

Lai, J.H.K. and Choi, E.C.K. (2015), Performance measurement for teaching hotels: A hierarchical system incorporating facilities management, *Journal of Hospitality, Leisure, Sport & Tourism Education*, Vol. 16, pp. 48-58.

Performance measurement for teaching hotels: A hierarchical system incorporating facilities management

Abstract:

Intended to establish a performance measurement system (PMS) for teaching hotels, a study was conducted involving face-to-face interviews with the senior management of a typical teaching hotel. Key performance indicators (KPIs), grouped into four dimensions - education support, brand enhancement, financial performance and facilities performance, were shortlisted to form a performance measurement hierarchy. Using an analytic hierarchy process (AHP), the intended PMS was developed. Instead of financial performance, education support was the most important dimension, followed by facilities performance. The PMS, which is a pilot of its kind, may be used for other teaching hotels.

Keywords:

Analytic hierarchy process; facilities management; hospitality education; key performance indicator; performance measurement; teaching hotel

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1. Introduction

Successful hotel management entails an array of works such as marketing, engineering, logistics, administration, accounting and human resources. Underpinning such activities is a variety of facilities services, including maintenance, cleaning, security, catering, etc. that require substantial resources (Rutherford & O'Fallon, 2007). Without proper management of these services (i.e. facilities management (FM)), the core businesses of hotels (e.g. guestrooms, food and beverages) would not be satisfactory. For teaching hotels, in particular, they need to attain not only a healthy business but also the mission of supporting hospitality education.

In general, facilities managers of hotels are expected to be well versed in managing their facilities services. But when asked about whether the services affect the overall performance of their hotels or to what level the services contribute to the overall performance, they often find it hard to give a definite answer. A common reason for this is the lack of a credible system that embraces assessment of the FM performance in hotels.

Over the past few decades, FM has been increasingly recognized as a multi-disciplinary profession encompassing a range of support services for ensuring functionality of built

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facilities, thereby enabling the growth of organizations (International Facility Management Association, 2014; European Facility Management Network, 2014). Yet, a performance measurement system (PMS) incorporating assessment of FM performance in hotels was not available. Intended to develop such a PMS and illustrate its application in practice, a multi-stage research project was carried out based on a case study of a teaching hotel.

In the first stage of the project, a desktop study was conducted to review literature and past research works that are related to performance measurement and facilities management for hotels. In the second stage, a methodology which is appropriate for obtaining the various types of data needed was formulated, and the corresponding data collection tools were designed. Then the data collected were analyzed, enabling the establishment of the intended PMS. In the final stage, the applicability of the system was verified based on the case study. These stages of works, analyses of the findings, results of the project as well as some suggested future works are reported in the following.

2. Literature Review

Traditionally support services belonging to the integrated FM function for hotels spread across different departments, and the term FM was not commonly applied in the hotel sector (Jones,

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2002). For many hotels, implementation of the integrated FM function remains a new initiative; holistic assessment of their FM performance is even an untried idea. Research studies in this area are yet to be seen.

In the beginning of the current study, a literature review was conducted to identify the key features and principles of facilities management and performance measurement so as to understand how they may be applied for assessing FM performance in the hotel environment.

The ensuing parts present the main findings of the review.

2.1 Scope and function of FM in the hotel environment

Facilities management is an integrated approach to operating, maintaining, improving and adapting the buildings and infrastructure of an organisation in order to create an environment that supports the primary objectives of that organization (Barrett, 1995; Atkin & Brooks, 2000).

According to Alexander (1996), FM is the process by which an organization ensures that its buildings, systems and services support core operations and processes as well as contribute to achieving its strategic objectives in changing conditions. As a business discipline, FM is concerned with all the processes that ensure user's needs are satisfied, setting up the conditions in which processes can be improved (Alexander, 1994).

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With reference to the above definitions, the scope and function of FM are wide-ranging.

Whereas it is the typical responsibility of the engineering department of a hotel to operate and maintain its facilities, the concept of FM, when applied in the hotel environment, requires the FM function to also cover ongoing improvement of the facilities, implementation of environmental conservation measures, compliance with health and safety requirements, and so on. The nature of such a comprehensive, dynamic role of FM is both operational and strategic, supporting the continual growth of the hospitality businesses. Assessing the contribution of the FM function, therefore, necessitates a PMS that covers not only the traditional engineering service but also the other essential, facilities services.

2.2 Importance and characteristics of a PMS

A PMS is defined by Neely et al. (1995) as “the set of indicators which can be used to quantify the efficiency and effectiveness of actions”. Performance measurement, being a key factor in ensuring the successful implementation of an organization’s strategy, is important to any function or operation (Fitzgerald et al., 1991). In the FM context, it also provides the basis for an organization to assess how well it is progressing towards its predetermined objectives and identify areas of strengths and weaknesses (Kincaid, 1994; Armaratunga & Baldry, 2002a;

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2002b). Facilities managers are accountable to senior management for the contribution of FM to the business result and economic health of their organizations (Amaratunga et al., 2005).

It is widely recognized that “what gets measured get done” is a cornerstone for achieving business goals (Eccles, 1991; Kaplan and Norton, 1992). If performance is not measured with the correct focus, issues that are potentially detrimental to the business of an organization would be overlooked (Atkinson et al., 1997). Given the increasing competition in the hotel market, it has become vital to measure and analyze all services playing a crucial role in a hotel organization (Zigan & Zeglat, 2010).

In order to develop an effective PMS for the FM function, one must be clear about the objective of having the PMS. As Armaratunga et al. (2002) stated, a PMS can achieve four potential benefits: satisfying customers, monitoring progress, benchmarking process and activities, and driving change. The main objective of an integrated PMS is to help organizations identify a set of measures that better reflect their performance (Kennerley & Neely, 2003). Such a PMS needs to be a balanced framework that consists of both financial and non-financial measures, enabling multi-dimensional evaluations of organizational performance (Martinez et al., 2004).

Before embarking on the development of a PMS, it is crucial to obtain a thorough

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understanding of the organization's business goal and missions, followed by converting them into facilities-related objectives. These objectives, in turn, will form the basis for establishing the necessary performance measures (Varcoe, 1996). For organizations with a hierarchy of workforce, different categories of performance indicators targeting the operational, tactical and strategic levels are needed (Lai & Yik, 2006). Such indicators, often grouped into different clusters, can be used to measure how well the organization's mission, management, program and individual goals are met (Cable & Davis, 2004).

2.3 Performance measurement in FM and hotels

In general, business performance is commonly measured using key performance indicators (KPIs) and may involve a benchmarking process in relation to the performance outcomes (Kaplan & Norton, 2001; Madritsch & Ebinger, 2011; McDougall & Hinks, 2000). While different categories of KPIs may be employed by hotel general managers to assess the performance of hotel properties (Harris & Mongiello, 2001), Zigan & Zeglat (2010) found that most hotels relied on financial metrics, such as operation and maintenance costs or expenses as percentage of total revenue, for performance measurement. Some hotels, recognizing the inadequacies of using financial metrics for performance measurement, use a qualitative approach to supplement financial measurement (Denton & White, 2000; Atkinson & Brander,

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2001). Based on a lodging chain, Banker et al. (2005) showed the association of nonfinancial performance measures with financial performance.

Over the years, many studies have been conducted to investigate hotel performance (Sainaghi, 2010). The case study of Haktanir & Harris (2005) showed that the hotel performance can be measured under six themes: business dynamics, overall performance, employee performance, customer satisfaction, financial performance, and innovative activity. A group of studies, particularly, focused on the financial performance of hotels (Sin et al., 2006; Hsu & Jang, 2007; Hanson et al., 2009). In the study of Pine & Phillips (2005), the performance of hotels was compared with respect to their ownership, size and star rating. In Taiwan, Chen (2011) carried out a data envelopment analysis to measure the performance of a seven-unit hotel chain. In Spain, Tarí et al., (2010) analyzed separate and joint effects of quality management and environmental management on hotel performance. In Australia, the work of McManus (2013) showed the use and antecedents of customer accounting and marketing performance measures based on a survey of 165 hotel managers. An assessment of the efficiency of hotels in terms of factors such as star rating, location, and availability of golf facilities was made in the study of Oliveira et al., (2013).

In parallel to the growth of the FM discipline over the past few decades, different models and

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tools have been introduced for measuring FM performance (McDougall et al., 2002; Meng & Minogue, 2011). Various research efforts have also been made to promote the use of KPIs for measuring FM performance. An example is the work of Hinks & McNay (1999). In view of the lack of an industry-wide set of KPIs for FM, they initiated a project and found that FM performance could be measured by 172 KPIs under eight dimensions: business benefit, equipment, space, environment, change, maintenance/service, consultancy, and general. On the side of empirical studies, some researchers have attempted to measure the performance of some particular FM aspects of hotels. For instance, Lai & Yik (2008) carried out a benchmarking study focusing on the operation and maintenance costs of a group of luxury hotels. The maintenance performance of a quality hotel was investigated in the case study of Lai & Yik (2012). An extended study, as reported in Lai (2013), was conducted to further probe into the maintenance demand and manpower of that hotel.

In the study of Lavy et al., (2010), it was found that different people rank the FM associated KPIs quite differently. Therefore, it is imperative that when applying the KPIs for measuring performance, proper ranking of the KPIs should be determined. As Brackertz & Kenley (2002) suggested, differential weighting of measures is a policy task that should be conducted by senior management with reference to the organization's business goals, and the weighting should reflect how important each KPI is in relation to the business. Effective KPIs, as

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Loosemore & Hsin (2001) pointed out, should also be comprehensible, measurable, and practical for data collection. Selection of appropriate KPIs is influential to the success of a performance measurement scheme (Man & Lai, 2014).

For determining a proper ranking of the KPIs of a PMS, the analytic hierarchy process (AHP) is a useful technique that allows allocation of importance weights to the parameters being measured (Saaty, 1980). Applications of the AHP method in FM research have continued to grow. For example, it was used by Gillead & Wong (2004) in a FM benchmarking study. With the use of the AHP technique, Lai & Yik (2011) developed an analytical assessment method for evaluation of residential FM services. Recently, the AHP method was adopted in exploring the curriculum frameworks of MICE (meeting, incentive travel, convention, and exhibition) courses in continuing education (Hsieh, 2013), constructing a competence model for educating and evaluating internal professionals for the MICE industry in Taiwan (Tang, 2014), and developing a model for evaluating the quality of hotel websites (Akincilar & Dagdeviren, 2014).

The above review failed to identify a recognized PMS that integrally assesses the relevant performance aspects, including the FM function, of hotels. But it shows that such an integrated PMS should bear the following features, which serve as guidance in developing the PMS under the current study:

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- The PMS should comprise a collection of KPIs which cover the essential performance aspects, linking with the missions and objectives of the hotel;
- The KPIs should provide a balanced view of the performance aspects, embracing both financial and non-financial metrics;
- The weightings of the KPIs should reflect their importance in the minds of the hotel's senior management.
- The KPIs should be measurable and comprehensible, enabling the outcome of the PMS to be actionable.

3. Method and Data

3.1 The hotel and the participants

As a pilot research study to establish the intended PMS, it is of vital importance to target a hotel where full support to the study is obtainable from its owner and senior management. For this reason, the selected hotel is a teaching hotel owned by a university. It is a purpose-built hotel that combines teaching, learning and research in a full-service environment. To fully integrate with the hotel, the hotel management school of the university has designed its

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curriculum to cover hotel operations, event management, financial administration, entrepreneurship and service quality management, all of which include practical training.

Besides serving as a training ground for the hotel management school, the hotel runs in a way not different from the usual commercial operation. With a total floor area of over 42,000 m², the hotel accommodates about 260 rooms, three restaurants, and leisure facilities such as fitness center, spa and swimming pool. Hiring more than 360 regular staff among them some are responsible for facility services. For instance, 20 staff of the engineering department take care of the maintenance work, five managers/supervisors look after an outsourced team of 15 security guards, and 25 staff are deployed for the reception service. As the hotel is in the upmarket category, the guests as well as the hotel management have high expectation for its facilities management standard. At the time of the study, the hotel had been in operation for over two years.

Since it is necessary for those who participate in developing the PMS to have a good understanding of the management information such as the mission, organizational goal and business strategy of the hotel, the senior management of the hotel who are familiar with the management information were invited to participate in the study. This group of participants comprised an owner's representative who is also a member of the hotel's board of directors and

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the department heads of the hotel: 1) General Manager; 2) Director of Finance and Administration; 3) Director of Marketing; 4) Director of Rooms; 5) Director of Food and Beverage; 6) Director of Human Capital; 7) Quality Assurance Manager; 8) Director of Engineering; and 9) Director of Technology Innovation.

3.2 Interviews and questionnaires

In order to collect in-depth opinions from the participants, face-to-face interviews were adopted. This approach, allowing direct communication between the interviewer and the interviewees, can help ensure that the latter are clear about the interview questions and, where necessary, the former can provide clarification for any queries the interviewees may have.

The flowchart in Fig. 1 shows the overall data collection and processing sequence. The interviews were conducted individually with the participants and in each round of the interviews, all the ten participants were interviewed. After a briefing on the background and purpose of the study, the participant was given a key question: “How to establish a performance measurement system that incorporates assessment of the integrated facilities management function of a hotel?” A set of subsidiary questions, asking about the missions and goals of the hotel and what they consider as the main dimensions/groups of hotel performance, was also

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included in this (first) questionnaire in order to stimulate the interviewees to think of the parameters that influence the hotel's overall performance. Then the participants were given a list of the 172 KPIs (Hinks & McNay, 1999) that were identified from the earlier literature review, followed by asking them to pick those they regard as applicable for measuring hotel performance. Furthermore, they were encouraged to suggest any indicators they consider relevant but had not been on the list.

“Insert Fig. 1 here”

Based on the responses of the interviewees, a list of the applicable KPIs was consolidated. In order to select the most relevant indicators, a supplementary (second) questionnaire was devised. This questionnaire asked the participants to rate the degree of relevancy of each indicator based on a 5-point scale: from 1 (none), through 3 (fair), to 5 (high). The questionnaire was distributed by hand to the participants and they were allowed sufficient time to complete and return it to the research team. Based on the ratings collected, the ranking of relevancy was determined and the most relevant KPIs shortlisted.

After the shortlisting process, it is necessary to determine the degrees to which the KPIs contribute to the overall performance of the hotel. The findings of this part inform the

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weightings of the KPIs under the intended PMS. For this purpose, a further (third) questionnaire, divided into two parts, was designed for use in a second round of interviews.

The initial part (i.e. part I) of this questionnaire contained a series of questions, which ask the respondents to rate the relative importance between different pairs of the KPIs. To this end, the following 9-point rating scale of the analytic hierarchy process (AHP) was used when making comparison between each pair of indicators (Saaty, 1990; 1995):

- 1: Equally important, meaning two indicators (A and B) are of equal importance
- 2: Slightly more important (A is slightly more important than B)
- 3: Moderately more important (A is moderately more important than B)
- 4: Intermediate level between the two adjacent levels
- 5: Strongly more important (A is strongly more important than B)
- 6: Intermediate level between the two adjacent levels
- 7: Very strongly more important (A is dominantly more important than factor B)
- 8: Intermediate level between the two adjacent levels
- 9: Extremely more important (importance of A over B is of the highest possible order)

After completing the above pairwise comparison process for the KPIs, the same process was carried out for different pairs of performance groups, followed by different pairs of

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performance dimensions.

The questions in the final part (i.e. part II) of the third questionnaire were designed for collecting the performance ratings of the KPIs under the PMS. Under this part, the interviewees were asked to rate, according to a 5-point scale (1: poor; 2: below expectation; 3: satisfactory; 4: very good; and 5: excellent), their perceived performance levels of the KPIs being rated.

3.3 Calculations

Based on the responses to the second questionnaire, the average value of the ratings given by all the participants was calculated for each indicator. The calculated values, which informed the levels of relevancy of the respective indicators in measuring the FM performance in the hotel, enabled selection of the most relevant KPIs for inclusion in the PMS.

Through the third questionnaire, the ratings of each cluster of pairwise comparisons were collected. Once such ratings were given by the interviewees, they were input into Eq. (1) to compute the consistency ratio (*CR*) of the corresponding data set, where λ is principal eigenvalue, n is number of rated items, and r is random consistency.

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$$CR = \frac{\lambda - n}{n - 1} \times \frac{1}{r} \quad (1)$$

For data sets with a CR value larger than 0.1, i.e. exceeding the limit for consistent judgments, the data were rejected and the interviewees were requested to review and revise the ratings they indicated. Once the ratings were revised, the consistency ratios of the new data sets were calculated. This procedure was repeated until the CR values fell within the limit. The data sets accepted were then processed by the AHP method to find out the importance weights of the KPIs.

The performance ratings given by the interviewees were recorded and taken for calculating the performance scores of each attribute. First, the performance ratings under each performance group were multiplied by the importance weights of the respective KPIs. The weighted performance ratings obtained in this way were processed by Eq. (2) to yield a weighted performance score for the corresponding performance group. The scores so obtained, after multiplying by the importance weights of their respective performance groups, were summed together to give the weighted scores of the respective performance dimension (Eq. (3)). Each of these scores was further multiplied by the importance weight of the corresponding performance dimension and, finally, the aggregate value of such calculated scores provides an overall performance score for the FM function (Eq. (4)).

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$$PG_y = \sum_{x=1}^a KPI_x \times W_x \quad (2)$$

$$PD_z = \sum_{y=1}^b PG_y \times W_y \quad (3)$$

$$PS = \sum_{z=1}^c PD_z \times W_z \quad (4)$$

Where KPI_x = rating of the x^{th} KPI in a performance group ($x = 1, 2, \dots, a$)

PD_z = score of the z^{th} performance dimension ($z = 1, 2, \dots, c$)

PG_y = score of the y^{th} performance group ($y = 1, 2, \dots, b$)

PS = overall performance score of the FM function

W_x = importance weight of the x^{th} KPI in a performance group

W_y = importance weight of the y^{th} performance group

W_z = importance weight of the z^{th} performance dimension

4. Results and Discussion

4.1 Performance measurement hierarchy

From the responses to the first questionnaire, it was clear that the 172 KPIs of Hinks & McNay (1999) were too generic and too voluminous for application to the hotel. Nonetheless, that list

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of KPIs served as a useful reference, based on which the interviewees suggested a set of specific indicators for measuring the performance of the hotel. Such indicators, the total number of which being 94, were categorized into four dimensions, namely education support, brand enhancement, financial performance, and facilities performance (Fig. 2).

“Insert Fig. 2 here”

Referring to the calculated average values of the ratings that were obtained from the second questionnaire, indicators with an average rating below 3 (fair) were excluded; only those with a higher-than-fair rating were retained. Consequently, the total number of indicators was reduced to 23 and the largest cluster, under the facilities performance group, consists of 13 indicators. A further scrutiny on this cluster of indicators found that they belonged to 4 subgroups: maintenance standard, safety & security, service standard, and guest satisfaction.

Fig. 3 depicts an overall hierarchy of the PMS and the descriptions of the shortlisted KPIs are shown in Table 1.

“Insert Fig. 3 here”

“Insert Table 1 here”

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4.2 Importance weights

Based on the pair-wise comparison ratings given by the interviewees, the importance weights of the KPIs were calculated using the AHP method and the results of each KPI were averaged to obtain their mean importance weights. For each cluster of KPIs, the total value of their importance weights is unity; the weight of a neutral KPI is: 1/2 for a cluster of 2 KPIs; 1/3 for a cluster of 3 KPIs; or 1/4 for a cluster of 4 KPIs.

Fig. 4 shows the mean importance weights of the KPIs under three performance dimensions: education support, brand enhancement, and financial performance. There were four indicators under the first dimension and the two more-important KPIs, with a weight value greater than 0.25, were for measuring student learning satisfaction (ES₂) and outcome level of student learning (ES₄). Under the financial performance dimension where there are also four indicators, keeping operation and maintenance costs within budget (FP₁) and minimizing energy consumption of the hotel (FP₄) were rated as more important than controlling utilities costs (FP₂) or implementing capital expenditure projects within budget (FP₃). When considering brand enhancement, the importance of participation in environmental protection related accreditation programmes (BE₂) prevailed.

“Insert Fig. 4 here”

The importance weights of the 13 KPIs grouped under 4 different performance groups of the facilities performance dimension are displayed in Fig. 5. Among the indicators in the maintenance standard group, only indicator MS₂ carried a higher-than-neutral importance weight. This highlights the unparalleled importance the interviewees placed on ensuring the hotel facilities are in compliance with the statutory requirements. Under the safety & security group, the difference between the weights of the two KPIs was not substantial but indicator ‘SS2’, which denotes number of staff safety incidents, was rated as slightly more important. Regarding service standard, both compliance with time limit on response to guest complaints (SD₁) and implementation of and compliance with quality assurance programmes (SD₂) were considered as more important. In the final group – guest satisfaction, the greatest important weight was given for measuring the number of guest requests not settled within the pre-set time limits (GS₃), followed by measuring the number of guest complaints on facilities conditions (GS₂).

“Insert Fig. 5 here”

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4.3 Performance ratings and scores

Under the first performance dimension - education support (see Fig. 3), there are no subdivided performance groups. The performance score of this dimension, therefore, was taken as the total of the weighted performance ratings of the KPIs at the lowest level of the hierarchy. This is represented by Eq. (5), where the importance weights of the KPIs are indicated. Such importance weights, ranging between 0.125 and 0.388, refer to the mean values of the AHP weights obtained from the pairwise comparisons of all the interviewees.

Likewise, the performance score of the second dimension, brand enhancement, is shown as Eq. (6), where two KPIs are involved. For the financial performance dimension, the performance score is constituted by four components and the importance weights of the relevant KPIs are between 0.203 and 0.312 (Eq. (7)). A much wider spread of the weights (0.190 to 0.410) was found with Eq. (8), which represents the performance score of the final dimension – facilities performance. Note, however, should be taken that the independent parameters in this equation, unlike those for the preceding three dimensions, are four performance groups with sub-categorized KPIs at the bottom level of the hierarchy.

The performance scores of the four clusters of KPIs under the facilities performance dimension,

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namely maintenance standard, safety & security, service standard, and guest satisfaction, are represented by Eqs. (9), (10), (11) and (12) respectively. The overall performance score of the FM function is shown as Eq. (13), which combines the weighted constituent scores of the four performance dimensions: education support, brand enhancement, financial performance, and facilities performance.

$$PD_{ES} = 0.125ES_1 + 0.388ES_2 + 0.202ES_3 + 0.286ES_4 \quad (5)$$

$$PD_{BE} = 0.433BE_1 + 0.567BE_2 \quad (6)$$

$$PD_{FP} = 0.312FP_1 + 0.224FP_2 + 0.203FP_3 + 0.261FP_4 \quad (7)$$

$$PD_{FA} = 0.190PG_{MS} + 0.410PG_{SS} + 0.199PG_{SD} + 0.202PG_{GS} \quad (8)$$

$$PG_{MS} = 0.205MS_1 + 0.333MS_2 + 0.249MS_3 + 0.213MS_4 \quad (9)$$

$$PG_{SS} = 0.478SS_1 + 0.522SS_2 \quad (10)$$

$$PG_{SD} = 0.395SD_1 + 0.359SD_2 + 0.246SD_3 \quad (11)$$

$$PG_{GS} = 0.234GS_1 + 0.258GS_2 + 0.270GS_3 + 0.238GS_4 \quad (12)$$

$$PS = 0.316PD_{ES} + 0.237PD_{BE} + 0.166PD_{FP} + 0.282PD_{FA} \quad (13)$$

Where PD_{ES} = score of performance dimension (education support)

PD_{BE} = score of performance dimension (brand enhancement)

PD_{FP} = score of performance dimension (financial performance)

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PD_{FA} = score of performance dimension (facilities performance)

PG_{MS} = score of performance group (maintenance standard)

PG_{SS} = score of performance group (safety & security)

PG_{SD} = score of performance group (service standard)

PG_{GS} = score of performance group (guest satisfaction)

PS = overall performance score of the FM function

Referring to the performance ratings given by the interviewees on the 23 KPIs under the various clusters, their minimum, maximum and mean values were computed, as summarized in Table 2. Inspections across the tabulated figures found that the lowest rating (= 1) was associated with FP_1 , indicating that the corresponding interviewee considered the performance of ‘operation and maintenance costs within budget’ as poor. For the remaining KPIs, their lowest ratings were either 2 or 3, meaning that some of the interviewees rated their performances as below expectation while some perceived them as satisfactory.

“Insert Table 2 here”

As for the maximum ratings, the performance levels of 14 KPIs were rated by at least one of the interviewees as excellent (rating = 5); the counterpart of the remaining 9 KPIs recorded a

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rating of 4, i.e. at the 'very good' level. When it comes to the mean ratings, the smallest value was found with SD₂. This shows that the interviewees, on average, considered the level of 'implementation of and compliance with quality assurance programmes' as the most inferior among all the KPIs. On the other hand, 'energy consumption per unit area' (FP₄), with a mean rating of 3.889, outperformed all the other KPIs.

Multiplying the mean performance ratings of the various KPIs in Table 2 by their respective importance weights generated the numeric values of the weighted performance scores of the KPIs, and the results are listed in the final column of the same table. The smallest weighted score, 0.417, was found with ES₁ (number of lecture hours given by engineering staff) whereas the largest, 1.806, pertained to SS₁ (number of guest safety incidents). Such findings were resulted from taking into account not only the raw performance ratings of the KPIs but also their importance weights determined from the AHP calculations.

In Table 3, the importance weights and weighted performance scores of the various performance groups and dimensions above the KPI level are tabulated. Shown in the final column are the shares of the weighted scores contributed by the corresponding clusters. Among the importance weights of the performance groups, the greatest, as high as 0.410, belonged to the safety & security cluster. The share of its weighted score was also the largest. In contrast,

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the importance weights and the shares of weighted scores of the other two clusters, namely maintenance standard and service standard, were the smallest.

“Insert Table 3 here”

According to the AHP weights of the four performance dimensions (Table 3), the most important dimension is education support. This, as observed during the interviews, is largely because the management team was fully aware of the mission that the hotel has to serve as a teaching ground for hotel and tourism management students. Referring to the shares of the weighted scores, the education support dimension prevailed over the other three dimensions.

Second to education support, as reflected by the calculated importance weight, is the facilities performance dimension. The share of weighted score contributed by this dimension (28.7%) also ranked second among the four dimensions. Intriguingly, the financial performance dimension recorded the smallest importance weight. The fact that making profit is not the prime objective of the hotel is a reason for this finding.

Substituting the mean performance ratings of Table 2 into Eqs. (5) to (12) resulted in the performance scores for the various performance groups and dimensions. Eventually the overall

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performance score of the FM function, which was obtained using Eq. (13), was found to be 3.332, or 66.6%. This indicates that the performance level of the FM function, though not up to very good, was higher than satisfactory.

5. Conclusions

Management of facilities services such as maintenance, cleaning, security, catering and reception falls within the scope of FM. While in practice this group of services commonly spreads across various departments of a hotel, it has been increasingly recognized that delivering FM as an integrated function is more effective, which is beneficial to the core business of hotels.

The literature review showed that in order to enable the development of an organization, it is essential to properly measure its activities. In the hospitality sector, many research works have been undertaken to investigate hotel performance. But a holistic PMS that measures also the performance of the integrated FM function was not available. Without such a PMS, it is not feasible to ascertain the contribution of FM to the overall performance of hotels.

Grounded on the key features of a proper PMS and with the support of the owner of a teaching

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hotel, in-depth opinions of the hotel's senior management were collected through a series of face-to-face interviews. This part of the study revealed that KPIs in the general FM context were not fit for measuring the performance of FM in hotels; specific KPIs were needed. Based on the opinions collected, a three-level hierarchy consisting of 23 KPIs grouped under four performance dimensions, namely education support, brand enhancement, financial performance and facilities performance, was developed. With the use of the AHP method, importance weights of the KPIs were determined, enabling the establishment of the intended PMS. Inputting the performance ratings solicited from the interviewees to the PMS not only unveiled the overall performance of the hotel, but also demonstrated the applicability of the PMS in practice.

6. Implications, limitations and future research

Using the PMS, the contribution made by the FM team of the hotel to its overall performance can be assessed. The PMS can be used to evaluate not only the current FM performance of the hotel but also benchmark the hotel's ongoing performance if it is implemented regularly, e.g. on an annual basis, to measure the FM performance.

The practical implications of the study are not confined to the establishment of the PMS for

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use by the managers who look after the current hotel. For other teaching hotels with a nature similar to that of the current hotel, the framework of the PMS may be adapted for use to measure the performance of their FM functions. For hotels which are not entrusted with an education mission, the approach of this study may be taken to customize a PMS for their use. To this end, researchers in future studies may adopt the sequence of data collection and processing of the current study to shortlist specific sets of KPIs, followed by obtaining scores of individual performance groups, performance dimensions as well as overall performance of the FM functions of hotels being studied.

From a broader perspective, the PMS is a pilot of its kind. It addresses the long-standing need of such a PMS in the hospitality sector. The methodology of the study, which has proved useful for establishing a PMS for the hotel's FM function, can also be applied to other settings such as hostels etc. to tailor a PMS for their use. Researchers of such future works, in addition to observing the characteristics of the settings being studied, can take note of their findings and those obtained in the current study. Comparison of the findings would inform any differences or similarities in their performance attributes.

Yet the above study is not without limitations. In particular, the ratings of individual KPIs, performance groups and performance dimensions were obtained based on the performance

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levels perceived by the participants. Such responses, by their nature, could not be made without the judgments of the participants. In order to avoid involvement of subjective judgments, further works are needed to identify appropriate quantitative measures for representing the performance levels of the rated attributes.

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Table 1 Final list of KPIs

KPI No.	Symbol	Description
1	ES_1	Number of lecture hours given by engineering staff
2	ES_2	Student learning satisfaction index
3	ES_3	Number of training hours completed by students/interns
4	ES_4	Outcome level of student learning
5	BE_1	Participation of FM staff in corporate social responsibility activities
6	BE_2	Participation in environmental protection related accreditation programmes
7	FP_1	Operation and maintenance costs within budget
8	FP_2	Utilities costs within budget
9	FP_3	Completion of capital expenditure projects within budget
10	FP_4	Energy consumption per unit area per month
11	MS_1	Indoor environment comfort and cleanliness meeting customer expectation
12	MS_2	Facilities in compliance with statutory requirements

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13	<i>MS₃</i>	Implementation of maintenance programme for guestrooms
14	<i>MS₄</i>	Facilities condition meeting customer expectation
15	<i>SS₁</i>	Number of guest safety incidents
16	<i>SS₂</i>	Number of staff safety incidents
17	<i>SD₁</i>	Compliance with time limit on response to guest complaints
18	<i>SD₂</i>	Implementation of and compliance with quality assurance programmes
19	<i>SD₃</i>	Number of facilities and equipment failures
20	<i>GS₁</i>	Number of guest complaints on facilities performance
21	<i>GS₂</i>	Number of guest complaints on facilities conditions
22	<i>GS₃</i>	Number of guest requests not settled within the pre-set time limits
23	<i>GS₄</i>	Guest satisfaction index on hotel hardware and environmental friendliness

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Table 2 Ratings and weighted scores of KPIs

Cluster	KPI	Rating			Weighted score
		Min	Max	Mean	
Education support	<i>ES₁</i>	3	5	3.333	0.417
	<i>ES₂</i>	3	4	3.111	1.207
	<i>ES₃</i>	2	4	3.111	0.628
	<i>ES₄</i>	2	5	3.556	1.017
Brand enhancement	<i>BE₁</i>	3	4	3.333	1.443
	<i>BE₂</i>	2	5	3.111	1.764
Financial performance	<i>FP₁</i>	1	5	3.222	1.005
	<i>FP₂</i>	3	5	3.556	0.796
	<i>FP₃</i>	2	5	3.444	0.699
	<i>FP₄</i>	3	5	3.889	1.015
Maintenance standard	<i>MS₁</i>	2	4	3.444	0.706
	<i>MS₂</i>	3	5	3.444	1.147
	<i>MS₃</i>	2	5	3.333	0.830
	<i>MS₄</i>	2	4	3.222	0.686
Safety & security	<i>SS₁</i>	3	5	3.778	1.806
	<i>SS₂</i>	3	5	3.300	1.723
Service standard	<i>SD₁</i>	2	5	3.222	1.273
	<i>SD₂</i>	2	4	3.000	1.077
	<i>SD₃</i>	2	5	3.111	0.765
Guest satisfaction	<i>GS₁</i>	3	4	3.333	0.780
	<i>GS₂</i>	3	4	3.333	0.860
	<i>GS₃</i>	2	5	3.333	0.900
	<i>GS₄</i>	3	4	3.444	0.820

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Table 3 Weighted scores of performance groups and dimensions

Hierarchical level	Cluster	Weight	Weighted score	Share
Performance group	Maintenance standard	0.190	0.640	18.9%
	Safety & security	0.410	1.447	42.7%
	Service standard	0.199	0.620	18.3%
	Guest satisfaction	0.202	0.679	20.0%
Performance dimension	Education support	0.316	1.033	31.0%
	Brand enhancement	0.237	0.760	22.8%
	Financial performance	0.166	0.584	17.5%
	Facilities performance	0.282	0.955	28.7%

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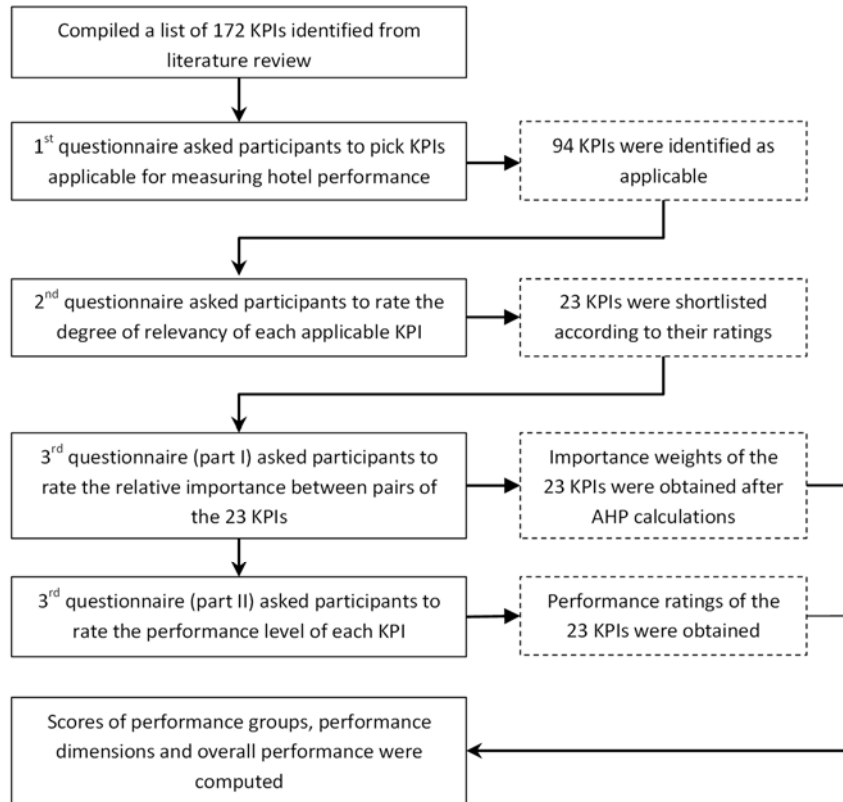


Fig. 1 Overall data collection and processing flowchart

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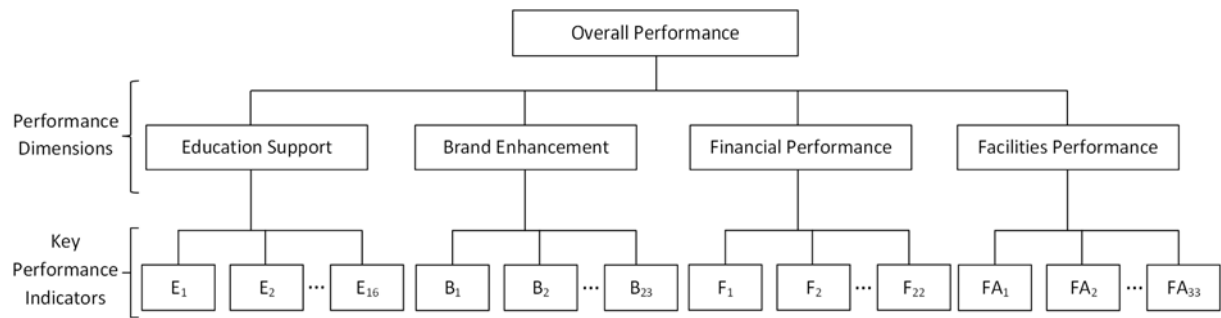


Fig. 2 Initial hierarchy of the PMS

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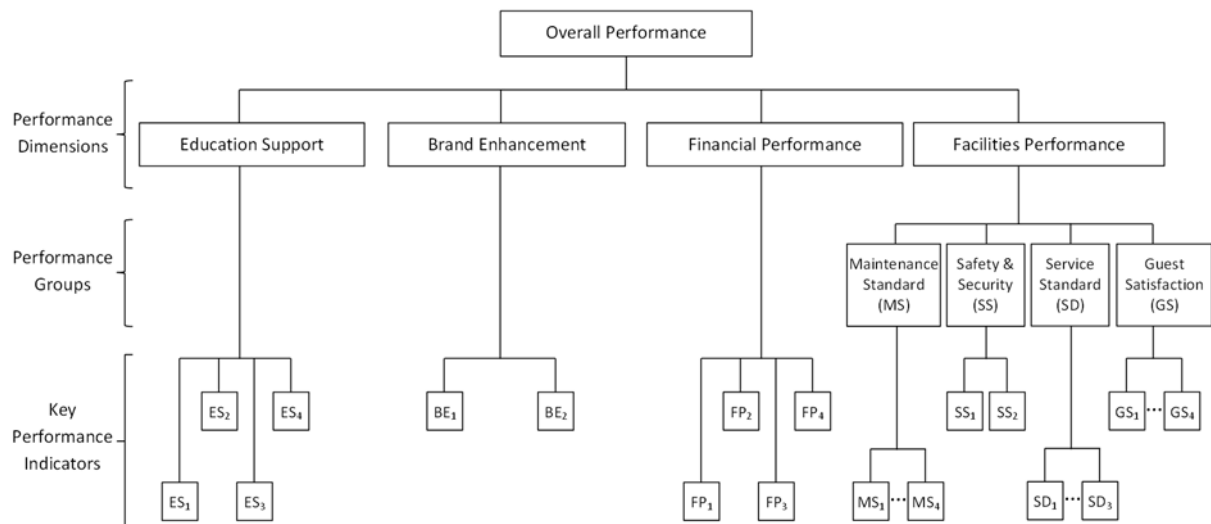


Fig. 3 Final hierarchy of the PMS

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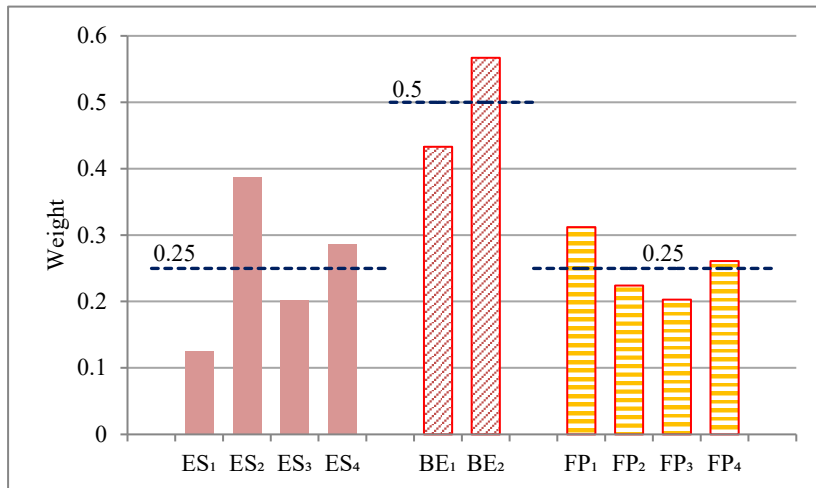


Fig. 4 Weights of KPIs under the ES, BE and FP dimensions

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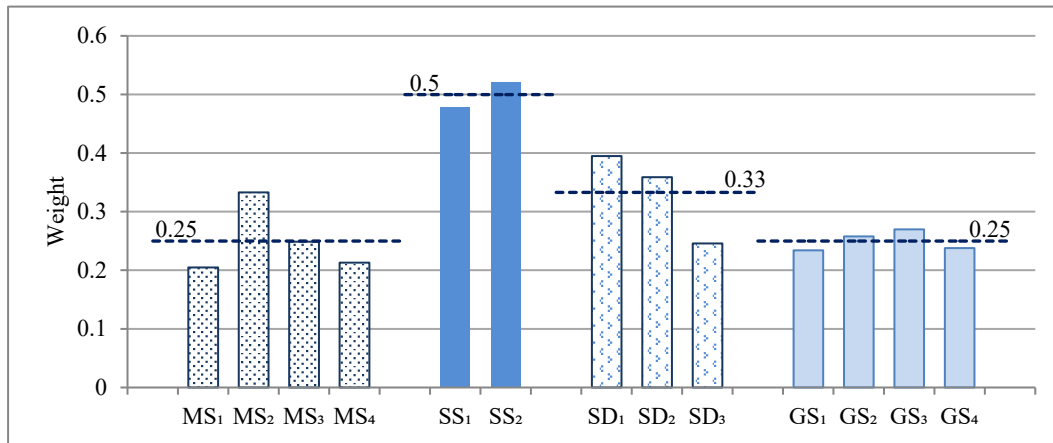


Fig. 5 Weights of KPIs in subgroups of the facilities performance dimension