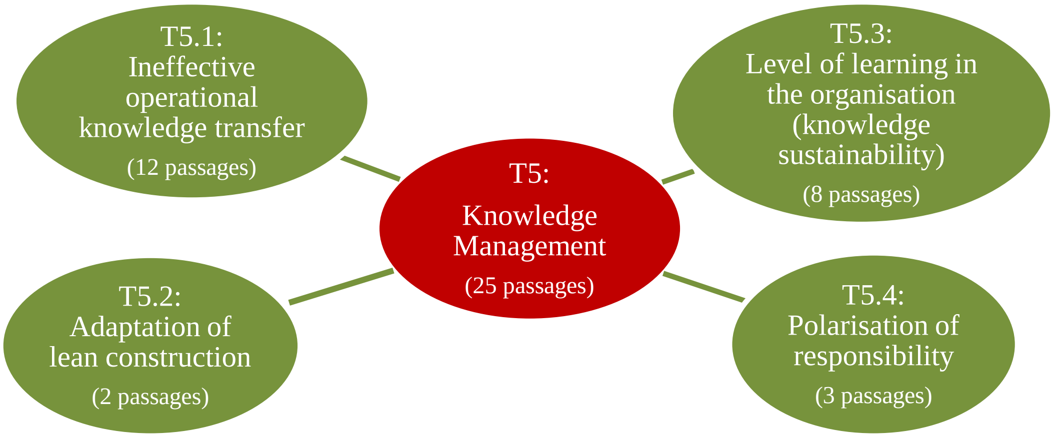


Figure 5.11 Thematic diagram of T5: Knowledge Management. Source: Self-study

The most prominent (12 passages) sub-theme in this theme is the **ineffective operational knowledge transfer** within the property development industry. It was generally felt that the problems could come from different areas that contribute to the constraint to FM-DP integration. One (1) participant (Interviewee 2) noted that there are *"no real drivers to ensure the information is managed"*. He further explained that knowledge management in the development project is not successful due to its *"involvement of additional cost"*. Related to this view, Interviewee 10 explained the current economic situation affecting the property development industry in the UK, stating that "*fees [are] very, very tight right across the board with all design professionals"*. One (1) participant (Interviewee 5) also stressed that the absence of an effective knowledge-sharing mechanism is stunting the FM role in the development process. Interviewee 1 and Interviewee 7 shared their experiences, stating that *"some professionals are quite protective of their own professions"*. Another interesting response was from Interviewee 6, who stated that there is *"no specific framework for the level of information [that has] to be provided"*.

Two (2) passages regarding **adaptation of lean construction** practice were from Interviewee 5. Although the term lean construction itself was not mentioned directly, Interviewee 5 had a positive belief that incorporating the element of lean construction in the development process could optimise the role of FM, stating that *"a number of mechanisms are put in place to effectively manage the design process, design meetings, document management"* and knowledge transfer.

Participants also noted that the level of involvement of FM in the development process would be affected by the **level of learning in the organisation** (8 passages). This was predominantly mentioned by Interviewee 1, who stated that *"there is a huge gap in the exchange of the knowledge. The more knowledge that everybody on the project has, the better it is for the project"*. Interviewee 2 insisted that FM needed to be engaged in the preparation stage of the development process and *"use Building Information Modelling (BIM) to stack something [information] together so that they could talk about the size or the potential size of a building"*. Related to this idea, Interviewee 7 discussed the role of FM to achieve **knowledge sustainability** by learning the knowledge of other professionals. For this, BIM is the most appropriate, as it is a very important and current issue in the property development industry.

Polarisation of responsibility was identified as one of the factors discouraging the role of FM in the development process. Three (3) participants produced three (3) passages related to this issue. There are two (2) different circumstances in these aspects. Firstly, Interviewee 1 and Interviewee 7 emphasised that every profession has its own agenda and they remain with that interest. In the development process, FM and other professionals acted in separate entities that have an impact on the preparation stage right through to the use stage. Secondly, Interviewee 4 opined that, in the same organisation, the FM department was often isolated from the main teams: *"The problem you've got as well with the organisations is that you are Facilities Management Team but sometimes you're completely different and separate to your Capital teams. And I find that quite a lot actually and sometimes there's kind of internal rivalry between the two (2) teams and there isn't that co-ordination"*. This kind of attitude will contribute to poor integration of FM in the development process.

5.2.3.6 T6: Management Tools

The theme of **management tools** produced 26 related passages from ten (10) interviews undertaken. The passages were sorted into four (4) sub-themes, as illustrated in Figure 5.12.

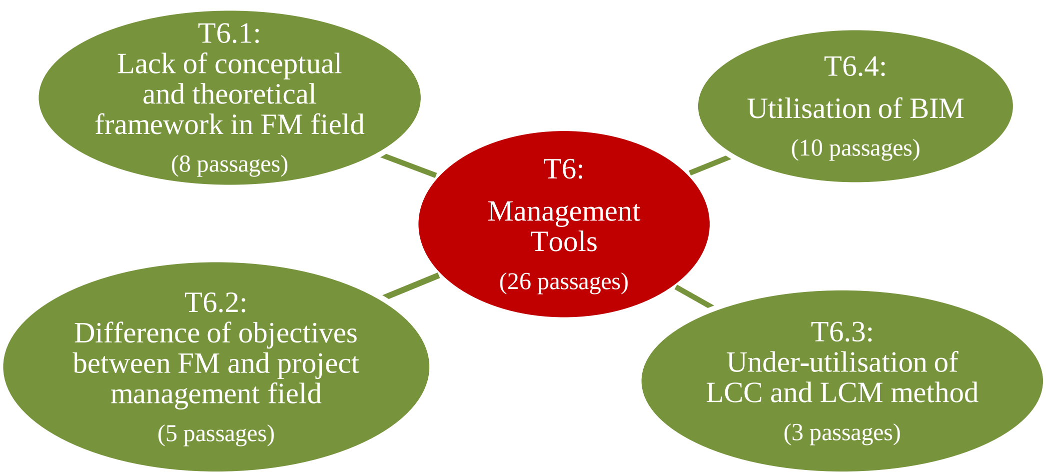


Figure 5.12 Thematic diagram of T6: Management Tools. Source: Self-study

The **lack of a conceptual and theoretical framework in FM field** was mentioned with regard to how effectively are life cycle costing (LCC) and life cycle management (LCM) being used by facilities management professionals in order to contribute to the FM value in the property development process. The effectiveness of LCC and LCM in this process relies heavily on the accuracy of the data that is put into them. Interviewee 1 claimed that, otherwise, *"ideal LCC and LCM will never be achieved"*. Meanwhile, Interviewee 9 opined that the effectiveness of LCC and LCM can only be achieved by taking into account any required changes in the input. However, this situation does not occur as the property development professionals such as engineers and architects are over-reliant on the formal methods and rigid tangible engineering tools. At the same time, Facilities Managers have less sensitivity to the changes of human needs and a lack of understanding of social construction in the property development industry.

Four (4) participants also talked about the **difference of objectives between FM and the project management field**, producing five (5) related passages. Participants noted that there is a conflict of interest towards the utilisation of LCC between FM and the project management field. One (1) interviewee elaborated on this, saying that the project management field is not always that interested in the LCC of the building due to the short period of a construction project (2-5 years). This is in contrast to Facilities Managers who are interested in LCC as they realise its long-term contribution to the operation of the building. The use of LCC and LCM in the development project depends on the authorities and client's needs. However, a different view was highlighted by Interviewee 4: that the contracting company might not be interested about life cycle costing due to the short period of the maintenance contract. The use of LCC and LCM is avoided particularly when the costs in imposing LCC on the project are removed in order to reduce the project cost. Interviewee 2 suggested that imposing other management tools such as Building Information Modelling (BIM) would improve the integration of FM in the development process; however, this would increase the cost of the project, which is often not preferred by the client.

When discussing the potential barriers to the integration of FM in the development process, three (3) participants emphasised the **under-utilisation of LCC and LCM methods** in the development process. Three (3) participants agreed that the life cycle costing (LCC) method was not used to the maximum in the property development industry. Although it has always been present in the construction industry, Interviewee 5 noted that it is not customary to put it into practice, particularly from the perspective of the contractor. Interviewee 7 elaborated that most developers say the right things about life cycle costing; however, *"when they met with simple economic problems all of those methods were neglected and they end up doing things the old way"*. This was also noted by Interviewee 10, who mentioned that there is no comprehensive implementation of LCC and LCM methods in the property development process, particularly from the perspective of FM.

Utilisation of Building Information Modelling (BIM) produced a high number of related passages (10). There were a number of positive comments and suggestions made on how the use of BIM can improve FM integration into the development process. Predominantly, the comments were from a consultant background, in which one (1) participant (Interviewee 2) commented that BIM is a tool for FM and the development process for the future. Another participant (Interviewee 6) explained that it is not going to be driven by the private sector unless they are forced in to it. Therefore, the Facilities Managers should support the government's efforts in expanding the use of BIM. It is obvious that BIM is not only to reinforce the FM skills to all professionals; in addition, it could be utilised for knowledge management. Facilities Managers who have the technical and operational knowledge, coupled with the use of BIM will be able to integrate into the development process. One (1) participant (Interviewee 8) did, however, also mention a negative comment with regard to how BIM could contribute to effective integration between FM and the development process. For him, BIM is a typical computer application system and works perfectly, depending on the accuracy of the data entered into the system. Although the value and the benefit of using BIM would improve the FM-DP integration, Interviewee 3 reminded us that Facilities Managers have to be careful that their role is not diluted into other disciplines.

5.2.3.7 T7: Operations

The theme of **operations** produced 22 related passages from ten (10) interviews undertaken. From the analysis, the passages were sorted into three (3) sub-themes, as illustrated in Figure 5.13.

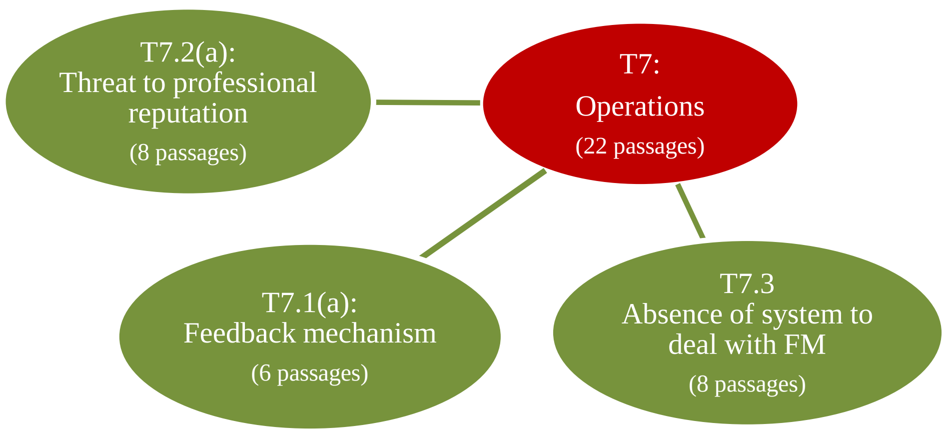


Figure 5.13 Thematic diagram of T7: Operations. Source: Self-study

Participants commented less (six (6) passages) on the fact that there was an element of **feedback mechanism** where the post-occupancy evaluation was conducted after the facilities were handed over and possibly the feedback was not distributed to relevant parties. Post-occupancy evaluation is often viewed as a mechanism to obtain feedback from the end users during In Use stage of the facilities. However, the participants agreed that an ineffective post-occupancy evaluation exercise is due to the reluctance of the relevant professionals to carry out post-occupancy evaluation and analysis professionally. This viewpoint seemed to be reiterated several times by four (4) participants, with Interviewee 2 emphasising that there is *"no formal post-occupancy assessment"* in the project as it was not addressed in the contract. Furthermore, the cost of post-occupancy evaluation was one of the elements often considered to be removed to reduce the project cost. For this, Interviewee 9 commented that post-occupancy evaluation is too concerned about evaluating the building as a physical matter rather than *"evaluating the building as a means to business objective"* which will give more impact to the operations of the organisations and the users. Interviewee 8 further commented that the negative feedback mechanism is also caused by the situation of *"no man's land"*, in which the feedback from the users on this matter might be neglected.

The **threat of professional reputation** was frequently mentioned, with eight (8) passages. Interviewee 4 noted that the post-occupancy evaluation exercise is within the knowledge of the client; however, it is not a common practice for the client, as he elaborated: *"POE are the things that clients really keep closer to their chests"*. Interviewee 6 further discussed this matter, saying that the client is the driver in the implementation of post-occupancy evaluation; nevertheless, *"it depends upon their reasons for doing it in the first place"*. One (1) participant (Interviewee 3) was extremely critical of the implementation of post-occupancy evaluation in the property development industry, stating that *"a lot of people do not like it because it is difficult, it is challenging"*. However, one (1) participant (Interviewee 1) had more positive comments, encouraging the professionals within the industry to benefit from the post-occupancy evaluation exercise.

Another prominent sub-theme regarding the operations which was noted by the participants was regarding the **absence of a system to deal with FM issues**, producing eight (8) passages. Based on experience, Interviewee 3 suggested that the Facilities Managers should understand the functional requirements of the organisations. He further argued that Facilities Managers play an important role in gathering all the information and conveying these requirements to the designers (architects and engineers). Interviewee 3 used the term *"output-based specification"* to describe the desired approach from the FM professionals, stating that *"FM professionals [Facilities Managers] have a real opportunity in helping to develop what those functions"* which encourage building flexibility. Subsequently, this sort of design promotes flexibility in the operation of the organisations, including *"minimal disruption due to replacement of assets during the life of the building"*. The importance of having an asset life cycle-based maintenance programme was noted by Interviewee 4, who claimed that there are two (2) aspects in the building operations. They are legal requirements, which most of the times is prescriptive and has to be fulfilled, and asset-based maintenance strategy, where Interviewee 4 found it hard to find organisations that comply with their maintenance strategy *"as the* *buildings change ownership and different organisations come into a building and take over that [building] they don't have that [facilities management] knowledge of what's gone on before"*. Interviewee 10 made a condensed statement, insisting that the absence of systems to deal with FM issue is the factor causing ineffective building design and interruption in the planning process due to FM being disjointed from the development process.

5.2.3.8 T8: Decision making

The theme **decision making** produced 31 related passages from ten (10) interviews undertaken. The related passages were sorted into three (3) sub-themes, as illustrated in Figure 5.14.

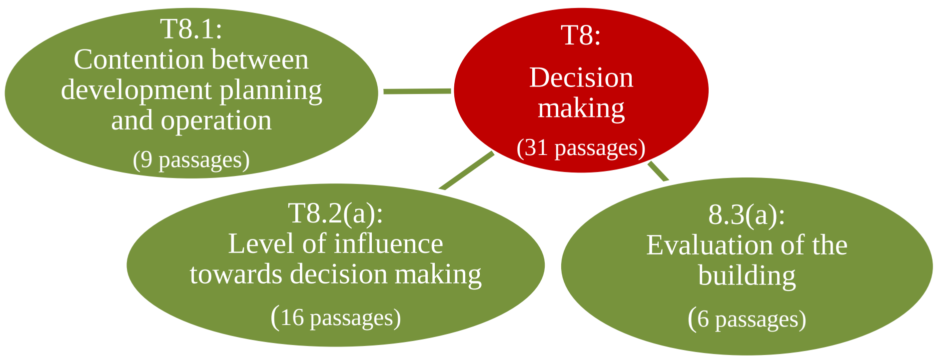


Figure 5.14 Thematic diagram of T8: Decision making. Source: Self-study

The **contention between development planning and operation** produced nine (9) related passages. Based on the financial management perspective in the organisation, Interview 2 noted there are operational costs and revenue in managing the organisation. Interviewee 8 and Interviewee 2 commented that this situation triggered contention between FM team and management team in the organisation. The FM team is often associated with spending while the management group is more focused on accumulating revenue and increasing the income for the organisation. In terms of financial management, it is apparent that the situation creates conflict between these two (2) groups although they are in one (1) organisation. The contention is also contributed by improper maintenance of the facilities, which require high expenditure in maintenance. This is highlighted by Interviewee 4, who stated that high expenditure is due to *"no strategy to reduce the number of breakdowns"*. From the strategic point of view, Interviewee 2 claimed that the *"lack of data in life cycle cost exercise to support the operational of FM"* contributes to the contention between development planning and FM operation. Those passages can be categorised as highlighting the cause of the problems of conflict between development planning and FM operations.

The **level of FM influence towards decision making** was mentioned by nine (9) participants, which produced 16 passages. Interviewee 8 stressed that, in any property development project meeting, most knowledgeable and experienced professionals have the biggest opportunity to influence the decision making. However, people who have information also have a considerable effect. This was mainly enforced by Interviewee 4, who said that *"FM [Facilities Managers] are only as good to influence as the information obtained and knowledge sharing"*. Facilities Managers should view information as being directed towards the design within the FM responsibility in order to maximise the effectiveness and efficiency of the decision-making process. Similarly, in a new-build project, Facilities Managers have an adequate understanding, with all due respect to the designers, of the needs of the people who are going to use the building. From this view, Interviewee 4 elaborated that *"FM can really have influence towards innovation in working practices and flexible working"*. In public organisations, Interviewee 2 contended that Facilities Managers have a bigger role in the decision making. This is in contrast with Facilities Managers within businesses in the private sector, which is generally at a lower level. Interviewee 6 emphasised that the involvement of FM in the decision making relies on the type of the project scheme, whether it was contractor driven or client driven. Interviewee 5 highlighted that, in a conventional contract, FM is more important at the back-end of the development process, specifically in the use stage. Interviewee 5 claimed that, in this type of project, *"FM influence in decision making is none"*. This contrasts to PFI projects, where the role of *"FM is important, as the contractor is also the operator"*. Therefore, the influence of FM on decision making is substantial at the front-end of the development process. The same issue was also highlighted by Interviewee 7 and Interviewee 1.

The **evaluation of the building as a means to a business** was another prominent theme identified with regard to how FM could contribute in the strategic level, specifically in terms of achieving business objectives (Interviewee 6). This sub-theme produced six (6) passages accumulated from six (6) participants. Two (2) participants affirmed that the level of influence of Facilities Managers towards decision making relies on the business objectives. Interviewee 9 and Interviewee 6 asserted that the role should be critical; however, *"too many FM professionals [Facilities Managers] express their contribution towards decision making in building terms not business terms"*. Interviewee 9, a professor in FM, elaborated that there are respectable professionals such as civil engineers and building services engineers who are experts in building design. He further advised that FM should not try to replicate the roles of those professionals; nevertheless, they have to evaluate facilities as a means to achieve business objectives. Interviewee 2 emphasised the ability of the Facilities Managers to assess the long-term operational cost and its effect on the revenue of the organisation. The importance of Facilities Managers to understand the project brief, building construction and life cycle was noted by Interviewee 8. This is supported by Interviewee 4, who agreed that Facilities Managers should demonstrate their innovative thinking in terms of working practices, flexible working principle, energy saving and sustainability concept in order to have considerable influence in the development process. Ultimately, FM would be able to be involved extensively in the construction activities, beginning with advice on procurement of sustainable materials and equipment for the project.

5.2.3.9 T9: Sustainability

The final theme regarding the barriers for integration of FM and the development process was regarding **sustainability**, producing 10 related passages. This theme was broken down into two (2) sub-themes, as illustrated in Figure 5.15.

Figure 5.15 Thematic diagram of T9: Sustainability. Source: Self-study

Four (4) participants discussed **usage optimisation**, producing four (4) related passages. This sub-theme was critically discussed by Interviewee 9, who pointed out that the *"biggest challenge for FM is to provide the necessary business from as small a built footprint as possible, instead of which we build fancy buildings without considering the embodied imaging"*. To ensure a promising FM involvement in the development process, Interviewee 6 emphasised the *"need for FM to understand the reason design decisions have been made so that that can be carried forward in the post-completion"* stage. Meanwhile, Interviewee 8 urged Facilities Managers to have a decent understanding about unquantifiable values of sustainability.

The **environmental sustainability** was discussed by four (4) participants, producing six (6) related passages. In this sub-theme, the perspective of sustainability was discussed by the participants from different angles. One (1) participant (Interviewee 4) considered that FM has a significant role to play towards a Green Agenda and carbon reduction. Interviewee 4 further commented that the sustainability aspect that FM can look at is how materials are sourced and a new understanding of recycling philosophy. Interviewee 3 opined that sustainability in FM is around the operational costs of the building, such as replacement cycles, and to look at the throwaway culture. Finally, Interviewee 10 acknowledged that sustainability in construction needs FM engagement, as he expressed that the *"FM role in sustainability is as big as the design team"* in the development process.

5.2.4 Step 3: Summary - Identify the issues

The intention of the discussion in Section 5.2.3 is to achieve Objective (ii): to identify a number of issues perceived to be barriers for the integration of FM in the development process. It is concluded that there are nine (9) themes: perception, competence, regulations, organisations, knowledge management, management tools, operations, decision making and sustainability (see Table 5.4). The analysis identified 266 passages that resulted in the generation of 35 sub-themes perceived to be barriers for the integration of FM in the development process.

Table 5.4 Summary of qualitative analysis findings

Main themes	No. of sub-themes	Total no. of passages	No. of passages	Sub-themes
T1: Perception	6	53	8	T1.1: Less recognition by other professionals due to no unique identity
			14	T1.2: Unclear professional boundaries
			10	T1.3: Unable to demonstrate strategic value
			4	T1.4: FM as a profession of 'jack of all trades'
			7	T1.5: FM is client & authoritative driven
			8	T1.6: Continues to be reliant on other professions
T2: Competence	6	40	6	T2.1: Lack of experience
			12	T2.2: Lack of operational elements in the design
			3	T2.3: Chartered status
			6	T2.4: Unique selling point
			3	T2.5: Lack of communicative skill
			10	T2.6 Multi knowledge and experience
T3: Regulations	4	33	13	T3.1: Unconvincing PPP implementation
			5	T3.2: Collision of professional interest
			11	T3.3: Recent emergence of soft landings concept
			4	T3.4: Enforcement of regulations
T4: Organisations	3	26	15	T4.1: Huge complexity and temporary involvement with permanent operational interest
			11	T4.2: Negligence of FM cost and life cycle costing
			4	T4.3: Continuous professional development
T5: Knowledge Management	4	25	12	T5.1: Ineffective operational knowledge transfer
			2	T5.2: Adaptation of lean construction
			8	T5.3: Level of learning in the organisation (knowledge sustainability)
			3	T5.4: Polarisation of responsibility
T6: Management Tools	4	26	5	T6.2: Difference of objectives between FM and project management field
			8	T6.1: Lack of conceptual and theoretical framework in FM field
			3	T6.3: Under-utilisation of LCC and LCM methods
			10	T6.4: Utilisation of BIM
T7: Operations	3	22	6	T7.1: Feedback mechanism
			8	T7.2: Threat to professional reputation
			8	T7.3: Absence of system to deal with FM
T8: Decision making	3	31	9	T8.1: Contention between development planning and operation (9 passages)
			16	T8.2: Level of influence towards decision making (16 passages)
			6	8.3: Evaluation of the building
T9: Sustainability	2	10	4	T9.1: Usage optimisation
			6	T9.2: Environmental sustainability
Overall total	**35**	**266**		

This section summarises the findings of the qualitative analysis, the inductive approach, by means of semi-structured interviews conducted with ten (10) experienced professionals in the property development industry and FM in the UK. This section focuses specifically on the feedback in relation to the barriers for FM–DP integration. The discussion identified the constraints, recommendations, expectations and suggestions to encourage the involvement of FM in the development process. The results of the interview analysis were utilised to confirm the findings obtained in the literature reviews and further contextualise the main issues in FM and the development process.

5.3 Amalgamation of literature review and interview analysis findings

As stated in Section 4.9.2, survey research is interested in the relationships between the variables rather than in describing the features of each variable (Punch, 2003). It is essential for the researcher to be clear regarding the conceptual framework as well as to visualise the meaningful interaction between the variables prior to proceeding with designing the questionnaire survey. The purpose of this endeavour is to achieve Objective (iii): to establish the best practices for the integration of FM in the property development process.

Combining the data obtained from the literature review and the interview analysis, there are factors that encourage the extensive involvement of FM in the development process. With the outcome of the amalgamation process (refer to Appendix I), it is concluded that the factors should be evaluated using eight (8) constructs[14]: competences, strategic role, development scheme, strategic value, management tools, knowledge management, post-occupation evaluation and sustainability. From this process, 39 items[15] were generated that formed the initial pool for the survey. Each item was reassigned into two (2) statements; one to measure perceived importance about the qualities Facilities Managers acquire and the other to assess the extent to which the factors would influence the level of integration. An overview of the eight (8) constructs and their items is listed in Table 5.5.

[14] Construct is a group of formulated items as a result of a particular statistical analysis procedure. In this case, factor analysis develops the construct. In order to avoid confusion and to distinguish the terminology of variables, it is decided to use 'main themes' during qualitative analysis and 'construct' during quantitative analysis.
[15] Similarly, for the underlying variables, 'sub-themes' is used during qualitative analysis and 'items' during quantitative analysis.

Qualitative analysis	Quantitative analysis
Main themes	Construct
Sub-themes	Items

Table 5.5 The critical factors of FM-DP integration

Competences – FM having possession of required individual skills and knowledge		
1.	Having adequate experience in building maintenance	Comp1
2.	Having adequate knowledge about construction phases	Comp2
3.	Having adequate knowledge in construction procurement	Comp3
4.	Ability to give clear instructions to others in the project team	Comp4
5.	Get involved in continuous professional development activity	Comp5
6.	Ability to anticipate the operational consequences of design and construction decision	Comp6
7.	Ability to champion lean construction practice	Comp7
Strategic role – FM having the ability to play an effective role within and outside the organisation		
8.	Having a good rapport with client	StrR1
9.	Having a good rapport with third party (local authority)	StrR2
10.	Having trust from other professionals	StrR3
11.	Having a seat at a table in higher management level	StrR4
Development scheme – FM having the ability to adapt to various construction schemes, e.g. Public Private Partnership (PPP) and Government Soft Landings (GSL)		
12.	Having familiarity with GSL concept	DevS1
13.	Willing to anticipate operational issues in PPP project development	DevS2
Strategic value – FM having the ability to demonstrate strategic value and uniqueness		
14.	Understand user's organisational strategy	StrV1
15.	Get involved in briefing stage	StrV2
16.	Take a leadership role in the client organisation as an advisor	StrV3
17.	Proactive in ensuring end users' satisfaction	StrV4
18.	Establish Key Performance Indicators (KPI) of FM at all stages	StrV5
19.	Actively collaborate with users during handing-over period	StrV6
20.	Having chartered status	StrV7
21.	Ability to present service level agreement of FM operations at design stage	StrV8
Management Tools – FM having the ability to use reliable tools		
22.	Ability to apply life cycle costing in the selection of materials/equipment	MgtT1
23.	Ability to apply Building Information Modelling (BIM)	MgtT2
24.	Ability to apply Computerised Aided Facilities Management (CAFM)	MgtT3
25.	Having familiarity with BRE Environmental Assessment Method (BREEAM)	MgtT4
26.	Having mechanism to communicate with end users about their requirements at all stages	MgtT5
Knowledge Management – FM having willingness to learn, share and transfer knowledge		
27.	Commitment to training on operational aspects during handing-over phase	KnowM1
28.	Proactive in managing design changes	KnowM2
29.	Willingness to share information with others	KnowM3
30.	Willingness to learn from others (openness to ideas)	KnowM4
31.	Having comprehensive facilities maintenance records	KnowM5

Post-occupancy evaluation (POE) – FM being able to exploit POE results to optimise building performance	
32. Ability to implement POE	POE1
33. Ability to lead in handling POE database development	POE2
34. Ability to balance the positive and the negative criticism in the POE reports	POE3
35. Ability to transfer POE outcomes in a project to briefing stage of other projects	POE4
Sustainability – FM having the ability to optimise space and demonstrate sustainability philosophy	
36. Ability to take lead in refurbishment works	Sust1
37. Ability to take lead in mobile flexible working patterns	Sust2
38. Involved in selection of construction materials/equipment	Sust3
39. Knowledgeable with regard to sustainable initiatives (Green Agenda, recycling philosophy, etc.)	Sust4

Source: Self-study

5.4 Chapter summary

Chapter Five has provided qualitative findings of this research. The findings can be summarised as below:

- The views of professionals in FM and the property development industry were sought in order to understand their perceptions and expectations of the importance of FM in the development process. It can be concluded that the recognition of FM in the property development industry is encouraging. FM is expected to play an important role and integrate with other professionals in the development process to improve the buildability and operability of the facilities.

- A further thematic analysis provided a final eight (8) constructs containing 39 items that need to be considered in the quantitative research methods.

- Objective (ii) and Objective (iii) of this research were achieved.

The following chapter will discuss the quantitative stage with the main focus being to formulate an FM-DP integration framework that establishes the best practices for the integration of FM into the development process. The process is conducted through a deductive approach.

Chapter Six

Quantitative Data Analysis

6.1 Introduction

This chapter discusses the findings obtained from the questionnaire survey analysis in order to achieve Objective (iii): to establish the best practices for the integration of FM in the development process as well as Objective (iv): to develop an FM-DP integration framework. This chapter provides the evidence of the implementation of the statistical analysis technique explained earlier in Section 4.9.4. At the end of the chapter, the draft FM-DP integration framework is to be established prior to validation – the last objective of this research.

6.2 Quantitative data analysis: Phase 4 – Survey questionnaires

Survey data was collected through electronic means, mail and face-to-face communication between 31st January 2014 and 30th April 2014. For electronic means, the announcements were made through e-bulletin by the Chartered Institute of Architectural Technologists (CIAT) (refer to Appendix J) and Institution of Civil Engineers (ICE) (refer to Appendix K). As an alternative, the British Institution of Facilities Management (BIFM) helped in disseminating the questionnaire on Twitter (refer to Appendix L). The researcher also initiated a discussion in a LinkedIn group with the Royal Institute of Chartered Surveyors (RICS), Chartered Institute of Building Services Engineering (CIBSE) and other professional groups (refer to Appendix M). For face-to-face communication, the survey questionnaires were distributed at ICE's events on 13th and 17th February 2014, BIFM's event on 13th March 2014 and a LJMU event on 2nd April 2014. With regard to the mailed survey, 528 survey questionnaires were distributed to 171 organisations primarily targeted at consultants (architect and engineers) and contractors. The overall response rate is summarised in Table 6.1.

Table 6.1 Response rate

	Distributed	**Returned**	**Response rate**
Electronic	Approx. 500	99	19.8%
Event	150	26	17.0%
Postal	528	31	5.9%
Total		**156**	

Source: Self-study

As explained in Section 4.9.4.2, this section focuses on the professional perspective with regard to the perceived importance and perceived level of integration based on the nine constructs containing 39 underlying items. The next sub-section begins with a descriptive analysis of the data collected followed by purification of the scale by computing the reliability and factor analysis.

The second part of this sub-section reports the crucial findings of the statistical analysis with appropriate hypothesis testing. Firstly, the researcher is to explore the relationships between all critical factors identified to affect the perceived importance and the perceived level of integration. Secondly, examine the differences between all types of professionals concerning all factors in perceived importance and the level of integration. Thirdly, identify the differences between all types of professionals in various organisation classifications and sectors concerning all factors in perceived importance and perceived level of integration. Finally, the FM-DP framework is validated through focus group discussions, the analysis of which is discussed in Chapter Seven.

6.2.1 Descriptive analysis

The descriptive analysis recorded five (5) main characteristics: respondents' professions, membership of professional body, type and sector of organisation respondents were working for, working experience, and respondents' level of involvement in the development process.

6.2.1.1 Respondents' professions

As shown in Figure 6.1, the majority of the respondents came from the facilities management sector, which was mainly due to the interest in the research subject. The researcher received a number of responses from Facilities Managers and BIFM members showing their interest in the overall results of the study. Other professionals were less interested in participating in the questionnaire survey and this was proven when the researcher received blank questionnaires from a number of architects' firms and civil engineering consultants. For 'other' groups, 24 out of 29 respondents are involved in at least Stage 7 in the development process. Ten (10) out of 29 respondents are members of either BIFM or IFMA, with working experience between ten (10) and 30 years. Therefore, overall the response is considered to be reliable and provide valuable information.

Table 6.2 Respondents' professions

	N	%
Civil Engineer	19	12.3
Quantity Surveyor	12	7.7
Building Services Engineer	11	7.1
Architect	13	8.4
Facilities Manager	71	45.8
Other	29	18.7
Sub-total	155	100.0
Missing data	1	
Total	**156**	

Source: Self-study

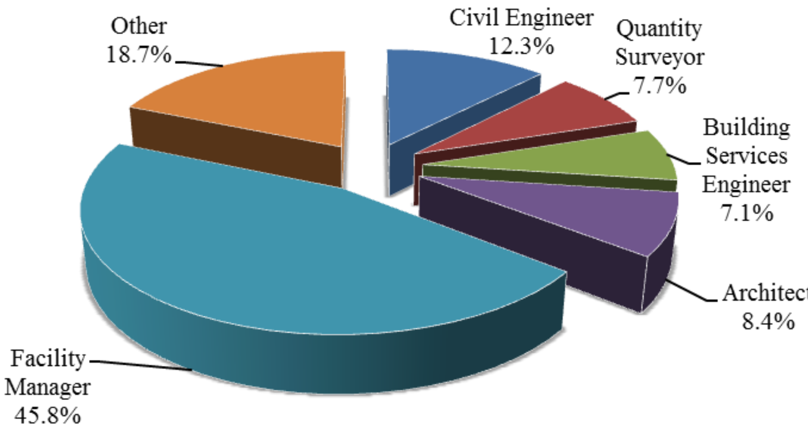


Figure 6.1 Respondents' professions. Source: Self-study

6.2.1.2 Qualification to membership of professional body

Table 6.3 and Figure 6.2 indicate the trend of membership of a professional body of the respondents. Based on the survey results, 87.8 per cent out of 156 respondents are members of a professional body. This accounts for 137 respondents, while the rest are not members of any professional body. The result shows that the academic qualification and working experience of the respondents have been assessed by a reliable professional body. Hence, their contribution to the quality of this study is trustworthy.

Table 6.3 Membership of professional bodies

	N	%
Yes	137	87.8
No	19	12.2
Total	**156**	**100.0**

Source: Self-study

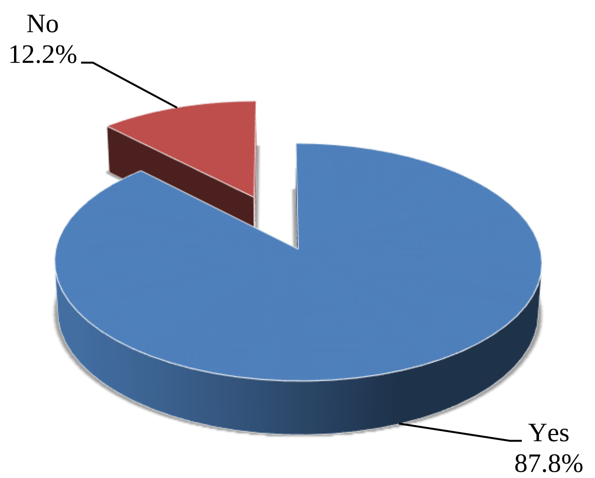


Figure 6.2 Membership of professional bodies. Source: Self-study

As can be observed in Table 6.4, the majority of the respondents are members of BIFM (71), followed by RICS (18), CIBSE (15), and ICE and RIBA (10). For 'other' groups, 40 respondents are members of professional bodies such as the Chartered Institute of Building (CIOB), International Facilities Management Association (IFMA) and Middle East Facilities Management Association (MEFMA). This indicates that the respondents have appropriate knowledge about building development and facilities management.

Table 6.4 Respondents' membership of professional bodies

	Institution of Civil Engineers (ICE)	Royal Institute of Chartered Surveyors (RICS)	Chartered Institution for Building Services Engineers (CIBSE)	Royal Institute of British Architects (RIBA)	British Institute of Facilities Management (BIFM)	Other
Civil Engineer	10	-	-	-	-	6
Quantity Surveyor	-	10	1	-	-	3
Building Services Engineer	-	-	5	-	4	4
Architect	-	-	-	9	-	3
Facilities Manager	-	7	5	1	58	14
Other	-	1	4	-	9	10
Total	**10**	**18**	**15**	**10**	**71**	**40**

Source: Self-study

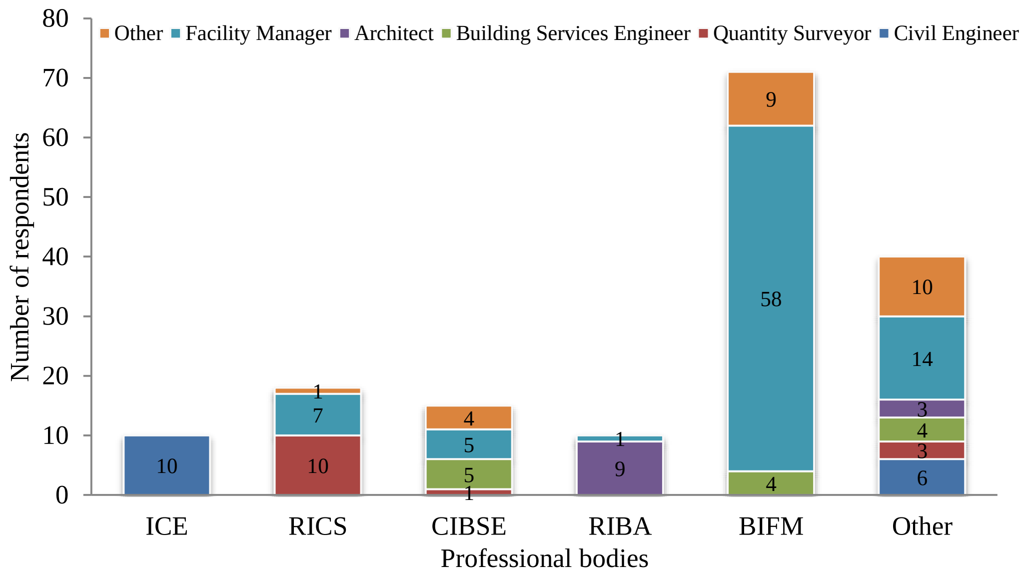


Figure 6.3 Respondents' membership of professional bodies. Source: Self-study

6.2.1.3 Characteristics of responding type of organisations

The respondents were asked the type of organisation for which they were working during the data collection. Table 6.5 shows that 28.21 per cent of the respondents worked with client/owner, while 28.85 per cent worked in consultancy services type of organisations. 16.67 per cent of the respondents worked with developer/contractor and the remaining professionals worked with supplier (5.13 per cent) and manufacturer (2.56 per cent). In 'other' column, 17.95 per cent of the respondents reported that they worked in various types of organisation, namely education, health, sports, FM soft services and retailing sectors. Consequently, the surveys were returned from a wide range of organisational types, which contributes to the reliability of the data collected.

Table 6.5 The types of organisation for which respondents worked

	Client/ Owner	Developer/ Contractor	Consultant	Manufacturer	Supplier	Other	Total
Civil Engineer	2	4	11	-	-	2	19
Quantity Surveyor	2	4	4	-	-	2	12
Building Services Engineer	2	4	2	2	-	1	11
Architect	5	-	8	-	-	-	13
Facilities Manager	27	9	10	2	4	19	71
Other	6	5	10	-	4	4	29
Missing data	-	-	-	-	-	-	1
Total	**44**	**26**	**45**	**4**	**8**	**28**	**156**
Percentage	28.21	16.67	28.85	2.56	5.13	17.95	

Source: Self-study

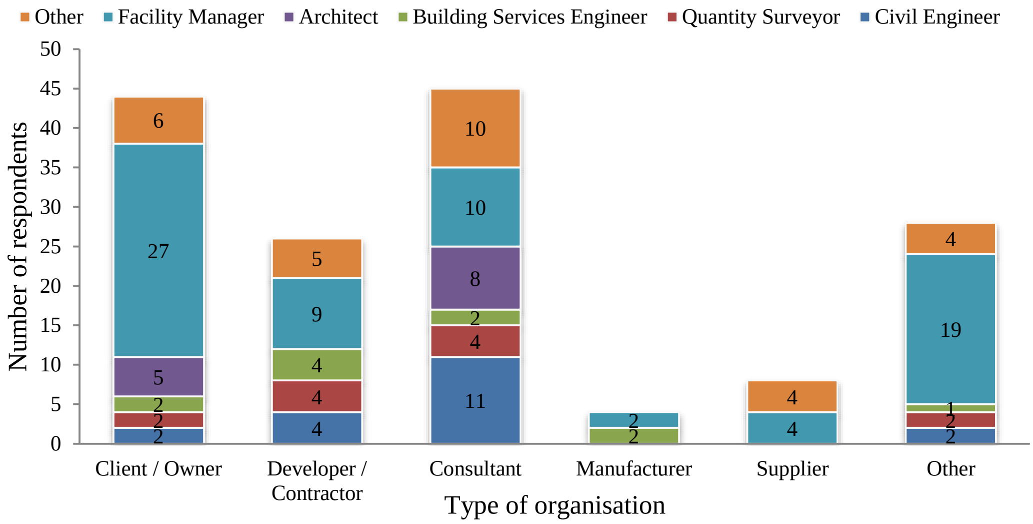


Figure 6.4: The types of organisation for which respondents worked. Source: Self-study

6.2.1.4 Distribution of responding organisation sectors

Based on survey responses, the majority (62.2 per cent) of the respondents worked in private organisations. Only 27.0 per cent worked within the public sector while about 10.0 per cent worked in an industry that served both the public and private sectors. Hence, the survey reveals that the data obtained is reliable due to the comprehensive involvement of the participants in various sectors.

Table 6.6 The organisational sector in which respondents worked

	Frequency	Per cent
Public	42	26.9
Private	97	62.2
Other	16	10.3
Missing data	1	0.6
Total	156	100.0

Source: Self-study

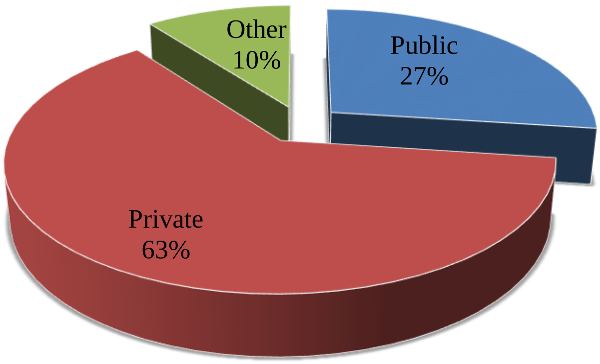


Figure 6.5 The organisational sector in which respondents worked. Source: Self-study

6.2.1.5 Professional itemisation of organisation sector

Combining the data in Section 6.2.1.1 and Section 6.2.1.4, the results can be itemised based on individual professionals. This data is useful in identifying the number of professional who worked in different sectors. As shown in Figure 6.6, the data collected came from various professionals working in either the public or the private sector, or both, with the exception of quantity surveyors, none of whom worked in the public sector. This indicates that the data obtained from the survey is comprehensive, which will enable rigorous statistical analysis in the later stage.

Table 6.7 The organisational sectors in which the professionals worked

	Public	Private	Other	Total
Civil Engineer	6	10	3	19
Quantity Surveyor	-	9	2	11
Building Services Engineer	3	6	2	11
Architect	1	11	1	13
Facilities Manager	27	39	5	71
Other	5	21	3	29
Missing data	-	-	-	2
Total	42	96	16	156

Source: Self-study

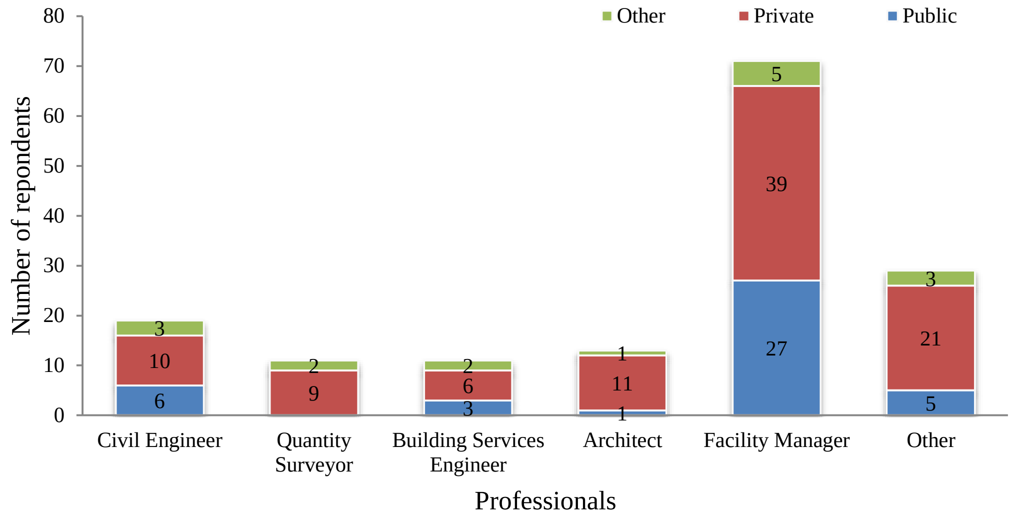


Figure 6.6 The organisational sectors in which the professionals worked. Source: Self study

6.2.1.6 Length of working experience

Figure 6.7 shows the length of respondents' working experience in the property development industry. The working experience ranges from a minimum of one (1) year to a maximum of 60 years. The result shows that 91.0 per cent of the respondents have more than five (5) years' working experience. This indicates that the respondents contribute to the reliability and validity of the responses received.

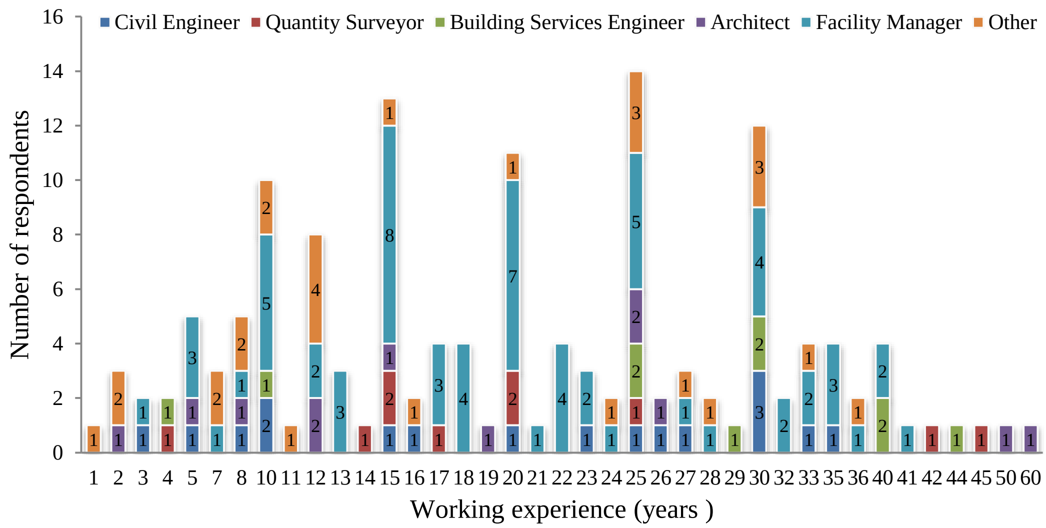


Figure 6.7 Respondents' working experience. Source: Self-study

6.2.1.7 Level of involvement in the development stages

Figure 6.8 indicates the level of involvement of each professional in the development stages. There are eight (8) stages in the development process based on the RIBA Plan of Work 2013, namely: Stage 0-Strategic Definition, Stage 1-Preparation and Brief, Stage 2-Concept Design, Stage 3-Developed Design, Stage 4-Technical Design, Stage 5-Construction, Stage 6-Handover and Close Out and Stage 7-In Use.

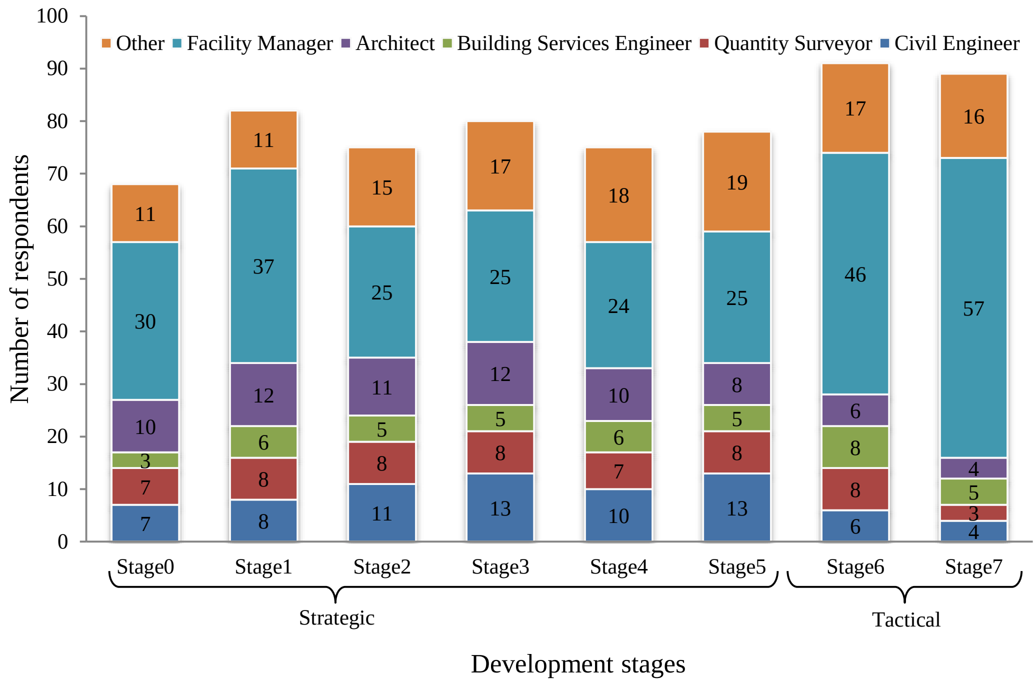


Figure 6.8 Respondents' level of involvement in the development process. Source: Self-study

As shown in Table 6.8, the responses range between 43.59 per cent and 58.33 per cent, which indicates that there is uniformity with the responses of each item regarding participants' involvement in the development process. Surprisingly, 50.0 per cent or more of the respondents had been involved in Stage 1, Stage 3, Stage 5, Stage 6 and Stage 7.

Table 6.8 Respondents' level of involvement in the development process

	Strategic						Tactical	
	Stage0	Stage1	Stage2	Stage3	Stage4	Stage5	Stage6	Stage7
Civil Engineer	7	8	11	13	10	13	6	4
Quantity Surveyor	7	8	8	8	7	8	8	3
Building Services Engineer	3	6	5	5	6	5	8	5
Architect	10	12	11	12	10	8	6	4
Facilities Manager	30	37	25	25	24	25	46	57
Other	11	11	15	17	18	19	17	16
Total	**68**	**82**	**75**	**80**	**75**	**78**	**91**	**89**
Percentage	43.59	52.56	48.08	51.28	48.08	50.00	58.33	57.05

Source: Self-study

6.2.2 Purification of the scale

As explained in Section 4.9.4.1, purification of the scale begins with calculating the value of reliability coefficients, which is known as Cronbach's Alpha (Churchill Jr, 1979; Parasuraman *et al.*, 1988; Peter, 1981). This continues with examining the dimensionality of the instrument by accomplishing the factor analysis and the validity of the scale. The raw data used in this analysis was taken directly from the survey questionnaire in the form of perceived level of integration (PLOI).

6.2.2.1 Reliability analysis

From the reliability analysis procedure, it was discovered that the lowest value of corrected item-total correlations was 0.474 for StrV7 (refer to Table 5.5). Parasuraman *et al.* (1988) recommend that the researcher should drop the items with low value of corrected item-total correlation and whose removal of the item increased Cronbach's Alpha. Deletion of this item improved the value for Strategic Value to 0.905. Table 6.9 shows the final value of Cronbach's Alpha of the eight (8) constructs.

Table 6.9 Reliability coefficients of the eight (8) constructs

FM-DP construct	Number of items	Items dropped	Cronbach's Alpha
Competences	7	-	.840
Strategic Role	4	-	.854
Development Scheme	2	-	.745
Strategic Value	8	1	.905
Management Tools	5	-	.849
Knowledge Management	5	-	.895
Post-Occupancy Evaluation (POE)	4	-	.925
Sustainability	4	-	.832

Source: Self-study

The range of the value of Cronbach's Alpha for individual constructs in Perceived Level of Integration (PLOI) is between 0.745 and 0.925 through the eight (8) variables. Development scheme is the variable with the lowest value; however, it is still within acceptable value (0.7) (Gaur and Gaur, 2009; Pallant, 2010). There is no need for any further action for item elimination and the item remained at 38 numbers.

6.2.2.2 Examine the dimensionality of the instrument

In addition to the earlier explanation in Section 4.9.4.1.2, factor analysis is an appropriate method for this study as it has been designed based on the underlying constructs that are expected to produce scores on the observed items (Tabachnick and Fidell, 2013, p.640). To start with factor analysis, it is beneficial to scrutinise the reliability of the scale (Field, 2013) followed by examining the dimensionality of the instruments by factor analysing the perceived level of integration scores on the 38 items. Examination of the correlation matrix found that the values of 0.3 and above are spread out in the matrix (refer to Appendix N). The value of Kaiser-Mayer-Olkin was 0.928 and the value of Bartlett's Test of Sphericity reached statistical significance, supporting the factorability of the correlation matrix.

In line with the purpose of this analysis, Tabachnick and Fidell (2013) suggest that Principle Components Analysis (PCA) is an appropriate solution in reducing a large number of items down to a smaller number of components. To allow the factors to be correlated as well as to check the degree of correlation between the factors (Pallant, 2010), Direct Oblimin (oblique rotation) approach was selected. Using this approach also facilitates the interpretation of the results. There are two (2) criteria used to decide whether or not to discard the item(s) in the analysis: (i) each component comprises fewer than three items (Pallant, 2010) and/or (ii) the factor loading value is less than 0.4 (Field, 2013). This process is repeated until a clear factor pattern appears and fulfils the above two (2) criteria.

In the first trial, a clear pattern of seven (7) components with the rotation converged in 26 iterations was obtained. Comp5 is the only item in component 7, indicating that this item is irrelevant and therefore it was deleted from the data set before the oblique rotation analysis was reran. There are now 37 items remaining.

Second trial output: The pattern matrix now consisted of six (6) components with the rotation converged in 16 iterations. There are four (4) items: MgtT4, Sust1, StrR2 and MgtT1, which have a loading value of less than 0.4. As a result, these items were deleted before reran the oblique rotation analysis. There are now 33 items remaining.

Third trial output: The resulting pattern matrix now contained five (5) components with the rotation converged in nine (9) iterations. There are three (3) items with a loading value of less than 0.4 (Sust4, StrV5 and DevS1). These items were deleted from the data set before reran the oblique rotation analysis. There are now 30 items remaining.

Fourth trial output: The resulting pattern matrix now contained five (5) components with the rotation converged in 17 iterations. Table 6.10 shows the summary of the cycle of the factor analysis.

Table 6.10 Summary of the cycle of the factor analysis

Trial cycle	*(a)* Initial items	*(b)* Item(s) dropped	Code of dropped item	*(a-b)* Items remaining	No. of components	Iterations
1st	38	1	Comp5	37	7	26
2nd	37	4	MgtT4, Sust1, StrR2, MgtT1	33	6	16
3rd	33	3	Sust4, StrR5, DevS1	30	5	9
4th	30	-	-	30	5	17

Source: Self-study

After four (4) trials, a clear factor pattern containing five (5) components and 30 items appeared. The cumulative percentage of variance explained by those five (5) components is 68.41 per cent, which indicates the majority of the variance within this set of data. Table 6.11 shows the factor loading of the items on the components.

Table 6.11 Pattern matrix of five (5) components

Items	Code	Component 1	2	3	4	5
1. Willingness to learn from others (openness to ideas)	KnowM4	.926				
2. Willingness to share information with others	KnowM3	.834				
3. Having comprehensive facilities maintenance records	KnowM5	.798				
4. Commitment to training on operational aspects during handing-over phase	KnowM1	.781				
5. Proactive in ensuring end users' satisfaction	StrV4	.725				
6. Having a good rapport with client	StrR1	.609			.371	
7. Actively collaborate with users during handing-over period	StrV6	.606				
8. Ability to give clear instructions to others in the project team	Comp4	.539	.376			
9. Having mechanism to communicate with end users about their requirements at all stages	MgtT5	.507				
10. Proactive in managing design changes	KnowM2	.440	.350			
11. Ability to anticipate the operational consequences of design and construction decision	Comp6	.410				
12. Having adequate knowledge about construction phases	Comp2		.924			
13. Having adequate knowledge in construction procurement	Comp3		.869			
14. Ability to champion lean construction practice	Comp7		.581			
15. Involve in selection of construction materials/equipment	Sust3		.553			
16. Having adequate experience in building maintenance	Comp1		.502			
17. Ability to implement POE	POE1			-.878		
18. Ability to lead in handling POE database development	POE2			-.871		
19. Ability to balance the positive and the negative criticism in the POE reports	POE3			-.816		
20. Ability to transfer POE outcomes in a project to briefing stage of other project	POE4			-.726		
21. Having a seat at a table in higher management level	StrR4				.705	
22. Ability to apply Computerised Aided Facilities Management (CAFM)	MgtT3				.648	
23. Having trust from other professionals	StrR3				.572	
24. Ability to apply Building Information Modelling (BIM)	MgtT2				.525	
25. Ability to present service level agreement of FM operations at design stage	StrV8				.522	
26. Willing to anticipate operational issues in PPP project development	DevS2				.477	.396
27. Ability to take lead in mobile flexible working patterns	Sust2				.424	-.393
28. Take a leadership role in the client organisation as an advisor	StrV3					-.728
29. Get involved in briefing stage	StrV2					-.700
30. Understand user's organisational strategy	StrV1	.324				-.408
	Eigenvalues	14.538	1.999	1.632	1.265	1.089
	Percentage of variance	48.461	6.662	5.438	4.218	3.631
	Cumulative percentage	48.461	55.123	60.561	64.780	68.410
	Cronbach's Alpha	0.936	0.833	0.925	0.864	0.840

Source: Self-study

6.2.2.1 Quantify the validity

Validity of instrument is an important procedure in research; it builds confidence for the researcher and the readers with the research findings. There are three types of validity measurement which are broadly discussed in the statistics field. They are content validity, criterion validity and construct validity. Based on reliability analysis, it was identified that the coefficient (Cronbach's Alpha) value of the eight (8) constructs is high, which supports the validity of the scale of the instrument. This section will explain the level of content validity based on the instrument development process, whereas the results obtained from statistical procedures will justify the level of criterion validity and construct validity.

Content validity relates to test quality in which the credibility of the sub-themes is measured. Judgemental methods is one of the procedures where professionals in the field are asked to subjectively evaluate the soundness of the sub-themes (Sireci, 1998; Yaghmaie, 2003). In this research, the sub-themes extracted from trustworthy sources (refer to Table 3.10) were brought to professionals who are considered to be experts in FM and the property development industry. They were interviewed to give subjective judgement prior to thorough qualitative analysis being conducted. This provided sufficient evidence of good content validity.

Criterion validity concerns the relationship between scale scores and measurable criterion (Pallant, 2010, p. 7). The correlation value of each item can be used to determine the level of criterion validity. Examination of Table 6.12 and Table 6.13 found that a large number of correlation values are greater than 0.3; this indicates adequate criterion validity (Rubio *et al.*, 2003).

Construct validity is a fundamental property in the research process that is directly associated with the instrument in measuring its ability to achieve the initial intention of what to measure (Churchill Jr, 1979). Construct validity can be measured by investigating its relationship with convergent validity and discriminant validity (Pallant, 2010, p. 7). Convergent validity refers to a higher degree of correlation value between items in the same construct (Bagozzi, 1981). Fornell and Larcker (1981) suggest that convergent validity is directly proportional to the correlation values. The larger the correlation value between items in the same construct (more than 0.30) indicates that the convergent validity is high. In contrast, discriminant validity suggests a lower level of correlation value between items from different constructs (Bagozzi, 1981). As a rule of thumb, discriminant validity should be lower than convergent validity. An overall examination of Table 6.12 and Table 6.13 found that there are situations where the former is higher than the latter, which leads to a comparison between the average value of convergent validity and discriminant validity. The results show that the value of convergent validity is higher than discriminant appraisal, which indicates that the construct validity of the scale is satisfactory.

Table 6.12: Correlation matrix of 30 items

		Component 1											Component 2				
		KnowM4	KnowM3	KnowM5	KnowM1	StrV4	StrR1	StrV6	Comp4	MgtT5	KnowM2	Comp6	Comp2	Comp3	Comp7	Sust3	Comp1
Component 1	KnowM4	1.000															
	KnowM3	.825	1.000														
	KnowM5	.587	.623	1.000													
	KnowM1	.662	.696	.663	1.000												
	StrV4	.733	.716	.630	.683	1.000											
	StrR1	.673	.667	.568	.574	.638	1.000										
	StrV6	.644	.674	.583	.671	.724	.602	1.000									
	Comp4	.610	.672	.443	.521	.621	.544	.525	1.000								
	MgtT5	.603	.620	.532	.605	.680	.544	.605	.553	1.000							
	KnowM2	.575	.658	.536	.653	.506	.566	.567	.591	.577	1.000						
	Comp6	.463	.527	.342	.488	.477	.450	.508	.605	.485	.482	1.000					
Comp 2	Comp2	.162	.286	.251	.304	.209	.323	.309	.429	.203	.471	.353	1.000				
	Comp3	.288	.347	.327	.325	.249	.304	.239	.454	.274	.456	.348	.690	1.000			
	Comp7	.359	.430	.310	.373	.338	.399	.389	.543	.466	.474	.381	.549	.522	1.000		
	Sust3	.329	.448	.415	.466	.356	.451	.452	.416	.376	.584	.405	.536	.460	.511	1.000	
	Comp1	.281	.372	.344	.417	.428	.408	.382	.460	.396	.431	.430	.571	.439	.385	.422	1.000
Comp 3	POE1	.444	.496	.463	.539	.540	.418	.548	.365	.560	.558	.397	.325	.272	.441	.397	.463
	POE2	.333	.382	.432	.491	.483	.378	.512	.379	.460	.462	.370	.346	.363	.424	.370	.451
	POE3	.480	.521	.467	.533	.526	.385	.549	.470	.489	.549	.395	.357	.363	.420	.456	.367
	POE4	.515	.587	.415	.549	.508	.410	.567	.495	.587	.619	.476	.387	.346	.476	.453	.454
Component 4	StrR4	.338	.461	.303	.332	.402	.530	.458	.428	.361	.405	.444	.315	.280	.301	.368	.293
	MgtT3	.425	.387	.367	.397	.476	.460	.445	.324	.502	.367	.274	.260	.266	.328	.352	.383
	StrR3	.538	.551	.393	.509	.505	.623	.625	.462	.483	.571	.423	.369	.333	.413	.445	.435
	MgtT2	.532	.563	.365	.514	.531	.530	.523	.514	.595	.611	.431	.406	.333	.552	.544	.398
	StrV8	.420	.542	.366	.487	.548	.534	.574	.519	.553	.539	.521	.401	.364	.468	.553	.489
	DevS2	.343	.353	.287	.409	.295	.343	.351	.347	.297	.409	.340	.311	.312	.360	.407	.356
	Sust2	.431	.453	.325	.403	.464	.515	.426	.392	.423	.424	.263	.303	.319	.454	.430	.251
Com 5	StrV3	.416	.472	.397	.352	.533	.510	.442	.527	.507	.519	.398	.310	.316	.383	.402	.427
	StrV2	.433	.505	.438	.471	.572	.479	.515	.518	.510	.563	.406	.360	.353	.407	.434	.398
	StrV1	.603	.620	.388	.565	.644	.555	.573	.553	.616	.469	.487	.261	.251	.416	.401	.494
	Convergent Validity	0.637	0.668	0.551	0.621	0.641	0.583	0.610	0.568	0.580	0.571	0.483	0.586	0.528	0.492	0.482	0.454
	Discriminant Validity	0.404	0.462	0.371	0.444	0.453	0.450	0.467	0.452	0.456	0.499	0.397	0.321	0.323	0.412	0.428	0.400

Table 6.13: Correlation matrix of 30 items (continued)

		Component 3				Component 4							Component 5		
		POE1	POE2	POE3	POE4	StrR4	MgtT3	StrR3	MgtT2	StrV8	DevS2	Sust2	StrV3	StrV2	StrV1
Component 1	KnowM4														
	KnowM3														
	KnowM5														
	KnowM1														
	StrV4														
	StrR1														
	StrV6														
	Comp4														
	MgtT5														
	KnowM2														
Comp 2	Comp6														
	Comp2														
	Comp3														
	Comp7														
	Sust3														
	Comp1														
Comp 3	POE1	1.000													
	POE2	.785	1.000												
	POE3	.767	.754	1.000											
	POE4	.771	.661	.800	1.000										
Component 4	StrR4	.315	.279	.346	.427	1.000									
	MgtT3	.498	.427	.495	.416	.479	1.000								
	StrR3	.491	.432	.498	.540	.595	.496	1.000							
	MgtT2	.595	.513	.506	.585	.428	.621	.587	1.000						
	StrV8	.562	.484	.491	.637	.564	.458	.579	.667	1.000					
	DevS2	.405	.449	.408	.442	.303	.355	.423	.500	.499	1.000				
	Sust2	.367	.337	.449	.490	.443	.418	.481	.480	.471	.323	1.000			
Com 5	StrV3	.308	.327	.347	.414	.519	.299	.447	.412	.500	.202	.558	1.000		
	StrV2	.442	.400	.470	.569	.431	.278	.458	.458	.437	.185	.504	.694	1.000	
	StrV1	.517	.396	.423	.538	.474	.388	.560	.582	.601	.337	.471	.567	.648	1.000
	Convergent Validity	0.775	0.733	0.774	0.744	0.469	0.472	0.527	0.547	0.540	0.401	0.436	0.630	0.671	0.607
	Discriminant Validity	0.451	0.411	0.452	0.496	0.383	0.383	0.483	0.504	0.504	0.346	0.411	0.417	0.444	0.488

Source: Self-study

6.2.2.2 Restructuring of the constructs and items

An examination of the content of each component as shown in Table 6.11 suggests that components 2, 3 and 5 have good commonality, leading the researcher to retain the original name of the construct and its definition. As a result, Component 2 was named Competences, Component 3 Post-Occupancy Evaluation and Component 5 was named Strategic Value. Component 1 demonstrates the combination of 11 items that were extracted from different constructs, in which they have a commonality with the role of knowledge sharing and willingness to learn new knowledge. Therefore, it was decided to name Component 1 as Knowledge Management. After assessing each item in Component 4, there was a need for FM to have the ability to make the most of resources in order to influence the decision maker in the organisations. Hence, component 4 was labelled as Organisation.

Table 6.14: Label of the items and concise definition for the constructs

	Construct / items	Code
	Knowledge Management – *FM having willingness to learn, share and transfer knowledge*	
1.	Willingness to learn from others (openness to ideas)	KnowM4
2.	Willingness to share information with others	KnowM3
3.	Having comprehensive facilities maintenance records	KnowM5
4.	Commitment to training on operational aspects during handing-over phase	KnowM1
5.	Proactive in ensuring end users' satisfaction	StrV4
6.	Having a good rapport with client	StrR1
7.	Actively collaborate with users during handing-over period	StrV6
8.	Ability to give clear instructions to others in the project team	Comp4
9.	Having mechanism to communicate with end users about their requirements at all stages	MgtT5
10.	Proactive in managing design changes	KnowM2
11.	Ability to anticipate the operational consequences of design and construction decision	Comp6
	Competences – *FM having possession of required individual skills and knowledge*	
12.	Having adequate knowledge about construction phases	Comp2
13.	Having adequate knowledge in construction procurement	Comp3
14.	Ability to champion lean construction practice	Comp7
15.	Involved in selection of construction materials/equipment	Sust3
16.	Having adequate experience in building maintenance	Comp1
	Post-Occupancy Evaluation – *FM being able to exploit POE results to optimise building performance*	
17.	Ability to implement POE	POE 1
18.	Ability to lead in handling POE database development	POE 2
19.	Ability to balance the positive and the negative criticism in the POE reports	POE 3
20.	Ability to transfer POE outcomes in a project to briefing stage of other project	POE 4

	Organisation – *FM having the ability to make the most of resources in order to influence the decision maker*	
21.	Having a seat at a table in higher management level	StrR4
22.	Ability to apply Computerised Aided Facilities Management (CAFM)	MgtT3
23.	Having trust from other professionals	StrR3
24.	Ability to apply Building Information Modelling (BIM)	MgtT2
25.	Ability to present service level agreement of FM operations at design stage	StrV8
26.	Willing to anticipate operational issues in PPP project development	DevS2
27.	Ability to take lead in mobile flexible working patterns	Sust2
	Strategic Value – *FM having the ability to demonstrate strategic value and uniqueness*	
28.	Take a leadership role in the client organisation as an advisor	StrV3
29.	Get involved in briefing stage	StrV2
30.	Understand user's organisational strategy	StrV1

Source: Self-study

6.2.3 Analysis for relationships of construct

The combination of items resulting from factor analysis is referred to as a 'construct' in order to differentiate it from the term 'component' in the factor analysis process. The descriptive analysis begins with assessing for normality in order to classify whether the non-parametric or parametric technique is appropriate. The dependent variables data used to check for normality is in the form of Perceived level of integration (PLOI). The result of the Kolmogorov-Smirnov statistic reveals a significant value (sig. value 0.00), suggesting violation of the assumption of normality. The assessment shows the result is in respect of linearity and homoscedasticity. Therefore, non-parametric techniques are expected to dominate in a subsequent statistical analysis.

6.2.3.1 Test for Hypothesis 1: To determine the relationship between perceived importance of FM to be considered and the extent to which the FM could integrate effectively into the property development process

Correlation Analysis: To assess the relationship between each construct in perceived importance and the perceived level of integration; there are two (2) possibilities in which the hypothesis can be categorised in terms of null hypothesis (H_0) and alternative hypothesis (H_1).

> *Null hypothesis (H_0): There is no relationship between the perceived importance of FM to be considered and the extent to which the FM could integrate effectively in the development process.*
>
> *Alternative hypothesis (H_1): There is relationship between the perceived importance of FM to be considered and the extent to which the FM could integrate effectively in the development process.*

Using Spearman's rho correlation analysis, the output is shown in Table 6.15, which explains that all of the constructs are in positive correlation. However, the attention is given in the shaded area, which represents the relationship of the constructs between perceived importance (PI) and perceived level of integration (PLOI). Within the same construct, it was identified that the correlation value (ρ) is between minimum 0.527 and maximum 0.633; hence, the strength of the relationships within the same construct fall under moderate (Dancey and Reidy, 2011) with high significance ($p < 0.01$). On top of that, the cross-construct relationships between PI and PLOI are between weak and moderate with high significance ($p < 0.01$). Only Knowledge Management has a weak but highly significant relationship with Competence ($\rho = 0.191$, $p = 0.017 < 0.05$). It is proven that there is relationship between the two measures; therefore, the null hypothesis (H_0) is rejected.

The relationship between constructs within perceived level of integration is categorised as positively moderate with high significance ($\rho > 0.40$, $p < 0.01$). Unlike the relationship of constructs within perceived importance, the relationship here falls between positively weak and moderate with high significance ($0.1 < \rho < 0.6$, $p < 0.01$).

Table 6.15: Correlation between perceived importance and perceived level of integration of all constructs

		Perceived level of integration					Perceived importance					
		Knowledge Mgt.	Competence	POE	Organisation	Strategic Value	Knowledge Mgt.	Competence	POE	Organisation	Strategic Value	
Perceived level of integration	Knowledge Mgt.	1.000										ρ
												Sig.
	Competence	.527**	1.000									ρ
		.000										Sig.
	POE	.699**	.517**	1.000								ρ
		.000	.000									Sig.
	Organisation	.740**	.571**	.637**	1.000							ρ
		.000	.000	.000								Sig.
	Strategic Value	.683**	.467**	.510**	.623**	1.000						ρ
		.000	.000	.000	.000							Sig.
Perceived importance	Knowledge Mgt.	**.547****	.312**	.351**	.513**	.369**	1.000					ρ
		.000	.000	.000	.000	.000						Sig.
	Competence	.191*	**.619****	.275**	.298**	.225**	.319**	1.000				ρ
		.017	.000	.001	.000	.005	.000					Sig.
	POE	.441**	.318**	**.568****	.410**	.278**	.525**	.344**	1.000			ρ
		.000	.000	.000	.000	.000	.000	.000				Sig.
	Organisation	.374**	.362**	.292**	**.633****	.339**	.618**	.399**	.482**	1.000		ρ
		.000	.000	.000	.000	.000	.000	.000	.000			Sig.
	Strategic Value	.343**	.236**	.241**	.345**	**.527****	.560**	.281**	.385**	.519**	1.000	ρ
		.000	.003	.002	.000	.000	.000	.000	.000	.000		Sig.

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

Source: Self-study

6.2.4 Zooming in on each item – Test for Hypothesis 2: To determine the difference between the level of involvement in the development stages in terms of perceived importance and perceived level of integration for each item

The next step is to determine the differences between the level of involvement in the development stages in terms of perceived importance and perceived level of integration in all of the 30 items. To determine the difference between the level of involvement in the development stages in terms of perceived importance and perceived level of integration for each item, there are two (2) possibilities in which the hypothesis can be categorised in terms of null hypothesis (H_0) and alternative hypothesis (H_1).

Null hypothesis (H_0): There is no difference between the level of involvement in the development stages in terms of perceived importance and perceived level of integration for each item.

Alternative hypothesis (H_1): There is difference between the level of involvement in the development stages in terms of perceived importance and perceived level of integration for each item.

240 one-way MANOVA tests were performed for each item in all stages of the development process. The hypothesis test results are as shown in Table 6.16.

Table 6.16 Hypothesis test results from one-way MANOVA to investigate the difference between the level of involvement in the development stages in terms of perceived importance and perceived level of integration for each item

Construct	Code	Items	DV	IV	Null hypothesis (H_0)	Alternative hypothesis (H_1)
Knowledge Management *(FM having willingness to learn, share and transfer knowledge)*	KnowM4	1. Willingness to learn from others (openness to idea)	PI PLOI	Stage 0	Accept	Reject
				Stage 1	Accept	Reject
				Stage 2	Accept	Reject
				Stage 3	Accept	Reject
				Stage 4	Accept	Reject
				Stage 5	Accept	Reject
				Stage 6	Accept	Reject
				Stage 7	Accept	Reject
	KnowM3	2. Willingness to share information with others	PI PLOI	Stage 0	Accept	Reject
				Stage 1	Accept	Reject
				Stage 2	Accept	Reject
				Stage 3	Accept	Reject
				Stage 4	Accept	Reject
				Stage 5	Accept	Reject
				Stage 6	Accept	Reject
				Stage 7	Accept	Reject
	KnowM5	3. Having comprehensive facilities maintenance records	PI PLOI	Stage 0	Accept	Reject
				Stage 1	Accept	Reject
				Stage 2	Accept	Reject
				Stage 3	Accept	Reject

Construct	Code	Items	DV	IV	Null hypothesis (H_0)	Alternative hypothesis (H_1)
				Stage 4	Accept	Reject
				Stage 5	Reject	Accept
				Stage 6	Accept	Reject
				Stage 7	Accept	Reject
	KnowM1	4. Commitment to training on operational aspects during handing-over phase	PI PLOI	Stage 0	Accept	Reject
				Stage 1	Accept	Reject
				Stage 2	Accept	Reject
				Stage 3	Accept	Reject
				Stage 4	Accept	Reject
				Stage 5	Accept	Reject
				Stage 6	Accept	Reject
				Stage 7	Accept	Reject
	StrV4	5. Proactive in ensuring end users' satisfaction	PI PLOI	Stage 0	Accept	Reject
				Stage 1	Accept	Reject
				Stage 2	Accept	Reject
				Stage 3	Accept	Reject
				Stage 4	Accept	Reject
				Stage 5	Accept	Reject
				Stage 6	Accept	Reject
				Stage 7	Accept	Reject
	StrR1	6. Having a good rapport with client	PI PLOI	Stage 0	Accept	Reject
				Stage 1	Accept	Reject
				Stage 2	Reject	Accept
				Stage 3	Reject	Accept
				Stage 4	Reject	Accept
				Stage 5	Accept	Reject
				Stage 6	Accept	Reject
				Stage 7	Accept	Reject
	StrV6	7. Actively collaborate with users during handing-over period	PI PLOI	Stage 0	Accept	Reject
				Stage 1	Accept	Reject
				Stage 2	Accept	Reject
				Stage 3	Accept	Reject
				Stage 4	Accept	Reject
				Stage 5	Accept	Reject
				Stage 6	Accept	Reject
				Stage 7	Accept	Reject
	Comp4	8. Ability to give clear instructions to others in the project team	PI PLOI	Stage 0	Accept	Reject
				Stage 1	Accept	Reject
				Stage 2	Accept	Reject
				Stage 3	Accept	Reject
				Stage 4	Accept	Reject
				Stage 5	Accept	Reject
				Stage 6	Accept	Reject
				Stage 7	Accept	Reject
	MgtT5	9. Having mechanism to communicate with end users about their requirements at all stages	PI PLOI	Stage 0	Accept	Reject
				Stage 1	Accept	Reject
				Stage 2	Accept	Reject
				Stage 3	Accept	Reject
				Stage 4	Reject	Accept
				Stage 5	Accept	Reject
				Stage 6	Accept	Reject
				Stage 7	Accept	Reject
	KnowM2	10. Proactive in managing design changes	PI PLOI	Stage 0	Accept	Reject
				Stage 1	Accept	Reject
				Stage 2	Accept	Reject
				Stage 3	Accept	Reject
				Stage 4	Accept	Reject
				Stage 5	Accept	Reject
				Stage 6	Accept	Reject
				Stage 7	Accept	Reject
	Comp6	11. Ability to anticipate the operational	PI PLOI	Stage 0	Accept	Reject
				Stage 1	Accept	Reject

Construct	Code	Items	DV	IV	Null hypothesis (H_0)	Alternative hypothesis (H_1)
		consequences of design and construction decision		Stage 2	Accept	Reject
				Stage 3	Accept	Reject
				Stage 4	Accept	Reject
				Stage 5	Accept	Reject
				Stage 6	Accept	Reject
				Stage 7	Accept	Reject
Competence *(FM having possession of required individual skills and knowledge)*	Comp2	12. Having adequate knowledge about construction phases	PI PLOI	Stage 0	Accept	Reject
				Stage 1	Accept	Reject
				Stage 2	Accept	Reject
				Stage 3	Accept	Reject
				Stage 4	Accept	Reject
				Stage 5	Accept	Reject
				Stage 6	Accept	Reject
				Stage 7	Reject	Accept
	Comp3	13. Having adequate knowledge in construction procurement	PI PLOI	Stage 0	Reject	Accept
				Stage 1	Accept	Reject
				Stage 2	Accept	Reject
				Stage 3	Accept	Reject
				Stage 4	Accept	Reject
				Stage 5	Accept	Reject
				Stage 6	Accept	Reject
				Stage 7	Accept	Reject
	Comp7	14. Ability to champion lean construction practice	PI PLOI	Stage 0	Accept	Reject
				Stage 1	Accept	Reject
				Stage 2	Reject	Accept
				Stage 3	Accept	Reject
				Stage 4	Reject	Accept
				Stage 5	Accept	Reject
				Stage 6	Accept	Reject
				Stage 7	Reject	Accept
	Sust3	15. Involved in selection of construction materials/equipment	PI PLOI	Stage 0	Accept	Reject
				Stage 1	Accept	Reject
				Stage 2	Accept	Reject
				Stage 3	Accept	Reject
				Stage 4	Accept	Reject
				Stage 5	Accept	Reject
				Stage 6	Accept	Reject
				Stage 7	Accept	Reject
	Comp1	16. Having adequate experience in building maintenance	PI PLOI	Stage 0	Reject	Accept
				Stage 1	Accept	Reject
				Stage 2	Accept	Reject
				Stage 3	Accept	Reject
				Stage 4	Accept	Reject
				Stage 5	Accept	Reject
				Stage 6	Accept	Reject
				Stage 7	Accept	Reject
Post-occupancy evaluation *(FM being able to exploit POE results to optimise building performance)*	POE1	17. Ability to implement POE	PI PLOI	Stage 0	Accept	Reject
				Stage 1	Accept	Reject
				Stage 2	Accept	Reject
				Stage 3	Accept	Reject
				Stage 4	Accept	Reject
				Stage 5	Accept	Reject
				Stage 6	Accept	Reject
				Stage 7	Accept	Reject
	POE2	18. Ability to lead in handling POE database development	PI PLOI	Stage 0	Accept	Reject
				Stage 1	Accept	Reject
				Stage 2	Accept	Reject
				Stage 3	Accept	Reject
				Stage 4	Accept	Reject
				Stage 5	Accept	Reject
				Stage 6	Accept	Reject
				Stage 7	Accept	Reject

Construct	Code	Items	DV	IV	Null hypothesis (H_0)	Alternative hypothesis (H_1)
	POE3	19. Ability to balance the positive and the negative criticism in the POE reports	PI PLOI	Stage 0	Accept	Reject
				Stage 1	Accept	Reject
				Stage 2	Accept	Reject
				Stage 3	Accept	Reject
				Stage 4	Accept	Reject
				Stage 5	Accept	Reject
				Stage 6	Accept	Reject
				Stage 7	Accept	Reject
	POE4	20. Ability to transfer POE outcomes in a project to briefing stage of other project	PI PLOI	Stage 0	Accept	Reject
				Stage 1	Accept	Reject
				Stage 2	Accept	Reject
				Stage 3	Accept	Reject
				Stage 4	Reject	Accept
				Stage 5	Accept	Reject
				Stage 6	Accept	Reject
				Stage 7	Accept	Reject
Organisation *(FM having trust to work with others effectively at all levels)*	StrR4	21. Having a seat at a table in higher management level	PI PLOI	Stage 0	Accept	Reject
				Stage 1	Accept	Reject
				Stage 2	Accept	Reject
				Stage 3	Reject	Accept
				Stage 4	Accept	Reject
				Stage 5	Accept	Reject
				Stage 6	Accept	Reject
				Stage 7	Accept	Reject
	MgtT3	22. Ability to apply Computerised Aided Facilities Management (CAFM)	PI PLOI	Stage 0	Accept	Reject
				Stage 1	Accept	Reject
				Stage 2	Accept	Reject
				Stage 3	Accept	Reject
				Stage 4	Reject	Accept
				Stage 5	Reject	Accept
				Stage 6	Accept	Reject
				Stage 7	Accept	Reject
	StrR3	23. Having trust from other professionals	PI PLOI	Stage 0	Reject	Accept
				Stage 1	Accept	Reject
				Stage 2	Accept	Reject
				Stage 3	Accept	Reject
				Stage 4	Accept	Reject
				Stage 5	Accept	Reject
				Stage 6	Reject	Accept
				Stage 7	Accept	Reject
	MgtT2	24. Ability to apply Building Information Modelling (BIM)	PI PLOI	Stage 0	Accept	Reject
				Stage 1	Reject	Accept
				Stage 2	Accept	Reject
				Stage 3	Accept	Reject
				Stage 4	Reject	Accept
				Stage 5	Accept	Reject
				Stage 6	Accept	Reject
				Stage 7	Accept	Reject
	StrV8	25. Ability to present service level agreement of FM operation at design stage	PI PLOI	Stage 0	Accept	Reject
				Stage 1	Accept	Reject
				Stage 2	Accept	Reject
				Stage 3	Accept	Reject
				Stage 4	Accept	Reject
				Stage 5	Accept	Reject
				Stage 6	Accept	Reject
				Stage 7	Accept	Reject
	DevS2	26. Willing to anticipate operational issues in PPP project development	PI PLOI	Stage 0	Accept	Reject
				Stage 1	Accept	Reject
				Stage 2	Accept	Reject
				Stage 3	Accept	Reject
				Stage 4	Accept	Reject
				Stage 5	Accept	Reject

Construct	Code	Items	DV	IV	Null hypothesis (H_0)	Alternative hypothesis (H_1)
				Stage 6	Accept	Reject
				Stage 7	Accept	Reject
	Sust2	27. Ability to take lead in mobile flexible working patterns	PI PLOI	Stage 0	Accept	Reject
				Stage 1	Accept	Reject
				Stage 2	Accept	Reject
				Stage 3	Accept	Reject
				Stage 4	Reject	Accept
				Stage 5	Accept	Reject
				Stage 6	Reject	Accept
				Stage 7	Accept	Reject
Strategic value *(FM having the ability to demonstrate strategic value and uniqueness)*	StrV3	28. Get involved in briefing stage	PI PLOI	Stage 0	Reject	Accept
				Stage 1	Accept	Reject
				Stage 2	Accept	Reject
				Stage 3	Accept	Reject
				Stage 4	Accept	Reject
				Stage 5	Accept	Reject
				Stage 6	Accept	Reject
				Stage 7	Accept	Reject
	StrV2	29. Ability to apply Computerised Aided Facilities Management (CAFM)	PI PLOI	Stage 0	Accept	Reject
				Stage 1	Accept	Reject
				Stage 2	Accept	Reject
				Stage 3	Accept	Reject
				Stage 4	Accept	Reject
				Stage 5	Accept	Reject
				Stage 6	Accept	Reject
				Stage 7	Accept	Reject
	StrV1	30. Understand user's organisational strategy	PI PLOI	Stage 0	Accept	Reject
				Stage 1	Accept	Reject
				Stage 2	Accept	Reject
				Stage 3	Accept	Reject
				Stage 4	Reject	Accept
				Stage 5	Reject	Accept
				Stage 6	Accept	Reject
				Stage 7	Accept	Reject

Note:
PI is perceived importance
PLOI is perceived level of integration

Source: Self-study

The one-way MANOVA was performed to investigate the difference between the level of involvement in the development stages in terms of perceived importance and perceived level of integration in all items. The results of the test are presented in Appendix P. The statement of the results of each item is explained in accordance with the stages of the development process, as follows:

6.2.4.1 Stage 0: Strategic Definition

Item: 13. Having adequate knowledge in construction procurement
Code: Comp3
Construct: Competence

Preliminary assumption conducted revealed that data is negatively skewed as assessed by descriptive statistics analysis and no multicollinearity (r = 0.515, $p < 0.05$) (Pallant, 2010, p. 290; Tabachnick and Fidell, 2013, p. 90). Univariate and multivariate outliers are present as assessed by boxplot and Mahalanobis distance ($p < 0.001$) respectively. The number of respondents who had score that exceed the critical value of 13.82 is low; therefore, further analysis is required as one-way MANOVA is fairly robust to such a condition (Pallant, 2010, p. 288). There were linear relationships as assessed by scatter plot. The *p*-value of Box's test of equality of covariance matrices is greater than 0.001, which indicates that the assumption of homogeneity of variance-covariance matrices is satisfied. There was statistically significant difference between the level of involvement of professionals in Stage 0 on the combined dependent variables F (2, 150) = 6.524, $p = 0.02$, Wilks' $\Lambda = 0.920$, partial $\eta^2 = 0.080$. Using a Bonferroni adjusted alpha level of 0.025, perceived importance has reached statistical significance, F (1, 151) = 10.019, $p = 0.002$, partial $\eta^2 = 0.062$. An inspection of the mean scores indicated that professionals who have working experience in Stage 0 reported slightly higher levels of perceived importance ($\mu = 3.56$, $\sigma = 0.887$) than professionals who have no working experience in Stage 0 ($\mu = 3.11$, $\sigma = 0.873$).

The output of one-way MANOVA statistics for Comp3 of Stage 0 is shown respectively in Table 6.17.

Table 6.17 The output of statistical analysis for Comp3 of Stage 0

Descriptive Statistics

InvolvementStage0		Mean	Std. Deviation	N
Comp3PI	Yes	3.56	.887	68
	No	3.11	.873	85
	Total	3.31	.905	153
Comp3PLOI	Yes	3.21	1.059	68
	No	3.19	.809	85
	Total	3.20	.925	153

Levene's Test of Equality of Error Variances[a]

	Levene Statistic	df1	df2	Sig.
Comp3PI	.755	1	151	.386
Comp3PLOI	5.387	1	151	.022

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a. Design: Intercept + InvolvementStage0

Box's Test of Equality of Covariance Matrices[a]

Box's M	5.805
F	1.907
df1	3
df2	6590421.980
Sig.	.126

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.
a. Design: Intercept + InvolvementStage0

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.946	1305.130b	2.000	150.000	.000	.946
	Wilks' Lambda	.054	1305.130b	2.000	150.000	.000	.946
	Hotelling's Trace	17.402	1305.130b	2.000	150.000	.000	.946
	Roy's Largest Root	17.402	1305.130b	2.000	150.000	.000	.946
InvolvementStage0	Pillai's Trace	.080	6.524b	2.000	150.000	.002	.080
	Wilks' Lambda	.920	6.524b	2.000	150.000	.002	.080
	Hotelling's Trace	.087	6.524b	2.000	150.000	.002	.080
	Roy's Largest Root	.087	6.524b	2.000	150.000	.002	.080

a. Design: Intercept + InvolvementStage0
b. Exact statistic

Tests of Between-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	Comp3PI	7.750[a]	1	7.750	10.019	.002	.062
	Comp3PLOI	.012[b]	1	.012	.014	.907	.000
Intercept	Comp3PI	1678.025	1	1678.025	2169.146	.000	.935
	Comp3PLOI	1544.535	1	1544.535	1792.576	.000	.922
InvolvementStage0	Comp3PI	7.750	1	7.750	10.019	.002	.062
	Comp3PLOI	.012	1	.012	.014	.907	.000
Error	Comp3PI	116.812	151	.774			
	Comp3PLOI	130.106	151	.862			
Total	Comp3PI	1798.000	153				
	Comp3PLOI	1693.000	153				
Corrected Total	Comp3PI	124.562	152				
	Comp3PLOI	130.118	152				

a. R Squared = .062 (Adjusted R Squared = .056)
b. R Squared = .000 (Adjusted R Squared = -.007)

Source: Self-study

Item: 16. Having adequate experience in building maintenance
Code: Comp1
Construct: Competence

Preliminary assumption conducted revealed that data is negatively skewed as assessed by descriptive statistics analysis and no multicollinearity (r = 0.489, $p < 0.05$). Univariate and multivariate outliers are present as assessed by boxplot and Mahalanobis distance ($p < 0.001$) respectively. The number of respondents who had scores that exceeded the critical value of 13.82 is low; therefore, further analysis is required as one-way MANOVA is fairly robust to such a condition (Pallant, 2010, p. 288). Linearity assumption is violated as assessed by the scatter plot, which caused power loss of the procedure. Nevertheless, power is not a concern as the sample size of the study is large (Pallant, 2010; p. 208). The p-value of Box's test of equality of covariance matrices is greater than 0.001, which indicates that the assumption of homogeneity of variance-covariance matrices is satisfied. There was statistically significant difference between the level of involvement of professionals in Stage 0 on the combined dependent variables F (2, 150) = 3.986, p = 0.021, Wilks' Λ = 0.950, partial η^2 = 0.050. Using a Bonferroni adjusted alpha level of 0.025, none of the dependent variables (p > 0.025) reached statistical significance. It can be concluded that there is no significant difference between professionals who have working experience and those who have no working experience in Stage 0.

The output of one-way MANOVA statistic for Comp1 of Stage 0 is shown in Table 6.18.

Table 6.18 The output of statistical analysis for Comp1 of Stage 0

Descriptive Statistics

InvolvementStage0		Mean	Std. Deviation	N
Comp1PI	Yes	4.50	.702	68
	No	4.21	.846	85
	Total	4.34	.796	153
Comp1PLOI	Yes	4.09	.989	68
	No	4.19	.779	85
	Total	4.14	.877	153

Levene's Test of Equality of Error Variances[a]

	Levene Statistic	df1	df2	Sig.
Comp1PI	2.254	1	151	.135
Comp1PLOI	.274	1	151	.601

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a. Design: Intercept + InvolvementStage0

Box's Test of Equality of Covariance Matrices[a]

Box's M	8.131
F	2.671
df1	3
df2	6590421.980
Sig.	.046

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.
a. Design: Intercept + InvolvementStage0

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.975	2883.301[b]	2.000	150.000	.000	.975
	Wilks' Lambda	.025	2883.301[b]	2.000	150.000	.000	.975
	Hotelling's Trace	38.444	2883.301[b]	2.000	150.000	.000	.975
	Roy's Largest Root	38.444	2883.301[b]	2.000	150.000	.000	.975
InvolvementStage0	Pillai's Trace	.050	3.986[b]	2.000	150.000	.021	.050
	Wilks' Lambda	.950	3.986[b]	2.000	150.000	.021	.050
	Hotelling's Trace	.053	3.986[b]	2.000	150.000	.021	.050
	Roy's Largest Root	.053	3.986[b]	2.000	150.000	.021	.050

a. Design: Intercept + InvolvementStage0
b. Exact statistic

Tests of Between-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	Comp1PI	3.139[a]	1	3.139	5.086	.026	.033
	Comp1PLOI	.378[b]	1	.378	.490	.485	.003
Intercept	Comp1PI	2867.139	1	2867.139	4645.843	.000	.969
	Comp1PLOI	2587.776	1	2587.776	3355.300	.000	.957
InvolvementStage0	Comp1PI	3.139	1	3.139	5.086	.026	.033
	Comp1PLOI	.378	1	.378	.490	.485	.003
Error	Comp1PI	93.188	151	.617			
	Comp1PLOI	116.459	151	.771			
Total	Comp1PI	2978.000	153				
	Comp1PLOI	2744.000	153				
Corrected Total	Comp1PI	96.327	152				
	Comp1PLOI	116.837	152				

a. R Squared = .033 (Adjusted R Squared = .026)
b. R Squared = .003 (Adjusted R Squared = -.003)

Source: Self-study

Item: 23. Having trust from other professionals
Code: StrR3
Construct: Organisation

Preliminary assumption conducted revealed that data is negatively skewed as assessed by descriptive statistics analysis and no multicollinearity (r = 0.325, $p < 0.05$). Univariate and multivariate outliers are present as assessed by boxplot and Mahalanobis distance ($p < 0.001$) respectively. The number of respondents who had scores that exceeded the critical value of 13.82 is low; therefore, further analysis is required as one-way MANOVA is fairly robust to such a condition (Pallant, 2010, p. 288). Linearity assumption is violated as assessed by the scatter plot, which caused power loss of the procedure. Nevertheless, power is not a concern as the sample size of the study is large (Pallant, 2010; p. 208). The *p*-value of Box's test of equality of covariance matrices is greater than 0.001, which indicates that the assumption of homogeneity of variance-covariance matrices is satisfied. There was statistically significant difference between the level of involvement of professionals in Stage 0 on the combined dependent variables $F\,(2, 150) = 3.307$, $p = 0.039$, Wilks' $\Lambda = 0.958$, partial $\eta^2 = 0.042$. Using a Bonferroni adjusted alpha level of 0.025, none of the dependent variables ($p >$ 0.025) reached statistical significance. It can be concluded that there is no significant difference between professionals who have working experience and those who have no working experience in Stage 0.

The output of one-way MANOVA statistic for StrR3 of Stage 0 is shown in Table 6.19.

Table 6.19 The output of statistical analysis for StrR3 of Stage 0

Descriptive Statistics

InvolvementStage0		Mean	Std. Deviation	N
StrR3PI	Yes	4.49	.635	68
	No	4.24	.718	85
	Total	4.35	.691	153
StrR3PLOI	Yes	3.99	.954	68
	No	4.09	.840	85
	Total	4.05	.891	153

Levene's Test of Equality of Error Variances[a]

	Levene Statistic	df1	df2	Sig.
StrR3PI	.000	1	151	.993
StrR3PLOI	.044	1	151	.834

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a. Design: Intercept + InvolvementStage0

Box's Test of Equality of Covariance Matrices[a]

Box's M	3.097
F	1.017
df1	3
df2	6590421.980
Sig.	.384

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.
a. Design: Intercept + InvolvementStage0

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.981	3853.193[b]	2.000	150.000	.000	.981
	Wilks' Lambda	.019	3853.193[b]	2.000	150.000	.000	.981
	Hotelling's Trace	51.376	3853.193[b]	2.000	150.000	.000	.981
	Roy's Largest Root	51.376	3853.193[b]	2.000	150.000	.000	.981
InvolvementStage0	Pillai's Trace	.042	3.307[b]	2.000	150.000	.039	.042
	Wilks' Lambda	.958	3.307[b]	2.000	150.000	.039	.042
	Hotelling's Trace	.044	3.307[b]	2.000	150.000	.039	.042
	Roy's Largest Root	.044	3.307[b]	2.000	150.000	.039	.042

a. Design: Intercept + InvolvementStage0
b. Exact statistic

Tests of Between-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	StrR3PI	2.361[a]	1	2.361	5.073	.026	.033
	StrR3PLOI	.447[b]	1	.447	.562	.455	.004
Intercept	StrR3PI	2872.949	1	2872.949	6172.723	.000	.976
	StrR3PLOI	2466.016	1	2466.016	3097.073	.000	.954
InvolvementStage0	StrR3PI	2.361	1	2.361	5.073	.026	.033
	StrR3PLOI	.447	1	.447	.562	.455	.004
Error	StrR3PI	70.279	151	.465			
	StrR3PLOI	120.232	151	.796			
Total	StrR3PI	2963.000	153				
	StrR3PLOI	2625.000	153				
Corrected Total	StrR3PI	72.641	152				
	StrR3PLOI	120.680	152				

a. R Squared = .033 (Adjusted R Squared = .026)
b. R Squared = .004 (Adjusted R Squared = -.003)

Source: Self-study

Item: 28. Having trust from other professionals
Code: StrV3
Construct: Strategic Value

Preliminary assumption conducted revealed that data is negatively skewed as assessed by descriptive statistics analysis and no multicollinearity (r = 0.325, $p < 0.05$). Univariate and multivariate outliers are present as assessed by boxplot and Mahalanobis distance ($p < 0.001$) respectively. The number of respondents who had scores that exceeded the critical value of 13.82 is low; therefore, further analysis is requires as one-way MANOVA is fairly robust to such a condition (Pallant, 2010, p. 288). Linearity assumption is violated as assessed by the scatter plot, which caused power loss of the procedure. Nevertheless, power is not a concern as the sample size of the study is large (Pallant, 2010; p. 208). The *p*-value of Box's test of equality of covariance matrices is greater than 0.001, which indicates that the assumption of homogeneity of variance-covariance matrices is satisfied. There was statistically significant difference between the level of involvement of professionals in Stage 0 on the combined dependent variables F (2, 150) = 3.159, $p = 0.045$, Wilks' $\Lambda = 0.960$, partial $\eta^2 = 0.040$. Using a Bonferroni adjusted alpha level of 0.025, none of the dependent variables ($p > 0.025$) reached statistical significance. It can be concluded that there is no significant difference between professionals who have working experience and those who have no working experience in Stage 0.

The output of one-way MANOVA statistic for StrV3 of Stage 0 is shown in Table 6.20.

Table 6.20 The output of statistical analysis for StrV3 of Stage 0

Descriptive Statistics

InvolvementStage0		Mean	Std. Deviation	N
StrV3PI	Yes	4.13	.976	68
	No	3.82	.902	85
	Total	3.96	.945	153
StrV3PLOI	Yes	3.69	1.026	68
	No	3.69	.845	85
	Total	3.69	.927	153

Levene's Test of Equality of Error Variances[a]

	Levene Statistic	df1	df2	Sig.
StrV3PI	.016	1	151	.900
StrV3PLOI	.817	1	151	.367

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a. Design: Intercept + InvolvementStage0

Box's Test of Equality of Covariance Matrices[a]

Box's M	5.396
F	1.772
df1	3
df2	6590421.980
Sig.	.150

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.
a. Design: Intercept + InvolvementStage0

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.955	1605.555[b]	2.000	150.000	.000	.955
	Wilks' Lambda	.045	1605.555[b]	2.000	150.000	.000	.955
	Hotelling's Trace	21.407	1605.555[b]	2.000	150.000	.000	.955
	Roy's Largest Root	21.407	1605.555[b]	2.000	150.000	.000	.955
InvolvementStage0	Pillai's Trace	.040	3.159[b]	2.000	150.000	.045	.040
	Wilks' Lambda	.960	3.159[b]	2.000	150.000	.045	.040
	Hotelling's Trace	.042	3.159[b]	2.000	150.000	.045	.040
	Roy's Largest Root	.042	3.159[b]	2.000	150.000	.045	.040

a. Design: Intercept + InvolvementStage0
b. Exact statistic

Tests of Between-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	StrV3PI	3.603[a]	1	3.603	4.117	.044	.027
	StrV3PLOI	.000[b]	1	.000	.000	.985	.000
Intercept	StrV3PI	2391.185	1	2391.185	2732.022	.000	.948
	StrV3PLOI	2060.497	1	2060.497	2383.049	.000	.940
InvolvementStage0	StrV3PI	3.603	1	3.603	4.117	.044	.027
	StrV3PLOI	.000	1	.000	.000	.985	.000
Error	StrV3PI	132.162	151	.875			
	StrV3PLOI	130.562	151	.865			
Total	StrV3PI	2536.000	153				
	StrV3PLOI	2217.000	153				
Corrected Total	StrV3PI	135.765	152				
	StrV3PLOI	130.562	152				

a. R Squared = .027 (Adjusted R Squared = .020)
b. R Squared = .000 (Adjusted R Squared = -.007)

Source: Self-study

6.2.4.2 Stage 1: Preparation and Brief

Item: 24. Ability to apply Building Information Modelling (BIM)
Code: MgtT2
Construct: Organisation

Preliminary assumption conducted revealed that data is negatively skewed as assessed by descriptive statistics analysis and no multicollinearity was detected (r = 0.558, $p < 0.05$) (Pallant, 2010, p. 290; Tabachnick and Fidell, 2013, p. 90). Univariate outliers are present as assessed by boxplot. There are no multivariate outliers as observed through Mahalanobis distance ($p > 0.001$) procedure. Linearity assumption is violated as assessed by the scatter plot, which caused power loss of the procedure. Nevertheless, power is not a concern as the sample size of the study is large (Pallant, 2010; p. 208). The *p*-value of Box's test of equality of covariance matrices is greater than 0.001, which indicates that the assumption of homogeneity of variance-covariance matrices is satisfied. There was statistically significant difference between the level of involvement of professionals in Stage 1 on the combined dependent variables $F(2, 150) = 3.547$, $p = 0.031$, Wilks' $\Lambda = 0.955$, partial $\eta^2 = 0.045$. Using a Bonferroni adjusted alpha level of 0.025, perceived importance has reached the statistical significance, $F(1, 151) = 6.761$, $p = 0.010$, partial $\eta^2 = 0.043$. An inspection of the mean scores indicated that professionals who have no working experience in Stage 1 reported slightly higher levels of perceived importance ($\mu = 3.89$, $\sigma = 0.838$) than professionals who do have working experience in Stage 1 ($\mu = 3.51$, $\sigma = 0.933$).

The output of one-way MANOVA statistic for MgtT2 of Stage 1 is shown in Table 6.21.

Table 6.21 The output of statistical analysis for MgtT2 of Stage 1

Descriptive Statistics

InvolvementStage1		Mean	Std. Deviation	N
MgtT2PI	Yes	3.51	.933	82
	No	3.89	.838	71
	Total	3.69	.907	153
MgtT2PLOI	Yes	3.28	.997	82
	No	3.44	.982	71
	Total	3.35	.990	153

Levene's Test of Equality of Error Variances[a]

	Levene Statistic	df1	df2	Sig.
MgtT2PI	1.680	1	151	.197
MgtT2PLOI	.015	1	151	.902

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a. Design: Intercept + InvolvementStage1

Box's Test of Equality of Covariance Matrices[a]

Box's M	4.654
F	1.529
df1	3
df2	12476370.505
Sig.	.205

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.
a. Design: Intercept + InvolvementStage1

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.950	1424.459[b]	2.000	150.000	.000	.950
	Wilks' Lambda	.050	1424.459[b]	2.000	150.000	.000	.950
	Hotelling's Trace	18.993	1424.459[b]	2.000	150.000	.000	.950
	Roy's Largest Root	18.993	1424.459[b]	2.000	150.000	.000	.950
InvolvementStage1	Pillai's Trace	.045	3.547[b]	2.000	150.000	.031	.045
	Wilks' Lambda	.955	3.547[b]	2.000	150.000	.031	.045
	Hotelling's Trace	.047	3.547[b]	2.000	150.000	.031	.045
	Roy's Largest Root	.047	3.547[b]	2.000	150.000	.031	.045

a. Design: Intercept + InvolvementStage1
b. Exact statistic

Tests of Between-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	MgtT2PI	5.355[a]	1	5.355	6.761	.010	.043
	MgtT2PLOI	.928[b]	1	.928	.946	.332	.006
Intercept	MgtT2PI	2083.472	1	2083.472	2630.770	.000	.946
	MgtT2PLOI	1716.901	1	1716.901	1751.543	.000	.921
InvolvementStage1	MgtT2PI	5.355	1	5.355	6.761	.010	.043
	MgtT2PLOI	.928	1	.928	.946	.332	.006
Error	MgtT2PI	119.586	151	.792			
	MgtT2PLOI	148.014	151	.980			
Total	MgtT2PI	2204.000	153				
	MgtT2PLOI	1869.000	153				
Corrected Total	MgtT2PI	124.941	152				
	MgtT2PLOI	148.941	152				

a. R Squared = .043 (Adjusted R Squared = .037)
b. R Squared = .006 (Adjusted R Squared = .000)

Source: Self-study

6.2.4.3 Stage 2: Concept Design

Item: 6. Having a good rapport with client
Code: StrR1
Construct: Knowledge Management

Preliminary assumption conducted revealed that data is negatively skewed as assessed by descriptive statistics analysis and no multicollinearity was detected (r = 0.558, $p < 0.05$) (Pallant, 2010, p. 290; Tabachnick and Fidell, 2013, p. 90). Univariate and multivariate outliers are present as assessed by boxplot and Mahalanobis distance ($p < 0.001$) respectively. Linearity assumption is violated as assessed by the scatter plot, which caused power loss of the procedure. Nevertheless, power is not a concern as the sample size of the study is large (Pallant, 2010; p. 208). The *p*-value of Box's test of equality of covariance matrices is greater than 0.001, which indicates that the assumption of homogeneity of variance-covariance matrices is satisfied. There was statistically significant difference between the level of involvement of professionals in Stage 2 on the combined dependent variables F (2, 150) = 4.589, $p = 0.012$, Wilks' $\Lambda = 0.942$, partial $\eta^2 = 0.058$. Using a Bonferroni adjusted alpha level of 0.025, perceived level of integration has reached the statistical significance, F (1, 151) = 6.519, $p = 0.012$, partial $\eta^2 = 0.041$. An inspection of the mean scores indicated that professionals who have no working experience in Stage 2 reported slightly higher levels of perceived level of integration ($\mu = 4.46$, $\sigma = 0.733$) than professionals who do have working experience in Stage 2 ($\mu = 4.12$, $\sigma = 0.915$).

The output of one-way MANOVA statistic for StrR1 of Stage 2 is shown in Table 6.22.

Table 6.22 The output of statistical analysis for StrR1 of Stage 2

Descriptive Statistics

InvolvementStage2		Mean	Std. Deviation	N
StrR1PI	Yes	4.57	.640	75
	No	4.51	.769	78
	Total	4.54	.707	153
StrR1PLOI	Yes	4.12	.915	75
	No	4.46	.733	78
	Total	4.29	.842	153

Levene's Test of Equality of Error Variances[a]

	Levene Statistic	df1	df2	Sig.
StrR1PI	1.036	1	151	.310
StrR1PLOI	.526	1	151	.469

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a. Design: Intercept + InvolvementStage2

Box's Test of Equality of Covariance Matrices[a]

Box's M	8.970
F	2.947
df1	3
df2	4317935.412
Sig.	.031

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.
a. Design: Intercept + InvolvementStage2

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.981	3772.914[b]	2.000	150.000	.000	.981
	Wilks' Lambda	.019	3772.914[b]	2.000	150.000	.000	.981
	Hotelling's Trace	50.306	3772.914[b]	2.000	150.000	.000	.981
	Roy's Largest Root	50.306	3772.914[b]	2.000	150.000	.000	.981
InvolvementStage2	Pillai's Trace	.058	4.589[b]	2.000	150.000	.012	.058
	Wilks' Lambda	.942	4.589[b]	2.000	150.000	.012	.058
	Hotelling's Trace	.061	4.589[b]	2.000	150.000	.012	.058
	Roy's Largest Root	.061	4.589[b]	2.000	150.000	.012	.058

a. Design: Intercept + InvolvementStage2
b. Exact statistic

Tests of Between-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	StrR1PI	.140[a]	1	.140	.279	.598	.002
	StrR1PLOI	4.460[b]	1	4.460	6.519	.012	.041
Intercept	StrR1PI	3156.637	1	3156.637	6285.480	.000	.977
	StrR1PLOI	2815.754	1	2815.754	4115.778	.000	.965
InvolvementStage2	StrR1PI	.140	1	.140	.279	.598	.002
	StrR1PLOI	4.460	1	4.460	6.519	.012	.041
Error	StrR1PI	75.834	151	.502			
	StrR1PLOI	103.305	151	.684			
Total	StrR1PI	3233.000	153				
	StrR1PLOI	2929.000	153				
Corrected Total	StrR1PI	75.974	152				
	StrR1PLOI	107.765	152				

a. R Squared = .002 (Adjusted R Squared = -.005)
b. R Squared = .041 (Adjusted R Squared = .035)

Source: Self-study

Item: 14. Ability to champion lean construction practice
Code: Comp7
Construct: Competence

Preliminary assumption conducted revealed that data is negatively skewed as assessed by descriptive statistics analysis and no multicollinearity was detected (r = 0.585, $p < 0.05$) (Pallant, 2010, p. 290; Tabachnick and Fidell, 2013, p. 90). Univariate outliers are present as assessed by boxplot. There are no multivariate outliers as observed through Mahalanobis distance ($p > 0.001$) procedure. Linearity assumption is violated as assessed by the scatter plot, which caused power loss of the procedure. Nevertheless, power is not a concern as the sample size of the study is large (Pallant, 2010; p. 208). The *p*-value of Box's test of equality of covariance matrices is greater than 0.001, which indicates that the assumption of homogeneity of variance-covariance matrices is satisfied. There was statistically significant difference between the level of involvement of professionals in Stage 2 on the combined dependent variables F (2, 148) = 3.617, $p = 0.029$, Wilks' $\Lambda = 0.953$, partial $\eta^2 = 0.047$. Using a Bonferroni adjusted alpha level of 0.025, none of the dependent variables ($p > 0.025$) reached statistical significance. It can be concluded that there is no significant difference between professionals who have working experience and those who have no working experience in Stage 2.

The output of one-way MANOVA statistic for Comp7 of Stage 2 is shown in Table 6.23.

Table 6.23 The output of statistical analysis for Comp7 of Stage 2

Descriptive Statistics

InvolvementStage2		Mean	Std. Deviation	N
Comp7PI	Yes	3.39	.999	75
	No	3.13	.900	76
	Total	3.26	.955	151
Comp7PLOI	Yes	3.24	1.184	75
	No	3.36	.905	76
	Total	3.30	1.051	151

Levene's Test of Equality of Error Variances[a]

	Levene Statistic	df1	df2	Sig.
Comp7PI	1.341	1	149	.249
Comp7PLOI	3.603	1	149	.060

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a. Design: Intercept + InvolvementStage2

Box's Test of Equality of Covariance Matrices[a]

Box's M	5.337
F	1.753
df1	3
df2	4018869.796
Sig.	.154

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.
a. Design: Intercept + InvolvementStage2

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.932	1009.388[b]	2.000	148.000	.000	.932
	Wilks' Lambda	.068	1009.388[b]	2.000	148.000	.000	.932
	Hotelling's Trace	13.640	1009.388[b]	2.000	148.000	.000	.932
	Roy's Largest Root	13.640	1009.388[b]	2.000	148.000	.000	.932
InvolvementStage2	Pillai's Trace	.047	3.617[b]	2.000	148.000	.029	.047
	Wilks' Lambda	.953	3.617[b]	2.000	148.000	.029	.047
	Hotelling's Trace	.049	3.617[b]	2.000	148.000	.029	.047
	Roy's Largest Root	.049	3.617[b]	2.000	148.000	.029	.047

a. Design: Intercept + InvolvementStage2
b. Exact statistic

Tests of Between-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	Comp7PI	2.456[a]	1	2.456	2.722	.101	.018
	Comp7PLOI	.502[b]	1	.502	.453	.502	.003
Intercept	Comp7PI	1603.834	1	1603.834	1777.123	.000	.923
	Comp7PLOI	1641.958	1	1641.958	1481.949	.000	.909
InvolvementStage2	Comp7PI	2.456	1	2.456	2.722	.101	.018
	Comp7PLOI	.502	1	.502	.453	.502	.003
Error	Comp7PI	134.471	149	.902			
	Comp7PLOI	165.088	149	1.108			
Total	Comp7PI	1740.000	151				
	Comp7PLOI	1808.000	151				
Corrected Total	Comp7PI	136.927	150				
	Comp7PLOI	165.589	150				

a. R Squared = .018 (Adjusted R Squared = .011)
b. R Squared = .003 (Adjusted R Squared = -.004)

Source: Self-study

6.2.4.4 Stage 3: Developed Design

Item: 6. Having a good rapport with client
Code: StrR1
Construct: Knowledge Management

Preliminary assumption conducted revealed that data is negatively skewed as assessed by descriptive statistics analysis and no multicollinearity was detected (r = 0.449, $p < 0.05$) (Pallant, 2010, p. 290; Tabachnick and Fidell, 2013, p. 90). Univariate and multivariate outliers are present as assessed by boxplot and Mahalanobis distance ($p < 0.001$) respectively. Linearity assumption is violated as assessed by the scatter plot, which caused power loss of the procedure. Nevertheless, power is not a concern as the sample size of the study is large (Pallant, 2010; p. 208). The *p*-value of Box's test of equality of covariance matrices is greater than 0.001, which indicates that the assumption of homogeneity of variance-covariance matrices is satisfied. There was statistically significant difference between the level of involvement of professionals in Stage 3 on the combined dependent variables F (2, 150) = 4.601, $p = 0.011$, Wilks' $\Lambda = 0.942$, partial $\eta^2 = 0.058$. Using a Bonferroni adjusted alpha level of 0.025, perceived level of integration has reached the statistical significance, F (1, 151) = 9.021, $p = 0.003$, partial $\eta^2 = 0.056$. An inspection of the mean scores indicated that professionals who have no working experience in Stage 3 reported slightly higher levels of perceived level of integration ($\mu = 4.50$, $\sigma = 0.707$) than professionals who do have working experience in Stage 3 ($\mu = 4.10$, $\sigma = 0.914$).

The output of one-way MANOVA statistic for StrR1 of Stage 3 is shown in Table 6.24.

Table 6.24 The output of statistical analysis for StrR1 of Stage 3

Descriptive Statistics

InvolvementStage3		Mean	Std. Deviation	N
StrR1PI	Yes	4.51	.749	79
	No	4.58	.662	74
	Total	4.54	.707	153
StrR1PLOI	Yes	4.10	.914	79
	No	4.50	.707	74
	Total	4.29	.842	153

Levene's Test of Equality of Error Variances[a]

	Levene Statistic	df1	df2	Sig.
StrR1PI	.478	1	151	.490
StrR1PLOI	1.197	1	151	.276

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a. Design: Intercept + InvolvementStage3

Box's Test of Equality of Covariance Matrices[a]

Box's M	14.651
F	4.814
df1	3
df2	4759420.804
Sig.	.002

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.
a. Design: Intercept + InvolvementStage3

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.981	3847.504[b]	2.000	150.000	.000	.981
	Wilks' Lambda	.019	3847.504[b]	2.000	150.000	.000	.981
	Hotelling's Trace	51.300	3847.504[b]	2.000	150.000	.000	.981
	Roy's Largest Root	51.300	3847.504[b]	2.000	150.000	.000	.981
InvolvementStage3	Pillai's Trace	.058	4.601[b]	2.000	150.000	.011	.058
	Wilks' Lambda	.942	4.601[b]	2.000	150.000	.011	.058
	Hotelling's Trace	.061	4.601[b]	2.000	150.000	.011	.058
	Roy's Largest Root	.061	4.601[b]	2.000	150.000	.011	.058

a. Design: Intercept + InvolvementStage3
b. Exact statistic

Tests of Between-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	StrR1PI	.214[a]	1	.214	.426	.515	.003
	StrR1PLOI	6.075[b]	1	6.075	9.021	.003	.056
Intercept	StrR1PI	3155.351	1	3155.351	6289.015	.000	.977
	StrR1PLOI	2826.781	1	2826.781	4197.506	.000	.965
InvolvementStage3	StrR1PI	.214	1	.214	.426	.515	.003
	StrR1PLOI	6.075	1	6.075	9.021	.003	.056
Error	StrR1PI	75.760	151	.502			
	StrR1PLOI	101.690	151	.673			
Total	StrR1PI	3233.000	153				
	StrR1PLOI	2929.000	153				
Corrected Total	StrR1PI	75.974	152				
	StrR1PLOI	107.765	152				

a. R Squared = .003 (Adjusted R Squared = -.004)
b. R Squared = .056 (Adjusted R Squared = .050)

Source: Self-study

Item: 21. Having a seat at a table in higher management level
Code: StrR4
Construct: Organisation

Preliminary assumption conducted revealed that data is negatively skewed as assessed by descriptive statistics analysis and no multicollinearity was detected (r = 0.589, $p < 0.05$) (Pallant, 2010, p. 290; Tabachnick and Fidell, 2013, p. 90). Univariate and multivariate outliers are present as assessed by boxplot and Mahalanobis distance ($p < 0.001$) respectively. Linearity assumption is violated as assessed by the scatter plot, which caused power loss of the procedure. Nevertheless, power is not a concern as the sample size of the study is large (Pallant, 2010; p. 208). The *p*-value of Box's test of equality of covariance matrices is greater than 0.001, which indicates that the assumption of homogeneity of variance-covariance matrices is satisfied. There was statistically significant difference between the level of involvement of professionals in Stage 3 on the combined dependent variables F (2, 150) = 3.363, $p = 0.037$, Wilks' $\Lambda = 0.957$, partial $\eta^2 = 0.043$. Using a Bonferroni adjusted alpha level of 0.025, perceived level of integration has reached the statistical significance, F (1, 151) = 6.264, $p = 0.013$, partial $\eta^2 = 0.040$. An inspection of the mean scores indicated that professionals who have no working experience in Stage 3 reported slightly higher levels of perceived level of integration ($\mu = 4.03$, $\sigma = 0.936$) than professionals who do have working experience in Stage 3 ($\mu = 3.65$, $\sigma = 0.948$).

The output of one-way MANOVA statistic for StrR4 of Stage 3 is shown in Table 6.25.

Table 6.25 The output of statistical analysis for StrR4 of Stage 3

Descriptive Statistics

InvolvementStage3		Mean	Std. Deviation	N
StrR4PI	Yes	3.99	.940	79
	No	4.12	.906	74
	Total	4.05	.923	153
StrR4PLOI	Yes	3.65	.948	79
	No	4.03	.936	74
	Total	3.83	.958	153

Levene's Test of Equality of Error Variances[a]

	Levene Statistic	df1	df2	Sig.
StrR4PI	.346	1	151	.557
StrR4PLOI	.759	1	151	.385

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a. Design: Intercept + InvolvementStage3

Box's Test of Equality of Covariance Matrices[a]

Box's M	1.259
F	.414
df1	3
df2	4759420.804
Sig.	.743

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.
a. Design: Intercept + InvolvementStage3

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.958	1719.146[b]	2.000	150.000	.000	.958
	Wilks' Lambda	.042	1719.146[b]	2.000	150.000	.000	.958
	Hotelling's Trace	22.922	1719.146[b]	2.000	150.000	.000	.958
	Roy's Largest Root	22.922	1719.146[b]	2.000	150.000	.000	.958
InvolvementStage3	Pillai's Trace	.043	3.363[b]	2.000	150.000	.037	.043
	Wilks' Lambda	.957	3.363[b]	2.000	150.000	.037	.043
	Hotelling's Trace	.045	3.363[b]	2.000	150.000	.037	.043
	Roy's Largest Root	.045	3.363[b]	2.000	150.000	.037	.043

a. Design: Intercept + InvolvementStage3
b. Exact statistic

Tests of Between-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	StrR4PI	.689[a]	1	.689	.807	.370	.005
	StrR4PLOI	5.560[b]	1	5.560	6.264	.013	.040
Intercept	StrR4PI	2512.454	1	2512.454	2943.381	.000	.951
	StrR4PLOI	2249.325	1	2249.325	2534.272	.000	.944
InvolvementStage3	StrR4PI	.689	1	.689	.807	.370	.005
	StrR4PLOI	5.560	1	5.560	6.264	.013	.040
Error	StrR4PI	128.893	151	.854			
	StrR4PLOI	134.022	151	.888			
Total	StrR4PI	2642.000	153				
	StrR4PLOI	2384.000	153				
Corrected Total	StrR4PI	129.582	152				
	StrR4PLOI	139.582	152				

a. R Squared = .005 (Adjusted R Squared = -.001)
b. R Squared = .040 (Adjusted R Squared = .033)

Source: Self-study

6.2.4.5 Stage 4: Technical Design

Item: 6. Having a good rapport with client
Code: StrR1
Construct: Knowledge Management

Preliminary assumption conducted revealed that data is negatively skewed in all conditions as assessed by descriptive statistics analysis and no multicollinearity was detected (r = 0.449, $p < 0.05$) (Pallant, 2010, p. 290; Tabachnick and Fidell, 2013, p. 90). Univariate and multivariate outliers are present as assessed by boxplot and Mahalanobis distance ($p < 0.001$) respectively. Linearity assumption is violated as assessed by the scatter plot, which caused power loss of the procedure. Nevertheless, power is not a concern as the sample size of the study is large (Pallant, 2010; p. 208). The *p*-value of Box's test of equality of covariance matrices is greater than 0.001, which indicates that the assumption of homogeneity of variance-covariance matrices is satisfied. There was statistically significant difference between the level of involvement of professionals in Stage 4 on the combined dependent variables $F\ (2, 150) = 4.200$, $p = 0.017$, Wilks' $\Lambda = 0.947$, partial $\eta^2 = 0.053$. Using a Bonferroni adjusted alpha level of 0.025, perceived level of integration has reached the statistical significance, $F\ (1, 151) = 8.441$, $p = 0.004$, partial $\eta^2 = 0.053$. An inspection of the mean scores indicated that professionals who have no working experience in Stage 4 reported slightly higher levels of perceived level of integration ($\mu = 4.48$, $\sigma = 0.714$) than professionals who do have working experience in Stage 4 ($\mu = 4.09$, $\sigma = 0.924$).

The output of one-way MANOVA statistic for StrR1 of Stage 4 is shown in Table 6.26.

Table 6.26 The output of statistical analysis for StrR1 of Stage 4

Descriptive Statistics

InvolvementStage4		Mean	Std. Deviation	N
StrR1PI	Yes	4.49	.646	74
	No	4.59	.760	79
	Total	4.54	.707	153
StrR1PLOI	Yes	4.09	.924	74
	No	4.48	.714	79
	Total	4.29	.842	153

Levene's Test of Equality of Error Variances[a]

	Levene Statistic	df1	df2	Sig.
StrR1PI	.006	1	151	.937
StrR1PLOI	1.078	1	151	.301

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a. Design: Intercept + InvolvementStage4

Box's Test of Equality of Covariance Matrices[a]

Box's M	8.160
F	2.681
df1	3
df2	4759420.804
Sig.	.045

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.
a. Design: Intercept + InvolvementStage4

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.981	3853.461[b]	2.000	150.000	.000	.981
	Wilks' Lambda	.019	3853.461[b]	2.000	150.000	.000	.981
	Hotelling's Trace	51.379	3853.461[b]	2.000	150.000	.000	.981
	Roy's Largest Root	51.379	3853.461[b]	2.000	150.000	.000	.981
InvolvementStage4	Pillai's Trace	.053	4.200[b]	2.000	150.000	.017	.053
	Wilks' Lambda	.947	4.200[b]	2.000	150.000	.017	.053
	Hotelling's Trace	.056	4.200[b]	2.000	150.000	.017	.053
	Roy's Largest Root	.056	4.200[b]	2.000	150.000	.017	.053

a. Design: Intercept + InvolvementStage4
b. Exact statistic

Tests of Between-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	StrR1PI	.449[a]	1	.449	.898	.345	.006
	StrR1PLOI	5.705[b]	1	5.705	8.441	.004	.053
Intercept	StrR1PI	3151.194	1	3151.194	6300.348	.000	.977
	StrR1PLOI	2809.941	1	2809.941	4157.395	.000	.965
InvolvementStage4	StrR1PI	.449	1	.449	.898	.345	.006
	StrR1PLOI	5.705	1	5.705	8.441	.004	.053
Error	StrR1PI	75.524	151	.500			
	StrR1PLOI	102.059	151	.676			
Total	StrR1PI	3233.000	153				
	StrR1PLOI	2929.000	153				
Corrected Total	StrR1PI	75.974	152				
	StrR1PLOI	107.765	152				

a. R Squared = .006 (Adjusted R Squared = -.001)
b. R Squared = .053 (Adjusted R Squared = .047)

Source: Self-study

Item: 9. Having mechanism to communicate with end users about their requirements at all stages
Code: MgtT5
Construct: Knowledge Management

Preliminary assumption conducted revealed that data is negatively skewed in all conditions as assessed by descriptive statistics analysis and no multicollinearity was detected (r = 0.359, $p < 0.05$) (Pallant, 2010, p. 290; Tabachnick and Fidell, 2013, p. 90). Univariate and multivariate outliers are present as assessed by boxplot and Mahalanobis distance ($p < 0.001$) respectively. Linearity assumption is violated as assessed by the scatter plot, which caused power loss of the procedure. Nevertheless, power is not a concern as the sample size of the study is large (Pallant, 2010; p. 208). The *p*-value of Box's test of equality of covariance matrices is greater than 0.001, which indicates that the assumption of homogeneity of variance-covariance matrices is satisfied. There was statistically significant difference between the level of involvement of professionals in Stage 4 on the combined dependent variables $F\ (2, 150) = 5.224$, $p = 0.006$, Wilks' $\Lambda = 0.935$, partial $\eta^2 = 0.065$. Using a Bonferroni adjusted alpha level of 0.025, perceived level of integration has reached the statistical significance, $F\ (1, 151) = 10.120$, $p = 0.002$, partial $\eta^2 = 0.063$. An inspection of the mean scores indicated that professionals who have no working experience in Stage 4 reported slightly higher levels of perceived level of integration ($\mu = 4.15$, $\sigma = 0.907$) than professionals who do have working experience in Stage 4 ($\mu = 3.66$, $\sigma = 0.997$).

The output of one-way MANOVA statistic for MgtT5 of Stage 4 is shown in Table 6.27.

Table 6.27 The output of statistical analysis for MgtT5 of Stage 4

Descriptive Statistics

InvolvementStage4		Mean	Std. Deviation	N
MgtT5PI	Yes	4.32	.796	74
	No	4.41	.707	79
	Total	4.37	.750	153
MgtT5PLOI	Yes	3.66	.997	74
	No	4.15	.907	79
	Total	3.92	.980	153

Levene's Test of Equality of Error Variances[a]

	Levene Statistic	df1	df2	Sig.
MgtT5PI	.193	1	151	.661
MgtT5PLOI	1.178	1	151	.280

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a. Design: Intercept + InvolvementStage4

Box's Test of Equality of Covariance Matrices[a]

Box's M	3.452
F	1.134
df1	3
df2	4759420.804
Sig.	.334

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.
a. Design: Intercept + InvolvementStage4

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.974	2862.546[b]	2.000	150.000	.000	.974
	Wilks' Lambda	.026	2862.546[b]	2.000	150.000	.000	.974
	Hotelling's Trace	38.167	2862.546[b]	2.000	150.000	.000	.974
	Roy's Largest Root	38.167	2862.546[b]	2.000	150.000	.000	.974
InvolvementStage4	Pillai's Trace	.065	5.224[b]	2.000	150.000	.006	.065
	Wilks' Lambda	.935	5.224[b]	2.000	150.000	.006	.065
	Hotelling's Trace	.070	5.224[b]	2.000	150.000	.006	.065
	Roy's Largest Root	.070	5.224[b]	2.000	150.000	.006	.065

a. Design: Intercept + InvolvementStage4
b. Exact statistic

Tests of Between-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	MgtT5PI	.249[a]	1	.249	.441	.508	.003
	MgtT5PLOI	9.164[b]	1	9.164	10.120	.002	.063
Intercept	MgtT5PI	2911.622	1	2911.622	5156.988	.000	.972
	MgtT5PLOI	2333.033	1	2333.033	2576.500	.000	.945
InvolvementStage4	MgtT5PI	.249	1	.249	.441	.508	.003
	MgtT5PLOI	9.164	1	9.164	10.120	.002	.063
Error	MgtT5PI	85.254	151	.565			
	MgtT5PLOI	136.731	151	.906			
Total	MgtT5PI	3002.000	153				
	MgtT5PLOI	2491.000	153				
Corrected Total	MgtT5PI	85.503	152				
	MgtT5PLOI	145.895	152				

a. R Squared = .003 (Adjusted R Squared = -.004)
b. R Squared = .063 (Adjusted R Squared = .057)

Source: Self-study

Item: 14. Ability to champion lean construction practice
Code: Comp7
Construct: Competence

Preliminary assumption conducted revealed that data is negatively skewed in all conditions as assessed by descriptive statistics analysis and no multicollinearity was detected (r = 0.585, $p < 0.05$) (Pallant, 2010, p. 290; Tabachnick and Fidell, 2013, p. 90). Univariate and multivariate outliers are present as assessed by boxplot and Mahalanobis distance ($p < 0.001$) respectively. Linearity assumption is violated as assessed by the scatter plot, which caused power loss of the procedure. Nevertheless, power is not a concern as the sample size of the study is large (Pallant, 2010; p. 208). The *p*-value of Box's test of equality of covariance matrices is greater than 0.001, which indicates that the assumption of homogeneity of variance-covariance matrices is satisfied. There was statistically significant difference between the level of involvement of professionals in Stage 4 on the combined dependent variables F (2, 150) = 5.224, $p = 0.006$, Wilks' $\Lambda = 0.935$, partial $\eta^2 = 0.065$. Using a Bonferroni adjusted alpha level of 0.025, perceived level of integration has reached the statistical significance, F (1, 151) = 10.120, $p = 0.002$, partial $\eta^2 = 0.063$. An inspection of the mean scores indicated that professionals who have no working experience in Stage 4 reported slightly higher levels of perceived level of integration ($\mu = 4.15$, $\sigma = 0.907$) than professionals who do have working experience in Stage 4 ($\mu = 3.66$, $\sigma = 0.997$).

The output of one-way MANOVA statistic for Comp7 of Stage 4 is shown in Table 6.28.

Table 6.28 The output of statistical analysis for Comp7 of Stage 4

Descriptive Statistics

InvolvementStage4		Mean	Std. Deviation	N
Comp7PI	Yes	3.19	1.009	73
	No	3.32	.904	78
	Total	3.26	.955	151
Comp7PLOI	Yes	3.05	1.129	73
	No	3.53	.922	78
	Total	3.30	1.051	151

Levene's Test of Equality of Error Variances[a]

	Levene Statistic	df1	df2	Sig.
Comp7PI	.486	1	149	.487
Comp7PLOI	.316	1	149	.575

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a. Design: Intercept + InvolvementStage4

Box's Test of Equality of Covariance Matrices[a]

Box's M	3.338
F	1.097
df1	3
df2	4654298.142
Sig.	.349

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.
a. Design: Intercept + InvolvementStage4

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.933	1024.713[b]	2.000	148.000	.000	.933
	Wilks' Lambda	.067	1024.713[b]	2.000	148.000	.000	.933
	Hotelling's Trace	13.847	1024.713[b]	2.000	148.000	.000	.933
	Roy's Largest Root	13.847	1024.713[b]	2.000	148.000	.000	.933
InvolvementStage4	Pillai's Trace	.058	4.520[b]	2.000	148.000	.012	.058
	Wilks' Lambda	.942	4.520[b]	2.000	148.000	.012	.058
	Hotelling's Trace	.061	4.520[b]	2.000	148.000	.012	.058
	Roy's Largest Root	.061	4.520[b]	2.000	148.000	.012	.058

a. Design: Intercept + InvolvementStage4
b. Exact statistic

Tests of Between-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	Comp7PI	.625[a]	1	.625	.683	.410	.005
	Comp7PLOI	8.360[b]	1	8.360	7.922	.006	.050
Intercept	Comp7PI	1599.221	1	1599.221	1748.202	.000	.921
	Comp7PLOI	1632.863	1	1632.863	1547.398	.000	.912
InvolvementStage4	Comp7PI	.625	1	.625	.683	.410	.005
	Comp7PLOI	8.360	1	8.360	7.922	.006	.050
Error	Comp7PI	136.302	149	.915			
	Comp7PLOI	157.230	149	1.055			
Total	Comp7PI	1740.000	151				
	Comp7PLOI	1808.000	151				
Corrected Total	Comp7PI	136.927	150				
	Comp7PLOI	165.589	150				

a. R Squared = .005 (Adjusted R Squared = -.002)
b. R Squared = .050 (Adjusted R Squared = .044)

Source: Self-study

Item: 20. Ability to transfer POE outcomes in a project to briefing stage of other project
Code: POE4
Construct: POE

Preliminary assumption conducted revealed that data is negatively skewed in all conditions as assessed by descriptive statistics analysis and no multicollinearity was detected (r = 0.498, $p < 0.05$) (Pallant, 2010, p. 290; Tabachnick and Fidell, 2013, p. 90). Univariate and multivariate outliers are present as assessed by boxplot and Mahalanobis distance ($p < 0.001$) respectively. Linearity assumption is violated as assessed by the scatter plot, which caused power loss of the procedure. Nevertheless, power is not a concern as the sample size of the study is large (Pallant, 2010; p. 208). The *p*-value of Box's test of equality of covariance matrices is greater than 0.001, which indicates that the assumption of homogeneity of variance-covariance matrices is satisfied. There was statistically significant difference between the level of involvement of professionals in Stage 4 on the combined dependent variables $F\,(2, 150) = 3.588$, $p = 0.030$, Wilks' $\Lambda = 0.954$, partial $\eta^2 = 0.046$. Using a Bonferroni adjusted alpha level of 0.025, none of the dependent variables ($p > 0.025$) reached statistical significance. It can be concluded that there is no significant difference between professionals who have working experience and those who have no working experience in Stage 4.

The output of one-way MANOVA statistic for POE4 of Stage 4 is shown in Table 6.29.

Table 6.29 The output of statistical analysis for POE4 of Stage 4

Descriptive Statistics

InvolvementStage4		Mean	Std. Deviation	N
POE4PI	Yes	4.12	.843	74
	No	3.96	.823	79
	Total	4.04	.834	153
POE4PLOI	Yes	3.51	1.024	74
	No	3.75	.993	79
	Total	3.63	1.011	153

Levene's Test of Equality of Error Variances[a]

	Levene Statistic	df1	df2	Sig.
POE4PI	.035	1	151	.852
POE4PLOI	.110	1	151	.740

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a. Design: Intercept + InvolvementStage4

Box's Test of Equality of Covariance Matrices[a]

Box's M	.093
F	.031
df1	3
df2	4759420.804
Sig.	.993

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.
a. Design: Intercept + InvolvementStage4

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.962	1903.075[b]	2.000	150.000	.000	.962
	Wilks' Lambda	.038	1903.075[b]	2.000	150.000	.000	.962
	Hotelling's Trace	25.374	1903.075[b]	2.000	150.000	.000	.962
	Roy's Largest Root	25.374	1903.075[b]	2.000	150.000	.000	.962
InvolvementStage4	Pillai's Trace	.046	3.588[b]	2.000	150.000	.030	.046
	Wilks' Lambda	.954	3.588[b]	2.000	150.000	.030	.046
	Hotelling's Trace	.048	3.588[b]	2.000	150.000	.030	.046
	Roy's Largest Root	.048	3.588[b]	2.000	150.000	.030	.046

a. Design: Intercept + InvolvementStage4
b. Exact statistic

Tests of Between-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	POE4PI	.973[a]	1	.973	1.402	.238	.009
	POE4PLOI	2.080[b]	1	2.080	2.047	.155	.013
Intercept	POE4PI	2496.790	1	2496.790	3597.767	.000	.960
	POE4PLOI	2014.106	1	2014.106	1982.295	.000	.929
InvolvementStage4	POE4PI	.973	1	.973	1.402	.238	.009
	POE4PLOI	2.080	1	2.080	2.047	.155	.013
Error	POE4PI	104.791	151	.694			
	POE4PLOI	153.423	151	1.016			
Total	POE4PI	2602.000	153				
	POE4PLOI	2176.000	153				
Corrected Total	POE4PI	105.765	152				
	POE4PLOI	155.503	152				

a. R Squared = .009 (Adjusted R Squared = .003)
b. R Squared = .013 (Adjusted R Squared = .007)

Source: Self-study

Item: 22. Ability to apply Computerised Aided Facilities Management (CAFM)
Code: MgtT3
Construct: Organisation

Preliminary assumption conducted revealed that data is negatively skewed in all conditions as assessed by descriptive statistics analysis and no multicollinearity was detected (r = 0.498, $p < 0.05$) (Pallant, 2010, p. 290; Tabachnick and Fidell, 2013, p. 90). Univariate outliers are present as assessed by boxplot. There are no multivariate outliers as observed through Mahalanobis distance ($p > 0.001$) procedure. Linearity assumption is violated as assessed by the scatter plot, which caused power loss of the procedure. Nevertheless, power is not a concern as the sample size of the study is large (Pallant, 2010; p. 208). The *p*-value of Box's test of equality of covariance matrices is greater than 0.001, which indicates that the assumption of homogeneity of variance-covariance matrices is satisfied. There was statistically significant difference between the level of involvement of professionals in Stage 4 on the combined dependent variables F (2, 149) = 3.321, $p = 0.039$, Wilks' $\Lambda = 0.957$, partial $\eta^2 = 0.043$. Using a Bonferroni adjusted alpha level of 0.025, perceived level of integration has reached the statistical significance, F (1, 150) = 5.778, $p = 0.017$, partial $\eta^2 = 0.037$. An inspection of the mean scores indicated that professionals who have no working experience in Stage 4 reported slightly higher levels of perceived level of integration ($\mu = 3.81$, $\sigma = 0.921$) than professionals who do have working experience in Stage 4 ($\mu = 3.44$, $\sigma = 0.986$).

The output of one-way MANOVA statistic for MgtT3 of Stage 4 is shown in Table 6.30.

Table 6.30 The output of statistical analysis for MgtT3 of Stage 4

Descriptive Statistics

InvolvementStage4		Mean	Std. Deviation	N
MgtT3PI	Yes	3.75	1.024	73
	No	3.89	.877	79
	Total	3.82	.950	152
MgtT3PLOI	Yes	3.44	.986	73
	No	3.81	.921	79
	Total	3.63	.968	152

Levene's Test of Equality of Error Variances[a]

	Levene Statistic	df1	df2	Sig.
MgtT3PI	1.273	1	150	.261
MgtT3PLOI	.530	1	150	.468

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a. Design: Intercept + InvolvementStage4

Box's Test of Equality of Covariance Matrices[a]

Box's M	2.318
F	.761
df1	3
df2	5069275.652
Sig.	.516

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.
a. Design: Intercept + InvolvementStage4

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.949	1397.296[b]	2.000	149.000	.000	.949
	Wilks' Lambda	.051	1397.296[b]	2.000	149.000	.000	.949
	Hotelling's Trace	18.756	1397.296[b]	2.000	149.000	.000	.949
	Roy's Largest Root	18.756	1397.296[b]	2.000	149.000	.000	.949
InvolvementStage4	Pillai's Trace	.043	3.321[b]	2.000	149.000	.039	.043
	Wilks' Lambda	.957	3.321[b]	2.000	149.000	.039	.043
	Hotelling's Trace	.045	3.321[b]	2.000	149.000	.039	.043
	Roy's Largest Root	.045	3.321[b]	2.000	149.000	.039	.043

a. Design: Intercept + InvolvementStage4
b. Exact statistic

Tests of Between-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	MgtT3PI	.668[a]	1	.668	.739	.391	.005
	MgtT3PLOI	5.244[b]	1	5.244	5.778	.017	.037
Intercept	MgtT3PI	2214.299	1	2214.299	2450.597	.000	.942
	MgtT3PLOI	1993.428	1	1993.428	2196.623	.000	.936
InvolvementStage4	MgtT3PI	.668	1	.668	.739	.391	.005
	MgtT3PLOI	5.244	1	5.244	5.778	.017	.037
Error	MgtT3PI	135.536	150	.904			
	MgtT3PLOI	136.125	150	.907			
Total	MgtT3PI	2357.000	152				
	MgtT3PLOI	2146.000	152				
Corrected Total	MgtT3PI	136.204	151				
	MgtT3PLOI	141.368	151				

a. R Squared = .005 (Adjusted R Squared = -.002)
b. R Squared = .037 (Adjusted R Squared = .031)

Source: Self-study

Item: 24. Ability to apply Building Information Modelling (BIM)
Code: MgtT2
Construct: Organisation

Preliminary assumption conducted revealed that data is negatively skewed in all conditions as assessed by descriptive statistics analysis and no multicollinearity was detected (r = 0.558, $p < 0.05$) (Pallant, 2010, p. 290; Tabachnick and Fidell, 2013, p. 90). Univariate outliers are present as assessed by boxplot. There are no multivariate outliers as observed through Mahalanobis distance ($p > 0.001$) procedure. Linearity assumption is violated as assessed by the scatter plot, which caused power loss of the procedure. Nevertheless, power is not a concern as the sample size of the study is large (Pallant, 2010; p. 208). The *p*-value of Box's test of equality of covariance matrices is greater than 0.001, which indicates that the assumption of homogeneity of variance-covariance matrices is satisfied. There was statistically significant difference between the level of involvement of professionals in Stage 4 on the combined dependent variables F (2, 150) = 3.157, $p = 0.045$, Wilks' $\Lambda = 0.960$, partial $\eta^2 = 0.040$. Using a Bonferroni adjusted alpha level of 0.025, perceived level of integration has reached the statistical significance, F (1, 151) = 6.318, $p = 0.013$, partial $\eta^2 = 0.040$. An inspection of the mean scores indicated that professionals who have no working experience in Stage 4 reported slightly higher levels of perceived level of integration ($\mu = 3.54$, $\sigma = 0.903$) than professionals who do have working experience in Stage 4 ($\mu = 3.15$, $\sigma = 1.043$).

The output of one-way MANOVA statistic for MgtT2 of Stage 4 is shown in Table 6.31.

Table 6.31 The output of statistical analysis for MgtT2 of Stage 4

Descriptive Statistics

InvolvementStage4		Mean	Std. Deviation	N
MgtT2PI	Yes	3.57	.980	74
	No	3.80	.822	79
	Total	3.69	.907	153
MgtT2PLOI	Yes	3.15	1.043	74
	No	3.54	.903	79
	Total	3.35	.990	153

Levene's Test of Equality of Error Variances[a]

	Levene Statistic	df1	df2	Sig.
MgtT2PI	2.230	1	151	.137
MgtT2PLOI	.823	1	151	.366

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a. Design: Intercept + InvolvementStage4

Box's Test of Equality of Covariance Matrices[a]

Box's M	3.132
F	1.029
df1	3
df2	4759420.804
Sig.	.378

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.
a. Design: Intercept + InvolvementStage4

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.950	1410.393[b]	2.000	150.000	.000	.950
	Wilks' Lambda	.050	1410.393[b]	2.000	150.000	.000	.950
	Hotelling's Trace	18.805	1410.393[b]	2.000	150.000	.000	.950
	Roy's Largest Root	18.805	1410.393[b]	2.000	150.000	.000	.950
InvolvementStage4	Pillai's Trace	.040	3.157[b]	2.000	150.000	.045	.040
	Wilks' Lambda	.960	3.157[b]	2.000	150.000	.045	.040
	Hotelling's Trace	.042	3.157[b]	2.000	150.000	.045	.040
	Roy's Largest Root	.042	3.157[b]	2.000	150.000	.045	.040

a. Design: Intercept + InvolvementStage4
b. Exact statistic

Tests of Between-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	MgtT2PI	2.020[a]	1	2.020	2.481	.117	.016
	MgtT2PLOI	5.981[b]	1	5.981	6.318	.013	.040
Intercept	MgtT2PI	2072.608	1	2072.608	2546.043	.000	.944
	MgtT2PLOI	1711.602	1	1711.602	1807.864	.000	.923
InvolvementStage4	MgtT2PI	2.020	1	2.020	2.481	.117	.016
	MgtT2PLOI	5.981	1	5.981	6.318	.013	.040
Error	MgtT2PI	122.922	151	.814			
	MgtT2PLOI	142.960	151	.947			
Total	MgtT2PI	2204.000	153				
	MgtT2PLOI	1869.000	153				
Corrected Total	MgtT2PI	124.941	152				
	MgtT2PLOI	148.941	152				

a. R Squared = .016 (Adjusted R Squared = .010)
b. R Squared = .040 (Adjusted R Squared = .034)

Source: Self-study

Item: 27. Ability to take lead in mobile flexible working patterns
Code: Sust2
Construct: Organisation

Preliminary assumption conducted revealed that data is negatively skewed in all conditions as assessed by descriptive statistics analysis and no multicollinearity was detected (r = 0.546, $p < 0.05$) (Pallant, 2010, p. 290; Tabachnick and Fidell, 2013, p. 90). Univariate and multivariate outliers are present as assessed by boxplot and Mahalanobis distance ($p < 0.001$) respectively. Linearity assumption is violated as assessed by the scatter plot, which caused power loss of the procedure. Nevertheless, power is not a concern as the sample size of the study is large (Pallant, 2010; p. 208). The *p*-value of Box's test of equality of covariance matrices is greater than 0.001, which indicates that the assumption of homogeneity of variance-covariance matrices is satisfied. There was statistically significant difference between the level of involvement of professionals in Stage 4 on the combined dependent variables F (2, 149) = 4.738, $p = 0.010$, Wilks' $\Lambda = 0.960$, partial $\eta^2 = 0.040$. Using a Bonferroni adjusted alpha level of 0.025, both dependent variables have reached the statistical significance: perceived importance, F (1, 150) = 6.511, $p = 0.012$, partial $\eta^2 = 0.042$ and perceived level of integration F (1, 150) = 8.128, $p = 0.005$, partial $\eta^2 = 0.051$. It can be concluded that there is no significant difference between professionals who have working experience and those who have no working experience in Stage 4.

The output of one-way MANOVA statistic for Sust2 of Stage 4 is shown in Table 6.32.

Table 6.32 The output of statistical analysis for Sust2 of Stage 4

Descriptive Statistics

InvolvementStage4		Mean	Std. Deviation	N
Sust2PI	Yes	3.62	.952	73
	No	3.99	.840	79
	Total	3.81	.912	152
Sust2PLOI	Yes	3.38	.967	73
	No	3.81	.878	79
	Total	3.61	.943	152

Levene's Test of Equality of Error Variances[a]

	Levene Statistic	df1	df2	Sig.
MgtT2PI	2.230	1	151	.137
MgtT2PLOI	.823	1	151	.366

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a. Design: Intercept + InvolvementStage4

Box's Test of Equality of Covariance Matrices[a]

Box's M	1.499
F	.492
df1	3
df2	5069275.652
Sig.	.688

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.
a. Design: Intercept + InvolvementStage4

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.956	1628.874[b]	2.000	149.000	.000	.956
	Wilks' Lambda	.044	1628.874[b]	2.000	149.000	.000	.956
	Hotelling's Trace	21.864	1628.874[b]	2.000	149.000	.000	.956
	Roy's Largest Root	21.864	1628.874[b]	2.000	149.000	.000	.956
InvolvementStage4	Pillai's Trace	.060	4.738[b]	2.000	149.000	.010	.060
	Wilks' Lambda	.940	4.738[b]	2.000	149.000	.010	.060
	Hotelling's Trace	.064	4.738[b]	2.000	149.000	.010	.060
	Roy's Largest Root	.064	4.738[b]	2.000	149.000	.010	.060

a. Design: Intercept + InvolvementStage4
b. Exact statistic

Tests of Between-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	Sust2PI	5.219[a]	1	5.219	6.511	.012	.042
	Sust2PLOI	6.904[b]	1	6.904	8.128	.005	.051
Intercept	Sust2PI	2193.641	1	2193.641	2736.404	.000	.948
	Sust2PLOI	1963.404	1	1963.404	2311.479	.000	.939
InvolvementStage4	Sust2PI	5.219	1	5.219	6.511	.012	.042
	Sust2PLOI	6.904	1	6.904	8.128	.005	.051
Error	Sust2PI	120.248	150	.802			
	Sust2PLOI	127.412	150	.849			
Total	Sust2PI	2331.000	152				
	Sust2PLOI	2110.000	152				
Corrected Total	Sust2PI	125.467	151				
	Sust2PLOI	134.316	151				

a. R Squared = .042 (Adjusted R Squared = .035)
b. R Squared = .051 (Adjusted R Squared = .045)

Source: Self-study

Item: 30. Understand user's organisational strategy
Code: StrV1
Construct: Strategic Value

Preliminary assumption conducted revealed that data is negatively skewed in all conditions as assessed by descriptive statistics analysis and no multicollinearity was detected (r = 0.404, $p < 0.05$) (Pallant, 2010, p. 290; Tabachnick and Fidell, 2013, p. 90). Univariate and multivariate outliers are present as assessed by boxplot and Mahalanobis distance ($p < 0.001$) respectively. Linearity assumption is violated as assessed by the scatter plot, which caused power loss of the procedure. Nevertheless, power is not a concern as the sample size of the study is large (Pallant, 2010; p. 208). The *p*-value of Box’s test of equality of covariance matrices is greater than 0.001, which indicates that the assumption of homogeneity of variance-covariance matrices is satisfied. There was statistically significant difference between the level of involvement of professionals in Stage 4 on the combined dependent variables $F\ (2, 150) = 4.608$, $p = 0.011$, Wilks’ $\Lambda = 0.942$, partial $\eta^2 = 0.058$. Using a Bonferroni adjusted alpha level of 0.025, perceived level of integration has reached the statistical significance $F\ (1, 151) = 6.591$, $p = 0.003$, partial $\eta^2 = 0.056$. An inspection of the mean scores indicated that professionals who have no working experience in Stage 4 reported slightly higher levels of perceived level of integration ($\mu = 4.25$, $\sigma = 0.808$) than professionals who do have working experience in Stage 4 ($\mu = 3.84$, $\sigma = 0.907$).

The output of one-way MANOVA statistic for StrV1 of Stage 4 is shown in Table 6.33.

Table 6.33 The output of statistical analysis for StrV1 of Stage 4

Descriptive Statistics

InvolvementStage4		Mean	Std. Deviation	N
StrV1PI	Yes	4.26	.741	74
	No	4.44	.655	79
	Total	4.35	.702	153
StrV1PLOI	Yes	3.84	.907	74
	No	4.25	.808	79
	Total	4.05	.880	153

Levene's Test of Equality of Error Variances[a]

	Levene Statistic	df1	df2	Sig.
StrV1PI	.312	1	151	.577
StrV1PLOI	.064	1	151	.800

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a. Design: Intercept + InvolvementStage4

Box's Test of Equality of Covariance Matrices[a]

Box's M	9.775
F	3.212
df1	3
df2	4759420.804
Sig.	.022

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.
a. Design: Intercept + InvolvementStage4

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.979	3439.898[b]	2.000	150.000	.000	.979
	Wilks' Lambda	.021	3439.898[b]	2.000	150.000	.000	.979
	Hotelling's Trace	45.865	3439.898[b]	2.000	150.000	.000	.979
	Roy's Largest Root	45.865	3439.898[b]	2.000	150.000	.000	.979
InvolvementStage4	Pillai's Trace	.058	4.608[b]	2.000	150.000	.011	.058
	Wilks' Lambda	.942	4.608[b]	2.000	150.000	.011	.058
	Hotelling's Trace	.061	4.608[b]	2.000	150.000	.011	.058
	Roy's Largest Root	.061	4.608[b]	2.000	150.000	.011	.058

a. Design: Intercept + InvolvementStage4
b. Exact statistic

Tests of Between-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	StrV1PI	1.326[a]	1	1.326	2.720	.101	.018
	StrV1PLOI	6.591[b]	1	6.591	8.967	.003	.056
Intercept	StrV1PI	2891.914	1	2891.914	5931.906	.000	.975
	StrV1PLOI	2501.336	1	2501.336	3403.002	.000	.958
InvolvementStage4	StrV1PI	1.326	1	1.326	2.720	.101	.018
	StrV1PLOI	6.591	1	6.591	8.967	.003	.056
Error	StrV1PI	73.615	151	.488			
	StrV1PLOI	110.991	151	.735			
Total	StrV1PI	2974.000	153				
	StrV1PLOI	2630.000	153				
Corrected Total	StrV1PI	74.941	152				
	StrV1PLOI	117.582	152				

a. R Squared = .018 (Adjusted R Squared = .011)
b. R Squared = .056 (Adjusted R Squared = .050)

Source: Self-study

6.2.4.6 Stage 5: Construction

Item: 3. Having comprehensive facilities maintenance records
Code: KnowM5
Construct: Knowledge Management

Preliminary assumption conducted revealed that data is negatively skewed in all conditions as assessed by descriptive statistics analysis and no multicollinearity was detected (r = 0.401, $p < 0.05$) (Pallant, 2010, p. 290; Tabachnick and Fidell, 2013, p. 90). Univariate and multivariate outliers are present as assessed by boxplot and Mahalanobis distance ($p < 0.001$) respectively. Linearity assumption is violated as assessed by the scatter plot, which caused power loss of the procedure. Nevertheless, power is not a concern as the sample size of the study is large (Pallant, 2010; p. 208). The *p*-value of Box's test of equality of covariance matrices is greater than 0.001, which indicates that the assumption of homogeneity of variance-covariance matrices is satisfied. There was statistically significant difference between the level of involvement of professionals in Stage 5 on the combined dependent variables F (2, 150) = 3.407, $p = 0.036$, Wilks' $\Lambda = 0.957$, partial $\eta^2 = 0.043$. Using a Bonferroni adjusted alpha level of 0.025, none of the dependent variables ($p > 0.025$) reached statistical significance. It can be concluded that there is no significant difference between professionals who have working experience and those who have no working experience in Stage 5.

The output of one-way MANOVA statistic for KnowM5 of Stage 5 is shown in Table 6.34.

Table 6.34 The output of statistical analysis for KnowM5 of Stage 5

Descriptive Statistics

InvolvementStage5		Mean	Std. Deviation	N
KnowM5PI	Yes	4.57	.572	77
	No	4.54	.599	76
	Total	4.56	.584	153
KnowM5PLOI	Yes	3.84	1.113	77
	No	4.20	.783	76
	Total	4.02	.977	153

Levene's Test of Equality of Error Variances[a]

	Levene Statistic	df1	df2	Sig.
KnowM5PI	.352	1	151	.554
KnowM5PLOI	8.005	1	151	.005

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a. Design: Intercept + InvolvementStage5

Box's Test of Equality of Covariance Matrices[a]

Box's M	10.342
F	3.398
df1	3
df2	4126866.361
Sig.	.017

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.
a. Design: Intercept + InvolvementStage5

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.984	4726.341[b]	2.000	150.000	.000	.984
	Wilks' Lambda	.016	4726.341[b]	2.000	150.000	.000	.984
	Hotelling's Trace	63.018	4726.341[b]	2.000	150.000	.000	.984
	Roy's Largest Root	63.018	4726.341[b]	2.000	150.000	.000	.984
InvolvementStage5	Pillai's Trace	.043	3.407[b]	2.000	150.000	.036	.043
	Wilks' Lambda	.957	3.407[b]	2.000	150.000	.036	.043
	Hotelling's Trace	.045	3.407[b]	2.000	150.000	.036	.043
	Roy's Largest Root	.045	3.407[b]	2.000	150.000	.036	.043

a. Design: Intercept + InvolvementStage5
b. Exact statistic

Tests of Between-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	KnowM5PI	.039[a]	1	.039	.114	.736	.001
	KnowM5PLOI	4.772[b]	1	4.772	5.141	.025	.033
Intercept	KnowM5PI	3174.941	1	3174.941	9266.099	.000	.984
	KnowM5PLOI	2473.373	1	2473.373	2664.487	.000	.946
InvolvementStage5	KnowM5PI	.039	1	.039	.114	.736	.001
	KnowM5PLOI	4.772	1	4.772	5.141	.025	.033
Error	KnowM5PI	51.739	151	.343			
	KnowM5PLOI	140.169	151	.928			
Total	KnowM5PI	3227.000	153				
	KnowM5PLOI	2617.000	153				
Corrected Total	KnowM5PI	51.778	152				
	KnowM5PLOI	144.941	152				

a. R Squared = .001 (Adjusted R Squared = -.006)
b. R Squared = .033 (Adjusted R Squared = .027)

Source: Self-study

Item: 22. Ability to apply Computerised Aided Facilities Management (CAFM)
Code: MgtT3
Construct: Organisation

Preliminary assumption conducted revealed that data is negatively skewed in all conditions as assessed by descriptive statistics analysis and no multicollinearity was detected (r = 0.640, $p < 0.05$) (Pallant, 2010, p. 290; Tabachnick and Fidell, 2013, p. 90). Univariate outliers are present as assessed by boxplot. There are no multivariate outliers as observed through Mahalanobis distance ($p > 0.001$) procedure. Linearity assumption is violated as assessed by the scatter plot, which caused power loss of the procedure. Nevertheless, power is not a concern as the sample size of the study is large (Pallant, 2010; p. 208). The *p*-value of Box's test of equality of covariance matrices is greater than 0.001, which indicates that the assumption of homogeneity of variance-covariance matrices is satisfied. There was statistically significant difference between the level of involvement of professionals in Stage 5 on the combined dependent variables F (2, 149) = 3.729, $p = 0.026$, Wilks' $\Lambda = 0.952$, partial $\eta^2 = 0.048$. Using a Bonferroni adjusted alpha level of 0.025, perceived level of integration has reached the statistical significance F (1, 150) = 6.737, $p = 0.007$, partial $\eta^2 = 0.048$. An inspection of the mean scores indicated that professionals who have no working experience in Stage 5 reported slightly higher levels of perceived level of integration ($\mu = 3.84$, $\sigma = 0.865$) than professionals who do have working experience in Stage 5 ($\mu = 3.42$, $\sigma = 1.023$).

The output of one-way MANOVA statistic for MgtT3 of Stage 5 is shown in Table 6.35.

Table 6.35 The output of statistical analysis for MgtT3 of Stage 5

Descriptive Statistics

InvolvementStage5		Mean	Std. Deviation	N
MgtT3PI	Yes	3.68	1.009	76
	No	3.96	.871	76
	Total	3.82	.950	152
MgtT3PLOI	Yes	3.42	1.023	76
	No	3.84	.865	76
	Total	3.63	.968	152

Levene's Test of Equality of Error Variances[a]

	Levene Statistic	df1	df2	Sig.
MgtT3PI	1.906	1	150	.169
MgtT3PLOI	3.255	1	150	.073

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a. Design: Intercept + InvolvementStage5

Box's Test of Equality of Covariance Matrices[a]

Box's M	3.096
F	1.017
df1	3
df2	4050000.000
Sig.	.384

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.
a. Design: Intercept + InvolvementStage5

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.951	1431.505[b]	2.000	149.000	.000	.951
	Wilks' Lambda	.049	1431.505[b]	2.000	149.000	.000	.951
	Hotelling's Trace	19.215	1431.505[b]	2.000	149.000	.000	.951
	Roy's Largest Root	19.215	1431.505[b]	2.000	149.000	.000	.951
InvolvementStage5	Pillai's Trace	.048	3.729[b]	2.000	149.000	.026	.048
	Wilks' Lambda	.952	3.729[b]	2.000	149.000	.026	.048
	Hotelling's Trace	.050	3.729[b]	2.000	149.000	.026	.048
	Roy's Largest Root	.050	3.729[b]	2.000	149.000	.026	.048

a. Design: Intercept + InvolvementStage5
b. Exact statistic

Tests of Between-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	MgtT3PI	2.901[a]	1	2.901	3.265	.073	.021
	MgtT3PLOI	6.737[b]	1	6.737	7.506	.007	.048
Intercept	MgtT3PI	2220.796	1	2220.796	2498.971	.000	.943
	MgtT3PLOI	2004.632	1	2004.632	2233.464	.000	.937
InvolvementStage5	MgtT3PI	2.901	1	2.901	3.265	.073	.021
	MgtT3PLOI	6.737	1	6.737	7.506	.007	.048
Error	MgtT3PI	133.303	150	.889			
	MgtT3PLOI	134.632	150	.898			
Total	MgtT3PI	2357.000	152				
	MgtT3PLOI	2146.000	152				
Corrected Total	MgtT3PI	136.204	151				
	MgtT3PLOI	141.368	151				

a. R Squared = .021 (Adjusted R Squared = .015)
b. R Squared = .048 (Adjusted R Squared = .041)

Source: Self-study

Item:30. Understand user's organisational strategy
Code: StrV1
Construct: Strategic Value

Preliminary assumption conducted revealed that data is negatively skewed in all conditions as assessed by descriptive statistics analysis and no multicollinearity was detected (r = 0.640, $p < 0.05$) (Pallant, 2010, p. 290; Tabachnick and Fidell, 2013, p. 90). Univariate and multivariate outliers are present as assessed by boxplot and Mahalanobis distance ($p < 0.001$) respectively. Linearity assumption is violated as assessed by the scatter plot, which caused power loss of the procedure. Nevertheless, power is not a concern as the sample size of the study is large (Pallant, 2010; p. 208). The *p*-value of Box's test of equality of covariance matrices is greater than 0.001, which indicates that the assumption of homogeneity of variance-covariance matrices is satisfied. There was statistically significant difference between the level of involvement of professionals in Stage 5 on the combined dependent variables F (2, 150) = 4.034, $p = 0.020$, Wilks' $\Lambda = 0.949$, partial $\eta^2 = 0.051$. Using a Bonferroni adjusted alpha level of 0.025, perceived level of integration has reached the statistical significance F (1, 151) = 7.982, $p = 0.005$, partial $\eta^2 = 0.050$. An inspection of the mean scores indicated that professionals who have no working experience in Stage 5 reported slightly higher levels of perceived level of integration ($\mu = 4.25$, $\sigma = 0.802$) than professionals who do have working experience in Stage 5 ($\mu = 3.86$, $\sigma = 0.914$).

The output of one-way MANOVA statistic for StrV1 of Stage 5 is shown in Table 6.36.

Table 6.36 The output of statistical analysis for StrV1 of Stage 5

Descriptive Statistics

InvolvementStage5		Mean	Std. Deviation	N
StrV1PI	Yes	4.27	.719	77
	No	4.43	.680	76
	Total	4.35	.702	153
StrV1PLOI	Yes	3.86	.914	77
	No	4.25	.802	76
	Total	4.05	.880	153

Levene's Test of Equality of Error Variances[a]

	Levene Statistic	df1	df2	Sig.
StrV1PI	.262	1	151	.610
StrV1PLOI	.211	1	151	.646

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a. Design: Intercept + InvolvementStage5

Box's Test of Equality of Covariance Matrices[a]

Box's M	1.994
F	.655
df1	3
df2	4126866.361
Sig.	.580

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.
a. Design: Intercept + InvolvementStage5

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.979	3426.122[b]	2.000	150.000	.000	.979
	Wilks' Lambda	.021	3426.122[b]	2.000	150.000	.000	.979
	Hotelling's Trace	45.682	3426.122[b]	2.000	150.000	.000	.979
	Roy's Largest Root	45.682	3426.122[b]	2.000	150.000	.000	.979
InvolvementStage5	Pillai's Trace	.051	4.034[b]	2.000	150.000	.020	.051
	Wilks' Lambda	.949	4.034[b]	2.000	150.000	.020	.051
	Hotelling's Trace	.054	4.034[b]	2.000	150.000	.020	.051
	Roy's Largest Root	.054	4.034[b]	2.000	150.000	.020	.051

a. Design: Intercept + InvolvementStage5
b. Exact statistic

Tests of Between-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	StrV1PI	.997[a]	1	.997	2.037	.156	.013
	StrV1PLOI	5.903[b]	1	5.903	7.982	.005	.050
Intercept	StrV1PI	2899.638	1	2899.638	5921.327	.000	.975
	StrV1PLOI	2513.903	1	2513.903	3399.035	.000	.957
InvolvementStage5	StrV1PI	.997	1	.997	2.037	.156	.013
	StrV1PLOI	5.903	1	5.903	7.982	.005	.050
Error	StrV1PI	73.944	151	.490			
	StrV1PLOI	111.679	151	.740			
Total	StrV1PI	2974.000	153				
	StrV1PLOI	2630.000	153				
Corrected Total	StrV1PI	74.941	152				
	StrV1PLOI	117.582	152				

a. R Squared = .021 (Adjusted R Squared = .015)
b. R Squared = .048 (Adjusted R Squared = .041)

Source: Self-study

6.2.4.7 Stage 6: Handover and Close Out

Item: 23. Having trust from other professionals
Code: StrR3
Construct: Organisation

Preliminary assumption conducted revealed that data is negatively skewed in all conditions as assessed by descriptive statistics analysis and no multicollinearity was detected (r = 0.325, $p < 0.05$) (Pallant, 2010, p. 290; Tabachnick and Fidell, 2013, p. 90). Univariate and multivariate outliers are present as assessed by boxplot and Mahalanobis distance ($p < 0.001$) respectively. Linearity assumption is violated as assessed by the scatter plot, which caused power loss of the procedure. Nevertheless, power is not a concern as the sample size of the study is large (Pallant, 2010; p. 208). The *p*-value of Box's test of equality of covariance matrices is greater than 0.001, which indicates that the assumption of homogeneity of variance-covariance matrices is satisfied. There was statistically significant difference between the level of involvement of professionals in Stage 6 on the combined dependent variables $F(2, 150) = 3.295$, $p = 0.040$, Wilks' $\Lambda = 0.958$, partial $\eta^2 = 0.042$. Using a Bonferroni adjusted alpha level of 0.025, none of the dependent variables ($p > 0.025$) reached statistical significance. It can be concluded that there is no significant difference between professionals who have working experience and those who have no working experience in Stage 6.

The output of one-way MANOVA statistic for StrR3 of Stage 6 is shown in Table 6.37.

Table 6.37 The output of statistical analysis for StrR3 of Stage 6

Descriptive Statistics

InvolvementStage6		Mean	Std. Deviation	N
StrR3PI	Yes	4.43	.671	90
	No	4.22	.706	63
	Total	4.35	.691	153
StrR3PLOI	Yes	3.97	.917	90
	No	4.16	.846	63
	Total	4.05	.891	153

Levene's Test of Equality of Error Variances[a]

	Levene Statistic	df1	df2	Sig.
StrR3PI	.168	1	151	.683
StrR3PLOI	.091	1	151	.763

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a. Design: Intercept + InvolvementStage6

Box's Test of Equality of Covariance Matrices[a]

Box's M	.971
F	.319
df1	3
df2	1270372.078
Sig.	.812

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.
a. Design: Intercept + InvolvementStage6

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.980	3721.652[b]	2.000	150.000	.000	.980
	Wilks' Lambda	.020	3721.652[b]	2.000	150.000	.000	.980
	Hotelling's Trace	49.622	3721.652[b]	2.000	150.000	.000	.980
	Roy's Largest Root	49.622	3721.652[b]	2.000	150.000	.000	.980
InvolvementStage6	Pillai's Trace	.042	3.295[b]	2.000	150.000	.040	.042
	Wilks' Lambda	.958	3.295[b]	2.000	150.000	.040	.042
	Hotelling's Trace	.044	3.295[b]	2.000	150.000	.040	.042
	Roy's Largest Root	.044	3.295[b]	2.000	150.000	.040	.042

a. Design: Intercept + InvolvementStage6
b. Exact statistic

Tests of Between-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	StrR3PI	1.652[a]	1	1.652	3.513	.063	.023
	StrR3PLOI	1.367[b]	1	1.367	1.730	.190	.011
Intercept	StrR3PI	2776.397	1	2776.397	5905.655	.000	.975
	StrR3PLOI	2446.700	1	2446.700	3096.500	.000	.954
InvolvementStage6	StrR3PI	1.652	1	1.652	3.513	.063	.023
	StrR3PLOI	1.367	1	1.367	1.730	.190	.011
Error	StrR3PI	70.989	151	.470			
	StrR3PLOI	119.313	151	.790			
Total	StrR3PI	2963.000	153				
	StrR3PLOI	2625.000	153				
Corrected Total	StrR3PI	72.641	152				
	StrR3PLOI	120.680	152				

a. R Squared = .023 (Adjusted R Squared = .016)
b. R Squared = .011 (Adjusted R Squared = .005)

Source: Self-study

Item: 27. Ability to take lead in mobile flexible working patterns
Code: Sust2
Construct: Organisation

Preliminary assumption conducted revealed that data is negatively skewed in all conditions as assessed by descriptive statistics analysis and no multicollinearity was detected (r = 0.546, $p < 0.05$) (Pallant, 2010, p. 290; Tabachnick and Fidell, 2013, p. 90). Univariate and multivariate outliers are present as assessed by boxplot and Mahalanobis distance ($p < 0.001$) respectively. Linearity assumption is violated as assessed by the scatter plot, which caused power loss of the procedure. Nevertheless, power is not a concern as the sample size of the study is large (Pallant, 2010; p. 208). The *p*-value of Box's test of equality of covariance matrices is greater than 0.001, indicates that the assumption of homogeneity of variance-covariance matrices is satisfied. There was statistically significant difference between the level of involvement of professionals in Stage 6 on the combined dependent variables F (2, 149) = 5.495, $p = 0.005$, Wilks' $\Lambda = 0.931$, partial $\eta^2 = 0.069$. Using a Bonferroni adjusted alpha level of 0.025, none of the dependent variables ($p > 0.025$) reached statistical significance. It can be concluded that there is no significant difference between professionals who have working experience and those who have no working experience in Stage 6.

The output of one-way MANOVA statistic for Sust2 of Stage 6 is shown in Table 6.38.

Table 6.38 The output of statistical analysis for Sust2 of Stage 6

Descriptive Statistics

InvolvementStage6		Mean	Std. Deviation	N
Sust2PI	Yes	3.91	.887	89
	No	3.67	.933	63
	Total	3.81	.912	152
Sust2PLOI	Yes	3.52	1.001	89
	No	3.73	.846	63
	Total	3.61	.943	152

Levene's Test of Equality of Error Variances[a]

	Levene Statistic	df1	df2	Sig.
Sust2PI	1.066	1	150	.304
Sust2PLOI	3.926	1	150	.049

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a. Design: Intercept + InvolvementStage6

Box's Test of Equality of Covariance Matrices[a]

Box's M	2.987
F	.981
df1	3
df2	1367145.371
Sig.	.401

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.
a. Design: Intercept + InvolvementStage6

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.953	1496.102[b]	2.000	149.000	.000	.953
	Wilks' Lambda	.047	1496.102[b]	2.000	149.000	.000	.953
	Hotelling's Trace	20.082	1496.102[b]	2.000	149.000	.000	.953
	Roy's Largest Root	20.082	1496.102[b]	2.000	149.000	.000	.953
InvolvementStage6	Pillai's Trace	.069	5.495[b]	2.000	149.000	.005	.069
	Wilks' Lambda	.931	5.495[b]	2.000	149.000	.005	.069
	Hotelling's Trace	.074	5.495[b]	2.000	149.000	.005	.069
	Roy's Largest Root	.074	5.495[b]	2.000	149.000	.005	.069

a. Design: Intercept + InvolvementStage6
b. Exact statistic

Tests of Between-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	Sust2PI	2.186[a]	1	2.186	2.660	.105	.017
	Sust2PLOI	1.678[b]	1	1.678	1.898	.170	.012
Intercept	Sust2PI	2117.660	1	2117.660	2576.628	.000	.945
	Sust2PLOI	1937.336	1	1937.336	2190.939	.000	.936
InvolvementStage6	Sust2PI	2.186	1	2.186	2.660	.105	.017
	Sust2PLOI	1.678	1	1.678	1.898	.170	.012
Error	Sust2PI	123.281	150	.822			
	Sust2PLOI	132.637	150	.884			
Total	Sust2PI	2331.000	152				
	Sust2PLOI	2110.000	152				
Corrected Total	Sust2PI	125.467	151				
	Sust2PLOI	134.316	151				

a. R Squared = .017 (Adjusted R Squared = .011)
b. R Squared = .012 (Adjusted R Squared = .006)

Source: Self-study

6.2.4.8 Stage 7: In Use

Item: 12. Having adequate knowledge about construction phases
Code: Comp2
Construct: Competence

Preliminary assumption conducted revealed that data is negatively skewed in all conditions as assessed by descriptive statistics analysis and no multicollinearity was detected (r = 0.550, $p < 0.05$) (Pallant, 2010, p. 290; Tabachnick and Fidell, 2013, p. 90). Univariate and multivariate outliers are present as assessed by boxplot and Mahalanobis distance ($p < 0.001$) respectively. Linearity assumption is violated as assessed by the scatter plot, which caused power loss of the procedure. Nevertheless, power is not a concern as the sample size of the study is large (Pallant, 2010; p. 208). The *p*-value of Box's test of equality of covariance matrices is greater than 0.001, which indicates that the assumption of homogeneity of variance-covariance matrices is satisfied. There was statistically significant difference between the level of involvement of professionals in Stage 7 on the combined dependent variables F (2, 150) = 5.766, $p = 0.004$, Wilks' $\Lambda = 0.929$, partial $\eta^2 = 0.071$. Using a Bonferroni adjusted alpha level of 0.025, perceived importance has reached the statistical significance F (1, 151) = 7.548, $p = 0.004$, partial $\eta^2 = 0.048$. An inspection of the mean scores indicated that professionals who have no working experience in Stage 7 reported slightly higher levels of perceived importance ($\mu = 3.77$, $\sigma = 0.745$) than professionals who do have working experience in Stage 7 ($\mu = 3.42$, $\sigma = 0.798$).

The output of one-way MANOVA statistic for Comp2 of Stage 7 is shown in Table 6.39.

Table 6.39 The output of statistical analysis for Comp2 of Stage 7

Descriptive Statistics

InvolvementStage7		Mean	Std. Deviation	N
Comp2PI	Yes	3.42	.798	88
	No	3.77	.745	65
	Total	3.57	.793	153
Comp2PLOI	Yes	3.43	.932	88
	No	3.40	.787	65
	Total	3.42	.871	153

Levene's Test of Equality of Error Variances[a]

	Levene Statistic	df1	df2	Sig.
Comp2PI	.932	1	151	.336
Comp2PLOI	1.547	1	151	.216

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a. Design: Intercept + InvolvementStage7

Box's Test of Equality of Covariance Matrices[a]

Box's M	7.338
F	2.410
df1	3
df2	2027727.416
Sig.	.065

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.
a. Design: Intercept + InvolvementStage7

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.960	1804.219[b]	2.000	150.000	.000	.960
	Wilks' Lambda	.040	1804.219[b]	2.000	150.000	.000	.960
	Hotelling's Trace	24.056	1804.219[b]	2.000	150.000	.000	.960
	Roy's Largest Root	24.056	1804.219[b]	2.000	150.000	.000	.960
InvolvementStage7	Pillai's Trace	.071	5.766[b]	2.000	150.000	.004	.071
	Wilks' Lambda	.929	5.766[b]	2.000	150.000	.004	.071
	Hotelling's Trace	.077	5.766[b]	2.000	150.000	.004	.071
	Roy's Largest Root	.077	5.766[b]	2.000	150.000	.004	.071

a. Design: Intercept + InvolvementStage7
b. Exact statistic

Tests of Between-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	Comp2PI	4.548[a]	1	4.548	7.548	.007	.048
	Comp2PLOI	.038[b]	1	.038	.050	.824	.000
Intercept	Comp2PI	1932.522	1	1932.522	3207.359	.000	.955
	Comp2PLOI	1744.927	1	1744.927	2287.367	.000	.938
InvolvementStage7	Comp2PI	4.548	1	4.548	7.548	.007	.048
	Comp2PLOI	.038	1	.038	.050	.824	.000
Error	Comp2PI	90.982	151	.603			
	Comp2PLOI	115.191	151	.763			
Total	Comp2PI	2044.000	153				
	Comp2PLOI	1903.000	153				
Corrected Total	Comp2PI	95.529	152				
	Comp2PLOI	115.229	152				

a. R Squared = .048 (Adjusted R Squared = .041)
b. R Squared = .000 (Adjusted R Squared = -.006)

Source: Self-study

Item: 14. Ability to champion lean construction practice
Code: Comp7
Construct: Competence

Preliminary assumption conducted revealed that data is negatively skewed in all conditions as assessed by descriptive statistics analysis and no multicollinearity was detected (r = 0.585, $p < 0.05$) (Pallant, 2010, p. 290; Tabachnick and Fidell, 2013, p. 90). Univariate outliers are present as assessed by boxplot. There are no multivariate outliers as observed through Mahalanobis distance ($p > 0.001$) procedure. Linearity assumption is violated as assessed by the scatter plot, which caused power loss of the procedure. Nevertheless, power is not a concern as the sample size of the study is large (Pallant, 2010; p. 208). The *p*-value of Box's test of equality of covariance matrices is greater than 0.001, which indicates that the assumption of homogeneity of variance-covariance matrices is satisfied. There was statistically significant difference between the level of involvement of professionals in Stage 7 on the combined dependent variables F (2, 148) = 3.668, $p = 0.028$, Wilks' $\Lambda = 0.953$, partial $\eta^2 = 0.047$. Using a Bonferroni adjusted alpha level of 0.025, none of the dependent variables ($p > 0.025$) reach statistical significance. It can be concluded that there is no significant difference between professionals who have working experience and those who have no working experience in Stage 7.

The output of one-way MANOVA statistic for Sust2 of Stage 7 is shown in Table 6.40.

Table 6.40 The output of statistical analysis for Sust2 of Stage 7

Descriptive Statistics

InvolvementStage7		Mean	Std. Deviation	N
Comp7PI	Yes	3.14	.942	87
	No	3.42	.956	64
	Total	3.26	.955	151
Comp7PLOI	Yes	3.33	1.042	87
	No	3.25	1.069	64
	Total	3.30	1.051	151

Levene's Test of Equality of Error Variances[a]

	Levene Statistic	df1	df2	Sig.
Comp7PI	.346	1	149	.557
Comp7PLOI	.007	1	149	.932

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a. Design: Intercept + InvolvementStage7

Box's Test of Equality of Covariance Matrices[a]

Box's M	1.326
F	.435
df1	3
df2	1894739.221
Sig.	.728

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.
a. Design: Intercept + InvolvementStage7

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.931	994.837[b]	2.000	148.000	.000	.931
	Wilks' Lambda	.069	994.837[b]	2.000	148.000	.000	.931
	Hotelling's Trace	13.444	994.837[b]	2.000	148.000	.000	.931
	Roy's Largest Root	13.444	994.837[b]	2.000	148.000	.000	.931
InvolvementStage7	Pillai's Trace	.047	3.668[b]	2.000	148.000	.028	.047
	Wilks' Lambda	.953	3.668[b]	2.000	148.000	.028	.047
	Hotelling's Trace	.050	3.668[b]	2.000	148.000	.028	.047
	Roy's Largest Root	.050	3.668[b]	2.000	148.000	.028	.047

a. Design: Intercept + InvolvementStage7
b. Exact statistic

Tests of Between-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	Comp7PI	2.973[a]	1	2.973	3.307	.071	.022
	Comp7PLOI	.256[b]	1	.256	.231	.632	.002
Intercept	Comp7PI	1586.735	1	1586.735	1764.957	.000	.922
	Comp7PLOI	1598.137	1	1598.137	1440.256	.000	.906
InvolvementStage7	Comp7PI	2.973	1	2.973	3.307	.071	.022
	Comp7PLOI	.256	1	.256	.231	.632	.002
Error	Comp7PI	133.954	149	.899			
	Comp7PLOI	165.333	149	1.110			
Total	Comp7PI	1740.000	151				
	Comp7PLOI	1808.000	151				
Corrected Total	Comp7PI	136.927	150				
	Comp7PLOI	165.589	150				

a. R Squared = .022 (Adjusted R Squared = .015)
b. R Squared = .002 (Adjusted R Squared = -.005)

Source: Self-study

6.3 The rationale for the development of the FM-DP integration framework

A significant involvement of FM in the various stages of the development process is essential to help the improvement of the quality of the facilities provided to users. In Chapter Two, it was demonstrated that FM has not significantly participated in the UK property development industry since the 1990s. The last decade has seen the growth of awareness to get FM integrated into and contributing significantly to the development process. However, the gist of FM-DP integration is that it requires the Facilities Managers to acquire quality in terms of knowledge management, competence, post-occupancy evaluation, organisation and strategic value. Chapter Three has proved that the role of FM is important and there is a need to develop a mechanism to control and manage the development of the facilities in the most effective way (Pitt and Hinks, 2001). The more intense the integration of FM into the development process, the better the facilities will be designed, built and function. However, there is not much evidence of good practice guidelines to enable FM-DP integration. Thus, it is crucial to provide a mechanism to enable Facilities Managers to participate effectively in the development process. In addition, it helps other professionals in the construction industry to consider FM in their activities. As discussed in Chapter Three, the literature recognised the need to develop a framework for FM-DP integration.

Since the publication of the Latham and Egan reports in 1994 and 1998 respectively, the concept of FM-DP integration at every stage of the development process has been limited in the academic world. For instance, Cooper *et al.* (1998) and M. Kagioglou *et al.* (1998) are the earliest studies undertaken at the University of Salford in the development of process protocol which take into account the development process whilst integrating various disciplines including FM under a common structure. Similar studies are available for European, Asian and African conditions; however, the focus is limited to design and use stages. The challenges for FM to integrate into the development process have been reviewed in Chapter Three and have been confirmed through comprehensive qualitative analysis in Chapter Five. This procedure resulted in an acknowledgement of elements of the best practices that need to be considered when developing the FM-DP integration framework. The combination of the elements of the best practice and the development stages gives a value to the framework in encouraging the FM-DP integration. Three (3) key objectives have been formulated in order to achieve the aim of developing a FM-DP integration framework that is to provide a guideline for the construction industry in optimising the role of FM:

To identify the significant elements of the best practice which encourages the awareness of FM-DP integration;

To establish the elements of the best practice required to optimise the role of FM in the development process in a form of simple graphic yet comprehensive and relevant to FM and property development industry; and

To guide individual professionals as well as the organisations to systematically prioritise their efforts in optimising the role of FM.

Figure 6.9 Three (3) key objectives for developing the FM-DP integration framework. Source: Self-study

The development of the FM-DP integration framework will take into account the above objectives through statistical analysis results and the literature review. The structure of the framework is discussed in Section 6.4.

6.4 The structure of the framework

In general, the structure of the framework as shown in Figure 6.10 is an alteration from the proposed solution in implementation of FM for construction (Damgaard and Erichsen, 2009) and the incorporation of the RIBA Plan of Work 2013. Both features have become the foundation of establishing this framework, as the target is to optimise the role of FM in the development process. Furthermore, this framework is prescriptive[16] and directive[17] in its character. In brief, the framework is applicable to individual professionals as well as to organisations in optimising the role of FM in the development process.

The framework comprise three (3) major sections. The ***upper left section*** is identified as the ***circle of integration***, which is presented in a form of an illustration comprising eight (8) circles representing stages of the RIBA Plan of Work 2013. The circles contain labels of the stages as well as 15 items of the best practices. It is essential to make a cross-reference to the upper right section and the foundation. The ***upper right section*** is called ***the codes***; it contains five (5) colour codes and the titles of the constructs, and 15 descriptions of the items with their coding. For ease of reference, the definitions of the constructs are provided at the bottom part of ***the codes***. The foundation of the

[16] Stating how FM should be integrated into the development process.
[17] Under the control of the framework, the FM should be able to improve the integration reputation.

framework encompasses ***the stages*** and core objectives of the RIBA Plan of Work 2013. The two arrows in the framework indicate the need to cross-reference between ***the circle***, ***the codes*** and ***the stages*** in order to fully utilise the framework. The rationale for the existence of the items at each stage is justified supported with the literature and triangulation of the previous qualitative findings.

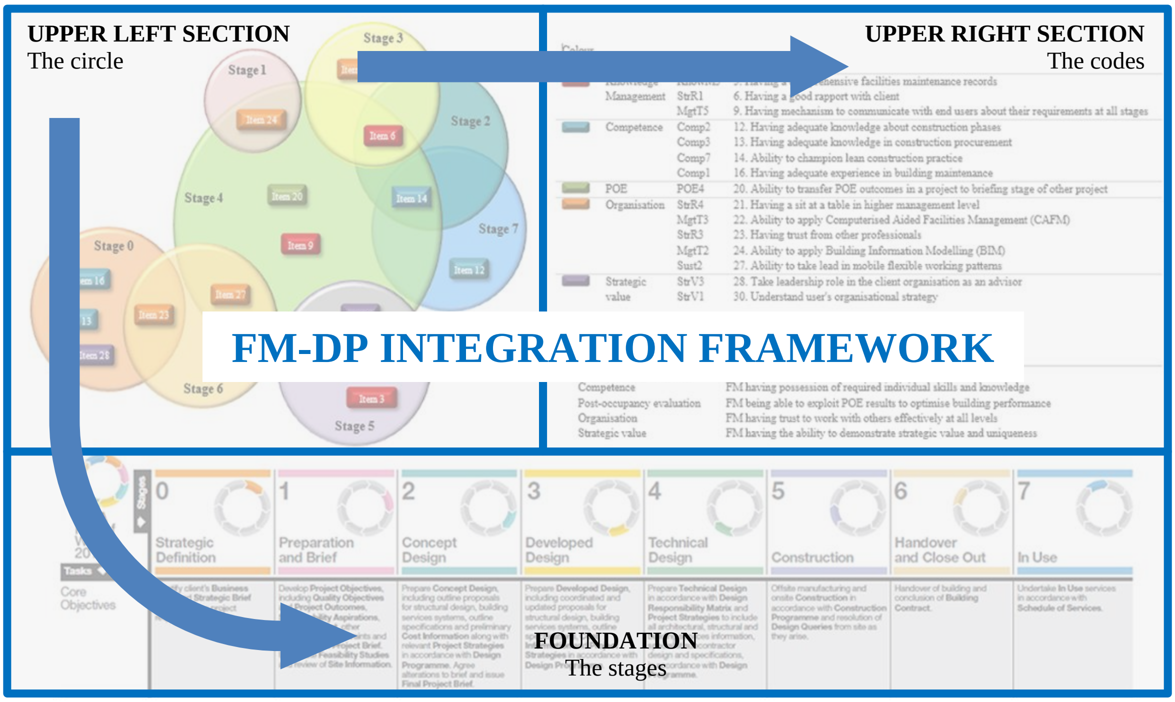


Figure 6.10 The structure of the FM-DP integration framework. Source: Inspired by Damgaard and Erichsen (2009) and the RIBA Plan of Work 2013

6.5 The development of the FM-DP integration framework

The findings from statistical analysis carried out in Section 6.2.3 and Section 6.2.4 have identified the best practice in optimising the role of FM in various stages of the development process. Therefore, the study has achieved research Objective (iii) and Objective (iv). In addition, this chapter has answered research question (iii) as posted in Section 1.3.

To satisfy Objective (iv) of the research, the proposed FM-DP integration framework is as shown in Table 6.41. The table is divided into six (6) columns containing Development Stages, Constructs, Codes, Items (best practices needed to optimise the role of FM in each stage of the development process), Statistical significance and Response.

Overall, 15 out of 30 items showed the differences between the level of involvement in the development stages in terms of perceived importance (PI) and perceived level of integration (PLOI).

Table 6.41 indicates that three (3) items are shared by several development stages with different statistical significance performance. Firstly, Item 14 (Comp7) is shared between Stage 2, Stage 4 and Stage 7. A 'no[18]' group at Stage 4 has better mean value and the PLOI has reached the statistical significance (*p*-value less than 0.025) whereas neither PI nor PLOI has reached the statistical significance at Stage 2 and Stage 7 ('both[19]' groups provide consistent mean value). Secondly, item 24 (MgtT2) demonstrated that PI and PLOI have reached the statistical significance at Stage 1 and Stage 4 respectively; nevertheless, a 'no' group has provided a higher mean value at both stages. Thirdly, Item 27 (Sust2) is shared between Stage 4 and Stage 6; however, both PI & PLOI have reached the statistical significance at Stage 4 while neither have done so at Stage 6. The 'both' groups at Stage 4 and Stage 6 have provided a higher mean value. Also, Table 6.41 provides the information that the only 'yes[20]' group at Stage 0 has provided a higher mean value in which PI reaches the statistical significance.

Figure 6.11 shows that seven (7) items were shared by the different development stages, in which two (2) of them were shared between three (3) different stages. Item 6 (StrR1) is shared between Stage 2, Stage 3 and Stage 4, whereas item 14 (Comp7) is shared between Stage 2, Stage 4 and Stage 7. The remaining five (5) items were shared between two (2) different stages. Item 22 (MgtT3) and Item 30 (StrV1) are shared between Stage 4 and Stage 5; Item 27 (Sust2) is shared between Stage 4 and Stage 6; Item 23 (StrR3) is shared between Stage 0 and Stage 6; and Item 24 (MgtT2) is shared between Stage 1 and Stage 4. It indicates that, by leveraging a certain practice, FM professionals could integrate more effectively into various stages simultaneously.

Eight (8) items are individually owned by the development stages (refer to Figure 6.11), in which Stage 0 contained three (3) items: Item 13 (Comp3), Item 16 (Comp1) and Item 28 (StrV3); Stage 4 possessed two (2) items: Item 9 (MgtT5) and Item 20 (POE4); while Stage 3, Stage 5 and Stage 7 consisted of Item 21 (StrR4), Item 3 (KnowM5) and Item 12 (Comp2) respectively.

[18] A group of professionals who have no experience at certain development stages
[19] A group of professionals who have and do not have experience at certain development stages
[20] A group of professionals who have experience at certain development stages

6.6 Chapter summary

Chapter Six provides the most important findings of this research. This chapter has established the initial draft of FM-DP integration framework, which shows the progress of this study to fulfil the research aim. The achievement of quantitative analysis can be summarised as follows:

- The correlation analysis shows that there was positive relationship between perceived importance and perceived level of integration, which indicates that the presence of FM in the development process can have a positive impact on the property development industry in the UK.

- As has been highlighted in the literature review and the findings of qualitative analysis in Chapter Five, there is consistency in the benefits of having FM in the early stage of the development process as well as its contribution at the strategic level. The quantitative analysis in Chapter Six has confirmed that FM need to be integrated as early as Stage 0 (Strategic Definition). Stage 0 contained three (3) sole items of which Item 28 stressed on the quality of leadership of the Facilities Managers, ability to exploit the knowledge of post-occupancy evaluation (POE) (Item 20) and leveraging experience in building maintenance at higher management level in the organisation (Item 16). Meanwhile, Item 23 that is shared with Stage 6: Handover and Close Out, emphasised on the importance of Facilities Managers to gain trust from other professional colleagues through extensive involvement in the various activities of the development process. It is proven that FM need to be integrate at Stage 0.

- There are six (6) items in Stage 1 (Preparation and Brief), Stage 2 (Concept Design), Stage 3 (Developed Design), Stage 5 (Construction), Stage 6 (Handover and Close Out) and Stage 7 (In Use) shared with Stage 4 (Technical Design), which indicates a significant impact of Stage 4 in the development process. In other words, Stage 4 is critical considering its role to interpret the input of previous stages yet influences the product of the following stages. The shared items cover all of the construct groups namely (i) Knowledge Management: having willingness to learn, share and transfer knowledge, (ii) Competence: having possession of required individual skills and knowledge, (iii) Post-Occupancy Evaluation: able to exploit POE results to optimise building performance, (iv) Organisation: having trust to work with others effectively at all levels, and (v) Strategic Value: having the ability to demonstrate strategic value and uniqueness.

- The remaining five (5) items are solely fit in Stage 3 (Item 21), Stage 5 (Item 3), Stage 7 (Item 12) and Stage 4 (Item 9 and Item 20) to complete all of the 15 items required to optimise the role of FM in the development process.

- A rigorous statistical analysis in Chapter Six has successfully transformed the descriptive data in Chapter Five into a prescriptive medium; a guideline of how FM should be integrated into the development process. It demonstrates that Objective (iv) of the research is achieved.

The following chapter discusses the process of the validation of the FM-DP integration framework which further improved the appearance and the content of the framework.

Table 6.41 Summary of statistical analysis findings to fulfil Objective (iii) of the research

Development stages	Constructs	Codes	Items	Statistical significance[a]	Response[b]
Stage 0: Strategic Definition	Competence	Comp2	13. Having adequate knowledge in construction procurement	PI	Yes
	Competence	Comp1	16. Having adequate experience in building maintenance	None	Both
	Strategic Value	StrR3	23. Having trust from other professionals	None	Both
	Organisation	StrV3	28. Take leadership role in the client organisation as an advisor	None	Both
Stage 1: Preparation and Brief	Organisation	MgtT2	24. Ability to apply Building Information Modelling (BIM)	PI	No
Stage 2: Concept Design	Knowledge Management	StrR1	6. Having a good rapport with client	PLOI	No
	Competence	Comp7	14. Ability to champion lean construction practice	None	Both
Stage 3: Develop design	Knowledge Management	StrR1	6. Having a good rapport with client	PLOI	No
	Organisation	StrR4	21. Having a seat at a table in higher management level	PLOI	No
Stage 4: Technical Design	Knowledge Management	StrR1	6. Having a good rapport with client	PLOI	No
	Knowledge Management	MgtT5	9. Having mechanism to communicate with end users about their requirements at all stages	PLOI	No
	Competence	Comp7	14. Ability to champion lean construction practice	PLOI	No
	POE	POE4	20. Ability to transfer POE outcomes in a project to briefing stage of other project	None	Both
	Organisation	MgtT3	22. Ability to apply Computerised Aided Facilities Management (CAFM)	PLOI	No
	Organisation	MgtT2	24. Ability to apply Building Information Modelling (BIM)	PLOI	No
	Organisation	Sust2	27. Ability to take lead in mobile flexible working patterns	PI & PLOI	Both
	Strategic Value	StrV1	30. Understand user's organisational strategy	PLOI	No
Stage 5: Construction	Knowledge Management	KnowM5	3. Having comprehensive facilities maintenance records	None	Both
	Organisation	MgtT3	22. Ability to apply Computerised Aided Facilities Management (CAFM)	PLOI	No
	Strategic Value	StrV1	30. Understand user's organisational strategy	PLOI	No
Stage 6: Handover and Close Out	Organisation	StrR3	23. Having trust from other professionals	None	Both
	Organisation	Sust2	27. Ability to take lead in mobile flexible working patterns	None	Both
Stage 7: In Use	Competence	Comp2	12. Having adequate knowledge about construction phases	PI	No
	Competence	Comp7	14. Ability to champion lean construction practice	None	Both

Note:

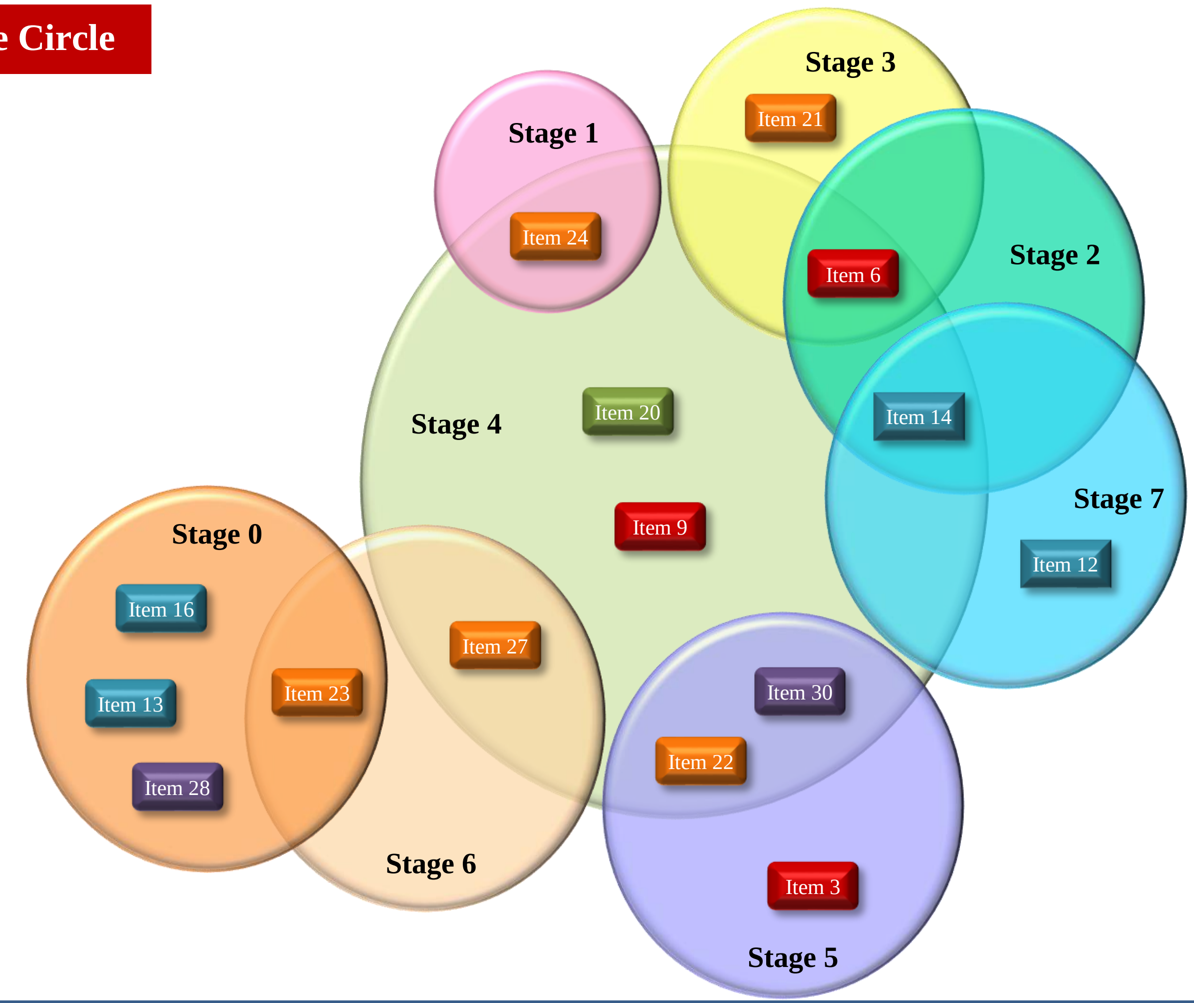
PI - Perceived importance, PLOI - Perceived level of integration

a. Statistical significance denotes dependent variable(s) (DV) with *p*-value less than 0.025 obtained from Tests of Between-Subjects Effects. This study involves two (2) DVs that produce four (4) possible results: either PI or PLOI, both (PI & PLOI) and none (neither PI nor PLOI) can reach statistical significance

b. Response indicates a group of participants that provide higher mean value. This study involves two (2) groups that produce three (3) possible results: Yes – Group of professionals who have experience in a certain stage provide higher response, No – Group of professionals who have no experience in a certain stage provide higher response and Both – There is consistency of feedback from the two (2) groups

Source: Self-study

The Circle



The Codes

Colour code	Constructs[a]	Code	Items
	Knowledge Management	KnowM5	3. Having comprehensive facilities maintenance records
		StrR1	6. Having a good rapport with client
		MgtT5	9. Having mechanism to communicate with end users about their requirements at all stages
	Competence	Comp2	12. Having adequate knowledge about construction phases
		Comp3	13. Having adequate knowledge in construction procurement
		Comp7	14. Ability to champion lean construction practice
		Comp1	16. Having adequate experience in building maintenance
	POE	POE4	20. Ability to transfer POE outcomes in a project to briefing stage of other project
	Organisation	StrR4	21. Having a seat at a table in higher management level
		MgtT3	22. Ability to apply Computerised Aided Facilities Management (CAFM)
		StrR3	23. Having trust from other professionals
		MgtT2	24. Ability to apply Building Information Modelling (BIM)
		Sust2	27. Ability to take lead in mobile flexible working patterns
	Strategic value	StrV3	28. Take leadership role in the client organisation as an advisor
		StrV1	30. Understand user's organisational strategy

Note:
a. For ease of reference, the definition of constructs is shown below:

Constructs	Definition
Knowledge Management	FM having willingness to learn, share and transfer knowledge
Competence	FM having possession of required individual skills and knowledge
Post-occupancy evaluation	FM being able to exploit POE results to optimise building performance
Organisation	FM having trust to work with others effectively at all levels
Strategic value	FM having the ability to demonstrate strategic value and uniqueness

The Stages

Figure 6.11 Proposed FM-DP integration framework to meet Objective (iv) of the research. Source: Self study and adapted from the RIBA Plan of Work 2013. Permission to reproduce this form has been granted by the Royal Institute of British Architects (RIBA)

Chapter Seven

Framework Validation

7.1 Introduction

The purpose of this chapter is to explain the execution of the focus group interview in order to validate the developed FM-DP integration framework and to present the results obtained from the analysis. The development of the framework as shown in Figure 6.11 indicates that Objective (iv) of this research has been achieved. This chapter is divided into seven (7) sections, in which the introduction explains the outline of the chapter. Section 7.2 addresses how the focus group interview was executed in this research. The focus group interview was conducted as member-checking, and was attended by three (3) professionals who possess significant experience in FM and the property development industry in the UK. Section 7.3 focuses on the appreciation of the invention of the framework expressed by the participants of the focus group interview and the evidence on how the developed FM-DP framework is regarded as a complementary document to the RIBA Plan of Work 2013. In addition, it was essential to assess the practicality of the framework as well as to notify the property development professionals about the strategy to optimise the role of FM for better performance of the building. Section 7.4 shows evidence that inspired modification of the structure of the framework. Each validated item is discussed in Section 7.5, in which the relevant statements that support the best practices are presented. Section 7.6 explains the strengths and weaknesses of the framework; this is followed by the summary of the chapter in Section 7.7.

7.2 The execution of focus group interview

Taking the example of the work carried out by Stewart *et al.* (2008) and advice from Creswell (2013), focus group is regarded as an appropriate method to validate the findings obtained from the previous phase of the research. Hence, focus group using a member-checking approach was implemented in fulfilling Objective (v) of this study: to validate the concept of the FM-DP integration framework. The focus group was held on 26th August 2014; three (3) participants with broad experience in FM and the property development industry were present. The focus group session took two (2) hours, including an approximately thirty-minute presentation on introduction, background and process followed by a 90 minute discussion on the topic. As illustrated in Figure 4.15, focus groups begin with planning, which is related to defining the magnitude of the focus group followed by the selection of the participants. However, the most important step prior to moderating a focus group session is to ensure the attendance of the participants. For this, notices of invitation containing details of the meeting were presented to the identified participants as soon as the consent of all participants had been obtained. The summary of the meeting details is demonstrated in Figure 7.1.

MEETING AGENDA

I would like to confirm that the focus group session will be conducted as follows:

Date: 26th August 2014 (Tuesday)
Time: 2.00 pm to 4.00 pm
Venue: Meeting Room, Built Environment and Sustainability Technology (BEST) Institute, Henry Cotton Building, Liverpool John Moores University, 15-21 Webster Street, L3 2ET Liverpool

Meeting tentative:
1.45 pm – 2.00 pm: Arrival of the participants
2.00 pm – 2.15 pm: Presentation
2.15 pm – 4.00 pm: Discussion
4.00 pm: Refreshment and dismiss

Regards,
Rayme Anang

Figure 7.1 The summary of meeting details. Source: Self study

7.2.1 Selection of the participants

This section focuses on the selection of the participants of this research. Purposive sampling is an appropriate method to recruit the participants as it encourage deeper data mining about the topic (Creswell and Clark, 2011). Thus, it is very useful to select the participants from among professionals who have profound experience and knowledge of FM and the property development industry in the UK. For this, the researcher outlined the eligibility criteria for the focus group participants, as listed in Table 7.1.

Table 7.1 Focus group participants' eligibility criteria

Eligibility criteria	Justification
Positioned in the management level in the organisation	This criterion is concerned with having experience in influencing strategic decision making at management level. An individual positioned in the management level (project manager/coordinator or senior managerial position) in organisation or property development project was required.
Combination of experience in FM and the property development industry	Professionals who possess both experience in FM and the property development industry provide different views from wide-ranging disciplines. This would cover planning, technical aspects, contract administration and procurement. An individual with extensive experience of more than 15 years in each field was preferred.
Knowledgeable about the development process	This aspect ensures that the participants are able to appreciate the theory of the development process and share the practical experience that they have gone through.

Source: Self-study

Combining a convenient list (Morgan *et al.*, 1998) and social media network (LinkedIn) helps the researcher to get an adequate candidate. To minimise the no-show rate, the researcher takes precautions by taking into consideration the cost, travelling period (Morse, 2003) and distance to travel that would probably burden the participants. In terms of time and distance, the researcher argued that priority should be given to participants from around the North West, so that the travelling period and the distance to the meeting location in the Henry Cotton Building, Liverpool John Moores University would be reasonable. In ensuring the researcher is able to assemble the right participants, it is essential to design a sampling procedure that satisfies the purposive sampling strategy, as failure to recruit the right participants would deviate the whole strategy to convenience sampling (Teddlie and Yu, 2007).

The purposive sampling strategy of this research is illustrated in Figure 7.2.

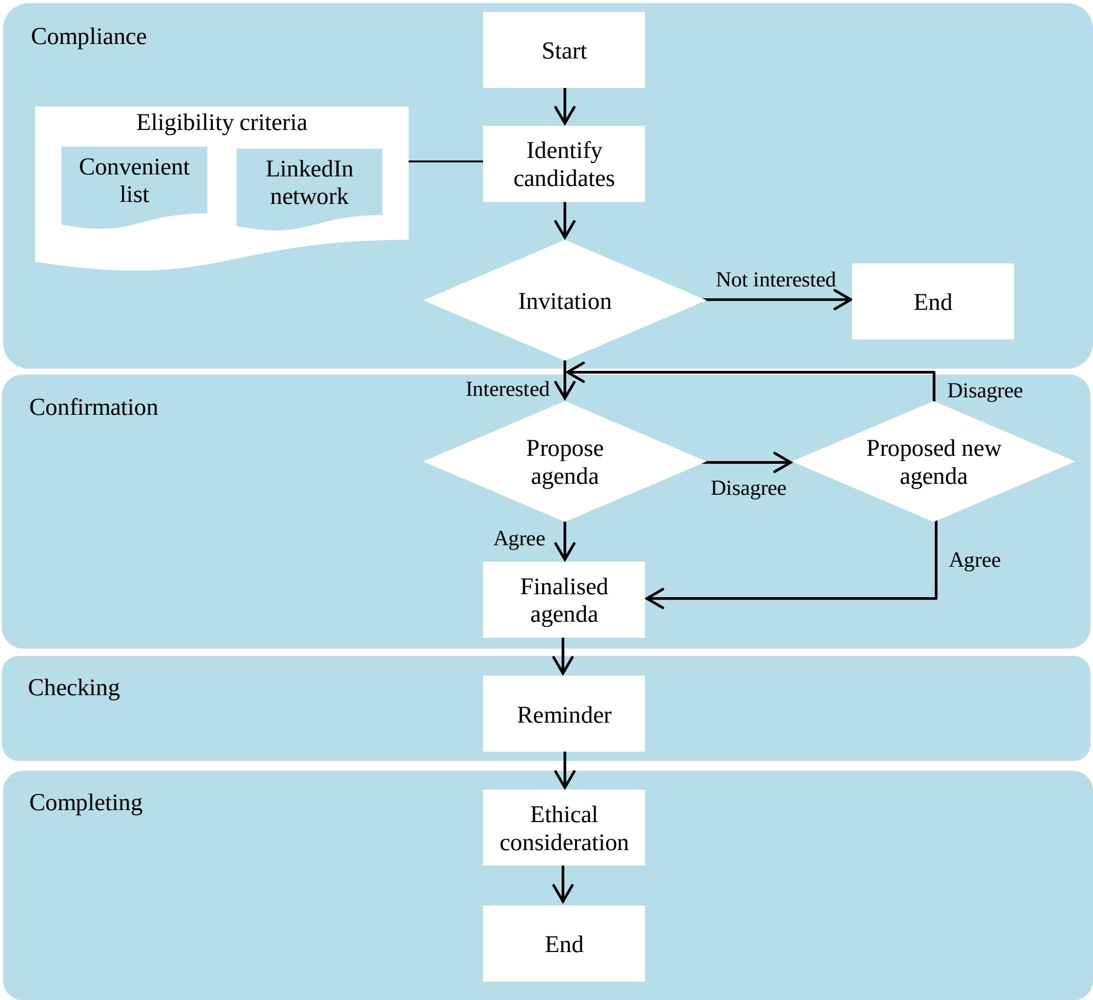


Figure 7.2 Purposive sampling strategy. Source: Self-study

The 'compliance' is concerned with the relevance of the participants to the research questions (Bryman, 2012, p. 418) and its capability to contribute to framework validation. Apart from fulfilling the secondary factors such as cost, time and distance, the participants must meet the criteria set as in Table 7.1. Teddlie and Yu (2007) advocate that objective(s) of the research and the findings obtained should dominate the sampling strategy. For that, Objective (v) of this research and findings obtained from previous stages were utilised in choosing the participants. The 'confirmation' is to warrant the practicality and the efficiency of the focus group session. The meeting agenda containing details such as time, location and points of discussion was prepared as a platform to obtain consensus from each participant. The 'checking' kept the participants alert about the meeting; emails were sent one (1) week and one (1) day before the meeting. In the morning of the meeting day, a phone call followed by text message was sent to remind the participants and to check their whereabouts. To 'complete' the sampling strategy, Teddlie and Yu (2007) note that the ethical requirements should be considered. Before the focus group session started, the participants were asked to sign a consent form, which includes the understanding of the potential benefits and risks, the assurance of confidentiality and the right to withdraw from the study at any time (p. 97).

Three (3) participants showed interest in participating in the focus group – evidence for this is provided in Appendix Q. Table 7.2 provides the career background and current responsibility of each participant, who were coded as FGP#1, FGP#2 and FGP#3. This provides an impression of the extensiveness and the value of the collected data in the focus group interview.

Table 7.2 The profile of focus group interview participants

	Participants' codes		
	FGP#1	**FGP#2**	**FGP#3**
Office based	Liverpool	Liverpool	Manchester
Experience in FM	15 years	15 years	20 years
Total experience	30 years in built environment	30 years in built environment	24 years in built environment
Career background and current responsibility	Having formal education in electrical engineering. He has been involved in construction for various trades including architectural, structural, mechanical and electrical engineering. As a Facilities Manager, his role is to ensure the smoothness of the operation of the organisation in a 100-year-old building. The facilities provided should be operated at a high level and satisfy the regulations as well as standards set by various safety and international sports authorities. In addition, he has to carry out procurement process and administer contracts.	Having formal education in quantity surveyor. He has been involved in various types of procurement contract such as PFI and conventional for new construction, refurbishment and maintenance work. As a Senior QS consultant, he was responsible for procurement of various trades including civil works, structure, building services and architectural. He has experience in preparing project brief and life cycle costing report to the client.	Having experience in oil and gas industry for eight (8) years at operational level. He started FM career mainly involved in knowledge FM. Currently holds a position as Deputy Director of Special Purpose Vehicle (SPV) for a public PFI project. He was interested in the integration of FM in the property development process and concerned about the role of FM to enhance the buildability and operability of the buildings. He has comprehensive involvement in the development process from feasibility study right through to handing-over of the project.
Involvement in previous data collection	Stage 1: Individual interview	None	Stage 2: Survey questionnaire

Note: FGP represents focus group participant

Source: Self-study

7.2.2 Moderating and debriefing

Prior to moderating a focus group, several issues need to be considered. For instance, the seating plan of the focus group is essential in order to minimise the complexity when moderating the session, to enhance the quality of the collected data to be easy to transcribe and analyse (Smithson, 2008). To ensure the focus group is well recorded, two (2) high-quality voice recorders were used while a video camera was placed at the other side of the meeting table to record physical actions of the participants (refer to Figure 7.3).

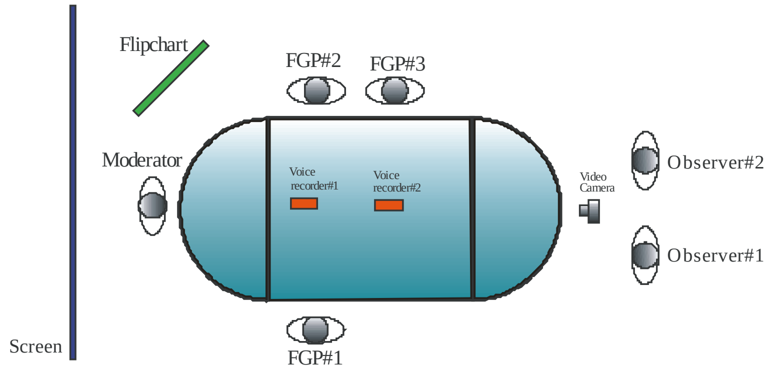


Figure 7.3 Focus group seating and equipment plan. Source: Self study

In addition, two (2) observers were employed whose main task was to note verbal and non-verbal communication. At the beginning of the session, the participants were reminded about the ethical aspects with a list of 'dos and don'ts' (Smithson, 2008, p. 360) including explanation of the role of the moderator, asking the participants to respect each other, assurance of confidentiality, and a request to speak clearly and to clarify what is happening in the process of the research. At the end of the session, the debriefing was performed between the moderator and the observers. Several comments were gathered from the observers in terms of the satisfactory overall performance of the participants and the moderator, punctuality (the ability to complete the session timely) and the richness of the collected data. This builds confidence in the data analysis to produce high-quality results (Krueger, 1993).

7.2.3 Transcribing analysis

The audio record of the focus group interview was sent to a professional transcriber to get it transcribed verbatim. Word count analysis discovered that the total number of words generated in the focus group interview was 15,306 words, of which 13,266 (87.0 per cent) came from the participants, whereas 2,040 (13.0 per cent) were produced by the moderator. A comparison of word intensity between moderator and the participants is shown in Figure 7.4. A sample of the transcription can be found in Appendix S.

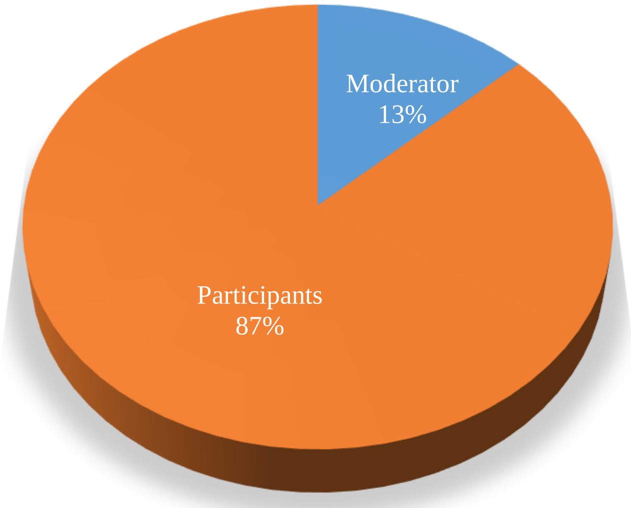


Figure 7.4 Focus group word count analysis. Source: Self-study

7.3 The appreciation

At the beginning of the focus group interview, the presentation took approximately 30 minutes to cover the structure of the framework and the process to build it (refer to Appendix R). The participants were provided with two (2) sheets of A3 documents: the draft of the FM-DP integration framework and RIBA Plan of Work 2013. During the presentation and throughout the focus group interview session, the researcher realised that the participants were trying to make a connection between the features available in the framework such as 'The Circle', 'The Code' and 'The Stages' with the RIBA Plan of Work 2013 in order to understand how the framework works. Upon completion of the presentation, the participants were asked about the practicality of the developed framework to be implemented in the industry. Basically, this aimed to look at the first impression of the professionals in FM and the property development industry towards the framework. Generally, the participants were impressed with the creation of the framework, with one of the participants expressing that the tendency to integrate FM elements into the development process has been undertaken in some organisations in the UK for a number of years. However, the practice for FM-DP integration was not recognised. Coupled with the absence of tangible medium to guide the integration effort, this research found there is an opportunity to contribute to close the gap. The creation of the framework has been able to translate the best practices of FM-DP integration in to a medium that is more organised and tangible. With the creation of this framework, best practices of FM-DP integration have been translated into a medium that is more tangible. However, their concern with the developed framework is whether the framework is fit for new-build schemes, refurbishment and maintenance works or procurement. To ensure the discussion was more focused, there was consensus that the framework is fit for new-build projects based on three (3) main reasons:

a. It is more beneficial to provide a separate framework for each development scheme that corresponds with the nature of the work.
b. It is easier to get multi-discipline involvement at the early stage of the development process, which leads to better FM-DP integration. The RIBA Plan of Work 2013 highlighted that the considerations for assembling the project team are to be carried out at Stage 0: Strategic Definition.
c. The developed framework was regarded as a counterpart to the RIBA Plan of Work 2013, which was designed to commence sequentially from Stage 0: Strategic Definition to Stage 7: In Use. The experience of the whole life of the facilities is crucial for knowledge continuity where it supports continuous improvement during building operation.

7.4 Validation of the framework structure

Throughout the focus group interview session, the participants were identified to indicate six (6) locations on the RIBA Plan of Work 2013 to support their explanation. FGP#1, for instance, was identified to refer to two (2) points particularly on the Core Objectives of Stage 1 (refer to Callout A of Figure 7.5) and Procurement of Stage 1 (refer to Callout B of Figure 7.5), whereas FGP#3 pointed out four (4) different places on the RIBA Plan of Work 2013, two (2) of which were Procurement and Suggested Key Support Tasks in the Tasks column (refer to Callout C and Callout D respectively of Figure 7.5). Another two (2) referred to Core Objectives of Stage 4 (refer to Callout E of Figure 7.5) and Suggested Key Support Tasks of Stage 3 (refer to Callout F of Figure 7.5). Although FGP#2 did not directly denote any location of the RIBA Plan of Work 2013, it does not mean that the structure of the developed framework was inadequate. It was identified that FGP#2 regularly examined the RIBA Plan of Work 2013 to verify the explanations of others. Figure 7.5 demonstrates six (6) locations that were indicated by the participants.

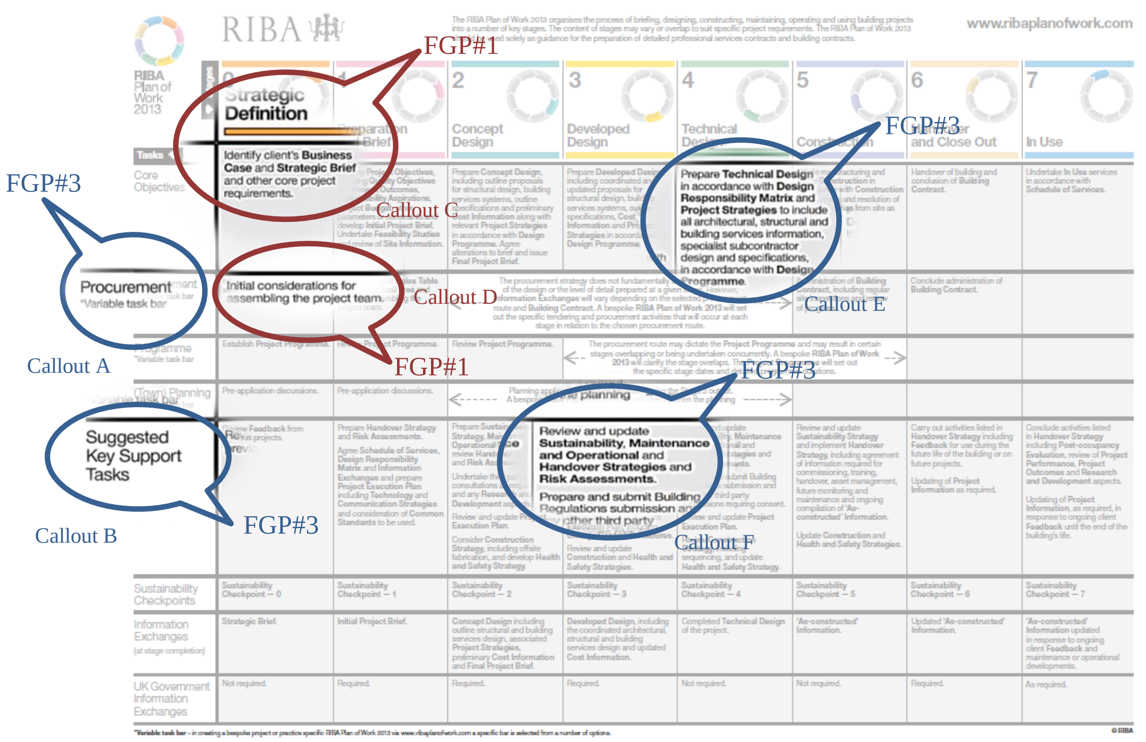


Figure 7.5 Locations denoted by the participants on the RIBA Plan of Work 2013. Source: Adapted from the RIBA Plan of Work 2013

To conclude, the Stages at the bottom of the framework were removed and the RIBA Plan of Work 2013 was regarded as a supplement to the framework. Figure 7.6 demonstrates the validated structure of the framework, which comprises The Circle and The Codes.

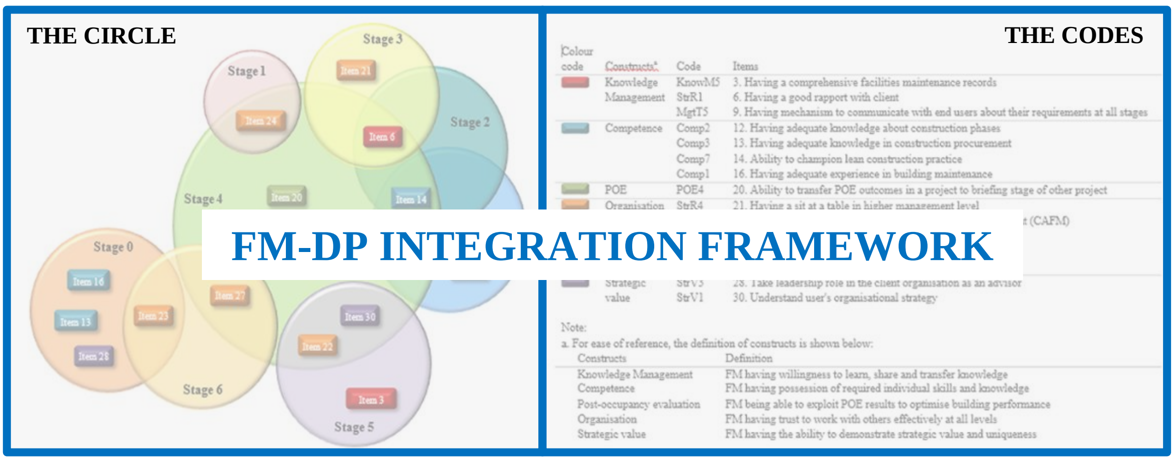


Figure 7.6 Validated structure of the FM-DP integration framework. Source: Self-study

7.5 Validation of the items and constructs

Analysis made using NVivo 10 software found that there are 52 relevant statements supporting 15 items in the FM-DP integration framework. Although the interview took only two (2) hours, the researcher discovered that there were situations where 'data saturation' had occurred in which the existing ideas were repeated frequently throughout the interview. Myers and Oetzel (2003) advise that such a situation indicates that the excitement in the discussion has dropped, whereas Morse (1995) urges the researcher to make a judgement on the adequacy of the collected data in such a situation. The breakdown of the relevant statements for each construct is shown in Figure 7.7.

Figure 7.7 The breakdown of relevant statements for each construct. Source: Self-study

7.5.1 Knowledge Management

Knowledge Management emphasises the possession of willingness to learn, share and transfer knowledge. Three (3) items in Knowledge Management generated 12 relevant statements; the breakdown of each item is shown in Figure 7.8.

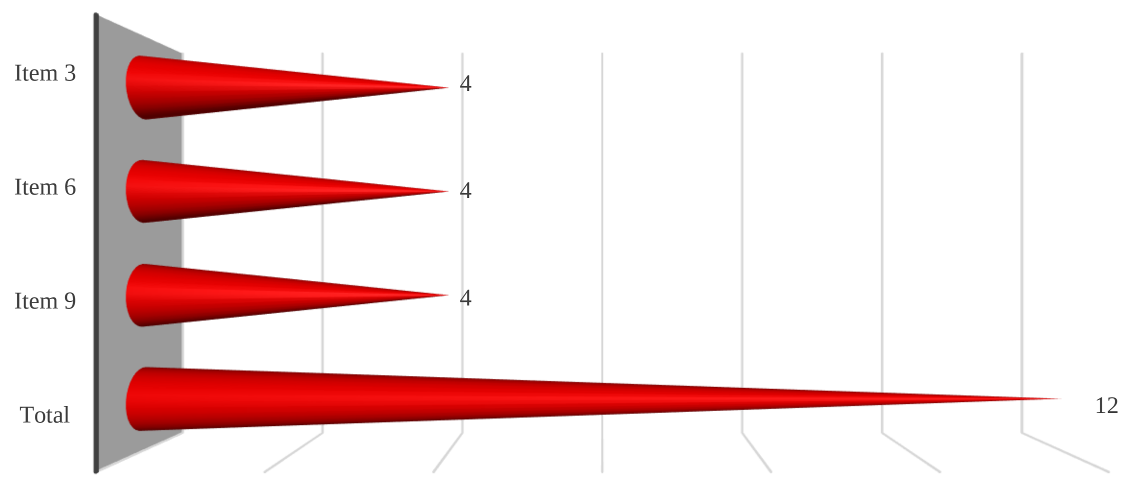


Figure 7.8 Number of relevant statements in Knowledge Management. Source: Self-study

7.5.1.1 Item 3: Having comprehensive facilities maintenance records

A common theme discussed in this topic is to encourage Facilities Managers to play a significant role in the construction stage and work hand-in-hand with the project initiator: *"The person driving that [project] is probably the corporate sales marketing team, but we have to work hand-in-hand with them. They come up with the concepts. We sit down and go through the concepts with them. Tell them what will work, what won't work and then as quickly as possible come to a conclusion, implement that on the construction side"*. There is also a general consensus to encourage Facilities Managers to be involved in the production of Operation and Maintenance (O&M) documents: *"If Facilities Manager [is] involved in the production of the O&Ms that really does help going forward"*. Stage 5 is the beginning of having a proper maintenance record, which comprises Operation and Maintenance (O&M) documents and as-constructed drawings (refer to Figure 7.9). As mentioned in Item 22 in Section 7.5.4.2, developing a maintenance system using CAFM in Stage 5 is a commendable initiative towards having comprehensive facilities maintenance records in the future. For refurbishment works, it is beneficial for Facilities Managers to look for the history of maintenance works and then to feed this into the CAFM system.

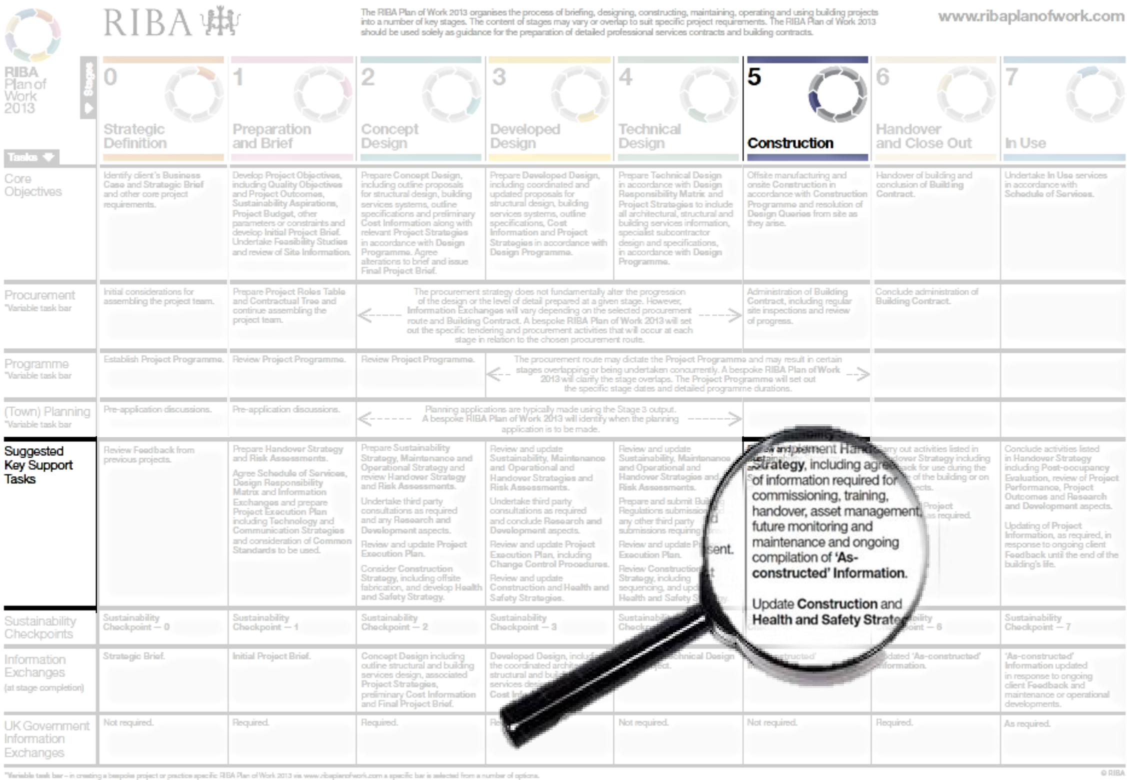


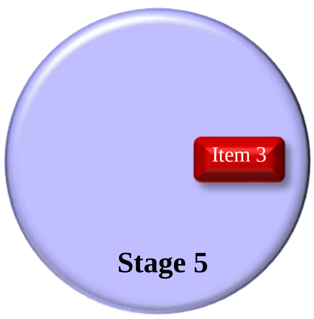
Figure 7.9 Production of O&M documents that comprise as-constructed drawings at Stage 5.

Source: Self-study

Four (4) relevant statements were captured that describe the best practices required in encouraging FM-DP integration, as tabulated in Table 7.3.

Table 7.3 Validated best practices of Item 3

Relevant statement
3a. Work closely with client
3b. Involved in production of O&M documents
3c. Apply CAFM to populate the validated data
3d. Gathering maintenance record and feed it in to existing CAFM system for refurbishment works



Source: Self-study

7.5.1.2 Item 6: Having a good rapport with client

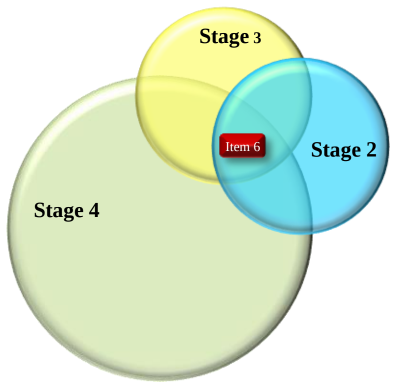
One of the motivations for FM-DP integration is having a good rapport with clients. The clients can come from internal and external organisations. However, Facilities Managers have to work with them in order to meet the organisation's objectives: *"I would assume the better the rapport you have with them, the more likely you'll have powers of influencing and persuading"*. Although it sounds discouraging, it has to be exploited for the purpose of advantage, as was expressed by one of the participants: *"Work together with builders and clients, it establishes a collaborative working environment, encourages people's input when appropriate to the best value and speeds up the process of approval as well"*. On top of that, one (1) participant claimed that FM is most likely not going to lead a project: *"To say that the Facilities Manager [will] lead the whole thing is highly unlikely to happen at the moment; normally they call a project manager"*. However, it does not mean that FM was ignored throughout the development process. This is where having a good relationship with the client is useful for the good of the project. One (1) participant suggested, *"It takes a good Project Manager to get that together and know when to bring the right people in or who's who"*. Therefore, an influential Facilities Manager would be able to advise the Project Managers to consider the elements of FM in the development process.

There was a suggestion to improve the wording of Item 6, with one of the participants suggesting that 'good professional relationship' is more appropriate than 'rapport'. Although there was a suggestion to use *"having a good understanding of client's objective"* or *"understanding of client's business strategies"*, it was found to be consistent with Item 30. Therefore, it was decided that Item 6 would be reworded to 'Having a good professional relationship with client'.

Four (4) relevant statements supported Item 6, which describes the best practices to be implemented in encouraging FM-DP integration (refer to Table 7.4).

Table 7.4 Validated best practices of Item 6

Relevant statement
6a. Work closely with the client (internal or external)
6b. Work with client to speed up the process (approval process, selection of materials etc.)
6c. Promote people's input when appropriate to the best value
6d. Advise Project Manager in terms of FM involvement



Source: Self-study

7.5.1.3 Item 9: Having the mechanism to communicate with end users about their requirements at all stages

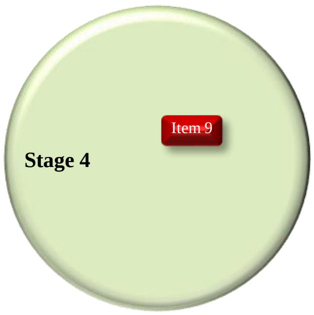
At the beginning of the discussion, there was an argument on the difference between users and client. One of the participants argued: *"users is slightly different to the client"*. Further discussion in Item 9 focused on the interest of the client. The concern is understandable as Stage 4 is an activity that involves various professionals producing a technical design in which client requirements could be overlooked. Furthermore, at the end of Stage 4 the design is going to be finalised, ready for planning application to authority and tender. One (1) participant highlighted their concern, saying: *"Tender stage [is] highly likely going to be at Stage 4. You've got a firm design and freeze design at Stage 4"*. Any changes after Stage 4 will increase project cost and additional time, which is unfavourable to most clients: *"What happen is once a design [has been] agreed, when changes come from designer to Mr Client, why tell me at this stage? It's a bit too late for me now. It's going to cost me more.* The same participant further justified: *"It's nothing wrong to tweak around with engineering design but when you've got changes, the cost's not going down"*. Although the designers are allowed to develop their technical designs independently, it would be advantageous to determine the level of degree of autonomy so that the clients have minimum control over the interest of the requirements. Apart from that, the RIBA Plan of Work 2013 suggested that responding to Design Queries would be an appropriate communication mechanism to explain about clients' requirement fulfilment.

As the discussion was focused on the interests of the client, it was decided to reword Item 9 to 'Having a mechanism to communicate with clients about their requirements at all stages'.

Within Item 9, four (4) statements were captured explaining the best practices needed during Technical Design for better FM-DP integration (see Table 7.5).

Table 7.5 Validated best practices of Item 9

Relevant statement
9a. Determine the level of degree of design autonomy
9b. Respond to Design Queries
9c. Collaboration with building users and client
9d. Focus on the client's requirements



Source: Self-study

7.5.2 Competence

Competence emphasises the possession of individual skills and knowledge. Four (4) items in Competence generated 11 relevant statements for which the breakdown of each item is shown in Figure 7.10.

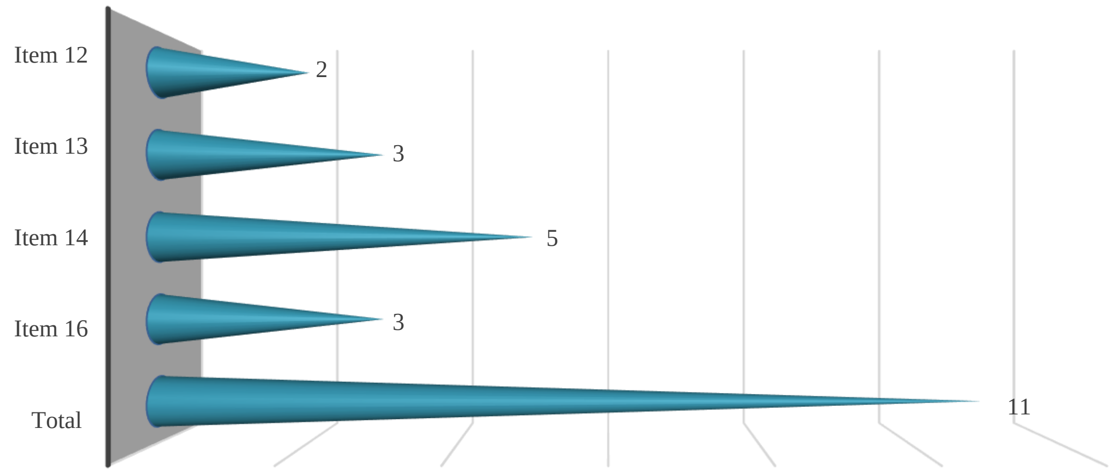


Figure 7.10 Number of relevant statements in Competence. Source: Self-study

7.5.2.1 Item 12: Having adequate knowledge about construction phases

At the beginning of the discussion, one of the participants felt sceptical about how FM could manipulate Item 12 to contribute in Stage 7: *"I disagree [that] to know how the building was built is really beneficial in Stage 7"*.

Further discussions, however, discovered that Facilities Managers who have knowledge about construction phases will play an important role in Stage 7. One of the participants highlighted the benefit of having knowledge about construction phases: *"It would be an advantage for FM to know this knowledge [construction phases]. By understanding how the building was constructed, you have more knowledge on how to maintain and operate it afterwards"*. Another participant further explained that, *"It's really beneficial to know how it was built cos you are the one who is going to maintain the building"*. Therefore, it is important for Facilities Managers to study the history of the building so that *"they get the sense of ownership"*. The same participant clarified that *"They owned the building, they love the building, they've seen it grow up, they've nurtured it, they've had that input and then right the way through and then they start maintaining it and developing it and growing it and helping the building to become alive"*.

Interestingly, at the end of the discussion, there was general agreement that having adequate knowledge about the construction phases is crucial: *"I think we all agree with that"*.

There are two (2) statements that support Item 12, which describes the best practices to be implemented in encouraging FM-DP integration (refer Table 7.6).

Relevant statement
12a. Understand how the building was constructed
12b. Have a sense of ownership

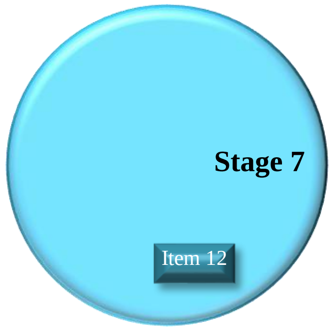


Table 7.6 Validated best practices of Item 12.

7.5.2.2 Item 13: Having adequate knowledge in construction procurement

There was general agreement amongst the participants on the importance of Facilities Managers having adequate knowledge in construction procurement at Stage 0: *"I think just as a general point, FM should know the procurement process.* This was supported by another participant, who suggested that Item 13 would be advantageous at Stage 1: *"You really need Item 13 at stage one, so, client got clear brief what they are going to do [at the] next stage and they know the strategy"*. Based on the RIBA Plan of Work 2013, it is understood that FM would offer a meaningful contribution when preparing the Initial Project Brief, which contains the budget. Based on this comment, it is essential to position Item 13 at Stage 1 (refer to magnifier A of Figure 7.11). In addition, the procurement activities during Stage 3, Stage 4 and Stage 5 will depend on the procurement route determined during Stage 1. The RIBA Plan of Work 2013 reminds us that improper procurement planning from the beginning of the development process may result in distraction of work programme (refer to magnifier B of Figure 7.11). One of the participants reiterated the issue, saying: *"If you pick the wrong one [procurement route] the risk becomes higher and higher"*. One (1) participant interestingly interpreted construction procurement from a different perspective: *"For me, an understanding of the construction procurement is understanding the cost of change at any point along the development process. It's about the process of change rather than what the change actually is"*. Therefore, it is advantageous for Facilities Managers to understand the impact of changes during the development process. In general, *"Having knowledge of construction procurement would be of great benefit to any FMs"*, said one of the participants.

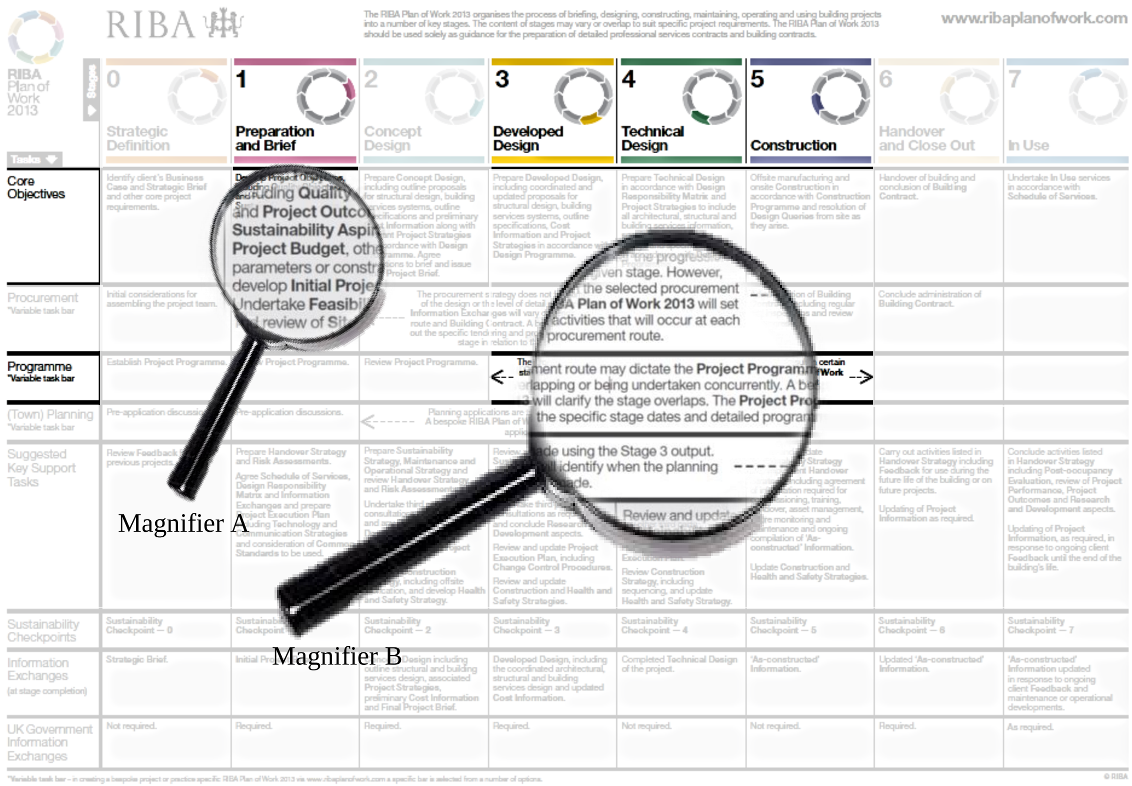
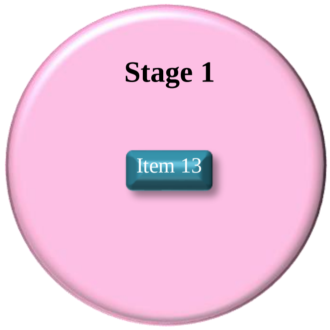


Figure 7.11 Improper procurement planning may result in distraction of work programme. Source: Self-study

Three (3) relevant statements were captured which describe the best practices required in encouraging FM-DP integration, as tabulated in Table 7.7.

Table 7.7 Validated best practices of Item 13

Relevant statement
13a. Understand the process of different procurement route e.g. PFI, Design & Build, conventional contract, etc.
13b. Assessment of risk of different procurement strategies
13c. Understand the process of change during the development process



Source: Self-study

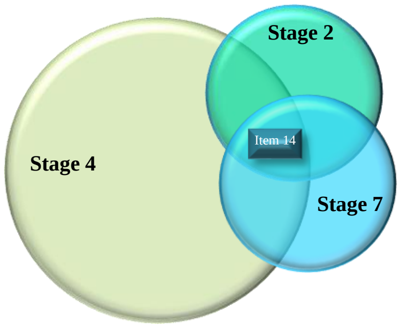
7.5.2.3 Item 14: Ability to champion lean construction practice

At the beginning of discussion of Item 14, the participants had a conversation on the concept of lean construction. The conversation revealed that the participants have good general knowledge about lean construction practice, in which the growth of understanding of lean construction in the United States of America is compared with the United Kingdom. They also agreed that the concept of lean construction came from the manufacturing industry, where it is related to proper *"coordination, cutting down on waiting time and wasted resources"*. The participants expressed their concern that failure to employ a concept of lean construction at Stage 4 would have an effect on the building operation. They insisted that a soft service supply chain relies heavily on proper technical design to ensure the *"cleaning and heating got to operate"* efficiently during occupancy. On top of that, the participants expressed their concern with failure to optimise empty space, which is detrimental to the productivity of the organisation, should the concept of lean construction be neglected at Stage 4. In simple terms, they comprehend that the lean construction practice *"cut[s] out the fat"*. Within the idea of this research, one of the participants stated that lean construction is *"highly likely with integration between professionals… about partnering, it is about working together as a team"*. For this, the FM *"got to have very good data and also got to have very good communications between all the various trades and contractors on a specific site [project] to work successfully".*

There was a suggestion to rephrase Item 14 and replace the word 'champion' with 'knowledge'. Therefore, Item 14 was reworded to 'having adequate knowledge in lean construction'.

Five (5) relevant statements were captured which describe the best practices required in encouraging FM-DP integration (refer to Table 7.8).

Table 7.8 Validated best practices of Item 14

Relevant statement	
14a. Effective communication line with various stakeholders	
14b. Emphasise on occupant's comfort, i.e. cleaning, heating and ventilation system	
14c. Work coordination	
14d. Understand lean construction as it would benefit in decision making on technical as well as financial issues	
14e. Leveraging the data and feedback into the development process	

Source: Self-study

7.5.2.4 Item 16: Having adequate experience in building maintenance

At the beginning of the discussion, one of the participants was sceptical about having FM with broad experience in building maintenance at Stage 0. However, it was argued that having *"knowledge and experience of building maintenance is to influence a decision made at that point [Stage 0]*". Another participant stated that *"I do agree that item number 16 is very good to be applied at stage zero; however, it depends on the scale and value of the works"*. By utilising Item 16 at Stage 0, FM would be able to play its role to assist the client in making decisions in terms of costs, type of building or project and technology used: *"It's more likely informed decision"*. The decision was made to keep Item 16 at Stage 0 despite there being a suggestion to apply Item 16 at all stages. Referring to the RIBA Plan of Work 2013, this is where the importance of building maintenance experience gathered in Feedback of Stage 6 and Stage 7 brought to Feedback of Stage 0 of a new or similar project (refer to Figure 7.12) can be seen.

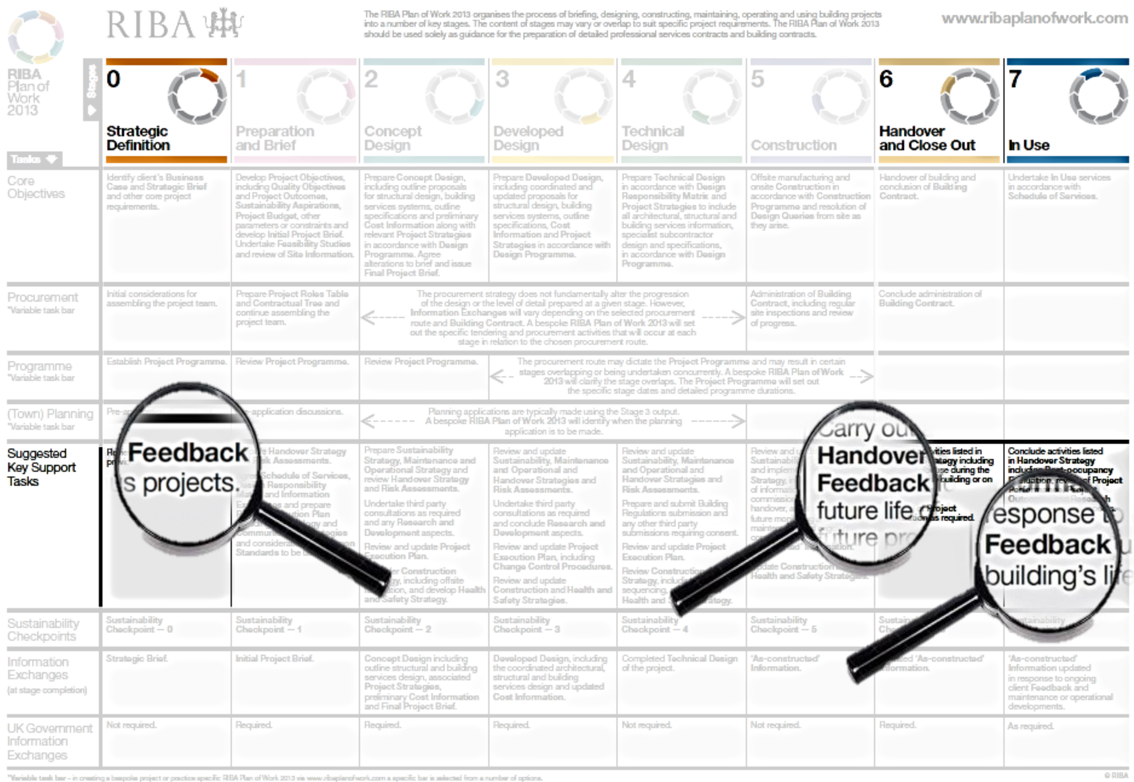
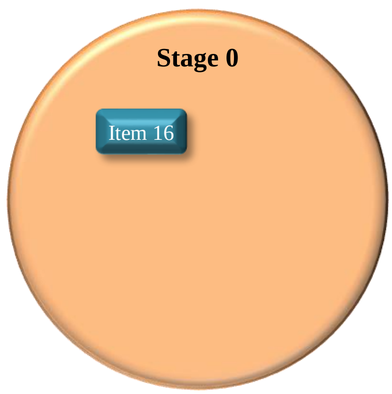


Figure 7.12 Feedback of Stage 6 and Stage 7 brought to Feedback of Stage 0 of new or similar type of projects. Source: Self-study

In general, participants realised that Item 16 is one of the options for FM to be integrated into Stage 0. Four (4) relevant statements were captured which describe the best practices required in encouraging FM-DP integration (refer to Table 7.9).

Table 7.9 Validated best practices of Item 16

Relevant statement
16a. Leveraging experience and knowledge of building maintenance at Stage 0
16b. Record maintenance experience in Stage 6 and Stage 7
16c. Informed decision - A decision by the client about the development process in terms of costs, type of building/project and technology used



Source: Self-study

7.5.3 Post-Occupancy Evaluation (POE)

Post-Occupancy Evaluation (POE) emphasises being able to exploit POE results to optimise building performance. One (1) item in POE generated two (2) relevant statements for which the breakdown of each item is shown in Figure 7.13.

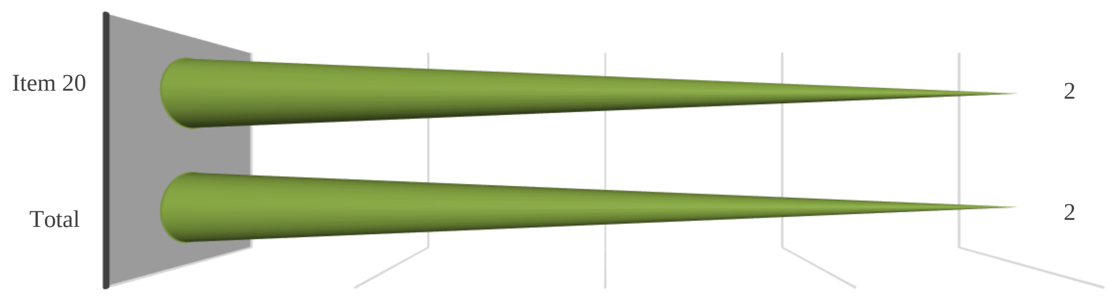


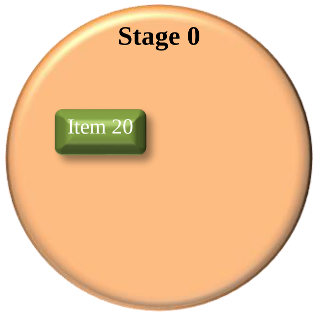
Figure 7.13 Number of relevant statements in POE. Source: Self-study

7.5.3.1 Item 20: Ability to transfer POE outcomes in a project to briefing stage of other project

The participants observed that the POE exercise would be useful for occupied buildings, in which the performance of the buildings and the satisfaction of the users are assessed at Stage 7. There is also a view that utilising the POE report in Stage 4 is too late, with one of the participants suggesting that Item 20 is to be placed at Stage 0: *"Item 20 at Stage 4: it's too late because POE outcomes is something that they learn from the similar project. So, they can bring this POE knowledge to other projects at Stage 0"*. Apart from as an assessment exercise, the POE report is also beneficial for defect management and building performance monitoring. It would be useful to improve the design of the building: *"We can monitor how your building is performing and then enhance the post-occupancy evaluation, and we can feed that back to you to improve your product going forward"*.

Two (2) relevant statements were captured which describe the best practices required in encouraging FM-DP integration (refer to Table 7.10).

Table 7.10 Validated best practices of Item 20

Relevant statement	
20a. Emphasise the management and monitoring of building defects that enhance POE output	
20b. Use of POE to improve the service and the building performance	

Source: Self-study

7.5.4 Organisation

Organisation emphasises having trust to work with others effectively at all levels. Five (5) items in Organisation generated eighteen (18) relevant statements; the breakdown of each item is shown in Figure 7.14.

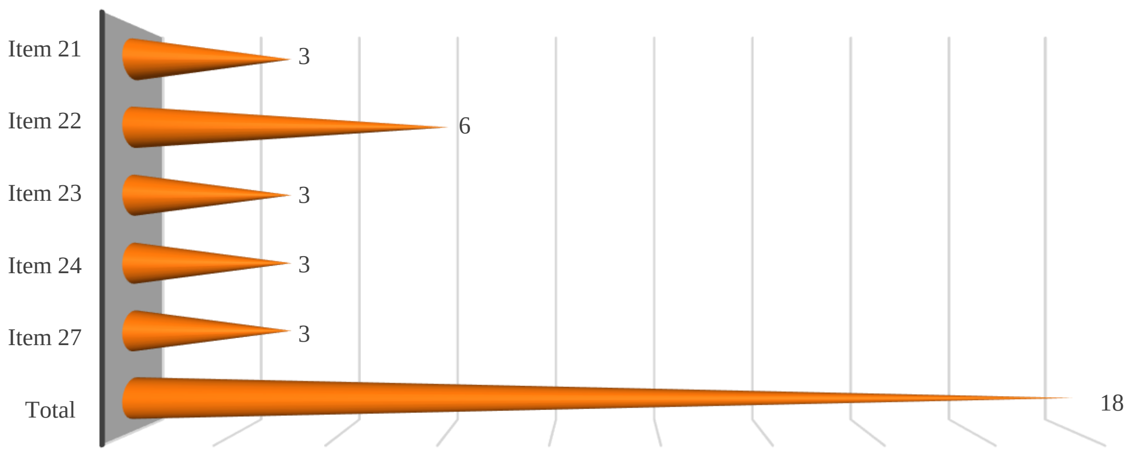


Figure 7.14 Number of relevant statements in Organisation. Source: Self-study

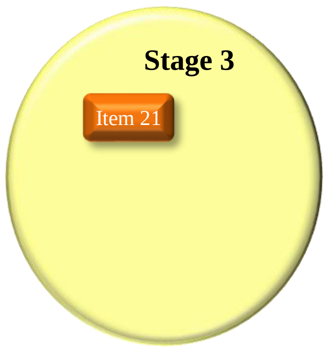
7.5.4.1 Item 21: Having a seat at a table in higher management level

The participants agreed that nowadays the FM representative is vital in the organisation, particularly at management level. One of the participants expressed that *"a lot of organisations today are very integrated at management level because we all work towards the core business [objectives]. So, you [FM professionals] have to [gain] trust [from] the other professionals around the table"*. As FM is a *"source of information"*, there should not be an issue for FM to gain trust in the organisations and be actively involved at a higher management level. One of the participants encouraged client organisations to have an inclusive management structure that would provide an opportunity for FM to have influence in the decision making. Nevertheless, this is not the case in the property development industry where FM is often ignored in project organisation despite the emergence of Public Finance Initiative (PFI) and partnering scheme, which aim to encourage the integration of all parties. The consideration of FM involvement at Stage 3 would be useful to review and update project execution plan, construction, handover, maintenance and operational strategies.

Three (3) relevant statements were captured which describe the best practices required in encouraging FM-DP integration (refer to Table 7.11).

Table 7.11 Validated best practices of Item 21

Relevant statement
21a. Given an opportunity to be actively involved in decision making
21b. Setting up of inclusive management structure in project organisation
21c. Serve as a source of information



Source: Self-study

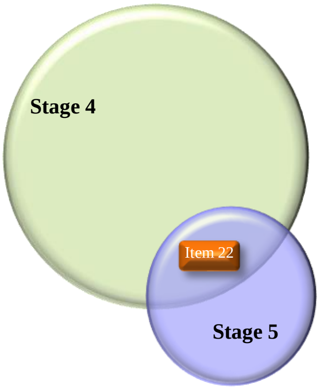
7.5.4.2 Item 22: Ability to apply Computerised Aided Facilities Management (CAFM)

An interesting discussion during focus group interview was around the ability of FM to become proficient in application of CAFM. One of the participants shared their thoughts on the benefit of having knowledge of using CAFM in the development process: *"my view on CAFM is, the best use of CAFM is used to record data on the builder's performance. It's great for your KPI"*. An example of how CAFM data is beneficial to the overall performance of the building design was also shared by the participants: *"You can get some great data out of there [CAFM]. For example, how does a certain type of air outlet unit perform, how many breakdowns do you have, how many hours do you spend looking after maintaining that. And then, feed that back in right through to concept design development at the design stage [of other projects]"*. This justifies the inclusion of FM professionals in building equipment selection that could influence the design. One (1) participant noted that the benefits of applying CAFM at Stage 4 would be beneficial at that stage: *"Getting [CAFM] involved at that stage [Stage 4] to prepare for the introduction of CAFM"*. Another participant supported that *"having CAFM at Stage 5, by the time you get to Stage 6 and Stage 7 you have populated it with preliminary data. It is validated as well as good data"*. There is also a suggestion that implementation of CAFM at Stage 5 is not limited to preparing precise and comprehensive O&M documents but is also useful in administration of building contract, site inspection, review of progress, non-conformance records, taking photographs, and preparation of as-built drawings.

Six (6) relevant statements were captured which describe the best practices required in encouraging FM-DP integration (refer to Table 7.12).

Table 7.12 Validated best practices of item 22

Relevant statement
22a. Apply CAFM in Stage 5 to populate the validated data
22b. CAFM to monitor KPI achievement
22c. Introduce CAFM at Stage 4
22d. Feed data recorded in CAFM for selection of building equipment
22e. Exploit CAFM to prepare accurate O&M documents
22f. CAFM in Stage 5 is to collate data for administration of building contract, site inspection, review of progress, non-conformance records, taking photographs and prepare as built.



Source: Self-study

7.5.4.3 Item 23: Having trust from other professionals

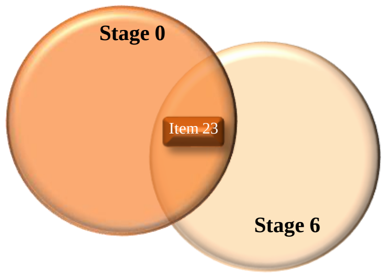
This perception of having trust from other professionals at Stage 0 was reflected by the opinion of the participants that FM professionals are lacking in leadership quality: *"I think another key issue with that leadership is having the gravitas, if you like, to influence these decisions"*. There is a suggestion for the FM professionals to be able to visualise the impact of backlog maintenance in which the information can be used to alert the decision maker. *"So a key issue would be to be able to talk about backlog maintenance that influenced decisions to go for a development and at the end all the advisors around the table understand [the effect of] backlog maintenance [in future]"*. Although FM is known to have *"an overall view of maintaining the structure [building]"*, there were, however, some sceptical responses regarding FM contribution in Stage 0: *"Are they getting involved with this? I think we all know what's brought on in the process of making some decisions. Are you being involved at this level at the moment?"*

To gain trust from other professionals at Stage 6, one of the participants suggested: *"Facilities Manager [should be] involved in the production of the O&Ms, that really does help going forward [to FM-DP integration] cos I just have nightmares with O&Ms with me now. It's all marketing stuff"*. On top of that, Facilities Managers are encouraged to be present at *"witnessing the testing and commissioning, training and familiarisation"* sessions.

Three (3) relevant statements were captured which describe the best practices required in encouraging FM-DP integration (refer to Table 7.13).

Table 7.13 Validated best practices of item 23

Relevant statement
23a. Being convincing about backlog maintenance
23b. Involved in preparation of O&M documents
23c. Witnessing the testing and commissioning



Source: Self-study

7.5.4.4 Item 24: Ability to apply Building Information Modelling (BIM)

Issues related to BIM were highly anticipated by the participants. One of the participants expressed their excitement, saying: *"I am quite surprise that BIM is such a big thing and it is being mooted as a new thing, as [for years and years we] never had a name for it"*. Another participant showed the same feeling: *"the interesting one for me at the moment (is) the ability to apply BIM*". This may be due to the current situation where BIM is being widely discussed in FM and the property development industry: *"It's a buzz word at the moment,"* said one of the participants.

Generally, the basic understanding of the participants towards BIM is an effort for trans-disciplinary data sharing. One (1) participant explained: *"What they are trying to do is sharing the data. The architect produces technical information and specification drawings, at the same token the whole design team get involved"*. In addition, they were optimistic that BIM would be able to integrate various professionals, including Facilities Managers. *"I've seen myself this BIM model has been incorporated by so many professionals"*. There is also hope that in the future various computer-aided systems for building management and FM will be integrated with BIM: *"[in] the next ten (10) years you are going to see BIM integrating with all different… with CAFM and your building management systems… So, I see in the future, probably a lot of integration between all these different kinds of systems"*. This suggestion would be beneficial to be considered at Stage 1, which would need an early decision as it might involve additional cost to the project: *"Good software, good tools are not cheap… Yeah, I think Stage 1 is [right], because there is where you start with the development of project outcomes, project objectives and quality outcomes can be modelled through the BIM system"*.

There was a general consensus amongst the participants that justified the need to apply BIM at Stage 4: *"If Facilities Manager joins in at Stage 4, he would need to know or have the ability to apply BIM…. So, I think it is a key driver at Stage 1 and Stage 4"*. Moreover, one of the participants anticipated that, with the support of BIM, FM would have a major contribution to carry out Suggested

Key Support Tasks of Stage 4: "*I'm just looking at Stage 4, review and update Sustainability, Maintenance and Operational and Handover Strategies and Risk Assessments. For the FM to input at those I would imagine they are going to be around with BIM".* Figure 7.15 indicates the specific point in the RIBA Plan of Work 2013 that was referred to by the participants.

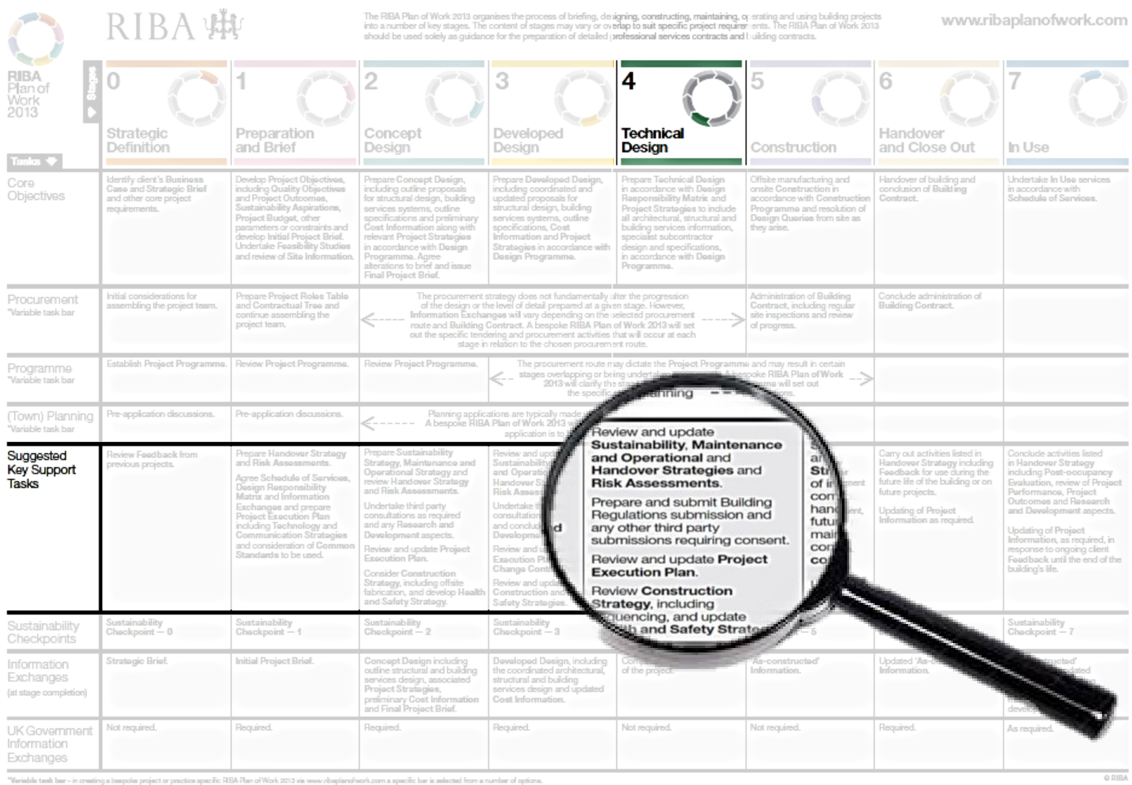
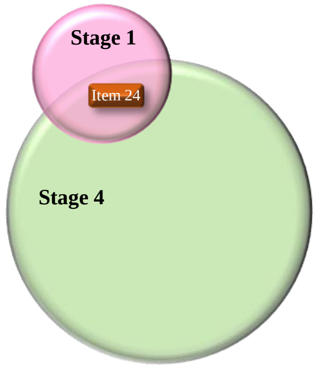


Figure 7.15 Suggested Key Support Tasks of Stage 4. Source: Self-study

Three (3) relevant statements were captured which describe the best practices required in encouraging FM-DP integration (refer to Table 7.14).

Table 7.14 Validated best practices of item 24

Relevant statement
24a. Integration between BIM, CAFM and BMS
24b. Ability to create scenarios and predict the performance of the building services and the cost estimation of the maintenance
24c. Exploit BIM to review and update Sustainability, Maintenance and Operational and Handover Strategies and Risk Assessments



Source: Self-study

7.5.4.5 Item 27: Ability to take lead in mobile flexible working pattern

A major theme discussed by the participants around the mobile flexible working pattern is on the actual usage of space. Despite their appreciation of the practice of *"hot desk"* in the office, it was discovered that their concern was more on the flexibility of the building design that supports the optimisation of space. Taking the healthcare industry as an example, one of the participants questioned the need to provide huge hospitals that resulted in a waste of space: *"For example, you take healthcare [services], they're going towards smaller community; [having] little surgeries in pre-packed theatre units [would be sufficient]. Do we need these great big hospitals anymore?"*. There is general consensus that the flexibility of working space should be considered in Stage 4 although *"the main driver for that will come from the organisation*". An interesting perspective of the need for flexible elements in the design was on the practicality of physical changes: *"… for me, flexibility means whatever changes that you can see and maybe some that you can't. But how easy it is to change moveable partition walls and things like that"*. It would be useful to consider the feedback on this aspect in such a way that would benefit the future life of the building or future projects. The professionals including Facilities Managers involved in the project should be aware of the feedback exercise at Stage 6. Figure 7.16 indicates the feedback activities at Stage 6 that need the element of flexibility of space.

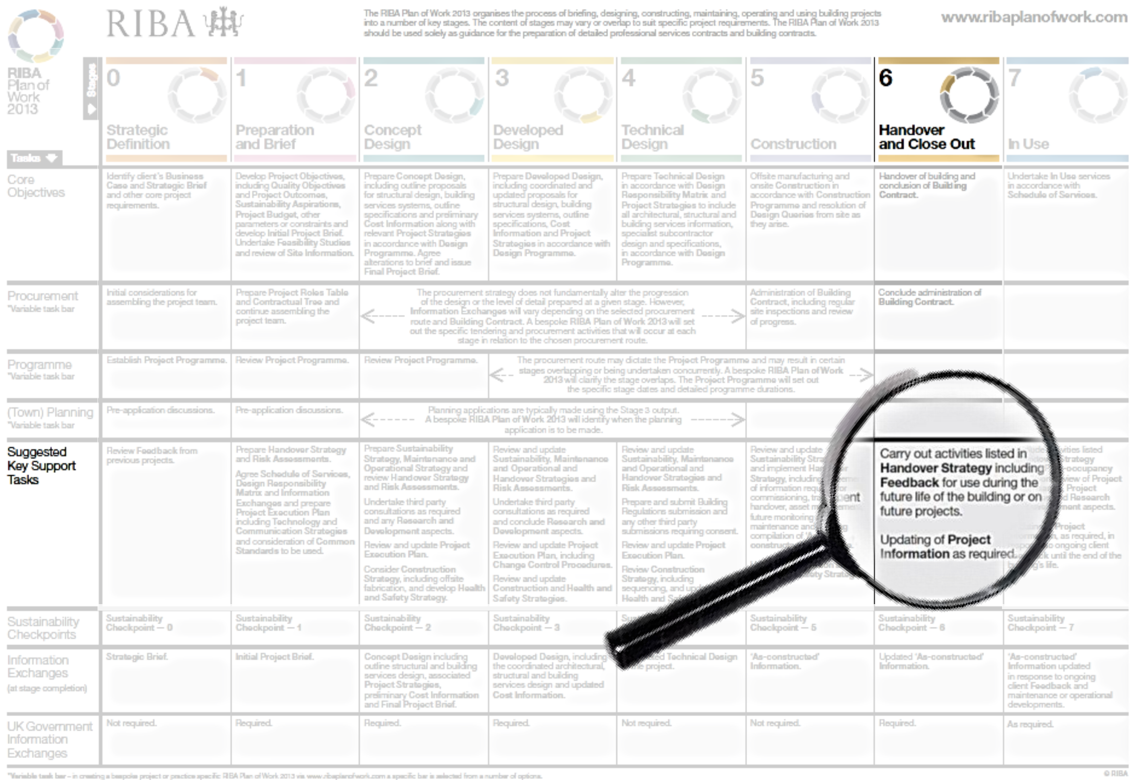


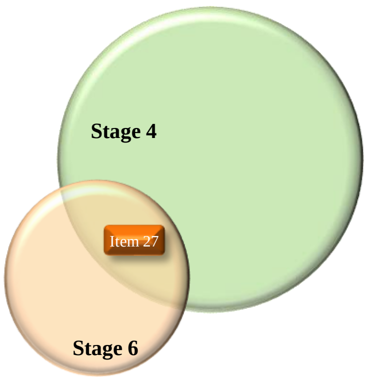
Figure 7.16 Feedback activities at Stage 6 that need the element of flexibility. Source: Self-study

As the discussion emphasised the optimisation of space, it was decided to replace the word ‘pattern’ with ‘space’. Now, Item 27 is known as ‘Ability to take lead in mobile flexible working space’.

Three (3) relevant statements were captured which describe the best practices required in encouraging FM-DP integration (refer Table 7.15).

Table 7.15 Validated best practices of item 27

Relevant statement
27a. Focusing on smaller community
27b. Promoting ‘hot desk’ working approach
27c. Emphasise the flexibility elements in the feedback



Source: Self-study

7.5.5 Strategic Value

Strategic value emphasises having the ability to demonstrate value and uniqueness. Two (2) items in Strategic Value generated seven (7) relevant statements; the breakdown of each item is shown in Figure 7.17.

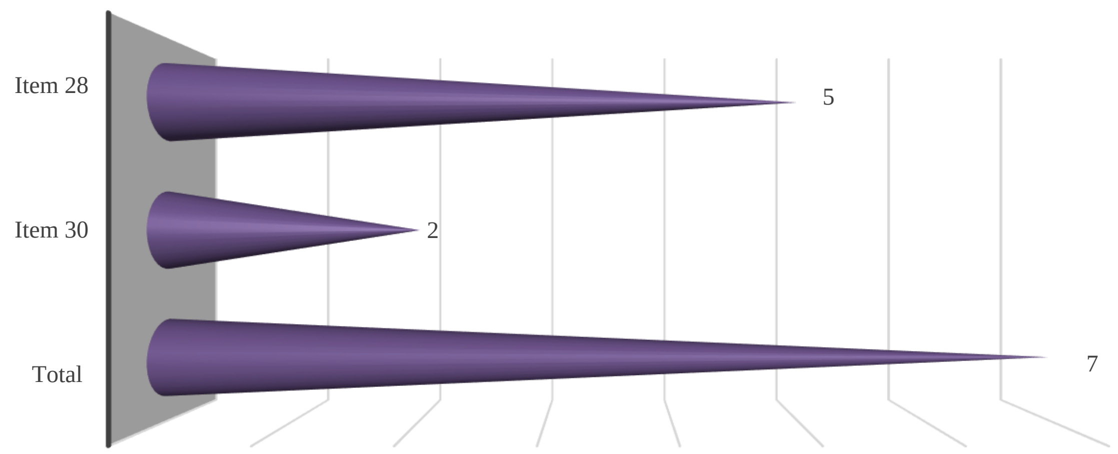


Figure 7.17 Number of relevant statements in Strategic Value. Source: Self-study

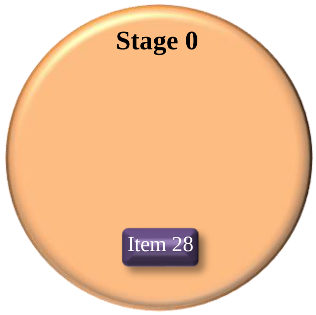
7.5.5.1 Item 28: Take leadership role in the client organisation as an advisor

"With broad contacts and experience learning from people at various levels and backgrounds, Facilities Manager would be able to come up with an idea of [better] solution". This viewpoint was agreed by the participants who regularly connect with various stakeholders and experience learning throughout the development process. Another participant supported this: *"It's difficult without an idea on the table but the influence of the FM, even if it's just minor nuggets of information, might influence a decision at that stage".* To encourage the Facilities Manager to take a leadership role in the client organisation as an advisor, they should be able to optimise the knowledge they possess: *"FM also tends to have an awful lot of knowledge about the existing estate"*. On top of that, Facilities Managers need to update their knowledge to reflect the latest interests in the industry. This was crucial to get trust from the stakeholders, who often have the wrong perception of FM: *"Maybe you've got a client at senior level just thinking 'We need a new building' for what reason*". Moreover, Facilities Managers were regularly considered *"as cost generators"* and *"go in to the meetings with a wish lists"* attitude. Therefore, it would be advantageous for FM to *"come up with some ideas and different way of looking"* at the challenges.

Five (5) relevant statements were captured which describe the best practices required in encouraging FM-DP integration (refer to Table 7.16).

Table 7.16 Validated best practices of item 28

Relevant statement
27a. Create broad connections
27b. Experience learning
27c. Knowledge about existing facilities
27d. Update knowledge on the latest interests, e.g. maintenance and servicing, energy consumption and space optimisation
27e. Unique idea of solution



Source: Self-study

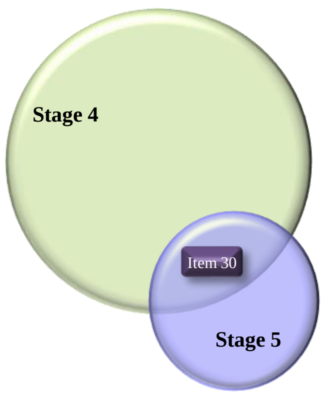
7.5.5.2 Item 30: Understand user's organisational strategy

One (1) participant noted that a key enabler to getting Facilities Managers integrated into the development process was to understand the user’s organisational strategy: *“The better you know about the users, what they are going to do, the closer you are to better integration”.* The business objectives of the users or client are often emphasised at Stage 0 in order to prepare a Business Case and Strategic Brief. However, the business objectives are regularly overlooked towards Stage 4 and Stage 5, resulting in deviation from the user’s requirements. Therefore, it is crucial to build a good relationship with the users in order to appreciate their needs: *“You need a good professional relationship with the client [so] that you can understand exactly what he or she, the organisation, wants”.* For this, Facilities Managers could play an important role at Stage 4 and Stage 5 to keep the business objectives in place.

Two (2) relevant statements were captured which describe the best practices required in encouraging FM-DP integration (refer to Table 7.17).

Table 7.17 Validated best practices of item 30

Relevant statement
30a. Understand the business objectives
30b. Professional relationships



Source: Self-study

7.6 Strengths and weaknesses of FM-DP integration framework

Qualitative analysis carried out on the focus group interview identified 52 relevant statements explaining the best practices to encourage FM-DP integration, which is evidence in validating the developed framework. Simultaneously, the analysis has revealed the strengths and the weaknesses of this framework in two (2) perspectives: contribution and practicality.

It was obvious that the potential main contribution of this framework is to raise awareness of the importance of the involvement of FM in the development process. This framework is useful for guiding the community in FM and the property development industry to optimise the role of FM in the development process. As mentioned in the validation, a collaborative working environment is crucial for effective FM-DP integration. Therefore, this framework would be useful to support that endeavour. Another important contribution is promoting the RIBA Plan of Work 2013 within FM and the property development industry, which has become the supplementary document to this framework.

The main strength of the FM-DP framework in terms of practicality is its compatibility with new projects. It is more advantageous for the project to begin with Stage 0 where the value of integration could be exploited while various professionals are brought together in that stage to form a project team. Although there is evidence that this framework is useful for refurbishment works, overall, it is suitable for new and large-scale projects. This framework is expected to be used by all professionals within FM and the property development industry in various organisations in public and private sectors – not to forget that the framework was designed for self-learning and ease of use.

In terms of weaknesses, the framework is vulnerable to misunderstanding and misinterpretation of the terms used. A reasonable way to confront this issue could be explanation by the researcher at the beginning of the use of the framework. Coupled with the absence of a mechanism to assess the degree of FM-DP integration at the end of the project, the framework's effectiveness is debatable. Furthermore, the presence of this framework will be treated as an additional responsibility for project team members.

From practical weaknesses, it was noted that this framework is unsuitable for refurbishment works, as the project might skip an important development process, which inhibits the effort to integrate FM into the development process. In addition, the framework is highly likely suitable only for certain procurement routes e.g. Private Finance Initiative (PFI). Builders are definitely not suitable to apply this framework, particularly during the construction stage.

The strengths and weaknesses of the FM-DP integration framework are illustrated in Figure 7.18.

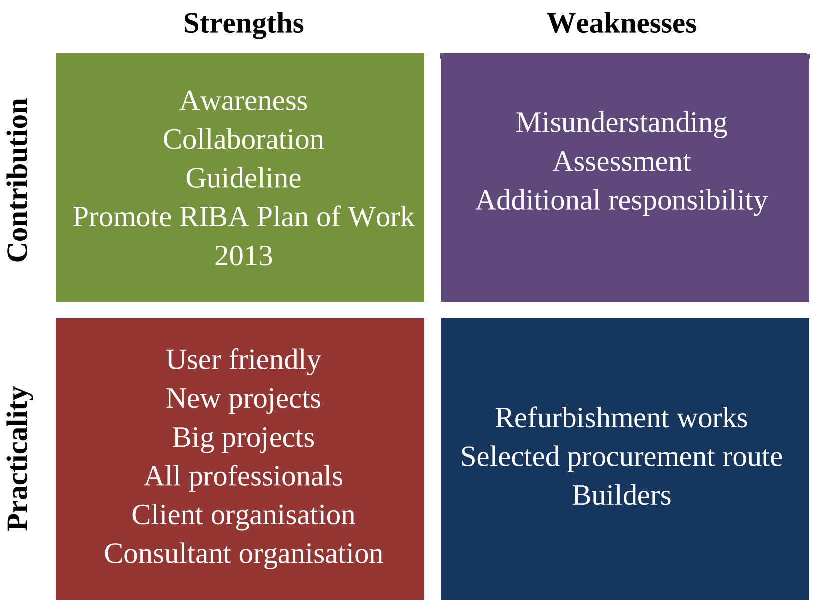


Figure 7.18 The strengths and weaknesses of the FM-DP integration framework. Source: Self-study

7.7 Chapter summary: The validated FM-DP integration framework

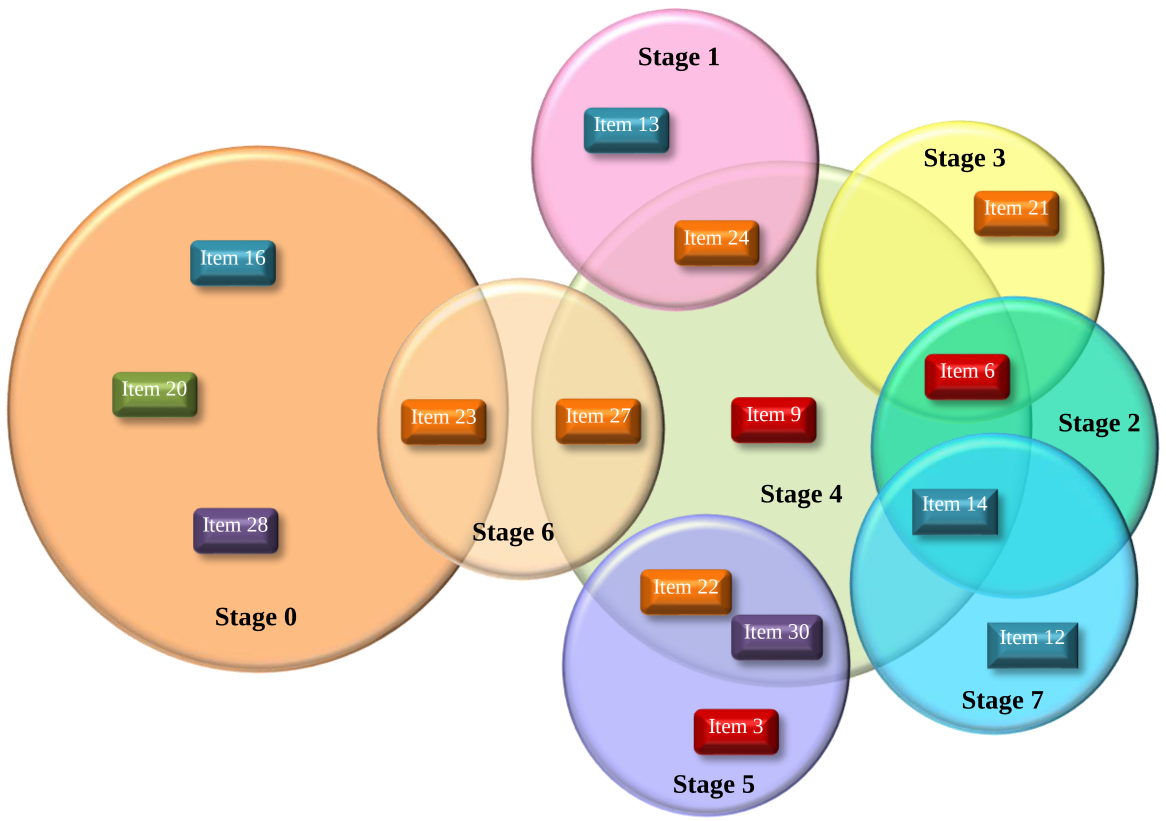
This chapter has presented the validation procedure undertaken to validate the developed FM-DP integration framework as exhibited in . The chapter can be summarised as below:

- The framework was validated through focus group interview comprised of three (3) experienced professionals in FM and the property development industry. The validation captured 52 relevant statements that supported 15 items available in the framework, which are also identified as the best practices needed to encourage FM-DP integration.

- This validation provides additional information in terms of strengths and weaknesses. The evaluation describes the practicality of the framework to be implemented in the industry. In addition, it was apparent that the framework enables Facilities Managers to play their role effectively in the development process. At the same time, the framework is to be embedded in the practice of other property development professionals to enhance the buildability and operability of the facilities.

Finally, the validated FM-DP integration framework and its supplementary document, the RIBA Plan of Work 2013, illustrated in Figure 7.19 and Figure 7.20 respectively, represent the answer for research question (iii) of this research (see Section 1.3). It also proves that Objective (v) of this research (see Section 1.5) has been successfully achieved.

THE CIRCLES



Note:

a. For ease of reference, the definition of constructs is shown below:

Constructs	Definition
Knowledge Management	FM having willingness to learn, share and transfer knowledge
Competence	FM having possession of required individual skills and knowledge
Post-occupancy evaluation	FM being able to exploit POE results to optimise building performance
Organisation	FM having trust to work with others effectively at all levels
Strategic value	FM having the ability to demonstrate strategic value and uniqueness

THE CODES

Colour code	Constructs[a]	Code	Items	Best practices
	Knowledge Management	KnowM5	3. Having a comprehensive facilities maintenance records	3a. Work closely with client 3b. Involved in production of O&M 3c. Apply CAFM to populate data 3d. Gathering maintenance record
		StrR1	6. Having a good professional relationship with client	6a. Work closely with the client 6b. Work with client to speed up the process 6c. Promote people's input 6d. Advice Project Manager
		MgtT5	9. Having mechanism to communicate with client about their requirements at all stages	9a. Determine the degree of autonomy 9b. Respond to Design Queries 9c. Collaboration with building users and client 9d. Focus on the clients requirements
	Competence	Comp2	12. Having adequate knowledge about construction phases	12a. Understand construction process 12b. Have a sense of ownership
		Comp3	13. Having adequate knowledge in construction procurement	13a. Understand the process of procurement 13b. Assessment of risk of procurement strategy 13c. Understand the process of change
		Comp7	14. Having adequate knowledge in lean construction practice	14a. Effective communication line 14b. Emphasise on occupant's comfort 14c. Work coordination 14d. Understand lean construction 14e. Leveraging the data
		Comp1	16. Having adequate experience in building maintenance	16a. Leveraging experience 16b. Record maintenance experience 16c. Informed decision
	POE	POE4	20. Ability to transfer POE outcomes in a project to briefing stage of other project	20a. Emphasise building defects management 20b. Utilise POE to enhance building performance
	Organisation	StrR4	21. Having a seat at a table in higher management level	21a. Actively involved in decision making 21b. Inclusive management structure 21c. Source of information
		MgtT3	22. Ability to apply Computerised Aided Facilities Management (CAFM)	22a. Apply CAFM 22b. Monitor KPI achievement 22c. Introduce CAFM 22d. Feed data in CAFM 22e. Exploit CAFM to prepare O&M documents 22f. Apply CAFM in Stage 5 to collate data
		StrR3	23. Having trust from other professionals	23a. Convincing about backlog maintenance 23b. Involved in production of O&M 23c. Witnessing the testing and commissioning
		MgtT2	24. Ability to apply Building Information Modelling (BIM)	24a. Integration between BIM, CAFM and BMS 24b. Create scenarios 24c. Review and update Sustainability, O&M, Handover Strategies and Risk Assessments
		Sust2	27. Ability to take lead in mobile flexible working space	27a. Focusing on smaller community 27b. Promoting hot desk working approach 27c. Emphasise on the flexibility elements
	Strategic value	StrV3	28. Take leadership role in the client organisation as an advisor	27a. Create broad connections 27b. Experience learning 27c. Knowledge about existing facilities 27d. Update knowledge with latest interest 27e. Unique idea of solution
		StrV1	30. Understand user's organisational strategy	30a. Understand the business objectives 30b. Professional relationships

Figure 7.19 Validated FM-DP integration framework. Source: Self-study

RIBA Plan of Work 2013

The RIBA Plan of Work 2013 organises the process of briefing, designing, constructing, maintaining, operating and using building projects into a number of key stages. The content of stages may vary or overlap to suit specific project requirements. The RIBA Plan of Work 2013 should be used solely as guidance for the preparation of detailed professional services contracts and building contracts.

www.ribaplanofwork.com

Tasks ▼ / Stages ▶	0 Strategic Definition	1 Preparation and Brief	2 Concept Design	3 Developed Design	4 Technical Design	5 Construction	6 Handover and Close Out	7 In Use
Core Objectives	Identify client's **Business Case** and **Strategic Brief** and other core project requirements.	Develop **Project Objectives**, including **Quality Objectives** and **Project Outcomes**, **Sustainability Aspirations**, **Project Budget**, other parameters or constraints and develop **Initial Project Brief**. Undertake **Feasibility Studies** and review of **Site Information**.	Prepare **Concept Design**, including outline proposals for structural design, building services systems, outline specifications and preliminary **Cost Information** along with relevant **Project Strategies** in accordance with **Design Programme**. Agree alterations to brief and issue **Final Project Brief**.	Prepare **Developed Design**, including coordinated and updated proposals for structural design, building services systems, outline specifications, **Cost Information** and **Project Strategies** in accordance with **Design Programme**.	Prepare **Technical Design** in accordance with **Design Responsibility Matrix** and **Project Strategies** to include all architectural, structural and building services information, specialist subcontractor design and specifications, in accordance with **Design Programme**.	Offsite manufacturing and onsite **Construction** in accordance with **Construction Programme** and resolution of **Design Queries** from site as they arise.	Handover of building and conclusion of **Building Contract**.	Undertake **In Use** services in accordance with **Schedule of Services**.
Procurement *Variable task bar	Initial considerations for assembling the project team.	Prepare **Project Roles Table** and **Contractual Tree** and continue assembling the project team.	<-- The procurement strategy does not fundamentally alter the progression of the design or the level of detail prepared at a given stage. However, **Information Exchanges** will vary depending on the selected procurement route and **Building Contract**. A bespoke **RIBA Plan of Work 2013** will set out the specific tendering and procurement activities that will occur at each stage in relation to the chosen procurement route. -->			Administration of **Building Contract**, including regular site inspections and review of progress.	Conclude administration of **Building Contract**.	
Programme *Variable task bar	Establish **Project Programme**.	Review **Project Programme**.	Review **Project Programme**.	<-- The procurement route may dictate the **Project Programme** and may result in certain stages overlapping or being undertaken concurrently. A bespoke **RIBA Plan of Work 2013** will clarify the stage overlaps. The **Project Programme** will set out the specific stage dates and detailed programme durations. -->				
(Town) Planning *Variable task bar	Pre-application discussions.	Pre-application discussions.	<-- Planning applications are typically made using the Stage 3 output. A bespoke **RIBA Plan of Work 2013** will identify when the planning application is to be made. -->					
Suggested Key Support Tasks	Review **Feedback** from previous projects.	Prepare **Handover Strategy** and **Risk Assessments**. Agree **Schedule of Services**, **Design Responsibility Matrix** and **Information Exchanges** and prepare **Project Execution Plan** including **Technology** and **Communication Strategies** and consideration of **Common Standards** to be used.	Prepare **Sustainability Strategy, Maintenance and Operational Strategy** and review **Handover Strategy** and **Risk Assessments**. Undertake third party consultations as required and any **Research and Development** aspects. Review and update **Project Execution Plan**. Consider **Construction Strategy**, including offsite fabrication, and develop **Health and Safety Strategy**.	Review and update **Sustainability, Maintenance and Operational** and **Handover Strategies** and **Risk Assessments**. Undertake third party consultations as required and conclude **Research and Development** aspects. Review and update **Project Execution Plan**, including **Change Control Procedures**. Review and update **Construction and Health and Safety Strategies**.	Review and update **Sustainability, Maintenance and Operational** and **Handover Strategies** and **Risk Assessments**. Prepare and submit Building Regulations submission and any other third party submissions requiring consent. Review and update **Project Execution Plan**. Review **Construction Strategy**, including sequencing, and update **Health and Safety Strategy**.	Review and update **Sustainability Strategy** and implement **Handover Strategy**, including agreement of information required for commissioning, training, handover, asset management, future monitoring and maintenance and ongoing compilation of '**As-constructed' Information**. Update **Construction** and **Health and Safety Strategies**.	Carry out activities listed in **Handover Strategy** including **Feedback** for use during the future life of the building or on future projects. Updating of **Project Information** as required.	Conclude activities listed in **Handover Strategy** including **Post-occupancy Evaluation**, review of **Project Performance**, **Project Outcomes** and **Research and Development** aspects. Updating of **Project Information**, as required, in response to ongoing client **Feedback** until the end of the building's life.
Sustainability Checkpoints	**Sustainability Checkpoint — 0**	**Sustainability Checkpoint — 1**	**Sustainability Checkpoint — 2**	**Sustainability Checkpoint — 3**	**Sustainability Checkpoint — 4**	**Sustainability Checkpoint — 5**	**Sustainability Checkpoint — 6**	**Sustainability Checkpoint — 7**
Information Exchanges (at stage completion)	**Strategic Brief.**	**Initial Project Brief.**	**Concept Design** including outline structural and building services design, associated **Project Strategies**, preliminary **Cost Information** and **Final Project Brief**.	**Developed Design**, including the coordinated architectural, structural and building services design and updated **Cost Information**.	Completed **Technical Design** of the project.	**'As-constructed' Information.**	Updated **'As-constructed' Information.**	**'As-constructed' Information** updated in response to ongoing client **Feedback** and maintenance or operational developments.
UK Government Information Exchanges	Not required.	Required.	Required.	Required.	Not required.	Not required.	Required.	As required.

*Variable task bar – in creating a bespoke project or practice specific RIBA Plan of Work 2013 via www.ribaplanofwork.com a specific bar is selected from a number of options.

Figure 7.20 RIBA Plan of Work 2013 – A supplementary document to the Validated FM-DP integration framework. Source: Royal Institute of British Architects (2013). Permission to reproduce in this form has been granted by the Royal Institution of British Architects (RIBA)

Chapter Eight

Discussions and Conclusion

8.1 Introduction

This chapter aims to provide understanding for the reader on how the research was able to develop an FM-DP integration framework, which will be a guide to professionals in FM and the property development industry. The discussion begins with the introduction of the outline of this chapter. The discussion in Section 8.2 concentrates on the research processes to achieve each objective of the study, including a systematic literature review, data collection and analysis (qualitatively and quantitatively), interpretation, development of framework and validation. The summary of the research in Section 8.3 explains the findings of each process that represent answers to the research questions. Section 8.4 delineates research limitations encountered during the study. Section 8.5 concludes the whole research in two (2) important aspects: contribution of this research to the body of knowledge and recommendations for future research in this field. The chapter ends with a summary, which also indicates the completion of this research.

8.2 Reflection on research aim and objectives

The aim of this research was to develop a Facilities Management-Development Process (FM-DP) integration framework that offers a guideline to enable professionals in FM and the property development industry to optimise the role of Facilities Managers in the development process. The effect of utilising this framework would help to improve the level of integration and subsequently enhance the performance of the facilities in terms of buildability and operability. Five (5) objectives were formulated to help the researcher achieve the research aim. The following sub-sections explain the 'modus operandi' of each objective, covering the research design and methodology. This includes a systematic literature review, data collection, analysis, interpretation and validation. The findings of each objective is connected back to answer the research questions and fulfil the research aim.

8.2.1 Objective (i): To explore the importance of FM and its relationship to the development process

Based on the literature reviewed, it was found that the position of FM in the development process was less than overwhelming. This situation also affects the role of Facilities Managers, who are considered incapable of contributing to the development process holistically. Furthermore, Facilities

Managers are synonymous with hard services like maintenance works, and soft services such as cleaning, catering and security. Consequently, they are perceived to be relevant only at the In Use stage (Stage 7). It is such a waste if the knowledge and experience possessed by the Facilities Managers concerning the In Use stage are not utilised in the earlier stages of the development process. Their input would contribute to enhance the performance of the facilities in terms of buildability and operability. There is no doubt that FM is considered a new field, which has resulted in a conflict of identity for the Facilities Managers. Nevertheless, the role of Facilities Manager needs to be optimised for the benefit of the property development industry. The discouraging perception of other established professionals in the construction industry towards FM has to be improved.

The understanding with respect to Objective (i) was extended to ten (10) professionals from FM and the property development industry. Individual interviews were employed as a method to confirm the findings obtained from the literature review. There were four (4) themes identified to satisfy Objective (i):

a. The importance of FM in the development process – There was general consensus that the FM role is important in the development process. Earlier input of FM in the development process would contribute to effective operations of the facilities at the In Use stage.

b. FM is a supporting element in core business – FM is synonymous with providing soft services and maintenance works. The FM team works closely with end users and clients to support the core business.

c. Contribution of FM to sustainability – FM has a crucial role in ensuring the principle of sustainability and value for money are achieved. Therefore, the involvement of FM elements at the earlier stage of the development process should be considered.

d. FM current performance in the development process – Currently, the role of FM is not optimised for the benefit of the property development industry. However, it is believed that FM is very much an integrator between various disciplines in the property development industry.

To sum up, it is crucial for Facilities Managers as an FM ambassadors to be equipped with knowledge and qualities that enable them to integrate into the property development industry effectively.

The themes identified above shaped the theoretical foundation of this research.

8.2.2 Objective (ii): To identify a number of issues perceived to be barriers for the integration of FM into the development process

This objective was achieved through extensive literature review and individual interviews. The literature review identified 33 critical issues that are perceived to be barriers for the integration of FM into the development process. The literature findings were brought to ten (10) professionals from FM and the property development industry as a model for validation. The thematic analysis undertaken identified 35 sub-themes, which were grouped into nine (9) main themes: perception, competence, regulations, organisations, knowledge management, management tools, operations, decision making and sustainability. The sub-themes derived from the interviews can be defined as expressions that cover several aspects such as constraints, expectations and suggestions to encourage FM-DP integration. The results obtained from the interview analysis show that Objective (ii) was achieved successfully.

8.2.3 Objective (iii): To establish the best practices for the integration of FM into the development process

Considering that this study was conducted through exploratory sequential mixed methods (QUAL $_{\text{individual interview}}$ → quan $_{\text{survey questionnaire}}$ → qual $_{\text{focus group}}$), it was apparent that priority was given to the individual interview endeavour and its findings. A detailed analysis further emphasised the amalgamation of findings obtained in Objective (i) and Objective (ii). During the analysis, the comparison constant principle was applied to check for similarities and differences. As a result, some of the main themes and sub-themes were newly created whereas a number of existing main themes and sub-themes had to be retained, revised or removed. It was apparent through literature review and individual interview findings that the level of FM-DP integration predominantly relies on competences, strategic role, development scheme, strategic value, management tools, knowledge management, post-occupancy evaluation and sustainability. The nine (9) main themes contain 39 sub-themes that promote best practices to enable Facilities Managers to integrate effectively into the development process. The establishment of best practices for FM-DP integration into the development process signifies the achievement of Objective (iii). In addition, the findings obtained in this objective demonstrate that the prerequisites for Objective (iv) have been met. In general, this objective is crucial given that the data obtained in qualitative research (QUAL $_{\text{individual interview}}$) need to be quantified statistically. At this point, the main themes were identified as constructs, whereas the sub-themes were known as items. This is to distinguish the same data used in qualitative and quantitative analysis.

8.2.4 Objective (iv): To develop an FM-DP integration framework

To develop an FM-DP integration framework, findings obtained in Objective (iv) were translated into survey questionnaires. Two (2) hypotheses were formulated based on the theoretical foundation created in the previous objectives. The best practices that encourage FM-DP integration were measured through statistical analysis, in which five (5) constructs (Knowledge management, Competence, Post-occupancy evaluation, Organisation and Strategic value) with 30 items were produced during purification of the scale. Analysis for relationships of constructs found that there is relationship between the perceived importance of FM to be considered and the extent to which the FM could integrate effectively in the development process. Zooming in on each item, 240 repetitions of one-way MANOVA tests of different variables identified that 15 significant items fitted perfectly into the RIBA Plan of Work 2013. Generally, this framework offers professionals and organisations in the property development industry a guideline to optimise the role of FM in the development process. In addition, it promotes awareness for better FM-DP integration.

8.2.5 Objective (v): To validate the concept of the FM-DP integration framework

Objective (v) was achieved through validation in the form of focus group interview attended by three (3) professionals with broad experience in FM and the property development industry. Two (2) of the participants were chosen from among those who had previously been involved with different stages of data collection in this research, whereas the other one was newly recruited. This approach enabled a more comprehensive review of the framework. In addition, the focus group interview provided a platform for the participants to criticise the reliability of the framework, including its appearance. The validation identified the strengths and the weaknesses of the framework in terms of its potential practicality and contribution. The discussion in the focus group interview was then qualitatively analysed. In general, there are 52 relevant statements that support 15 items in the FM-DP integration framework. In addition, the framework was designed to be read in conjunction with the RIBA Plan of Work 2013, which can be considered as a supporting document to it.

8.3 Research summary – Answering the research questions

By achieving all of the objectives, this research should be able to answer all three (3) research questions. Table 8.1 summarises the research endeavour by providing answers to each research question.

Table 8.1 Research summary – The answers to the research questions

Research questions	Answers	Relevant chapters
What are the current perceptions of the property development community towards FM?	FM is a new field, which results in an improper perception towards the role of Facilities Managers in the development process. FM was synonymous with maintenance works and soft services such as cleaning, catering and security during In Use stage of the facilities or building. Having Facilities Managers in the development process is an option. However, there is an encouraging view that FM need to be considered in the development process to enhance the performance of the building or facilities in terms of buildability and operability	Chapter 2 Chapter 3 Chapter 5
What are the issues that hinder the integration of FM into the development process?	There are 35 factors perceived to be barriers for the integration of FM into the development process, which can be divided into nine (9) categories, namely perception, competence, regulations, organisations, knowledge management, management tools, operations, decision making and sustainability	Chapter 2 Chapter 3 Chapter 5
What are the best practices needed to optimise the integration of FM into the development process?	The validated framework consists of 15 items that are considered as best practices needed to encourage FM-DP integration. The items were grouped into five (5) categories, namely knowledge management, competence, post-occupancy evaluation, organisation and strategic value	Chapter 5 Chapter 6 Chapter 7

Source: Self-study

The answers given above are the result of meeting the objectives and aim of the study. The validated framework should be beneficial to guide the professionals in the property development industry to optimise the role of FM in the development process. Furthermore, this would enhance the buildability and operability of the facilities and the buildings.

8.4 Research limitations

In any research work, the presence of uncontrollable factors that limits the research endeavour is inevitable. It can exist in each research process and needs to be addressed by the researcher in order to minimise its impact. This is a challenge that needs to be faced by the researcher. Similar issues were encountered in this research, in which a number of limitations have been identified as below:

a. It was identified that previous research concentrates on encouraging the involvement of FM in selected stages of the development process, particularly in the design stage. As this research is to encourage the integration of FM into the whole development process, the sources of literature are limited.

b. This research focused on two (2) disciplines: facilities and project management. To find participants involved in both industries and simultaneously provide a fair view is very limited.

Most of the professionals in the FM industry were involved in Stage 7 (In Use), whereas professionals in the property development industry were engaged in particular stages of the development process. This can cause bias in the qualitative and quantitative data obtained.

c. The link of the online survey posted in LinkedIn discussion can be accessed worldwide. Therefore, the reliability of the respondents to complete the questionnaires with accurate information can be disputed.

d. As discussed in Section 7.6, the validation stage identified the strengths and the weaknesses of the framework in terms of practicality and its contribution to FM and the property development industry. However, this should be proven by applying this framework in the industry.

e. To increase confidence among professionals in FM and the property development industry to use this framework, a mechanism should be established to evaluate its effectiveness. The framework needs to be validated by the professionals in the FM and property development industry.

f. The difficulties in contacting professionals who had knowledge and experience in both FM and the property development industry within a reasonable timeframe is the main factor why small focus group interview was used to validate the FM-DP integration framework. However, it is worthwhile noting that the data obtained was comprehensive and difficult to obtain (see Section 7.5).

g. It is important to have a skilful moderator during focus group interview in order to keep the discussion on the right topic.

8.5 Conclusion

To conclude the whole research work, it is essential to keep the discussion focused on two (2) aspects: contribution to the body of knowledge and recommendations that can be considered for future research work:

8.5.1 Contribution to the body of knowledge

In general, the contribution of this research is identified in two (2) components: contribution of knowledge in the academic field and contribution of knowledge in FM and the property development industry.

8.5.1.1 Contribution to academia

Five (5) important points have been identified that demonstrate that this study contributes to the academic field:

a. A critical literature review produced new insights about integration of FM into the development process. This research has contributed to the academic area by providing the latest setting of FM in the property development industry.

b. Comprehensive information gathered during literature review of FM and the development process has been the basis for this study to adopt exploratory sequential mixed methods. The findings obtained through exploratory sequential mixed methods have never been achieved in any study related to FM-DP integration. This should also be counted as a contribution to knowledge in the academic field.

c. The existing research concentrates on encouraging FM in the design stage of the development process. The design stage was perceived to be the most reliable stage for FM to influence the building design for a better FM operation in Stage 7 (In Use). However, this research provides evidence that there has been demand to integrate FM at the strategic level, which has resulted in comprehensive involvement of FM in the development process.

d. The findings of previous studies are subjective, resulting from qualitative study. Exploratory sequential mixed methods that involve qualitative and quantitative approaches have resulted in reliable results. The statistical analysis conducted in this research is the first endeavour of its kind of study, which has produced objective findings as well as a catalyst for the formation of the framework.

e. This research creates a new view of the role of Facilities Managers throughout the development process. This research was able to identify the challenges to optimise the role of FM in the development process. At the same time, the potential contribution of FM in the property development industry is undeniable.

8.5.1.2 Contribution to the property development industry

Three (3) important points have been identified that demonstrate that this study contributes to the property development industry:

a. As stated by one of the participants during validation of the proposed framework, some practices for FM-DP integration have long been implemented in the industry. However, this has never been properly documented. The emergence of the framework is something that has been long awaited, in which such practices have been registered in a form of a tangible document known as the FM-DP integration framework.

b. The development of the framework increases awareness amongst professionals in the property development industry about the potential contribution of FM in enhancing the buildability and operability of the buildings and facilities.

c. The framework would be a guideline for professionals in the property development industry to optimise the role of FM in the development process. The framework is highly likely to be used by various professionals such as engineers, quantity surveyors and architects from distinctive organisations, predominantly clients and consultants.

8.5.1.3 Contribution to the FM industry

Two (2) important points have been identified that demonstrate that this study contributes to the FM industry:

a. It raises awareness about the presence of FM in the development process from the very beginning. According to the professionals involved in the validation of the proposed framework, Facilities Managers are ‘sources of data’. Therefore, it is essential to utilise operational experience and knowledge possessed by Facilities Managers as early as Stage 0 (Strategic Definition).

b. This framework helps in boosting the confidence of Facilities Managers to participate actively in the development process.

8.5.2 Recommendations for future study

The profile of FM now has increased and there is an awareness that the advantages of having FM in the development process cannot be wasted. To further enhance the momentum, it is essential to continue to promote research in this field by considering five (5) recommendations that emerged from this research:

a. The findings of this research provide a firm foundation to further measure the efficiency of the FM-DP integration framework. Its capability to produce a maximum outcome with a minimum amount of sources needs to be evaluated. The findings should be exploited to build confidence among professionals in FM and the property development industry to apply the FM-DP integration framework in their development projects.

b. The effectiveness of the FM-DP integration framework can be assessed by investigating the outcome. However, a benchmark needs to be established so that there is a basis to compare and rank the achievements. It is suggested that the framework is to be implemented in the construction industry in order to validate it.

c. In order to establish a benchmark, other strategies of enquiry need to be considered. For example, phenomenology, which allows prolonged engagement of the researcher with the subject under investigation. As the framework was designed to be used in a new project, phenomenology could be used to evaluate the effectiveness of the framework throughout the development project from Stage 0 (Strategic Definition) to Stage 7 (In Use).

d. The involvement of FM in the development process would have an influence on time, cost and quality of a property development project. Hence, there is potential to develop a mathematical model to forecast the future behaviour.

e. To conclude, the profile of FM is increasing over time, which generates various innovative practices for better FM-DP integration. Apparently, the existing framework will need to be reviewed based on alternative samples at certain times. It is recommended that the research methodology in this study be applied in other parts of the UK, if not in other countries. The findings can be utilised for improving and maturing the existing framework.

8.6 Chapter summary

- This chapter has summarised the key findings by showing evidence that the research aim and objectives of this study were achieved. Although there were constraints during the research work, they were addressed by the researcher to minimise their impact.

- This research has answered the research questions with the emergence of an FM-DP integration framework. The framework provides an original contribution to the body of knowledge in the academic field and both FM and the property development industry.

- The profile of FM continues to increase and its presence in the property development industry can bring positive impact to buildability and operability of the buildings and facilities. To maintain this momentum, there are recommendations in this thesis that can be considered to encourage research in this field.

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Appendices

Appendix A: Cover Letter

The School of the Built Environment,
Faculty of Technology and Environment
Liverpool John Moores University

Dear Sir/Madam,

Preliminary Interview – PhD Study

Currently I am doing a PhD in The School of the Built Environment, Faculty of Technology and Environment Liverpool John Moores University, United Kingdom. The title of the study is "Optimising the Role of Facilities Management (FM) in the Development Process (DP): The Development of the FM-DP Integration Framework for Sustainable Property Development". The aim of the study is to develop a facilities management-development process integration framework towards sustainable development (FM-DP), which will provide a guideline to property industry professionals to optimise the role of FM in the full development process.

Kindly, I would like to invite you to participate in the interview. Your acceptance to participate in this interview is greatly appreciated.

Please find attached a Participant Information Sheet which provides the details of the participation. Kindly complete and sign the Consent Form attached as an indication that you agree to participate in the interview.

Should you have any queries, please do not hesitate to contact me. The contact details are provided as below:

Mohd Rayme Anang Masuri
The School of the Built Environment, Faculty of Technology and Environment,
Liverpool John Moores University, Peter Jost Enterprise Centre, Byrom Street,
Liverpool, L3 3AF.
Tel (School): +44 (151) 231 2861Fax: +44 (0)151 231 2873
HP: +44 (0)777 444 0643
Email: M.R.Bin-Anang-Masuri@2011.ljmu.ac.uk

Thank you for your cooperation.

Yours faithfully,

Mohd Rayme Anang Masuri

The School of the Built Environment,
Faculty of Technology and Environment
Liverpool John Moores University

Dear Sir/Madam,

Questionnaire Survey – PhD Study

I am writing to invite you to take part in a PhD research survey on Optimising the Role of Facilities Management (FM) in the Property Development Process (DP). The survey is intended to obtain various construction professionals' views about the factors that enable Facilities Managers to integrate effectively into the various stages of the property development process. I am not asking for your identity in the survey, so you can be assured that your response will be anonymous and not identifiable from the analysed data.

I do hope you can find the time to complete the questionnaire enclosed and return it to me in the self-addressed envelope by 15 April 2014 as your response is crucial to the success of the research.

I anticipate that the ultimate results of this study can be helpful in improving the performance of buildings in terms of buildability and operability.

Should you have any queries, please do not hesitate to contact me on 0777 444 0643 or email M.R.Bin-Anang-Masuri@2011.ljmu.ac.uk

Thank you for your contribution.

Yours faithfully,

Mohd Rayme Anang Masuri

Appendix B: Consent Letter

LIVERPOOL JOHN MOORES UNIVERSITY

CONSENT FORM
(PRELIMINARY INTERVIEW)

Title of Project:
Optimising the Role of Facilities Management (FM) in the Development Process (DP): The Development of the FM-DP Integration Framework for Sustainable Property Development

Name of Researcher and School/Faculty:
Mohd Rayme Anang Masuri,
School of the Built Environment, Faculty of Technology and Environment

1. I confirm that I have read and understood the information provided for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. ☐

2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason and that this will not affect my legal rights. ☐

3. I understand that any personal information collected during the study will be anonymised and remain confidential. ☐

4. I understand that any direct quotes published will be anonymised and will not be attributable to me. ☐

5. I understand that the interview will be audio recorded and I am happy to proceed. ☐

6. I understand that parts of our conversation may be used verbatim in future publications or presentations but that such quotes will be anonymised. ☐

7. I agree to take part in the above study. ☐

Name of ParticipantDate Signature

……………………………...   …………….   ………………………..

Name of ResearcherDateSignature

……………………………...   …………….   ………………………..
Name of Person taking consentDateSignature
(if different from researcher)

……………………………...   …………….   ………………………..

***Note**: When completed 1 copy for participant and 1 copy for researcher*

Appendix C: Participants Information Sheet

LIVERPOOL JOHN MOORES UNIVERSITY

PARTICIPANT INFORMATION SHEET (Preliminary Interviews)

Title of Project:
Optimising the Role of Facilities Management (FM) in the Development Process (DP): The Development of the FM-DP Integration Framework for Sustainable Property Development

Name of Researcher and School/Faculty:
Mohd Rayme Anang Masuri, School of the Built Environment, Faculty of Technology and Environment, Liverpool John Moores University

You are being invited to take part in a research study that I am undertaking as part of a PhD programme at the School of the Built Environment, Faculty of Technology and Environment, Liverpool John Moores University. Before you decide to participate, it is important that you understand why the research is being done and what it involves. Please take time to read the following information.

What is the purpose of the study?

FM is often viewed differently in terms of its significance regarding its involvement in the property development process and its contribution to sustainability. This study contends that there is a need to integrate FM more holistically into the property development process. However, the most suitable mechanism for integration for better control and management of property is yet to be developed.

The aim of this study is therefore to develop a facilities management-development process integration framework towards sustainable development (FM-DP InFuSeD), which will provide a guideline to property industry professionals to optimise the role of FM in the full development process. This research will take the form of data collection via interviews within your organisation, by the researcher, as described below.

The interviews will be conducted between January and February 2013 at your convenience. Each interview will last between 30-60 minutes.

Do I have to take part?

Your participation in the research is voluntary and it is up to you to decide whether or not to take part. If you agree, to take part, you will be given this information sheet and asked to sign a consent form. You are still free to withdraw at any time and without giving a reason.

If you wish to receive a summary of the research findings once the study has been completed please contact me at the email address below.

What will happen to me if I take part?

The findings from the interview will be analysed and will be used as a basis to prepare a closed-ended survey questionnaire to send to the wider industry. The survey questionnaire will later be distributed manually or online to selected property development organisations in the UK. The questionnaire will focus on the perception within designed variables of the establishment of a Facilities Management-Development Process (FM-DP) integration framework.

Are there any risks / benefits involved?

There are no potential risks involved in participating in the interviews. There should, however, be benefits; the aim of the research is to formulate a Facilities Management-Development Process (FM-DP) integration framework, which will provide a guideline to property development industry professionals to optimise the role of FM in the development process and FM contribution to sustainable property development.

The proposed framework is accessible to all professionals involved in the property development process. It could guide Facilities Managers to harness their influence and fit into the development process culture. It also could instil awareness of other professionals in the development process of the presence of facilities management elements in their planning, design, construction and facilities' operation.

Will my taking part in the study be kept confidential?

Transcripts from the interviews and answered survey questionnaire will be coded and made anonymous so that no individuals can be identified in future reports and publications of the findings. The publication of direct quotes from the interviews will not be attributed to named individuals and their identities will be protected.

Contact Details of Researcher:

Please contact me, using the details below, if there is anything that is not clear or if you would like more information, and please take time to decide if you want to take part in the research or not.

Mohd Rayme Anang Masuri
The School of the Built Environment, Faculty of Technology and Environment, Liverpool John Moores University, Peter Jost Enterprise Centre, Byrom Street, Liverpool, L3 3AF.
Tel (School): +44 (151) 231 2861Fax: +44 (0)151 231 2873
Email: M.R.Bin-Anang-Masuri@2011.ljmu.ac.uk

Contact Details of Supervisor:

Dr. Matthew Tucker
The School of the Built Environment, Faculty of Technology and Environment, Liverpool John Moores University, Peter Jost Enterprise Centre, Byrom Street, Liverpool, L3 3AF.
Tel (School): +44 (151) 231 2861Fax: +44 (0)151 231 2873
Email: M.P.Tucker@ljmu.ac.uk

The School of the Built Environment, Liverpool John Moores University, would like to thank you for agreeing to take part in this research.

Appendix D: Sample of Interview Checklist

Participant / interview details	Description	Tick
	BEFORE	
Name:	Bring the recorder	☐
………..…………………	HTC phone	☐
	IPad	☐
Date:	IPhone	☐
…………………………..…	Enough battery / power?	☐
	Bring your name card	☐
Location:	Bring the souvenir / gift	☐
……………………………	Bring the list of questions	☐
	Bring the list of themes	☐
Time:	Bring the interview script	☐
Begin: ….……….am/pm	**DURING**	☐
Finish: ….……..…am/pm	Hand over the name card	☐
	Hand the ethics documents to participants:	
	Cover letter	☐
	Participant Information Sheet	☐
	Consent Letter	☐
	Hand over the list of questions	☐
	Hand over the list of themes	☐
	AFTER	
	Collect the Consent Letter	☐
	Hand over the souvenir / gift	☐

Appendix E: Interview Questions Protocol

Research Title:
Optimising the Role of Facilities Management (FM) in the Development Process (DP): The Development of the FM-DP Integration Framework for Sustainable Property Development

Interview Questions

Part 1: General involvement in the property development process

Question 1:
Could you describe your experience and involvement in facilities management, construction and property development projects?

Question 2:
Who are the key stakeholders you regularly communicate with in the property development process?

Question 3:
What key stage(s) of the development process are you predominantly involved in?

Part 2: Critical issues of integrating FM into the property development process

From an extensive literature review, there are eight (8) key themes consisting of 33 critical issues that present challenges hinderign the integration of FM into the property development process.

Question 4:
With regard to theme no. 1: Perception
How do you perceive the role of FM in the property development process?

Question 5:
Now, we move to theme no.2: Competence
What sort of competences do you think FM professionals should have in order to be recognised in the property development industry?

Question 6:
Theme no. 3: Regulations
How big is the impact of law enforcement and regulations to help accelerate the integration of FM into the property development process? eg. Soft Landings / PPP

Question 7:
Theme no. 4: Organisations
Where do you feel the FM remit / function is usually positioned in organisations and projects? E.g. strategic / operational

Question 8:

Let us look at theme no. 5: Knowledge Management
Ineffective knowledge transfer or exchange is due to lack of mechanism, professional gap as well as different interests towards projects, which ultimately affects the project itself. From your experience, are there internal and external factors involved in this issue?

Question 9:

With regard theme no. 6: Definition
From your experience in construction projects, how extent is FM professionals utilise management tools/approach {e.g. Life Cycle Costing (LCC) / Life Cycle Management (LCM) / Building Information Modelling (BIM)] in the property development process?

Question 10:

Theme no. 7: Operation
Operations are a prerequisite for buildings to function satisfactorily and are often related to supply, maintenance and cleaning. From your understanding, how do you define the scope and responsibility of the operational stages of buildings?

Question 11:

Theme no. 8: Communication
How would you describe the level of influence of FM professionals towards decision making?

<u>Part 3: General opinions of FM in the property development process</u>

Question 12:

In general, what impact do you think FM can have in the property development process in achieving sustainability?

Question 13:

Do you have any further comment with regard to anything with in our discussion?

Appendix F: Sample of Interview Transcription

TITLE

Interviewee:	No.9
Interviewer:	Rayme
Date:	25th April 2013
Venue	Sheffield

R: [NAME], before I start, I think it would beneficial for me to explain to you what I have done so far. After one year of literature review, I managed to come up with 8 key themes comprise of 33 variables, and as you know FM is a new field but the most growing profession in the UK.

Int. 9: Yes.

R: FM is now extending its scope from a single building, I mean from cleaning and soft services now it's more to the building peripherals and the built environment.

Int. 9: Yes.

R: However, FM was not considered as a strategic factor in property development process.

Int. 9: Yes.

R: So, the purpose of this interview is to gain your experience and your view how to optimise the role of FM in the property development process.

Int. 9: Yes.

R: More importantly is to confirm the critical issues that have been discovered. This interview will take place in three parts. Part one is general involvement in property development process consists of three questions. Part two is critical issues in integrating of FM in to property development process consist of 8 questions and part three is general opinions of FM in property development process.

Int. 9: Ok.

R: Can I start with question number one. Could you please describe your experience and involvement in Facilities Management, Construction and Property Development projects.

Int. 9: I have been involved with Facilities Management since, in a formal way since 1993 when we set the original research unit up here in Sheffield Hallam University. I have been involved with utilising workspace to facilitate business outcomes since 1983. I have been an advisor on various big and small property development projects more than the construction phase of projects per say and that's everything from domestic scale to some of the biggest building PFIs in the country

R: Ok.

Int. 9: And I was also nominated by the BIFM as one of the 20 most influential founders of the discipline.

R: Yes I'm very please to meet a great leader like you, Sir. Thank you for the explanation. For question number two. During your involvement in construction or in Facilities Management who are the key stakeholders you regularly communicate with?

Int. 9: The management of the occupying business assuming its not a spec development, I don't get involved in spec. developments. The users of the property sometimes and the design team.

R: How about your involvement with authority, government authority for example.

Int. 9: Yup. I probably wouldn't be communicating in the commercial world with things like local authority government, planning departments. In the domestic world, yes, I've communicated and done property appeals and I've seen most stages of the dispute resolution process.

R: What key stages of the development process are you predominantly involved in?

Int. 9: The strategic briefing, the change management and sometimes the user familiarisation

R: There are 3 main development process you are predominantly involved in the design process?

Int. 9: Yes.

Int. 9: I am going to give you a different perspective than many of the people who you will be interviewing probably. Go on with your question.

R: For Part Two: Critical issues of integrating FM into the property development process. This question will be related with the list of critical issues that I shared with you, Sir. How do you perceived the role of FM in the property development process.

Int. 9: That's a very tricky question because it depends as some of the papers you've got down there are noting what we are calling FM in practice. If you go back to [NAME] work on the total workplace and the early days of the [NAME] programme and [NAME] version on organisational ecology which you can find in the first chapter of [NAME] and my book. FM was very much an integrator or a translator between the technology providers, the building providers and the architects or other designers and the users. Not so much for the actual project phase of a fit out as for the preconstruction phase and the post-occupancy phase, and I am talking about property being developed for a known user rather than you know property being built with a view to leasing for unknown tenants.

R: When you say building for unknown tenants, what does it mean?

Int. 9: Building, a building for an intended user, rather than a building that is just being put up assuming it will be rented or sold, so cases that are business led rather than developer led.

R: Ok.

Int. 9: And yes, all the seven points that you've got down there hold true and other people including me at various times have said the same thing. If you go back to you ok, something that I did with [NAME] in 2001/2002 something like that, actually most of the business supplying FM wasn't really interested in all this we are the new profession and everything else they were interested in winning business and the people who were most concerned about sticking this professional label on were either the then powers that be or powers that were in BIFM or various academics trying to "beef up", "sex up" the subject. But in the process since FM started with the [NAME] and others of this world around that translation function a lot of its decayed in to either building services engineering and or service management

R: With regards question number five, what sort of competencies do you think FM professionals should have to be recognised in property development industry.

Int. 9: The property development industry would not be the first on my list of the fields that FM should be recognised in yeah. Because the competencies that you typically need to be recognised in the building and property development industry around project management, contract management, surveying and economics are not always to my mind the competencies that FM professionals should be having, exhibiting.

R: To highlight their profile?

Int. 9: Clarity of what is required and at certain levels if the FM professionals are acting, actually acting as client side project managers then clearly high level project management commercial skills that mainly the FM involvement as opposed to the project manager involvement would to my mind come pre-construction or post-construction. This building you're sitting in here was designed as the strategic beginning of a new space and facility strategy for this school and this university and an awful lot of involvement up to the award of the, up to the final design and the award of the production construction contract the only involvement, the only FM other than project management involvement in the construction process itself was when one contractor went broke, in receivership because the university procurement had insisted on taking the cheapest tender. The if you like the missing skill there was the FMs ability to insist on decent procurement

R: Ok, on the theme number three, Regulations. How big is the impact of law enforcement and regulations to help accelerate the integration of FM into the property development process?

Int. 9: Not big at all. Law enforcement, regulations, finance is they're there, whoever deals with them. I don't see that as I know, FMs like claiming that its big and its changing and they cope with it but I think a lot of that is bullshit.

R: What's your view regarding Soft Landings?

Int. 9: The way to win that argument is to convince the people for whom the building is being constructed. The involvement of smart FM early enough will deliver a better result for them.

R: how about PPP,which FM could involve in the development process?

Int. 9: Yes, it can be, probably should be involved. I've seen some very good PPP projects delivered. I've seen some fairly disastrous PPP projects where the eventual users within public sector organisations thought they were having a shed load of money thrown that them and built facilities that were too large or otherwise weren't fit for purpose yeah. Internal FM departments colluded with that. As I say once the property construction process, your property development process starts. Once the actual construction is the drawings are signed off as it were the contract is signed. Its too late in the process to involve FM. FM should be able to challenge what the business is actually constructing in the first place yeah. But that means the skills to translate objectives written in business language to designs expressed in building language.

R: Question number seven regarding with Organisation. Where do you feel the FM function is usually positioned in organisation project. In strategic level or operational?

Int. 9: Usually its positioned at operational.

R: Operational?

Int. 9: Yes. On many projects perhaps it should be positioned strategically but the FM as it has developed over the last twenty years does not position itself strategically very often.

R: Question number eight with regards theme Knowledge Management. Ineffective knowledge transfer or exchange is due to lack of mechanism, professional gap as well as different interests towards projects, which ultimately affects the project itself. From your experience are there internal and external factors involved to this issue?

Int. 9: Yes, definitely. Particularly factors of misunderstanding, mistranslation between different disciplines particularly those aspects of knowledge that are socially and culturally constructed. Huge areas of, well the interplay between perceptions and actions. Misunderstandings, mistrust across the boundary between the construction project and users. See the chapter by [NAME] and [NAME] in [NAME] and [NAME]. [NAME] did his MBA with us and while working part, while working full time he started on a PhD and he was looking at relationships between the organisation and the contractor in a couple of PFI projects. He decided, he got some very interesting data but then decided that he wasn't going to pursue a PhD and went off and became international property, Head of Property for a big law firm instead . But he was ...... so he's specifically written about that question.

R: From your experience in construction projects, how does FM professionals utilise management tools approach such as life cycle costing, life cycle management, building information modelling?

Int. 9: Ummm. A lot. Probably they over rely on those sorts of tools, formal methods and frameworks and under rely on understanding of social construction in general. There has become an over reliance on tangible engineering tools in FM and then under reliance on broadly the human factors

R: Social construction? What do you mean by that, Sir?

Int. 9: There is a developed theory of organisation behaviour, organisation theory, social theory that says that the way we interpret the world, the way we act in it, the way we understand it is a function of what we previously learnt through socialisation, through language and everything yeah. So human behaviour yeah is intensely tied up with belief systems, models, perceptions, these are not the tangible stuff of sort of engineering and wires of buildings.

R: It is very philosophical, Sir.

Int. 9: It is, philosophical. But, it is also probably the best developed sets of organisational theories that there are yeah. If you can just reach the book again and you read that chapter written by [NAME]. She was chair of [ORGANISATION] at the time when she wrote it. Yeah. She is or was an engineer, project manager by trade, by training. You know she wrote that book as to that chapter as to what we need to incorporate in the understanding of the social world for the future development of FMsand it will explain social construction there better than I can in a few words.

R: That will answer my question number nine?

Int. 9: Yes. All that comes in question number nine. Many people will define it in terms of service level agreements and failure to comply you know long complicated lists of KPIs many of those don't actually tell you whether the building is meeting the needs of the users.

R: Question number ten is regarding with Operations. Operations are the prerequisite for buildings to function satisfactorily and often related to the supply and maintenance of the building.

Int. 9: Yes.

R: How do you define that, Sir?

Int. 9: Sorry, see my last remark about service level agreement and KPIs was aimed at question number ten.

R: When you say KPI, is it related with post-occupation evaluation in the building. What do you think about that, Sir?

Int. 9: Sometimes it is related with KPI. Many post-occupancy evaluations get far too concerned about evaluating the building as a building and far less interested in evaluating the building as a means to a business objective. Actually, often it is not expressed in terms of satisfaction, it is usually expressed in terms of notional meeting of space standards, cost per square metre standards. The measurement of satisfaction can be very difficult and is easily distorted.

R: POE is a bad way how to assess the project performance?

Int. 9: I didn't say that, I didn't say that. A lot of what gets done in the name of POE is a waste of time, space and money yeah. That doesn't mean that all POE is a bad idea.

R: Ok.

Int. 9: I have seem elaborate schemes for POE exercises that look totally how the project delivered and construction KPIs and that sort of thing and don't ask whether the building is doing what it was supposed to do. Yeah I could take you, well I couldn't take you I know of a big health centre constructed under a PPI, constructed very well, met all of the design criteria. Sailed through a conventional POE. The demand for services from that building was less than half what was predicted so the building was 50% utilised. The constructor got their money, the tax payer via the health service lost out. And the POE process didn't scratch asking those sorts of questions

R: Thank you, Sir. For question number eleven, theme Communication. How would you describe the level of influence of FM professionals towards decision making?

Int. 9: should be critical but usually isn't because too many FM professionals express their contribution towards decision making in building terms not business terms. There's a very respectable profession called civil engineering and there's the chartered institute of building services engineers yeah. And FM should not be trying to replicate what either of those two groupings does yeah, frequently it tries to with people who are less well qualified than the building services engineers or others.

R: I'm quoting from my findings from other interview. They mentioned that FM should try to get their charteredship. Is that you mean by replicate, Sir?

Int. 9: I am not sure that it will actually make that much difference. I see RIBA and RICS and BIFM and IFMA squabbling over frameworks and becoming the sort of dominant position maker that strategic. FM I would say is around this translation role between those different professional groups, you could call it brokering, brokering relationships between different professional groups so. And I mentioned that paper I wrote with [NAME] some time ago. The people pushing for this professionalism tend to be those who think their own status would be enhanced if FM was recognised as a profession. I don't know who you've interviewed and I won't ask but do look up that [NAME] advice paper in Facilities yeah. He investigated precisely that issue

R: On part three, question number twelve. In general, what impact do you think FM can have in property development process in achieving sustainability?

Int. 9: Build half as much building. The best way, the most sustainable building is a green field. So the biggest sustainability impact is to provide the necessary business from as small a built footprint as possible, instead of which we build fancy buildings without considering the embodied imaging.

R: Last question, do you have any further comment with regard anything with our discussion?

Int. 9: No. I don't think so, I think its been a useful welcome strategic exercise.

R: Thank you very much, Sir. That is the end of our interview session.

Appendix G: Sample of Questionnaire

Optimising the Role of Facilities Managers (FM) in the Property Development Process (DP)

INTRODUCTION

This survey is part of a PhD research project at Liverpool John Moores University (LJMU). The survey is intended to obtain your opinion about the factors that enable Facilities Managers to integrate effectively into the various stages of the property development process.

You are asked to consider various factors of the role Facilities Managers play in the property development process through two perspectives:

i. **Perceived importance** – The statements relate to your feelings about the quality Facilities Managers should have / or what they should do to enable them to integrate effectively into the development process.

ii. **Perceived level of integration** – The statements relate to your expectation and the extent to which the factors would influence the level of integration.

It will take approximately 10 to 15 minutes to complete the survey.

Data protection: All data provided will be treated in confidence. You will remain anonymous throughout the data analysis and the results.

Please return the completed survey using the self-addressed stamped envelope provided. If you have any queries please feel free to contact Mohd Rayme Anang Masuri, Postgraduate Researcher at Liverpool John Moores University at M.R.Bin-Anang-Masuri@2011.ljmu.ac.uk and/or call 0777 444 0643.

Thanks for your support.

Kind regards,

Mohd Rayme Anang MasuriDr. Matthew Tucker
Postgraduate Researcher Senior Lecturer
Liverpool John Moores UniversityLiverpool John Moores University

SECTION A: Professional Background

This section aims to record your professional background. Kindly tick (√) the relevant box.

Please specify your current designation

- ☐ Civil Engineer
- ☐ Quantity Surveyor
- ☐ Building Services Engineer
- ☐ Architect
- ☐ Facilities Manager
- Other (please state): ....

Are you a member of any professional body? ☐ Yes ☐ No
(You may tick (√) more than one)

- ☐ Institution of Civil Engineers (ICE)
- ☐ Royal Institute of Chartered Surveyors (RICS)
- ☐ Chartered Institution for Building Services Engineers (CIBSE)
- ☐ Royal Institute of British Architects (RIBA)
- ☐ British Institute of Facilities Management (BIFM)
- Other (please state): ....

Please specify the type of organisation you are working for

- ☐ Client / Owner
- ☐ Developer / Contractor
- ☐ Consultant
- ☐ Manufacturer
- ☐ Supplier
- Other (please state): ....

Please specify the sector of organisation you are working for

- ☐ Public
- ☐ Private
- Other (please state): ....

Please specify your working experience (years): ....

Please specify your level of involvement in the development process
(Based on the RIBA Plan of Work 2013)
(You may tick (√) more than one)

- ☐ Stage 0-Strategic Definition
- ☐ Stage 1-Preparation and Brief
- ☐ Stage 2-Concept Design
- ☐ Stage 3-Developed Design
- ☐ Stage 4-Technical Design
- ☐ Stage 5-Construction
- ☐ Stage 6-Handover and Close Out
- ☐ Stage 7-In Use

Section B: Critical Success Variables

The table below contains critical factors essential to enable Facilities Managers to play a significant role in the property development process. The statements are assessed from two perspectives: perceived importance and perceived level of integration.

a) **Perceived importance**: The statements relate to your feelings about the quality Facilities Managers should have / or what they should do to enable them to integrate effectively into the development process.

b) **Perceived level of integration**: The statements relate to your expectation and the extent to which the factors would influence the level of integration.

Please complete the two scales below by circling the relevant numbers.

PERCEIVED IMPORTANCE						PERCEIVED LEVEL OF INTEGRATION				
Very unimportant	Unimportant	Fairly important	Important	Very important		Very low	Low	Medium	High	Very high
					Competences – FM having possession of required individual skills and knowledge					
1	2	3	4	5	Having adequate experience in building maintenance	1	2	3	4	5
1	2	3	4	5	Having adequate knowledge about construction phases	1	2	3	4	5
1	2	3	4	5	Having adequate knowledge in construction procurement	1	2	3	4	5
1	2	3	4	5	Ability to give clear instructions to others in the project team	1	2	3	4	5
1	2	3	4	5	Get involved in continuous professional development activity	1	2	3	4	5
1	2	3	4	5	Ability to anticipate the operational consequences of design and construction decision	1	2	3	4	5
1	2	3	4	5	Ability to champion lean construction practice	1	2	3	4	5
					Strategic role – FM having the ability to play an effective role within and outside the organisation					
1	2	3	4	5	Having a good rapport with client	1	2	3	4	5
1	2	3	4	5	Having a good rapport with third party (local authority)	1	2	3	4	5
1	2	3	4	5	Having trust from other professionals	1	2	3	4	5
1	2	3	4	5	Having a seat at the table at senior management level	1	2	3	4	5

PERCEIVED IMPORTANCE						PERCEIVED LEVEL OF INTEGRATION				
Very unimportant	Unimportant	Fairly important	Important	Very important		Very low	Low	Medium	High	Very high
					Development scheme – FM having the ability to adapt to various construction schemes e.g. Public Private Partnership (PPP) and Government Soft Landings (GSL)					
1	2	3	4	5	Having familiarity with the GSL scheme	1	2	3	4	5
1	2	3	4	5	Willing to anticipate operational issues in PPP project development	1	2	3	4	5
					Strategic value – FM having the ability to demonstrate strategic value and uniqueness					
1	2	3	4	5	Understand user's organisational strategy	1	2	3	4	5
1	2	3	4	5	Get involved in briefing stage	1	2	3	4	5
1	2	3	4	5	Take a leadership role in the client organisation as an advisor	1	2	3	4	5
1	2	3	4	5	Proactive in ensuring end users satisfaction	1	2	3	4	5
1	2	3	4	5	Establish Key Performance Indicators (KPI) of FM at all stages	1	2	3	4	5
1	2	3	4	5	Actively collaborate with users during handing over period	1	2	3	4	5
1	2	3	4	5	Having chartered status	1	2	3	4	5
1	2	3	4	5	Ability to present service level agreement of FM operations at design stage	1	2	3	4	5
					Management Tools – FM having the ability to use reliable tools					
1	2	3	4	5	Ability to apply life cycle costing in the selection of materials/equipment	1	2	3	4	5
1	2	3	4	5	Ability to contribute to Building Information Modelling (BIM) at all stages	1	2	3	4	5
1	2	3	4	5	Ability to apply Computerised Aided Facilities Management (CAFM)	1	2	3	4	5
1	2	3	4	5	Having familiarity with BRE Environmental Assessment Method (BREEAM)	1	2	3	4	5
1	2	3	4	5	Having a mechanism to communicate with end users about their requirements at all stages	1	2	3	4	5
					Knowledge Management – FM having the willingness to learn, share and transfer knowledge					
1	2	3	4	5	Commitment to training on operational aspects during handing-over phase	1	2	3	4	5
1	2	3	4	5	Proactive in managing design changes	1	2	3	4	5
1	2	3	4	5	Willingness to share information with others	1	2	3	4	5
1	2	3	4	5	Willingness to learn from others (openness to ideas)	1	2	3	4	5
1	2	3	4	5	Having a comprehensive facilities maintenance records	1	2	3	4	5

PERCEIVED IMPORTANCE						PERCEIVED LEVEL OF INTEGRATION				
Very unimportant	Unimportant	Fairly important	Important	Very important		Very low	Low	Medium	High	Very high
					Post-occupancy evaluation (POE) – FM being able to exploit POE results to optimise building performance					
1	2	3	4	5	Ability to implement POE	1	2	3	4	5
1	2	3	4	5	Ability to lead in handling POE database development	1	2	3	4	5
1	2	3	4	5	Ability to balance the positive and the negative criticism in the POE reports	1	2	3	4	5
1	2	3	4	5	Ability to transfer POE outcomes in a project to briefing stage of other project	1	2	3	4	5
					Sustainability – FM having the ability to optimise space and demonstrate sustainability philosophy					
1	2	3	4	5	Ability to take the lead in refurbishment works	1	2	3	4	5
1	2	3	4	5	Ability to take the lead in mobile flexible working patterns	1	2	3	4	5
1	2	3	4	5	Involved in selection of construction materials/equipment	1	2	3	4	5
1	2	3	4	5	Knowledgeable about regard to sustainable initiatives (Green Agenda, recycling philosophy etc.)	1	2	3	4	5

Thank you for your support.

Appendix H: Online Survey

Optimising the Role of Facility Managers (FM) in the Property Development Process (DP)

LIVERPOOL JOHN MOORES UNIVERSITY

Page 1 of 5

INTRODUCTION

This survey is part of a PhD research project at Liverpool John Moores University (LJMU). The survey is intended to obtain your opinion about the factors that enable Facility Managers to integrate effectively in the various stages of the property development process.

You are asked to consider various factors affecting the role Facility Managers play in the property development process through two perspectives:

i. **Perceived importance** - the statements relate to your feelings about the attributes Facility Managers should have to enable them integrate effectively in the development process.

ii. **Perceived level of integration** - the statements relate to your expectation and the extent to which the factors would influence the level of integration.

It will take approximately 10 minutes to complete the survey.

Data protection: All data provided will be treated in confidence. You will remain anonymous throughout the data analysis and the results.

Note that once you have clicked on the CONTINUE button at the bottom of each page you can not return to review or amend that page.

We count on your collaboration.

Thank you.
Kind regards,
Mohd Rayme Anang Masuri
Postgraduate Researcher
Liverpool John Moores University

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Optimising the Role of Facility Managers (FM) in the Property Development Process (DP)

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DEMOGRAPHIC

Note that once you have clicked on the CONTINUE button your answers are submitted and you can not return to review or amend that page

PROFESSIONAL BACKGROUND

This section aims to record your professional background.

1. Please specify your current designation

- Civil Engineer
- Quantity Surveyor
- Building Services Engineer
- Architect
- Facility Manager
- Other *(please specify)*:

2. Are you a member of any professional body?

Yes No

(select all that apply)

- Institution of Civil Engineers (ICE)
- Royal Institute of Chartered Surveyors (RICS)
- Chartered Institution for Building Services Engineers (CIBSE)
- Royal Institute of British Architects (RIBA)
- British Institute of Facilities Management (BIFM)
- Other *(please specify)*:

3. Please specify the type of organisation you are working for

- Client / Owner
- Developer / Contractor
- Consultant
- Authority Agency
- Manufacturer
- Supplier
- Other *(please specify)*:

4. Please specify the sector of organisation you are working for

- Public
- Private
- Other *(please specify)*:

5. Please specify your working experience (years)

6. Please specify your level of involvement in the development process (based on RIBA Plan of Work 2013) *(select all that apply)*

- Stage 0-Strategic definition
- Stage 1-Preparation and brief
- Stage 2-Concept design
- Stage 3-Developed design
- Stage 4-Technical design
- Stage 5-Construction
- Stage 6-Handover and close out
- Stage 7-In use

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CRITICAL FACTORS

The table below contains critical factors essential to enable Facility Managers to play a significant role in the development process.

PERCEIVED IMPORTANCE

The statements are assessed to measure **PERCEIVED IMPORTANCE**, in which relate to your feelings about the attributes Facility Managers should have to enable them to integrate effectively in the development process.

7. Competence - *FM having possession of required individual skills and knowledge*

	PERCEIVED IMPORTANCE				
	Very unimportant	Unimportant	Fairly important	Important	Very important
a. Having adequate experience in building maintenance	○	○	○	○	○
b. Having adequate knowledge about construction phases	○	○	○	○	○
c. Having adequate knowledge in construction procurement	○	○	○	○	○
d. Ability to give clear instructions to others in the project team	○	○	○	○	○
e. Get involved in continuous professional development activity	○	○	○	○	○
f. Ability to anticipate the operational consequences of design and construction decision	○	○	○	○	○
g. Ability to champion lean construction practice	○	○	○	○	○

8. Strategic role - *FM having the ability to play effective role within and outside the organisation*

	PERCEIVED IMPORTANCE				
	Very unimportant	Unimportant	Fairly important	Important	Very important
a. Having a good rapport with client	○	○	○	○	○
b. Having a good rapport with third party (local authority)	○	○	○	○	○
c. Having trust from other professionals	○	○	○	○	○
d. Having a seat at the table at senior management level	○	○	○	○	○

9. Development scheme - *FM having the ability to adapt with various construction scheme i.e. Public Private Partnership (PPP) and Government Soft Landings (GSL)*

	PERCEIVED IMPORTANCE				
	Very unimportant	Unimportant	Fairly important	Important	Very important
a. Having familiarity with GSL scheme					
b. Willing to anticipate operational issues in PPP project development					

10. Strategic value - *FM having the ability to demonstrate strategic value and uniqueness*

	PERCEIVED IMPORTANCE				
	Very unimportant	Unimportant	Fairly important	Important	Very important
a. Understand user's organisational strategy					
b. Get involved in briefing stage					
c. Take a leadership role in the client organisation as an advisor					
d. Proactive in ensuring end users satisfaction					
e. Establish Key Performance Indicators (KPI) of FM at all stages					
f. Actively collaborate with users during handing over period					
g. Having chartership status					
h. Ability to present service level agreement of FM operations at design stage					

11. Management Tools - *FM having the ability to use reliable tools*

	PERCEIVED IMPORTANCE				
	Very unimportant	Unimportant	Fairly important	Important	Very important
a. Ability to apply life cycle costing in the selection of materials/equipment					
b. Ability to contribute to Building Information Modelling (BIM) at all stages					
c. Ability to apply Computerised Aided Facilities Management (CAFM)					
d. Having familiarity with BRE Environmental Assessment Method (BREEAM)					
e. Having mechanism to communicate with end users about their requirements at all stages					

12. Knowledge Management - *FM having willingness to learn, share and transfer knowledge*

	PERCEIVED IMPORTANCE				
	Very unimportant	Unimportant	Fairly important	Important	Very important
a. Commitment to training on operational aspects during handing over phase					
b. Proactive in managing design changes					
c. Willingness to share information with others					
d. Willingness to learn from others (openness to ideas)					
e. Having a comprehensive facilities maintenance records					

13. Post-occupancy evaluation (POE) - *FM being able to exploit POE results to optimise building performance*

	PERCEIVED IMPORTANCE				
	Very unimportant	Unimportant	Fairly important	Important	Very important
a. Ability to implement POE					
b. Ability to lead in handling POE database development					
c. Ability to balance the positive and the negative criticism in the POE reports					
d. Ability to transfer POE outcomes in a project to briefing stage of other project					

14. Sustainability - *FM having the ability to optimise space and demonstrate sustainability philosophy*

	PERCEIVED IMPORTANCE				
	Very unimportant	Unimportant	Fairly important	Important	Very important
a. Ability to take lead of refurbishment works					
b. Ability to take lead in mobile flexible working patterns					
c. Involve in selection of construction materials/equipment					
d. Knowledgeable with sustainable initiative (Green Agenda, recycling philosophy etc.)					

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Optimising the Role of Facility Managers (FM) in the Property Development Process (DP)

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CRITICAL FACTORS

The table below contains critical factors essential to enable Facility Managers integrate effectively in the development process.

PERCEIVED LEVEL OF INTEGRATION

The statements are assessed from **PERCEIVED LEVEL OF INTEGRATION** in which relate to your expectation and the extent to which the factors would influence the level of integration.

15. Competence - *FM having possession of required individual skills and knowledge*

	PERCEIVED LEVEL OF INTEGRATION				
	Very low	Low	Medium	High	Very high
a. Having adequate experience in building maintenance					
b. Having adequate knowledge about construction phases					
c. Having adequate knowledge in construction procurement					
d. Ability to give clear instructions to others in the project team					
e. Get involved in continuous professional development activity					
f. Ability to anticipate the operational consequences of design and construction decision					
g. Ability to champion lean construction practice					

16. Strategic role - *FM having the ability to play effective role within and outside the organisation*

	PERCEIVED LEVEL OF INTEGRATION				
	Very low	Low	Medium	High	Very high
a. Having a good rapport with client					
b. Having a good rapport with third party (local authority)					
c. Having trust from other professionals					
d. Having a seat at the table at senior management level					

17. Development scheme - *FM having the ability to adapt with various construction scheme i.e. Public Private Partnership (PPP) and Government Soft Landings (GSL)*

	PERCEIVED LEVEL OF INTEGRATION				
	Very low	Low	Medium	High	Very high
a. Having familiarity with GSL scheme					
b. Willing to anticipate operational issues in PPP project development					

18. Strategic value - *FM having the ability to demonstrate strategic value and uniqueness*

	PERCEIVED LEVEL OF INTEGRATION				
	Very low	Low	Medium	High	Very high
a. Understand user's organisational strategy					
b. Get involved in briefing stage					
c. Take a leadership role in the client organisation as an advisor					
d. Proactive in ensuring end users satisfaction					
e. Establish Key Performance Indicators (KPI) of FM at all stages					
f. Actively collaborate with users during handing over period					
g. Having chartership status					
h. Ability to present service level agreement of FM operations at design stage					

19. Management Tools - *FM having the ability to use reliable tools*

	PERCEIVED LEVEL OF INTEGRATION				
	Very low	Low	Medium	High	Very high
a. Ability to apply life cycle costing in the selection of materials/equipment					
b. Ability to contribute to Building Information Modelling (BIM) at all stages					
c. Ability to apply Computerised Aided Facilities Management (CAFM)					
d. Having familiarity with BRE Environmental Assessment Method (BREEAM)					
e. Having mechanism to communicate with end users about their requirements at all stages					

20. Knowledge Management - *FM having willingness to learn, share and transfer knowledge*

	PERCEIVED LEVEL OF INTEGRATION				
	Very low	Low	Medium	High	Very high
a. Commitment to training on operational aspects during handing over phase					
b. Proactive in managing design changes					
c. Willingness to share information with others					
d. Willingness to learn from others (openness to ideas)					
e. Having a comprehensive facilities maintenance records					

21. Post-occupancy evaluation (POE) - *FM being able to exploit POE results to optimise building performance*

	PERCEIVED LEVEL OF INTEGRATION				
	Very low	Low	Medium	High	Very high
a. Ability to implement POE					
b. Ability to lead in handling POE database development					
c. Ability to balance the positive and the negative criticism in the POE reports					
d. Ability to transfer POE outcomes in a project to briefing stage of other project					

22. Sustainability - *FM having the ability to optimise space and demonstrate sustainability philosophy*

	PERCEIVED LEVEL OF INTEGRATION				
	Very low	Low	Medium	High	Very high
a. Ability to take lead of refurbishment works					
b. Ability to take lead in mobile flexible working patterns					
c. Involve in selection of construction materials/equipment					
d. Knowledgeable with sustainable initiative (Green Agenda, recycling philosophy etc.)					

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Final Page

Thank you for completing this survey.

Appendix I: Amalgamation of literature review and interview analysis – Identifying the best practices

Variables created from literature review	Direct narratives	Interviewee	New / Retained / Revised / Removed	Alternative narratives	Interviewee	Revised variables (analysis from literature review and interview)	Comments	Items
T2: Competences								
T2.1 Absence of comprehensive FM academic program	-	-	Revised	*'I think it is more to do as well having the qualification, its greater engagement and understanding of FM and what FM can bring to organisations…'*	4	T2.1 (a) Lack of initiative to promote FM professional development program	There are many options to enhance the FM qualifications through BIFM, RICS or other University's program such as Applied Facilities Management (MSc) program. Nevertheless the structure of the programme need more attractive element and extensive promotion Damgaard and Erichsen (2009) advocates, education is a long term solution to enable effective integration of facilities managers in the development process.	Get involved in continuous professional development activities
				'… BIFM qualifications from level 3 to level 7 so there's for the first time a career path or a qualification path for Facilities Management which I think is very good.'	3			
				'… I think programs like Liverpool JMUs MSc and the other MSc's are great in developing a capability…'	2			
				'… but it do feel that for the future perhaps some kind of communication skills and management skills being part of the overall FM qualifications …'	1			
				'… form of entrance examination or entrance assessment which would lead with anybody with a certain credential from an FM body that anybody could differentiate them between perhaps somebody who is not a Facilities, a competent Facilities Manager …'	10			

Variables created from literature review	Direct narratives	Interviewee	New / Retained / Revised / Removed	Alternative narratives	Interviewee	Revised variables (analysis from literature review and interview)	Comments	Items
T2.2 Scarcity of FM professional development in the organisations	*'I think the lack of a professional qualification as such can help the perception of FM quite difficult within the UK'.* *'But by the same token I'm still sceptical that you can get a professional qualification that's recognised by all because of the whole variety of different roles with FM you know that all fall under the FM umbrellas it is very difficult …'*	4	Removed	-	-	-	Interviewee 3 and 4 opined that Facility Managers need to enhanced their qualification by enrol to formal academic program offered by higher learning institution or attend competency training organised by relevant professional bodies. The discussion is more focus on T2.1	-
	'… will then dispel some of the myths around Facilities Managers not having you know the suitable requirements, suitable qualifications, knowledge, experience, intelligence to carry out their tasks.	3						
T2.3 Lack of facility manager experience in property development industry	*'… if you like the missing skill there was the FMs ability to insist on decent procurement.'*	9	Retained			T2.2(a) Lack of facility manager experience in property development industry	Interviewee 8 insists the facility managers require an adequate knowledge about building construction. This is also emphasised by Damgaard and Erichsen (2009) Interviewee 9 insists the facilities managers require decent procurement knowledge	Having adequate experience in building maintenance Having adequate knowledge about construction work Having adequate knowledge in procurement law
	'I think the other thing is facilities managers they have to have a kind of some basic understanding of the construction.' *'… how much the facilities managers understands the brief, how much the facilities managers understand the building construction and how much the facilities managers have experience in life cost and maintenance cycle of the facilities.'*	8						

Variables created from literature review	Direct narratives	Interviewee	New / Retained / Revised / Removed	Alternative narratives	Interviewee	Revised variables (analysis from literature review and interview)	Comments	Items
T2.4 Lack of serviceability and operational consideration in design	*'… what happened with the banks last year when their data centre went down for five days and the bad publicity that generated … so that the link that FM has got really in terms of supporting their core businesses are crucial.'* *'… for example the university work at some of the properties that we work at there's some very important research material that's been done that needs to be kept at certain temperatures and humidity levels. They are critical environments and if things went wrong and there wasn't the backup strategy, a year's worth of research could be lost within a few hours. So you know criticality of environments is really key and we check that FM plays a massive role in …'* *'… a lot of Facilities Managers don't understand the technical performance of it …'*	4	Retained	-		T2.3(a) Lack of serviceability and operational consideration in design	Damgaard and Erichsen (2009) suggested an ignorance of literature on the operation is the barriers that hinder the integration of FM in the development process. Therefore, it is essential for facilities manager s to demonstrate operational elements in the design. FM are often told to cut their budgets without reference to the causal chain of consequences to the operations and productivity. FM has become a commodity rather than a professional skill. FM is unable to analyse and report on the consequences of the budget cutting (Ware and Carder 2012)	Ability to anticipate the operational consequences of design decision

Variables created from literature review	Direct narratives	Interviewee	New / Retained / Revised / Removed	Alternative narratives	Interviewee	Revised variables (analysis from literature review and interview)	Comments	Items
	'One is the physical wellbeing, one is the environmental wellbeing. I think facilities managers have to be knowledgeable in both sets of the building. The physical side of the building that is probably got to do with your maintenance, how you clean it, how you service, how you use the space, how do you see how the regulation side of it. The other side is the environment side of it which is about the energy, the quality of the air or stuff like that you know.' *'… I think maybe facilities managers can assist the lack of less of sensitivity in the operational.'* *'Sometimes it been neglected by the designers because it been neglected by the client itself because of costing or what. Maybe in that sense facilities can assist which is good for the client in term for the operational I mean from the maintenance.'*	8						
T2.5 Lack of communicative skill and prestige	*'So it is quite a demanding, I mean a deep pool of knowledge there they need to have so no it is not an easy job by any means in terms of that. But despite in terms of that, you don't need to be an expert in all of those fields because if you use your contractors well you tap in to their knowledge and understanding and that's what they're there for.'*	4	Retained	*'So I think for me I'm very passionate about having Facilities Management involved in the early stages of the design process because it can show real benefit and I think it is more of a communications process*	3	T2.4(a) Lack of communication skills	Damgaard and Erichsen (2009) highlighted the lack of communicative skills of FM staff is one of the factor that hinder the integration of FM in the development process. Sun and Scott (2005) emphasises on the inability to communicate among facilities managers. This involves the skills in expressing effectively any thoughts or information in the	Ability to give clear instructions to other professionals

Variables created from literature review	Direct narratives	Interviewee	New / Retained / Revised / Removed	Alternative narratives	Interviewee	Revised variables (analysis from literature review and interview)	Comments	Items
	'... a lack of communicative skill and prestige is perceived but I don't think that's a reality. I think the reality is that most FM managers whether they realise it or not are probably very good communicators and probably quite skilled communicators but it do feel that for the future perhaps some kind of communication skills and management skills being part of the overall FM qualifications' *'...you have to be able to communicate from your workers right up to board room level.'*	1		*'...project management want to get the building built and handed over. The project management view is not always that interested in the life cycle of the building. Whereas, the Facilities Manager would be interested in that, that's their job.'*	7		mind, causes difficulties to draw attention of the project team. According to Pitt and Hinks (2001) the differing objectives between facilities managers and project managers are traditionally divide their role. They should have the same understanding of organisational/project objectives. Having a clear, concise and unambiguous instruction would lead to good working practice. Jensen (2008) claimed facilities managers is incapable to be a dialogue partner in the design process. Shah (2007) claims that greater involvement of FM in the development process require the skills to communicate ideas effectively.	
	'I think there's another barrier to that though and it is only partially communication.'	2						

Variables created from literature review	Direct narratives	Interviewee	New / Retained / Revised / Removed	Alternative narratives	Interviewee	Revised variables (analysis from literature review and interview)	Comments	Items
T2.6 Less sensitivity of the designer to operational requirements	-	-	Removed	-	-	-	Item T2.6 was discussed in T2.4 in which the facilities manager should play a big role to speak on behalf of client and end users who do not have the necessary technical knowledge and do not know how to express their business requirements in the discussions and meetings (Damgaard and Erichsen 2009)	-
-	-		New	*'… we have a number of mechanisms in place from a design management perspective so we have a number set things that we would implement in order to help us manage the design process.'* *'There is a bit of flexibility …'* *'… there is four steps in our collaborative client processes. And that workshop is basically involves relevant parties in relation to particular aspects of the business design.'* *'So all those relevant parties that provide a forum basically to critic certain aspects of the design …'* *'So our mechanisms do provide a bit of flexibility in terms of integrating other people in to the process.'*	5	T2.6(a) Adaptation of lean construction practice	Koskela (1992) suggested property development industry to adopt lean production philosophy in improving the competetiveness by identifying and elminating non-value activities in the process. This was recommended by Interviewee 5 who claimed there is an activity to critic certain aspects of the design in which would eliminate non-value elementsto the development process.	Ability to champion lean construction practice

Variables created from literature review	Direct narratives	Interviewee	New / Retained / Revised / Removed	Alternative narratives	Interviewee	Revised variables (analysis from literature review and interview)	Comments	Items
				'So by having an FM as part of that knowledge base, the team will be able to input his knowledge in to the project from the beginning which could eliminate some of the problems that an operator is going to encounter once that building is operational	1			

Variables created from literature review	Direct narratives	Interviewee	New / Retained / Revised / Removed	Alternative narratives	Interviewee	Revised variables (analysis from literature review and interview)	Comments	Items
T4: Strategic role (Organisations)								
T4.1 Huge complexity and temporary involvement with different interest	*'It is quite correct, it is a very complex role …'* *'I would say most companies today the FM doesn't have much input in to senior management level or influence decision. However I must say that my organisation where I work we are specifically brought in to strategic meeting looking at the future of the organisation.'* *So before big decisions are made the entire team is consulted which includes the FM.'*	1	Revised	*'They need to be educated around what the benefits are'*	3	T4.1(a) FM is not in strategic position in organisation	Elmualim et al. (2010) claims lack of understanding and commitment of senior executive causes the expertise of facilities managers being abandoned. Therefore, Damgaard and Erichsen (2009) suggested facilities managers to develop confidence by share the experiences. On the other hand, it also educational challenge to other professional in the development process, giving them the tools to educate other professionals to understand in what areas and when facilities managers can contribute in the development process. In line with Interviewee 3, there is a need to have an effective mechanism to educate around what the benefits of having FM in the decision making	Having a sit at a table in management level to share the experience
	'In public sector, FM professional sits in higher level compared to FM professionals in private sector.' *'Property and FM does not appear to have any impact in the decision that an organisation takes so you almost wonder how they come to a decision that they need to go in to the development process to start off with without having that strategic input.'*	2		*'… how could you persuade a developer to take a risk on something that's new that could have good long term effects if they don't have a track record so it probably has a slightly negative effect on innovation as well, in construction.'*	2			
	'Good clients, good consultants, good organisations that understands property, understands whole life cost, that is not the case.'	3						
	'FMs getting more involved in strategic decisions in terms of the equipment that will be installed and the green technology …' *'I think FM is getting more involved in that and giving advice …'*	4						
	'If you ask the person work as the contractor how would you describe the level of influence FM professionals have towards decision making they will turn around and say none.'	5						

Variables created from literature review	Direct narratives	Interviewee	New / Retained / Revised / Removed	Alternative narratives	Interviewee	Revised variables (analysis from literature review and interview)	Comments	Items
	'… they have just been made aware of decisions that are being made …'	6						
T4.2 Offensive to individual professions	*'I think things are changing, slowly but they are changing.'*	1	Removed	-	-	-	This issue is unfavourable to most of the participants.The discussion on this matter is discouraging as Interviewee 1 concluded the culture is changing and the professionalism is increasing. Form further discussion, sharing of values and interests is increasing among professionals (refer Interviewee 8). This theme is considered irrelevent, therefore it was removed	-
T4.3 Client's focus on capital investment, neglects FM costs.	*'… no I disagree with that …'* *'… clients are now focused on the whole life costs …'* *'So they're looking at investment profiling, operational costs of buildings, utility costs and so on.'*	3	Removed	-	-	-	This issue is unfavourable to most of the participants.The discussion on this matter is discouraging as Interviewee 3 disagree with the theme. He argued that operational costs is also taken into consideration in investment providing new facilities. No further discussion on this matter therefore it was removed	-
-	-	-	-	-	-	T4.2(a) Lack of trust between all parties due to internal tendering competition within PPP structure	Damgaard and Erichsen (2009) claimed other than PPP, partnering is a possible solution to get FM in to the development process. Nevertheless, the element of trust between FM and other parties will ensure the long lasting relationship.	Having trust from other professionals
T8.2 Inability to coordinate and gather the knowledge within team	-	-	Revised	*'FM should be positioned in senior management level for effective decision making.'*	1	T4.3(a) Level of FM influence in the decision making	-	Having a good rapport with client organisation Having a good rapport with third party (local authority)
				'In public sector-senior people with FM responsibility will be part of the decision making process.' *'In private sector-FM person within the business will be generally at a lower level.'*	2			

Variables created from literature review	Direct narratives	Interviewee	New / Retained / Revised / Removed	Alternative narratives	Interviewee	Revised variables (analysis from literature review and interview)	Comments	Items
				'Temporary post for FM professional in private organization.'				
				'FM can really have influence towards innovation in working practices and flexible working.' *'FM are only as good to influence as the information obtained and knowledge sharing.'*	4			
				'FM is important at the back end of the development process.' *'In PFI project FM is important as the contractor is the operator of the building.'* *'In contractor side, FM influence towards decision making is none.'*	5			
				'Knowledgeable client on FM would appreciate the presence of FM in the decision making that subsequently influence the operational behavior.' *'The involvement of FM is driven by the project scheme, contractor driven or client driven project.'*	6			
				'During the operational phase FM would have a much greater influence.' *'In the planning stage FM professionals would have quite low level of influence.'*	7			
				'Anybody have the most knowledge and experience will have the biggest influence on the decision making.'	8			

Variables created from literature review	Direct narratives	Interviewee	New / Retained / Revised / Removed	Alternative narratives	Interviewee	Revised variables (analysis from literature review and interview)	Comments	Items
T3: Development scheme (Regulations)								
T3.1 Unconvincing PPP implementation ability	*'… I don't think that the owner or the investor has received good value for money.* *'… and that's why I find these PPPs quite not effective financially.'* *'… but I think they need to be looked at in a lot more detail as far as the ongoing life of the building and what it is costing the owner or the investor.'*	1	Revised	-	-	T3.1(a) Implementation of PPP	Based on the respondents comment it can be concluded that PPP is not favourable in bringing FM to the forefront in the property development industry. In line with Interviewee 2 and 3 is Baldwin (2003) who appreciate the contribution of PPP that allows FM to extend their role from traditional areas as well as enhanced the function of life cycle costing.	Willing to deal with operational problems in Public Private Partnership (PPP) project scheme
	'… PPP theoretically should be a champion to incorporating Facilities Management in to projects. In the recent history it doesn't …' *'But if you wanted me to talk about PPP specifically, we are maybe in the infancy of this and I think we have a lot to learn and I think contractors would hold their hands up if they could speak honesty we're not the best at producing buildings that are FM friendly.'*	10						
	'… because constructors had to take the risk of the cost of that building over the thirty years PFI/PPP has its distracters …' *'… the biggest benefit of PFI/PPP thing without a shadow of a doubt is that constructors are having to take the risk of the ongoing construction, the ongoing building …'* *'…PPP has done for the construction industry, it is actually brought Facilities Management and life cycle costing to the forefront.'*	3						
	'I've seen some very good PPP projects delivered. I've seen some fairly disastrous PPP projects where the eventual users within public sector organisations thought	9						

Variables created from literature review	Direct narratives	Interviewee	New / Retained / Revised / Removed	Alternative narratives	Interviewee	Revised variables (analysis from literature review and interview)	Comments	Items
	they were having a shed load of money thrown to them and built facilities that were too large or otherwise weren't fit for purpose.'.							
	'The fact that the PPP contracts that it takes life cycle risks is positive.' *'…however there is still lack of enough data out there for developers and the consultants that are supporting them to be able to predict accurately the long term costs …'*	2						
T3.3 Recently emergence of soft-landings concept	*'Soft Landing is something, a buzz phrase at the moment that I only heard about this week.'* *'I've never heard of a Soft Landing before.'* *'… it needs strong support from the government, from BIFM definitely and if they've got that and they have the strength and will to drive this then, and like you say it's the biggest growing professional body …'*	10	Revised	-		T3.2(a) Recently emergence of Government Soft-Landings (GSL) concepts	BIFM (2012) affirms, in essence GSL is implemented to ensure the involvement of facilities managers in the development process. As a results, this will improve the performance of the buildings and fulfil the end users requirements. GSL is intend to engage FM in the early stage of the development process, consider operational elements in the design process, continuous commitment to post-completion and aftercare and usage evaluation for knowledge. With GSL, the role of FM enhanced to the strategic level in the development process (Ware and Carder 2012)	Having a good understanding of Soft Landings concept
	'So if you look at the likes of the (organization society) and their new headquarters building in (location), their design team had FM input from the very beginning and it was very much a Soft Landing approach.'	3						
	'…I don't think the industry will move towards that (soft landings) without a government push to do it.'	6						
	'… soft landings I think is a very good concept. I think it is something that would promote as a very effective way of transition from construction and handover in to operations and ensuring that the	2						

Variables created from literature review	Direct narratives	Interviewee	New / Retained / Revised / Removed	Alternative narratives	Interviewee	Revised variables (analysis from literature review and interview)	Comments	Items
	contractor, that's building or fitting out the premises is doing it with the end user in mind because they have the responsibility of making sure that it is set up properly for the end user and they take the risk on that.'							
	'I personally think that they shouldn't be any law enforcement of regulation imposed to appoint facilities managers or soft landings to any projects. I think it should come from the client itself.' *'If you tendering for a government project you have to state your soft landing procedure or your soft landing take in your tender you are bidding for the project. So, this like a soft way of enforcing the soft landing and facilities management into project.'* *'... the definition of soft landing now is like a more apparent is more distinctive.'* *'It is not a new concept. This soft landing is always been there. It just been clearly defined what is a soft landings concept but we already done it.'*	8						
	'... this Soft Landings approach I've heard of, and so as far as I can tell these sorts of initiatives do bring Facilities Managers much more integral to the design process.	7						
	'... The way to win that argument is to convince the people for whom the building is being constructed. The involvement of smart FM early enough will deliver a better result for them.'	9						

Variables created from literature review	Direct narratives	Interviewee	New / Retained / Revised / Removed	Alternative narratives	Interviewee	Revised variables (analysis from literature review and interview)	Comments	Items
T1: Strategic value (Perceptions)								
T1.1 Less recognition by other professionals due to no unique identity	*'Recognition towards FM is increasing.'*	3	Revised	*'… a building for an intended user rather than a building that is just being put up assuming it will be rented or sold….'* *'so cases that are business led rather than developer led.'* *'… FM was very much an integrator between the building providers and the designers, and the users.'* *'… too many FM professionals express their contribution towards decision making in building terms not business terms.'*	9	T1.1(a) Evaluation of the building as a means to a business	This variable needs a modification. In line with Jaunzens et al. (2001), Interviewee 9, 4 and 6 emphasised that FM should focus on the 'softer' issues of people's productivity and comfort without ignoring the 'hard' aspects. In order to gain recognition facility managers have to have a good understanding of end user organisation policy, strategy, objectives and tactics.	Having a good understanding of end user organisation business policy
	'… lack of having an identity and recognition of the profession itself.'	1		*'… a very prestigious architect was involved in that and some of the light fittings could only be obtained from Milan…'*	4			
	'… the function of FM was decayed into either building services engineering or service management.'	9		*'… how somebody manages a facility so that you can design it to their requirements…'* *'… fundamental things about how that building is going to operate…'*	6			
T1.2 Unclear professional boundaries, the vague way of define FM	*'I don't think the concept is vague.'*	8	Revised	*'Projects setup are different from one project to another makes the concept of FM in the development process is inconsistent.'*	10	T1.2(a) Unclear professional boundaries	This variable needs a modification. For this issue, Jaunzens et al. (2001) suggested establishment of an appropriate KPI would determine the boundary of responsibility for FM	Establish Key Performance Indicators (KPI) at all development process stages
				'Most of Facilities Managers do not have an understanding of fundamentally the purpose of FM.'	4			
				'The definition of FM is subjective.'	2			
				'It is not so much that we don't know what a Facilities Manager does but we don't know the boundaries of the responsibilities … *'… there is an overlap between what those people do and what facilities managers do…'* *'… I think there is a misunderstanding amongst*	7			

Variables created from literature review	Direct narratives	Interviewee	New / Retained / Revised / Removed	Alternative narratives	Interviewee	Revised variables (analysis from literature review and interview)	Comments	Items
				Facilities Managers of what mechanical and electrical services entail …'				
				'All the seven points that you've got down there hold true.'	9			
				'… categorizing people within the FM industry as you're qualified and experienced and have the knowledge to be a strategic FM advisor and differentiating that from somebody who you know has a first line supervision responsibility for staff that are delivering cleaning or security or waste management or whatever. It is very hard I think for end user to understand what the difference is…'	3			
T1.3 Unable to demonstrate strategic value	*'I don't agree 100% with that is difficult to demonstrate the strategic value of the FM but it is measurable in some instances…'*	1	Retained	*'FM is a key part of administration from writing policies, procedures and documentation, producing new standards, procuring new right through to design support on asset replacement, or new assets.'*	3	T1.3 Unable to demonstrate strategic value	There are two aspects to enable facilities managers to demonstrate strategic value: 1. get involved in Stage 0- Strategic Definition level of the development process 2. be positioned in the higher level in the client organisation	Get involved in briefing stage Take a leadership role in the client organisation as an advisor
	'I'm not as concerned about FM's recognition at board level than I was'	4		*'I think the Facilities Manager has the potential to make the most impact on a project, if they can take leadership and become more influential at feasibility stage.'*	10			
	'I don't think … the higher levels people … understand how a proposed building … work in reality and how that supports the operational needs of the end users …' *'… there is no framework on how to close the gap between facilities management and the construction.'*	2		*'the strategic value of having an FM upfront in the design process …. Is invaluable.'*	1			
				'I think that its very client driven isn't FM?'	6			
	'…. Unable to demonstrate strategic value… would strike a chord with me'	7		*'… it was more somewhere sits on the client, someone who sits on the*	5			

Variables created from literature review	Direct narratives	Interviewee	New / Retained / Revised / Removed	Alternative narratives	Interviewee	Revised variables (analysis from literature review and interview)	Comments	Items
	Times value hasn't been given for facilities manager early enough in the development process''	6		*client team or someone who liaises with the design team upfront.'*				
				'I don't think that Facilities Managers are usually brought on board at that early stage…' *'…it may very well benefit the whole project if that were the case, if they were a facilities manager or somebody with that responsibility and remit for that skill set to guide the other professions.'*	7			
T1.4 Profession stuck at operational level	*'… it can range from that person operating, delivering the building, managing the building right through to a strategic consultant who is as qualified if not over qualified as the architect and the design team'* *'…if you walk in to a design team now as an FM consultant not just as an FM you're treated on the same level as an architect or as a structural engineer.'* *'… if you can imagine the two circles so you have a design circle and you have an operational circle the place where they overlap that's where the FM sit.'*	3	Revised	*'… it is a very proactive type of job…'* *'… it requires certain skills and certain knowledge that range from everything from building knowledge to health and safety knowledge to people management to negotiation skills, all of those skills are required in FM.'*	1	T1.4(a) Pro-active and multi-skills type of profession	Majority of facilities managers are coming from technical qualification background such as engineering, architectural, quantity survey. They have the opportunities to enhance their profession as well widening their experience in which will affects their career path. Jaunzens et al. (2001) suggested proactive facilities management is important in ensuring end user satisfaction with a building cannot be underestimated. Eley (2001) concluded FM need to be proactive in measuring performance and acting on the information.	Be proactive in ensuring end user satisfaction
T1.5 Unclear responsibility makes FM less proactive and strategically focus	*'… there is an overlap between what those people do and what facilities managers do…'* *' … I think there is a misunderstanding amongst Facilities Managers of what*	7	Removed	-	-	-	The term of 'unclear responsibility was discussed in T1.4. FM is a proactive type of job to produce a good facilities management (eg. Speed of	-

Variables created from literature review	Direct narratives	Interviewee	New / Retained / Revised / Removed	Alternative narratives	Interviewee	Revised variables (analysis from literature review and interview)	Comments	Items
	mechanical and electrical services entail …'						response). As a result, organisations secure end user satisfaction and the interest of the stakeholders.	
	'… it is a very proactive type of job…'	1						
	'FM being decayed to either building services engineering or service management.'	9						
	'… facilities manager in any organisation may have such a wide variety of roles…'	2						
	'… whole variety of different roles with FM fall under the FM umbrellas it is very difficult.'	4						
T1.6 Continues to be reliant to other professions	*'… we do rely on other professions…'*		Revised	*'… from a handover prospective we need to be sure the aftercare and the training and the awareness is there.'* *'… more of towards the end of construction period integrated in with the client's team and the FM team to make sure that they understand how to use the building, training and awareness when dealing with aftercare*	5	T1.5(a) Continuously reliance to other professions	FM professions do rely on other professions particularly during the handing over period. At this stage, the facilities manager needs to collaborate with other professionals to make sure that they understand how to operate the building, training and awareness when dealing with aftercare. Jaunzens et al. (2001) highlighted facilities manager to actively associate with other design teams during the handing over period.	Actively collaborate with users during handing over period
				'… get the building ready to be handed over and that's usually when FM comes in to its own.'	4			
				'… handing over process in helping the end user and the owner and the maintenance to understand the building.'	8			
T1.7 The concept of FM is vague	*'… it is very hard to define what a facilities manager is and it means something different to every organisation.'*	2	Removed	-	-	-	Item T1.7 was discussed in T1.2	-
-	*'… I think there's a need for Facilities Managers to aim towards a chartered status ultimately …'*	3	New	-	-	T1.6(a) Having chartership status	The interviewee anticipated, by having chartership status, the facilities managers would integrate	Having chartership status

Variables created from literature review	Direct narratives	Interviewee	New / Retained / Revised / Removed	Alternative narratives	Interviewee	Revised variables (analysis from literature review and interview)	Comments	Items
	'... to become chartered it has to be the pinnacle ...'						effectively in the development process.	
	'... have some sort of like a code of conduct for facilities managers.'	8						
	'The people pushing for this professionalism tend to be those who think their own status would be enhanced if FM was recognised as a profession.'	9						
	'I would deem the FM professional to be similar to any other profession where it would have its own self-regulating body that would insist on transparency, ethical procedures and a level of competency which would be monitored and would allow for those particular professionals with that competence to be entered in to their membership.'	10						
T7.3 Absence of systems to deal with everything (with FM issue) in that it must resolve	*'Many people will define it in terms of service level agreements and failure to comply. Long complicated lists of KPIs many of those don't actually tell you whether the building is meeting the needs of the users.'* *Sometimes it is related with KPI. Many post-occupancy evaluations get far too concerned about evaluating the building as a building and far less interested in evaluating the building as a means to a business objective.'*	9	Revised	-		T1.7(a) Absence of systems to deal with FM issue	Pitt and Hinks (2001) advised the integration of FM in the development process will be success provided an efficient mechanism for the control and management of property is identified. de Lucy (1988) suggested service level agreement is presented in the briefing stage	Having an opportunity to present service level agreement of FM operations at briefing stage

Variables created from literature review	Direct narratives	Interviewee	New / Retained / Revised / Removed	Alternative narratives	Interviewee	Revised variables (analysis from literature review and interview)	Comments	Items
T6: Management Tools								
T6.1 Lack of conceptual and theoretical framework in FM field	*'There has become an over reliance on tangible engineering tools in FM and then under reliance on broadly the human factors.'*	9	Revised	*'… they're far more interested in reducing their short term costs than spending a bit more in the short term and then showing that you had a long term benefit for the organisation.'* *'… sort of split between capital and revenue from a taxation point of view, from a budgeting point of view within organisations is almost counterproductive in terms of looking at what are the long term effects. We spend a little bit more now and then we reduce our operational costs over the full life cycle of the building. It almost puts a barrier between that kind of connection.'*	2	T6.1(a) Lack of understanding in management tools	East and Brodt (2007) claimed that BIM is required to eliminate problems with current procedure for construction handover documents: a. Contractors prepare the documents introduces errors b. Formatting of the information exchange is inadequate. c. Paper documents is easily lost, not easily updated and need huge space for storage. d. Information provided in sufficient to inform the replacement of equipment to comply with design intent. Facilities managers have had a very little input in the growth of FM (BIFM 2012). With the government support, it is imperative for facilities managers to engage in to BIM instantly.	Ability to apply Building Information Modelling (BIM)
	''Similar BREEAM has a bit of a driver on carrying out life cycle cost analysis …' *'I don't think it is been developed enough to be entirely useful from an FM point of view. But it is something to watch and something that will be much more applicable and much more useful in the future.'*	2						
	'So I think BIM is really important and it will become as important as life cycle costing …' *'…BIM has a number of key stakeholders so architect, Facilities Managers, Designers have an input in to BIM. It will reinforce the Facilities Management skills …'*	3		*'I think that always both contention between the facilities manager and the cost consultant or the QS. I think that is always be issues with life cycle cost and capital cost.'*	8			

Variables created from literature review	Direct narratives	Interviewee	New / Retained / Revised / Removed	Alternative narratives	Interviewee	Revised variables (analysis from literature review and interview)	Comments	Items
	'It is quite correct, it is a very complex role …' *'I'm fully involved in all the interests …'* *'We are looking ahead, we are future planning, future proofing. We are looking all the time at ways of reducing costs, saving money. So like I said to you there's ongoing commitment to gathering knowledge as well.'*	1		*'FM helps to generate savings on operational costs'* *'Element around saving should contribute to a better ways of working.'* *'I think the FM influence has actually increased also with legislation around Health and Safety in the FMs being in the forefront of legislation within the workplace. I think that's actually brought the FM industry, the FM professional further up the chain on towards the board, so it is actually its increasing.*	3		Damgaard and Erichsen (2009) asserts the demand for innovative building solution is increasing suggesting the involvement of operational knowledge become more imperative. Azhar et al. (2008) highlighted that BIM is emerging for a better customer service. From this research perspective, application of BIM is considered as an innovative way to record operation knowledge as well as improved collaboration between facilities managers within project teams There is conflict of interest between planning and construction, and operational side. Effective facilities management would lower operating costs. It is the indicator to measure the achievement of the building design. Therefore Felten et al. (2009) suggested having suitable generic tool would essential for analysing and communicating the status of FM planning.	
	'So I would say from a contracting prospective BIM is what, is the next big thing being pushed.' *'… a BREEAM excellent building I think got more to do with probably save money in the long run in the actual maintenance of the building.'* *'BREEAM has got a bit to do with life cycle management because they're putting sustainable features in the building …'*	5		*'… I think FM is playing a crucial role in that in terms of all kind of areas of space utilization …'* *'The whole issue of hot-desking and mobile flexible working patterns. FM is really leading the way on those.'* *'No strategy to reduce the number of breakdowns'*	4			

Variables created from literature review	Direct narratives	Interviewee	New / Retained / Revised / Removed	Alternative narratives	Interviewee	Revised variables (analysis from literature review and interview)	Comments	Items
	Building information modelling is something which is relatively new. It is been around a little while. But it is being enshrined in legislation ....' *' So I would say probably with looking at this with a positive aspect probably the building information modelling, the legislation that goes with that would probably work positively in the future.'*	7		*'CAFM system to data analysis and sharing to monitor the building performance.'*				
							BREEAM measures a building performance against environmental issues at all stages of the development process (Bevan 2011). Interviewee 2 emphasised there is a relationship between BREEAM and life cycle cost analysis in which the facilities managers have to advocate on this matter.	Having a good understanding of BRE Environmental Assessment Method (BREEAM)

Variables created from literature review	Direct narratives	Interviewee	New / Retained / Revised / Removed	Alternative narratives	Interviewee	Revised variables (analysis from literature review and interview)	Comments	Items
							de Lucy (1991) suggested use of CAFM could benefit facilities managers to manage the properties Pitt and Hinks (2001) advised the integration of FM in the development process will be success provided an efficient mechanism for the control and management of property is identified.	Ability to apply CAFM at use stage
T6.2 Difference of objectives between FM and project management field	-		Removed	-	-		As discussed in T2.4(a) different understanding of organisational/project objectives between facilities managers and other professionals can be minimised through clear, concise and unambiguous instructions as suggested by Pitt and Hinks (2001)	
T6.3 Under-utilisation of LCC and LCM method	*'In the PFI projects life cycle costing is looked at from concept …'* *'… when we have produced life cycle costing reports, Facilities Management professionals haven't been involved in that data collection or thought process and reporting …'* *'The major part of the life cycle costing for us was mechanical and electrical systems …'*	10	Retained	*'… a little bit in strategic and that's mainly through life cycle costing …'* *'… the PPP contracts that it takes life cycle risks is positive. That's where FM consultants are being engaged in that process.'* *'I think the developer takes on a life cycle risk for PPPs is positive in that it ensures that they're not going lowest cost in terms of their selection of systems and assets and*	2	T6.2(a) Under-utilisation of LCC and LCM method	Life cycle costing is useful during the design stage where the possibilities to reduce the operation and maintenance cost are large (Sterner 2000). Lack of relevant input data and limited experience in using life cycle costing are two main constraints in implement life cycle costing in the development process.	Ability to apply life cycle costing in the selection of materials/equipment

Variables created from literature review	Direct narratives	Interviewee	New / Retained / Revised / Removed	Alternative narratives	Interviewee	Revised variables (analysis from literature review and interview)	Comments	Items
	'Most developers say the right things about that but when they are met with simple economics all of those things go out the window and they end up doing things the old way.'	7		*they're installing in new builds, so that's positive.'* *'We spend a little bit more now than we reduce our operational costs over the full life cycle of the building.'* *'Construction projects generally speaking have to have some elements of life cycle costing. Unfortunately too often, it is a bit of an afterthought. It is not carried out at the right stage. It doesn't influence decision making, it is carried out after the decisions have been made in order to tick some boxes.'*			According to Wübbenhorst (1986) at the individual level they should have an ability to apply life cycle costing method and have intention to use the concept Wübbenhorst (1986) argue the individual professionals should be able to identify when is appropriate to apply life cycle costing. In addition, they have to have a good knowledge in choosing the most effective technique. Woodward (1997) advocates that life cycle costing encourages a long-term outlook to the investment decision making process. It is to optimise value for money of the facilities by taking into consideration all the cost factors related to the operational life of the facilities. Interviewee 2 and 8 supported this argument. Woodward (1997) suggested this includes ensuring the right	
	'I would expect that they would be able to undertake an appraisal of certain materials in the specifications so they should be able to advised the architects on life cycle costing and the life cycle of certain products and long term maintenance issues.' *'But it is always been something that has been pushed at the client's side as opposed to the contracting side.'* *'Life cycle costing, life cycle management I think has always been present but it is not something from a contracting prospective.'*	5		*'I think that is always been a contention between life cycle costing and capital costing. If you want to spend less in the capital but you end up paying more later on the life cost.'*	8			
				'I utilise management tools …' *'…they are fantastic tools to use, however you have to ensure that the*	1			

Variables created from literature review	Direct narratives	Interviewee	New / Retained / Revised / Removed	Alternative narratives	Interviewee	Revised variables (analysis from literature review and interview)	Comments	Items
	'… for PFI it is within the contractors best interests to carry out life cycle costing and to make sure that the product or the system that they are offering has got that longevity.' *'… best outcome of that life cycle costing has already been decided by the contractor because it is their best interests to do that.'*	6		*data that's being put in life cycle programs is correct and accurate…'* *'… it gives you a good idea or where the project is going …'* *'But in reality your model doesn't cater for but it is a good way of benchmarking …'*			selection, use and replacement of the materials and equipment. Facilities managers can have a significant role in this aspect.	
T3.2 Collision of professional interest between investors and operators	*'Again it involves cost, so in the current economic climate I think it would be one of the first casualties.'* *'It might be seen as one of the first things that could be cut out of the capital cost of the overall development cost.'*	2	Revised	-		T6.4 Conflict of interest between investors and building users	Felten et al. (2009) highlighted integration of FM planning in the projects increased the building costs and time investment in the project. As a result, Interviewee 2 asserts FM might be as one of the first thing to be discarded in the development process. (Felten et al. 2009) suggested FM should be the person to update the end users the status of FM-related planning in the development process.	Having a good mechanism to update the end users the status of their requirements
	'FM should be able to challenge what the business is actually constructing in the first place. But that means the skills to translate objectives written in business language to designs expressed in building language.	9						

Variables created from literature review	Direct narratives	Interviewee	New / Retained / Revised / Removed	Alternative narratives	Interviewee	Revised variables (analysis from literature review and interview)	Comments	Items
	'… private contractors are driven by profit and they won't see perhaps the benefit of it if they've got to spend money	6						

Variables created from literature review	Direct narratives	Interviewee	New / Retained / Revised / Removed	Alternative narratives	Interviewee	Revised variables (analysis from literature review and interview)	Comments	Items
				T5: Knowledge Management				
T5.1 Ineffective operational knowledge transfer	*'I think actually knowledge is getting better. How information is captured is getting a lot better with the introduction of more CAFM systems ...'*	3	Revised	*'So we have mechanisms in place to effectively manage the design process …'* *'… we call them Work Sequencing and Programming Workshops …'* *'So our mechanisms do provide a bit of flexibility in terms of integrating other people in to the process.'*	5	T5.1 Ineffective operational knowledge transfer	Shah (2007) argued there is a gap between design intention and the actual operations of the facilities throughout its life cycle due to lack of knowledge transfer. In order to improve this deficiency, there is a need to better manage the knowledge and change management process from design through to operation to enable properties to deliver their real value. Grimshaw (1999) suggested facilities managers need to be proactive in any changes in the design at any stage in the development process while in most cases facilities managers are often reactive in this issue.	Commitment to training on operational aspects during hand over phase Proactive in managing design changes
	'I think the problem is all about ownership and different people within different phases.' *'There isn't invariably somebody that is perhaps very senior to make sure that there is knowledge transfer.'* *'… large number of organisations have lost people and I think a lot of the time have taken knowledge with them and it is not properly documented and you've got people who have suddenly taken over a property and they don't really understand how its working …'*	4		*'… the information is going to follow the CIOB process and they've detailed out the information that is required at certain stages of the design and I think a similar thing has to happen really with the Facilities Management is that framework for the level of information that's got to be provided.'* *'… if they're involved in the process earlier on and can explain the level of information they want or provide some sort of framework for how information is going to be transferred …'* *'… sort of standardisation I guess from them for the level of information that they want.'*	6			
	'I would say there is a lack of mechanism there' *'I would say we heavily rely on the architects in terms of engaging with FM …'*	5		*'… this is are the maintenance routine, this is how we commission and all in the operations and maintenance manual we provide all the time.'*	8			
	'There's an expectation that all relevant information for using that facility would be passed on …' *'I've worked on there's been no indication by the end user or the Facilities Manager or the client for the level of information that they require and the level of information being provided has not been suitable for their purpose …'*	6						

Variables created from literature review	Direct narratives	Interviewee	New / Retained / Revised / Removed	Alternative narratives	Interviewee	Revised variables (analysis from literature review and interview)	Comments	Items
	'I think yes. The things that influence knowledge transfer is the degree of specialism …'	7						
	'That is where we learn from each other. That is where facility manager, architect, engineers, surveyors to come in to look the overall side of it.'	8						
	'Particularly factors of misunderstanding, mistranslation between different disciplines particularly those aspects of knowledge that are socially and culturally constructed.' *'Huge areas of, well the interplay between perceptions and actions. Misunderstandings, mistrust across the boundary between the construction project and users.'*	9						
T5.2 Technical knowledge gap between Facility Manager and other professionals	*'I think in term of the professional gap, it is just that too narrow …'*	8	Removed	-	-	-	-	-
	'It would be I of an architect or designer or professional, building developer to think that facilities manager does not have sufficient knowledge to assist in the project. Most FMs have a very good understanding of buildings. There's certainly FMs that I know out there today who would fit in to any professional development or design team without the slightest problem.'	1						
T5.3 Unclear operational concept and its impact to development process	-		Removed	-	-	-	Not discussed	-

Variables created from literature review	Direct narratives	Interviewee	New / Retained / Revised / Removed	Alternative narratives	Interviewee	Revised variables (analysis from literature review and interview)	Comments	Items
T5.4 Knowledge transfer and levels of learning in the organization - Individual to team, team to individual, team to organisational, organisational to team, organisational to inter-organisational	-	-	Revised	-		T5.2(a) Level of learning	At the individual level, Sun and Scott (2005) highlighted the fear of loss of ownership and control of knowledge will result in loss of individual's competitive edge	Willingness to learn from others (openness to ideas)
T8.3 Unwillingness to share the knowledge	*'So, there is huge gap in the exchange of knowledge.'* *'… every design from every architect should have an FM in their office itself.'* *'I think it is due to architects, building designers operate here, FMs and operators are here. They're separate entities …'*	1	Revised	*'I think holding back knowledge from each other is bad attitude …'* *'I feel offended because why would you withhold knowledge from me that's going to make not just my job easier but everybody's job easier.'*	1	T5.3(a) Level of knowledge sharing	Interviewee 1 and 8 encourage the knowledge should be shared.	Willingness to share information with others
	'… it is probably not a bad idea to get facilities managers to work in the architect's office or in the designer's office or they be independent body to advise …' *'they can help to design it better …'* *'It could work both ways, as outside body or it could work as somebody inside the organisation. I find that is quite intriguing because you know it just opened up the whole professional scope for facilities manager they can create their own specialty. They can come in as somebody who works with client, somebody who works with the designers.'*	8						

Variables created from literature review	Direct narratives	Interviewee	New / Retained / Revised / Removed	Alternative narratives	Interviewee	Revised variables (analysis from literature review and interview)	Comments	Items
-	-	-	-	-	-	T5.4(a) FM operations is not regarded as strategic resulting in improper maintenance record	Interviewee 4 emphasised that analysis of equipment breakdowns is required in the operations. In other words, maintenance performance should be properly recorded so that the operating experience would benefit when building new, rebuilt or renovate facilities (Damgaard and Erichsen 2009) Operation is not regarded as a strategic discipline. As a result, the operational knowledge and experience is ignored.	Having a good facilities maintenance record

Variables created from literature review	Direct narratives	Interviewee	New / Retained / Revised / Removed	Alternative narratives	Interviewee	Revised variables (analysis from literature review and interview)	Comments	Items
				T7: Post-occupancy evaluation (POE)				
T7.1 Poor feedback due to ineffective POE exercise	*'I would probably substitute ineffective from none at all really. The majority of new buildings are occupied and there is no formal assessment of how they're operating afterwards …'*	2	Retained	-		T7.1 Poor feedback due to ineffective POE exercise	Hadjri and Crozier (2009) advocate that POE have a positive relationship to strengthen the role of FM in the development process. The reasons why POE are low in the priority to be implemented in the development process are discussed by Bordass et al. (2001), Eley (2001), Cooper (2001), Cohen et al. (2001) and Zimmerman and Martin (2001) Preiser (2003) suggested facilities management team is an appropriate group to handle POE and take in-	Ability to lead in handling POE database development Ability to implement POE
	'The process with construction feedback in to the construction process so that the building operates in the way the FM professional wants it …'	6						
	'… the responsibility of the building is always been with the owner. And second thing is the user.' *'I think most of the time where it fails because there is been a grey area.'*	8						

Variables created from literature review	Direct narratives	Interviewee	New / Retained / Revised / Removed	Alternative narratives	Interviewee	Revised variables (analysis from literature review and interview)	Comments	Items
	'Sometimes it is related with KPI. Many post-occupancy evaluations get far too concerned about evaluating the building as a building and far less interested in evaluating the building as a means to a business objective.' *'It is often not expressed in terms of satisfaction. It is usually expressed in terms of notional meeting of space standards, cost per square meter standards. The measurement of satisfaction can be very difficult and is easily distorted.'* *'A lot of what gets done in the name of POE is a waste of time, space and money …'* *'I have seen elaborate schemes for POE exercises that look totally how the project delivered and construction KPIs and that sort of thing and don't ask whether the building is doing what it was supposed to do.'* *'… a big health centre constructed under a PFI, constructed very well, met all of the design criteria. Sailed through a conventional POE. The demand for services from that building was less than half what was predicted. So, the building was 50% utilised. The constructor got their money, the tax payer via the health service lost out. And the POE process didn't scratch asking those sorts of questions.'*	9					charge the POE database development. Eley (2001) concluded FM need to be proactive in measuring performance and acting on the information.	
	'The issue I have is that when you get to the end of a project the feedback is almost like a wish list. It's something that is not going to help this project so why would the client want to maybe pay me	10						

Variables created from literature review	Direct narratives	Interviewee	New / Retained / Revised / Removed	Alternative narratives	Interviewee	Revised variables (analysis from literature review and interview)	Comments	Items
	additional fees to feedback on a project that will help future projects which may not be his.' *'So it is kind of who pays for this feedback, who pays for this capture of knowledge and this knowledge then transfer.'*							
T7.2 Negative outcome from POE may harmful to professional liability and reputation	*'… architects and designers don't like you really going back to them when something doesn't work and they sometimes take offence at that …'*	1	Revised	-		T7.2 POE reports may harmful to professional reputation	Ellis (1988) claimed that negative criticisms are inevitable with POE reports. This goes against what is expected by the designers. Therefore, it is essential to balance up the good as well as the bad. POE should not be seen harmful to professional reputation (Bordass et al. 2001). Eley (2001) suggested facilities managers to share the lesson learn from POE report in the briefing stage of new projects.	Ability to balance the positive and the negative criticism in the POE reports Ability to transfer POE outcomes in different projects to briefing stage of other projects
	'A lot of people don't like it because it is difficult, it is challenging. That's a very apt point. I think it's very true …'	3						

Variables created from literature review	Direct narratives	Interviewee	New / Retained / Revised / Removed	Alternative narratives	Interviewee	Revised variables (analysis from literature review and interview)	Comments	Items
T8: Decision making								
T8.1 Explanation of the costs between development planning and operation	*'Sort of split between capital and revenue from a taxation point of view is almost counterproductive …'* *'It almost puts a barrier between that kind of connection.'*	2	Removed	-	-	-	-	-

Variables created from literature review	Direct narratives	Interviewee	New / Retained / Revised / Removed	Alternative narratives	Interviewee	Revised variables (analysis from literature review and interview)	Comments	Items
T9: Sustainability								
-	-	-	New	*'… clients are looking at the existing assets they've got, looking at redeveloping and improving existing buildings.'*	5	*T9.1 Usage optimisation*	-	Ability to take lead of refurbishment works
				'How people use the space, how people look at the space, how the space is uplifting or gift a different mood, so it is more about unquantifiable values of sustainability. I think facilities managers have to have this understanding as well.' *'They have to move from the mentality of sustainability just mean the energy sustainability or energy consumption. They have to have a good understanding that sustainability is about that energy consumption, it is about spatial, it is about life cycle cost, it is about the maintenance side of the building and it is all about how flexible of the building.'*	8			
				'So the biggest sustainability impact is to provide the necessary business from as small a built footprint as possible'	9			

Variables created from literature review	Direct narratives	Interviewee	New / Retained / Revised / Removed	Alternative narratives	Interviewee	Revised variables (analysis from literature review and interview)	Comments	Items
				'… it would be good to see a Facilities Manager in each and every design team giving crucial information to ensure that the running costs and maintenance and subsequent energy and carbon emissions are reduced to ensure sustainability in terms of the environment and economics.' *'… Facilities Manager's role in sustainability is as big as the design teams.'*	10			
-	-	-	-	*'… I think FM can have influence in terms of working practices, shift patterns and flexible working.'* *'… the use of natural ventilation and lighting …'* *for example their corporate social responsibility, their green ethics are really important.'*	4	-	-	Ability to take lead in mobile flexible working patterns
-	-	-	New	*'… it also hits on energy, it hits on everything.'* *'… we are putting in these lighting at this cost, if it wasn't energy lighting …'*	1	*T9.2 Environmental sustainability*	-	Involve in selection of construction materials/equipment Having a good understanding of sustainable initiatives (Green Agenda, recycling philosophy etc.)
				FM need to look at the throw away culture, a more maintained type of asset	3			
				'I think as well a large number of organisations now have, have got to get up to speed with the green agenda and sustainability and FM's got a massive part to play on that one …' *'FMs getting more involved in strategic decisions in terms of the equipment that will be installed and the green technology.'*	4			

Variables created from literature review	Direct narratives	Interviewee	New / Retained / Revised / Removed	Alternative narratives	Interviewee	Revised variables (analysis from literature review and interview)	Comments	Items
				'… the Green Agenda, carbon reduction commitments are big, big issues' *'So their approach to waste. The recycling philosophy. Again is crucial interesting from the contractors point of view every single tender that we do now asks us about our approach to the environment.'*				

Appendix J: Weekly E-bulletin Chartered Institute of Architectural Technologists (CIAT)

Chartered Institute of
Architectural Technologists
The technology of architecture

CIAT weekly Ebulletin - 30 January 2014

Welcome to CIAT's weekly Ebulletin

This week's banner image shows the Institute's Awards Luncheon which took place in London yesterday. For more information please see below.

If you have a project you would like to tell readers about, please email me at hugh@ciat.org.uk with details, including a JPEG image 640 pixels wide.

Yours,
Hugh Morrison, Editor

Achievement is the dish of the day at Awards Luncheon

Over 150 members and built environment professionals gathered at the Freemasons' Hall in London yesterday for the Institute's Awards Luncheon.
This high-profile event celebrated various individuals and organisations who have contributed to the discipline of Architectural Technology.
It included the presentation of CIAT's Open Award for Technical Excellence in Architectural Technology to its winners LSI Architects LLP, as well as the presentation of the Alan King Award, the Student Awards, Certificates of Accreditation to universities, and the Gold Awards (in recognition of outstanding service by members to the Institute).
Also at the event, David Cracknell (shown above), former Director of Skills and Lifelong Learning at CIC received Honorary Membership for 'immense and significant contribution to the Institute's membership qualifying process.'
The event was kindly sponsored by Fastrack/Koru Media.

Petition the Irish government over Building Control

Latest News

RIBA CPD events programme
Structured seminars supported by CIAT

CIOB membership workshops
Join the CIOB in the Republic of Ireland via a series of workshops

182,000 new jobs expected in construction
CITB research suggests improved picture for industry

Electronic planning submissions in the Republic of Ireland
Opinions requested from ROI and UK members for student member thesis

Consultation on the planning system in Wales
Members' views requested
More News

Upcoming Events

Members will be aware of the upcoming amendments to the Building Control (Amendment) Regulations in the Republic of Ireland, which, if passed, will have serious implications for Chartered Architectural Technologists. A petition to the *Oireachtas* (the Republic of Ireland's parliament) has been drawn up by Christophe Krief MCIAT. The full text is available here:
Petition on Building Control (Amendment) Regulations
NB: Anyone who wishes to support the petition should send their name and postal address by email to Mr Krief today, Thursday 30 January, as the petition will be submitted on 31 January.
Please email chris@ckarchitecture.ie

News in brief

Facility Managers survey
Mohd Rayme Anang Masuri is conducting a survey as part of a PhD research project at Liverpool John Moores University. The survey will canvass opinion on the factors that enable Facility Managers to integrate effectively in the various stages of the property development process. Please click here if you would like to take part. Responses are anonymous and the survey will take about ten minutes to complete.

If you have any queries please email m.r.bin-anang-masuri@2011.ljmu.ac.uk

Membership Progression Session – Aberdeen
A membership progression session will be held on Tuesday 18 March 2014 from 10-11am at the Holiday Inn Express, Chapel Street, Aberdeen, AB10 1SQ. Please come and hear the presentation about progressing your Membership; there will also be a Q&A session afterwards. NB a session will also be held near Dublin on 12 February.

To book your place please contact Amina Khanum, Membership Administrator. Email amina@ciat.org.uk

BIM Task Group
The BIM Task Group, a UK government initiative supported by CIAT publishes a weekly online newsletter. For the latest edition click here.
Planning news
The UK government's Planning Portal website issues a regular news bulletin. To view, please click here.

Rushlight Show
30 January 2014

BIM - the future of project information
31 January 2014

CPD event: East Midlands Region
3 February 2014

Committee meeting: Yorkshire Region
4 February 2014

WATEF: retrofitting for water efficiency
5 February 2014

Regional Business Meeting: Channel Islands Region
5 February 2014

RSAW event
5 February 2014

Ecoshowcase: Manchester
11 February 2014

Ecoshowcase Green Building Roadshow
11 February 2014

Construction Excellence Wales
11 February 2014

Membership Progression Session: Bolton
11 February 2014

BIM Showcase

11 February 2014

CPD event: Yorkshire Region
11 February 2014

Recognition meeting: Republic of Ireland Centre and Northern Ireland Region
12 February 2014

More Events

Our social sites

Appendix K: Weekly E-bulletin Institution of Civil Engineers (ICE)

Share:

ICE | Bulletin

Institution of Civil Engineers

ICE North West News, Events and Knowledge **4 February 2014**

Dear Rayme
In this edition, read on to find out about our North West successes for both Technician Quest Scholarships and the prestigious Tony Chapman Medal, for the best Member Professional Review Candidate, as well as your local events and training.
Remember, use the links (most titles and blue text) to find out more about an item. Do get in touch with any queries, feedback and suggestions for items to be included.
Best wishes,

Lynn Caddy
ICE North West
lynn.caddy@ice.org.uk

ICE near you: news

North West Technician QUEST Scholarship Winners
Find out who has been lucky enough to secure scholarships worth £1500 through our NW TQuest scheme.

NW Member wins Tony Chapman Medal
Read on to discover who won the Tony Chapman Medal - awarded annually to the best Member Professional Review candidate.

ICE NW Civil Engineering Awards 2014
Our Annual ICE NW Civil Engineering Awards take place on Friday 7 February at Chester Racecourse. Come and enjoy an evening of celebration as the winners are announced live on the night. Click here to see the nominations. We hope to see you there!

MORE NEWS

Contact us

Institution of Civil Engineers North West

9th Floor St James's Building
79 Oxford Street
Manchester
M1 6EG

t: +44 (0)7976 313 656
e: icenw@ice.org.uk
w: ice.org.uk/northwest

ICE near you: events

G&S Evening with the President

A chance for Graduates and Students to meet and discuss topical issues with the President. FREE but booking essential.
6 February 2014

Structural Failures - Some Lessons Learned * new topic

Lancashire Branch meeting with guest speaker Dr Andrew Crossley.
12 February 2014

DRS Locomotive Maintenance Sheds talk and tour **new date**

Organised by Cumbria Branch with guest speaker Neil McNicholas.
13 February 2014

Water - AMP 6

ICE Cheshire Branch meeting to discuss the UK Water industry's AMP6 and United Utilities' approach. Speakers: Chris Jones, Jacobs Steve Walsh, United Utilities, Kieran Brocklebank, United Utilities
13 February 2014

High Speed 2

Organised by Merseyside Branch with guest speakers - Andrew Went/Aleksandra Girling - HS2 Ltd.
17 February 2014

MORE EVENTS

See the NW Yearbook for our full events programme

ALL events are **FREE** to attend unless otherwise indicated

President's visit to the NW

Presidential Debate: Infrastructure as a Driver for Economic Growth

The debate will explore the role of infrastructure in facilitating the economic recovery of the North West, not only at political level but also at a project level. Presentations will be given by Network Rail on the Northern Hub, and Manchester Airports Group in terms of the Airport City development. The event will be hosted by ICE President Geoff French.
7 February 2014

Airport City image via MAG

ICE near you: training

Commercial issues for built environment professionals

This seminar seeks to give attendees a broad overview of commercial issues; from a basic understanding of risk and risk management, through the reasons for contracts, the types of contract, payments and variations to insurance and project finance.
11 February 2014

How to prepare for your professional review workshop 5/5

A recent successful candidate will share their experience of their own review preparation, submission and professional review day.
12 February 2014

NW Written Exercise Group Spring 2014

5th Session Topic: Technical/Academic
12 February 2014

Mock Reviews

Giving graduates the opportunity to practise their professional review presentations and field real live questions. Reviewers will provide feedback and suggestions.
13 February 2014

Written Exercise Webinar

This webinar is an overview of the process and will provide you with the necessary guidance to start to prepare for your written exercise.
18 February 2014

Recorded lectures

Access ICE's ever expanding library of free recorded lectures. You can view these lectures on your computer (flash required). If you have any questions please contact recordedlectures@ice.org.uk

ICE knowledge

ICE requires its members to have a sound knowledge of health and safety, and a high regard for the consequences of their professional activities on the safety of workers and others.

Site waste management plans - Regulations repealed.
HSE work at height guidance simplified
New H&S law posters to be displayed by 5 April 2014

SPECIALIST KNOWLEDGE

Membership surgeries

Liverpool 10 February 2014
Manchester, 27 February 2014
Warrington, 10 March
Manchester, 20 March
Liverpool, 7 April

BOOK NOW

More news from the region

Travel Funding Applications Open

Applications are now open for the QUEST Travel Award and the QUEST Kenneth Watson Travel Award which offer members the opportunity to apply for funding towards overseas travel costs. Find out more by clicking on the blue links above.

Careers Fair

The North West Regional Group of the Geological Society of London are holding a careers fair for undergraduates, graduates and those between jobs as well as people looking for new opportunities - Manchester University 5 March 2014. See more here.

Laing O'Rourke Trainee Opportunities Event 12/2/14 at 6pm

Do you know someone about to leave school? Laing O'Rourke is inviting students and parents/guardians to come along on a no commitment basis and hear about their Cadet programme, a five year part-time degree development programme for trainees. Email cadetprogramme@laingorourke.com for more information by 5/2/14.

Survey

A Postgraduate Researcher at Liverpool John Moores University is looking for help in completing a survey regarding the factors that enable Facility Managers to integrate effectively in the various stages of the property development process.
It will take approximately 10 minutes to complete and your time is much appreciated.
Access the survey here or contact M.R.Bin-Anang-Masuri@2011.ljmu.ac.uk for more info.

One Great George Street
Westminster
London
SW1P 3AA

Appendix L: Tweet of British Institute of Facilities Management (BIFM)

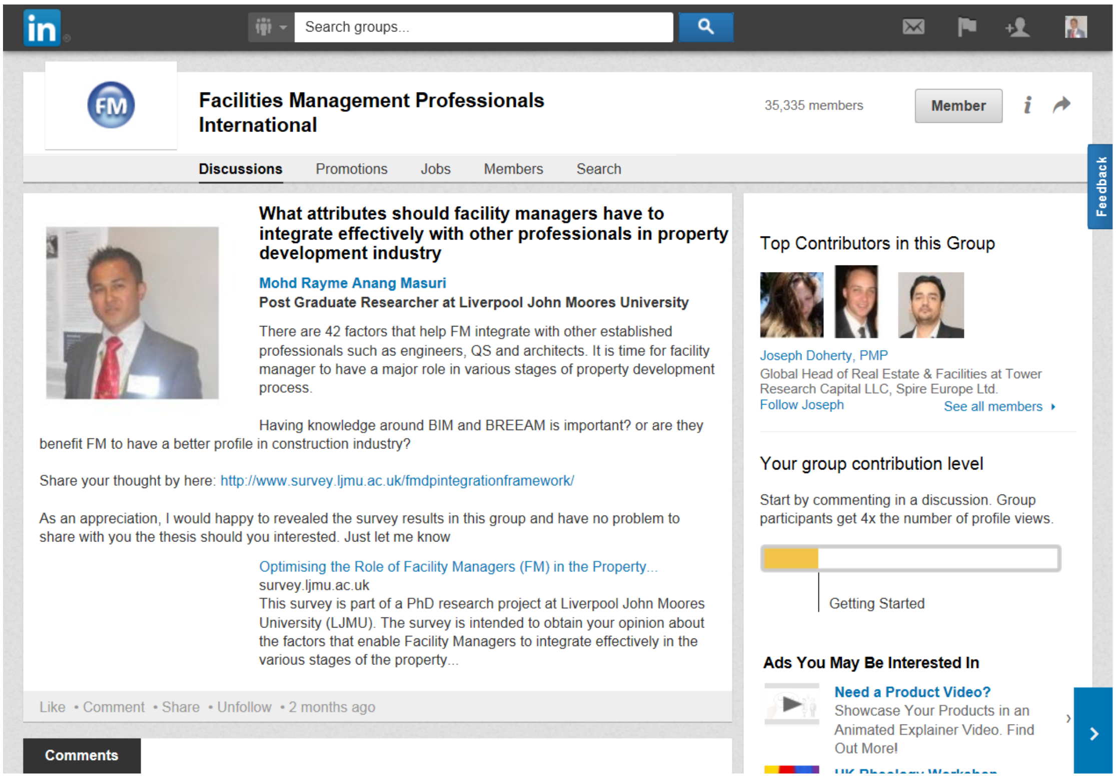
Rayme Anang @Rayme77 · Mar 26
@BIFM_NorthWest @LJMU Your contribution in this #facilitiesmanagement research is highly appreciated @Whitbags @matttuckerLJMU

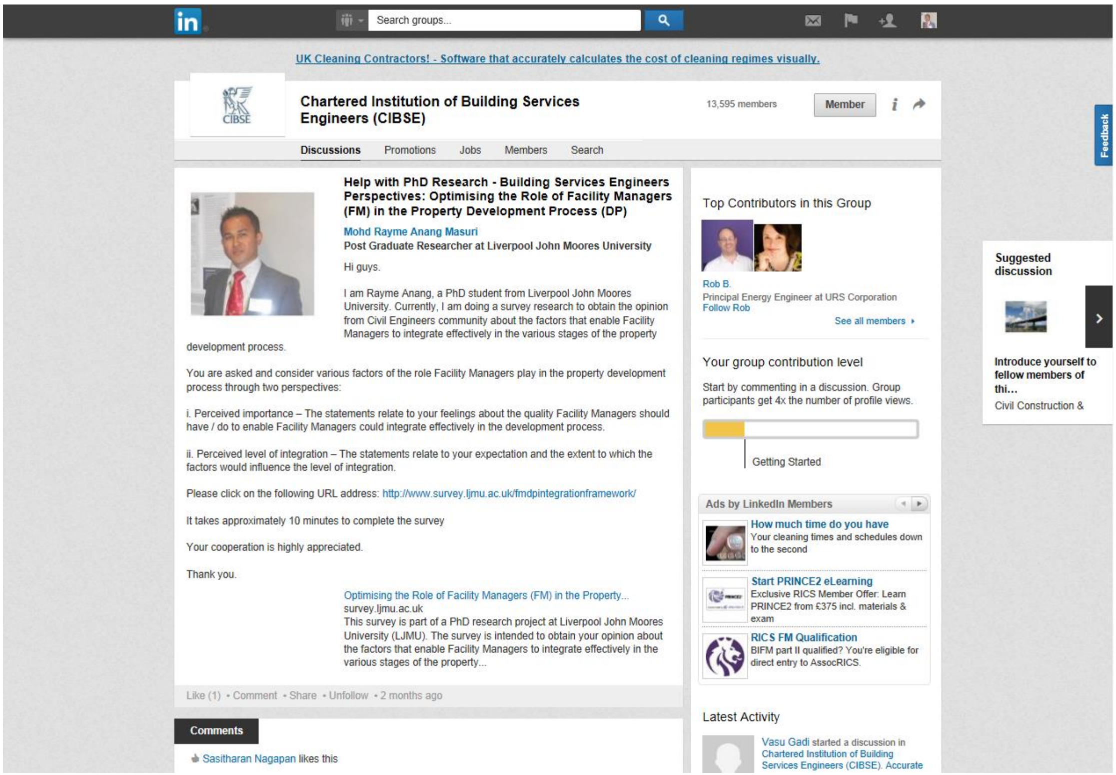
View conversation   Reply Delete Favorite •••

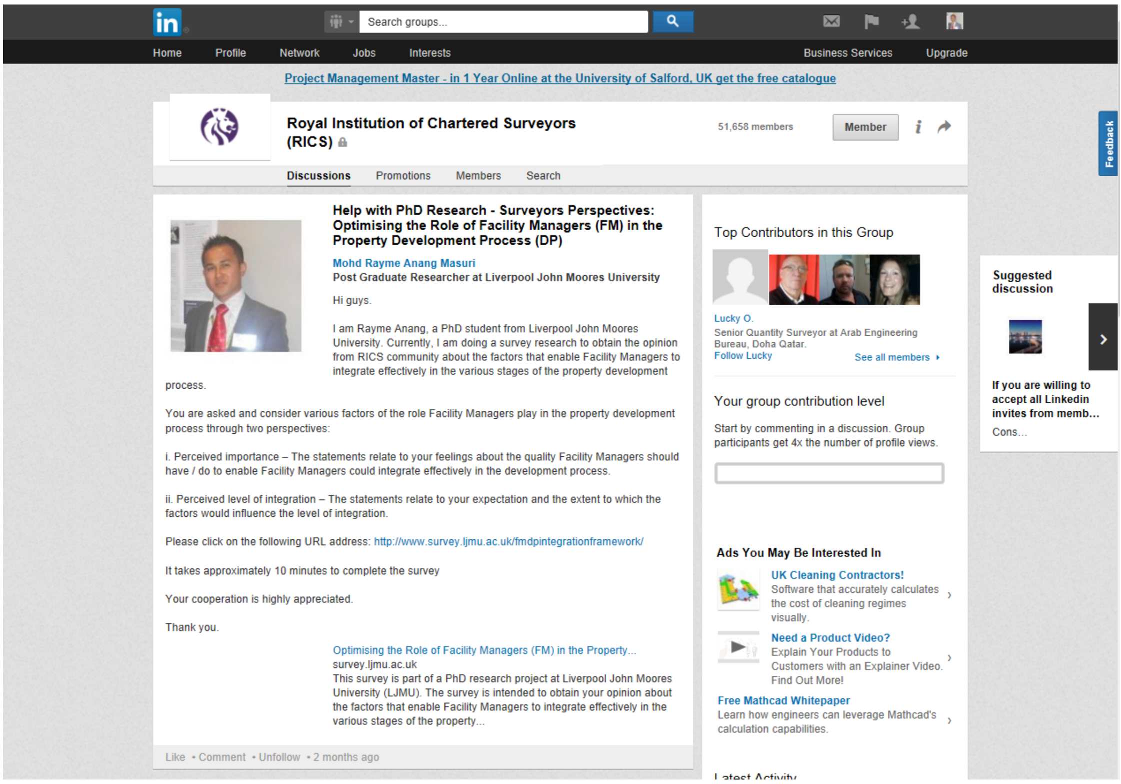
Retweeted by Rayme Anang
BIFM_North @BIFM_North · Mar 25
Please RT. If you work in #facilitiesmanagement can you help @Rayme77 of @LJMU with his #FACMAN Research Project plse survey.ljmu.ac.uk/fmdpintegratio…

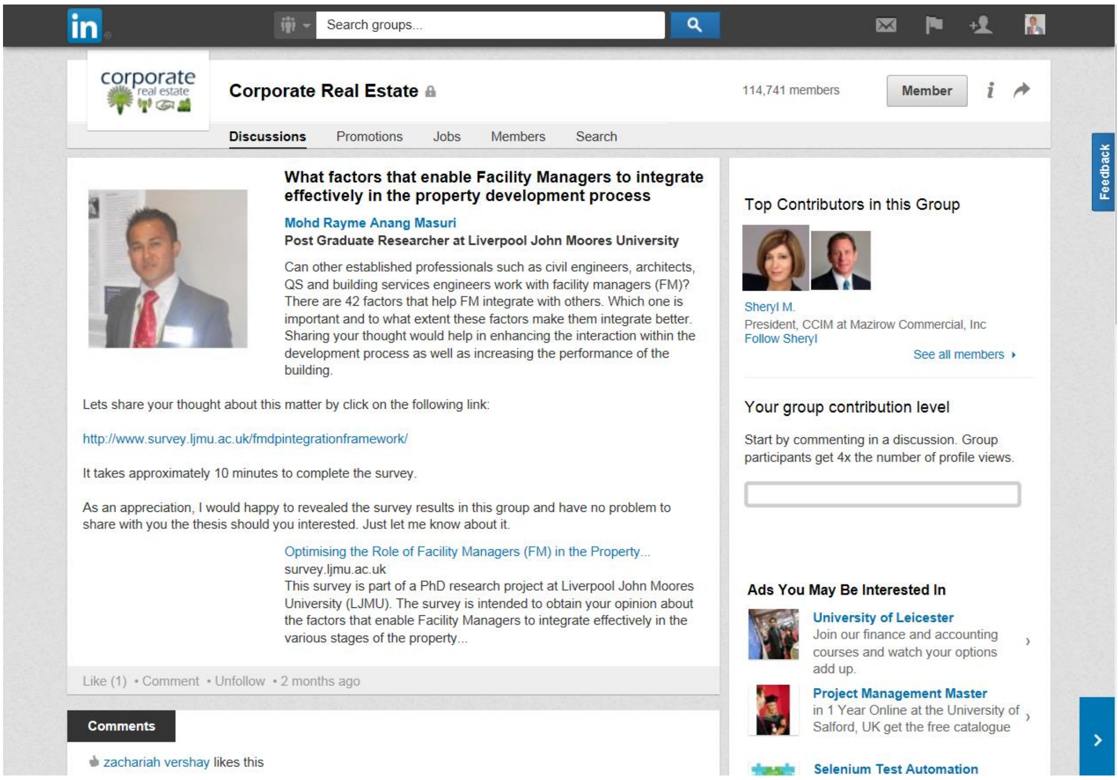
Expand   Reply Retweeted Favorited •••

Appendix M: Group Discussions in LinkedIn






Search groups...
Home
Profile
Network
Jobs
Interests
Business Services
Upgrade
Project Management Master - in 1 Year Online at the University of Salford, UK get the free catalogue
Royal Institution of Chartered Surveyors (RICS)
51,658 members
Member
Discussions
Promotions
Members
Search
Help with PhD Research - Surveyors Perspectives: Optimising the Role of Facility Managers (FM) in the Property Development Process (DP)
Mohd Rayme Anang Masuri
Post Graduate Researcher at Liverpool John Moores University
Hi guys.
I am Rayme Anang, a PhD student from Liverpool John Moores University. Currently, I am doing a survey research to obtain the opinion from RICS community about the factors that enable Facility Managers to integrate effectively in the various stages of the property development process.
You are asked and consider various factors of the role Facility Managers play in the property development process through two perspectives:
i. Perceived importance – The statements relate to your feelings about the quality Facility Managers should have / do to enable Facility Managers could integrate effectively in the development process.
ii. Perceived level of integration – The statements relate to your expectation and the extent to which the factors would influence the level of integration.
Please click on the following URL address: http://www.survey.ljmu.ac.uk/fmdpintegrationframework/
It takes approximately 10 minutes to complete the survey
Your cooperation is highly appreciated.
Thank you.
Optimising the Role of Facility Managers (FM) in the Property...
survey.ljmu.ac.uk
This survey is part of a PhD research project at Liverpool John Moores University (LJMU). The survey is intended to obtain your opinion about the factors that enable Facility Managers to integrate effectively in the various stages of the property...
Like • Comment • Unfollow • 2 months ago
Top Contributors in this Group
Lucky O.
Senior Quantity Surveyor at Arab Engineering Bureau, Doha Qatar.
Follow Lucky
See all members
Your group contribution level
Start by commenting in a discussion. Group participants get 4x the number of profile views.
Ads You May Be Interested In
UK Cleaning Contractors!
Software that accurately calculates the cost of cleaning regimes visually.
Need a Product Video?
Explain Your Products to Customers with an Explainer Video. Find Out More!
Free Mathcad Whitepaper
Learn how engineers can leverage Mathcad's calculation capabilities.
Suggested discussion
If you are willing to accept all Linkedin invites from memb...
Cons...
Feedback


Search groups...
Corporate Real Estate
114,741 members
Member
Discussions
Promotions
Jobs
Members
Search
What factors that enable Facility Managers to integrate effectively in the property development process
Mohd Rayme Anang Masuri
Post Graduate Researcher at Liverpool John Moores University
Can other established professionals such as civil engineers, architects, QS and building services engineers work with facility managers (FM)? There are 42 factors that help FM integrate with others. Which one is important and to what extent these factors make them integrate better. Sharing your thought would help in enhancing the interaction within the development process as well as increasing the performance of the building.
Lets share your thought about this matter by click on the following link:
http://www.survey.ljmu.ac.uk/fmdpintegrationframework/
It takes approximately 10 minutes to complete the survey.
As an appreciation, I would happy to revealed the survey results in this group and have no problem to share with you the thesis should you interested. Just let me know about it.
Optimising the Role of Facility Managers (FM) in the Property...
survey.ljmu.ac.uk
This survey is part of a PhD research project at Liverpool John Moores University (LJMU). The survey is intended to obtain your opinion about the factors that enable Facility Managers to integrate effectively in the various stages of the property...
Like (1) • Comment • Unfollow • 2 months ago
Comments
zachariah vershay likes this
Top Contributors in this Group
Sheryl M.
President, CCIM at Mazirow Commercial, Inc
Follow Sheryl
See all members
Your group contribution level
Start by commenting in a discussion. Group participants get 4x the number of profile views.
Ads You May Be Interested In
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Join our finance and accounting courses and watch your options add up.
Project Management Master
in 1 Year Online at the University of Salford, UK get the free catalogue
Selenium Test Automation
Feedback

Appendix N: Correlation Matrix of 38 Items

	Competences							Strategic Role				Development Scheme		Strategic value						
	Comp1PLOI	Comp2PLOI	Comp3PLOI	Comp4PLOI	Comp5PLOI	Comp6PLOI	Comp7PLOI	StrR1PLOI	StrR2PLOI	StrR3PLOI	StrR4PLOI	DevS1PLOI	DevS2PLOI	StrV1PLOI	StrV2PLOI	StrV3PLOI	StrV4PLOI	StrV5PLOI	StrV6PLOI	StrV8PLOI
Comp1PLOI	1.000																			
Comp2PLOI	.571	1.000																		
Comp3PLOI	.439	.690	1.000																	
Comp4PLOI	.460	.429	.454	1.000																
Comp5PLOI	.430	.353	.348	.605	1.000															
Comp6PLOI	.385	.549	.522	.543	.381	1.000														
Comp7PLOI	.408	.323	.304	.544	.450	.399	1.000													
StrR1PLOI	.287	.448	.502	.464	.391	.517	.679	1.000												
StrR2PLOI	.435	.369	.333	.462	.423	.413	.623	.605	1.000											
StrR3PLOI	.293	.315	.280	.428	.444	.301	.530	.553	.595	1.000										
StrR4PLOI	.399	.464	.387	.383	.340	.483	.373	.482	.444	.417	1.000									
DevS1PLOI	.356	.311	.312	.347	.340	.360	.343	.260	.423	.303	.594	1.000								
DevS2PLOI	.494	.261	.251	.553	.487	.416	.555	.479	.560	.474	.410	.337	1.000							
StrV1PLOI	.398	.360	.353	.518	.406	.407	.479	.476	.458	.431	.370	.185	.648	1.000						
StrV2PLOI	.427	.310	.316	.527	.398	.383	.510	.421	.447	.519	.287	.202	.567	.694	1.000					
StrV3PLOI	.428	.209	.249	.621	.477	.338	.638	.483	.505	.402	.332	.295	.644	.572	.533	1.000				
StrV4PLOI	.444	.280	.264	.475	.349	.435	.587	.511	.538	.430	.333	.284	.569	.539	.546	.668	1.000			
StrV5PLOI	.382	.309	.239	.525	.508	.389	.602	.483	.625	.458	.360	.351	.573	.515	.442	.724	.671	1.000		
StrV6PLOI	.489	.401	.364	.519	.521	.468	.534	.501	.579	.564	.488	.499	.601	.437	.500	.548	.612	.574	1.000	
StrV8PLOI	.479	.413	.387	.497	.494	.378	.495	.390	.489	.369	.448	.485	.477	.407	.388	.433	.394	.418	.566	1.000
MgtT1PLOI	.398	.406	.333	.514	.431	.552	.530	.553	.587	.428	.595	.500	.582	.458	.412	.531	.544	.523	.667	.613
MgtT2PLOI	.383	.260	.266	.324	.274	.328	.460	.499	.496	.479	.484	.355	.388	.278	.299	.476	.438	.445	.458	.452
MgtT3PLOI	.484	.507	.522	.435	.393	.499	.399	.469	.479	.363	.446	.397	.360	.345	.296	.391	.402	.399	.478	.554
MgtT4PLOI	.396	.203	.274	.553	.485	.466	.544	.459	.483	.361	.346	.297	.616	.510	.507	.680	.533	.605	.553	.542
MgtT5PLOI	.417	.304	.325	.521	.488	.373	.574	.522	.509	.332	.397	.409	.565	.471	.352	.683	.538	.671	.487	.462
KnowM1PLOI	.431	.471	.456	.591	.482	.474	.566	.526	.571	.405	.494	.409	.469	.563	.519	.506	.502	.567	.539	.568
KnowM2PLOI	.372	.286	.347	.672	.527	.430	.667	.524	.551	.461	.422	.353	.620	.505	.472	.716	.519	.674	.542	.461
KnowM3PLOI	.281	.162	.288	.610	.463	.359	.673	.524	.538	.338	.327	.343	.603	.433	.416	.733	.533	.644	.420	.462
KnowM4PLOI	.344	.251	.327	.443	.342	.310	.568	.509	.393	.303	.296	.287	.388	.438	.397	.630	.484	.583	.366	.388
KnowM5PLOI	.463	.325	.272	.365	.397	.441	.418	.454	.491	.315	.524	.405	.517	.442	.308	.540	.589	.548	.562	.506
POE1PLOI	.451	.346	.363	.379	.370	.424	.378	.398	.432	.279	.496	.449	.396	.400	.327	.483	.513	.512	.484	.415
POE2PLOI	.367	.357	.363	.470	.395	.420	.385	.448	.498	.346	.508	.408	.423	.470	.347	.526	.520	.549	.491	.428
POE3PLOI	.454	.387	.346	.495	.476	.476	.410	.437	.540	.427	.507	.442	.538	.569	.414	.508	.539	.567	.637	.544
POE4PLOI	.406	.409	.323	.449	.405	.510	.546	.500	.450	.342	.448	.371	.505	.548	.510	.567	.517	.551	.532	.433
Sust1PLOI	.251	.303	.319	.392	.263	.454	.515	.548	.481	.443	.356	.323	.471	.504	.558	.464	.530	.426	.471	.346
Sust2PLOI	.422	.536	.460	.416	.405	.511	.451	.499	.445	.368	.465	.407	.401	.434	.402	.356	.407	.452	.553	.531
Sust3PLOI	.363	.403	.511	.497	.316	.489	.527	.572	.518	.413	.382	.380	.450	.454	.444	.506	.528	.537	.596	.469
Sust4PLOI	.127	.148	.172	.215	.316	.020	.300	.186	.329	.231	.283	.235	.184	.082	.233	.324	.150	.453	.240	.377

Legend: Correlation value less than 0.3

Correlation matrix of 38 items (continued)

	Management Tools					Knowledge Management					Post-occupancy Evaluation				Sustainability			
	MgtT1PLOI	MgtT2PLOI	MgtT3PLOI	MgtT4PLOI	MgtT5PLOI	KnowM1PLOI	KnowM2PLOI	KnowM3PLOI	KnowM4PLOI	KnowM5PLOI	POE1PLOI	POE2PLOI	POE3PLOI	POE4PLOI	Sust1PLOI	Sust2PLOI	Sust3PLOI	Sust4PLOI
Comp1PLOI																		
Comp2PLOI																		
Comp3PLOI																		
Comp4PLOI																		
Comp5PLOI																		
Comp6PLOI																		
Comp7PLOI																		
StrR1PLOI																		
StrR2PLOI																		
StrR3PLOI																		
StrR4PLOI																		
DevS1PLOI																		
DevS2PLOI																		
StrV1PLOI																		
StrV2PLOI																		
StrV3PLOI																		
StrV4PLOI																		
StrV5PLOI																		
StrV6PLOI																		
StrV8PLOI																		
MgtT1PLOI	1.000																	
MgtT2PLOI	.621	1.000																
MgtT3PLOI	.553	.559	1.000															
MgtT4PLOI	.595	.502	.434	1.000														
MgtT5PLOI	.514	.397	.399	.605	1.000													
KnowM1PLOI	.611	.367	.470	.577	.653	1.000												
KnowM2PLOI	.563	.387	.373	.620	.696	.658	1.000											
KnowM3PLOI	.532	.425	.318	.603	.662	.575	.825	1.000										
KnowM4PLOI	.365	.367	.363	.532	.663	.536	.623	.587	1.000									
KnowM5PLOI	.595	.498	.463	.560	.539	.558	.496	.444	.463	1.000								
POE1PLOI	.513	.427	.424	.460	.491	.462	.382	.333	.432	.785	1.000							
POE2PLOI	.506	.495	.460	.489	.533	.549	.521	.480	.467	.767	.754	1.000						
POE3PLOI	.585	.416	.472	.587	.549	.619	.587	.515	.415	.771	.661	.800	1.000					
POE4PLOI	.539	.380	.349	.433	.555	.556	.556	.483	.538	.481	.410	.500	.503	1.000				
Sust1PLOI	.480	.418	.366	.423	.403	.424	.453	.431	.325	.367	.337	.449	.490	.591	1.000			
Sust2PLOI	.544	.352	.410	.376	.466	.584	.448	.329	.415	.397	.370	.456	.453	.635	.430	1.000		
Sust3PLOI	.552	.363	.461	.412	.489	.562	.545	.492	.457	.395	.347	.437	.413	.577	.483	.601	1.000	
Sust4PLOI	.365	.391	.357	.464	.210	.306	.244	.124	.118	.135	.367	.281	.344	.255	.444	.411	.504	1.000

Legend: Correlation value less than 0.3

Appendix O: Summary of Output of One-Way MANOVA of Constructs

Construct	IV	DV	Assumptions					Box Test		Multivariate Tests			Levene's Test		Test of Between Subject effects
			Normality	Multicollinearity r	Sig.	Linearity	Multivariate outliers Mahal. Dist.	Sig.	Homogeneity of variance-covariance matrices	Wilks' Lambda	Sig.	Decision	Sig.	Homogeneity of variances	Sig.
Knowledge Management	Stage 0	PLOI	-ve skewed	0.547	0.000	Yes	21.475	0.002	Not violated	0.976	0.163	No significant different	0.433	Not violated	0.539
		PI	-ve skewed										0.315	Not violated	0.064
	Stage 1	PLOI						0.041	Not violated	1.000	0.977	No significant different	0.421	Not violated	0.830
		PI											0.603	Not violated	0.884
	Stage 2	PLOI						0.009	Not violated	0.984	0.300	No significant different	0.050	Not violated	0.537
		PI											0.671	Not violated	0.390
	Stage 3	PLOI						0.035	Not violated	0.982	0.253	No significant different	0.029	Violated	0.182
		PI											0.977	Not violated	0.919
	Stage 4	PLOI						0.078	Not violated	0.967	0.082	No significant different	0.021	Violated	0.047
		PI											0.996	Not violated	0.836
	Stage 5	PLOI						0.092	Not violated	0.982	0.254	No significant different	0.011	Violated	0.211
		PI											0.559	Not violated	0.815
	Stage 6	PLOI						0.164	Not violated	0.994	0.645	No significant different	0.011	Violated	0.357
		PI											0.487	Not violated	0.514
	Stage 7	PLOI						0.373	Not violated	0.992	0.540	No significant different	0.607	Not violated	0.266
		PI											0.979	Not violated	0.562
Competence	Stage 0	PLOI	-ve skewed	0.619	0.000	Yes	15.886	0.199	Not violated	0.932	0.393	No significant different	0.249	Not violated	0.346
		PI	-ve skewed										0.053	Not violated	0.929
	Stage 1	PLOI						0.017	Not violated	0.997	0.793	No significant different	0.008	Violated	0.835
		PI											0.624	Not violated	0.523
	Stage 2	PLOI						0.021	Not violated	0.950	0.021	Significant different	0.010	Violated	0.827
		PI											0.593	Not violated	0.021
	Stage 3	PLOI						0.008	Not violated	0.969	0.091	No significant different	0.912	Not violated	0.912
		PI											0.075	Not violated	0.075
	Stage 4	PLOI						0.022	Not violated	0.949	0.019	Significant different	0.022	Violated	0.216
		PI											0.845	Not violated	0.235
	Stage 5	PLOI						0.025	Not violated	0.981	0.239	No significant different	0.030	Violated	0.463
		PI											0.906	Not violated	0.462
	Stage 6	PLOI						0.011	Not violated	0.985	0.326	No significant different	0.016	Violated	0.224
		PI											0.721	Not violated	0.945
	Stage 7	PLOI						0.135	Not violated	0.950	0.021	Significant different	0.061	Not violated	0.806
		PI											0.138	Not violated	0.021

Summary of output of One-Way MANOVA of constructs (continued)

Construct	IV	DV	Assumptions					Box Test		Multivariate Tests			Levene's Test		Test of Between Subject effects
			Normality	Multicollinearity r	Sig.	Linearity	Multivariate outliers Mahal. Dist.	Sig.	Homogeneity of variance-covariance matrices	Wilks' Lambda	Sig.	Decision	Sig.	Homogeneity of variances	Sig.
Post-occupancy Evaluation	Stage 0	PLOI	-ve skewed	0.568	0.000	Yes	19.622	0.620	Not violated	0.996	0.766	No significant different	0.029	Violated	0.479
		PI	-ve skewed										0.533	Not violated	0.568
	Stage 1	PLOI						0.055	Not violated	0.997	0.782	No significant different	0.049	Violated	0.856
		PI											0.391	Not violated	0.514
	Stage 2	PLOI						0.709	Not violated	0.994	0.637	No significant different	0.632	Not violated	0.401
		PI											0.060	Not violated	0.391
	Stage 3	PLOI						0.600	Not violated	0.997	0.774	No significant different	0.748	Not violated	0.535
		PI											0.056	Not violated	0.510
	Stage 4	PLOI						0.920	Not violated	0.989	0.430	No significant different	0.386	Not violated	0.345
		PI											0.381	Not violated	0.878
	Stage 5	PLOI						0.357	Not violated	1.000	0.995	No significant different	0.090	Not violated	0.937
		PI											0.780	Not violated	0.997
	Stage 6	PLOI						0.800	Not violated	0.997	0.774	No significant different	0.221	Not violated	0.728
		PI											0.996	Not violated	0.477
	Stage 7	PLOI						0.112	Not violated	0.993	0.594	No significant different	0.030	Violated	0.497
		PI											0.218	Not violated	0.308
Organisation	Stage 0	PLOI	-ve skewed	0.633	0.000	Yes	18.607	0.041	Not violated	0.998	0.889	No significant different	0.323	Not violated	0.929
		PI	-ve skewed										0.732	Not violated	0.771
	Stage 1	PLOI						0.008	Not violated	0.980	0.217	No significant different	0.433	Not violated	0.166
		PI											0.132	Not violated	0.084
	Stage 2	PLOI						0.036	Not violated	0.995	0.680	No significant different	0.129	Not violated	0.390
		PI											0.209	Not violated	0.655
	Stage 3	PLOI						0.196	Not violated	0.978	0.196	No significant different	0.217	Not violated	0.075
		PI											0.327	Not violated	0.337
	Stage 4	PLOI						0.057	Not violated	0.944	0.013	Significant different	0.064	Not violated	0.006
		PI											0.298	Not violated	0.294
	Stage 5	PLOI						0.050	Not violated	0.978	0.186	No significant different	0.028	Violated	0.067
		PI											0.467	Not violated	0.178
	Stage 6	PLOI						0.015	Not violated	0.965	0.070	No significant different	0.003	Violated	0.078
		PI											0.386	Not violated	0.911
	Stage 7	PLOI						0.107	Not violated	0.987	0.377	No significant different	0.048	Violated	0.509
		PI											0.227	Not violated	0.175

Summary of output of One-Way MANOVA of constructs (continued)

	IV	DV	Normality	Multicollinearity r	Sig.	Linearity	Multivariate outliers Mahal. Dist.	Sig.	Homogeneity of variance-covariance matrices	Wilks' Lambda	Sig.	Decision	Sig.	Homogeneity of variances	Sig.
Strategic Value	Stage 0	PLOI	-ve skewed	0.527	0.000	Yes	13.422	0.036	Not violated	0.966	0.075	No significant different	0.120	Not violated	0.758
		PI	-ve skewed										0.683	Not violated	0.082
	Stage 1	PLOI						0.520	Not violated	0.999	0.956	No significant different	0.441	Not violated	0.863
		PI											0.774	Not violated	0.908
	Stage 2	PLOI						0.633	Not violated	0.997	0.817	No significant different	0.329	Not violated	0.616
		PI											0.729	Not violated	0.550
	Stage 3	PLOI						0.856	Not violated	0.995	0.689	No significant different	0.453	Not violated	0.396
		PI											0.776	Not violated	0.556
	Stage 4	PLOI						0.467	Not violated	0.977	0.180	No significant different	0.068	Not violated	0.064
		PI											0.682	Not violated	0.332
	Stage 5	PLOI						0.809	Not violated	0.983	0.282	No significant different	0.544	Not violated	0.117
		PI											0.653	Not violated	0.553
	Stage 6	PLOI						0.245	Not violated	0.988	0.393	No significant different	0.069	Not violated	0.200
		PI											0.510	Not violated	0.780
	Stage 7	PLOI						0.340	Not violated	0.990	0.473	No significant different	0.664	Not violated	0.844
		PI											0.334	Not violated	0.259

Appendix P: Summary of Output of One-Way MANOVA of Items

Constructs	Items	IV	DV	Assumptions					Box Test		Multivariate Tests			Levene's Test		Test of Between Subject effects
				Normality	Multicollinearity r	Multicollinearity Sig.	Linearity	Multivariate outliers Mahal. Dist.	Sig.	Homogeneity of variance-covariance matrices	Wilks' Lambda	Sig.	Decision	Sig.	Homogeneity of variances	Sig.
Knowledge Management	KnowM4 1. Willingness to learn from others (openness to ideas)	Stage 0	PI	-ve skewed	0.444	0.000	No	17.070	0.049	Not violated	0.988	0.406	No significant different	0.009	Violate	0.180
			PLOI	-ve skewed										0.743	Not violate	0.596
		Stage 1	PI						0.940	Not violated	0.996	0.721	No significant different	0.396	Not violate	0.817
			PLOI											0.670	Not violate	0.509
		Stage 2	PI						0.808	Not violated	0.984	0.306	No significant different	0.429	Not violate	0.515
			PLOI											0.542	Not violate	0.267
		Stage 3	PI						0.827	Not violated	0.971	0.113	No significant different	0.716	Not violate	0.528
			PLOI											0.415	Not violate	0.093
		Stage 4	PI						0.426	Not violated	0.982	0.258	No significant different	0.983	Not violate	0.786
			PLOI											0.368	Not violate	0.147
		Stage 5	PI						0.747	Not violated	0.997	0.785	No significant different	0.623	Not violate	0.898
			PLOI											0.337	Not violate	0.543
		Stage 6	PI						0.234	Not violated	0.969	0.093	No significant different	0.016	Violate	0.030
			PLOI											0.785	Not violate	0.689
		Stage 7	PI						0.214	Not violated	0.972	0.125	No significant different	0.706	Not violate	0.955
			PLOI											0.069	Not violate	0.055
	KnowM3 2. Willingness to share information with others	Stage 0	PI	-ve skewed	0.415	0.000	No	23.660	0.233	Not violated	0.977	0.176	No significant different	0.392	Not violate	0.064
			PLOI	-ve skewed										0.126	Not violate	0.332
		Stage 1	PI						0.439	Not violated	0.999	0.911	No significant different	0.605	Not violate	0.673
			PLOI											0.318	Not violate	0.936
		Stage 2	PI						0.256	Not violated	0.986	0.335	No significant different	0.902	Not violate	0.260
			PLOI											0.015	Violate	0.666
		Stage 3	PI						0.075	Not violated	0.984	0.289	No significant different	0.266	Not violate	0.772
			PLOI											0.009	Violate	0.191
		Stage 4	PI						0.004	Not violated	0.982	0.253	No significant different	0.050	Not violate	0.612
			PLOI											0.002	Violate	0.099
		Stage 5	PI						0.060	Not violated	0.998	0.882	No significant different	0.410	Not violate	0.954
			PLOI											0.010	Violate	0.664
		Stage 6	PI						0.082	Not violated	0.982	0.253	No significant different	0.068	Not violate	0.136
			PLOI											0.243	Not violate	0.942
		Stage 7	PI						0.182	Not violated	0.985	0.332	No significant different	0.494	Not violate	0.488
			PLOI											0.180	Not violate	0.138

Summary of output of One-Way MANOVA of items (Continued)

Constructs	Items	IV	DV	Assumptions: Normality	Multicollinearity r	Multicollinearity Sig.	Linearity	Multivariate outliers Mahal. Dist.	Box Test Sig.	Box Test Homogeneity of variance-covariance matrices	Multivariate Tests Wilks' Lambda	Multivariate Tests Sig.	Multivariate Tests Decision	Levene's Test Sig.	Levene's Test Homogeneity of variances	Test of Between Subject effects Sig.
Knowledge Management	KnowM5 3. Having a comprehensive facilities maintenance records	Stage 0	PI	-ve skewed	0.401	0.000	No	13.261	0.235	Not violated	0.990	0.471	No significant different	0.097	Not violate	0.240
			PLOI	-ve skewed										0.646	Not violate	0.439
		Stage 1	PI						0.135	Not violated	0.984	0.301	No significant different	0.123	Not violate	0.131
			PLOI											0.027	Violate	0.818
		Stage 2	PI						0.379	Not violated	0.969	0.097	No significant different	0.161	Not violate	0.140
			PLOI											0.088	Not violate	0.367
		Stage 3	PI						0.460	Not violated	0.976	0.164	No significant different	0.296	Not violate	0.390
			PLOI											0.132	Not violate	0.212
		Stage 4	PI						0.120	Not violated	0.964	0.065	No significant different	0.133	Not violate	0.425
			PLOI											0.186	Not violate	0.083
		Stage 5	PI						0.017	Not violated	0.957	0.036	Significant different	0.554	Not violate	0.736
			PLOI											0.005	Violate	0.025
		Stage 6	PI						0.137	Not violated	0.988	0.418	No significant different	0.434	Not violate	0.779
			PLOI											0.143	Not violate	0.192
		Stage 7	PI						0.298	Not violated	0.994	0.629	No significant different	0.522	Not violate	0.385
			PLOI											0.220	Not violate	0.476
	KnowM1 4. Commitment to training on operational aspects during handing over phase	Stage 0	PI	-ve skewed	0.411	0.000	No	22.583	0.175	Not violated	0.996	0.760	No significant different	0.805	Not violate	0.792
			PLOI	-ve skewed										0.198	Not violate	0.613
		Stage 1	PI						0.118	Not violated	0.989	0.445	No significant different	0.429	Not violate	0.256
			PLOI											0.431	Not violate	0.308
		Stage 2	PI						0.160	Not violated	0.985	0.331	No significant different	0.924	Not violate	0.198
			PLOI											0.033	Violate	0.921
		Stage 3	PI						0.339	Not violated	0.978	0.193	No significant different	0.845	Not violate	0.220
			PLOI											0.199	Not violate	0.515
		Stage 4	PI						0.232	Not violated	0.977	0.173	No significant different	0.771	Not violate	0.478
			PLOI											0.055	Not violate	0.216
		Stage 5	PI						0.090	Not violated	0.975	0.145	No significant different	0.970	Not violate	0.172
			PLOI											0.027	Violate	0.511
		Stage 6	PI						0.121	Not violated	0.995	0.694	No significant different	0.593	Not violate	0.635
			PLOI											0.060	Not violate	0.669
		Stage 7	PI						0.096	Not violated	0.995	0.667	No significant different	0.324	Not violate	0.693
			PLOI											0.653	Not violate	0.367

Summary of output of One-Way MANOVA of items (Continued)

Constructs	Items	IV	DV	Assumptions: Normality	Multicollinearity r	Multicollinearity Sig.	Linearity	Multivariate outliers Mahal. Dist.	Box Test Sig.	Box Test Homogeneity of variance-covariance matrices	Multivariate Tests Wilks' Lambda	Multivariate Tests Sig.	Multivariate Tests Decision	Levene's Test Sig.	Levene's Test Homogeneity of variances	Test of Between Subject effects Sig.
Knowledge Management	StrV4 5. Proactive in ensuring end users satisfaction	Stage 0	PI	-ve skewed	0.287	0.000	No	16.296	0.119	Not violated	0.980	0.214	No significant different	0.024	Violate	0.079
			PLOI	-ve skewed										0.175	Not violate	0.552
		Stage 1	PI						0.418	Not violated	0.987	0.372	No significant different	0.110	Not violate	0.178
			PLOI											0.345	Not violate	0.994
		Stage 2	PI						0.066	Not violated	0.994	0.659	No significant different	0.125	Not violate	0.367
			PLOI											0.446	Not violate	0.677
		Stage 3	PI						0.152	Not violated	0.987	0.386	No significant different	0.113	Not violate	0.234
			PLOI											0.816	Not violate	0.308
		Stage 4	PI						0.139	Not violated	0.968	0.085	No significant different	0.240	Not violate	0.310
			PLOI											0.511	Not violate	0.029
		Stage 5	PI						0.035	Not violated	0.977	0.171	No significant different	0.535	Not violate	0.665
			PLOI											0.994	Not violate	0.060
		Stage 6	PI						0.045	Not violated	0.972	0.114	No significant different	0.039	Violate	0.299
			PLOI											0.746	Not violate	0.158
		Stage 7	PI						0.005	Not violated	0.965	0.067	No significant different	0.000	Violate	0.021
			PLOI											0.471	Not violate	0.335
	StrR1 6. Having a good rapport with client	Stage 0	PI	-ve skewed	0.449	0.000	No	34.169	0.147	Not violated	0.987	0.370	No significant different	0.082	Not violate	0.160
			PLOI	-ve skewed										0.864	Not violate	0.701
		Stage 1	PI						0.138	Not violated	0.975	0.152	No significant different	0.318	Not violate	0.906
			PLOI											0.850	Not violate	0.079
		Stage 2	PI						0.031	Not violated	0.942	0.012	Significant different	0.310	Not violate	0.598
			PLOI											0.469	Not violate	0.012
		Stage 3	PI						0.002	Not violated	0.942	0.011	Significant different	0.490	Not violate	0.515
			PLOI											0.276	Not violate	0.003
		Stage 4	PI						0.045	Not violated	0.947	0.017	Significant different	0.937	Not violate	0.345
			PLOI											0.301	Not violate	0.004
		Stage 5	PI						0.483	Not violated	0.983	0.278	No significant different	0.677	Not violate	0.958
			PLOI											0.724	Not violate	0.143
		Stage 6	PI						0.004	Not violated	0.980	0.221	No significant different	0.491	Not violate	0.264
			PLOI											0.131	Not violate	0.099
		Stage 7	PI						0.670	Not violated	0.982	0.254	No significant different	0.448	Not violate	0.528
			PLOI											0.427	Not violate	0.236

Summary of output of One-Way MANOVA of items (Continued)

Constructs	Items	IV	DV	Assumptions: Normality	Multicollinearity r	Multicollinearity Sig.	Linearity	Multivariate outliers Mahal. Dist.	Box Test Sig.	Box Test: Homogeneity of variance-covariance matrices	Multivariate Tests: Wilks' Lambda	Sig.	Decision	Levene's Test Sig.	Homogeneity of variances	Test of Between Subject effects Sig.
Knowledge Management	StrV6 7. Actively collaborate with users during handing over period	Stage 0	PI	-ve skewed	0.414	0.000	No	23.594	0.185	Not violated	0.999	0.933	No significant different	0.745	Not violate	0.756
			PLOI	-ve skewed										0.132	Not violate	0.746
		Stage 1	PI						0.228	Not violated	0.992	0.553	No significant different	0.237	Not violate	0.286
			PLOI											0.225	Not violate	0.786
		Stage 2	PI						0.013	Not violated	0.998	0.868	No significant different	0.413	Not violate	0.746
			PLOI											0.015	Violate	0.602
		Stage 3	PI						0.028	Not violated	0.998	0.839	No significant different	0.536	Not violate	0.750
			PLOI											0.005	Violate	0.555
		Stage 4	PI						0.060	Not violated	0.980	0.228	No significant different	0.893	Not violate	0.834
			PLOI											0.024	Violate	0.151
		Stage 5	PI						0.084	Not violated	0.993	0.607	No significant different	0.198	Not violate	0.454
			PLOI											0.159	Not violate	0.354
		Stage 6	PI						0.312	Not violated	0.997	0.794	No significant different	0.733	Not violate	0.985
			PLOI											0.029	Violate	0.548
		Stage 7	PI						0.757	Not violated	0.985	0.314	No significant different	0.210	Not violate	0.153
			PLOI											0.723	Not violate	0.268
	Comp4 8. Ability to give clear instructions to others in the project team	Stage 0	PI	-ve skewed	0.551	0.000	No	17.447	0.284	Not violated	0.980	0.226	No significant different	0.608	Not violate	0.133
			PLOI	-ve skewed										0.825	Not violate	0.148
		Stage 1	PI						0.628	Not violated	0.992	0.565	No significant different	0.694	Not violate	0.829
			PLOI											0.997	Not violate	0.303
		Stage 2	PI						0.282	Not violated	0.999	0.942	No significant different	0.764	Not violate	0.857
			PLOI											0.210	Not violate	0.731
		Stage 3	PI						0.265	Not violated	0.994	0.655	No significant different	0.398	Not violate	0.448
			PLOI											0.144	Not violate	0.415
		Stage 4	PI						0.140	Not violated	0.986	0.346	No significant different	0.308	Not violate	0.897
			PLOI											0.098	Not violate	0.178
		Stage 5	PI						0.149	Not violated	0.972	0.124	No significant different	0.624	Not violate	0.779
			PLOI											0.234	Not violate	0.097
		Stage 6	PI						0.346	Not violated	0.971	0.109	No significant different	0.622	Not violate	0.850
			PLOI											0.279	Not violate	0.077
		Stage 7	PI						0.376	Not violated	0.998	0.872	No significant different	0.626	Not violate	0.631
			PLOI											0.371	Not violate	0.684

Summary of output of One-Way MANOVA of items (Continued)

Constructs	Items	IV	DV	Assumptions					Box Test		Multivariate Tests			Levene's Test		Test of Between Subject effects
				Normality	Multicollinearity r	Multicollinearity Sig.	Linearity	Multivariate outliers Mahal. Dist.	Sig.	Homogeneity of variance-covariance matrices	Wilks' Lambda	Sig.	Decision	Sig.	Homogeneity of variances	Sig.
Knowledge Management	MgtT5 9. Having mechanism to communicate with end users about their requirements at all stages	Stage 0	PI	-ve skewed	0.359	0.000	No	21.945	0.177	Not violated	0.988	0.415	No significant different	0.926	Not violate	0.186
			PLOI	-ve skewed										0.472	Not violate	0.532
		Stage 1	PI						0.026	Not violated	0.998	0.882	No significant different	0.608	Not violate	0.832
			PLOI											0.415	Not violate	0.738
		Stage 2	PI						0.088	Not violated	0.995	0.673	No significant different	0.899	Not violate	0.584
			PLOI											0.495	Not violate	0.666
		Stage 3	PI						0.165	Not violated	0.977	0.180	No significant different	0.698	Not violate	0.985
			PLOI											0.229	Not violate	0.089
		Stage 4	PI						0.334	Not violated	0.935	0.006	Significant different	0.661	Not violate	0.508
			PLOI											0.280	Not violate	0.002
		Stage 5	PI						0.337	Not violated	0.989	0.425	No significant different	0.806	Not violate	0.369
			PLOI											0.190	Not violate	0.220
		Stage 6	PI						0.220	Not violated	0.991	0.491	No significant different	0.375	Not violate	0.281
			PLOI											0.035	Violate	0.371
		Stage 7	PI						0.006	Not violated	0.991	0.512	No significant different	0.095	Not violate	0.486
			PLOI											0.128	Not violate	0.563
	KnowM2 10. Proactive in managing design changes	Stage 0	PI	-ve skewed	0.452	0.000	No	17.013	0.010	Not violated	0.998	0.864	No significant different	0.096	Not violate	0.721
			PLOI	-ve skewed										0.013	Violate	0.881
		Stage 1	PI						0.004	Not violated	0.998	0.858	No significant different	0.031	Violate	0.892
			PLOI											0.025	Violate	0.599
		Stage 2	PI						0.052	Not violated	0.998	0.879	No significant different	0.034	Violate	0.611
			PLOI											0.172	Not violate	0.803
		Stage 3	PI						0.012	Not violated	0.998	0.887	No significant different	0.016	Violate	0.933
			PLOI											0.171	Not violate	0.719
		Stage 4	PI						0.007	Not violated	0.998	0.874	No significant different	0.029	Violate	0.933
			PLOI											0.049	Violate	0.633
		Stage 5	PI						0.012	Not violated	0.998	0.881	No significant different	0.018	Violate	0.620
			PLOI											0.106	Not violate	0.845
		Stage 6	PI						0.123	Not violated	0.998	0.833	No significant different	0.385	Not violate	0.551
			PLOI											0.244	Not violate	0.810
		Stage 7	PI						0.053	Not violated	0.994	0.616	No significant different	0.884	Not violate	0.324
			PLOI											0.394	Not violate	0.600

Summary of output of One-Way MANOVA of items (Continued)

Constructs	Items	IV	DV	Assumptions: Normality	Multicollinearity r	Multicollinearity Sig.	Linearity	Multivariate outliers Mahal. Dist.	Box Test: Sig.	Box Test: Homogeneity of variance-covariance matrices	Multivariate Tests: Wilks' Lambda	Multivariate Tests: Sig.	Multivariate Tests: Decision	Levene's Test: Sig.	Levene's Test: Homogeneity of variances	Test of Between Subject effects: Sig.
Knowledge Management	Comp6 11. Ability to anticipate the operational consequences of design and construction decision	Stage 0	PI	-ve skewed	0.325	0.000	No	12.668	0.627	Not violated	0.979	0.208	No significant different	0.092	Not violate	0.082
			PLOI	-ve skewed										0.125	Not violate	0.414
		Stage 1	PI						0.340	Not violated	0.984	0.305	No significant different	0.152	Not violate	0.498
			PLOI											0.814	Not violate	0.128
		Stage 2	PI						0.409	Not violated	0.972	0.122	No significant different	0.137	Not violate	0.070
			PLOI											0.355	Not violate	0.157
		Stage 3	PI						0.803	Not violated	0.988	0.396	No significant different	0.902	Not violate	0.232
			PLOI											0.744	Not violate	0.337
		Stage 4	PI						0.448	Not violated	0.997	0.786	No significant different	0.756	Not violate	0.572
			PLOI											0.804	Not violate	0.586
		Stage 5	PI						0.271	Not violated	0.985	0.317	No significant different	0.024	Violate	0.129
			PLOI											0.541	Not violate	0.665
		Stage 6	PI						0.701	Not violated	0.992	0.539	No significant different	0.140	Not violate	0.424
			PLOI											0.951	Not violate	0.335
		Stage 7	PI						0.845	Not violated	0.982	0.268	No significant different	0.444	Not violate	0.587
			PLOI											0.219	Not violate	0.105

Summary of output of One-Way MANOVA of items (Continued)

Constructs	Items	IV	DV	Assumptions					Box Test		Multivariate Tests			Levene's Test		Test of Between Subject effects
				Normality	Multicollinearity r	Multicollinearity Sig.	Linearity	Multivariate outliers Mahal. Dist.	Sig.	Homogeneity of variance-covariance matrices	Wilks' Lambda	Sig.	Decision	Sig.	Homogeneity of variances	Sig.
Competence	Comp2 12. Having adequate knowledge about construction phases	Stage 0	PI	-ve skewed	0.550	0.000	No	21.892	0.007	Not violated	0.979	0.201	No significant different	0.268	Not violate	0.275
			PLOI	-ve skewed										0.013	Violate	0.522
		Stage 1	PI						0.035	Not violated	0.997	0.780	No significant different	0.947	Not violate	0.492
			PLOI											0.007	Violate	0.617
		Stage 2	PI						0.178	Not violated	0.954	0.029	Significant different	0.823	Not violate	0.020
			PLOI											0.036	Violate	0.908
		Stage 3	PI						0.127	Not violated	0.968	0.085	No significant different	0.686	Not violate	0.039
			PLOI											0.023	Violate	0.718
		Stage 4	PI						0.186	Not violated	0.977	0.169	No significant different	0.717	Not violate	0.106
			PLOI											0.064	Not violate	0.993
		Stage 5	PI						0.285	Not violated	0.967	0.083	No significant different	0.506	Not violate	0.060
			PLOI											0.139	Not violate	0.969
		Stage 6	PI						0.466	Not violated	0.999	0.956	No significant different	0.970	Not violate	0.865
			PLOI											0.596	Not violate	0.903
		Stage 7	PI						0.065	Not violated	0.929	0.004	Significant different	0.336	Not violate	0.007
			PLOI											0.216	Not violate	0.824
	Comp3 13. Having adequate knowledge in construction procurement	Stage 0	PI	-ve skewed	0.515	0.000	No	18.188	0.126	Not violated	0.920	0.002	Significant different	0.386	Not violate	0.002
			PLOI	-ve skewed										0.022	Violate	0.907
		Stage 1	PI						0.103	Not violated	0.998	0.876	No significant different	0.835	Not violate	0.747
			PLOI											0.008	Violate	0.610
		Stage 2	PI						0.155	Not violated	0.964	0.062	No significant different	0.813	Not violate	0.032
			PLOI											0.042	Violate	0.822
		Stage 3	PI						0.328	Not violated	0.977	0.180	No significant different	0.994	Not violate	0.119
			PLOI											0.147	Not violate	0.932
		Stage 4	PI						0.581	Not violated	0.970	0.098	No significant different	0.957	Not violate	0.140
			PLOI											0.459	Not violate	0.541
		Stage 5	PI						0.129	Not violated	0.988	0.396	No significant different	0.978	Not violate	0.341
			PLOI											0.157	Not violate	0.715
		Stage 6	PI						0.121	Not violated	0.995	0.674	No significant different	0.387	Not violate	0.907
			PLOI											0.286	Not violate	0.411
		Stage 7	PI						0.354	Not violated	0.972	0.117	No significant different	0.817	Not violate	0.070
			PLOI											0.052	Not violate	0.964

Summary of output of One-Way MANOVA of items (Continued)

Constructs	Items	IV	DV	Assumptions: Normality	Multicollinearity r	Multicollinearity Sig.	Linearity	Multivariate outliers Mahal. Dist.	Box Test: Sig.	Homogeneity of variance-covariance matrices	Multivariate Tests: Wilks' Lambda	Sig.	Decision	Levene's Test: Sig.	Homogeneity of variances	Test of Between Subject effects: Sig.
Competence	Comp7 14. Ability to champion lean construction practice	Stage 0	PI	-ve skewed	0.585	0.000	No	11.686	0.099	Not violated	0.993	0.605	No significant different	0.791	Not violate	0.331
			PLOI	-ve skewed										0.005	Violate	0.434
		Stage 1	PI						0.274	Not violated	0.997	0.814	No significant different	0.225	Not violate	0.976
			PLOI											0.167	Not violate	0.595
		Stage 2	PI						0.154	Not violated	0.953	0.029	Significant different	0.249	Not violate	0.101
			PLOI											0.060	Not violate	0.502
		Stage 3	PI						0.092	Not violated	0.973	0.129	No significant different	0.361	Not violate	0.628
			PLOI											0.062	Not violate	0.202
		Stage 4	PI						0.349	Not violated	0.942	0.012	Significant different	0.487	Not violate	0.410
			PLOI											0.575	Not violate	0.006
		Stage 5	PI						0.088	Not violated	0.988	0.399	No significant different	0.326	Not violate	0.985
			PLOI											0.266	Not violate	0.283
		Stage 6	PI						0.430	Not violated	0.979	0.212	No significant different	0.321	Not violate	0.109
			PLOI											0.672	Not violate	0.121
		Stage 7	PI						0.728	Not violated	0.953	0.028	Significant different	0.557	Not violate	0.071
			PLOI											0.932	Not violate	0.632
	Sust3 15. Involve in selection of construction materials/equipment	Stage 0	PI	-ve skewed	0.589	0.000	No	10.064	0.345	Not violated	0.975	0.153	No significant different	0.093	Not violate	0.503
			PLOI	-ve skewed										0.289	Not violate	0.064
		Stage 1	PI						0.656	Not violated	0.996	0.723	No significant different	0.515	Not violate	0.952
			PLOI											0.273	Not violate	0.550
		Stage 2	PI						0.575	Not violated	1.000	0.980	No significant different	0.637	Not violate	0.883
			PLOI											0.201	Not violate	0.842
		Stage 3	PI						0.565	Not violated	0.998	0.872	No significant different	0.087	Not violate	0.601
			PLOI											0.400	Not violate	0.781
		Stage 4	PI						0.457	Not violated	0.991	0.509	No significant different	0.189	Not violate	0.924
			PLOI											0.290	Not violate	0.392
		Stage 5	PI						0.477	Not violated	0.994	0.647	No significant different	0.401	Not violate	0.802
			PLOI											0.154	Not violate	0.578
		Stage 6	PI						0.542	Not violated	0.989	0.429	No significant different	0.954	Not violate	0.550
			PLOI											0.168	Not violate	0.586
		Stage 7	PI						0.371	Not violated	0.994	0.636	No significant different	0.033	Violate	0.520
			PLOI											0.130	Not violate	0.872

Summary of output of One-Way MANOVA of items (Continued)

Constructs	Items	IV	DV	Assumptions: Normality	Multicollinearity r	Multicollinearity Sig.	Linearity	Multivariate outliers Mahal. Dist.	Box Test Sig.	Box Test Homogeneity of variance-covariance matrices	Multivariate Tests Wilks' Lambda	Multivariate Tests Sig.	Multivariate Tests Decision	Levene's Test Sig.	Levene's Test Homogeneity of variances	Test of Between Subject effects Sig.
Competence	Comp1 16. Having adequate experience in building maintenance	Stage 0	PI	-ve skewed	0.489	0.000	No	25.533	0.046	Not violated	0.950	0.021	Significant different	0.135	Not violate	0.026
			PLOI	-ve skewed										0.601	Not violate	0.485
		Stage 1	PI						0.062	Not violated	0.983	0.283	No significant different	0.340	Not violate	0.147
			PLOI											0.013	Violate	0.252
		Stage 2	PI						0.154	Not violated	0.978	0.195	No significant different	0.471	Not violate	0.084
			PLOI											0.072	Not violate	0.253
		Stage 3	PI						0.006	Not violated	0.979	0.206	No significant different	0.650	Not violate	0.098
			PLOI											0.015	Violate	0.222
		Stage 4	PI						0.065	Not violated	0.962	0.055	No significant different	0.995	Not violate	0.045
			PLOI											0.113	Not violate	0.628
		Stage 5	PI						0.071	Not violated	0.969	0.091	No significant different	0.473	Not violate	0.973
			PLOI											0.351	Not violate	0.041
		Stage 6	PI						0.009	Not violated	0.968	0.088	No significant different	0.118	Not violate	0.483
			PLOI											0.146	Not violate	0.094
		Stage 7	PI						0.142	Not violated	0.978	0.186	No significant different	0.438	Not violate	0.315
			PLOI											0.954	Not violate	0.072

Summary of output of One-Way MANOVA of items (Continued)

Constructs	Items	IV	DV	Assumptions					Box Test		Multivariate Tests			Levene's Test		Test of Between Subject effects
				Normality	Multicollinearity r	Multicollinearity Sig.	Linearity	Multivariate outliers Mahal. Dist.	Sig.	Homogeneity of variance-covariance matrices	Wilks' Lambda	Sig.	Decision	Sig.	Homogeneity of variances	Sig.
POE	POE1 17. Ability to implement POE	Stage 0	PI	-ve skewed	0.449	0.000	No	18.907	0.008	Not violated	0.997	0.775	No significant different	0.826	Not violate	0.981
			PLOI	-ve skewed										0.003	Violate	0.538
		Stage 1	PI						0.025	Not violated	0.980	0.221	No significant different	0.826	Not violate	0.163
			PLOI											0.014	Violate	0.808
		Stage 2	PI						0.132	Not violated	0.993	0.588	No significant different	0.221	Not violate	0.649
			PLOI											0.700	Not violate	0.302
		Stage 3	PI						0.401	Not violated	0.998	0.837	No significant different	0.367	Not violate	0.563
			PLOI											0.847	Not violate	0.683
		Stage 4	PI						0.556	Not violated	0.989	0.441	No significant different	0.857	Not violate	0.956
			PLOI											0.075	Not violate	0.272
		Stage 5	PI						0.029	Not violated	1.000	0.974	No significant different	0.336	Not violate	0.824
			PLOI											0.016	Violate	0.955
		Stage 6	PI						0.622	Not violated	0.990	0.457	No significant different	0.093	Not violate	0.245
			PLOI											0.366	Not violate	0.885
		Stage 7	PI						0.118	Not violated	0.992	0.556	No significant different	0.992	Not violate	0.369
			PLOI											0.004	Violate	0.336
	POE2 18. Ability to lead in hanling POE database development	Stage 0	PI	-ve skewed	0.542	0.000	No	11.870	0.136	Not violated	0.989	0.443	No significant different	0.181	Not violate	0.567
			PLOI	-ve skewed										0.140	Not violate	0.561
		Stage 1	PI						0.091	Not violated	0.983	0.274	No significant different	0.030	Violate	0.121
			PLOI											0.048	Violate	0.574
		Stage 2	PI						0.955	Not violated	0.991	0.518	No significant different	0.298	Not violate	0.817
			PLOI											0.924	Not violate	0.441
		Stage 3	PI						0.655	Not violated	0.994	0.631	No significant different	0.197	Not violate	0.923
			PLOI											0.962	Not violate	0.407
		Stage 4	PI						0.854	Not violated	0.998	0.852	No significant different	0.556	Not violate	0.743
			PLOI											0.734	Not violate	0.571
		Stage 5	PI						0.653	Not violated	0.997	0.791	No significant different	0.967	Not violate	0.494
			PLOI											0.159	Not violate	0.666
		Stage 6	PI						0.875	Not violated	0.988	0.394	No significant different	0.431	Not violate	0.172
			PLOI											0.696	Not violate	0.415
		Stage 7	PI						0.210	Not violated	0.982	0.259	No significant different	0.011	Violate	0.100
			PLOI											0.106	Not violate	0.334

Summary of output of One-Way MANOVA of items (Continued)

Constructs	Items	IV	DV	Assumptions: Normality	Multicollinearity r	Multicollinearity Sig.	Linearity	Multivariate outliers Mahal. Dist.	Box Test Sig.	Box Test Homogeneity of variance-covariance matrices	Multivariate Tests Wilks' Lambda	Multivariate Tests Sig.	Multivariate Tests Decision	Levene's Test Sig.	Levene's Test Homogeneity of variances	Test of Between Subject effects Sig.
POE	POE3 19. Ability to balance the positive and the negative criticism in the POE reports	Stage 0	PI	-ve skewed	0.512	0.000	No	15.170	0.276	Not violated	0.992	0.549	No significant different	0.207	Not violate	0.274
			PLOI	-ve skewed										0.314	Not violate	0.595
		Stage 1	PI						0.245	Not violated	0.998	0.878	No significant different	0.916	Not violate	0.625
			PLOI											0.202	Not violate	0.695
		Stage 2	PI						0.937	Not violated	0.997	0.773	No significant different	0.085	Not violate	0.479
			PLOI											0.700	Not violate	0.622
		Stage 3	PI						0.898	Not violated	0.997	0.813	No significant different	0.062	Not violate	0.911
			PLOI											0.660	Not violate	0.553
		Stage 4	PI						0.979	Not violated	0.999	0.947	No significant different	0.376	Not violate	0.752
			PLOI											0.924	Not violate	0.799
		Stage 5	PI						0.652	Not violated	1.000	0.992	No significant different	0.602	Not violate	0.917
			PLOI											0.446	Not violate	0.906
		Stage 6	PI						0.290	Not violated	0.995	0.711	No significant different	0.713	Not violate	0.644
			PLOI											0.830	Not violate	0.746
		Stage 7	PI						0.105	Not violated	0.984	0.300	No significant different	0.524	Not violate	0.195
			PLOI											0.341	Not violate	0.988
	POE4 20. Ability to transfer POE outcomes in a project to briefing stage of other project	Stage 0	PI	-ve skewed	0.498	0.000	No	15.401	0.534	Not violated	0.987	0.361	No significant different	0.952	Not violate	0.153
			PLOI	-ve skewed										0.933	Not violate	0.433
		Stage 1	PI						0.420	Not violated	0.989	0.430	No significant different	0.498	Not violate	0.262
			PLOI											0.978	Not violate	0.998
		Stage 2	PI						0.949	Not violated	0.974	0.142	No significant different	0.336	Not violate	0.051
			PLOI											0.332	Not violate	0.478
		Stage 3	PI						0.997	Not violated	0.984	0.291	No significant different	0.617	Not violate	0.126
			PLOI											0.787	Not violate	0.643
		Stage 4	PI						0.993	Not violated	0.954	0.030	Significant different	0.852	Not violate	0.238
			PLOI											0.740	Not violate	0.155
		Stage 5	PI						0.343	Not violated	0.995	0.682	No significant different	0.334	Not violate	0.442
			PLOI											0.059	Not violate	0.977
		Stage 6	PI						0.678	Not violated	0.991	0.513	No significant different	0.395	Not violate	0.628
			PLOI											0.108	Not violate	0.512
		Stage 7	PI						0.292	Not violated	0.994	0.645	No significant different	0.184	Not violate	0.762
			PLOI											0.051	Not violate	0.542

Summary of output of One-Way MANOVA of items (Continued)

Constructs	Items	IV	DV	Assumptions: Normality	Assumptions: Multicollinearity r	Assumptions: Multicollinearity Sig.	Assumptions: Linearity	Assumptions: Multivariate outliers Mahal. Dist.	Box Test: Sig.	Box Test: Homogeneity of variance-covariance matrices	Multivariate Tests: Wilks' Lambda	Multivariate Tests: Sig.	Multivariate Tests: Decision	Levene's Test: Sig.	Levene's Test: Homogeneity of variances	Test of Between Subject effects: Sig.
Organisation	StrR4 21. Having a seat at a table in higher management level	Stage 0	PI	-ve skewed	0.589	0.000	No	20.818	0.003	Not violated	1.000	0.995	No significant different	0.520	Not violate	0.992
			PLOI	-ve skewed										0.514	Not violate	0.940
		Stage 1	PI						0.017	Not violated	0.984	0.307	No significant different	0.362	Not violate	0.822
			PLOI											0.513	Not violate	0.173
		Stage 2	PI						0.030	Not violated	0.973	0.124	No significant different	0.666	Not violate	0.610
			PLOI											0.278	Not violate	0.057
		Stage 3	PI						0.743	Not violated	0.957	0.037	Significant different	0.557	Not violate	0.370
			PLOI											0.385	Not violate	0.013
		Stage 4	PI						0.509	Not violated	0.972	0.116	No significant different	0.747	Not violate	0.880
			PLOI											0.188	Not violate	0.078
		Stage 5	PI						0.115	Not violated	0.984	0.294	No significant different	0.249	Not violate	0.598
			PLOI											0.027	Violate	0.133
		Stage 6	PI						0.777	Not violated	0.988	0.405	No significant different	0.756	Not violate	0.560
			PLOI											0.603	Not violate	0.527
		Stage 7	PI						0.212	Not violated	0.984	0.299	No significant different	0.043	Violate	0.137
			PLOI											0.214	Not violate	0.616
	MgtT3 22. Ability to apply Computerised Aided Facilities Management (CAFM)	Stage 0	PI	-ve skewed	0.640	0.000	No	9.862	0.405	Not violated	0.987	0.376	No significant different	0.525	Not violate	0.483
			PLOI	-ve skewed										0.635	Not violate	0.652
		Stage 1	PI						0.075	Not violated	0.966	0.074	No significant different	0.013	Violate	0.030
			PLOI											0.329	Not violate	0.388
		Stage 2	PI						0.258	Not violated	0.991	0.528	No significant different	0.129	Not violate	0.409
			PLOI											0.374	Not violate	0.260
		Stage 3	PI						0.291	Not violated	0.984	0.301	No significant different	0.071	Not violate	0.295
			PLOI											0.318	Not violate	0.121
		Stage 4	PI						0.516	Not violated	0.957	0.039	Significant different	0.261	Not violate	0.391
			PLOI											0.468	Not violate	0.017
		Stage 5	PI						0.384	Not violated	0.952	0.026	Significant different	0.169	Not violate	0.073
			PLOI											0.073	Not violate	0.007
		Stage 6	PI						0.214	Not violated	0.983	0.283	No significant different	0.572	Not violate	0.214
			PLOI											0.480	Not violate	0.117
		Stage 7	PI						0.846	Not violated	0.980	0.230	No significant different	0.620	Not violate	0.673
			PLOI											0.639	Not violate	0.125

Summary of output of One-Way MANOVA of items (Continued)

Constructs	Items	IV	DV	Assumptions					Box Test		Multivariate Tests			Levene's Test		Test of Between Subject effects
				Normality	Multicollinearity r	Multicollinearity Sig.	Linearity	Multivariate outliers Mahal. Dist.	Sig.	Homogeneity of variance-covariance matrices	Wilks' Lambda	Sig.	Decision	Sig.	Homogeneity of variances	Sig.
Organisation	StrR3 23. Having trust from other professionals	Stage 0	PI	-ve skewed	0.325	0.000	No	14.919	0.384	Not violated	0.958	0.039	Significant different	0.993	Not violate	0.026
			PLOI	-ve skewed										0.834	Not violate	0.455
		Stage 1	PI						0.826	Not violated	0.966	0.073	No significant different	0.173	Not violate	0.075
			PLOI											0.492	Not violate	0.297
		Stage 2	PI						0.811	Not violated	0.970	0.106	No significant different	0.111	Not violate	0.101
			PLOI											0.956	Not violate	0.326
		Stage 3	PI						0.222	Not violated	0.978	0.189	No significant different	0.066	Not violate	0.539
			PLOI											0.743	Not violate	0.118
		Stage 4	PI						0.931	Not violated	0.962	0.055	No significant different	0.639	Not violate	0.433
			PLOI											0.716	Not violate	0.038
		Stage 5	PI						0.317	Not violated	0.971	0.107	No significant different	0.693	Not violate	0.139
			PLOI											0.357	Not violate	0.238
		Stage 6	PI						0.812	Not violated	0.958	0.040	Significant different	0.683	Not violate	0.063
			PLOI											0.763	Not violate	0.190
		Stage 7	PI						0.039	Not violated	0.984	0.292	No significant different	0.824	Not violate	0.124
			PLOI											0.112	Not violate	0.996
	MgtT2 24. Ability to apply Building Information Modelling (BIM)	Stage 0	PI	-ve skewed	0.558	0.000	No	9.772	0.666	Not violated	0.994	0.648	No significant different	0.583	Not violate	0.404
			PLOI	-ve skewed										0.353	Not violate	0.413
		Stage 1	PI						0.205	Not violated	0.955	0.031	Significant different	0.197	Not violate	0.010
			PLOI											0.902	Not violate	0.332
		Stage 2	PI						0.331	Not violated	0.994	0.613	No significant different	0.091	Not violate	0.331
			PLOI											0.299	Not violate	0.688
		Stage 3	PI						0.114	Not violated	0.976	0.168	No significant different	0.011	Violate	0.068
			PLOI											0.492	Not violate	0.147
		Stage 4	PI						0.378	Not violated	0.960	0.045	Significant different	0.137	Not violate	0.117
			PLOI											0.366	Not violate	0.013
		Stage 5	PI						0.137	Not violated	0.975	0.153	No significant different	0.047	Violate	0.053
			PLOI											0.113	Not violate	0.315
		Stage 6	PI						0.459	Not violated	0.977	0.181	No significant different	0.296	Not violate	0.077
			PLOI											0.949	Not violate	0.146
		Stage 7	PI						0.529	Not violated	0.991	0.497	No significant different	0.804	Not violate	0.542
			PLOI											0.751	Not violate	0.629

Summary of output of One-Way MANOVA of items (Continued)

Constructs	Items	IV	DV	Assumptions: Normality	Assumptions: Multicollinearity r	Assumptions: Multicollinearity Sig.	Assumptions: Linearity	Assumptions: Multivariate outliers Mahal. Dist.	Box Test: Sig.	Box Test: Homogeneity of variance-covariance matrices	Multivariate Tests: Wilks' Lambda	Multivariate Tests: Sig.	Multivariate Tests: Decision	Levene's Test: Sig.	Levene's Test: Homogeneity of variances	Test of Between Subject effects: Sig.
Organisation	StrV8 25. Ability to present service level agreement of FM operation at design stage	Stage 0	PI	-ve skewed	0.495	0.000	No	13.000	0.119	Not violated	0.998	0.876	No significant different	0.381	Not violate	0.642
			PLOI	-ve skewed										0.635	Not violate	0.936
		Stage 1	PI						0.003	Not violated	0.968	0.091	No significant different	0.012	Violate	0.037
			PLOI											0.183	Not violate	0.526
		Stage 2	PI						0.688	Not violated	0.996	0.722	No significant different	0.724	Not violate	0.552
			PLOI											0.424	Not violate	0.909
		Stage 3	PI						0.381	Not violated	0.989	0.440	No significant different	0.671	Not violate	0.718
			PLOI											0.354	Not violate	0.223
		Stage 4	PI						0.115	Not violated	0.963	0.060	No significant different	0.361	Not violate	0.235
			PLOI											0.083	Not violate	0.018
		Stage 5	PI						0.056	Not violated	0.989	0.440	No significant different	0.042	Violate	0.443
			PLOI											0.013	Violate	0.200
		Stage 6	PI						0.035	Not violated	0.989	0.454	No significant different	0.085	Not violate	0.947
			PLOI											0.043	Violate	0.284
		Stage 7	PI						0.028	Not violated	0.995	0.667	No significant different	0.048	Violate	0.367
			PLOI											0.381	Not violate	0.590
	DevS2 26. Willing to anticipate operational issues in PPP project development	Stage 0	PI	-ve skewed	0.586	0.000	No	14.886	0.367	Not violated	0.980	0.220	No significant different	0.171	Not violate	0.168
			PLOI	-ve skewed										0.763	Not violate	0.983
		Stage 1	PI						0.222	Not violated	0.998	0.884	No significant different	0.131	Not violate	0.619
			PLOI											0.283	Not violate	0.783
		Stage 2	PI						0.361	Not violated	0.976	0.166	No significant different	0.277	Not violate	0.094
			PLOI											0.675	Not violate	0.083
		Stage 3	PI						0.282	Not violated	0.984	0.308	No significant different	0.333	Not violate	0.169
			PLOI											0.611	Not violate	0.165
		Stage 4	PI						0.218	Not violated	0.995	0.697	No significant different	0.703	Not violate	0.462
			PLOI											0.771	Not violate	0.904
		Stage 5	PI						0.262	Not violated	0.994	0.618	No significant different	0.843	Not violate	0.796
			PLOI											0.426	Not violate	0.559
		Stage 6	PI						0.015	Not violated	0.982	0.257	No significant different	0.064	Not violate	0.365
			PLOI											0.055	Not violate	0.100
		Stage 7	PI						0.472	Not violated	0.970	0.102	No significant different	0.218	Not violate	0.283
			PLOI											0.162	Not violate	0.436

Summary of output of One-Way MANOVA of items (Continued)

Constructs	Items	IV	DV	Assumptions: Normality	Multicollinearity r	Multicollinearity Sig.	Linearity	Multivariate outliers Mahal. Dist.	Box Test Sig.	Box Test Homogeneity of variance-covariance matrices	Multivariate Tests Wilks' Lambda	Multivariate Tests Sig.	Multivariate Tests Decision	Levene's Test Sig.	Levene's Test Homogeneity of variances	Test of Between Subject effects Sig.
Organisation	Sust2 27. Ability to take lead in mobile flexible working patterns	Stage 0	PI	-ve skewed	0.546	0.000		16.439	0.019	Not violated	0.997	0.804	No significant different	0.140	Not violate	0.725
			PLOI	-ve skewed										0.680	Not violate	0.508
		Stage 1	PI						0.273	Not violated	0.972	0.121	No significant different	0.102	Not violate	0.136
			PLOI											0.084	Not violate	0.044
		Stage 2	PI						0.231	Not violated	0.969	0.099	No significant different	0.013	Violate	0.034
			PLOI											0.012	Violate	0.131
		Stage 3	PI						0.640	Not violated	0.964	0.067	No significant different	0.030	Violate	0.031
			PLOI											0.082	Not violate	0.053
		Stage 4	PI						0.688	Not violated	0.940	0.010	Significant different	0.024	Violate	0.012
			PLOI											0.103	Not violate	0.005
		Stage 5	PI						0.489	Not violated	0.964	0.067	No significant different	0.104	Not violate	0.040
			PLOI											0.056	Not violate	0.039
		Stage 6	PI						0.401	Not violated	0.931	0.005	Significant different	0.304	Not violate	0.105
			PLOI											0.049	Violate	0.170
		Stage 7	PI						0.148	Not violated	0.974	0.143	No significant different	0.133	Not violate	0.052
			PLOI											0.761	Not violate	0.411

Summary of output of One-Way MANOVA of items (Continued)

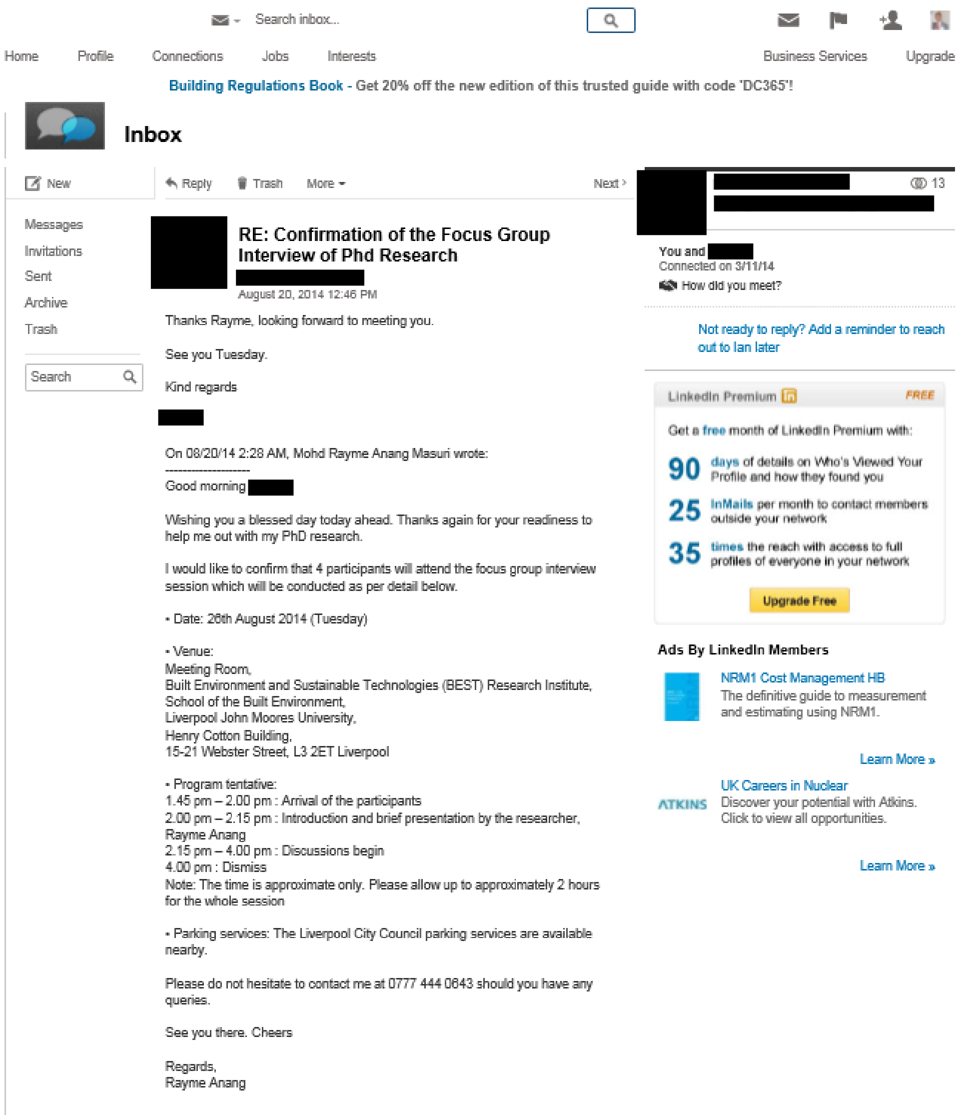
Constructs	Items	IV	DV	Assumptions					Box Test		Multivariate Tests			Levene's Test		Test of Between Subject effects
				Normality	Multicollinearity r	Multicollinearity Sig.	Linearity	Multivariate outliers Mahal. Dist.	Sig.	Homogeneity of variance-covariance matrices	Wilks' Lambda	Sig.	Decision	Sig.	Homogeneity of variances	Sig.
Strategic Value	StrV3 28. Take a leadership role in the client organisation as an advisor	Stage 0	PI	-ve skewed	0.560	0.000	No	11.695	0.150	Not violated	0.960	0.045	Significant different	0.900	Not violate	0.044
			PLOI	-ve skewed										0.367	Not violate	0.985
		Stage 1	PI						0.508	Not violated	0.996	0.751	No significant different	0.901	Not violate	0.705
			PLOI											0.645	Not violate	0.753
		Stage 2	PI						0.281	Not violated	0.997	0.780	No significant different	0.164	Not violate	0.489
			PLOI											0.168	Not violate	0.607
		Stage 3	PI						0.198	Not violated	0.993	0.579	No significant different	0.050	Not violate	0.403
			PLOI											0.374	Not violate	0.319
		Stage 4	PI						0.473	Not violated	0.993	0.588	No significant different	0.719	Not violate	0.878
			PLOI											0.269	Not violate	0.458
		Stage 5	PI						0.536	Not violated	0.998	0.882	No significant different	0.493	Not violate	0.997
			PLOI											0.196	Not violate	0.684
		Stage 6	PI						0.565	Not violated	0.987	0.389	No significant different	0.355	Not violate	0.791
			PLOI											0.331	Not violate	0.344
		Stage 7	PI						0.281	Not violated	0.986	0.341	No significant different	0.281	Not violate	0.144
			PLOI											0.735	Not violate	0.479
	StrV2 29. Get involved in briefing stage	Stage 0	PI	-ve skewed	0.434	0.000	No	15.781	0.038	Not violated	0.997	0.805	No significant different	0.175	Not violate	0.518
			PLOI	-ve skewed										0.471	Not violate	0.871
		Stage 1	PI						0.792	Not violated	0.998	0.841	No significant different	0.319	Not violate	0.680
			PLOI											0.951	Not violate	0.576
		Stage 2	PI						0.235	Not violated	0.999	0.943	No significant different	0.212	Not violate	0.964
			PLOI											0.117	Not violate	0.777
		Stage 3	PI						0.566	Not violated	1.000	0.997	No significant different	0.534	Not violate	0.940
			PLOI											0.408	Not violate	0.992
		Stage 4	PI						0.381	Not violated	0.987	0.374	No significant different	0.817	Not violate	0.279
			PLOI											0.079	Not violate	0.200
		Stage 5	PI						0.959	Not violated	0.992	0.566	No significant different	0.881	Not violate	0.836
			PLOI											0.979	Not violate	0.302
		Stage 6	PI						0.945	Not violated	0.993	0.596	No significant different	0.395	Not violate	0.542
			PLOI											0.853	Not violate	0.317
		Stage 7	PI						0.908	Not violated	0.994	0.634	No significant different	0.957	Not violate	0.816
			PLOI											0.656	Not violate	0.467

Summary of output of One-Way MANOVA of items (Continued)

Constructs	Items	IV	DV	Assumptions: Normality	Assumptions: Multicollinearity r	Assumptions: Multicollinearity Sig.	Assumptions: Linearity	Assumptions: Multivariate outliers Mahal. Dist.	Box Test: Sig.	Box Test: Homogeneity of variance-covariance matrices	Multivariate Tests: Wilks' Lambda	Multivariate Tests: Sig.	Multivariate Tests: Decision	Levene's Test: Sig.	Levene's Test: Homogeneity of variances	Test of Between Subject effects: Sig.
Strategic Value	StrV1 30. Understand user's organisational strategy	Stage 0	PI	-ve skewed	0.404	0.000	No	18.338	0.263	Not violated	0.968	0.086	No significant different	0.549	Not violate	0.165
			PLOI	-ve skewed										0.170	Not violate	0.306
		Stage 1	PI						0.473	Not violated	0.995	0.679	No significant different	0.969	Not violate	0.499
			PLOI											0.721	Not violate	0.431
		Stage 2	PI						0.112	Not violated	0.995	0.709	No significant different	0.443	Not violate	0.426
			PLOI											0.836	Not violate	0.777
		Stage 3	PI						0.233	Not violated	0.989	0.424	No significant different	0.850	Not violate	0.666
			PLOI											0.756	Not violate	0.191
		Stage 4	PI						0.022	Not violated	0.942	0.011	Significant different	0.577	Not violate	0.101
			PLOI											0.800	Not violate	0.003
		Stage 5	PI						0.580	Not violated	0.949	0.020	Significant different	0.610	Not violate	0.156
			PLOI											0.646	Not violate	0.005
		Stage 6	PI						0.060	Not violated	0.986	0.352	No significant different	0.308	Not violate	0.681
			PLOI											0.349	Not violate	0.151
		Stage 7	PI						0.461	Not violated	0.994	0.632	No significant different	0.231	Not violate	0.360
			PLOI											0.703	Not violate	0.529

Appendix Q: Example of Correspondence of Focus Group Interview

Focus Group Participant 1 (FGP#1)



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[redacted]

RE: Confirmation of the Focus Group Interview of Phd Research

[redacted]

August 20, 2014 12:46 PM

Thanks Rayme, looking forward to meeting you.

See you Tuesday.

Kind regards

[redacted]

On 08/20/14 2:28 AM, Mohd Rayme Anang Masuri wrote:

Good morning [redacted]

Wishing you a blessed day today ahead. Thanks again for your readiness to help me out with my PhD research.

I would like to confirm that 4 participants will attend the focus group interview session which will be conducted as per detail below.

- Date: 26th August 2014 (Tuesday)

- Venue:
Meeting Room,
Built Environment and Sustainable Technologies (BEST) Research Institute,
School of the Built Environment,
Liverpool John Moores University,
Henry Cotton Building,
15-21 Webster Street, L3 2ET Liverpool

- Program tentative:
1.45 pm – 2.00 pm : Arrival of the participants
2.00 pm – 2.15 pm : Introduction and brief presentation by the researcher, Rayme Anang
2.15 pm – 4.00 pm : Discussions begin
4.00 pm : Dismiss
Note: The time is approximate only. Please allow up to approximately 2 hours for the whole session

- Parking services: The Liverpool City Council parking services are available nearby.

Please do not hesitate to contact me at 0777 444 0643 should you have any queries.

See you there. Cheers

Regards,
Rayme Anang

[redacted] 13

You and [redacted]
Connected on 3/11/14
How did you meet?

Not ready to reply? Add a reminder to reach out to Ian later

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[redacted]

RE: Invitation to participate in Focus Group Interview of Phd Research

[redacted]

August 19, 2014 7:18 PM

You replied to this message:

Hi Rayme, I confirm I'm available on Tuesday 26th. Please advise on time and venue details?

Kind regards

[redacted]

On 08/18/14 4:01 AM, Mohd Rayme Anang Masuri wrote:

Good morning [redacted]

Wishing you a nice Monday.

For your information, including your good self, 5 participants have agreed to participate in the research study.

However, two participants have free themselves to come to the focus group session on 26th August 2014 (Tuesday).

The rest will confirm their attendance soon.

I would be grateful if everyone can free themselves on the 26th August 2014 (Tuesday).

Regards,
Rayme

On 07/25/14 2:24 AM, [redacted] wrote:

Hi Rayme

It would be a pleasure to take part in your focus group interview. Thank you for the invite.

Kind regards

[redacted]

On 07/22/14 3:32 AM, Mohd Rayme Anang Masuri wrote:

Hi [redacted]

I am writing to invite you to take part in a focus group interview of my PhD study.

At the moment, I am doing a research regarding the development of framework to optimise the role of FM in the various stages of the development process.

The focus group interview is a final stage of data collection and the purpose is to obtain your view in order to validate the developed framework.

The focus group will involve 3 to 5 participants from various technical background in FM and property development industry.

If you agree to participate, I would arrange the time and location of the meeting that is available for all of the participants.

Your cooperation is highly appreciated.

Regards,

Rayme Anang

[redacted] 13

You and [redacted]
Connected on 3/11/14
How did you meet?

Not ready to reply? Add a reminder to reach out to Ian later

Focus Group Participant 2 (FGP#2)

Bin Anang Masuri, Mohd

From: Bin Anang Masuri, Mohd
Sent: 15 August 2014 09:30
To: [redacted]
Subject: RE: Invitation to participate in Focus Group Interview of Phd Research

Good morning [redacted]

Wishing you a blessed Friday mate.

Thanks for reply. For information including your good self, two participants have choose 26th Aug.

Therefore, I pre-book your time on 26 August 2014 @ 2.00 pm.

Regards,
Rayme

From: [redacted]
Sent: 15 August 2014 08:01
To: Bin Anang Masuri, Mohd
Subject: RE: Invitation to participate in Focus Group Interview of Phd Research

Good morning
Due to other commitments, the only date that I would be able to do would be Tuesday 26th August.
Regards
[redacted]

From: Bin Anang Masuri, Mohd [mailto:M.R.Bin-Anang-Masuri@2011.ljmu.ac.uk]
Sent: 14 August 2014 11:23
To: [redacted]
Subject: RE: Invitation to participate in Focus Group Interview of Phd Research
Importance: High

Hi [redacted]

Thanks for your readiness to help me out with my PhD research. For your information, 5 participants have agreed to participate in the focus group interview session.

The focus group session is suggested to be conducted on **ONE** of the dates listed below:

Option 1: 26 August 2014 (Tuesday)
Option 2: 28 August 2014 (Thursday)
Option 3: 2 September 2014 (Tuesday)

I would appreciate if you could let me know the date of your preference.

The session will be held at:
Meeting Room,
Ground Floor,
Built Environment and Sustainable Technologies (BEST) Research Hub,
Liverpool John Moores University,
Henry Cotton Building,
15-21 Webster Street, L3 2ET Liverpool

1

The program tentative is also provided herewith for your view:

1.45 pm – 2.00 pm : Arrival of the participants
2.00 pm – 2.10 pm : Brief presentation by the researcher, Rayme Anang
2.10 pm – 3.10 pm : Discussions begin
3.10 pm : Refreshment and dismiss

Parking services: The Liverpool City Council parking services are available nearby.

Your immediate feedback on this matter is highly appreciated.

Regards,
Rayme Anang

From: Bin Anang Masuri, Mohd
Sent: 13 August 2014 11:27
To: [redacted]
Subject: RE: Invitation to participate in Focus Group Interview of Phd Research

Hi [redacted]

How are you?

Thanks for your feedback and readiness to help me out with my PhD research.
At the moment I have 4 professionals who are agreed to participate in the focus group interview. I need another one to make it five.

I will let you know the provisional dates soon.

Regards,

Rayme

From: [redacted]
Sent: 22 July 2014 12:25
To: Bin Anang Masuri, Mohd
Subject: RE: Invitation to participate in Focus Group Interview of Phd Research

Good day
I would be happy to take part in your focus group. It will be dependent on the date and time, as I may have other commitments.
Regards
[redacted]

From: Bin Anang Masuri, Mohd [mailto:M.R.Bin-Anang-Masuri@2011.ljmu.ac.uk]
Sent: 22 July 2014 11:20
To: [redacted]
Subject: Invitation to participate in Focus Group Interview of Phd Research
Importance: High

Hi,

I am writing to invite you to take part in a focus group interview of my PhD study.

2

At the moment, I am doing a research regarding the development of framework to optimise the role of FM in the various stages of the development process.

The focus group interview is a final stage of data collection and the purpose is to obtain your view in order to validate the developed framework.

The focus group will involve 3 to 5 participants from various technical background in FM and property development industry.

If you agree to participate, I would arrange the time and location of the meeting that is available for all of the participants.

Your cooperation is highly appreciated.

Regards,

Rayme Anang

Focus Group Participant 3 (FGP#3)

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RE: Invitation to participate in Focus Group Interview of Phd Research
[redacted]
August 14, 2014 11:32 AM

You replied to this message:

Rayme,

I'm afraid I can only do the 26th August (Tuesday), I have meetings already booked in on the other 2 days.

Regards

[redacted]

On 08/14/14 3:26 AM, Mohd Rayme Anang Masuri wrote:

Hi [redacted]

Thanks for your readiness to help me out with my PhD research. For your information, 5 participants have agreed to participate in the focus group interview session.

The focus group session is suggested to be conducted on ONE of the dates listed below:

Option 1: 26 August 2014 (Tuesday)
Option 2: 28 August 2014 (Thursday)
Option 3: 2 September 2014 (Tuesday)

I would appreciate if you could let me know the date of your preference.

The session will be held at:
Meeting Room,
Ground Floor,
Built Environment and Sustainable Technologies (BEST) Research Hub,
Liverpool John Moores University,
Henry Cotton Building,
15-21 Webster Street, L3 2ET Liverpool

The program tentative is also provided herewith for your view:

1.45 pm – 2.00 pm : Arrival of the participants
2.00 pm – 2.10 pm : Brief presentation by the researcher, Rayme Anang
2.10 pm – 3.10 pm : Discussions begin
3.10 pm : Refreshment and dismiss

Parking services: The Liverpool City Council parking services are available nearby.

Your immediate feedback on this matter is highly appreciated.

Regards,
Rayme Anang

On 08/13/14 9:32 AM, [redacted] wrote:

That's fine.
I am away next week, but not planning to be away until October after that.
Regards
[redacted]

On 08/13/14 3:33 AM, Mohd Rayme Anang Masuri wrote:

Hi [redacted]

How are you?

Thanks for your feedback and readiness to help me out with my PhD research. At the moment I have 4 professionals who are agreed to participate in the focus group interview. I need another one to make it five.

[redacted]

You and [redacted]
Connected on 4/17/12
How did you meet?

Not ready to reply? Add a reminder to reach out to Mark later

RE: Invitation to participate in Focus Group Interview of Phd Research
8/14/14

RE: Invitation to participate in Focus Group Interview of Phd Research
8/13/14

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I will let you know the provisional dates soon.

Regards,

Rayme

On 07/23/14 3:26 AM, [redacted] wrote:

Rayme,
That's fine.
Regards
[redacted]

On 07/22/14 8:01 AM, Mohd Rayme Anang Masuri wrote:

Hi [redacted]

Thanks for your support and immediate reply.

Catering and vending is part of soft service in FM. I would like to hear from you, suggestions or advice of how FM could contribute to enhance the building function in order to support soft services to the building users.

It would be great to share your experience.

I will suggest a suitable time and location of the meeting later together with other participants.

Thank you,

Rayme

On 07/22/14 7:19 AM, [redacted] wrote:

Hello,
I would be happy to help, but my sector (catering and vending) is probably not technical enough to be of use.
Kind regards
[redacted]

On 07/22/14 3:36 AM, Mohd Rayme Anang Masuri wrote:

Hi,

I am writing to invite you to take part in a focus group interview of my PhD study.

At the moment, I am doing a research regarding the development of framework to optimise the role of FM in the various stages of the development process.

The focus group interview is a final stage of data collection and the purpose is to obtain your view in order to validate the developed framework.

The focus group will involve 3 to 5 participants from various technical background in FM and property development industry.

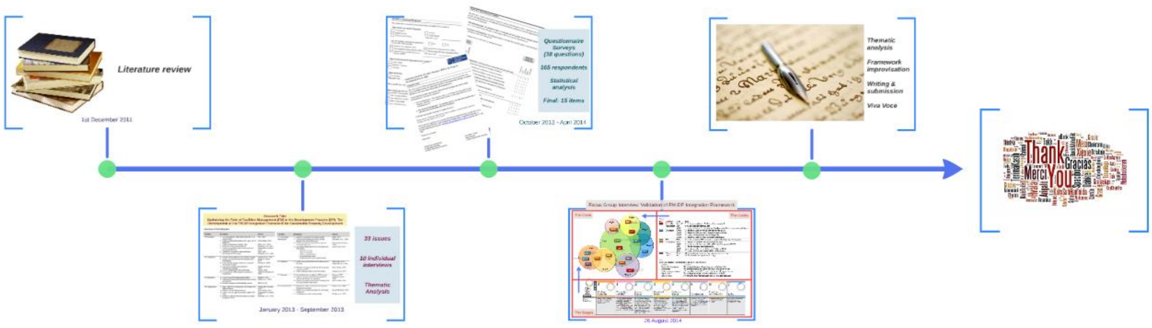
If you agree to participate, I would arrange the time and location of the meeting that is available for all of the participants.

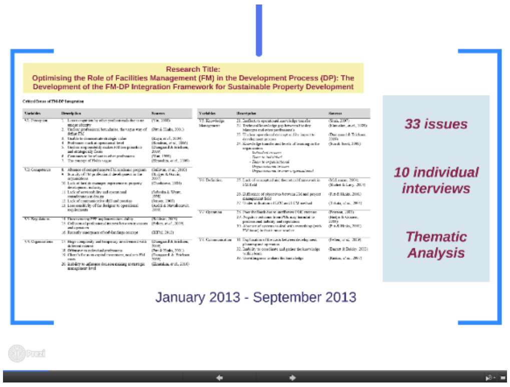
Your cooperation is highly appreciated.

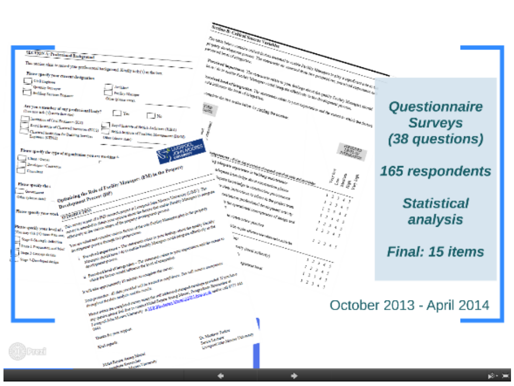
Regards,

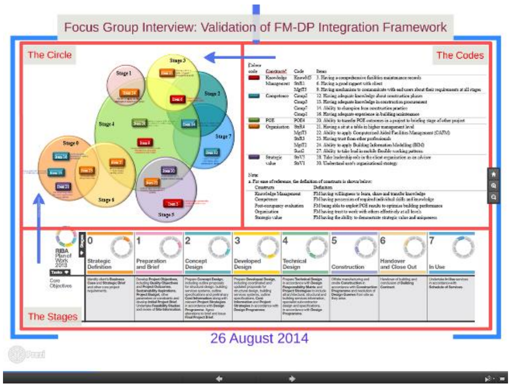
Rayme Anang

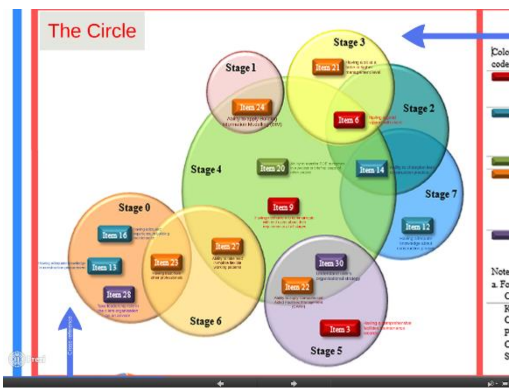
Appendix R: Slides of Focus Group Presentation

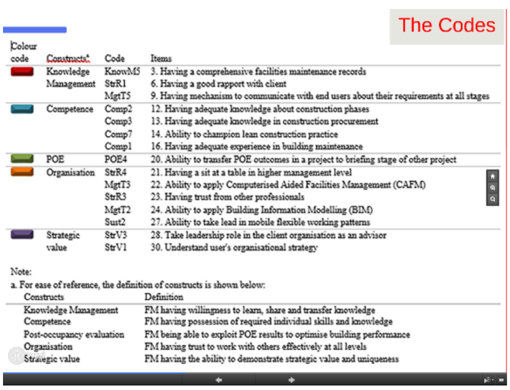


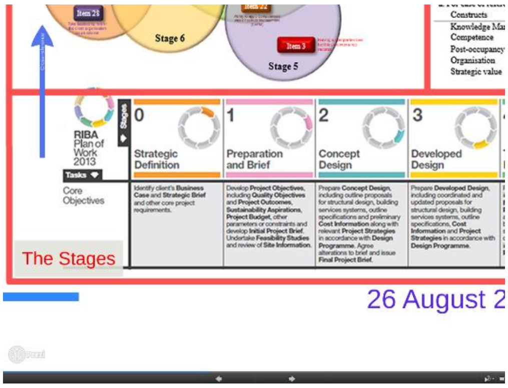


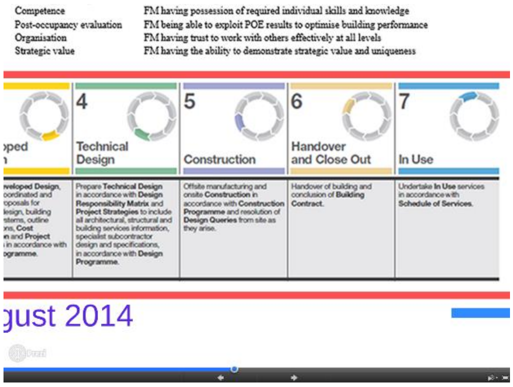


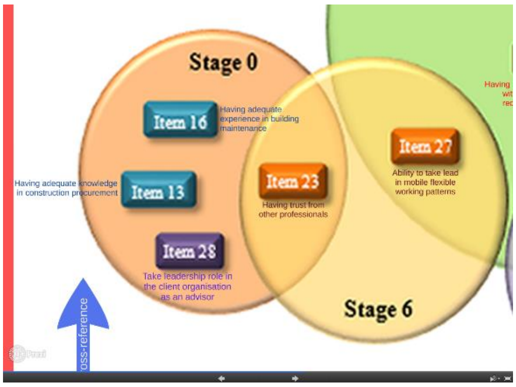


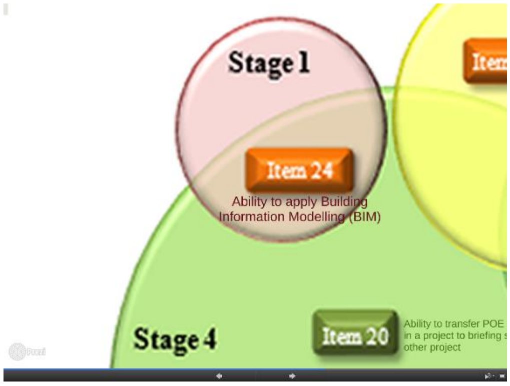


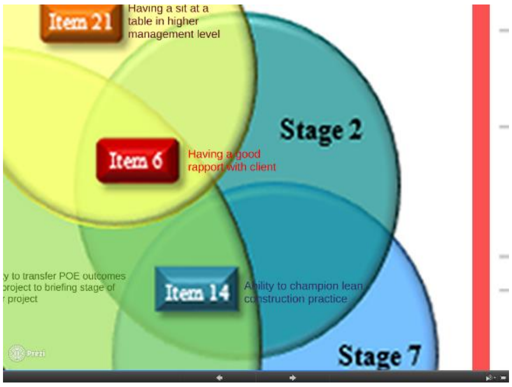


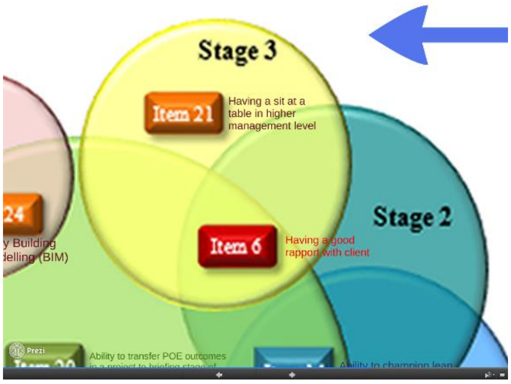

Stage 6
Stage 5
RIBA Plan of Work 2013
Tasks
Core Objectives
0
Strategic Definition
1
Preparation and Brief
2
Concept Design
3
Developed Design
The Stages
26 August 2

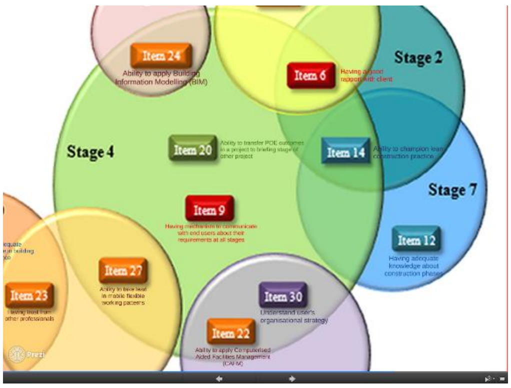

Competence
Post-occupancy evaluation
Organisation
Strategic value
FM having possession of required individual skills and knowledge
FM being able to exploit POE results to optimise building performance
FM having trust to work with others effectively at all levels
FM having the ability to demonstrate strategic value and uniqueness
4
Technical Design
5
Construction
6
Handover and Close Out
7
In Use
gust 2014

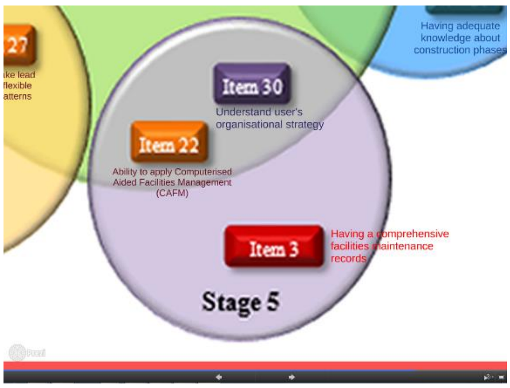

Stage 0
Item 16
Having adequate experience in building maintenance
Having adequate knowledge in construction procurement
Item 13
Item 23
Having trust from other professionals
Item 27
Ability to take lead in mobile flexible working patterns
Item 28
Take leadership role in the client organisation as an advisor
Stage 6

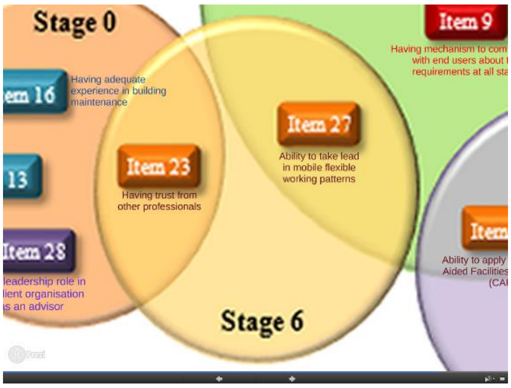

Stage 1
Item 24
Ability to apply Building Information Modelling (BIM)
Stage 4
Item 20
Ability to transfer POE in a project to briefing s other project

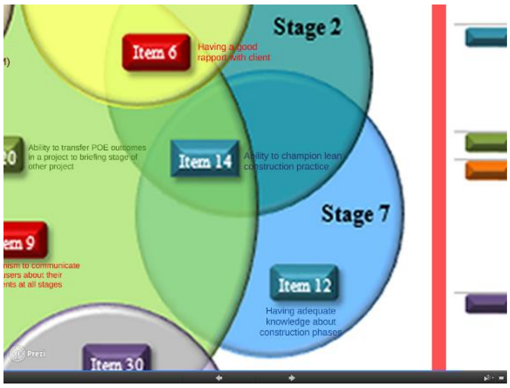

Item 21
Having a sit at a table in higher management level
Stage 2
Item 6
Having a good rapport with client
y to transfer POE outcomes project to briefing stage of project
Item 14
Ability to champion lean construction practice
Stage 7

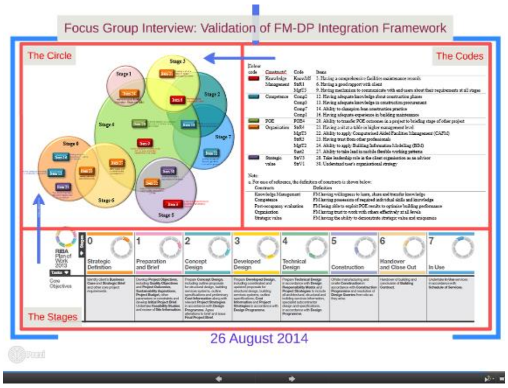

Stage 3
Item 21
Having a sit at a table in higher management level
Stage 2
Item 6
Having a good rapport with client
y Building delling (BIM)
Ability to transfer POE outcomes


Item 24
Stage 2
Item 6
Stage 4
Item 20
Item 14
Stage 7
Item 9
Item 12
Item 27
Item 23
Item 30
Item 22


Having adequate knowledge about construction phase
Item 30
Understand user's organisational strategy
Item 22
Ability to apply Computerised Aided Facilities Management (CAFM)
Item 3
Having a comprehensive facilities maintenance records
Stage 5


Stage 0
Item 9
Having adequate experience in building maintenance
Item 23
Having trust from other professionals
Item 27
Ability to take lead in mobile flexible working patterns
Item 28
Stage 6


Stage 2
Item 6
Item 14
Stage 7
Item 12
Having adequate knowledge about construction phase
Item 30


Focus Group Interview: Validation of FM-DP Integration Framework
The Circle
The Codes
The Stages
26 August 2014


Thank
You
Merci
Gracias
Danke
Arigato
Spacibo
Xiexie

Appendix S: Sample of Transcription of Focus Group Interview

Interviewee:	FGP 1, FGP2, FGP 3
Interviewer:	Mohd Rayme Anang Masuri
Date:	26th August 2014 (Tuesday)
Venue:	Henry Cotton Building, Liverpool John Moores University

Moderator:

1. Welcome

Hi everyone.

Welcome to our session tonight. I would like to express my gratitude to all of you for taking time to join our discussion. My name is Rayme Anang a final year PhD researcher under supervision of Dr. Matthew Tucker. Assisting me is [OBSERVER 1] and [OBSERVER 2]. You were selected because you are all involved in Facilities Management as well as project and construction management. I am particularly interested in your views because you have had lots of experience managing a building contract and business and we want to fully utilise those experiences.

Today we will be discussing your views about a framework that I have developed. Basically I want you to critically comment on the framework, what can be improved to make it reliable and practical. There are no wrong answers but rather differing points of view. Please feel free to share your view even if it differs from others have said. Keep in mind that I want to discover your highly reliable views and critical comments towards the developed framework that I am going to present in the next agenda.

2. Overview Of The Topic (Presentation)-Why You Are Here

Explanation of the framework.

3. Guidelines

Before we begin, with the discussion, let me suggest some things that make our discussion productive. I would want the focus group is a discussion amongst you. This discussion is tape recorded because we do not want to miss any of your comments. As I am going to transcribe and analyse the discussion from the voice recorder, I would appreciate if you could avoid to speak simultaneously. Only one person should talk at a time. We'll be on a first name basis. I have place a name label in front of you so that you can call each other with their first name. Keep in mind that in the thesis or any academic paper the informer will be kept anonymous. You may be assured of the confidentiality.

Another important thing is if you have an agreement with something please say 'Yes, I agree', that would be sufficient. If you do not agree with something, maybe you have the reason or other opinion, please explain it clearly.

I am here as a moderator, I won't participating in the conversation, however I have prepared a couple of questions to stimulate the discussion.

There is a tendency in this discussions for some people to talk more than others. But it is important for us to hear from each of you as you may have had unique experiences.

Before the discussion take place, I suggest we find out some more about each other by going around the table. You may explain your role and how long have you been in the industry. Shall we begin with you?

The conversation of self-introduction have been removed to keep the anonymity of the participants

Moderator: Look back at the framework, do you think it is practical to be implemented in the industry? As you have the experience in PFI project, we know the involvement of FM is really important not only in the design stage but it supposed to involved at the earlier stage such as Stage 0 Strategic Definition of RIBA Plan of Work.

FGP#2: Sorry, can I interrupt a bit. If you go further in details I just want to clarified something. I believed this model has been developed just for the purpose of new build scheme not sort of like for the existing building been performed or in use building? Or is it like purely for a new build scheme what you try to do. If it is not a new building, it is building in use. Are we cover both of the side or are we cover on the new build scheme only?

Moderator: It tried to look at both scheme. When talk about new scheme, totally we need FM to involve (in the project), but for the second one what you mentioned just now, let's say refurbishment?

FGP#2: Yeah, yeah. It might be refurbishment, it might be a sort of authorisation building in use. Because it good the framework have to be workout on a different way aren't they? If you started with a new build you start from the scratch. It is more likely more easier to integrate the whole team together, but if you are procure a building in use it is depending what nature of work you carried out or purposely of I don't know, it could be PPM, periodic plant maintenance, they could be like purely refurbishment. So, so I rather, this is try to help you, try to narrow down the scope instead of go too wider. Otherwise you will get confuse yourself.

FGP#3: I think might be with this, it was down to a new build, from brief, feasibility right away through in use and the experience of whole life facilities management. How we can then put into the brief to get maximum benefit and continuing improvement.

FGP#2: That is what I see.

FGP#3: The environment getting build. I am trying to get the stages, when is the best to bring in the knowledge. Is that…

FGP#2: That is my understanding at the moment. I just want to clarify with the moderator what is he trying to do. That's fine yeah? That's fine?

Moderator: Yeah. That's fine. I think we can focus on that.

FGP#3: Yeah.

Moderator: We can focus that this is for a new build projects.

FGP#3: Okay

Moderator: Do you have any other comment on the framework FGP#1?

FGP#1: Yeah, I just look in… to tell you the previously I worked for, The Hilton Group, and my job is opening new hotels and Hilton, this is going back 15 years now used to bring in the FM team right up at stage, I probably say Stage 0. Initially, probably at the higher level than I was, but they worked with the end user right through the entire project. So much so that I assist to come on board as an FM manager while the building was still in construction phase. So that I gained the inside into basically everything about that building. As far as cable layout, plumbing layout, I just gave a much much better understanding and also, it was also if being on site, I also picked up operational issue which could be changed at that stage rather than coming in at stage 6 or 7 which is too late to do that kind of thing. So, the framework here is… I can see exactly how you laying out and a lot… some company has been doing it for a number of years now. I am quite surprise that BIM is such a big thing and it is…

FGP#2: Yeah… and it started in…

FGP#1: Been mooted a new thing, as if being a years and years… it has never had a name for it. But, I'll join in and there are some things we are think there could be some changes I'll discussed as we are go along.

Moderator: Okay. I think we can look at stage by stage. If you look at Stage 0 which is Strategic Definition, we can look at item 16, having adequate experience in building maintenance. When I say building maintenance, it is not only about the experience. It is about the information or the people itself who have experience where they can bring it from other projects to a new project. So, having building maintenance knowledge is should be fully harnessed in Stage 0.

FGP#1: I do not think… I think Stage 0… Please correct me if I'm wrong but Stage 0 is Strategic Definition objective is identify client's Business Case and Strategic Brief and other core project requirements. I don't think… this is my personal view. At that stage, having adequate experience in building maintenance is not that key at that stage. I don't think… I don't know what people's view.

FGP#2: I need a further definition in terms of your study. When you say experience of building maintenance. What do you mean by that, can you explain it further?

Moderator: Okay, when I say having adequate experience in building maintenance. It is not only about the experience of the professional itself, the experience they have, but how they can manipulate the past experience they have in other projects to new projects. It is not only having adequate but having ability to manipulate the experience and knowledge they have. So, I think this is quite an important skills where they can use that knowledge to help the clients to prepare a proper business case and strategic brief. Because, if you look at Strategic Definition, we want from the beginning of the project, we want the clients to try to think what are their maintenance cost for thirty years of the building, during the operation.

FGP#2: Okay, I catch you. From the cost consultant point of view, as a QS, we normally called it terminology as a life cycle costing. That is what early input in that stage. What normally happened is that we received from client's brief a sort of… for instance it shouldn't be a new build, it could be a building in use, i.e. for the hotel in case, and we already got a series of hotel all over the country and going to develop more. What we tried to advise the client at this stage as FM team from the cost consultant point of view, what we saying that in terms of life cycle costing for the next thirty years, RICS got a standard model been developed to forecast i.e. if a project up two to twenty million pounds. What sort of cost incurred within the twenty five years, thirty years after building been used. That model have been developed by the RICS anyway. So, yeah, I mean you're quite right, it is important if LCC, life cycle costing been integrated at the early stage. However, that's the thing… it is depending on what really the clients want. Some of the cost could be turned off client straight away, because it is my personal experience. It is going to be a minor refurbishment works at one of the building by the city centre, you know the multiuse building, the old Barclays Bank next to the town hall. Just highly likely get an advice what highly likely going to be like it is old building, it is not cheap to be refurbished, Victorian building whatever it is and we come out with some figure expound. They said no you can't, you can't be serious. That's what it is. The older the building is, the higher the figure to maintained it i.e. M&E side, mechanical and electrical should be lift, ventilation and heating system they are not cheap for the old building. And now with BREEAM requirements and then it cost going to be higher and higher. That's what you got to be careful. It is depending what client wish what exactly client's brief and then, ultimately it is going to be the budget isn't it?

FGP#1: Yeah.

FGP#2: yeah I think that's a key point.

FGP#3: its the knowledge and experience of building maintenance is that going to influence a decision made at that point and I think it probably, it maintenance might not unless the decision being made is the type of building that we want. Do we want an iconic statement in do we want to say we want a full natural ventilated super green building and then the knowledge of building maintenance might influence us in do you know how much that costs to look at you know about renewables and the maintenance side of it that maybe offset any, you know what I'm trying to say, that input.

FGP#1: I know exactly what you are saying.

FGP#3: Yeah, its difficult without an idea on the table but the influence of the FM, because the influence at that time to say that sounds great but you know just at that time its just a minor nuggets of information might be thrown in there that will influence a decision at that stage.

FGP#3: And maybe that…

FGP#2: Its informed decision, its more likely informed decision yeah. It is quite good I mean I do agree with you I mean item number 16 is very good to be you know imply of a stage zero however again its depend on the scale of the works and depend on the sort of value of the work. Some clients can afford it you know we don't want you to be in that stage where you can't afford to pay your fees that sort of thing.

FGP#1: I think, like I said I think at item 16 having adequate experience in building maintenance at that stage as the gentlemen said it would depend entirely what type of project or building or whatever was going to be. I don't think its stage zero for a lot of clients that would be a key, a key issue. I think like I said I would probably start looking at, it would be more falling in to stage one.

FGP#3: Right.

FGP#1: Would just start looking at BIM modelling where a maintenance or FM professional at that stage would have a very good. Because once, cause I take it stage zero is the design stage.

FGP#2: The brief.

FGP#1: The briefing, that kind of thing so by the time you get to stage one the design concept everything is there. I think at that stage FM professional looking at the overview would then be able to pick out.

FGP#2: Yes.

FGP#1: Certain things from operational, from a maintenance point of view that you may not have picked up at that early stage because by stage one you'd have a better overview of the building itself, the concept and I think at that stage for me the FM professional would have a lot more input in to it at that stage.

FGP#3: It is interesting that item 16 isn't shared isn't it then, the stage zero and the stage one. Item 16 seems to be solely.

FGP#2: Yeah solely.

FGP#3: The stage one so for the rest of this so one two three four five six seven the knowledge having adequate experience in building maintenance surely that sits in them all really and not be isolated in to that.

FGP#1: I would agree with you, yeah.

FGP#2: I always think that if you want to distinguish upon for your own purpose of research purposes you might I don't know you might be able to this is my personal view not the construction view. I am might saying usually at this stage people prepare feasibility studies so in other words that's what normally happen we do our self. So you do that feasibility studies that so what highly likely to happen you know you know you are Mr Client you are advised to consult any FM specialist in case you are you know preferred to get involved any sort of FM issue in the future. I mean it is sort of a brief in your feasibility report or early report to say if the scheme X, Y, Z to be done you know. But I do agree with FGP#3 I mean why not item 16 to be incorporated with the other stages you know it be good you might think about it you know.

FGP#3: Is it sort of these are the items that you need to have input at that stage. Is that how this thing has been developed. Not necessarily we only need that skill at that stage but to input to provide FM input at that stage you would need to have that that that and that is that.

Moderator: Yes, that's the quality.

FGP#3: Yeah.

Moderator: Which Facilities Managers have to be better integrated in stage zero.

FGP#3: Right, I've got that.

FGP#2: Sorry, I haven't seen that questionnaire to be honest. Was it in the questionnaire. You put item 16 for all question or just part of the questions item 16.

Moderator: in the questionnaire 38 items.

FGP#2: Right, so,

Moderator: there are 38 items.

FGP#1: So, every single question apply to all items.

Moderator: Yes to all items, so…

FGP#2: Oh, ok.

Moderator: So this…

FGP#1: That's interesting, isn't' it?

Moderator: This comes out from the statistical analysis,

FGP#1: That's very interesting.

Moderator: I quite interesting with what FGP#1 mentioned just now at stage zero, sorry on stage one item 24. If you look at it, it was shared with stage four as well. If you look at stage four it is a Technical Design

FGP#1: Yeah.

FGP#3: Yeah.

Moderator: So, it is really…

FGP#1: I would put 16 across one four three, I agree with the rest of the gentlemen. I'd put 16 throughout

Moderator: Ok.

FGP#1: Especially stage one, stage four. Cos your stage four is the ability to transfer POE outcomes, what item 20, item 9 is having mechanism to communicate with the end users about requirements at all stages and item 14 is ability to champion LEAN construction practice. I think item 16 sits nicely in that as well.

FGP#2: Cos at tender stage highly likely going to be stage three and stage four anyway that's why I mean you know more likely than the tender stage. You've got a firm design and then the you know freeze design been done at stage three and stage four. Some of the consultant produce a tender at that stage three, some of the consultant produce tender at stage four so I mean you know usually the client or the might up at that stage you know I don't know whether is it a bit too late sort of the other provisional at that stage again it just depend what type of scheme on it.

FGP#1: Sorry, to stage zero if I can go to the list below. I take it we are working through this as well. Would you the initial consideration for assembling the project team established program I see why you have put 16 there if you read further down the whole thing, it would be good to have someone on the project team.

FGP#3: Yeah.

FGP#1: Who has good FM experience and good experience in maintenance so cos reading further down your checklist I can see where it does fit in there nicely.

Moderator: Umm…

FGP#1: Like you say just to have that knowledge there from the very beginning.

FGP#3: I would agree with that, that's probably the main, out of that list

Moderator: Ok.

FGP#3: That procurement variable task bar.

Moderator: So, in overall, I mean this stage part should be the in whole RIBA, this part should be put here on the top of, on the end of column isn't it. So make it easier for you to refer why this item is sitting here.

FGP#1: Yeah, why its sitting there?

FGP#2: I think for your research purposes you probably like throw the bullet point you know based upon my data collection of questionnaires that's what your finding is, however what actually happen you know in actual world you know it could be distributed at any stages depending upon you know the scope and what type of works so again it is up to you how you manipulate the data. That's what you found it you found from your data collection it doesn't mean it could be like you know standardised across a board of the other practices. It could be change for whatever reason but you know you might say you know it is very interesting to find out when I took my questionnaires about blah blah blah and I found out soon that everyone agreed that item number 16 at initial stage you know. It is why the group finding isn't it? But, it doesn't mean you can you can allow that case then to be at the other stages can you.

Moderator: Ok.

FGP#2: This is my personal view to be honest.

FGP#3: Yeah. To me, it is about what people know and how these, let's take, if we could take all these as FM points, FM points the best FM point to influence at that stage

FGP#2: At any stage.

FGP#3: Is item 16, 13 it doesn't say that you can't do them anywhere else.

FGP#1: Yeah, that's right.

FGP#3: But to influence at that stage.

FGP#2: It would be very good, very good.

FGP#3: At 16 you would need 16 that's all I'm saying is that…

FGP#1: That's fine, yeah.

FGP#3: Ok. I think one of the key ones for me just moving on from that, can we move on from buildings.

Moderator: Yes. This is open for discussion

FGP#3: I'll ask FGP#1 do you need to have a…

FGP#1: No, no.

FGP#3: Something's been brought up I don't want to move on from it without…

FGP#1: No.

FGP#3: Ok. I think one of the key ones is this item 28. Take a leadership role in the client organisation as an advisor. Cos the FM also tends to have an awful lot of knowledge about the existing estate so what challenges they've had in maintaining it and not only maintaining it servicing it as well. We've got the energy consumption and different issues and space plan, whether there's any space in the existing estate and that could influence these core objectives. Cos maybe you've got a client at senior level just thinking we need a new building for what reason. The FM provider may be able to influence that, he knows what space is, he knows what space they've got. You know the estate's territory that sort of thing he should be keeping a tally on all that and influencing do we really need a building you know. Is the relationships, we have relationships with other organisations we should be sharing space with, its about space eventually isn't it.

FGP#2: Yes.

FGP#3: You know it isn't about buildings its creating space for people to be able to deliver something from. And I think that the FM at that point if they have a lead role in the client organisation, they can certainly influence that strategy at that time

FGP#2: I mean normally they are part of the design team aren't they I mean most of FM

FGP#3: They are part of the design team yeah

FGP#2: Architect and then cost consultant M&E engineers they are part of the design team

FGP#3: This is going even further back before you start

FGP#2: Yes, yes.

FGP#3: Getting the design team on board they are saying do we need a place, do we need space you know and just for that knowledge that's just just just one of my views on taking this leadership role in the client organisation as an advisor

Moderator: Ok.

FGP#3: Yeah.

Moderator: Maybe they can be an advisor for the energy sustainability

FGP#3: Yeah. I know its just, its looking what space we've actually got and we're not using, space utilisation that sort of thing, do we need the new building, what does that mean. You can influence that sort of decision making at that stage I think before we get.

FGP#2: What normally happen I mean FGP#3

FGP#3: Yeah

FGP#2: In most circumstances nowadays you know it depend on procurement on the design and build sort of PFI scheme. The project manager could be like an architect could be like a project manager himself could be like building surveyor. The appoint a leader team by the same token they call upon a specialist from FM guys. There you go guys we are going to put sort of the report to client now you are going to provide a space can you can we get some of it inputs in there you know cos I don't know this is based on my personal experience. The FM could be anyone nowadays. It used to be more technical on site but it could be architect, it could be project manager, it could be the building surveyors on FM.and similar they got their own knowledge already, they just try to lead the team. But to say that the Facilities Manager to lead the whole thing is highly unlikely happen at the moment. Normally they call a project manager or project co-ordinator or architect

FGP#3: Yeah. I think the Facilities Manager will be a source of information that may influence decisions

FGP#2: yes cos they normally employ specialists like you say SPV specialist employ the you know heating specialist and lift specialist and there we go please come up with a report you know I want to integrate your report to the client now and come up with an idea of solution.

FGP#3: I think another key issue with that leadership is having the gravitas if you like to influence these decisions.

FGP#1: Precisely, yeah.

FGP#2: Yes

FGP#3: so somebody who really is respected

FGP#2: Correct, yeah.

FGP#3: and their opinion is respected so they have the gravitas. So a key issue would be to be able to talk about backlog maintenance. What is that worth, I'm in St Helens and Knowsley £50 million pound backlog maintenance that influenced decisions to go for a new hospital at the end there was procurement, PFI what does that mean and all the advisors all getting around the table but its understanding that backlog maintenance. What that sort of means what that's costing for the existing facilities that influencing that and the gravitas and the respect of everybody else whose sat around there

FGP#2: well that's what happened to [PROJECT] now yeah

FGP#3: yeah

FGP#2: I get involved in the early stage of that scheme, its caught sort of ideas in it.

FGP#3: You involved in that one yeah

FGP#2: yeah [PROJECT] early stage of feasibility studies. They keep saying that they can't afford to maintain the old hospital now. We need a new one but sadly at the same time when I designed developed, we still had an extension of the old building and now the new building coming up they want to get part of it, I mean what a waste. If you spend two three four millions pound to maintain existing building and now you got a new one

FGP#1: Well, we're at that stage, we're at that stage at [ORGANISATION] where its becoming more and more expensive to maintain [ORGANISATION] and its where do you get that breakeven point would you say.

FGP#2: I know hundred years old isn't it

FGP#1: you know we're continually looking for a new stadium. We've done numerous feasibility studies but it's that, its just knowing when that critical point when you achieve, when you get that critical point one where it doesn't become cost effective to maintain the existing facility anymore. And then you'll have other people that will argue. Well, there's all these types. I mean we're talking about a stadium now but it could be a listed building, it could be anything. Do you make a, you know you need to, at that stage you do need an FM professional who knows the building, who knows the costings, who knows what's involved in maintaining the building to have the input and also have like you said the correct and the most up to date costing on all of this.

In order not to add to the scope of appendices, only part of focus group transcript shown here (approximately 5,000 words out of 16,000).

Appendix T: Letter of Appreciation of Participating in Focus Group Interview

Bin Anang Masuri, Mohd

From:	Bin Anang Masuri, Mohd
Sent:	27 August 2014 15:28
To:	[redacted]
Subject:	Appreciation: Focus Group Interview of Phd Research
Importance:	High

Assalamualaikum [redacted],

Thank you very much for your contribution yesterday. I am glad that the discussion among the participants was great and fruitful.

I will transcribe the discussion followed with the analysis. The purpose of the session that is to validate the framework has been achieved. At the same time, I learned a lot from all the three participants about the FM and construction industry in the UK.

The effort and time you take to participate in the focus group session yesterday are highly appreciated.

Regards,
Rayme

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[redacted]

RE: Gentle reminder: Focus Group Interview of Phd Research

[redacted]

August 26, 2014 4:41 PM

You replied to this message:

Hi Rayme, thanks for today, I thoroughly enjoyed it and found the discussion very informative; I have taken some learning away and I do hope it achieves the anticipated input to your research.

I wish you the best of luck and would be grateful if you could pass on my thanks to the other participants as I came away without their contact details.

Please don't hesitate to contact me should you feel I could contribute further.

Kind regards.

[redacted]

On 08/26/14 2:25 AM, Mohd Rayme Anang Masuri wrote:

Good morning [redacted]

The purpose of this message is to remind you about our meeting today at 2.00 pm.

The meeting will be held at:
Meeting Room,
Built Environment and Sustainable Technologies (BEST) Research Institute,
School of the Built Environment,
Liverpool John Moores University,
Henry Cotton Building,
15-21 Webster Street, L3 2ET Liverpool

- Program tentative:
1.45 pm – 2.00 pm : Arrival of the participants
2.00 pm – 2.15 pm : Introduction and brief presentation
2.15 pm – 4.00 pm : Discussions begin
4.00 pm : Dismiss
Note: The time is approximate only. Please allow up to approximately 2 hours for the whole session

- Parking services: The Liverpool City Council parking services are available nearby.

Please do not hesitate to contact me at 0777 444 0643 should you have any queries.

See you there. Cheers

Regards, [redacted]
Rayme Anang

Reply to message

[redacted] 13

You and [redacted]
Connected on 3/11/14
How did you meet?

Not ready to reply? Add a reminder to reach out to Ian later

RE: Gentle reminder: Focus Group Interview of Phd Research
8/26/14

RE: Confirmation of the Focus Group Interview of Phd Research
8/20/14

See more