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Integration of Facilities Management Considerations in Design Stage of Construction Project

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Abstract: Ineffective design of a facilities is one of the factors that challenge the execution of activities supported by facilities management (FM). Designers and clients are not usually interested in FM service considerations during design stage because they think they are saving money. However, ineffective design has cause issues during the post-occupancy activities of a facilities. Without any denial, integration of FM considerations in design stage is a challenging task. Therefore, the objectives of this research are to identify the challenges of integrating FM consideration during building design stage and to suggest potential approaches to improve the integration of FM considerations in building design. The scope of this research is involves FM contractor in Selangor. Quantitative method was adopted by distributing a questionnaire survey to the FM contractor. In this research, data being collected was analyzed by using Statistical Package for Social Science (SPSS) version 22.0. The results show that the most significant challenges is related to FM challenges category namely FM is still immature in Malaysia and knowledge transfer from FM to the design are still poor. The most significant potential approaches suggested is designers and clients should get the FM on board early during design stage. In conclusion, this research is important as one of the steps to improve the integration of FM considerations in design stage of a construction project.

Keywords: Integration, Facility Management, Constructions Design Stage

1. Introduction

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In this era of technology and increased competition in emerging markets, organizations have been forced to create efficient consumer distribution systems to achieve business objectives. When a company invests in some facility for the purpose of introducing its core business systems and procedures, facility management (FM) is necessary to sustain the core business and maintain consistency of operations. Combining assets and programs, efficient FM activities is important to the performance of every company. FM leads to the delivery of company strategic and financial requirements, as well as ensuring a secure and productive atmosphere by day-to-day activities. The responsibility of facility manager is of strategic importance because it converts the needs of senior decision-makers into a day-to- day condition that impacts people at work or where they work (BIFM, 2012). However, the design of the facilities is one of the reasons that threatens the introduction of these successful frameworks assisted by FM. Seldom will designers get back to evaluate the construction efficiency of the buildings they were responsible for constructing, suggesting a lack of contact between designers and facility managers (Nawakorawit, 2012). This coordination is often considered an anomaly rather than a standard in the design and development of buildings, given the increasing usage of post-occupation surveys and the significance of their findings for building success. Above all, design has an effect on revenues, employees, income, performance, operating costs and capital investment (Ransley and Ingram, 2013). Those issues affect the operation of facilities as well as they contribute to the performance of the organization's core sector. The integration of FM in the building design is essential for the company to reach its goals by maintaining a newly built facility. According to Jensen (2009), achieving FM integration during the design process will contribute to facilities that: satisfy corporate market requirements more efficiently, gain more clients, be easier to operate and approve, be easier to handle and monitor, be more cost-effective and react more effectively to occupant requirements. Other than that, there are also many benefits of integrating facilities management during building design. For examples; increase accessibility for replacements and maintenance, proper addressing of client and FM requirements to achieve satisfaction, extend the facility lifetime, achieve efficient operation and maintenance, achieve cost savings throughout the facility life-cycle and more.

Despite many benefits in integrating FM consideration during design stage of a construction project, it is rarely practiced. Way (2012) points out that designers are not usually interested in learning about building efficiency at the occupation stage; a basic truth that describes why designers and facility managers may not generally collaborate together during the design phase, and reveals the lack of facility management relevant problems throughout the construction system. This anti-collaboration is going toward product creativity. Alexander (2015) say that integrating internal and external expertise in design processes allows designers to reach up to externally generated information and not only to focus on their internally created knowledge. In addition, according to Karp (2012), while the transition of knowledge from FM to design is important for enhancing design decisions, the role of FM in the overall cycle is still overlooked these days. Jensen (2011) suggests that enhancing the design of the facilities requires input from the organizational level, and reflects on the wrong decisions and conclusions that have taken place in the design phase, as well as reconsidering the specifications of the customer / user and the needs of the designed facility. Jensen (2011) discuss design-build activities saying that experienced building facility manager trying to function as customers are willing to get development companies (in this case design-build companies) closer to the client / user requirements. Smith *et al*. (2012) says, although the task of bridging the difference between designers and users' requirements is complicated by time and budget limitations, product makers also need to develop customer expertise, connect it with project capital and adapt it to their product and development processes in order to achieve goals. Yiu (2014) focuses on the loss of reputation of FM and, based on Nutt (2000), the key cause for this failure is the lack of the authoritative professional archive on best practices and numerous developments in the area on FM. Nutt (2000) underlines that the absence of such a database impacts the output of FM and prohibits it from fulfilling its promises. Jensen (2015) have showed that construction facilities are historically

perceived to have restricted reach and development requirements. This fact seriously affects the dynamic management of facilities, contributing to higher expenses and the creation of static and in extensive architectural designs.

Therefore, this research was conducted to identify the challenges of integrating FM consideration during building design stage and suggest potential approaches to improve the chances of integrating FM considerations in building design. It is hope that the findings of this research can give industry player such as designers and facility managers with information to fully grasp the condition in operation, in regards to integration of FM considerations and building design. This understanding may be used to test the processes of organisation in relation to improvements of infrastructure value, key market processes, occupants and FM resources offered.

2. Literature Review

Facilities management (FM) is a profession that encompasses multiple disciplines to ensure functionality, comfort, safety and efficiency of the built environment by integrating people, place, process and technology. If a company owns some facility for the purpose of executing its core business programs and procedures, facilities management is needed to sustain the core business and maintain consistency. The role of FM is of strategic importance because it converts the needs of senior decision-makers into a day-to-day scenario involving people at work or where they stay (BIFM, 2012).

2.1 The Importance of Integrating Facilities Management considerations in building design

Mostly designers agree that addressing customer expectations and taking control of construction functionality to reduce uncertainty are essential advantages for FM and design integration. According to Martin and Guerin's (2006), standard design procedures are still inadequate to solve specific problems and specifications which demonstrate that designers are already meeting these problems in building design.

Moreover, the effect of convergence in meeting client and FM specifications and standards is also significant (Smith, 2015). Cost savings was stressed for both FM and designer participants. This may be accomplished by increasing the productivity of buildings and facilities, and reducing abortive work and retrofitting. At the same period, consumers would gain from improved income, stronger credibility and higher stock prices, and FM managers would gain from more productive building operations and maintenance. (Buchanan, 2016)

2.2 Purpose for the Integration of Facilities Management during building design

The first one is resolving complexity in projects. Based on Kaya and Alexander (2016) facilities management functions is depending on the context in which they operate, making an effort to adapt to changes resulting from differences in organizations in different contexts. Martin and Guerin (2016) also stated that the standard design process are insufficient nowadays in resolving complexity in projects. Therefore, with the integrating of facilities management, designers can easily to satisfy clients expectations and to create more FM-efficient projects.

The second purpose is solve FM problems. Facilities management faces many problems while operating a facility, while all of this problems can be solved if integrating with building design. For example, according to Schwede, Davies and Purdey (2018), the workshop design is one of the problems FM facing. The findings revealed that problems relating to noise suppression and the avoidance of visual distractions are generally unattended in the design of new projects, keeping in mind that acoustics and visual quality are essential factors influencing efficiency and comfort in a given setting.

2.3 The Challenges of Integrating Facilities Management Consideration in Building Design Stage

The challenges of integrating facilities management consideration in building design stage were mainly classified into three categories namely Facilities Management (FM)-related, Design-related, Client- related.

(a) Facilities Management (FM)-related challenges

First of all, the main challenges that affecting integrating of FM is cost. There is an extra fee charged by FM companies in order to undertake early in design stage, to undertake workshop and review drawings. For the client, this extra cost is not being presented as a saving on the long run. Designers will not being prove that the integration of FM will actually lead to save money in the future. Therefore, it is not enough to only promote FM services during design stage, it is also important for FM talk over to client about their value during early design stage. (Badger, 2019)

After that, the second challenges affecting integration is the fact of FM is still immature in Malaysia. The FM companies is still in beginning stage and not well established in some big projects. At the same time, the FM services provided to client can affects how clients see the value of facilities management in the organizations. This also affects what building owners know about FM's performance and contribution. (Nik and Pitt, 2014)

Other than that, another challenge is the knowledge transfer from FM to the design. For example, peoples in facilities management always keep all of the information and without sharing it, because they will not be asked for their expertise anymore after they share the information. FM managers sometimes think the designer is their enemy and did not work together with designers. This challenges will harm their relationship and also widen the gap between FM and designers. Communication and collaboration should be encouraged by both of them to achieve better goal. (Per Anker Jensen, 2015)

(b) Design-related challenges

The first challenges from the design side are the designers not interest in FM services. Designers did not see any personal responsibility to handle FM challenges. This challenge could be caused by they did not see any benefit of the integration of FM in building design. (Way, 2015)

After that, the second challenges relate to new design students. For example, new design students are not teach about the importance of FM services, and FM challenges are not responsibility that design student would take part about it. (M. Katelman, 2008)

Other than that, how the designers treat FM and FM managers are also one of the challenges. Designers usually think that integrating of FM is a burden for them. At the same time, designers should be having initial meeting and appreciate FM's knowledge at the early design stage. (Ben Gelnay, 2015)

(c) Client-related challenges

The first challenges are the lower-than-expected client education and their lack of knowledge about the importance of FM and the operation stage in general. (Robison, 2014) For example:

a. Clients might not be educated on FM
b. Not full client understanding of the whole building life cycle
c. Not full client understanding how a facility operate
d. Clients believe that they are saving cost by not getting the FM early on

2.4 Potential Approaches to Improve the Chances of Integrating Facilities Management Considerations in Building Design

There are a few potential approaches to improve the chance of integrating facilities management considerations in building design as follow.

(a) Designers and Clients should get the Facilities Management on Board Early during Design Stage

The benefits of this approaches are better to communicate FM feedbacks to designers before the design start. When the design is almost complete, there are many decisions cannot be reversed and FM requirement will not be considered. FM managers are not effect of changes during design stage. Changes related to FM criteria may have had a significant effect on integration of structures, ducts and shaft positioning. Therefore, FM managers must be bought in early design stage in order for their view in a project. (Ying Wang, 2013).

(b) Brief Preparation of Facilities Management to Designers Early during Design Stage

According to Afhahowa Enoma (2005), there are very important that the FM team offer information with detailed and technical enough for designers. It is seen from the above-mentioned FM tasks that the knowledge received must be scientific, quantitative and measurable in relation to the design. This technological knowledge will then act as a standard guide that takes into consideration the specifications of FM and consumers, at the same time, it also can be used by designers to represent certain product requirements. Facilities management can:

a. Make preparations for checklists for space, connect directly other documented FM requirements.
b. Assemble the FM request and set the operational characteristics to be used for assessment against design
c. Offer information about specific operational issues related to multi-use facilities
d. Help in providing instructions on the collection of facilities, access criteria and service

(c) Project Management in Promoting Facilities Management Integrating during Building Design

Based on Nutt (2000), it is clearly that project management can affect the decision of clients on the integration of FM, and also have a role connect between design and FM consultants. Participants will accept the idea as having a positive effect if it happened on future projects. Project Management can promote FM integrating during building design through:

a. Partnered with design consultants and FM consultants to build a connection for the transfer of FM information
b. Assisting in the processing of building status reports that are required for FM takeover
c. Encouraging FM engagement as part of their position
d. Integrating FM to the PM team
e. Explained to clients about the threats when FM absence during design stage

3. Research Methodology

According to Kallet (2004), research methodology is a method to carry out a study and describes the specific procedures or techniques used to identify, select and analyses information that applied in this research. It is important in order to achieve an accurate, systematic and theoretical result of the research that has been arranged and designed. Research design is a process of finding solutions to discusses the research structure and procedures used. Based on Creswell (2008), research plan consists of three steps which contains research question, collect data to answer the question and present an answer to the question. A general framework is applied in order to provide the guideline throughout the investigation and research in this study (Creswell, 2003). In general, there are three basic approaches to do a research which is qualitative method, quantitative method and mixed method. This research applied a quantitative research. According to Aliaga & Gunderson (2000),

quantitative research defined as social research that collect numerical data from the interested population and employs empirical method which a form of determine the degree of a specific item. Quantitative research process contains the element of concept, selection of respondent, research design, collect data, analyzing data and data findings. According to Survey Research Methods, as cited by Folwer (2009), quantitative research is an objective, formal and systematic process in which numerical data are utilized to obtain information and produce findings. In this study, survey questionnaire was conducted for data collection. This method is used to examine and identify 'what' the challenges and potential approaches of integrating facilities management consideration during building design. The collected information and results that is obtained from the respondents, together with the literature review that the analyzed and studied to achieve the objectives of this study. Questionnaires are made up of a list of questions and has a clear instruction. The purpose is to check whether the research is compatible with the objectives according to the questionnaires (Uyar et. al., 2014). In this research, the questionnaire was made up of four parts as follow:

i. Section A: Respondents Background

In section A, question related to respondents' demographic information which consists of gender, race, age, and occupational.

ii. Section B: Challenges of Integrating FM Consideration

Section B cover questions related to the challenges of integrating facilities management consideration during building design.

iii. Section C: Potential Approaches to Improve FM Consideration

In section C, questions related to potential approaches to improve the chances of incorporating facilities management considerations in building design.

Pilot study was conducted to seek expert reviews for pre-testing of the questionnaire. Five sets of questionnaires were distributed to 5 FM contractors to the actual questionnaire distribution. The questionnaire distributed were verified by the FM contractors in terms of suitability of the questions. The experts had read through and stated their comments on questions that need improvement. There were several changes made to the questionnaire in terms of sentence structure. The pilot study findings and reliability statistic result was shown in Table 1.

Table 1: Pilot Study Findings

No. of Respondent	Respondent's comments	Action Taken
1	- Must include Facilities Management (FM)	- Change 'FM-Related Challenges' to 'Facilities Management (FM) Challenges'
2	- Insert page number	- Add page number on each page in questionnaires
3	- No comment and he just answer the questionnaires.	-
4	- Can also add highest academic qualification.	- Add highest academic qualification which includes Diploma, Bachelor Degree, Master Degree, PhD and others.
5	- overall okay	-

A research population is also known as a well-defined collection of individuals or objects known to have similar characteristics. Sampling frame refers to a list of all the elements in the population from which the sample is drawn. In this research, the respondents were selected among FM contractor. Selangor was the research area because the FM contractor register with CIDB in Selangor is the highest if compared to other state as shown in Table 2 (CIDB, 2020). Based on the information of CIDB Malaysia, total of FM contractor in Malaysia are 799 contractors and Selangor are the highest with 280 contractors.

Table 2: Facility Management Contractor in Malaysia (CIDB, 2020)

No.	State	Number of Facility Management (FM) Contractor
1.	Johor	46
2.	Kedah	26
3.	Kelantan	17
4.	Melaka	12
5.	Negeri Sembilan	27
6.	Pahang	27
7.	Perak	24
8.	Perlis	3
9.	Pulau Pinang	19
10.	Sabah	32
11.	Sarawak	27
12.	Selangor	280
13.	Terengganu	23
14.	Wilayah Persekutuan Kuala Lumpur	223
15.	Wilayah Persekutuan Putrajaya	13
	TOTAL	799

Random sampling consists of simple random sampling, systematic sampling, stratified sampling and cluster sampling; non-random sampling consists of convenience sampling, quota sampling, purposive or judgemental sampling and snowball sampling (Neuman, 2012). Random sampling was used for this research based on Krejcie & Morgan's (1970) table to aid in determining the sample size for research activities determine the sample size. Simple random sampling is the basic sampling technique where we select a group of subjects (a sample) for study from a larger group (a population). Every possible sample of a given size has the same chance of getting to be selected. According to CIDB statistic, the targeted population was a list 280 FM contractor in Selangor. According to Table 3 in Appendix A, a total of 162 respondent respondents were chosen randomly from the targeted population of CIDB (Krejcie & Morgan, 1970)

In this research, data collected was analysed by using Statistical Package for Social Science (SPSS) version 22.0. SPSS able to help researchers to manage, present and analyse large number of data by creating fast and accurate results in form of table and graphical chart and determine frequency, percentage, mean and ranking of the data collected (Landau & Everitt, 2004). Thus, the results of this research were analysed and summarized by using descriptive analysis (Neuman, 2012). Descriptive analysis was used to describe the data and phenomenon being studied so that it is easier to understand.

4. Results and Discussion

4.1 Response Rate

To avoid invalid and incomplete data, 162 sets of questionnaires were sent out by email to the selected company to be responded. Despite the total of 162 questionnaires that were sent out, 97 questionnaires were received back for this research which represent 60% response rate. According to Draugalis (2008), response rates approximating 60% for most research should be the goal of researchers and certainly are the expectation of the editor and associate. This is because there are respondents who refuse to answer questionnaires for various reasons and some of the respondents also took a long time to answer the questionnaires.

4.3 Respondent Background

This section aims to identify respondent's background participating in this research includes gender, age, years of working experience, highest academic qualifications, and position. Table 4 shows the profile of the respondents.

Table 4: Analysis of Respondent Background

Variable	Details	Frequency (N)	Percentage (%)
Gender	Male	63	64.9%
	Female	34	35.1%
Age	20 - 30 years old	17	17.5%
	31 - 40 years old	31	32.0%
	41 - 50 years old	38	39.2%
	51 years old and above	11	11.3%
Years of Working Experience	1 – 5 years	17	17.5%
	6 – 10 years	29	29.9%
	11 – 25 years	40	41.2%
	26 years and above	11	11.3%
Highest Academic Qualifications	Diploma	2	2.1%
	Bachelor Degree	59	60.8%
	Master	23	23.7%
	PhD	13	13.4%
Position	Facilities Administrator	17	17.5%
	Facilities Supervisor	20	20.6%
	Facilities System Specialist	14	14.4%
	Facility Coordinator	13	13.4%
	Space Manager	8	8.2%
	Building Administrator	12	12.4%
	Contract Manager	13	13.4%

From the result in Table 3, the number of male respondents were higher than female respondent for both samples. From the frequency distribution of 97 respondents, there are 63 male (64.9%) and 34 female respondents (35.1%). From the categories of respondent's age, the majority of respondents were 41 – 50 years old with 38 respondents (39.2%). Next, the second and third majority of the respondents who were 31 – 40 years old with 31 respondents (32.0%) and followed by respondents who were 20 – 30 years old with 17 respondents (17.5%). The minority of respondents were in age 51 years old and above with 11 respondents (11.3%).

From the years of working experience categories, the majority of respondent were 11 – 25 years working experience with 40 respondents (41.2%). Next, the second and third of respondents who were 6 – 10 years working experience with 29 respondents (29.9%) and followed up by respondents who were 1 – 5 years working experience with 17 respondents (17.5%). The minority of respondents were 26 years and above working experience with 11 respondents (11.3%). Analysis of the highest academic qualifications shown that most of the respondents were had Bachelor Degree which were 59 respondents (60.8%) and followed up by Master which consists of 23 respondents (23.7%). Next is the PHD with 13 respondents (13.4%) and the last one is Diploma with 2 respondents (2.1%). Lastly, the position categories. Most of the respondents were Facilities Supervisor with 20 respondents (20.6%) and followed up by the Facilities Administrator with 17 respondents (17.5%). Next is the Facilities System Specialist with 14 respondents (14.4%), Facility Coordinator with 13 respondents (13.4%), Contract Manager with 13 respondents (13.4%), Building Administrator with 12 respondents (12.4%), and the last one is Space Manager with 8 respondents (8.2%).

4.4 Challenges of Integrating Facilities Management Considerations in Building Design Stage

In this section, the variables in the questionnaire is provided to identify the challenges of integrating facilities management during building design. There are 15 variables of challenges which categorized into 3 categories. The 15 variables were then computed into mean and standard deviation value in order to get an average response from each item that the respondents answered. Apart from that, 3 categories also then computed into average mean value in order analyses by ranking. Table 5 shows the level of mean measurement used to analyse the data.

Table 5: Level of mean measurement (Wiersma, 1995)

Mean Range	Central Tendency Level
High	3.68 – 5.00
Moderate	2.34 – 3.67
Low	1.00 – 2.33

(a) Facilities Management (FM)-Related Challenges

The results of the challenges in FM related category are shown in Table 6 below. Based on the table, it can be seen that the highest mean value is 4.61 which indicate challenges of FM is still immature in Malaysia and followed by knowledge transfer from FM to the design are poor challenge with second highest mean value of 4.57. Next challenges under this category is the extra fee charged by FM companies in order to undertake early in design stage with mean value of 4.47 and followed by cost affecting integrating of FM challenge with mean of 4.43. The less significant challenges with lowest mean value of 4.30 is FM people keep information to themselves and without sharing it.

(b) Design-Related Challenges

The results of challenges in design-related category are shown in Table 6. Based on the table, it can be seen that the most significant challenges in this category with highest mean value of 4.22 is new design students were not informed about the importance of FM and followed by designers are not interest in FM services challenge with mean value of 4.10. Next challenge is the designers only focus on the design and did not care about FM with mean value of 4.06 and followed by do not see any personal responsibility to handle FM challenges with mean value of 3.95. The less significant challenges with the lowest mean value of 3.65 is designers would not like someone to tell them what to do challenge.

(c) Client-Related Challenges

The results of challenges in client-related category are shown in Table 6. Based on the table, it can be seen that the most significant challenge with highest mean value of 3.92 is lack of client

understanding on how to operate a facility. Lack of client understanding on the whole building life cycle challenge and clients might not be educated on the importance of FM, were both in second place with same mean value of 3.85. Next challenge in this category was the clients believe they are saving money by not getting the FM input early on with mean value of 3.82 and the less significant challenge with the lowest mean value of 3.79 is lack of knowledge among client about the importance of FM.

Table 6: Finding related to the Challenges of Integrating FM Consideration during Design Stage

No	Item	Mean	Interpretation	Rank
A.	*Facilities Management (FM)-Related Challenges*	4.47	High	1
1.	Cost affecting integrating of FM.	4.43	High	4
2.	Extra fee charged by FM companies in order to undertake early in design stage.	4.47	High	3
3.	FM is still immature in Malaysia.	4.61	High	1
4.	Knowledge transfer from FM to the design are poor.	4.57	High	2
5.	FM people keep information to themselves and without sharing it.	4.30	High	5
B.	*Design-Related Challenges*	3.99	High	2
1.	Designers are not interest in FM services.	4.10	High	2
2.	Designers do not see any personal responsibility to handle FM challenges.	3.95	High	4
3.	New design students are not told about the importance of FM.	4.22	High	1
4.	Designers only focus on the design and did not care about FM challenges.	4.06	High	3
5.	Designers would not like someone to tell them what to do.	3.65	Moderate	5
C.	*Client-Related Challenges*	3.84	High	3
1.	Lack of knowledge among client about the importance of FM.	3.79	High	4
2.	Clients might not be educated on the importance of FM.	3.85	High	2
3.	Lack of client understanding of the whole building life cycle.	3.85	High	2
4.	Lack of client understanding of how to operate a facility.	3.92	High	1
5.	Clients believe they are saving money by not getting the FM input early on.	3.82	High	3

4.5 Potential Approaches to Improve the Chances of Integrating Facilities Management Considerations in Design Stage of a Construction Project

In this section, the variables in the questionnaire was provided to suggest the potential approaches to improve the chances of integrating facilities management considerations in building design. There are 15 variables of potential approaches that categorized into 3 categories. The 15 variables data were then computed into mean and standard deviation value in order to get an average response from each variables that the respondents answered. Apart from that, 3 categories also then computed into average mean value in order analyses by ranking. Table 5 above shows the level of mean measurement used to analyse the data.

(a) Designers and Clients should get the Facilities Management (FM) on Board Early during Design Stage

The results related to potential approaches in first category are shown in Table 7. Based on the table, it can be seen that the most significant approach with mean value of 4.34 is FM should review the detailed design submitted by designers. This approach was followed by FM should participate in the preparation of the design brief approach with second highest mean value of 4.33. Next approach was to check if FM requirements are incorporated in concept design with mean value of 4.28 and followed by FM should be interview by designers as part of the end user groups approach with mean value of 4.22. The less significant approach with the lowest mean value of 4.10 is FM should review design drawings (issued for construction) prior to sign off and transmittal to contractor.

(b) Early Briefing related to Preparation of Facilities Management (FM) to Designers during Design Stage

The results related to potential approaches in second category are shown in Table 7. Based on the table, the most significant approach is FM can prepare checklists for space, access and all other documented FM requirements with the highest mean value of 4.13. Followed by FM can gather FM requirements and set operational parameters to be used for measurement against the design which indicates the second highest mean value of 3.87. Next approach is the FM can provide guidance on equipment selection, requirements for access and operation with mean value of 3.84 and followed by FM can provide information on specific operation issues related to multi-use facilities approach with mean value of 3.68. The less significant approach with the lowest mean value of 3.62 is FM descriptions should show measurable parameters for designers' use approach.

(c) Enhanced Project Management (PM) Roles in Promoting Facilities Management (FM) Integration during Building Design

The results related to potential approaches in third category are shown in Table 7. Based on the table, it can be seen that the most significant approaches under this category with the highest mean value of 4.28 is PM can collaborate with design and FM consultants to create a link for the transfer of FM knowledge approach. Followed by PM can inform clients about the risks associated with FM absence during design stage which indicates the second highest mean value 4.15. Next approach is PM can incorporate FM within the PM team with mean value of 4.13 and followed by PM can help in preparation of building condition reports that are necessary for FM take-over approach with mean value of 4.03. The less significant approach with the lowest mean value of 4.01 is PM can enforce FM participation as part of their role approach.

Table 7: Findings related to Potential Approaches to Improve the Chances of Integrating Facilities Management Considerations In Building Design

No	Item	Mean	Interpretation	Rank
A.	*Designers and Clients should get the Facilities Management (FM) on Board Early during Design Stage*	4.25	High	1
1.	FM should participate in the preparation of the design brief.	4.33	High	2
2.	FM should be interviewed by designers as part of the end user groups.	4.22	High	4
3.	Check if FM requirements are incorporated in concept design.	4.28	High	3
4.	FM should review the detailed design submitted by designers.	4.34	High	1
5.	FM should review design drawings (Issued for Construction) prior to sign off and transmittal to contractor.	4.10	High	5

B.	*Brief Preparation of Facilities Management (FM) to Designers Early during Design Stage*	3.82	High	3
1.	FM can prepare checklists for space, access and all other documented FM requirements.	4.13	High	1
2.	FM can gather FM requirements and set operational parameters to be used for measurement against the design.	3.87	High	2
3.	FM can provide information on specific operation issues related to multi-use facilities.	3.68	High	4
4.	FM can provide guidance on equipment selection, requirements for access and operation.	3.84	High	3
5.	FM descriptions should show measurable parameters for designers' use.	3.62	High	5
C.	*Project Management (PM) in Promoting Facilities Management (FM) Integration during Building Design*	4.12	High	2
1.	PM can collaborate with design and FM consultants to create a link for the transfer of FM knowledge.	4.28	High	1
2.	PM can help in preparation of building condition reports that are necessary for FM take-over.	4.03	High	4
3.	PM can enforce FM participation as part of their role.	4.01	High	5
4.	PM can incorporate FM within the PM team	4.13	High	3
5.	PM can inform clients about the risks associated with FM absence during design stage.	4.15	High	2

4.6 Discussion

(a) Discussion on challenges of integrating Facilities Management (FM) consideration during building design

In this research, the challenges of integrating Facilities Management consideration during building design have been examined and listed according to ranking. Therefore, the discussion will focus on top 3 challenges which including FM is still immature in Malaysia, poor knowledge transfer from FM to the design and extra fee charged by FM companies in order to undertake early in design stage as shown in Table 6.

The first challenges of FM integration in design stage is FM is still immature in Malaysia. The challenges affecting integration is the fact of FM is still immature in Malaysia. The FM companies is still in beginning stage and not well established in some big projects. At the same time, the FM services provided to client can affects how clients see the value of facilities management in the organizations. This also affects what building owners know about FM's performance and contribution. (Nik and Pitt, 2014). The second significant challenges is poor knowledge transfer from FM to the design team. For example, FM people keep information to themselves and without sharing it, because they think if they share the knowledge then they will not be asked for their expertise anymore. Facility managers sometimes think the designer as their enemy and did not work together with designers. This challenge will harm their relationship and also widen the gap between FM and designers. Communication and collaboration should be encouraged by both of them to achieve better goal. (Per Anker Jensen, 2012). The third most significant challenge is extra fee charged by FM companies in order to undertake early in design stage. There is an extra fee charged by FM companies in order to undertake early in design stage, to undertake workshop and review drawings. For the client, this extra cost is not being presented as a saving on the long run. Designers will not being prove that the integration of FM will actually lead to save money in the future. Therefore, it is not

enough to only promote FM services during design stage, it is also important for FM talk over to client about their value during early design stage (Badger, 2019)

(b) Discussion on potential approaches to improve the chances of integrating Facilities Management (FM) considerations in building design

In this research, the potential approaches to improve the chances of integrating Facilities Management (FM) considerations in building design have been examined and listed according to ranking. Therefore, the discussion will focus on top 3 approaches including FM should review the detailed design submitted by designers., FM should participate in the preparation of the design brief and to check if FM requirements are incorporated in concept design.

First of all, FM should review the detailed design submitted by designers. This finding was supported by Ying Wang (2013), that indicates that the benefits of this approaches are better to communicate FM feedbacks to designers before the design start. It's no longer a question of whether or not designers think about these criteria, but now they have the guidelines and they will be taken into consideration as soon as they start design. Besides that, FM should participate in the preparation of the design brief. Based on Ying Wang (2013), FM integrating in design varied between programming/brief preparation, design stage, concept, schematic, and design development. The main issue is to undertake FM as soon as possible to provide ideas when preparing the project program and take part in the selection of different design alternatives. This early integrating is necessary for introducing changes of paper without affecting the detailed of design and causing any useless work. The third most significant approach is to check if FM requirements are incorporated in concept design. The fast the FM requirements are stated, the higher the chances that these requirements will affect in design. When the design is halfway complete, there are many decisions cannot be reversed and FM requirement will not be considered. FM managers are not effect of changes during design stage. Changes related to FM criteria may have had a significant effect on integration of structures, ducts and shaft positioning. Therefore, FM managers should be bought in early of design stage in order for their view counted in a project (Ying Wang, 2013).

5. Conclusion

The first and second objective of this research has been achieved through the questionnaire survey and analysed by SPSS software. It was found that the challenges of integrating FM consideration during building design are FM is still immature in Malaysia, knowledge transfer from FM to the design are poor and extra fee charged by FM companies in order to undertake early in design stage. Meanwhile, it was found that the potential approaches to improve the chances of integrating Facilities Management (FM) considerations in building design are FM should review the detailed design submitted by designers, FM should participate in the preparation of the design brief and check if FM requirements are incorporated in concept design.

In conclusion, this research is aims to benefit and provide references to all parties involves construction project especially in FM activities, such as clients, consultants, FM contractors, government agencies and also academic researchers. Important construction stakeholders such as client, consultant and FM contractor can refer the related issues and measure to minimize the challenges of integrating FM consideration during building design in order to encourage the consideration of FM in design stage of a construction project. The relevant academic experts and government agencies such as CIDB can refer to the related topic and expected to be used in assisting the related field of academic study in the future.

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Appendix A

Table 3: Population and Sampling Size (Krejcie & Morgan, 1970)

Table 3.1

Table for Determining Sample Size of a Known Population

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	346
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	354
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	191	1200	291	6000	361
45	40	170	118	400	196	1300	297	7000	364
50	44	180	123	420	201	1400	302	8000	367
55	48	190	127	440	205	1500	306	9000	368
60	52	200	132	460	210	1600	310	10000	370
65	56	210	136	480	214	1700	313	15000	375
70	59	220	140	500	217	1800	317	20000	377
75	63	230	144	550	226	1900	320	30000	379
80	66	240	148	600	234	2000	322	40000	380
85	70	250	152	650	242	2200	327	50000	381
90	73	260	155	700	248	2400	331	75000	382
95	76	270	159	750	254	2600	335	1000000	384

Note: N is Population Size; S is Sample Size *Source: Krejcie & Morgan, 1970*