Improving the built environment performance through facility management practices: The opportunities and challenges

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Abstract. Facilities management (FM) is becoming increasingly important in the built environment. FM is currently well-known in several countries. The goal of this research is to determine the extent to which FM can positively contribute to FM opportunities and the challenges that must be addressed. FM combines all physical environment components, including people, process, location, and technology, to assure the system's performance. FM is one of the world's fastest-growing companies because it helps to tackle the problem of inefficiency in building operations and maintenance. The purpose of this research is to conduct a literature review in order to learn more about FM practices in various parts of the world, as well as to investigate opportunities and problems. By conducting a literature analysis of previous research published between 2000 and 2017, this study aims to give a better knowledge of FM practices in both developed and developing nations. The FM industry is relatively new, therefore there are numerous prospects for future growth.

1. Introduction
Climate change and the energy crisis have emerged as two of the world's most urgent concerns in recent years. The building industry (including residential and commercial) utilizes more than one-third of total primary energy consumption, the largest percentage of any sector, according to the International Energy Agency (IEA), 2015 [1]. Furthermore, global population growth, urban migration, rising wealth, and lifestyle changes, according to IPPC (2014) [2], have the potential to double or triple the building sector's energy consumption and emissions by the mid-century [3]. Green construction is one method proposed to address the issue. Unfortunately, a growing body of research suggests that many green buildings are inefficient and emit much more CO2 during operation [4]. Furthermore, numerous green buildings have been designed and constructed utilizing energy-efficient technologies and have already received accolades such as LEED Platinum. Many green buildings that have been created and built utilizing energy-efficient technologies and have previously won distinction awards such as LEED Platinum have the greatest energy usage, according to the OECD/IEA [5].
These buildings' energy usage is nearly usually significantly greater than expected [3]. Disparities in technical workmanship and installations between the building design and the as-built building, equipment and material selection during the construction stage, and unnoticed occupant energy behaviour can all contribute to the gap between predicted and actual energy consumption in green buildings. The more sophisticated a building's technology becomes, the more vital it is for residents to understand how it works and how to maintain it so that it continues to perform properly. These findings demonstrate the ability of the construction sector to reduce energy consumption, address environmental concerns about greenhouse gas emissions, and, in the long run, avert global climate change. Differences in technical craftsmanship and installations between the building design and the as-built building, equipment and material choices during the construction stage, and occupant energy behaviour can all contribute to the gap between projected and actual energy consumption in green buildings [6]. The more sophisticated a building's technology becomes, the more vital it is for inhabitants to understand how it works and how to maintain it so that it can function properly. Because tenants use and maintain the facility on a regular basis, their awareness of and involvement with the building's systems and technologies is crucial to the plan's success [7]-[8]-[9]. To guarantee that a facility operates as expected, a good and effective maintenance system, as well as increased occupant awareness, are necessary throughout the operational phase [10]. As previously said, efficient building operation decreases energy consumption, maintenance expenses, and pollution levels in the environment. Unfortunately, building management and maintenance efficiency remains an issue in most countries across the world, which may be one of the primary reasons why green buildings do not perform as well as they might perform [11].

2. Facilities management strategy: Improving the energy and economic efficiency of a building

FM has the potential to make a significant contribution to the reduction of inefficiencies in building operations and maintenance. FM is a form of asset management in which all physical environment components, such as people, processes, location, and technology, are integrated to ensure proper system operation [12]. FM requires multidisciplinary abilities such as architecture, civil engineering, behaviour, accountancy, and management to carry out its tasks since a building or constructed environment is a complex system [13]. Traditionally, building operations and upkeep were thought to be entirely the responsibility of FM. Because FM encompasses such a wide range of activities, it is seen as a critical component in a building's ability to function optimally as intended [14]. To appropriately manage resources, lower the cost of repairs and replacements, and reduce the overall risk of equipment failure, an effective maintenance strategy must be created [15]. A professional facility management system ensures that all building technology and facilities are operational and code compliant. The FM will also manage the building's operations and maintenance team to ensure that the structure operates and maintains itself effectively and efficiently in terms of cost, operations, and maintenance, all while meeting the expectations and objectives of the clients [16].

3. Research methodology

By performing a literature review of prior research published between 2000 and 2017, this study seeks to provide a better understanding of facility management (FM) approaches in both developed and developing countries. During the initial search, we identified 52 papers on FM published in journals, conferences, and theses between 2000 and 2017. Following that, we chose several publications that were primarily focused on management and education, leaving 22 articles to be reviewed that were more focused on architectural and civil engineering approaches. The publications chosen primarily use observation, interviews, and surveys to give FM practitioners with a short overview of their country's FM activities.
4. Discussion

Integrating integrated facilities management (FM) with proactive maintenance has been demonstrated to be more successful and efficient in terms of both time and money than traditional reactive maintenance. Furthermore, different eastern and western cultures may have distinct preferences and difficulties, therefore there may be other approaches that are more suited and successful in certain cultures. More research in this area is recommended to solve the issue. Furthermore, because the preference gap in service area priority between FM practitioners and customers is a problem for management practises, further research into customer satisfaction and post-occupancy evaluation is needed.

4.1. Facilities management in the United States, Europe, and Australia

Facilities management (FM) services were initially provided in the 1950s and 1960s in the United States, and they were completely established in the 1970s, whereas facilities management techniques arose in Europe in the 1980s [18]. The United Kingdom was the first country in Europe to employ facilities management ideas. At the time, the United Kingdom was considered as Europe's most significant facilities management market, followed by Germany and France [17]. At the moment, the United Kingdom, the United States, the Nordic European countries, and the Netherlands are thought to be at the forefront of global FM developments [18].

When compared to other nations, Italy has one of the worst FM practices in Europe. The unusual structure of the Italian economy, which is heavily skewed toward small and medium-sized enterprises, might be to blame for this delay. This peculiar circumstance, in particular, is incompatible with integrated FM methods or standard internal management paradigms. Nonetheless, the Italian market has grown substantially in recent decades as a result of the expansion of non-core job outsourcing and the process of supply market restructuring [17]. However, the availability of a certification system developed by The Facility Management Association of Australia (FMA Australia) in 2000 indicates the development of FM practices in this country. This sort of accreditation offers a business with three levels of FM competency.

Property developers and FM firms in the United States and Europe are already making extensive use of FM methods. In both the United States and Europe, operation and maintenance are critical components of FM techniques. Nevertheless, the scope has grown to cover both short and long-term real estate development and building utilisation. The fast adoption of FM methods in the United States and Europe indicates a growing awareness of the role of the physical environment in organisational growth [19]. The ISO 9000 Quality Standards and EN 15221-3: 2008 Facility Management Part 3 [20], which provide guidelines on how to attain quality in FM, were created in Europe as a result of field research. This standard is designed to establish the basis for a shared understanding of FM services, with an emphasis on increasing fundamental business productivity and improving people's quality of life [21]. Certain FM services in Europe and the US have already transitioned away from the old technique (reactive maintenance) and toward integrated FM services that employ proactive maintenance [22]. The proactive maintenance provided by Integrative FM services will combine all data from the facility's design, construction, and operating phases to make controlling and maintaining it much easier. As part of proactive maintenance, all systems and technologies will be monitored on a regular basis, allowing component ageing, function loss, and damage to be forecasted and rectified sooner, saving time and money while ensuring that the building functions optimally [23]. Facilities managers in the United States and Europe confront a variety of challenges when it comes to implementing proactive maintenance.

The first difficulty arises from the challenging shift from reactive to proactive maintenance, which necessitates both technology development and expertise [10][19]. The second issue is that building data from the design and construction phases is disorganised, making proactive maintenance difficult to implement [10][24]. FM and design professionals will be able to exchange information using the most recent Building Information Modeling (BIM) software, which is utilised during the design and construction phases. According to studies conducted in the United States [24] and Nordic
Europe [19], there is a knowledge and technological gap between designers and facility managers. As a result, improved techniques and technologies are required to transmit such data while also taking FM needs into mind. Another problem in Europe's expanding FM service business is how to deal with service quality [20]. Despite the fact that FM techniques have previously been recognised as ISO standards in Europe and the United States, there are still gaps in service priorities between FM practitioners and customers. Customer satisfaction research and post-occupancy evaluation are essential because customer happiness and post-occupancy evaluation are two of the most significant features of almost all service goods [25].

4.2. Facilities management practices in Asia & Africa

When compared to Europe and the United States, building facilities management (FM) in Asia and Africa is still regarded a newcomer to the industry [26]. FM methods have advanced rapidly in Japan, Hong Kong, and Singapore, while they are still in their infancy in Malaysia and Thailand. Hong Kong has emerged as Asia's top facilities management leader, acting as the region's "front door" and a meeting point of western and Asian cultures. The International Facilities Management Association has been in charge of Hong Kong's FM since 1994 [26]. This organisation supports and organises any study in the field of FM in Hong Kong by hosting an annual conference to share information among researchers and FM practitioners. Despite popular belief, Singapore's FM business is already utilising integrated FM services with proactive maintenance. When preventive maintenance is performed, buildings can function better and save more energy [3].

4.3. Possibilities and challenges in Malaysia

Because FM is still a relatively new problem in Malaysia, there are more opportunities because it is still being formed. As a result, some aspects of FM in the United States are more adaptable to diverse methodologies and approaches than in other nations.

The following possibilities have an influence on Malaysia's FM development potential. [27]-[28], in particular (a) the government has pushed consultants and contractors to specialise in more specialised areas like as maintenance and service management, façades, and conservation work, resulting in a much more competitive construction business, (b) in Malaysia, maintenance and service costs are increasing, and FM is being perceived as a substitute for strategic and effective management capable of controlling and managing overall building expenses. FM also provides strategic planning, which includes the collection of all essential data particular to the FM region. (c) the well-known instruments of performance-based or incentive contracting, as well as better operational management techniques, are commonly recognised as the beginning point for services supplied by numerous important players in the outsourcing business today. Leading organisations are increasingly responding to essential business demands, both internally and via industry suppliers. They are achieving this by addressing a broader strategic problem by developing service agreements that liberate core business capital connected to facilities while decreasing pricing and enhancing quality, all while utilising construction industry principles, (d) a number of metropolitan regions, like Kuala Lumpur and Johor Bahru, are considered overcrowded and congested, restricting future growth expansion.

As a result, structures in city centres are required to be preserved since destruction is too expensive. Furthermore, because the cost of services and maintenance is expensive, FM is seen as a way to reduce excessive maintenance expenditures that may have occurred in the past as a result of inadequate maintenance, (e) another issue that has emerged is the inability of property or building management to collect the rental rate for rented space, services, and bills from tenants, resulting in a shortage of funds to pay for necessary expenditures. FM is used to guarantee that rent is collected on time, as failure to deliver the monthly payment may result in the disconnection of services provided to renters, such as mechanical and electrical. The following are the genuine challenges to properly integrating FM in buildings; (a) a scarcity of criteria for assessing the degree of quality and performance of conventional and integrated FM services provided by building/property management.
The present situation in Malaysia exemplifies how processes change from one firm to the next, based on the services provided or the structures employed. Another reason for immediate notice and action is (b) the slow speed at which applicable FM standards or regulations are being created, (c) FM installation is viewed as too late for certain properties, as there are now many older structures with significant levels of degradation. If the building services are in poor condition due to poor maintenance in the past, FM may help standardise future maintenance allocation requirements, but this may not result in maintenance cost savings; (d) Malaysia is behind in FM software development, and adopting integrated FM may be prohibitively expensive at first unless computerised programmes are available locally. Most building managers report that their earnings aren't as high as they expected, and that financial help is needed to implement this integrated system. The installation of an integrated FM demands the availability of storage space for the automation mechanism required to run the integrated services system. This may not be a concern for new construction, but as previously said, there are many elderly structures and densely populated buildings.

5. Conclusion
Facilities management (FM) is done differently in developed countries like the United States and Europe than it is in underdeveloped ones like Asia and Africa. The contrasts are in service quality, the number of FM standards, and the number of research papers published, while the similarities are in the absence of financial support in Asian nations, as well as in certain European countries and Australia, and the difficulties in implementing integrated FM. Despite the fact that FM is still a new discipline, the industry's incredible development over the last 25 years has proven that it is gaining traction. Many of the problems that FM practitioners face throughout the world, on the other hand, present a lot of possibilities for researchers to help with problem solving and knowledge gaps in this field.

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