Maintenance Cost Index for Egyptian Hotels: An Exploratory Study
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Abstract

In the hotel industry maintenance is important despite of its complex processes as its effectiveness will directly affect the quality of hotel service and have direct effect on guests' impression of the hotel. in the same time, the costs of operating and maintaining the hotel engineering systems must be properly monitored and controlled in particular the in-house manpower, out-source contracts, energy consumption and equipment deterioration.

There are limited literatures available regarding the hotel maintenance cost analysis, This is what urged the researcher to conduct this study which aims to develop a hotel maintenance cost index, to compare hotel maintenance costs and the distribution of this cost over the different maintenance approaches and in-house and out-sourced strategies among the three, four, and five-star hotels.

The quantitative research methodology of the interview was conducted with hotel's chief engineer or maintenance supervisor in three, four, and five-star hotels in Egypt (via-phone interview). The study revealed an index benchmark number that could be used to compare maintenance operations cost in three, four, and five-star hotels which also could be used in planning hotels maintenance expenditures if we know the value of this expenditure in other hotel categories.

Keywords: Maintenance costs, Outsourcing, Maintenance Approach, Maintenance Cost Index

Introduction

Hotels are one of the main pillars of the tourism industry. They provide tourists with the essential physiological needs. Hotel Customers typically have a high expectation on service quality and can easily be upset by unsatisfactory services. Maintenance of the hotel facilities is significant as its effectiveness will directly affect the quality of services, which have direct and significant effect on satisfying customers' wants and expectations (Lai and Yik 2012).

The services rendered directly by hotel workers, such as receptionist or room attendant is critical in hotel customer satisfaction, but the functions served by the engineering and maintenance department in a hotel are no less critical to keeping customers satisfied. Unsatisfactory performance of such facilities can render weak services and erode the hotel reputation and profitability (Chan 2008).

The importance of maintenance and engineering facilities in hotels has been well recognized for a long time (Lai 2013). It is also known as a key guest satisfaction component of hotels (Mattila and O'Neill 2003). Also the adoption of maintenance strategy appear to be critical, especially if we consider the global competition and strict cost control to minimize expenditure, while sustaining the quality of services (Chan 2008).

Maintenance costs is one of the factors that must be well studied when selecting maintenance Approach, it can represent from 15 to 70% of total production costs (Bevilacqua and Braglia 2000). A proper maintenance Approach provides an effective tool for cost assignment and tracking cost efficiency, and better knowledge about major cost derivers would enable organisations to optimise the utilisation of resources in their planned maintenance activities (Chan 2008).

The present research aims to give hoteliers a maintenance cost index that can help judging the efficiency of hotel maintenance Approach and activities. The selection of inefficient maintenance

Approach has negative consequences on direct maintenance costs in an organization. Selection of most efficient maintenance Approach is an important issue that an organization is dealing with.

Maintenance Concept and Importance

Dhillon (2002) defined maintenance as *all actions appropriate for retaining an item/part/equipment in or restoring it to, a given condition*. Further, Maintenance has been defined as *the combination of technical and associated administrative actions intended to retain an item or system in, or restore it to, a state in which it can perform its required function* (Standardization 2006).

Many hotels think of maintenance as an inevitable source of cost. For these hotels, maintenance operations have a corrective function and are only executed in emergency conditions. Nowadays, with the increasing technology's and machinery quantities and industry automation development, this form of intervention is no longer acceptable due to certain critical work concepts such as product quality, plant safety, and the increase in maintenance department costs (Bevilacqua and Braglia 2000).

Nowadays, maintenance issues are considered as vital elements for facilities to ensure the efficiency of performance (Hassanain, Assaf et al. 2015). The real purpose of maintenance and engineering is to reduce the adverse effects of breakdown and to increase the availability at a low cost, in order to increase performance and improve the dependability level (Simeu-Abazi and Sassine 2001).

In hotel industry, the proper operation relies on the availability of the engineering systems to provide water supply, lighting, air conditioning, laundry, and kitchen services. As hotels are operative for 24-hour operation all year round, the maintenance of the engineering systems is a complex process, and its effectiveness will directly affect the quality of hotel service (Chan, Lee et al. 2003).

GETACHEW (2017) stated that just like meeting a person for the first time, it takes hotel travelers less than 60 seconds to form an initial impression of a hotel or resort. Travelers may first take notice of the parking, signage, décor, carpet, or even the smell. Although each visitor is keyed to something different, each first impression is influenced by aspects of asset management and maintenance.

General Managers should be conversant with hotel maintenance management. This is because effective hotel maintenance should be viewed strategically. GMs are the ones leading the maintenance strategy. Big hotel chains follow this top-down approach successfully (Velmurugan and Dhingra 2015).

Maintenance importance

The proper operation of a hotel depends on the availability of the good engineering systems that provide air conditioning, water supply, lighting, transportation, laundry, and kitchen services. Hotels operate for 24-hour all year round, the maintenance of the engineering systems is a complex process, and its effectiveness will directly affect the quality of hotel service, food, and beverage (Aryee 2011).

One equipment failure might not cause an immediate loss of business, but it would eventually project on the established reputation and that in turn could affect business. Hence, development of an appropriate maintenance strategy is becoming more important, as greater reliance is placed on it to maintain high system availability and achieve satisfactory environmental conditions for

the occupants. Maintenance management plays a dominant role in improving energy efficiency and keeping the total costs optimal (Chan, Lee et al. 2003).

Maintenance Approaches
It is difficult to choose the best mix of maintenance Approach; the managers have to select the best maintenance approach for each piece of equipment or system from a set of possible alternatives (Bevilacqua and Braglia 2000).
Bevilacqua and Braglia (2000) also discussed five alternatives of maintenance policies/ approaches in his case study.
- **Corrective maintenance.** The main feature of corrective maintenance is that actions are only performed when a machine breaks down.
- **Preventive maintenance.** Preventive maintenance allows the maintenance engineer to define a periodic maintenance program for the machine and determine a series of checks, replacements and/or component revisions to overcome the problems.
- **Opportunistic maintenance.** This type of maintenance can lead to the whole plant being shut down at set times to perform all relevant maintenance interventions at the same time.
- **Condition-based maintenance.** A requisite for the application of condition-based maintenance is the availability of a set of measurements to monitor the machine performance. When these measurements point out an abnormal situation, the process administrator perform the necessary controls and, if necessary, stop the machine before a failure can occur.
- **Predictive maintenance.** In predictive maintenance, the acquired controlled parameters data are analyzed to find a possible temporal trend. This makes it possible to predict when the controlled quantity value will reach or exceed the threshold values. The maintenance staff will then be able to plan when, depending on the operating conditions.

According to Chanter and Swallow (2008), there are various categories of building maintenance as stated below:
- **Planned maintenance:** "The maintenance is well organized and carried out with forethought, control and the use of records to a predetermined plan".
- **Unplanned maintenance:** "The maintenance implemented without predetermined plan".
- **Preventive Maintenance:** "The maintenance carried out at predetermined intervals of time or period and intended to reduce the probability of failure or unsatisfactory performance of an item." This type of maintenance relies on the predicted probability that the system, equipment or even a part of it will breakdown in a specific period of time.
- **Corrective maintenance:** "The maintenance implemented after failure has occurred and intended to restore or repair an item to the state that can perform its required function".
- **Emergency maintenance:** "The necessary maintenance to be implemented immediately in order to prevent further damage or serious impacts on an item." For example, the repair of serious structural cracks in a building is necessary to avoid further cracking or collapse.
- **Condition-based maintenance:** "The preventive maintenance initiated as a result of knowledge of the condition of an item from routine or continuous monitoring and inspection".
- **Scheduled maintenance:** "The preventive maintenance implemented to a predetermined interval of time, number of operations, mileage and others." For example, change of light bulbs or tubes for best performance according to their lifetime.

Chan (2008) mentioned that maintenance activities/approaches in hotels can be broadly categorized as Routine, Corrective, Preventive and Emergency Maintenance. Routine Maintenance refers to the daily activities of a repetitive nature, such as taking meter readings,

lubricating, monitoring, and start-up / shutdown chillers and pumps, etc. Corrective maintenance includes scheduled or unscheduled activities to restore the facilities/ equipment to their as-built or normal functions. Preventive Maintenance includes scheduled activities of inspection, adjustment, replacement and overhaul to prevent unnecessary system breakdown with extension to its useful life. Emergency Maintenance refers to immediate actions taken to avoid further facilities / equipment failure, while avoiding adverse consequences such as loss of business.

In-House versus Outsourced maintenance
Maintenance work may be undertaken by the in-house technicians, outsource contract, or a combination of both based on the work nature and availability of resources. There are no general rules of desirable proportion on in-house to outsourced tasks (Chan, Lee et al. 2001).
Outsourced contractors are used for painting, electrical, carpet cleaning, maintenance of elevators, annual oiling of wooden floors among others which require special competence in the field of maintenance delivery, therefore they are hired when need arises. These services are also not needed every day and will be expensive to have stand-by technicians not doing anything (Lai and Yik 2012).
The factors that are extensively considered during outsourcing decision making includes; Time constraint, statutory requirements, skills of in house technicians, availability of in house technicians, use of specialized tools, financial constraints, degree of systems complexity, reduced operational cost and specialized competence of maintenance firms (Aryee 2011).

Maintenance Cost.
Expenditure on hotel maintenance has increased with a growth rate one-third faster than other hotel operating costs. Although a stronger focus has been placed on it (Pitt, Cannavina et al. 2016). Maintenance costs embrace all money consumed on a building to keep it up to an acceptable standard. The maintenance costs are increasing quickly over the facility service life. This quick rising of the maintenance cost in hotel building is influenced by many factors that make the estimation of such cost in advance difficult task for the maintenance managers (Ihsan and Alshibani 2018).
Many researchers addressed the factors affecting maintenance cost such as (El-Haram and Horner 2002, Al-Khatam 2003, Lai and Yik 2008, Ali, Kamaruzzaman et al. 2010, Sanjeev, Jauhari et al. 2012, Hassanain, Assaf et al. 2013). And limited researches tried to set a benchmark or index number for maintenance cost especially in hotel industry (Chan 2008, Róka-Madarász, Mályusz et al. 2016)
Planning the maintenance activities and allocating constrained budgets required to carry such operations in advance are difficult tasks for the maintenance managers (Ihsan and Alshibani 2018). So, it is necessary to identify index numbers for hotel maintenance cost rationale to the hotel capacity parameters

Index Number
Aggarwal (2013) Define index number as quantitative measure of growth of prices, production, inventory and other quantities of economic interest. And Rao and Selvanathan (2016) define it as an abstract concept which is generally used to measure the change in a set of related variables over time or to compare general levels in these variables across different places.
According to Balk (2012) there are two methods of computing the index numbers:
(a) Simple index number and
(b) Weighted index number.

Simple index number again can be constructed either by – (i) Simple aggregate method, or by (ii) simple average relative's method. Similarly, weighted index number can be constructed either by (i) weighted aggregative method, or by (ii) weighted average relative's method. The choice of method depends upon the availability of data, degree of accuracy required and the purpose of the study.

METHODOLOGY

In order to achieve this research aim and establish an index number of hotel maintenance cost in three, four, and five-star hotels in Egypt that can help us evaluate the hotel maintenance Approach. A questionnaire was designed to collect information from hotel maintenance manager (Executive Engineer/ Assistant executive Engineer).

The questionnaire comprises three sections. The first section contains the hotel data covering the hotel class (star category), number of rooms and number of maintenance staff in the hotels. Section 2 deals with maintenance payroll and expenditure spent in supporting the hotel business. Section 3 gathers the current maintenance approach, in-house and outsourcing labor force for maintenance.

This research used the index number concept to establish a generic value that can be used to compare hotel maintenance cost in the three, four, and five Stare Hotels.

Researchers used the ***Simple Average of Relatives Method***; where the data would be converted to respective maintenance cost per guestroom, payroll per guestroom, relative proportions of in-house and outsourced costs and maintenance cost index (MCI) will be calculated. Index number were calculated by finding the ratio of the current value to a base value consider that the value of the three-star hotels are the base value.

Research Population and Sample Size

This research is limited to the three, four, and five Star hotels in Egypt. As these categories usually have well-established working strategies for maintenance activities, while one and two star hotels almost don't have even a maintenance department and depend on out of the house skilled technicians to do only corrective maintenance tasks.

The total number of three, four and five-star hotels in Egypt according to Egyptian Hotel Association website in July 2019 is 598 Hotels, these hotels are divided over the hotels categories as in the following table

Table 1: Number of hotels Hotels in Egypt

Hotel Category	No of Hotels	Percentage of total hotels
3 Star Hotels	250	26.46 %
4 Star Hotels	194	20.53 %
5 Star Hotels	154	16.30 %
Total	598	63.29 %

Egyptian Hotel Association website:
http://www.egyptianhotels.org/statistics.aspx visited in September 2019

Sample size was calculated using Taro Yamane sample size equation (Yamane 1973)

$$n = \frac{N}{1 + N * (e)^2}$$

Where;

N: The population size = 598

e: The acceptable sampling error = 0.05

The calculated Sample size n = 240 Hotels

stratified Sample was used to select hotels participated in this research; as hotels were divided into clusters according to the star category, then a simple random sample were selected from each cluster. 280 hotels were contacted by phone to complete the number of hotels needed in the sample size (240 hotels).

Table 2 : Number of hotels included in this research from each hotel category

Hotel Category	No of Hotels	Sample size
5 Star Hotels	154	62
4 Stare Hotels	194	78
3 Star Hotels	250	100
Total	598	240

Results and Discussion
Hotel Category analysis
The number of hotels needed in each stratum was calculated using Taro Yamane sample size equation (Yamane 1973).

Figure 1 : Percentage of Hotels category Included in this research
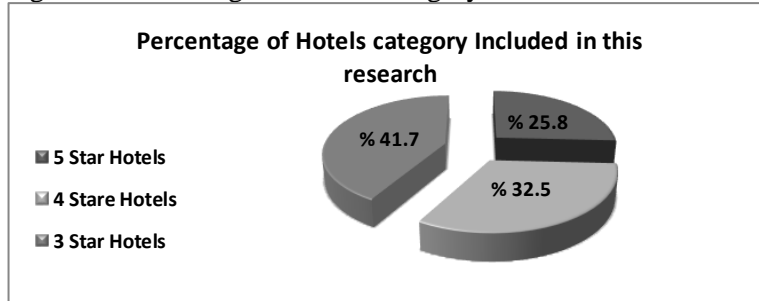
Only 100 three-star hotels were included in this research representing 41.7% of total sample size, while four-star hotels were 78 hotels representing 32.5 % of total sample size and five-star hotels were 62 hotels representing 25.8% of total sample size.

Maintenance Cost per Room

Table 3: Annual maintenance cost per room

Hotel Category	Annual maintenance cost per room in LE			
	maximum	Minimum	Average	Index
3 star Hotels	10,769.00	4405.80	7,500.40	100
4 star Hotels	25,380.50	5216.00	20,225.35	107
5 stare Hotels	64,955.70	6315.50	20,225.35	270
overall Hotels	64,955.70	4,405.80	12,670.50	169

The study revealed that; the average annual maintenance cost per room is LE 12,670.50. 5-Star hotels have the highest annual maintenance cost with an average of LE 20,225.35 per room, Followed by the 4-star hotels where annual maintenance average cost is LE 20,225.35 per room, then comes the 3-star hotels where the annual maintenance average cost is LE 7,500.40 per room.

To compare the annual maintenance cost per room among three, four and five star hotels researcher used the index number concept which indicated that 4-star hotels index number is 107 with an increase of maintenance cost per room = 7% of the three-star hotels. And 5-star hotels index number is 270 with an increase of maintenance cost per room = 170 % of the three-star hotels.

That means for each LE 100 spent on hotel room maintenance in three stare hotels, LE 107 could be spent on hotel room maintenance in four stare hotels and LE 270 could be spent on hotel room maintenance in five stare hotels.

Chan (2008) discussed maintenance performance and cost index in major hotel operators in Hong Kong. He argued that hotel maintenance cost is $ 11,614.67 per room p.a. he also reveals that 5-Star hotels have the highest maintenance cost with an average of $ 19,231.50 per room p.a., then the 4-Stars and then the 3-Stars.

Average Maintenance payroll per Room

Table 4: Average annual maintenance payroll per room

Hotel Category	Average annual maintenance payroll per room			
	Maximum	Minimum	Average	Index
3 star Hotels	3,780.00	1,680.00	2,022.22	100
4 star Hotels	6,264.00	3,654.00	3,967.20	196
5 stare Hotels	15,120.00	9,072.00	7,560.00	374
overall Hotels	15,120.00	1,680.00	4,516.47	223

As it is shown in table (4), the study indicated that; the average annual maintenance payroll per room is LE 4516.47. Five Star hotels have the highest annual maintenance payroll per room with an average of LE 7560.00, Followed by the four star hotels where average annual maintenance payroll per room is LE 3967.20, then comes the Three star hotels where the average annual maintenance payroll per room is 2022.22 LE.

Index number in table (4) shows that 4-star hotels index number is 196 with an increase of maintenance payroll per room = 96% of the three-star hotels. And 5-star hotels index number is 374 with an increase of maintenance payroll per room = 274% of the three-star hotels.

That means each 100 LE spent on maintenance payroll in three stare hotels, 196 LE could be spent on maintenance payroll in four stare hotels and 374 LE could be spent on maintenance payroll in five stare hotels.

Maintenance Cost Distribution (In-house and Outsourcing)

Table 5:Maintenance Cost Distribution (In-house versas Outsourcing)

Hotel Category	Maintenance cost distribution (%)			
	in-House	Index	Outsourced	Index
3-star Hotels	76.00	100	24.00	100
4-star Hotels	48.00	63	52.00	217
5-star Hotels	65.00	86	35.00	146
Average	63.00	83	37.00	154

The study agreed with Aryee (2011) who stated that a combination of in- house and outsourced contactors are used by most hotels now. But the study also revealed that; the maintenance of 3-Star hotels is largely performed by in-house staff (76 percent in-house versus 24 percent outsourced), while 4-Star hotels outsource more maintenance works (48 per cent in-house versus 52 per cent outsourced), and 5-Star hotels fall in between (65 per cent in-house versus 35 per cent outsourced).

This is dis-agreed with Maley, Kowalkowski et al. (2015) who examine the choice of in-house operations vs buying maintenance in the Swedish mining industry through a qualitative case study approach, he reported that; the firms' approach toward outsourcing appears to be related to their size. The two large Firms outsourced around 80 percent of their maintenance, the middle-sized Firm outsourced around 90 percent, and the start-up Firm outsourced nearly 100 percent.

Index numbers for maintenance cost distribution indicated that if 3-star Hotels spent 100% of maintenance cost in-house, 4-star hotels will spend 63% of this cost (maintenance cost in 3-star hotels) in house and 5-star hotels will spend 86 % of this cost in house. And if 3-star Hotels spent 100% of maintenance cost on outsourced contracts, 4-star hotels will spend 217 % of this cost (maintenance cost in 3-star hotels) on outsourced contracts and 5-star hotels will spend 146 % of this cost on outsourced contracts.

Maintenance Cost distribution cross Maintenance Approaches

Figure 2:diferencess of Maintenance Cost distribution across Maintenance Approaches
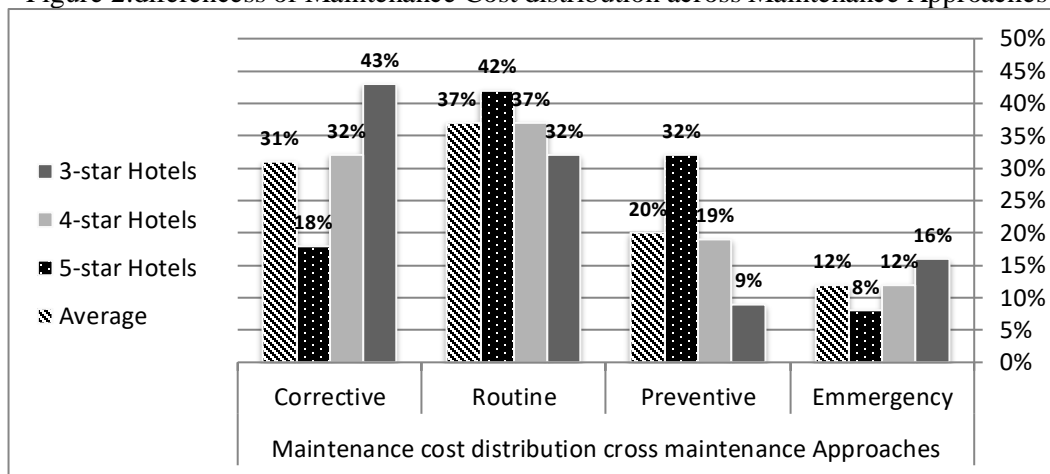
The study revealed that 3-star hotels spend its maintenance cost on a mix of hotel Approaches/activities composed of 43% of corrective activities, 32% of routine activities, 9% of preventive activities and 16 % of emergency activities. While 4-star hotels maintenance cost mix composed of 32% of corrective activities, 37% of routine activities, 19% of preventive activities and 12% of emergency activities, and 5-star hotels maintenance cost mix composed of 18% of corrective activities, 42% of routine activities, 32% of preventive activities and 8% of emergency activities.

3-star hotels have the highest average cost of corrective maintenance activities and the lowest average cost of preventive maintenance activities that reflect the characteristics of its unplanned maintenance Approach which leads to more breakdowns and stoppage periods. While 5-star hotels have the highest average cost of routine and preventive maintenance activities and the lowest average cost of emergency maintenance activities that reflect the characteristics of its planned maintenance Approach which leads to less breakdowns and rare emergencies.

Chan (2008) also indicated that maintenance cost of Hong Kong Hotels are quite a substantial cost distribution (37 per cent) is deployed to Routine Maintenance, then Corrective Maintenance (31 percent), then Preventive Maintenance (21 per cent) and then finally Emergency Maintenance (11 per cent), which is an unavoidable item.

Conclusion

The cost of operation and maintenance in buildings, and particularly in hotels represents a major part of the total cost of the constructed facility. 5-star hotels have the highest average maintenance cost per room which represent 251% of the 3-star hotels maintenance cost per room, followed by 4-star hotels where its maintenance cost per room represent 104 % of the 3-star hotels maintenance cost per room.

Most hotels use a combination of in- house and outsourced maintenance strategies, and there are no general rules of desirable proportion on in-house to outsourced tasks but 4- star hotels have the highest level of outsourcing of maintenance tasks, it represent 217% of 3-star hotels maintenance outsourcing.

Hotels don't apply one maintenance Approach; they apply a mixture of approaches according to their resources and available facilities. There is a clear difference among hotel categories regarding the hotel mix of maintenance strategies and the distribution of this maintenance cost. 5-Star hotels which have the highest annual maintenance cost per room, apply a mix of maintenance approaches that have the highest average cost of routine and preventive maintenance activities and the lowest average cost of emergency maintenance activities. While 3-star hotels which have the lowest annual maintenance cost per room, apply a mix of maintenance Approaches that have the lowest average cost of preventive maintenance activities and the highest average cost of corrective maintenance activities.

Implications and Further Studies

The study revealed that there is a great difference among hotel categories regarding the distribution of maintenance cost. 5-star hotels mostly sue in-house maintenance operations and focus on preventive and routine maintenance Approach, while 4-star hotels spend most of its maintenance cost on outsourced contracts and have a balanced mix of maintenance Approaches.

These differences do not refer to the number of rooms as researchers used index numbers and data converted to respective maintenance cost per guestroom. This assures that hotel size or number of rooms is not the factor affecting the hotel maintenance cost distribution, and more studies are needed to identify the factors affecting the hotel decision of maintenance Approaches suitable mix, and hotel maintenance outsourcing decision.

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