

INCORPORATING FACILITY MANAGERS INTO THE DESIGN AND CONSTRUCTION PHASES TO ENHANCE BUILDING PERFORMANCE

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ABSTRACT

Facilities Management (FM) is a relatively new discipline that envelops many essential areas of the built environment. Facility Manager concerns both optimising building performance and ensuring success of the project. Direct incorporation of the Facility Manager into design and construction phases have potential to reduce many problems during the operational phase of buildings. However, many professionals are still unclear on the roles of Facility Manager in the design and construction phases and hence, their potential contribution during these stages. Therefore, aim of this paper was to investigate the potential for incorporating of Facility Managers into design and construction phases of building to enhance building performance. A critical review of literature was carried out for the purposes of understanding roles and essential functions of Facility Manager into design and construction phases.

The case study approach was used to identify the current involvement of Facility Manager in design and construction phases. Moreover, barriers that restrict the involvement of the Facility Managers in the design and construction phases in the current context are also identified. The findings of this research are useful to promote the incorporation of a Facility Manager into design and construction phases in order to enhance quality and performance of buildings.

Keywords: Construction Phase; Design Phase; Facilities Management; Facility Manager.

1. INTRODUCTION

The FM is an essential function consisting with a series of linked activities demanding a requirement to coordinate all activities related to planning, design, construction and management of an organization's physical resource. Building life cycle from a Facility Manager's point of view does not begin after a building is handed over, but in initial phases where preventive actions can be taken to look after the building with more sensitivity and commitment during operation phase (Shah, 2007).

Furthermore, Aghbar (2011) affirmed that Facility Management is not just about the operation and maintenance phases of buildings. It involves many activities which must be done during the design and construction phases of buildings. The ability of a Facility Manager can help to deliver a high performance building environment, which is largely accounted by initial design, construction and commissioning activities (Hao, et al., 2010). Moreover, from the beginning of building lifecycle maintenance serves as an important undertaking to remove or minimize all undesirable influences as severe faults and defects. Therefore, maintainability is considered as a significant aspect that should be considered right from the early stage of design and construction (Chew, et al., 2004). Meanwhile, Latham (2001) says that, Facility Manager is the eyes and ears of the clients. Therefore, incorporation of Facility Manager should exist during design and construction (John and Croome, 2005).

Hodges (2005) has contended that FM integration into design and construction phases will extend the building lifetime as well as enhance the satisfaction of users, increase productivity and reduce the damaging effect on the environment. Similarly, Akadiri, et al. (2012) have highlighted that, interaction is essential between design

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and construction phases and Facility Manager. This paper initially provides a comprehensive literature review on the importance of the involvement of Facility Manager during design and construction phases. Then, findings of case studies are presented to discuss the roles and functions of a Facility Manager during design and construction phases. Finally, conclusions are drawn from the findings.

2. LITERATURE REVIEW

2.1. ROLES OF FACILITY MANAGER IN LIFE CYCLE PHASES OF BUILDING

The Facility Manager's role spans from acquisition, design and construction to operation of properties (Nerija *et al.*, 2008). During these phases, Facility Manager will have a role to support initial brief definition, and how various measures are implemented to reduce operating costs and also to deliver most sustainable performance of building (Amaratunga, 2000). According to Jensen (2008c), Facility Manager not only involves during operation phase of building, but also have to have a role in other phases of a building. This can be further specified in relation to different phases of a building project as shown in Table 2.

Table 2: Facility Manager in Life Cycle Phases of Buildings

| Building project phase | FM-specific functions |
|------------------------|--|
| Decision | Incorporating real estate strategies Information on space needs etc. Estimation of impacts on cost of FM |
| Briefing | Organization of user involvement Formulation of considerations for operation and sustainability Overall requirements for documentation |
| Design | Incorporation of considerations for operation, sustainability and user needs Formulation of operational concept Formulation of requirements for building automation system |
| Construction | Interior planning Prepare commissioning Contracting-out operational tasks |
| Occupation | Move Handling former building(s) Implementation of operational procedures |

(Source: Jensen, 2009)

2.2. ROLE OF FACILITY MANAGER IN DESIGN PHASE OF HIGH RISE BUILDINGS

The Facility Manager who is not conversant with the design concept employed by the developer often faces challenges in making any critical decisions (Alexander, 2009) such as space expansion, division and remodelling. Conversely, early involvement of a Facility Manager with design team will result in procuring a facility that could be maintained and managed easily (Kok, 2013). If FM integrated with design team will make a greater result on enhancing functionality, sustainability, economy, time, and maintainability of projects (Mohammed and Hassanain, 2010). Ashworth (1989) mentioned that, most of construction faults results from design errors and omissions or carelessness. While building technology systems and level of system integration may occur in design phase of a new building and many decisions will be left to the Architect and Engineers, Facility Managers actively involve in building design and the systems integration effort for it to succeed (Sinopoli, 2010). Furthermore, design of a building has a major impact and influence on operational performance of a building (Silva and Ranasinghe, 2010). However, it does not happen because designer does not understand the remit. Figure 1 shows the actual place of a Facility Manager in the design phase

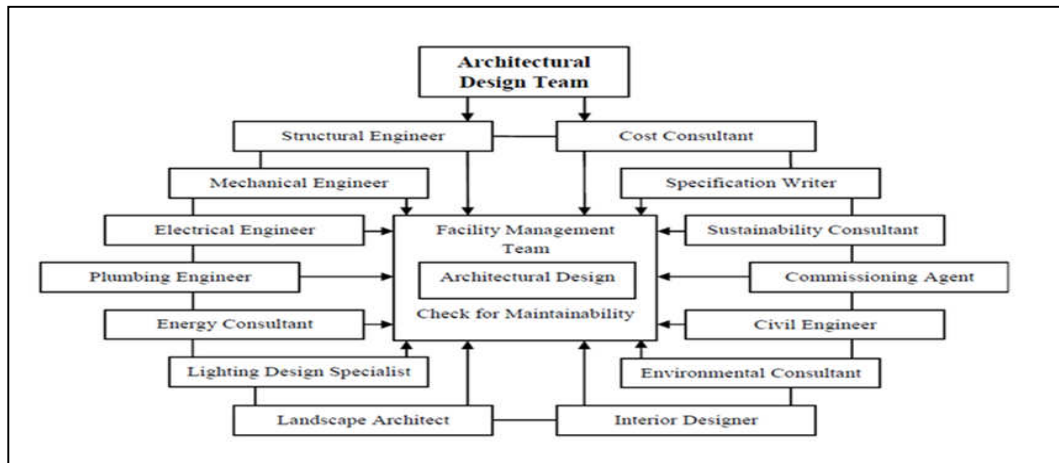


Figure 1: Role of Facility Manager in Design Team

(Sources: Mohammed and Hassanain, 2010)

2.3. BARRIERS FOR INVOLVEMENT OF FACILITY MANAGERS IN DESIGN PHASE

The barriers to the involvement of Facility Manager into design process mainly depends on cost. When procuring a facility, budget usually will look at most cost effective option and Facility Managers may be powerless against decision making expert when the consequences of their actions have significant implication for the facility to be procured (Enoma, 2005). Moreover, there is usually conflict between commercial needs of client and operational needs of the facility provided. In most facilities, there is belief in construction industry that client is often not occupier and so there is no need to involve the Facility Manger (Jensen, 2009). However, to improve value for money, project team must define clearly the needs of client, eliminate unnecessary expenditure and obtain optimum balance between cost, time and quality (Kok *et al.*, 2011).

2.4. ROLE OF FACILITY MANAGER IN CONSTRUCTION PHASE OF HIGH RISE BUILDINGS

The construction phase environment is generally viewed as being distinctive from other phases due to the number of unique characteristics. Such as, immobility, complexity, durability, low technology and high cost (Senaratne and Sexton, 2003). The implications of a Facility Manager in the construction phase of the building can bring motivation and appropriate criteria for successful project specific focus on to the project quality, time and cost. A significant task of construction-related FM is to ensure on-going data consistency from the construction to the operation phase (Moos, 2009). Besides, Roper and Payant (2014) have highlighted that, if the Facility Manager incorporate in construction phase, the project will be constructed on time and within budget. Meanwhile, Facility Manager must be of concerned factors as building system, maintainability, operating cost energy management, staffing and organizing, as built drawings/ models, warranties and sample books (Senaratne and Sexton, 2003). RICS (2006) stated that, Facility Manager should have a clear understanding of construction process. Moreover, competent of property and corporate management, construction technology and environmental services will be required for a Facility Manager (RICS, 2006).

2.5. BARRIERS FOR INVOLVEMENT OF FACILITY MANAGERS IN CONSTRUCTION PHASE

The construction of a facility, either a new building or major refurbishment, will deliver agreed designs. Role of a Facility Manager during this phase is limited (Sinopoli, 2010). Most of the FM professionals' point of view is that FM has traditionally been regarded as poor relations with Architecture, Engineering and Construction (AEC) professions. Total FM only practiced in UK and Europe, is that it cannot be adequately integrated with a client organization without a lengthy contract (for feasibility). This may be a barrier to longevity of Total FM (Atkin and Brook, 2005).

3. RESEARCH METHOD

The research commenced with literature synthesis to locate the roles and essential functions of a Facility Manager during design and construction phases of high rise buildings. By using the literature findings, theoretical framework was developed. The qualitative approach was adopted as best suitable method for research among construction industry professionals working in Sri Lankan construction firms to ascertain their perception on incorporation of Facility Managers into design and construction phases of buildings in order to enhance building performance. Semi-structured interviews were used as a technique to collect data under qualitative approach. Four (04) professionals who are directly involved in construction projects were interviewed in each selected cases by means of semi structured interviews. Altogether, 12 interviews were conducted and each normally lasted for 45 minutes to one hour. Content analysis method was used to analyze data collected through semi structured interview, in order to arrive at suitable conclusions and recommendations. In order to derive patterns to present the information, this research used the NVivo10 software programme. Finally, arrived at conclusions and recommendations. The Table 1 illustrates the details of interviewees.

Table 1: Details of the Interviewees

| Case | Respondent | Designation | Years of Experiences |
|---------|------------|---|----------------------|
| Case 01 | A-01 | Senior Manager: Facilities Management | 20 Years |
| | A-02 | Project Manager | 28 Years |
| | A-03 | Health and Safety Engineer | 15 Years |
| | A-04 | Electrical and Mechanical Engineer | 12 Years |
| Case 02 | B-01 | Facility Manager | 20 Years |
| | B-02 | Project Manager | 40 Years |
| | B-03 | Safety Engineer | 23 Years |
| | B-04 | Architect | 12 Years |
| Case 03 | C-01 | Project Manager | 18 Years |
| | C-02 | Chief Engineer | 15 Years |
| | C-03 | Health and Safety Engineer | 18 Years |
| | C-04 | Licentiate Architect and Chartered Town Planner | 25 Years |

4. RESEARCH FINDINGS AND ANALYSIS

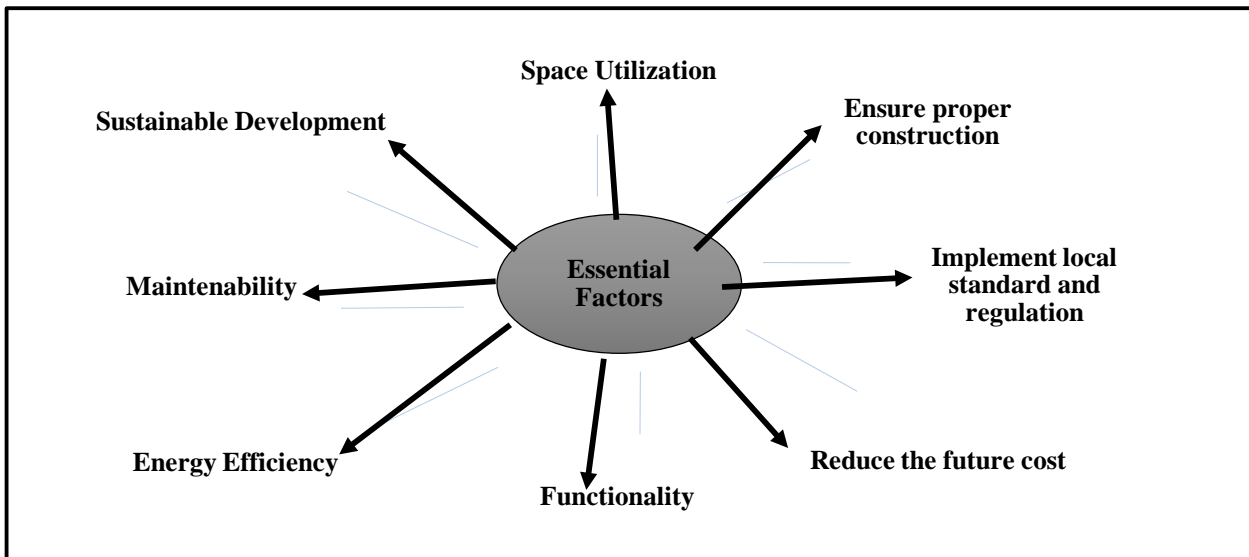
4.1. CURRENT PRACTICE OF FACILITY MANAGER IN DESIGN PHASE

Current involvement regarding Facility Manager into design phase is not well established in the Sri Lankan construction industry. Instead, there is a tendency in the field to appoint a technical person involved in design phase of building as a Facility Manager of that particular building later on. In the current practice, the Facility Manager's involvement in design phase is very rare. Anyhow, Facility Manager's involvement during design phase is there even in the Sri Lankan construction industry. Even though, most of the respondents refused to agree that Facility Manager's involvement is needed in the design phase, when considering Sri Lankan construction industry, it has not been well developed yet. Conversely, some projects have engaged Facility Managers and realised the value of them. However, most of the time, a Facility Manager was not engaged during design phase of building. According to the empirical findings, every expert agreed that a Facility Manager is essential in the design phase, even though it cannot be seen in practice. This is a situation that should be changed because having a Facility Manager in design phase is beneficial for building operational performance (refer section 2).

4.2. ESSENTIALITY OF FACILITY MANAGER IN DESIGN PHASE

In many respondents' view, Facility Managers are professionals who are responsible for managing buildings once construction is completed. In Facility Managers' point of view, professionals responsible for operation and maintenance phases should be there from the design phase in order to fulfil the objectives in an effective manner and to add value to the whole project. Furthermore, in order to reduce future problems which will arise mainly during the operation phase, well experienced Facility Manager in the field of building operation and maintenance should be engaged during the design phase. Figure 2 elaborates the main factors supporting this essentiality to incorporate a Facility Manager in the design phase.

Figure 2: Essentiality of Facility Manager in Design Phase



4.3. KEY FUNCTIONS AND TASKS OF FACILITY MANAGER IN DESIGN PHASE

When considering functions, it can be identified as areas which are performed by a Facility Manager in the design phase. The functions were highlighted through revealed empirical findings which were preferred by respondents to be performed during the design phase by Facility Managers (Refer Table 3).

Table 3: Key Functions and Tasks of Facility Manager in Design Phase

| Functions | Tasks |
|--|---|
| <ul style="list-style-type: none"> • Maintenance • Operation • Documentation • Life Cycle Cost • Health and Safety • Material Selection • Guidance • Procurement of Material • Cost Management • Energy Management | <ul style="list-style-type: none"> • Review of drawings • Review of tenders • Inspection on design team • Review of specification • Preparing life cycle costing • Review of alternatives • Train staffs and workers |

4.4. CURRENT PRACTICE OF FACILITY MANAGER IN CONSTRUCTION PHASE OF THE BUILDING

It was found that even in construction phase, a Facility Manager's involvement is very rare, even in companies involved in both construction as well as management of properties. Many such companies have developed construction experts to perform operation or building management functions. So such a company will have their in-house resources which can be deployed or can be shared among construction and operation. However, other companies, who are just involved in property management, may not have the opportunity to have Facility Managers involved in the construction phases. Moreover, even on occasions where the project teams include

Facility Managers, their actual involvement in construction phase of projects is less. Likewise, there was general agreement among professionals that Facility Manager's involvement is rare in the Sri Lankan construction industry.

4.5. ESSENTIALITY OF FACILITY MANAGER IN CONSTRUCTION PHASE OF THE BUILDING

The construction phase is an essential phase in the building life cycle where new projects which are already planned and designed are actually developed. It is done with the involvement of many professionals and experts sometimes including or excluding a Facility Manager. From empirical findings it was clear that most of the professionals involved in construction process will not be doing work after completing the construction. Facility Manager is the person who will be working when the construction is completed and will be maintaining and operating the building. Thus, Facility Managers will face many difficulties if the project did not identify and eliminate errors during construction which is not visible prior to building occupation. The findings revealed several areas where Facility Manager's involvement becomes essential during the construction phase (refer Figure 3).

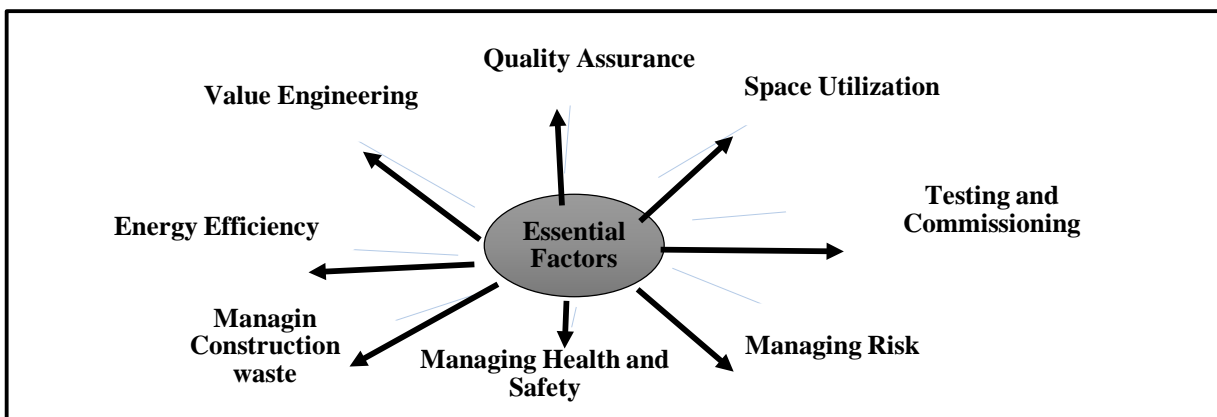


Figure 3: Essentiality of Facility Manager in Construction Phase

4.6. KEY FUNCTIONS AND TASKS OF FACILITY MANAGER IN CONSTRUCTION PHASE

The study revealed the key functions and tasks which are performed by Facility Managers during the construction phase. Table 4 indicates the key functions that should be performed by a Facility Manager during the construction phase.

Table 4: Key Functions for Facility Manager in Construction Phase

| Functions | Tasks |
|---|---|
| <ul style="list-style-type: none"> Managing project Risk Management Value Engineering Waste Management Quality Assurance Documentation Testing and Commissioning Health and Safety Management Human Resource Management Defect Rectification Performance Management Emergency Evacuation and Fire arrangement | <ul style="list-style-type: none"> Site inspection Testing of services Report defect and fault Handling documents Measuring the quality Preparation for testing and commissioning Go through the changes Authority changes Service area agreements Preparing policies Preparing quality assurance report Alternative review of value engineering Review of drawings Monitoring Waste Management |

4.7. BARRIERS TO ENHANCE THE INVOLVEMENT OF FACILITY MANAGER INTO DESIGN AND CONSTRUCTION PHASES

The barriers which were extracted from the empirical findings are illustrated in Figure 4. Armstrong (2005) stated that without a Facility Manager in design and construction phases, lots of significant issues can be occurred. By observing non-Facility Managers and Facility Managers' points of views, it was clear that the biggest challenge to the involvement of Facility Managers is unawareness regarding their essentiality in design and construction phases. This makes many combined problems as developer's choice of Facility Manager will be limited since he/she thinks it is nothing but an unnecessary cost. Moreover, it leads to limit the Facility Managers' involvement to after a building project is completed rather than from design and construction phases itself. This in turn can make a building hard to maintain leading to high energy costs.

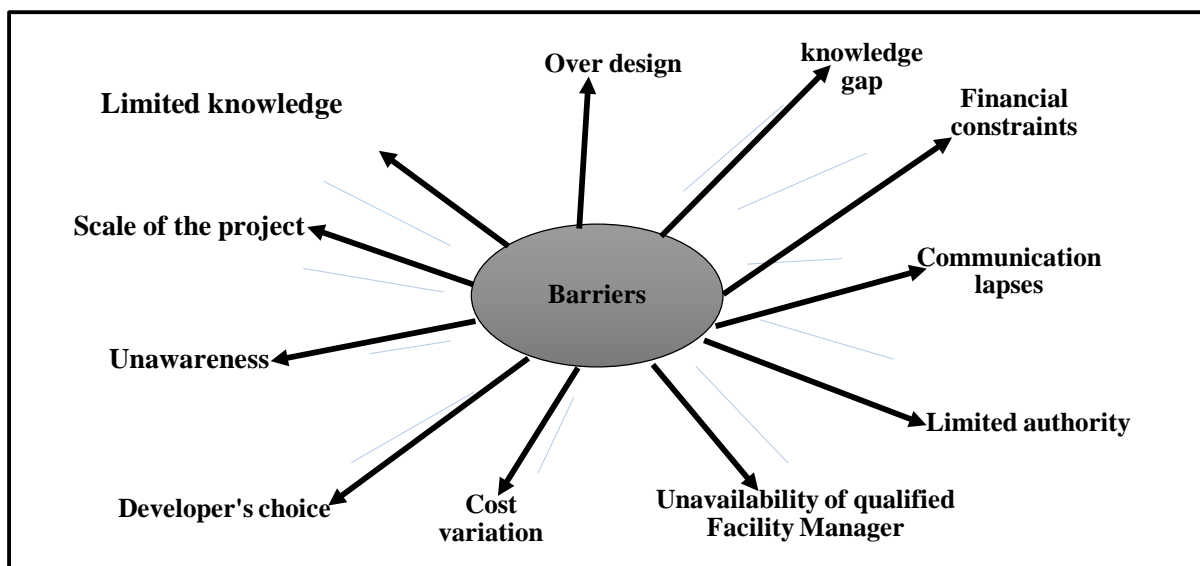


Figure 4: Main Barriers to Incorporate a Facility Manager into Design and Construction Phases

Another identified barrier as highlighted by both Facility Managers and non-Facility Managers is the knowledge gaps of Facility Managers as they are not experts in some essential fields. But, at times it requires comprehensive knowledge in some fields related to the project. This challenge must be won by a Facility Manager by some means.

The remedies which can be used to overcome those barriers are rather similar in both views. Both parties suggested various marketing tools to inform rest of the world about Facility Managers role in design and construction phases. Many problems arise due to unawareness in the industry about Facility Manager's role in design and construction phases of the buildings. However, this challenge cannot be solved in the short run. Conducting promotional seminars and symposium will help to remove the unawareness about Facility Manager's incorporation into design and construction phases to some extent. Once all the unawareness is eliminated, there will be a demand for Facility Managers in design and construction phases. With regard to knowledge gaps it is Facility Managers' responsibility to fill up the lapses. Involving a Facility Manager and giving a rightful position will eliminate other challenges which they have pointed out. The reasons for barriers to incorporate a Facility Manager into design and construction phases are mainly cost and unawareness. But in some projects non-Facility Managers agreed that the Facility Manager can help with reducing future costs.

It was also noted that Facility Managers themselves should take the initiative in finding jobs in construction industry itself not limiting themselves to jobs in already constructed buildings. It was highlighted that in most cases, Facility Managers are reluctant to work in design and construction phases. This is happening mainly due to a lack of self-confidence. According to the case study findings, this was identified as one of the most common barriers to incorporate a Facility Manager into design and construction phases.

Overall, it was observed that not all these identified challenges are common to all Facility Managers. Overcoming these challenges depend on each Facility Manager who is working in design and construction phases. Furthermore, Facility Managers have to take the necessary action to increase their knowledge and

experience in construction industries. This is a better option to overcome Facility Manager's barriers in design and construction phases.

5. DISCUSSION

While having many phases in a building, it is important to get involvement of Facility Manager at right phase if they are involved in a project. As role of Facility Managers and scope are not fully understood by the client or developer, they tend to get Facility Manager after construction or after occupation of building. This is the current practice which has been worked so far. However, necessity to incorporate a Facility Manager into design and construction phases becomes vital to optimize performance of building. From empirical findings it can be shown that for enhancement of building performance, a Facility Manager should be engaged in design and construction phases of the building.

The capabilities and scope of work of Facility Managers mean that their participation can bring many rewards to a project. It does not only provide maintainability or smooth operation, but embraces space planning, health and safety, risk management, meeting standards, energy efficiency, and high productive operation too. However, many clients do not insist that a Facility Manager's role can be very critical on design and construction phase's activities and processes. Depending on the scale, cost and the size of a particular project, Facility Managers must be chosen and involved. However, by looking at all practitioner responses it is clear that there are still gaps to be filled in design and construction process and perhaps a Facility Manager can eliminate them. The interviewees agreed a Facility Manager can perform better if they have chance of going through the project before the building has been made. Weighing up both parties' arguments it can be said that, it will be better if a Facility Manager can involve in the design and construction phases at least as an advisor.

5.1. FRAMEWORK DEVELOPMENT

According to the research findings, a framework can be developed overcoming the identified barriers in order incorporate a Facility Manager into the design and construction phases to enhance the performance of the buildings. The framework is developed addresses the effective incorporation of a Facility Manager into design and construction phases in the Sri Lankan construction industry while mitigating the barriers associated in current practice. Figure 5 shows the essential function which should be considered by Facility Manager during the design and construction phases. Additionally, it interprets the roles which can be performed by Facility Manager. Ultimately, it demonstrates the benefits, which can be achieved by incorporating a Facility Manager into the design and construction phases. Eventually, better performance can be achieved by incorporating a Facility Manager into the design and construction phases.

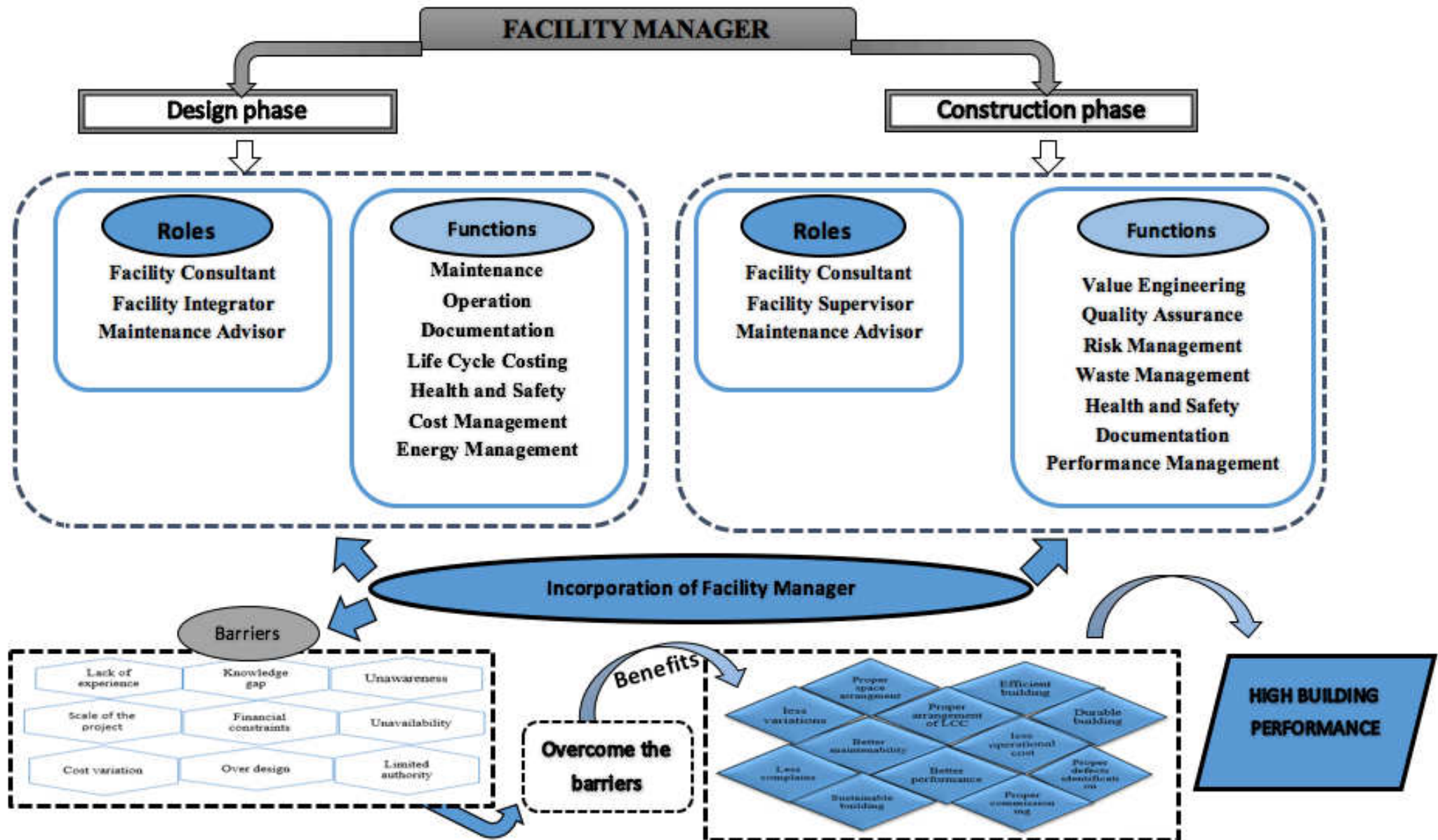


Figure 5: Conceptual Framework to Incorporate a Facility Manager into the Design and Construction Phases

6. CONCLUSIONS

The study has captured the essentiality of Facility Manager's incorporation into the design and construction phases of the buildings in order to enhance the performance of the buildings in the Sri Lankan construction industry. In the current situation, the Facilities Management is not well established in Sri Lanka yet. Consequently, most of the buildings fail to meet the operational objectives because of the improper approaches used during the design and construction phases. The major reason lies in the aforesaid gap between the Facility Manager and initial phases of the buildings. Throughout the literature synthesis, it was clear that the incorporation of Facility Manager is essential concept in the Sri Lankan construction industry. The incorporation of Facility Manager in design and construction phases therefore have been derived from the current practice of Sri Lanka and the involvement were studied from the case studies.

The present situation, in the incorporation of Facility Manager into design and construction phases still not well implemented. Even though, some projects have included Facility Manager into aforementioned phases, there is no framework given to indicate the proper place for a Facility Manager into design and construction phases. In order to eliminate the gap, the research has developed a framework to incorporate a Facility Manager into the design and construction phases of the building in order to enhance the building performance with the involvement of a Facility Manager. The Figure 5 presents the framework to engage facility managers in the construction industry.

7. REFERENCES

- Aghbar, M. A. 2011. Essential information for fm and start professionals, building owners, developer and contractors. *Facilities Management*, 6(11), 300-328.
- Akadiri, P., Chinyio, E., and Olomolaiye, P. 2012. Design of a sustainable building: A conceptual framework for implementing sustainability in the building sector. *Buildings*, 33(8), 126-152. doi:10.3390/buildings2020126
- Alexander, K. 2009. *Facilities management futures*. Manchester, UK: A Euro FM Publication.
- Amaratunga, D. 2000. Assessment of facilities management performance. *Property Management*, 18(4), 258-266. doi: abs/10.1108/02637470010348816
- Atkin, B., and Brooks, A. 2005. *Total facilities management* (2nd ed.). Oxford: Blackwell Publishing Ltd.
- Ashworth, A. 1989. Life cycle costing: A practice tool. *Construction Engineering*, 3(1), 8-11.
- Chew, M., Tan, S., and Kang, K. 2004. Building maintainability-Review of state of the Art. *Architectural Engineering*, 10(3), 80-87. doi:10.1061/~ASCE!1076-0431~2004!10:3~80!
- Enoma, A., and Khosrowshahi, F. (Eds.). 2005. *The role of facilities management at the design stage. 21st Annual ARCOM Conference, University of London*, Association of Research in Construction Management.
- Hao, Q., Mak, H., Neelamkevil, J., Xie, H., Dickinson, J., Thomas., Pardasani, A., and Xue, H. 2010. System integration and collaboration in architecture, engineering, construction and facilities management. *Advance Engineering Informatics*, 24(2), 196-207. Retrived from <http://www.sciencedirect.com/science/article/pii/S1474034609000664>
- Jensen, P. 2008. Integration of considerations for facilities management in design. In: *Proceedings of the CIB W096 Architectural Management and TG49 Architectural Engineering Conference. 319*, pp. 191-199. Denmark: Design Management in the Architectural Engineering and Construction Sector.
- Jensen, P. 2009. Design integration of facilities management. *Architectural Engineering and Design Management*, 5(3), 124-135. Derived from <http://www.tandfonline.com/doi/abs/10.3763/aedm.2009.0101#.VZ4f0vIViko>
- John, G. A., and Croome, D. J. 2005. Contextual prerequisites for the application of ILS principles to the building services industry. *Engineering, Construction and Architectural Management*, 12(4), 356-367. doi: abs/10.1108/09699980510608794
- Hodges, C. P. 2005. A facility manager's approach to sustainability. *Facilities Management*, 3(4), 312-324. doi: 10.1108/14725960510630498
- Khalil, N., Husin, H. N., Mahat, N., and Nasir, N. 2011. *Sustainable environment: issues and solutions from the perspective of facility manager*. Perak: Elsevier Ltd.
- Kok, H. B., Mobach, M. P., and Omta, O. S. W. F. 2011. The added value of facility management in the educational environment. *Facilities Management*, 9(2), 249-266. doi: 10.1108/14725961111170662

- Kok, C. C. 2013. Facility management value dimension demand perspective. *Facilities Management*, 11(4), 339-353. doi: org/10.1108/JFM-10-2012-0049
- Latham, M. 2001. Classic Facilities Management. *Building*, 12 January 2001.
- Mohammed, A. M., and Hassanain, M. A. 2010. Towards improvement in facilities operation and maintenance through feedback to the design team. *The Built and Human Environment*, 3(2), 72-82. Retrieved from <http://www.tbher.org/index.php/tbher/article/viewFile/28/29>
- Nerija, B., Audrius, B., Arturas, K., and Edmundas, K. Z. 2008. Evaluating the life cycle of a building: A multivariant and multiple criteria approach. *The International Journal of Management Science*, 36(6), 429-441.
- RICS draft guidance note. 2006. *Strategy, planning and procurement*. Retrieved from Building maintenance: https://consultations.rics.org/consult.ti/building_maintenance/viewCompoundDoc?docid=2724756andpartid=2725076andsessionid=andvoteid=
- Roper, K. O., and Payant, R. P. 2014. *The facility management hand book* (4th ed.). United States of America: American Management Association.
- Senaratne, S., and Sexton, S. 2003. *Managing chances in construction projects: A knowledge based approach*. UK: Wiley Blachwell Publishing Ltd.
- Shah, S. 2007. *Sustainable practice for facilities manager*. 2nd ed. UK: Blackwell Publishing Ltd.
- Silva , N. D., and Ranasinghe, M. 2010. Maintainability risks of condominiums in Sri Lanka. *Financial Management of Property and Construction*, 15(1), 41-60. doi: abs/10.1108/13664381011027971
- Sinopoli, J. 2010. *Smart building system for architects, owners and builders*. Oxford: UK.