



# Ascertaining the Transfer of Facility Management Knowledge to the Development of New Students' Residential Colleges in UTHM Malaysia

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**Abstract:** Facility management (FM) knowledge has been deemed beneficial because it arises from the use and operation of buildings. Transferring the knowledge from old buildings to new ones will ensure that maintenance problems which occur as a result of poor design decisions will be avoided. Despite the numerous benefits that stem from the transfer of FM knowledge, existing literature has revealed that FM knowledge is rarely included in the design of new buildings. To combat this, a typology was created to identify mechanisms needed for the transfer of FM knowledge to new buildings. This study adopted this typology to ascertain the transfer of FM knowledge to new students' residential colleges in UTHM Malaysia. The qualitative case study design was used to obtain data by interviewing selected individuals that played key roles in the development of the new students' residential colleges in UTHM. When compared to the old students' residential colleges, study findings revealed a decline in the transfer FM knowledge to new students' residential colleges. This was basically as a result of the fact that the new students' residential colleges were built by private developers. Problems with the current transfer process for FM knowledge were revealed, and suggestions were made for improvements.

**Keywords:** Facility management knowledge, knowledge transfer, students' residential colleges, UTHM

## 1. Introduction

Apart from the staff and students, the most significant asset to the university as an organisation are the buildings (Lateef, 2012). The main purpose of university buildings is to create and sustain a conducive environment that will support teaching, learning, research, and innovation (Lateef, Khamidi & Idrus, 2010). This makes the academic buildings valuable, and it is for this purpose that the Malaysian government invests heavily on them (Khalil et al., 2015). However, buildings only have value when they can efficiently provide their intended service (Lateef, Khamidi &

Idrus, 2011). Therefore, it is important to ensure they are properly maintained as that is the only way to maintain and increase property value (Ali et al., 2013).

Ninety percent (90%) of the total fund allocated by the Malaysian government to universities are used on the operation and maintenance of university buildings (Lateef, 2012). Except something is done to reduce the high maintenance cost, it may end up being higher than the initial construction cost (Mydin, 2014). Thanaraju & Ali (2015) state that in public sectors where the allocated budget or funding is limited, maintenance cost is a critical factor in cost management. Lateef (2012) opined that besides FM processes and procedure, the high cost of operation and maintenance was due to the selection of materials, workmanship, construction methods, regulations, rules, and standard. Therefore, regardless of the improvement to the quality of FM service, it will have no effect to the maintenance problems that were born out of wrong design decisions made at the early stages of the building development process (Bröchner, 2003). However, existing literature revealed that despite the many benefits to be gained from the transfer of FM knowledge to the development of new buildings, FM knowledge is rarely put into consideration during the development of new buildings (Jensen & Chatzilazarou, 2017).

To facilitate the transfer of FM knowledge, Jensen (2012) designed a knowledge transfer typology for FM. This typology identified mechanisms needed during the building development process to ensure the necessary steps are taken to link building design and maintenance.

Universities aim to enable students to attain intellectual competence and other qualities that can aid in fulfilling living experiences (Mohammed, Gambo & Omirin, 2012). The students' residential colleges represent a core element that plays a role in the achievement of those objectives (Kasim, Abubakar & Ishiyaku, 2014). With this knowledge, a lot of researchers set to view the students' residential colleges from the perspective of students in terms of their experience and satisfaction with the building (Khozaei et al., 2014; Mohammad et al., 2012; Najib & Sani, 2012). Although these studies provided useful FM knowledge, none looked to determine if the knowledge was put into consideration in the development of new buildings. To fill in the identified gaps, this study looked to ascertain the transfer of FM knowledge to the development of new students' residential colleges in UTHM, Malaysia.

The study began by describing FM knowledge, knowledge transfer, and the need for FM knowledge in the building development process. It then reviewed the typology for transfer by assessing the mechanisms required for the transfer of FM knowledge to new building development. UTHM was adopted as case for the research, by exploring the transfer of FM knowledge to the development of the students' residential colleges. Findings were compared with typology for transfer to ascertain if the mechanisms for the transfer of FM knowledge were implemented.

## 2. Literature Review

To ascertain the transfer of FM knowledge to the development of new students' residential colleges, the following concepts were discussed based on the analysis of literature.

### 2.1 Facility Management Knowledge

The facility manager's knowledge is vital because the FM responsibilities involve interaction with various facility service providers, internal clients (the facility end-user, owner or decision makers), and external participants (consultants). This leads to the accumulation of knowledge from various streams (Olatunji & Sher, 2009). Knowledge has been established to be the most noteworthy of organisational resources, and the knowledge that pertains to an organisation's use of its physical assets, working and production environment cannot be overlooked or underestimated (Katchamart, 2013). FM knowledge is key to understanding the relationship concerning the performance of the physical assets and their effect on the end-users of those resources (McLennan, 2000). FM knowledge be it from usage patterns or a preferred level of service, when amassed and applied systematically it delivers an optimum working environment and productive facilities (Waheed & Fernie, 2009).

FM has been uplifted from the practice of operation/maintenance only to a level where the use of formal FM process, deliberate contractual agreements, organised communications, and control channels through departmental boundaries now form the core competency of an organisation (Almarshad, Motawa, & Ogunlana 2010). This allows the FM profession to be regarded as more than just a cost center, but as a multidisciplinary function with a direct contribution towards productivity and profitability (Kamaruzzaman & Zawawi, 2010). For these reasons, FM is constantly challenged to build a distinguished knowledge-base in order to reinforce best practice to improve its field and bridge the gap between potential and performance (Nutt, 2000). Without having knowledge on end-users of a building and building operational process, there will be difficulty in management by the user (Firdaus et al., 2015).

FM knowledge has been argued to be very vital to new building development (Kreiner, 2005). This is because the facility manager is the farmer who develops a long-term relationship with the building, while the rest of the professionals of the building development team are hunters who move on in pursuit of the next contract at the completion of a building project (Johnstone, Dainty & Wilkinson, 2007). By tending to the buildings, the facility managers are tasked with building operation, maintenance, improvement, and adaptation (Booty, 2009). This provides them with the knowledge that will prove beneficial in the planning of new buildings (Jensen, 2009).

A major hindrance to the facility managers' involvement in new building projects is the mindset of the organisation and design team on facility managers, and the perception of facility managers on facility management responsibility (Jaunzens et al., 2001). This is because the facility managers are perceived to be lacking in their qualifications to be accepted as one of the members of the design team (Badger & Garvin, 2007). To resolve this, it has been suggested that there must be professional development among the facility managers.

## 2.2 Knowledge transfer

Knowledge in an organisational context is a resource that is contained within the mind of employees, it is also a resource that is generally used to augment the value of other capital and does not lose value (Harris, 2001). A simple definition of knowledge transfer is the application of knowledge from a particular situation to another (Fadel, Brown & Tanniru, 2008). Knowledge transfer is an important stage in the knowledge management process (Zaidi et al., 2016) especially in terms of organisational learning and innovation (Riege, 2007). Knowledge acquisition makes it possible for problems and tasks to be viewed from an alternative perspective thus leading to creativity and innovation (Leonard-Barton, 1995). Nonaka (1994), identified two dimensions of knowledge, tacit and explicit knowledge. The author further described explicit knowledge as knowledge that is written down or put into coded formats and tacit knowledge as verbalized knowledge. However, in whatever dimension knowledge is, its transfer brings about the transfer of information and information can only be of value if it highlights problems or inconsistencies of existing norms and practices (Yih-Tong & Scott, 2005). Although knowledge can be generated, coded and processed it is of value when it brings about meaning to a context (Bhatt, 2000). Transfer can be said to take place after knowledge has been communicated and applied. Transfer can also be said to occur if the recipient of the knowledge is capable of application (Doleman, 2013). Measurement of knowledge transfer can be obtained by determining the change in performance (Argote & Ingram, 2000). Walsh & Ungson (1991), opined that there are five knowledge retention repositories in the organisations. They are the individual members, roles and organisational structures, organisation's standard operating procedures and practices, its culture, and physical structure of the workplace. To measure the level of knowledge transfer, it is important to capture changes in knowledge and performance of these various repositories (Argote & Ingram, 2000). Szulanski (2000), noted that for the ease of knowledge transfer, it is imperative for it to be regarded as a process and not an act.

## 2.3 The Relevance of Facility Management to the Building Development Process

Buildings are faced with the threat of a lack of economic fulfilment as the quality of the building development process dwindles because of underachievement in relation to cost, duration of construction and certain building performance factors (Egan, 1998). Olatunji & Sher (2009), seconded this fact and added that the threat is gradually being transferred to the FM process. The performance of facilities is a major concern in the construction industry (Crawley & Aho, 1999). However, building performance means different things as viewed from a different perspective. While the owner may view the building performance from a financial perspective, the occupants are more concerned with the comfort, indoor air movement, health and safety factors (Ding, 2008).

Nutt (1999) established FM knowledge is sourced from knowledge of property and construction; FM knowledge; and knowledge of building design. Pathirage et al. (2008) identified FM knowledge as being comprised of a knowledge capital of human, end-user and structural capital. This makes FM knowledge so valuable because it emanates from a practice that involves the learning of certain management concept as it adopts technical expertise from various professional fields (Nutt & McLennan, 2000). A facility manager's involvement in the building development process will aid in addressing issues that arise from a maintenance perspective and will also factor cost-in-use into consideration while tendering advice for the best form construction, design, and finishes (Adeyemi et al., 2014a). By reapplying the knowledge to building development process, it eliminates reoccurring errors that may arise, thereby drastically reducing unnecessary expenses used to correct errors and improving in design and facility performance (Lê & Brønn, 2007). This is because knowledge has the capability to improve facilities decision making and support, increased globalization and mobility of tacit knowledge (Tiwana, 2002). However despite the numerous benefits of FM knowledge to building development process the construction industry is still lacking in delivering flawless facilities because they fail to learn from the experience generated from facility use and operations of existing buildings (Brôchner, 2003; Lê & Brønn, 2007).

The facility manager's knowledge is vital because the facility management function involves an interaction of various facility service providers, the internal clients (the facility end-user, owner or decision makers), they also interact with external participants (such as consultants) this leads to the accumulation and application of various knowledge streams from the functional areas of internal clients and external participants (Waheed & Fernie, 2009). It is general knowledge that users have an important role to play in the various service industries (Amaratunga et al., 2010). This especially relates to the construction industry where users are the very reason the industry existence, therefore there is a need for user requirement to be put into consideration to achieve satisfaction (Boyd & Chinyio, 2008). The previous method of determining satisfaction of FM services or to determine competitive position was service fee and it led to a neglect of user requirement (Shaw & Haynes, 2004). This would have led to the danger of FM being regarded

as just a commodity service that can be sought at the lowest price no matter the level of service (Loch, 2000). In addition, it contributed to the huge attention on user requirements by researchers and facility managers and fulfilling those requirements thereby by achieving user satisfaction became the benchmark for evaluating FM service performance (Amaratunga et al., 2010).

The maintenance and management duty of a building rests with the facility manager, despite not being familiar with the design concept used by the architect (Mohammed & Hassanain, 2010). The design stage is very complex and extensive especially in terms of information volume produced by the design team (Mitchell et al., 2011). In addition to this fact, a study by Thomas-Mobley & Khuncumchoo (2006) revealed that contractors and designers are oblivious to the downstream uses of their information, and this had led to loss or failure to record important information that would have added to the facility managers knowledge. Martin & Guerin (2006), revealed that the problem with building development process is that standard buildings do not take into consideration the relation between user and building, thus lacking FM knowledge transfer to new buildings which is a problem as FM handles the post construction activities. Therefore, involving a facility manager will ensure it is suitability for the intended use (Adeyemi, Martin & Kazim, 2014b).

The position of the facility manager in the built environment is one that provides an understanding of the building life cycle, and with the tools for proper financial and strategic planning, the long lasting value can be created for the organisation by the development, implementation, and maintenance of sustainable FM practices (Hodges, 2005). Therefore, it is important that the facility managers play an active role in the briefing process prior and during the construction and a new role be carved for them (Eley, 2001). This will result in issues from operations being addressed from the onset and an input of key knowledge that will benefit and develop the design process thus developing the organisation (Finch et al., 2005). However, the tradition for the inclusion of the facility managers in the building lifecycle has been limited and resulting in design decisions underestimating their impact on maintenance and operation cost (McAuley, Hore, & West, 2015).

## 2.4 Knowledge Transfer for Facility Management to the Building Development Process

According to Jensen, Damgaard & Kristiansen (2009), the transfer of FM knowledge to the building development process is generally viewed as knowledge pull and knowledge push. There are two phases of the knowledge transfer process, the front-end knowledge transfer, and the back-end knowledge transfer. The front-end knowledge transfer occurs at the early stage of the building development process. In this phase, the primary concern is designing and constructing the building in relation to the end-users' requirements (Jensen et al., 2009). It is mostly concerned with ensuring that the building is effective to fit its purpose, functionality, usability and adapt to the changing need over the course of time (Jensen, 2012). Back-end knowledge transfer, on the other hand, takes place at the post-construction stage of the building development process (Jensen et al., 2009). It is concerned with the efficiency of the building to ensure its use and operation at minimum cost (Jensen, 2012). Figure 2.2 depicts the knowledge transfer process for FM by Jensen et al. (2009).

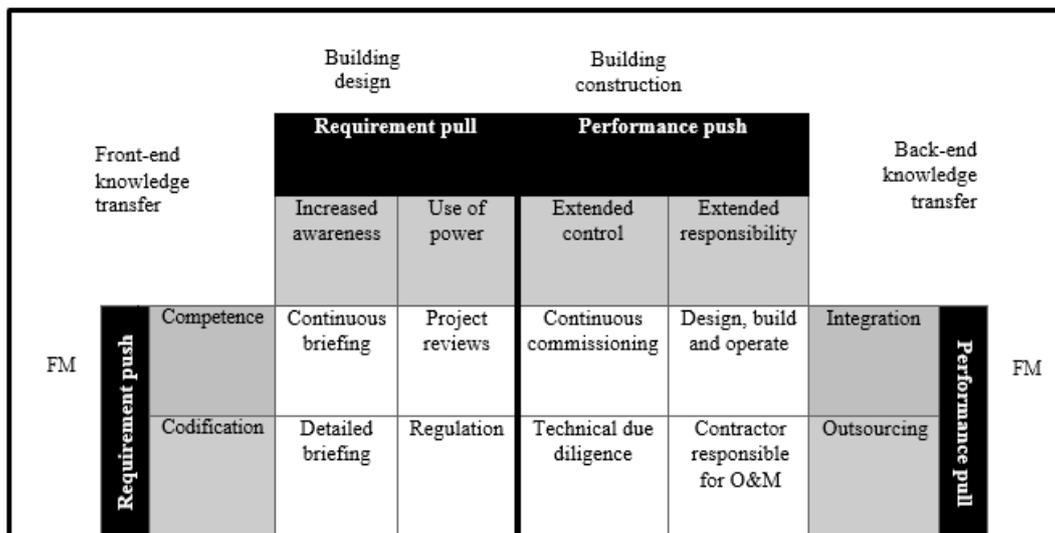


Fig. 1 - knowledge transfer typology for facility management (Jensen, Demgaard & Kristensen, 2008)

## 2.5 Front-End Knowledge Transfer (Requirement Push)

The front-end knowledge transfer has been described as a sender-receiver mode (Vianello & Ahmed, 2009). Sender refers to the client representative such as facility managers, end-users, and client consultants, while the receivers

are the building design team. According to Jensen (2012), there are two requirements to ensure the push of knowledge at the front-end of the building development process. These requirements are competence and codification. Competence refers to the involvement of competent facility managers, end-users or FM consultants in a continuous briefing process. Jensen (2012) specifically used the term competent because mere involvement does not add anything beneficial except competence is included in the mix. Codification of knowledge from the facility managers, end-users or FM consultants during the briefing is done with the use of tools like guidelines, checklist and databases (Jensen et al., 2009). The requirements to push FM to the development process as described in figure 2.1 is a practical representation of the personalisation and codification of the knowledge sharing strategies. There are four mechanisms that should be used to ensure front-end knowledge transfer (Jensen, 2012), they include:

- **Continuous Briefing:** According to Kamara, Anumba, & Evbuomwan (2000), problems with the traditional briefing process are poor involvement of parties, insufficient time allocation, inadequate deliberation of end-user's requirement, and poor communication between parties. Continuous briefing is a term that was introduced by Jensen (2006) to broaden the dialogue based briefing process as an improvement to the traditional, delimitating and specification focused process. It has also been tagged 'inclusive briefing' because it requires competent facility managers and end-users to be actively involved in a continuous briefing process during the design of the building. Two factors give this mechanism an edge over the tradition briefing process. It is dependent on the personalisation of FM knowledge, this promotes the sharing of FM knowledge at the early stages of the building development process. It is also a continuous process, thereby making it easy for adjustments to be made before the design phase is over
- **Detailed Briefing:** This is the sharing of FM knowledge in the form of written specification. It is dependent on the codification of the knowledge from the facility managers, end-users and FM consultants into tools like guidelines, checklists, and databases. Other tools that have been suggested for the sharing of FM knowledge are post-occupancy evaluation (POE) (Preiser, White, & Rabinowitz, 2015), computer-aided facility management (CAFM) (Lavy & Shohet, 2009), building information modelling for FM (BIM-FM) (Kassem et al., 2015).
- **Project Reviews:** This is done by ensuring that FM knowledge is taken into consideration by means of feedback, comments, and suggestions from the facility managers or FM consultant for improvements to the design team. This mechanism is important because of the poor communication between the facility managers and the architects (Meng, 2013). This usually leads to the cost of the building operation being high and affecting the building performance (Tucker & Masuri, 2016). Through the facility manager's feedbacks on design, the architect views the proposed building from a maintenance perspective.
- **Regulation:** This mechanism is facilitated by authorities like the government making regulations for the building development industry to guarantee that FM is included in the building development process. When authorities enforce the inclusion of FM knowledge, it leads to the identification of potential risks from design decisions as early as possible (Nutt & McLennan, 2000).

## 2.6 Back-End Knowledge Transfer (Performance Pull)

Jensen (2012) sender-receiver framework for the back-end knowledge transfer refers to the in-house facility managers, outsourced FM contractors or FM consultants as senders and the representative of the building construction team as receivers. The performance pull from FM at the back end can be divided into integration and outsourcing, while the performance push can be divided into extended responsibility and extended control. The combination of two forms of performance pull and two forms of performance push gives four methods of back end knowledge transfer from FM to the building process.

The methods of back end knowledge transfer are:

- **Continuous commissioning:** Commissioning is a documented way to diagnose and verify building performance. It also serves to improve the performance to conform to the requirements of the end-users. Present day building designs have focused more on aesthetics and budget than functionality (Valen & Olsson (2012), and this has led to building inefficiencies (Adeyemi, Martin, & Kazim, 2014). To combat this, it is important to take end-user requirements into consideration because they are knowledgeable about building performance (Lai & Yik, 2007). Commissioning is done to keep the entire building in optimal condition throughout the lifecycle from the perspective of the environment, energy consumption, and facility usage. The commissioning starts at the earliest phase of the development process and continues to the end. That is during the decision-making stage, the briefing stage, design stage, the construction stage, and the occupancy stage. This mechanism is enabled by the involvement of the experienced facility manager in a continuous commissioning process in design and construction. This ensures that the facility manager is equipped with enough knowledge to efficiently manage the building (Jawdeh, Wood, & Abdul-Malak, 2010).
- **Technical due diligence:** A description of due diligence is the duty of care especially when it comes to transactions. It involves providing information and evaluation to all parties in a transaction to reduce risk. Technical due diligence is often carried out as a part of real estate transactions and business mergers. It is also

used in contracting out FM duties for both existing building and new buildings. Technical due diligence should be carried out by FM consultants to provide a clear basis for the duty of FM.

- Design, build and operate: In the traditional design and construction of buildings, there is hardly an individual that will be present throughout the building development process (Wood, 2013). The different parties only focus on fulfilling their part of the contract. The moment the building has been handed over, the facility managers are left to handle whatever problem occurs as a result of the design decisions (Hassanain, Al-Hammad, & Fatayer, 2014). If the building operation is included in the design and build combination, it will serve as a mechanism to pull FM knowledge into the development process. This is because the developers will be fully aware of the economic implications of certain design decisions. This will lead to FM considerations in the design of new buildings.
- Contractors responsible for FM: This involves the outsourcing of FM duties of a building to the developer responsible for its construction. By the developers taking over the FM duties of the building, it will force them to deliver high-performance buildings that will not have unnecessary faults over its life cycle or require repairs to correct faults from the development process. This will influence the developer to include FM to the development process. This factor, however, is determined by the procurement method and the collaboration between the development team and the collaboration.

## 2.7 The Students' Residential College

Various studies have been undertaken to emphasise the impact of academic building performance on both student and staff performance (Amaratunga & Baldry, 2000; Fleming & Storr, 1999; Green & Turrell, 2005; Haugen & Fianchini, 2007; Lavy & Bilbo, 2009; Price & Clark, 2000). While global higher education is focused on enabling students to attain intellectual competence and other qualities that can aid in fulfilling living experiences, the students' residential colleges represent a core element that plays a role in the achievement of those objectives (Hassanain, 2008). Roberts & Higgins (1992) conducted a study to determine the perception of first-year students on the facilities provided in the United States. It was discovered that the housing/accommodation was one of the most criticised because its availability and quality revealed to have a high impact factor to students and the authors recommended it to be included in the marketing mix of student recruitment. The provision of students' residential colleges has also been identified as a factor in which students in Malaysia consider when choosing a university. According to Khozaei et al. (2012), if Malaysian universities fail to provide students' residential colleges, the lack of affordable accommodation may create a significant problem for students.

The students' residential colleges are generally said to be buildings that accommodate many students, comprises numerous room that contains several beds and shared bathrooms (Khozaei, Hassan, & Khozaei, 2010). The students' residential colleges fulfill several needs and desires, and rooms are furnished with ample facilities and services (Muslim, Karim, & Abdullah, 2012). Zahran (1972) highlighted the reasons why students' residential colleges are of importance to universities and they include:

- i. Lack of students' residential colleges may be a factor that lowers the academic performance of students.
- ii. Properly planned students' residential colleges bring about mutual interests and desirable outcomes in educational performance. This is because students' residential colleges provide cooperation, security, responsible citizenship, involvement, intellectual stimulation, mutual composition, and inspiration.
- iii. Students' residential colleges create and encourage institutional loyalty and eventually alumni support.
- iv. Students' residential college's aid in enlarging the knowledge and awareness of students in other academic disciplines via contacts with roommates of different backgrounds who are engaged in other fields of study.
- v. Students' residential colleges promote solidarity and unity among the student population. It serves as the magnet that attracts and unites students from other study fields apart from sports and cultural activities.
- vi. Students' residential colleges were introduced to fulfill three objectives. They include aiding students to achieve intellectual competence, personal character building and help in forming behavioural, thought and imagination patterns that can result in a fulfilling living experience.

In many Malaysian universities, the development of students' residential colleges has been a challenge because of the continuing extension of the universities and increase in the number of local and international students (Muslim et al., 2012). Universities in Malaysia that provide students' residential colleges for students generally have few vacancies and each year the number of students exceeds the accommodation available (Abubakar & Kasim, 2015).

## 3. Methodology

The purpose of this study was to ascertain the transfer of FM knowledge to the development of new students' residential colleges in UTHM, Malaysia. This study utilised the qualitative approach in collecting data because it aides in exploring issues from various perspectives, thus allowing for various facets of a phenomenon to be understood (Baxter & Jack, 2008). The case study research design was used because it provides an opportunity to probe into one aspect of a problem in more detail within a limited timeframe (Bell, 2014).

This research adopted a single case study with multiple units of analysis. UTHM was adopted as the case study for the research to ensure the focus was narrow and in a researchable frame. The university has a total of six students' residential colleges. Four of which are the old students' residential colleges that have been in operation between the timeline of fifteen (15) to eight (8) years. Two new students' residential colleges have been developed and occupied within the last two (2) years. They are Bestari students' residential colleges which began operation in May 2017 and the Pagoh students' residential colleges which opened to students in September 2017. These students' residential colleges were classified as embedded units of analysis within the holistic case (UTHM). This made the findings from the research richer because it illuminated the case (Baxter & Jack, 2008).

Face-to-face interviews were conducted with eight (8) individuals from various offices in UTHM responsible for the development, procurement, management and operation of the new students' residential colleges. Creswell and Clark (2011) opine that when cases are studied, a smaller number of participants between four (4) to ten (10) are chosen. When it comes to saturation there is no standard method to be used by all researchers. However, the guiding principles are that when there is no new data, theme, or code, the level of saturation has been attained (Guest, Bunce and Johnson, 2006). Guest, Bunce and Johnson (2006) noted that data saturation can be attained with as little as six (6) interviews. The interview is a popular method of qualitative data collection (Creswell, 2012). Semi-structured interviews were used because it makes use of a guided interview question to collect data without limiting the participant to the set of pre-determined answers (Creswell, 2007). The time frame per session with each participant varied from thirty (30) to forty-five (45) minutes within a six (6) month timeline.

The purposeful sampling method was utilised to select participants based on their ability to purposefully provide information and an understanding of the research problem (Creswell, 2007). A factor associated with purposeful sampling is that it is that the sample changes as the research progresses (Marshall & Rossman, 2011). The maximum variation method of purposeful sampling was applied because it pays attention to the diverse variations of different perspectives while identifying the common patterns (Creswell, 2013).

The study participants were chosen from various offices responsible for the development, procurement, management, operation, and maintenance of the students' residential colleges. The FM Division is responsible for the operation, management, and maintenance of all buildings in UTHM. The Development Division is responsible for the design, contracting and development of all the in UTHM. Residential college offices are responsible for the running and management of the UTHM students' residential colleges under their care. The Student Housing and Transportation Office oversees the entire students' residential colleges in UTHM. The private developer was responsible for the development of the students' residential colleges. Table 1 presents a summary of the participants' information.

**Table 1- Study Participants**

<b>Participant</b>	<b>Office/Division</b>	<b>Background</b>	<b>Number of years in university</b>	<b>Number of years in current position</b>
P1	Facility Management	Electrical engineering	17 years	17 years
P2	Civil and Architecture	Civil Engineering	15 years	15 years
P3	Development Planning and Design	Architecture	10 years	10 years
P4	Student Housing and Transportation	Management	21 years	21 years
P5	Contract and Survey	Quantity survey	15 years	15 years
P6	Residential College Principal	Ethics relations	11 years	2 years
P7	Residential College Principal	Education	12 years	5 years
P8	Private Developer	Electrical engineering	30 years	2 years

Each study participant has worked in UTHM for at least ten (10) years. The experience of the participants will aid in getting data on the subject matter from a subjective point of view (Ali, 2010). Ali (2010) suggests that interviewing managers and owners of the building as the best way to obtain knowledge in the building. To achieve the study purpose, the typology for the transfer of FM knowledge by Jensen (2012) was used as a frame for the interview. The mechanisms for both requirement push and performance pull were used as a guideline to ascertain the transfer of FM knowledge to the development of the new students' residential colleges in UTHM, Malaysia. Each students' residential college was analysed by comparing the development process to the typology for the transfer of FM knowledge suggested Jensen (2012).

## **4. Findings**

### **4.1 Requirement Push**

The basis of this front-end knowledge transfer process is to push FM knowledge to the early stages of the building development process. It can be done in two ways; first by increasing awareness among clients or the building

development team, and second by use of power by clients or authorities to ensure that FM knowledge included to the development process (Jensen, 2012). There are four mechanisms used to channel the transfer of FM knowledge to the building development process. For increased awareness, the mechanisms are continuous briefing and detailed briefing. For the use of power, the mechanisms are project reviews and regulations.

#### 4.1.1 Continuous Briefing

From the interview findings, it was discovered that the briefing process for the old students' residential colleges was not of the traditional sort. Instead of just meeting with the architect alone to discuss the plans, the Development Division invited members from the FM Division. The end-users (students) were represented in these meeting by the Student Housing and Transportation Office and the residential college principals who oversaw the students' residential colleges.

*“But then before we commence any building project, we will definitely have a meeting with them. That is the facility management together with Student Housing and Transportation Office, as well as all the college principals.” P2*

According to the participant during these meetings, they discuss the issues like the number of students expected to reside in the students' residential college, the room capacity, provision for the married students and other facilities to be provided. However, the interviews revealed that this form of the briefing is done when the buildings are developed by UTHM in the Parit Raja campus.

The Bestari and Pagoh students' residential colleges were procured and developed off-campus by private developers and then leased by UTHM. With the Bestari students' residential colleges, the university had no prior plans to obtain it. The plans were presented by the developer.

*“We did not make any plan to procure this college, it was presented to us by the developer” P5*

The private developer met with the Development Division after the building had been designed. The floor plan of the proposed building was then presented to the division to approve the design. They had no say in the design, they only checked to ensure it was safe for the students.

*“During the first discussion on the building, the drawing was sent to us to examine the layout plan of the structure. So, we noted certain things about the apartment, like the design layout- it has three (3) rooms and one toilet outside and living hall. We only commented on the layout plan but not the technical part. We also did not consider the facility issues like complaints about the existing colleges, because it is not our building.” P3*

The briefing process for the building design was done without the involvement of the Development Division, FM Division, or the residential college principals. It was designed according to the specification of the developer, and the Development Division had no say in the design. All that was required of them was to state if the buildings were suitable to serve as students' residential colleges for the university. When the floor plans were presented to the Development Division, the FM Division was not invited to the meeting.

During the early development stages of the Pagoh students' residential colleges, every decision on the design of the building was made by the Development Division. The FM Division and residential college principals were not involved in the briefing process. However, the Development Division was unable to obtain funds for its construction after the building was designed and they had to find a developer.

*“Since they were unable to get funding, they could not proceed with the proposed building. They then came to present their plans to us, and we took over the building” P8*

After gaining control of the building, the private developers used the design that was presented to them. They made no changes and had no future briefing with the Development Division, and they also did not involve the FM Division.

#### 4.1.2 Detailed Briefing

The Economic Planning Unit (EPU) has a guideline called the Schedule of Procedure with specifications for the development of students' residential colleges. These specifications are called Standard and Cost, and they must be followed in the development of any students' residential colleges.

*“For the college, we have specifications from the government called Standards and Cost. They are standards from EPU, and we follow the stated requirement for hostels. This Standard and Cost state the area required per student. So if we want to build a hostel for one thousand (1000) students we will refer to the guidelines for specifications. The guidelines also state how many people to one toilet and other things.” P1*

The guideline formed the checklist that is used in the development of the old on-campus students' residential colleges. Since it is a document, it is in a codified form of knowledge. However, it is not the only codified knowledge that was used. The complaints from students residing in the old students' residential colleges are obtained in the form of online and manual complaint forms. These complaints were analysed and put into consideration in the development of the old students' residential colleges.

During the development of the Pagoh students' residential colleges, the EPU schedule of procedure was partially used in the design. This was because there was a limited fund available and fully following the EPU guidelines would have led to a high cost of construction. Due to the limited funding, the Development Division proposed the Pagoh students' residential colleges to be a private finance initiative (PFI) project, as it will ensure the government having little control over its management and the EPU guidelines would not need to be followed fully. The design for the Pagoh students' residential colleges was by the Development Division and finance was the major factor that influenced the design decisions. The only form of codified FM knowledge used in making design decisions was the online complaint form. When the proposal for the Pagoh students' residential college to be a PFI project was rejected by the government, the Development Division then reached out to a private developer. The already proposed design was then handed over to the private developer who developed the Pagoh students' residential colleges with the design as is.

The Bestari students' residential colleges did not utilise any guideline or codified knowledge from FM Division. Since the buildings belonged to a private developer, every guideline and checklist for the design was set by the private developer alone. However, a participant stated that before the students' moved in there were some EPU requirements that had to be fulfilled.

*“From the beginning especially for the buildings like Taman Bintang (Bestari) when the university wanted to rent the building, we had to check certain requirements from the EPU guidelines. An example of the requirement to be followed is we have to ensure that the building is fenced, there are parking space and others.” P4*

Except these EPU requirements were met by the private developer, the university will be unable to accept the buildings as students' residential colleges.

### 4.1.3 Project Reviews

Participants mentioned that with the old students' residential colleges that were developed by UTHM, feedback from a maintenance perspective was very important to them. After the building was designed the FM Division was called upon to give comments from a maintenance perspective. A participant from the FM Division gave an example of how in the initial design, the old students' residential colleges were to have a butterfly roof. The design plan was then sent to the FM Division and in the feedback comments on the design, the roof was discouraged because it is prone to leakages and the cost of maintenance is expensive. From the FM perspective, it was not a good choice. Taking FM knowledge into consideration was possible because the students' residential colleges were developed by UTHM.

*“For design, the development office will present their design and we will comment on the design. We have given our opinion on issues like the roofing of the building. The architects proposed the butterfly roof but we commented that the roof cannot be used for a long time because it can lead to leakage and will be very expensive to maintain. From the FM perspective, it was not a good choice.” P1*

A participant stated that the layout of the older students' residential colleges was used as a reference when the Development Division designed the Pagoh students' residential colleges. But when the students' residential colleges were handed over to a private developer because the plans for PFI did not go through, the Development Division played no part in its development anymore. With the Bestari students' residential colleges, there was no feedback from the FM Division. This is because the building is owned by a private developer.

### 4.1.4 Regulation

Findings revealed there is no regulation that enforces the application of FM knowledge to the development of new students' residential colleges. Although conscious efforts were to transfer FM knowledge in the past, it was done because the Development Division was aware of its importance and not under any obligation to include it. EPU is the only regulatory body that monitors the development of new students' residential colleges, and there is no stipulation about the inclusion of FM knowledge in the building development process. The university has a master plan for past, present, and future projects, and there is nothing about the inclusion of FM knowledge to the development process of new students' residential colleges. The Bestari and Pagoh students' residential colleges were developed by private developers. The development was done according to the developers' accord, and there was no law enforcing the inclusion of the FM knowledge.

## 4.2 Performance Push

The aim of the back-end knowledge transfer process is to pull FM knowledge to the building development process by the design team. Like the front-end of knowledge transfer, it is also done in two ways- by extended responsibility and extended control of the facility managers. The mechanisms used to push the FM knowledge into the back-end of knowledge transfer are design, build and operate, continuous commissioning, contractor's responsibility, and technical due diligence.

### 4.2.1 Continuous Commissioning

Findings reveal that continuous commissioning is completely dependent on the procurement of the building. This was what influenced the participation of the FM Division in the development process of the students' residential colleges. The old students' residential colleges were developed by UTHM, through the Development Division. Since the FM Division is under the university, it was only natural for them to get involved from the early stages of development.

*“We participated in the development of the students' residential colleges on campus. From the initial kick-off stage when we did feasibility tests, to the building handover” P1*

At the completion of the building, they assumed responsibility for it and always kept the Development Division informed of the building operation. Findings also revealed that apart from the complaint form, there was nothing else that was used to monitor the performance of the students' residential colleges. The FM Division does not have a routine inspection for the building, they are only called upon when there is a maintenance problem.

The FM Division had no participation in the development of the new students' residential colleges. There was no opportunity for them to get involved because they were not consulted.

*“The facility manager is a participant of the decision-making stage only when the colleges are being built in the main campus. Outside of campus, they have no authority to make that decision.” P2*

In addition to the private developer not using FM Division, they also did not use any facility manager throughout the development of the new students' residential colleges.

### 4.2.2 Design Build and Operate

The since the old students' residential colleges were developed by UTHM, the development and management of the students' residential colleges rested with FM Division and Development Division of the university. With the development of the Pagoh students' residential colleges, the agreement between UTHM and the private developer was for design, build, lease and manage. This means that UTHM just leased the building from the private developer who is responsible for the design of the building, its development, and maintenance.

*“For the development, our agreement with them is actually design, build, lease and maintain (BDLM). That was the process for the Pagoh hostel.” P1*

This turned out to be effective because shortly after the students moved into the Pagoh students' residential colleges, there were a lot of maintenance issues that were discovered. If UTHM was responsible for its management, the private developer might have been unaware of the maintenance problems that ensued. This way they learned from the problems and understand the importance of designing efficient buildings from an FM point of view.

*“They should be involved from the early stages of the planning. We are now thinking about a new building project for a polytechnic. I am proposing that we should involve a facility manager from the beginning, so they know the type of maintenance that has to be done in the future. It's not only architects that are needed, as architects are only concerned with the design. But the maintenance of the building must be put into consideration.” P8*

Although being responsible for the operation and maintenance of the building was beneficial to the developer of the Pagoh students' residential colleges, the developer of the Bestari students' residential colleges does not handle the same responsibility. The private developer was not responsible for the maintenance of the Bestari students' residential colleges. After the building was constructed, it was handed over to the Students Housing and Transportation Office of UTHM. Feedback about the maintenance does not revert to the private developer.

### 4.2.3 Contractor's Responsibility

With the Pagoh students' residential colleges, the private developer was responsible for hiring the outsourced FM contractors and allocating their responsibilities to them.

*“The facility management for Pagoh is from the cooperative (private developer) not from the university.” P8*

This will be effective because they will be equipped with knowledge from the building design that will prove useful in understanding the origin of maintenance problems that may arise. With the Bestari students' residential colleges, the Students Housing and Transportation Office of UTHM was responsible for the hiring of the external FM contractors. The office consulted the FM Division to acquire a list of FM duties to be performed in the management of the students' residential colleges. After the building was handed over to them, the private developer had no part in the management of the building. The Students Housing and Transportation Office had no knowledge of the design process and in the occurrence of any maintenance issue, it might be difficult to trace the source.

#### 4.2.4 Technical Due Diligence

Interview findings revealed that the Development Division and FM Division collaborated during the development of the old students' residential colleges (on campus). This resulted in an adequate sharing of technical knowledge about the building between both divisions. Thus, equipping both divisions with the needed knowledge that can be used in the development of future buildings or in the management of the existing ones.

According to the private developer of the Pagoh students' residential colleges, the architect of the buildings was responsible for hiring and overseeing the contractors for FM. This will ensure sufficient exchange of knowledge from both the FM and design perspective. Since the private developer of the Bestari students' residential colleges was no longer involved at the completion of the building, there was no exchange of knowledge on FM and the building design.

### 5. Discussion

Continuous briefing is a mechanism that was fully implemented during the development of the old students' residential colleges. There was inclusive briefing as the FM Division was present during the briefing process and the residential college principals that served as representatives of the students with knowledge of the end-users' requirements. This aided in the not only transferring FM knowledge but ensured that the building will be suitable for the end-users (Jensen, 2012). This implies that the Development Division is aware of the benefits that arise from the inclusion of the FM knowledge to the building development process. During the development of the new students' residential colleges, there was no attempt at inclusive building. Since the Bestari students' residential colleges were by a private developer outside UTHM, they did not see the need to consult the FM Division. But with the Pagoh students' residential colleges that were designed by the Development Division, it was surprising to note that the FM Division was not included. This is because the Development Division is aware of the benefit of FM knowledge and practiced inclusive briefing with the old students' residential colleges.

For detailed briefing, there were two sources of codified knowledge. The first specifications from the EPU guidelines that were used as a checklist for the development of the old students' residential colleges. The second was the database of the students' complaints. These sources of knowledge were not fully utilised during the design of Pagoh students' residential colleges. This is because the Development Division wanted it to be a PFI project and they were not sure of funding. None of the knowledge sources was used during the development of the Bestari students' residential colleges. However, before the students' residential colleges could be accepted there were certain requirements from the EPU that were needed to be met.

During the project review of the old students' residential colleges, there as adequate feedback on design decision from a maintenance perspective. The design plans were sent for review to the FM Division and they commented on designs and also gave suggestions for improvements. For the Bestari students' residential colleges, what constituted the project review phase was the private developer sending the floor plan of the building for the Development Division to approve. There were no comments on the design decisions, no feedback nor suggestions from the FM Division. The Pagoh students' residential colleges did not undergo any project review process, as there was no consultation of the FM Division.

Due to the procurement of the new students' residential colleges from private developers, the requirement push of FM knowledge dynamics changed. The Development Division no longer had the final say about the design of the new students' residential colleges. No attempt was made to include the end-users to the briefing stage and the FM Division were not involved either. This is because there is no regulation by EPU or the university enforcing the inclusion of FM knowledge to the development of new students' residential colleges. Even when the old students' residential colleges were developed, the Development Division was under no obligation to include the FM Division. However, due to their awareness of the importance of FM knowledge and their collaboration with the FM Division, it was easy to include the knowledge. The EPU requirements have nothing about FM knowledge, so the students' residential colleges can be developed based on the specifications and no consideration will be made for FM knowledge. This makes it easier for FM knowledge to ignored in the development of new students' residential colleges. There is a need for the EPU to be made aware of the need and benefits of FM knowledge to the development of new buildings. This will encourage a law which enforces the inclusion of FM knowledge in the building development process (Jensen, 2012).

With the development of the old students' residential colleges, the FM Division was continuously commissioned from the decision-making phase to the building operation phase of the building development process. This made them equipped with adequate knowledge as they took over the maintenance of the students' residential colleges. The private developer of the Bestari students' residential colleges did not involve the Development Division or FM Division from the decision-making stage to the construction stage. However, at the occupancy/operation stage the building was handed over to the Students Housing and Transportation Office. They were responsible for the hiring of external contractors for FM. The FM Division was consulted to give them a list of the full duties that were needed to be performed. After the handover of the Bestari students' residential colleges, the private developer had no further involvement. Whatever design decisions that could lead to high cost of maintenance, the Students Housing and Transportation Office is now responsible for the cost. The deal made with the private developer for the Pagoh students' residential colleges was different. The private developer was not only charged with the development but also with

handling the maintenance responsibilities. After the students moved in, the students' residential colleges began operation, and maintenance commenced, the private developer began to understand the challenges from the lack of the facility manager during the design phase. By the inclusion of a facility manager in future developments, the private developer will be able to tackle the maintenance problem early. Jensen (2012) opines that if the developers are charged with the responsibility of maintenance, they will be forced to deliver high-performance buildings with minimal faults to repair over the lifecycle of the building.

## 6. Conclusion

From the semi-structured interviews conducted with individuals from the FM Division, Development Division, Students Housing and Transportation Office, and the private developer, insight was gotten into the requirement push and performance pull of FM knowledge. Findings from the interviews revealed that for FM knowledge to be pushed to the front-end of the building development process, it was totally dependent on the procurement of the building. With the old students' residential colleges developed by UTHM, there was continuous briefing as the FM Division and residential college principals (serving as end-users' representative) were present to ensure building maintenance and end-users' requirement were put into consideration. Codified knowledge tools like the online complaint form were used at the building design stage. However, with the newly developed students' residential colleges there was almost no transfer of FM knowledge. The new students' residential colleges were developed by private developers who were under no obligation to include FM knowledge to the design. This is because there is no regulation that enforces the transfer of FM knowledge. Since the EPU guidelines represent the benchmark for students' residential colleges in Malaysia, it should enforce the inclusion of FM knowledge to building design.

Overall it was ascertained that FM knowledge was not transferred to the Bestari students' residential colleges. This is because it was developed by a private developer who did not include either the FM Division or Development Division in the decision-making, briefing, design or construction of the students' residential colleges. For the Pagoh students' residential colleges, FM knowledge was also not transferred. Although it can be argued that minimal FM knowledge was transferred. This is because although the FM Division had no participation, the Development Division was responsible for the design of the Pagoh students' residential colleges. With the old students' residential colleges, the Development Division consistently got feedback from the FM Division on both the design and operation of the building. This means the Development Division was equipped with FM knowledge that could be included in the building design. However, the transfer of FM knowledge to the Pagoh students' residential colleges was heavily restricted by the availability of finance.

There has been a decline with the participation of the FM Division in the development of the new students' residential colleges. The effect of this decline was noticed in the Pagoh students' residential colleges after several maintenance problems occurred a few months after the buildings went into full operation. This made the private developer understand the importance of FM knowledge and commit to having facility managers present during their next building development project. It is to be noted that if the private developer was not responsible for the maintenance of the students' residential colleges, they would have been oblivious to the maintenance implicate of design decisions. If UTHM plans to hand over the development of students' residential colleges to private developers, it is recommended that the maintenance duty should also be handed over to the developers. This will lead to high-performance buildings and building designs that take FM knowledge into consideration.

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