

## Analysis and impact of facility management in performance of buildings



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### ABSTRACT

Facility management (FM) paves the way for sustainable improvements in building performance. It is a tool which allows the maintenance and operation of the buildings more effectively. Most of the designers used to design and develop all buildings without considering the requirements of FM. Unfortunately, this leads to huge problems especially in the construction of office buildings. These office buildings require some special considerations of FM during the implementation of different phases of the Facility which starts from the phases of planning and design until the phases of operation and maintenance. The developments in construction and urban planning have been undergone a tremendous change, improvements in concept during the last decade. They have identified the importance of FM during the life-cycle of the construction in order to protect them and to obtain satisfaction among the customers. The main aim of this paper is to identify the role and importance of FM in building construction. An extensive survey has been performed on various buildings in order to monitor and to point out the opinions about the uses of the FM in the design of buildings. Analysis of this survey illustrates the various advantages and disadvantages of the applications of FM in buildings. Finally, this paper depicts the significance and impact of FM in improving the performance of buildings.

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### 1. Introduction

The facility management (FM) comprises of building various corporate buildings, inventories for the real estate spaces, various constructions as projects which involves various phases such as the design phase, construction phase and the renovation phase, its maintenance and furnishing facilities etc. It manages all the various factors that enable the available facility to become an advantageous factor for its users. The FM requires various services running properly and more efficiently. The overall FM process depends on the skill of workers, experience of its users and, also computer based techniques in order to provide, a clear accuracy.

During recent years, the FM is not used commonly (Jylhä and Suvanto, 2015). In most of the cases, many buildings were only monitored and maintained, cleaned and serviced without considering the main phase of the FM. Moreover, the designers of buildings don't follow the various

operations, timely maintenance/repair, or the user's satisfaction in the buildings. These problems are there even for the office buildings which especially require additional concerns of the FM as a safest working environment for the employees who are working over there. Making this problem worse, alterations where done in commercial buildings instead of the office buildings (Brinda and Prasanna, 2014). Many Companies may utilize residential buildings and commercial apartments as their headquarters and offices by modifying it without considering the FM strategies. As a result, the employees who were working in these companies may usually be unsatisfied because of the design of the buildings its services. Moreover, its comfort level may also decrease due to alterations done on it.

In this era of improving the productivity of products and increasing the workmanship of the employees, workspace will act as significant criteria for the owners who own the business. Office buildings cannot be flexible for integrating the commercial and residential buildings as it requires technologically sound, more comfortable and safety, and energy efficient in order to propose a working environment (Wang and Xie, 2002). Hence, the designers and developers must take care of these crucial issues at the stage of planning and also these should be considered at the planning and design phases. Hence, the deployment of FM and is various

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phases is required for an effective construction of the buildings (Ekhaese et al., 2018). Hence, by understanding the overall process of FM, identifying the roles involved in it and the crucial factors which affects it paves the way for a practical implementation of the FM in the construction sector. This paper aims to find the application of FM in the performance of buildings, its life cycle along with its phases (Yassin and Razali, 2008).

### 1.1. What is facility management?

FM is the process that comprises of the combination of various areas such as planning, possession, designing, building and managing for maintaining the overall functionality of the constructed environment and to make sure it will be secure by integrating the customers who are using the building, the place where the building is constructed, the process which is used for the construction and the technology which is applied for the construction. The FM is linked with the construction and building management. In general,

the FM can be understood as the generalised building management which is inter linked with operations which takes place on buildings every day. It also includes the various long term planning, strategies and it also focuses on its users. This FM is an essential part of the first phase of investment. Various other parts and other operation costs of the FM process are explained in (Potkany et al., 2015).

### 2. Life cycle of FM

Cotts (1999) proposed the life cycle FM as four major phases. While, Potkany et al. (2015) proposed it in terms of five phases. According to them, these phases have to be applied during the construction of each and every building. The only difference between these two models is the approval of final building. The most common phases are: (1) the building planning phase, (2) the building possession phase, (3) the tasks and maintenance phase, and (4) the delivery phase. The life cycle of FM is shown in Fig. 1. During each phases, various tasks have been done as shown in Fig. 1.

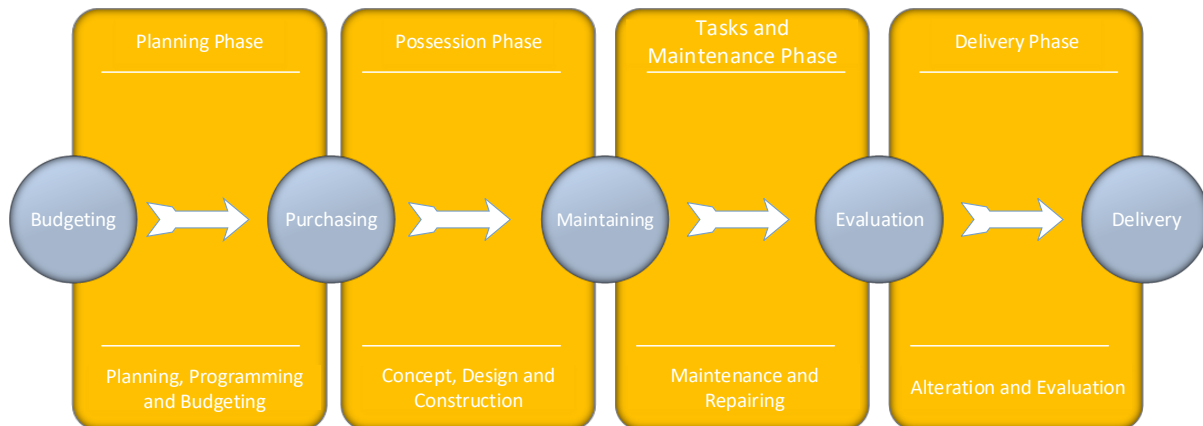


Fig. 1: Life cycle of the facility management

### 3. Phases of FM

Phases such as Planning, Possession, tasks and maintenance and the delivery are the various phases which should be followed by a FM team.

#### 3.1. The planning phase

In this phase, the team of FM executes the Strategic planning process in order to fix the important goals of the company for providing the rules that allows various plans in the future. One of its types is the short-term planning, which can be done in order to give the facilities which are required in the construction. The short term planning consists of planning of the space, which includes the various requirements of construction space, space for the employees etc. This type of planning is not simple because it consists of the overall growth of the construction sector, growth of the company, and the company's idea to allocate space needs for individual employee. Planning of the space depends movable goods such as furniture. Initially, a master plan of the

site which shows the present plan and the proposed plan, present condition of the building, costs of the operation and maintenance, costs for the repairs, modifications etc. where analysed and included in this stage (Cotts, 1999; Hou et al., 2014). At the stage of conceptual planning, overall objectives of the proposed building are clearly mentioned along with financial and functional requirements. The functional requirements consist of the necessary objectives to be satisfied, the necessary services to be done for the construction, the overall structural pattern of organization and staffing, proposed policies and procedures required for the proposed operational plan etc. where discussed and analysed. The FM also focuses on the methodology to evaluate it for assigning the cost for the overall plan.

#### 3.2. The possession phase

In this phase, various decisions regarding the acquisition such as the purchase or leasing of the building is done (Volk et al., 2014). The decisions on purchasing or leasing the space depend on the

budget of the company. It also depends on the company's policy on investing, controlling the money flow etc. During the process of acquisition and design of the building, the requirements that is necessary for the construction is fixed along with its estimates. The design process is obtained from the acquisition and design phase. This transforms the requirements of building towards a solution for the construction which is required for the customer. It also re confirms the scope, overall budget, time frame etc. At the stage of design, work which is to be performed is conformed and detailed drawings are drawn. At last, the documents phase analyses the detailed requirements of FM which consists of the documents required for the contractors in order to construct the building.

### 3.3. The tasks and maintenance phase

The tasks and maintenance phase intents for making the building to be occupied by the user or the customer. In this phase, the alteration of interior or exterior can be done until it customer or the end user is satisfied. It also reuses the already constructed buildings so that it can be easily re used more effectively. Nowadays, this process is used in majority of the buildings in Egypt so that the commercial buildings can be easily transformed in to buildings for offices. Following are the various functions of the Tasks and Maintenance Phase:

#### 3.3.1. Mechanical based functions

Mechanical operations related to the buildings such as monitoring the heating process, ventilation technology, Air condition technologies, and electric fittings, etc., where managed.

#### 3.3.2. Energy consumption monitoring

Energy is an important factor which is to be monitored periodically since it is costly to generate. Therefore, a device which monitors and maintained the constant usage of energy is sufficient in these buildings. Also, the buildings should be constructed in such a manner it should consume less energy.

#### 3.3.3. Unsafe garbage monitoring

This function is used to monitor the unsafe waste materials which are to be monitored periodically in the case of garbage monitoring. A centralised garbage management system can be a better solution for handling the dangerous wastes. The FM manager should maintain the garbage monitoring process with the help of a trained professional.

#### 3.3.4. Change monitoring

Changing is the process of transforming a specific space or a machine for making it to do another function from which it is initially designed for. This

change management should be done under the control of a FM manager so that whatever the changes done will be more effective.

#### 3.3.5. Recycling monitoring

The process of changing waste objects into new objects is called as recycling. This process can utilise the waste of objects which can be useful so that we can reduce the use of new objects. Main process in this recycling is the segregation. It can be done either by the re scale or the disposal of the materials. The FM manager should focus on arranging certain companied for making the effective use of recycling.

#### 3.3.6. Cable monitoring

The Communications system is a major user of space due to the presence of antennas, risers, file servers, modems, closets, and wire trays, and hence requires close and continuous coordination.

#### 3.3.7. Maintenance monitoring

This management process consists of the functionalities which are necessary to maintain the existing construction and its associated materials as explained by [Puķīte and Geipele \(2017\)](#). This process mainly consists of inspection / checking which could be done in periodically or occasionally. Works such as the adjustment of screws and bolts which are permanently fixed, applying oils in the necessary devices so that it can run smoothly, painting, cleaning and changing the damaged parts should be performed by the maintenance team of the FM. By monitoring all the above problems, the FM team can manage the unpredicted shutdown of equipment's present in the building.

#### 3.3.8. Security monitoring

The process of providing Security to the users in the constructed buildings is one of the main roles of the FM manager. This phase includes the functionalities to ensure the security for the users i.e., its occupants who are using the building.

### 4. The delivery phase

The final phase present in the Facility management is the delivery phase which is explained by [Christensen \(2014\)](#). When the construction comes to the finishing stage, FM managers inspect the building for a final verification so that it satisfies the user or the customers' need

#### 4.1. FM at the stage of design

The FM has an important role in the process of designing a building. During the design phase of buildings, many crucial decisions were made. Hence, this design phase has a direct effect on the users and

the facilities opted for them. The FM should make sure that all the requirements which have a direct impact on the design of a building can be obtainable at the actual time of design. The points to be considered at the stage of design are as follows:

- The FM should ensure that the design which is executed can be easily maintained.
- The FM should give guidelines to the designers, about the various documents which are related to project.
- By handover of the construction facility to the user, the physical state of the construction comes to a finishing stage.

#### 4.2. FM at the stage of construction

At the stage of construction, the representative of the FM should keep the given factors in mind. These factors should be kept in mind so that the representative of the FM can focus on assuming a functional building and to handover it to the user with reduced errors. Following are the factors which a FM representative should focus on:

- Functions of the overall construction
- Different ways to maintain various systems
- Cost of functionality and management of sources
- Maintaining the process and different steps
- Maintaining the construction materials such as the diagrams, working and its user manuals.

### 5. Analysis part

Data analysis part consists of the comparisons between the applications or implementations of FM in different countries. In this section, the analysis part is carried out in two different countries such as the Malaysia and in Egypt.

#### 5.1. Analysis of FM impact in Egypt

The impact of FM on buildings' and its performance is analysed in Egypt. For this process, an analysis is done on a group of office buildings. The overall analysis is based on three aspects evaluation such as the Functional, Technical, and Behavioural of the office buildings. The people who done the analysis asks the opinion the users who are using the buildings to maintain the level of their satisfaction in according to each of the above given aspects. The following factors were also used for this analysis.

#### 5.2. Selection of building for analysis of FM

In order to get the main objectives for implementation of the FM, various buildings were selected according to the following criteria:

- Buildings which are using the FM starting from the starting of its construction.

- Buildings which are moderately using the FM.
- Buildings which are not at all using the FM.

#### 5.3. Status of the company

The buildings which were selected consist of a mix of various national and international based. Size of the peoples working in these companies varies from 85 in the medium size and more than 5000 in the large sized one.

#### 5.4. Case study

Questionnaire is the tool which is used to get the objective of the case study. The Main aim of this study is to find the satisfaction of the users who are using the building in order to find the advantages and disadvantages of these types of buildings. These questions can be divided in to three types such as the open based. Closed based and the aptitude type.

#### 5.5. Analysis of FM impact in Malaysia

The work on analysis of FM in Malaysian buildings where carried out for finding its impact on the functions and its performance. This analysis was done in order to find the role of FM and its impact in the construction companies which are running in Malaysia. This can be achieved by practices based on knowledge and good management. The following are the various questions which are created as a part of the analysis.

1. What is the present scenario of FM in building management in Malaysia?
2. How does the FM applied in various other developed countries?
3. What are the factors that can make the FM stronger in the field of construction?
4. What are the various methods of creation, adaptation and adoption of FM in the construction sector?

These are the various questions that where created as a part of the FM and its analysis in the field of construction. Moreover, a three level research based mechanism is also applied in this analysis. It consists of the problem identification, Sampling and Analysis of the data.

### 6. Conclusion and future enhancements

Facility management in construction is the process of providing services by the FM team in order to make sure that the building constructed using the FM application satisfies the major FM functions such as the Mechanical Based, Energy Consumption, Unsafe Garbage, Change, Recycling, Cable and Security Monitoring etc. In general, the FM is an effective tool for maintainable and especially enhancements in office buildings. In this paper, all the types of buildings where considered for the

application of FM. The major role of this work is to analyse the FM and its functionalities for effective implementation in the buildings. A life cycle along with its various phases explaining all the important components in the application of Facility Management is depicted. A detailed analysis on the impact of Facility Management is done on two different countries. The analysis and the findings in this paper are useful to provide a way for further analysis of the application of Facility Management in other particular buildings. Future enhancement can be done on the Facility Management, its application and its impact in particular buildings such as office or commercial.

### Compliance with ethical standards

### Conflict of interest

The authors declare that they have no conflict of interest.

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