Cost decision making in building maintenance practice in Malaysia

Azlan Shah Ali

Department of Building Surveying, Faculty of Built Environment, University of Malaya, Kuala Lumpur, Malaysia

Abstract

Purpose – The main purpose of this paper is to systematically identify important factors that are considered in decision making of maintenance cost and discuss how these factors affect maintenance performance.

Design/methodology/approach – This paper employs triangulation technique, which combines quantitative and qualitative approaches. The paper starts with the identification of dominant factors through literature reviews followed by semi-structured interviews with ten building managers and questionnaire survey. A set of questionnaires are distributed to 200 selected buildings managers in Malaysia. The results from 62 completed questionnaires form a database for the quantitative analysis.

Findings – This paper concludes that the maintenance performance suffers from the insufficient allocation of maintenance cost. The main factors that are usually considered by the building managers in allocation of maintenance costs are availability of funding, client’s preference, and economic situation. Associative test results reveal that variance in maintenance cost could be improved by considering condition of building and complaint about building performance during decision making of maintenance cost.

Practical implications – This paper provides information for building manager on important factors that need to be considered during decision making of maintenance cost allocation. This would help the manager improve effectiveness and accuracy in preparing a maintenance budget.

Originality/value – With the building maintenance sector in Malaysia being conditionally driven and usually carried out only when there is money, it is critical that organization make effective decisions on priority. This paper determines the most important factors in decision making of maintenance budget.

Keywords Decision making, Maintenance costs, Buildings, Malaysia

Paper type Research paper

1. Introduction

British Standard 3811:1984 defined maintenance as:

[…] the combination of all technical and associated administrative actions intended to retain an item in, or restore it to a state in which it can be perform its required function (Seeley, 2003).

In the Ninth Malaysia Plan (2006-2010), the government forecasted that the construction sector would have an average growth of 3.5 percent per annum. Besides civil engineering infrastructure projects, the building sector is forecast to become the main contributor to the growth. The government will inject almost 19 billion Malaysia Ringgit during the next five years. This allocation includes the provision for repair and maintenance projects. The development plan allocation for repair and maintenance works increased from RM296 million during the Eighth Malaysian Plan to
The CIDB (2007) reported that in year 2006 repair and maintenance works constituted 16 percent of the total Malaysian construction output. However, repair and maintenance works carried out are unreported, especially those undertaken by house owners who have carried out illegal renovation works. Therefore, if this figure is taken into account, the actual value of repair and maintenance works in Malaysia would be higher.

Despite mentioning importance of maintenance, the industry is facing increased cost of maintenance activities. Lee (1996) noted that in the previous decade, up to 50 percent of the construction budget in the USA was spent in the form of repair and maintenance works for buildings. The US national average spending was about 25 percent of the new construction spending. This indicates that the repair and maintenance sector is important in the USA.

The quality of maintenance activities is however, influenced by the amount of budget allocated. To have good maintenance actions and to sustain the required level of the quality of a building, sufficient resources such as staffing and finance are needed for maintenance works (Lee and Scott, 2009). Therefore, it is the responsibility of maintenance stakeholders such as building manager, building owners and clients to give additional importance to the allocation of maintenance cost in order to produce good maintenance outcome (Mjema, 2002).

Maintenance activities are personnel-intensive and the costs of maintenance personnel constitute the largest parts in the maintenance costs (Mjema, 2002). Other parts of maintenance costs are contributed by equipment parts, building materials, consumable items, and overhead.

Preparing estimates for maintenance cost allocation is complex and difficult. The types of factors that need to be considered in decision making of maintenance cost allocation vary for the existing significant building. The nature of such maintenance works are difficult to predict in term of final content, extent, and specification. When preparing the cost plan, it is essential to gain advice from experts where the nature of the work involves any issues of technicality of any part of the building.

By identifying the dominant factors, it provided more information regarding the maintenance cost of buildings. Besides, this would be able to assist building managers to familiarize on the degree of risk and uncertainty that need to be mitigated in the future. In literature reviews, there is no empirical study investigating on the dominant factors that affect the decision-making process with regards to the maintenance cost. Therefore, the main objective of this paper is to identify the dominant factors that have been considered by building managers in decision-making process of maintenance cost and shows their relationship towards the maintenance performance.

2. Decision making in maintenance cost
Rahmat (1997) defined decision making as a study of identifying and choosing alternatives based on the values and preferences of the decision maker. Decision making is an essential element to building maintenance works. Decision making is universally accepted as the central role of building management. Some management authors argue that decision making is synonymous with management. Hence, it is important to examine the decision-making process in allocation of maintenance cost especially on the relative involvement of various maintenance stakeholders (Rahmat, 2008).
In maintenance works, any decisions made have implications on cost, quality, duration, and resource allocation of the buildings (Ali et al., 2008). To produce good decisions, the quality and the amount of information available are critical. Since the decisions made during this process commit a large percentage of project funds, adequate and accurate information are needed in a timely manner. The quality of decision making depends on the accuracy and completeness of information. Kam and Fischer (2004) noted good decision making required informative formulation, clear evaluation, and quick re-formulation of alternatives. Without a sufficient amount of data, it is impossible for the maintenance stakeholders to make good decisions, especially during the inception stage of design when the quantity of data available is very limited.

Moreover, the maintenance stakeholders need to explore differences such as perception, expectation, languages, and work activities to avoid inaccuracies and mistakes in the decision-making process (Ali, 2008).

Ramly (2002) noted that the lack of maintenance knowledge on the part of building managers and inadequate building inspections could result in problems with implementation of maintenance works, which could cause deficiencies in decision making of maintenance cost. Besides, criteria that need to be considered in decision making of maintenance cost also need to be established explicitly. Therefore, the identification of criteria in decision-making of maintenance cost is paramount to ensure the quality of the decision outcome.

3. Research methodology
This study was designed with a triangulation technique, which combined the quantitative and qualitative approaches (Hammersley and Atkinson, 1983; Ali, 2008). Semi-structured interview were used for qualitative part whereas for quantitative, questionnaires surveys have been used for data collection method. In order to get a high-response rate, the questionnaires were short and simple and did not take much time for respondents to answer. Sample of the questions asked are shown below:

Please indicate the degree of importance of the following variables in cost decision making in building maintenance works of the building:

- Existing building condition
  - Least important
  - OOOOO Very important
- Building age
  - Least important
  - OOOOO Very important
- Availability of funding
  - Least important
  - OOOOO Very important

The respondents in this study were building managers, clients or any parties who are directly involved in decision making of building maintenance cost. A set of questionnaire sent to the final list of 205 respondents. After filtration made from 71 replied questionnaires, 62 questionnaires found to be useful for analysis, giving a response rate of 30 percent. The replied questionnaires represent 62 different buildings that the build-up area is more than 50,000 square feet. Demographic profile of the respondents is shown in Table I. The profile shows almost two-third of the respondents was building managers. The result also indicates that nearly 95 percent of them had more that ten years of experience in building maintenance works.

For qualitative part, the data were analysed together with the discussion in ranking analysis to complement the answers. This is in order to make a discussion more realistic. In the discussion, the researcher highlighted the number of occurrence of the
subjects issued during the interviews. This approach of analysis has been used by Rahmat (1997).

For statistical data analysis, associative tests were use in deriving conclusion of the study. This test is to express a relationship between two variables (Ruyon, 1977; Lind et al., 2003). In this study, the associative test was used to check significant relationships between decision-making variables and design performance variables.

4. Factors considered in decision making of maintenance cost
Through literatures, the author had identified six dominant variables that are associated with the decision making of building cost. The variables are:

(1) existing building condition;
(2) building age;
(3) complaint received regarding building performance;
(4) client’s request;
(5) availability of funding; and
(6) safety and health requirements.

4.1 Existing building condition
The existing conditions of buildings were assessed through several ways. One of the easiest methods is by using visual survey. The exterior of each building structure was viewed from the ground level and all important information would be documented and some areas of deterioration are noted through annotated sketches and plans. However, with recent new technology, detecting building defects would be more effective by implementing non-destructive test (Pitt, 1997; Lee and Scott, 2009). For instance, detecting a rusty steel bar is by using scanning instrument. By implementing visual inspection only, not many things about the condition of building can be discovered (Yiu, 2008). Ali (2008) argues that any allocation of maintenance cost must consider existing conditions of a building. This is because decision maintenance is complex and the best solution is by referring to the existing conditions of the building. Hence, factor of existing building condition need to be considered during the decision-making process of maintenance cost.

4.2 Building’s age
Age of building provides important indication on level of maintenance service required. Lateef (2008) argues that one of the important elements that need to be considered in allocation of maintenance resources is the building’s age. In order to know the future image of building, building manager needs to offer right service so that the building has competitive advantage. Services given must meet expectation in response

<table>
<thead>
<tr>
<th>Position</th>
<th>n = 62 (in percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building manager</td>
<td>69</td>
</tr>
<tr>
<td>Client</td>
<td>15</td>
</tr>
<tr>
<td>Consultant</td>
<td>10</td>
</tr>
<tr>
<td>Others</td>
<td>6</td>
</tr>
</tbody>
</table>

Table I. Demographic profile of the respondents
to time, delivery schedules and within the agreed performance indicator. In general, the older is the building, the more attention and focus to special maintenance works need to be carried out. Based on the consideration of life cycle management and facility management which are connected to each other, maintenance works such as a major refurbishment and retrofitting of building equipments need to take place when a building has reach its economic life span. To implement this, large allocation of money is required from the building owner. Therefore, the building stakeholders need to consider this factor during their decision-making process of maintenance cost of a building.

4.3 Complaint received regarding building performance
Inefficient maintenance works could invite complaints by the building users. Users are normally looking for a comfortable space in a building. This includes well functions of building equipments, clean environment, and safe. If buildings do not fulfil the user’s needs, complaints with regards to maintenance performance would be made by the users. Therefore, in formulating decision with regards to maintenance cost, element of user’s satisfaction is vital and need to taken into consideration (Lateef, 2008; Government Malaysia, PWD, 2009). This data are considered important in which the building manager would investigate and try to figure out the reason for the complaints. If the complaint due to non-performance of building equipments or other services, more attention is required to maintain those problem. To do that, more allocation is needed to perfectly maintain the system. Hence, this factor is vital to be considered in the decision making of maintenance cost.

4.4 Client’s request
Client refers to the owner of a building. The client is the one who provides maintenance finance and a project brief in the early stage of maintenance works. Quality of client’s brief would influence the building performance. Boyle (2003) notes that the key successful of design is rests much with the clients besides others such as a good budget. Poor briefing and breakdown communication always happened when the client is not committed in the maintenance works. Some of the clients, they have set organization strategies, corporate image and identity. To achieve that, a part of maintenance allocation has been put aside to fulfil those requirements (Ali, 2008). This becomes dilemma to a building manager to make decision when the budget allocation for maintenance work is limited and there are other important factors that need to be taken into account.

4.5 Availability of maintenance funding
A most trying constraint from the design point of view is the budget allocation. Boyle (2003) noted that most important factor contributing to successful maintenance work was a sufficient budget allocated for a project. The project fund must be sufficient to ensure the maintenance works could run smoothly. One of the reasons clients initiated changes in maintenance planning was due to limited allocation of budget. Moreover, Tilley and McFallen (2000) claimed that insufficiency in a maintenance fund could affect the maintenance performance. The maintenance brief prepared by the clients should reflect the amount of funds allocated for buildings. A limited project fund could result in low-quality parts being used for buildings, which was incompatible with existing equipment parts. Hence, the clients must be committed in providing resources
such as financial and management supports. A committed client would ensure project resources such as financial are sufficient for a project. This is important towards the successful of maintenance works. The clients should be certain on their financing cash flow requirement when the maintenance works started. The lack of ability of the clients to provide faster decision often creates problem to the maintenance works.

4.6 Safety and health requirements
Safety and health are command factors influenced in the decision making of maintenance works (Lee and Scott, 2009). This is because building maintenance works can lead a risk to maintenance personnel and building users. It is the responsibility of building stakeholders particularly the manager to ensure that health and safety assessments and safety work procedure are documented. This as a guideline to the maintenance personnel who perform maintenance works in buildings. In addition, control measures need to be available and implement when undertaking the maintenance activities (Ali, 2008; Hashim, 2004). However, to implement and control safety and health in maintenance works demand monetary support. Safety equipments such as harness, glove, shoes, etc. need to be available when they are required. This is to prevent accidents and work-related health and safety. Hence, some portion of maintenance budget need to be put aside in order to cater safety and health needs.

5. Maintenance performance
The measurement of performance is important in providing an indicator of the level of success and for improving the quality of work. Salter and Torbett (2003) mentioned that the measurement of performance could lead to innovation and comparativeness. Without an indicator to measure products, it is difficult for the individual or organization to improve their product wisely. With the performance measurement, participants especially the building manager could tell their client whether the building maintenance was running well, was profitable and when the necessary action could be taken for improving the maintenance performance before the end of the year.

In measuring performance, some of the indicators that are normally used are time and cost. Johnson (1995) found that most practitioners agreed that performance is typically categorized in terms of schedule, cost, and functionality. Meanwhile, Sidewell (1990) maintained that variables with regard to money and effort hours were suitable in measuring the performance. Therefore, the element of cost is used in measuring maintenance performance of buildings. The maintenance performance is calculated using variance from actual and planned cost for building maintenance works.

6. Data analysis and discussion
Researchers have used descriptive and inferential approaches in analysing data in this study. Table II shows the ranking of priority based on mean readings for the decision-making factors in allocating maintenance cost. To rank some of the variables, calculation of central tendency using the mean was carried out. Five-point scale used in the questionnaires was transformed to mean readings to determine the ranks of each variable, following the procedure used by Egbu (1994).

The results indicate that existing building condition was considered to be the most important factor considered in decision making of maintenance cost. In contrast, safety and health were rated the least important among all the other factors.
The complaint received regarding building performance ranked second in the analysis; thus, it could be considered important as a factor that needs to be considered in cost decision making for maintenance works. This finding reconfirmed the statement by Ramly (2002) who said that allocation of maintenance budget must refer to the complaints made by the building users. Maintenance works require much information from the users who is more familiar about their needs than the building owners. Thus, poor information by the building manager needs to be avoided since it is a major factor to interfere accurate decision in allocation of maintenance cost.

It is interesting to note that safety and health score lowest. This result contradicted Ramly (2002) and Hashim (2004) who mentioned that safety and health must give high priority in any decision making made with regards to maintenance cost allocation. In the semi-structured interview, nine building managers in the Kuala Lumpur revealed that safety and health is not a main priority in deciding allocation for maintenance cost. There are other elements they considered important in the decision-making process such as customer's complaints, investment return, etc. The result implies that safety and health consciousness among building maintenance stakeholders are still lacking. In industry, other factors such as profit and high-building performance are considered more important during the decision-making process.

To check significance relationship between decision-making factors and maintenance performance, associative test using Spearman rank correlation coefficient has been used for the analysis. The decision-making factors were recoded ascending from the least important to the very important. In contrast, the performance variables recoded opposite. Thus, the result expected to show negative correlations that indicate more important is the factor in decision-making process the higher is the maintenance performance. The results of the associative test are shown in Table III.

<table>
<thead>
<tr>
<th>Factors considered in cost decision making</th>
<th>Mean (n = 62)</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing building condition</td>
<td>4.31</td>
<td>1</td>
</tr>
<tr>
<td>Complaint received regarding building performance</td>
<td>3.73</td>
<td>2</td>
</tr>
<tr>
<td>Building age</td>
<td>3.33</td>
<td>3</td>
</tr>
<tr>
<td>Client's request</td>
<td>3.32</td>
<td>4</td>
</tr>
<tr>
<td>Availability of funding</td>
<td>3.01</td>
<td>5</td>
</tr>
<tr>
<td>Safety and health requirements</td>
<td>2.72</td>
<td>6</td>
</tr>
</tbody>
</table>

Table II.
Analysis of results based on means for the decision making factors in allocation of maintenance cost

<table>
<thead>
<tr>
<th>Variables</th>
<th>Cost variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing building condition</td>
<td>−0.378*</td>
</tr>
<tr>
<td>Building age</td>
<td>−0.067</td>
</tr>
<tr>
<td>Complaint received regarding building performance</td>
<td>−0.308*</td>
</tr>
<tr>
<td>Client's request</td>
<td>−0.148</td>
</tr>
<tr>
<td>Availability of funding</td>
<td>−0.130</td>
</tr>
<tr>
<td>Safety and health requirements</td>
<td>−0.053</td>
</tr>
</tbody>
</table>

Note: *Correlation at 5 percent significance level
In the associative test, null hypothesis rejected at 5 percent significance level. In other words, the probability of error in rejecting the null hypothesis is 5 percent. The null (H0) and alternative (H1) hypothesis set as follows:

\[
H_0. \quad \text{There is no correlation between the decision-making factors and maintenance performance.}
\]
\[
H_1. \quad \text{There is correlation between the decision-making factors and the maintenance performance.}
\]

Result of the associative test indicates that there are two significance correlations detected. The factors are “existing building condition” and “complaint received regarding building performance.” Therefore, reject null hypothesis and accept the alternative.

7. Conclusion

Literature review identified six dominant decision-making variables, which affects the performance of maintenance works. The result of associative test shows two significant correlations between the decision-making factors and cost variance. This indicates that the maintenance performance suffered from inaccuracy decision made in the maintenance cost allocation. The significant factors are “existing building condition” and “complaint received regarding building performance.”

References


Boyle, G. (2003), Design Project Management, Ashgate, Burlington, NC.


Further reading


Corresponding author

Azlan Shah Ali can be contacted at: asafab@um.edu.my

To purchase reprints of this article please e-mail: reprints@emeraldinsight.com
Or visit our web site for further details: www.emeraldinsight.com/reprints