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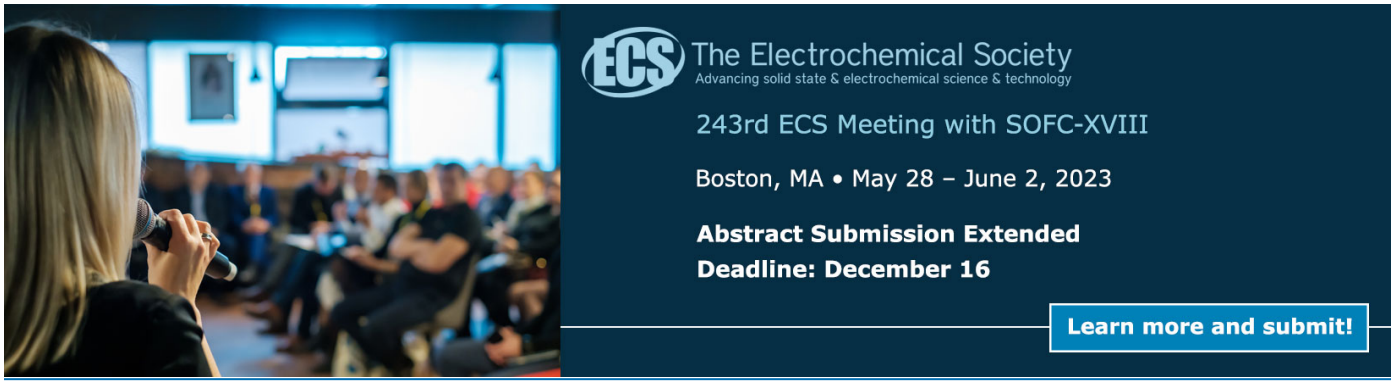


Conceptualizing the identification of critical success factors for heritage building maintenance management (HBMM)

M I Adegoriola[1], J H Lai[2], E H Yung[3] and E H Chan[4]

[1,3 and 4] Department of Building and Real Estate, The Hong Kong Polytechnic University, Hung Hom, 999077, Hong Kong
[2] Department of Building Environment and Energy Engineering, The Hong Kong Polytechnic University, Hung Hom, 999077, Hong Kong

mayowa.adegoriola@connect.polyu.hk

Abstract. Heritage building maintenance management (HBMM), which has been recognized as a tool to enhance sustainability, enables the preservation of past legacies for future generations. HBMM is also known for reducing the intensity of climate change and preserving embodied energy through adaptive reuse and conservation. To this end, facility management (FM) – a multidisciplinary approach toward achieving the functionality of the built environment – has been increasingly applied. However, the absence of clearly identified critical success factors (CSFs) and a systematic framework for identifying the CSFs for effective performance measurement of HBMM remains a salient problem. Intended to bridge this gap, this study aims at developing a framework for identifying the CSFs for HBMM. Conducted at the beginning of the study was a review of relevant literature in the domains of HBMM and FM. Afterward, a conceptual framework was developed by integrating different levels (strategic, tactical, and operational) of FM concepts and useful building performance measurement tools, thus resulting in a guide for identifying CSFs to meet the objectives of HBMM stakeholders. This study's outcome helps practitioners identify relevant CSFs for achieving organizational maintenance goals and contributes to the existing knowledge about the management of heritage buildings. It can also serve as a basis for future studies that assess the significance of the identified CSFs in HBMM.

1. Introduction

Heritage buildings (HBs) have been identified as structures inherited from ancient times that possess historical, aesthetic, architectural, and cultural significance [1] in the context of sustainability for buildings. Global efforts are being channelled towards reducing social, economic, and environmental costs incurred by the continuous development of urban areas [2]. Therefore, it is imperative to make the most of existing HBs to reduce the effects of excessive urbanization. Thus, Sodangi et al. [3] explained that preserving HBs are vital in achieving a sustainable modern society. Furthermore, the conservation of HB is critical to the development of any nation. HB maintenance management (HBMM), which can be regarded as a tool to enhance sustainability, enables the preservation of past legacies for future generations, reducing the intensity of climate change and preserving embodied energy through adaptive

reuse and conservation. Hence, it is imperative to ensure that HBMM is efficiently and effectively practiced to optimize deployed resources.

To this end, facility management (FM) – a multidisciplinary approach toward achieving the functionality of the built environment – has been increasingly applied in HBMM. FM is a multidisciplinary approach that involves the integration of management of the core business and non-core business activities in achieving the functionality of the built environment to meet stakeholders' satisfaction while taking cognizance of the environmental impact of their actions. However, for FM to be effective in HBMM, it is essential to ensure that its practices meet the required expectations. For this reason, performance measurement (PM) is used to appraise FM operations in most cases.

As a veritable tool that can assess the quality of practice and service provided, PM helps identify areas of competence and improvement. FM practices can be measured quantitatively and qualitatively through some indicators such as critical success factors (CSFs). CSFs are actions that must be fulfilled satisfactorily in order to attain the corresponding objective(s). However, studies have shown that performance evaluation measures that guide FM practices in HBMM are lacking [4]. To address this problem, a study is needed to identify CSFs applicable to HBMM and develop a framework to guide the identification of the CSFs.

The work presented in the following is part of an ongoing Ph.D. study that aims to identify relevant CSFs for FM operations and assess the significance of the identified CSFs. The sections below are section 2 - findings from the past, relevant studies; section 3 - research methodology for the present study; section 4 - findings and discussions of major past studies on HBMM and FM and development of the conceptual framework; and section 5 - conclusion and recommendation for future studies.

2. Findings from the past

Kagioglou et al. [5] describe PM as a platform to rate organizational success in achieving its strategies and objectives. PM can indicate any improvements needed to enhance facilities' performance to satisfy users' requirements optimally and in the overall resource allocation planning [6]. PM is not stagnant and can be adapted to suit organizational goals. To this end, efforts have been made by different researchers to measure performance in various contexts such as financial [5], globalization, diversification, innovations [7], cost, flexibility, speed, dependability, quality [8], safety [9], staff development, team flexibility, and cash flow [10]. For effective and efficient PM, it is vital to have a defined set of tools to aid data collection and assessment [11]. Despite the benefit of PM, studies revealed a lack of proper identification of critical performance indicators to conduct practical performance assessments [12]. However, for a PM to be effectively conducted in maintenance management, it requires a systematic assessment [13, 14]. In this light, various building performance assessment tools have been developed to facilitate performance assessment concerning building maintenance management.

2.1. Performance measurement tools in maintenance management

PM tools enable an organization to assess its activities compared to the organizational strategic objectives, thus identifying its competence and lapses. Some notable PM tools used in the assessment of maintenance management are discussed below.

2.1.1. European Foundation for Quality Management (EFQM) or Business Excellence Model. The European Foundation for Quality Management (EFQM) model is a self-assessment tool that provides an organization the platform to evaluate its performance concerning a targeted excellence position[15]. Organizations use it to identify areas of deficiency within their scope of operations and initiate necessary improvement strategies. EFQM also allows strategic planning toward achieving organizational vision and mission [16]. The EFQM model covers all aspects of management and measurement of organizational results. It comprises nine criteria; five are regarded as enablers, and the remaining four are the results. The enablers create a platform that facilitates organizational operations to achieve the desired excellent results. Meanwhile, the results signify the accomplishment levels in the target areas. The five enablers in the EFQM model include people; partnerships and resources; leadership; strategy; and processes, products, and services [17]. In addition, the four results criteria include people, society, customer, and business results [17]. The EFQM model provides a platform for appraising the

effectiveness of operations with a stakeholder-oriented result. Therefore, the EFQM concept can be applied in HBMM to help in meeting the HB stakeholders' requirements by focusing on the enablers to achieve the desired HBMM objectives.

2.1.2. Balanced Score Card (BSC). The Balanced Score Card (BSC) is a measurement concept introduced by Kaplan and Norton [18] as a corporate-level strategy to improve organizational performance. It can provide measures that motivate performance. Over time, BSC has transcended beyond mere performance measurement to incorporating strategic management systems for long-term planning to enhance future performance [19, 20]. The scorecard measures performance from four perspectives: customers; financial; internal business processes; learning, and growth, all aligned towards achieving organizational vision and strategy. The process of BSC allows clarification and translation of vision into strategy, information flow, connecting strategic objectives and measures, and aligning tactical actions to enable strategic feedback [19]. The BSC can be adapted to suit the unique needs of different organizations, which allows for a holistic framework for achieving corporate objectives. Therefore, incorporating the BSC concept in identifying CSFs for FM operations in HBMM will be useful in ensuring that the concerned HB meets its stakeholders' expectations.

2.1.3. Identification of applicable CSFs in HBMM. Identification of CSFs and indicators are an essential aspect of the performance assessment of FM operations. CSF serves as a pointer or direction to measure performance in line with an organization's aims and objectives while considering feedback from end-users [10]. It can be described as a range of factors or indicators derived from organizational goals and objectives for performance evaluation and best practices. Best practices in FM and maintenance can be evaluated quantitatively and qualitatively by benchmarking actual practices with performance indicators. A list of CSFs relevant to assessing HBMM performance is indicated in Table 1.

Table 1. Critical success factors (CSFs) for heritage building maintenance management (HBMM).

Critical success factors (CSFs)	**References**
Community involvement/public participation on HB maintenance related issues	[21]
Stakeholders' engagement in decisions making on HBMM	[22]
Stakeholders agreement and satisfaction	[23]
Adherence to maintenance plan and policy	[24]
Planning and scheduling of maintenance works	[10]
Verification of maintenance works and procurement to meet required standards	[25]
Consciousness to protect delicate building fabrics during maintenance	[24]
Conducting regular inspections of the facility and ongoing maintenance works	[25]
Combining insourcing and outsourcing approaches of maintenance contracting works	[26]
Integrating maintenance decisions with corporate strategy	[25]
Keeping updated records on HB and maintenance related activities conducted	[26]
Top management commitment to the maintenance of HBs	[26]
Performance evaluation of maintenance practices	[14]
Risk management control system	[6]
Organizing courses and workshops to update staff knowledge on HBMM	[27]
Providing training for new staff to upskill them on HBMM	[10]
Implementing teamwork strategies	[28]
Use of maintenance software tools	[29]

Use of advanced techniques to improve maintenance practice	[30]
Provision of an online communication system to get feedback from users of HBs (e.g., HB used for tourism)	[29]
Resource planning and allocation for HB maintenance works	[10]
Timely release of the maintenance funds	[29]
Management of budget to cover allocation period of maintenance	[30]
Use of cost-efficient and value-for-money maintenance practices	[10]

3. Research Methodology

The foundation of this study is based on an extensive literature review of relevant articles focused on HBMM and FM [31]. The methodology process comprises of four sequential steps. The process entails keyword search of articles related to the study, extraction of relevant articles, in-depth review of the relevant articles, and synthesizing findings to develop a conceptual framework. The first step was to identify relevant articles to the study through keywords. Keywords search such as facility management, heritage building, critical success factor, and performance measurement was conducted on the academic search engine – SCOPUS. This search process generated 83 papers. Second, a further step was carried out to extract relevant works of literature to the study by reading through the abstract; 31 articles were found helpful. Third, in-depth scrutiny of the 31 articles was conducted to extract the significant findings of the studies and the relevant CSFs to improve FM operations in HBMM. This process resulted in the identification of 24 CSFs that apply to HBMM. In addition, some PM models were identified as helpful in appraising organizational practices. These PM models were synchronized with the FM concept to develop a systemic guide to correctly identify CSFs relevant to HBMM. Finally, this process developed a conceptual framework for CSFs identification in HBMM.

4. Findings and Discussion Sections

Over time, several attempts have been made to identify PM indicators to improve the maintenance management of buildings. According to Atkins and Brooks [32], CSFs are those steps that should be achieved to meet the organizational target goals and objectives. Therefore, CSFs are essential in the performance assessment of any organization. Without clearly outlined CSFs, a performance measurement system (PMS) is likely to fail. Hence, developing a PMS requires an in-depth knowledge of the CSFs to ensure that they align with the organization's strategic goals [29]. The strategic role of identifying CSFs in maintenance management has been a driver propelling various research. Some notable contributions from scholars on performance evaluation indicators are discussed below.

Reineck et al. [33] conducted a study on performance assessment of sustainability in FM services within building maintenance scope to create an integrated performance measurement framework. The study was on the outcome of a research project entitled 'Return on Sustainability System' (RoSS), which identified and analyzed a significant set of indicators relevant to measuring sustainability in FM services. As a result, a software tool was developed to evaluate the sustainability of FM practices that is useful in achieving an efficacious administration.

Likewise, other researchers have identified indicators to rate FM operations, primarily focusing on the commercial properties to achieve optimum managerial results [6, 34]. For example, Myeda et al. [4] developed a performance measurement model for maintenance management. They emphasized that measurement should be established based on relevant performance indicators. The study identified three basic measurement categories: functional management service delivery, technical maintenance service, and image building. These categories have 17 performance indicators.

Similarly, Lai and Man [12] conducted a study to develop KPIs for assessing the operational maintenance performance of commercial buildings and developed a performance evaluation scheme for an engineering building. Seventy-one indicators were initially identified as suitable for the performance appraisal of engineering facilities and later categorized into five distinct categories for effective

management [13, 14]. A matrix-oriented process–hierarchy (P-H) model was developed with consideration to the FM organizational hierarchy (strategic, tactical, and operational level), and the facilities services delivery process (input, process, and output phases) was the criteria for identification of helpful performance indicators. The application of the P-H model was later extended to a KPI study based on which an analytic network process (ANP) model was developed for hospital FM [19, 35].

In the educational sector, Amaratunga and Baldry [36] realized the need for better performance of higher education institution (HEI) facilities and, as such, conducted a study to identify the CSFs within the scope of the HEI sector for effective FM practices. The CSFs were identified based on the BSC performance measurement scale to aid strategic planning. More detailed research on HEI maintenance evaluation was carried out by [10]. The study itemized the critical requirements for PM of maintenance management: public perception, effectiveness and efficiency of maintenance management operations, financial control, and organizational learning growth process with corresponding indicators. It was emphasized that maintenance management should be evaluated and monitored regularly to address the public's needs. The uniqueness of HB may be associated with its age; for its sustained relevance in this contemporary time, it is essential to ensure that it meets stakeholders' expectations. Hence, it is necessary to identify relevant CSFs to ensure suitable maintenance delivery based on their peculiarities.

Concerning EFQM in management, Calvo-Mora et al. [37] carried out a study to establish the relationship between the EFQM model's enablers and managerial excellence in the university environment. The study revealed that anchoring managerial practices based on the EFQM enablers can help attain effective university administration. Further, senior management commitment propels the well-outlined development of key processes in the university through strategic leadership, resource apportionment and personnel management. From the preceding, the selection of CSFs based on the EFQM fundamentals may be useful in achieving HBMM excellence. In this light, a conceptual framework to identify salient CSFs for effective FM operations in HBMM is developed.

4.1. Conceptual framework development

According to Atkins and Brooks [32], the inability to identify the appropriate CSFs and performance indicators invalidate the essence of performance measurement systems. Thus, the CSFs need to be appropriately established to improve FM practices through performance evaluation. This conceptual framework's development targeted the adequate identification of CSFs for FM operations in HBMM. The major models applied to develop the conceptual framework for this study include the concepts of FM organizational operations, the BSC performance evaluation model, and the EFSQ performance assessment tool, as discussed below (Figure 1).

BSC perspective - holistically, the conceptual framework reflects the essence of the BSC assessment concept from the financial perspective, internal business perspective, user perspective, learning and growth perspective, all geared towards achieving organizational vision and strategy. Thus, it is vital to ensure HBMM CSFs are identified to improve practices from the perspectives mentioned above. The financial perspective is to support the core and non-core functions of the HBs. The internal business perspective aligns the organizational vision and mission with stakeholders' requirements. The learning and growth aspect entails identifying relevant CSFs to improve FM operations, performance evaluation, and seeking improvement strategies through feedback systems. The user perspective focuses on aligning CSFs with HB stakeholders' requirements. Lastly, the vision and mission are to prolong the useful life span of the HB through FM application to achieve sustainable use of HB.

FM perspective - concerning FM's objective of a strategic, tactical, and operational management plan, Marquez and Gupta [38] asserted that the maintenance management goals should: integrate business priorities with maintenance priorities (strategic level), adequate resource allocation for maintenance activities (tactical), effective and efficient execution of maintenance works (operational level). It is essential to establish indicators helpful in accomplishing the targets' realization, to achieve the aforementioned managerial expectations. Hence, it should be incorporated in mapping CSFs required for FM operations.

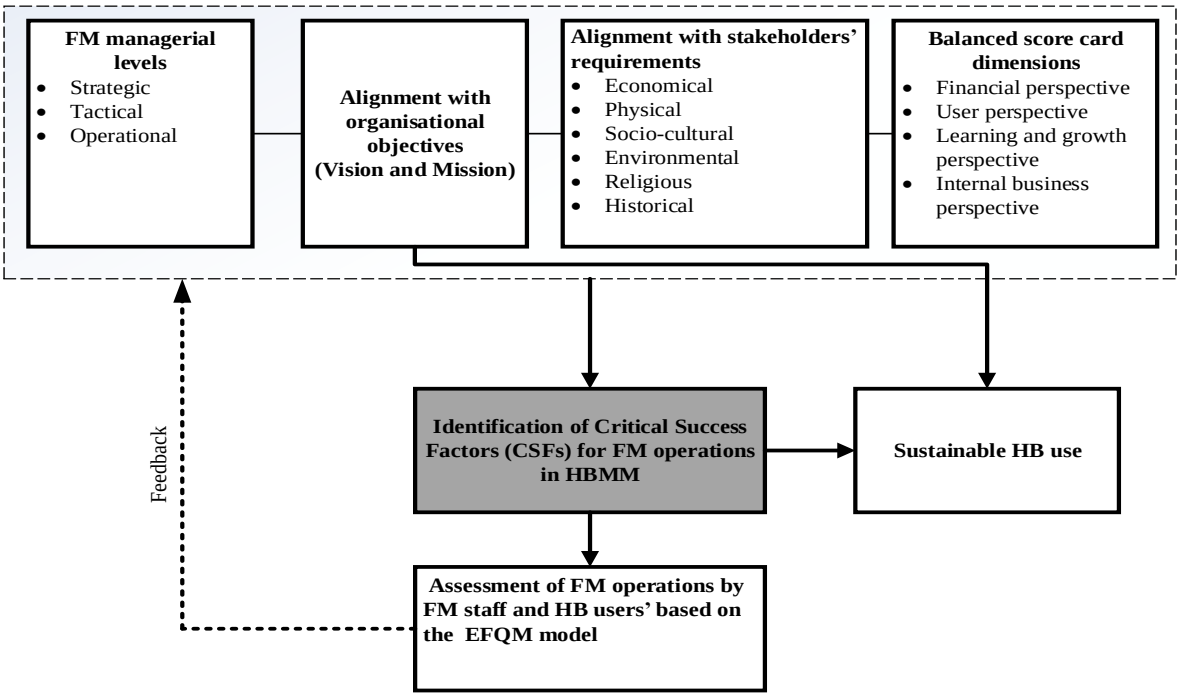
Regarding HBs, the strategic plans may be related to the overall maintenance strategy for the continued sustenance of HBs. Such maintenance strategies may relate to conservation, revitalization, or adaptive reuse of the building, which is case-dependent. The strategic management plan is usually long-

term and may cover 3 – 5 years and be reviewed periodically. The strategic plan may include policy formulations, maintenance plans, environmental management plans, financial management, and budgeting. The tactical operations entail breaking down the strategic plans into achievable goals and deliverables, usually on a medium-term basis. This may involve resource (capital and human) allocation, space management, maintenance schedule, and contingency plans. Lastly, the operational plans are short-term, based on daily activities, and plan to achieve the tactical objectives. It may include activities for coordination and monitoring operations daily, bi-weekly, or monthly to ensure users' satisfaction with the facilities. Such activities may include cleaning, fumigation, and security services [9].

Relating to HBMM, FM operations should integrate all activities necessary to prolong the life span of the HB. These activities should reduce or prevent the rate of physical, functional, economic, and social obsolescence of an HB. Incorporating FM in HBMM should be geared towards achieving the sustainable use of HBs. Sustainability is hinged on the tripod of social, economic, and environmental factors. Proper identification and evaluation of relevant CSFs to FM operations would be beneficial in achieving HB sustainability. CSFs should agree with organizational vision, mission, stakeholders' expectations, and due consideration for enhancing the core and non-core functions of an HB. The role of stakeholders in HBMM cannot be over-emphasized; they should be involved as far as practicable [4]. Thus, the CSFs should reflect the stakeholders' requirements. For HBs, stakeholders may be government, private owners of HBs, religious bodies, and non-governmental organizations. In addition, stakeholders' expectations of HB may vary depending on their perception of the building. For instance, community members may hold an HB in esteem due to its cultural relevance of the HB; hence, such individuals may demand that the building should be kept for that reason. Other stakeholders' expectations for HB may include meeting the economic, physical, environmental, religious, and historical requirements.

For CSFs to be relevant for performance evaluation, they must align with organizational vision and mission. CSFs should also reflect the core and non-core objectives of the HB to enhance effective management. For instance, if an HB is used for tourism purposes, the primary function should be to keep the building in a state to enhance tourist attraction. At the same time, the supportive services may include hotel reservations, catering, photography, and all other services needed to boost tourist experience and users' satisfaction. In addition, the organizational vision and mission should aim to prolong the HB's useful life span through FM application to achieve sustainable use of HB. Furthermore, a properly identified CSF could help in achieving sustainable HB use.

EFQM Perspective - after pinpointing CSFs, performance evaluation is another crucial step required to ascertain the level of accomplishment of the pre-set goals. As previously mentioned, the EFQM model has two main dimensions, the enablers, and the results. Therefore, this conceptual framework focused on the result dimension, i.e., people, society, and customer results. Concerning HBMM, FM operations should be geared towards achieving stakeholders' expectations. Hence, identified CSFs should be targeted at achieving the desired results. Relevant questions like 'how has FM practices improved the safety of HB to users and the community?' 'how has FM practices encouraged community participation in HBMM'?, 'has the maintenance conditions of the HB improved the level of community awareness on its importance?'. Such questions help in evaluating the results achieved by an FM organization. Further, EFQM is a self-assessment tool; therefore, the identified performance parameters can be rated through self-assessment by the FM organization and facility end-users as suggested by the EFQM model. Feedback is reported based on the assessment outcome. This process would help the managerial board deliberate or brainstorm strategies to achieve sustainable HB use.



Note: FM = Facility management; HB = Heritage building ; HBMM = Heritage building maintenance management ; EFQM = European foundation for quality management

Figure 1. Conceptual Framework for Application of CSFs in HBMM

In summary, the essence of Figure 1 is to conceptualize the process of identifying CSFs for FM operations in HBMM. This process is conducted by integrating the BSC model with FM managerial fundamentals to ensure that CSFs are aligned with organizational objectives and stakeholders' requirements while taking cognizance of HB function. The importance of PM through CSF identification cannot be over-emphasized. However, its effectiveness lies in ensuring the CSFs can help achieve an effective and efficient HBMM practice. At the same time, the FM operations focus on actions to achieve the desired target from a financial perspective, user perspective, learning and growth perspective, and internal business perspective. For instance, FM operations should aim to achieve sustainable and cost-efficient maintenance practices. Such practices may include using recyclable materials for repairs and energy-efficient lighting and fittings to reduce carbon emissions. Regarding the users' perspective, FM should focus on keeping an HB in a state to meet stakeholders' objectives.

Regarding learning and growth, FM operations should include staff training to upskill them with the required competence for handling HBMM technicalities. Furthermore, from the internal business perspective, FM should aim to identify the strategies for supporting the core and non-core functions of an HB. Hence, FM activities should preserve an HB to fulfill the stakeholders' expectations. In addition, the evaluation process should be conducted on strategic, tactical, and operational levels. This process will help break down long-term goals into achievable short-term objectives and further enhance the effectiveness of the performance evaluation action. Based on the fundaments of the EFQM model, HB facility managers can assess their performance on the achievement of the CSFs. Therefore, proper identification of CSFs builds a foundation for PM in HBMM. Also, establishing appropriate CSFs is pivotal in improving HBMM, consequently achieving sustainable use of HB.

5. Conclusion and recommendation for future studies

The essence of PM to improve FM operations in other building sectors has been investigated in previous studies but has received little attention in the HBMM domain. Hence, this study defined a road

map for identifying relevant CSFs for effective FM operation in HBMM pinned on the foundation of FM operational scope, the BSC, and the EFQM models. Further, a conceptual framework was developed on this basis by integrating the different levels (strategic, tactical, and operational) of FM concepts and the BSC dimensions (financial, user, learning and growth, internal business) and the EFQM result dimensions (people, society, and customer results). The theoretical contributions of this framework are that it highlights the relationship of key concepts to be considered in identifying CSFs for FM operations in HBMM. For instance, the framework shows that CSFs should aim to achieve stakeholders' requirements concerning HBs while aligning with the FM organization's objectives. In addition, it is shown that the BSC dimensions directly influence establishing CSFs for HBMM; therefore, CSFs should seek to promote FM practices from this perspective. This framework serves as a theoretical direction in identifying the appropriate CSFs for effective FM operations in HBMM. Through the above review process, 24 CSFs that apply to FM activities in HBMM have been identified.

These CSFs would help conduct performance measurements of FM operations in HBMM. In addition, the CSFs are useful for pinpointing areas that need improvement and aspects that need to be maintained. Therefore, this study identifies the CSFs for meeting HBMM stakeholders' objectives and helps improve FM practices in HBMM. Using too many indicators to appraise the performance of FM operations in practice is ineffective [19]. Thus, it is essential to shortlist the most important indicators that may be useful for real scenarios of maintenance of HBs. Based on the outcome of this current study, a further step will be taken to assess the significance of the CSFs, via shortlisting and categorizing them into different groups [41]. For this purpose, the opinions of FM experts in the HB sector will be solicited through, for example, questionnaire surveys, case studies, and interviews. The results from these tasks will be reported and discussed in the future.

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