Influences of Key Stakeholders’ Involvement in Maintenance Management

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Abstract

Purpose – Proper maintenance management ensures a long-term investment and provides a support function in business continuity to achieve organisational goal. However, inadequate involvement and participation of key stakeholders in maintenance management limit the continuous improvement of maintenance performance. Currently, there is a lack of studies about the influence of key stakeholders’ involvement in maintenance. Thus, this paper deals with enhancement of maintenance management through the involvement of key stakeholders.

Design/methodology/approach – This research adopted mixed method approach to determine the relationship between involvement of key stakeholders in maintenance management and maintenance effectiveness. The approach comprised of literature review, questionnaire survey, and semi-structured interviews.

Findings – This research suggests a positive correlation between involvement of maintenance manager, maintenance staff, organisation, user and maintenance service provider in improving the effectiveness of maintenance management. The logistic regression analysis indicated that the involvement of maintenance manager and service provider are significant predictors of maintenance effectiveness. The research further identified that there was a lack of involvement of the user and service provider in maintenance management.

Originality/value – The research demonstrated that all key stakeholders should value the important roles of their participation in maintenance management to ensure an optimum return on a long-term investment. To create the awareness for the involvement of key stakeholders in building maintenance, studies on the advantages of participating in building maintenance and the impacts of ignorant towards building maintenance can be beneficial to the industry.

Keywords: maintenance; business performance; involvement; maintenance effectiveness; key stakeholders
Introduction

Malaysia has experienced rapid development in the construction industry, resulting in the increase of the built assets. The built assets require maintenance over their life cycle, which are currently not addressed. Improper maintenance in the past and the lack of awareness led to the poorly maintained buildings. The Government of Malaysia recognises the importance of building maintenance by allocating substantial resources for building repair and maintenance activities (Lateef, 2008). The increase in the allocation indicated the government’s commitment to strengthen facilities management. For example, the government has privatised the non-clinical support services in public hospitals to three facilities management firms in 1996, which were the largest facilities management contracts of all time in Malaysia (Kamaruzzaman & Zawawi, 2010).

However, increase in resource allocation without improving the management systems is not the strategic solution to optimise the allocation because it could lessen the maintenance backlogs, but it would not improve the productivity, user satisfaction and service delivery. Despite the substantial resources for building maintenance, there is no guideline or standard operating procedure as the blueprint to be referred and used by the building owners and public as a whole (Mohd-Noor et al., 2011). Consequently, the organisations often struggled with the lack of knowledge to implement an effective maintenance management.

To fulfil the maintenance needs of buildings, outsourcing their maintenance-related tasks to the maintenance management team are preferred by organisations. These organisations totally rely on the management team to provide maintenance services (Straub, 2010). However, in some situations, outsourcing the services of an entire function might be more expensive to the company and more risky from a strategic perspective (Dubbs, 1992; Hui & Tsang, 2004). An effective maintenance management requires the involvement of key stakeholders, including the organisation, maintenance manager and personnel, building users, as well as the maintenance service providers (Au-Yong et al., 2014a).

Although building and infrastructure stocks in Malaysia have increased significantly within the last two decades, the nation carries a stigma of “first world infrastructure but third world mentality” about the nation experience of poor maintenance quality (Al - Turki, 2011). Despite the government’s urge for the nation to improve their mindset towards better care of assets and higher involvement in maintenance activities, the involvement and participation in maintenance management are rather weak, and it limits continuous improvement of maintenance performance (Arca & Prado, 2008). Specifically, the absence of key
stakeholders in the development process or maintenance planning stage leaves some gaps either in analysing or in evaluating the maintenance strategies (Leong, 2005).

Currently, there is a lack of studies about the significance of key stakeholders’ involvement in maintenance, especially in Malaysia. Sinha (2015) highlighted that the previous studies focus more on solving maintenance problems with specific maintenance strategies; while the studies about involvement in maintenance are rather limited and neglected. In cognizance of the preceding, this paper aims to investigate the involvement of the key stakeholders in maintenance management and its influence on the effectiveness of building maintenance in Malaysia.

**The Involvement of Key Stakeholders in Maintenance Management**

The involvement of key stakeholders in maintenance management provides additional and different viewpoints, comments, opinions, suggestions and solutions over the maintenance activities (Low & Omar, 1997; Newig et al., 2008). However, this involvement requires the willingness of organisation, maintenance manager and personnel, building users, as well as service providers to commit and contribute to the maintenance management. Low (1998) posit that the organisation and management would benefit by accepting valuable and unexpected individual contributions. Furthermore, Arca and Prado (2008) emphasised that improvement of any project always rely on the participation and involvement of all related personnel throughout the planning, implementation and feedback stages.

Repetti and Prelaz-Droux (2003) identified the involvement, individual capabilities and coordination of all key stakeholders as dominant factors in improving the efficiency of maintenance management. The involvement should focus on information, knowledge and skill sharing, communication, and training for the key stakeholders. Similarly, Newig et al. (2008) described that the primary purpose of participation and involvement is to incorporate different sources of knowledge and to foster learning process. Rahmat and Ali (2010) further supported that the involvement of key stakeholders helps to improve communication flow and feedback systems. As a result, it leads to a better teamwork and job satisfaction.

Proper coordination and communication allow key stakeholders to express and discuss the demands, expectations, issues and problems regarding the existing maintenance program, as well as knowledge sharing (Goh et al., 2005). Furthermore, Lee and Scott (2009) argued that the relationship between organisations and maintenance personnel is fundamental as it would affect the outcome of building maintenance operation processes. For example, it is important to allow key stakeholders to exert influence on decision-making practices, so that
the experience, skills, knowledge, and competence can be shared among the key stakeholders (Rahmat & Ali, 2010). For the purpose of this study, the key stakeholders are defined as:

(a) Maintenance manager
(b) Maintenance staff (in-house staff employed by the organisation)
(c) Organisation (building owner-occupier)
(d) User
(e) Maintenance service provider (outsourced contractor that has contractual relationship with the organisation)

**Maintenance Manager**

Maintenance manager plays a significant role in maintenance management. According to Pintelon and Puyvelde (1997), the maintenance manager must be able to handle the entire management complexity in building maintenance which includes planning, purchasing, personnel, quality control, inventories, technical problems and budgets. In maintenance planning, the maintenance manager is not only responsible for the maintenance program but also on the impact of technological changes, economic factors and investment criteria (Pintelon et al., 1999).

Based on the factors and decisions obtained from the organisation and maintenance department, a maintenance manager would need to plan and organise actions to achieve the maintenance objective and resolve the existing problems. For instance, by arranging for a meeting that involves organisations, building users and maintenance personnel to share the knowledge and discuss the problems. Without an understanding of the needs of all parties, implementation of maintenance tasks might not match with the organisation’s objective (Kamaruzzaman & Zawawi, 2010). Acknowledging that the availability of services and facilities supports the organisation’s business critically, it is necessary for the maintenance manager to be aware of the organisational business objective, as he or she manages the maintenance resources such as the maintenance personnel, information, and others (Simoes et al., 2011).

**Maintenance Staff**

Maintenance staff that perform the maintenance tasks are one of the primary assets in maintenance management as evidenced by the substantial amount of budget allocation for staffing cost (Lai et al., 2008; Pandey et al., 2010). The maintenance staff performs the tasks based on the instruction from the maintenance manager. However, they should not be limited
to the instruction. Initiatives from the staff to notify and perform extra maintenance tasks are required to improve the maintenance performance (Mann et al., 1995). During the inspection and maintenance, they may identify the need of maintenance based on their technical skill and experience.

According to Kangwa and Olubodun (2003), one of the main barriers to effective maintenance management is the lack of skill and knowledge. They further explained that inability to determine the quality of work done by the maintenance personnel themselves might lead to adverse outcomes such as incompetency in detecting unwanted error and mistake made by them. Thus, the maintenance staff must develop their skill and knowledge continuously by participating in the relevant training (Groote, 1995).

**Organisation**

The organisation should clearly indicate its needs and requirements towards core business to ensure maintenance strategy is parallel to the organisation’s objective. The communication between the organisation and maintenance management team helps to set agreed-upon performance goals, allocate and prioritise sufficient resources or budgets, inform the management of policy and direction changes to meet these goals, and report the performance of meeting these goals (Amaratunga & Baldry, 2002). In fact, the organisations should consider all aspects that affect maintenance performance by using the life-cycle costing approach, instead of the initial cost alone (De Silva et al., 2004).

According to Goh et al. (2005), organisations’ feedback and opinion are one of the factors to generate effective communication. The involvement of organisations in the forms of comments and satisfaction is taken into account while formulating maintenance policy, allocating maintenance budget, as well as selecting maintenance strategy (Lateef, 2008). Furthermore, organisation’s involvement in maintenance management would create better understanding between the parties and help to avoid major disruptions in the maintenance activities (Rahmat & Ali, 2010).

**User**

Building users are the people who most frequently utilise building services and facilities in their daily activities. Douglas (1996) pointed out that the actual building performance often relates to the users’ abuse or misuse of building systems. For example, one of the significant deficiencies and irregularities on fire safety in buildings is the misuse of building and systems by users, such as the use of hose reel for car-wash (Yau et al., 2008).
The degradation of service components may reflect the level of care of building users towards the services rather than the effectiveness of maintenance programs.

Furthermore, Yik et al. (2010) observed that users’ perception of the service performance offers feedback on the users’ expectations. It is important to understand and control the users’ expectation and attitude towards the performance of building services and facilities. Thus, the building users play a crucial role in evaluating the effectiveness of maintenance management system (Oladapo, 2006). The maintenance management should encourage the involvement of building users by providing a platform to voice out their comments and opinions on the provided maintenance services so that the maintenance personnel could continuously improve the maintenance performance (Myeda et al., 2011).

**Maintenance Service Provider**

The involvement of service providers in maintenance management is necessary as it provides maintenance expertise that is often unavailable from the in-house maintenance staff (employed by the organisation). Similarly, technical documentation is necessary to select appropriate maintenance strategies and provide a diagnosis (Carnero, 2006). The service provider needs to provide complete documentation to the in-house staff. Furthermore, the service provider shall assist the in-house staff so that they can maintain the conditions of the system, such as lift, firefighting system, and others.

Undeniably, regular maintenance carried out by the service provider is likely to maintain or prolong the component lifetime. Therefore, maintenance and replacement under the recommendations of the service provider are necessary at times because the conditions of a building or system components affect the operation directly, and subsequent downtime is unacceptable (Arditi & Nawakorawit, 1999). To ensure efficient maintenance of the building services, a collaboration between the management and the service providers is essential (Au-Yong et al., 2014b).

**Maintenance Effectiveness**

Construction practitioners in Malaysia have begun to recognise the importance of building maintenance instead of focusing on new construction projects only. Thus, researchers start to study on the performance measurements of building maintenance. Numerous researchers have widely explored the formulation of maintenance policies and strategies. However, the effectiveness of the policies and strategies is still questionable (Kumar et al., 2013). Maintenance performance measurement is an assessment that helps to
evaluate the outcomes of the maintenance activities. Then, the management team can update the maintenance policies and strategies as well as continually improve the maintenance performance (Maletič et al., 2012).

The level of success or failure of schedule, cost and functionality determine the measurement of performance (Sidwell, 1990). Furthermore, Salonen and Deleryd (2011) argued that maintenance management is not only about the cost and budget because the impact of poor quality would also lead to undesired maintenance outcomes. Thus, the overall maintenance performance has to concern about the time (variance of planned and exact downtime), cost (variance of planned and exact expenditure) and quality of maintenance (Ali, 2009). The quality of maintenance commonly refers to the workmanship in maintenance. Nevertheless, Cao et al. (2015) argued that customer satisfaction critically reflects the maintenance and service quality. Meanwhile, Tätäilä et al. (2014) noted that maintenance effectiveness captures the extent of fulfilling customer requirements.

Most researchers focused only on one aspect of the performance measurements. Indeed, it is essential to consider various aspects when assessing the current best practice (Juuso & Lahdelma, 2013). Based on the preceding discussion, this study seeks to evaluate the overall maintenance performance (maintenance effectiveness) in the aspect of maintenance downtime variance (time), maintenance expenditure variance (cost), and customer satisfaction (quality). For example, maintenance is measured as not effective when the management team cannot achieve at least two (2) of the aspects.

Research Methods
This research adopted a mixed method approach that comprised literature review, questionnaire survey, and semi-structured interviews. This approach obtains data from different sources or methods, usually combination of quantitative and qualitative, to verify the data from a single source and best understand the research problems. (Creswell & Plano Clark, 2007; Hammersley & Atkinson, 1983; Morse, 1991). Firstly, the key stakeholders in maintenance management were determined through literature reviews and subsequently, close-ended questionnaires were drafted based on the theoretical framework developed from the literature findings (see Figure 1). The literature highlighted that the extent of key stakeholders’ involvement influences the effectiveness of maintenance management. Thus, questions to identify the degree of key stakeholders’ involvement were asked and then followed by the question about the maintenance effectiveness (see Appendix).
Next, the research identified the maintenance personnel who have been or currently involved in maintenance management of owner-occupied office building as research samples. Meanwhile, the selection criteria included building requirements which were high-rise office buildings (7-storey and above, as defined under Uniform Building By-Laws 1984) located in Klang Valley, Malaysia. The samples of the study were limited in Klang Valley due to the concentration of the high-rise office buildings in that area. Moreover, the maintenance practices in Malaysia are similar throughout the country. Overall, 398 office buildings met the criteria. Hence, the figure was determined as the research population. A set of the questionnaire was sent out to each building from the research population, and 132 sets of the valid questionnaire were returned, which gave a return rate of 33 percent. Hoxley (2008) stated that the questionnaire survey requires a minimum response rate of 30 percent to produce reliable and convincing results. The respondents were maintenance management personnel working in different office buildings. Eighty-two (82) percent of the respondents were building manager, building supervisor, and executive specialising in the planning and execution of maintenance management activities (see Table 1).

<table>
<thead>
<tr>
<th>Position</th>
<th>Frequency (N=132)</th>
<th>Percentage (N=132)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building manager</td>
<td>58</td>
<td>43.9</td>
</tr>
<tr>
<td>Building executive/ supervisor</td>
<td>50</td>
<td>37.9</td>
</tr>
<tr>
<td>Building technician</td>
<td>13</td>
<td>9.8</td>
</tr>
<tr>
<td>Others</td>
<td>11</td>
<td>8.4</td>
</tr>
</tbody>
</table>

Reliability analysis was conducted for the independent variables (involvement of key stakeholders in maintenance management) to enhance the reliability of the data. The purpose of this analysis was to check the consistency of the scale of data (Leech et al., 2011). The
Cronbach’s alpha coefficient test shows the coefficient for the variables was 0.747. The coefficient of more than 0.70 indicates good reliability.

Subsequently, a correlation test was used to measure the relationship between the involvement of key stakeholders in maintenance management and maintenance effectiveness through Statistical Package for Social Science (SPSS) (Diamond & Jefferies, 2006). Spearman rank-order correlation analysis is suitable to analyse either or both variables are ordinal (Graziano & Raulin, 2010). Then, binary logistic regression analysis was conducted to produce the prediction model for maintenance effectiveness. Whereby, the probability of an event is measured using logistic regression (Chua, 2009). The logistic regression function is as follows:

\[ Z = \beta_0 + \beta_1X_1 + \beta_2X_2 + \ldots + \beta_kX_k + \epsilon \]

Where,

- \( Z \) = latent variable
- \( X_1, X_2, \ldots, X_k \) = independent variables
- \( \beta_0 \) = constant
- \( \beta_1, \beta_2, \ldots, \beta_k \) = change in \( Y \) for a change of one unit in \( X_1, X_2, \ldots, X_k \) respectively
- \( \epsilon \) = error term

\( Z \) value is transformed using a link function to obtain the probability of the event occurring. Following is the link function to compute the probability of maintenance effectiveness:

\[ P [\text{maintenance effectiveness}] = \frac{e^Z}{1+e^Z}, \text{the value is between 0 and 1.} \]

Interview sessions with building managers with more than five years’ experiences in office building maintenance were carried out in the following stages to validate the questionnaire results. Semi-structured interviews were conducted to obtain further details and understandings about the involvement of key stakeholders in maintenance management towards maintenance effectiveness. For example, one of the interview questions was “Does the involvement of the maintenance service provider significantly influence the maintenance effectiveness? How it influences the effectiveness?” The interview allows the researcher to explore and uncover the respondents’ views in detail (Marshall & Rossman, 2006).

Various interview guides were used to eliminate the issues of response bias and reliability of data gathered through a semi-structured interview. Sekaran and Bougie (2009) noted that the willingness of individuals to take part in the interview might result in the response bias. Thus, before the conduct of the interview, the interviewer requested for the permission and willingness to participate from the potential stakeholders. A consent form was
distributed to the stakeholders to acknowledge their rights when participating in the interview. Besides that, an information sheet has been circulated and explained to the stakeholders at the beginning of the interview session. This information sheet consisted of the research brief and aim, participant’s requirements, and confidentiality statement.

Fifty-three (53) respondents from the questionnaire survey met the interviewee’s requirement. However, only fifteen (15) of them agreed to participate in the interview session. Apparently, the answers provided by the respondents reached a saturation after twelve (12) of them were interviewed, where the answers given by the respondents were similar and predictable without new information (Ali, 2009). Nevertheless, the interview session continued with all fifteen (15) respondents. Unlike the questionnaire survey, the interviewees were required to answer the interview questions and provide further explanation about the involvement of key stakeholders in maintenance management toward maintenance effectiveness.

Subsequently, the interview data were analysed in three main steps, namely data reduction, data display and drawing conclusions (Miles & Huberman, 1994). This analysis method involves a process of summarising and categorising the data in a matrix form and then, drawing conclusions from the analysis (Sekaran & Bougie, 2009). In this paper, however, only the summary of interview results and some quotations were transcribed into the discussion to validate the questionnaire survey result.

**Findings and Discussion**

In this research, hypotheses were formulated and then tested using correlation test. In the test, the null hypothesis was rejected at a significance level of 0.05. Therefore, the probability of error in rejecting the null hypothesis was 5 per cent. The null ($H_0$) and alternative ($H_1$) hypothesis are as follows:

- $H_0$. There is no significant correlation between the involvement of key stakeholders in maintenance management and maintenance effectiveness.
- $H_1$. There is a significant correlation between the involvement of key stakeholders in maintenance management and maintenance effectiveness.

The correlation analysis result revealed the relationship between involvement of key stakeholders in maintenance management and maintenance effectiveness as shown in Table 2. A correlation coefficient of fewer than 0.3 points to a weak relationship; a coefficient of 0.3 to 0.5 denotes a moderate relationship; and a correlation coefficient of 0.5 or more points to a strong relationship between two variables (Gray & Kinnear, 2012; Saunders et al., 2009).
However, SPSS determines significantly correlated variables with the significance value of 0.05 or below. The analysis indicated that all the independent variables significantly correlated to the maintenance effectiveness, namely:

- Maintenance manager
- Maintenance staff
- Organisation
- User
- Maintenance service provider

<table>
<thead>
<tr>
<th>Maintenance Characteristics</th>
<th>Maintenance Effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correlation Coefficient</td>
<td>Significance Value</td>
</tr>
<tr>
<td>Manager</td>
<td>.317**</td>
</tr>
<tr>
<td>Maintenance Staff</td>
<td>.309**</td>
</tr>
<tr>
<td>Organisation</td>
<td>.335**</td>
</tr>
<tr>
<td>User</td>
<td>.307**</td>
</tr>
<tr>
<td>Service Provider</td>
<td>.290**</td>
</tr>
</tbody>
</table>

**Correlation is significant at the 0.01 level (2-tailed)**

The involvement of maintenance manager in maintenance management significantly correlated with the maintenance effectiveness, with a coefficient of 0.317 (p < 0.05). The statement of Pintelon and Puyvelde (1997) was proven, which mentioned that the manager must be able to handle the entire management complexity in building maintenance. The organisations always acquire expert advice from the manager to make a maintenance decision. The manager acts as a moderator to distribute all the maintenance tasks in accordance with the decision. Therefore, close communication between the manager and other key stakeholders is necessary to ensure the effectiveness of maintenance works. For validation purpose, all interviewees acknowledged that building manager is responsible for gathering required information from other stakeholders to ensure effective decision-making for maintenance executions. One interviewee mentioned that:

“...building manager must closely communicate with his staff and organisation to make sure the works are done smoothly.”

Then, the correlation coefficient of 0.309 (p < 0.05) indicated a significant correlation between the involvement of maintenance staff in maintenance management and maintenance
effectiveness. Mann et al. (1995) stated that the initiative of the staff to notify and perform extra maintenance tasks is required to improve the maintenance performance. The statement matched with the analysis result, which demonstrated the importance of the staff involvement in maintenance management to improve the effectiveness. All interviewees suggested that provision of training was essential to enhance staff’s skill and initiative in performing their tasks. One of the interviewees acknowledged the importance of staff’s initiative in maintenance work that:

“...the technicians should do extra inspection rather than just follow the instruction of the manager.”

The correlation analysis computed a significant correlation coefficient of 0.335 ($p < 0.05$) between the involvement of organisation in maintenance management and maintenance effectiveness. Whereby, the involvement of organisations in the aspects of the comments and satisfactions is taken into account while formulating maintenance policy, allocating maintenance budget, as well as selecting maintenance strategy (Lateef, 2008). The result verified the importance of organisations’ involvement in maintenance management that creates a better understanding between the parties and helps to avoid major disruptions in the maintenance activities (Rahmat & Ali, 2010). Thirteen interviewees confirmed that organisation’s commitment to attend issues faced by the maintenance team was helpful to achieve better maintenance outcome. An interviewee highlighted that:

“...to expedite the maintenance progress, organisations must give full support in approving the maintenance tasks, especially respond to the maintenance related issues and requisitions regularly.”

Furthermore, the involvement of building users in maintenance management significantly correlated with the maintenance effectiveness, with a correlation coefficient of 0.307 ($p < 0.05$). In fact, the involvement of users is essential to obtain feedbacks on the satisfaction and expectation of maintenance programs, as well as to sustain the level of care towards the building and systems. The findings supported Oladapo (2006), who argued that building users play a significant role in evaluating the effectiveness of maintenance management system. For example, the building users can report to the management office immediately when they detect an abnormality in the lift operation. Therefore, the technician can examine and inspect the condition of the lift promptly. Then, remedial work takes place if necessary. Eleven interviewees stated that user’s feedback call for immediate maintenance action and further unwanted maintenance implication could be mitigated. An interviewee confirmed the result by claiming that:
“...immediate action can be taken to fix the problem that is notified by the users, as they use the systems frequently and able to observe abnormal conditions instantly.”

In most buildings, maintenance service providers look after various maintenance tasks. The analysis result indicated a significant correlation between the involvement of maintenance service provider in maintenance management and maintenance effectiveness, with a correlation coefficient of 0.290 (p < 0.05). The result verified the statement of Arditi and Nawakorawit (1999) that the maintenance services provided and recommended by the service provider are necessary to retain the good condition of building systems without jeopardising its daily operations. Ten interviewees noted that they always acquire advice from the service providers in regards to maintenance need and condition of building systems. An interviewee said that:

“...the in-house technician might not know everything, some of the maintenance works require the expert service provider to perform.”

The correlation analysis result demonstrated that the involvement of all key stakeholders significantly correlated to maintenance effectiveness. Subsequently, logistic regression analysis for maintenance was conducted by including the key stakeholders as its predictors. The analysis included all significant predictors (with a significant value of less than 0.05) in the model and excluded all insignificant predictors (with a significant value of more than 0.05) from the regression model.

In the analysis, maintenance effectiveness was coded with the value of 0 and 1. Whereby, “not satisfy” and “satisfy” were labelled as 0 and 1 respectively. By using the forward stepwise method, SPSS produced two steps to include the predictor that significantly contributed to the logistic regression model. Step 1 highlighted the involvement of maintenance manager is significantly predicting the probability of maintenance effectiveness with $X^2 = 20.48$, $p < .05$. Then, Step 2 computed the involvement of maintenance service provider with $X^2 = 7.63$, $p < .05$.

In this case, 25.8% of the variance in maintenance effectiveness could be predicted from the involvement of maintenance manager (MM) and service provider (SP). Whereby, the model predicted 76.3% and 57.1% of the cases for “not satisfy” and “satisfy” respectively. Overall, the model predicted 68.2% of the cases correctly. Furthermore, the p-value for Hosmer-Lemeshow goodness of fit was 0.323, which was more than 0.05. Thus, the model adequately fit the data. Then, the logistic regression equation was produced as follows (see Table 3):

$$Z = -5.099 + 0.864 \text{MM} + 0.599 \text{SP}$$
Table 3: Variables in the equation

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>S.E.</th>
<th>Wald</th>
<th>df</th>
<th>Sig.</th>
<th>Exp(B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1a</td>
<td>Manager</td>
<td>.921</td>
<td>.227</td>
<td>15.608</td>
<td>1</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>Constant</td>
<td>-3.512</td>
<td>.827</td>
<td>18.046</td>
<td>1</td>
<td>.000</td>
</tr>
<tr>
<td>Step 2b</td>
<td>Manager</td>
<td>.864</td>
<td>.236</td>
<td>13.425</td>
<td>1</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>ServiceProvider</td>
<td>.599</td>
<td>.226</td>
<td>7.020</td>
<td>1</td>
<td>.008</td>
</tr>
<tr>
<td></td>
<td>Constant</td>
<td>-5.099</td>
<td>1.097</td>
<td>21.612</td>
<td>1</td>
<td>.000</td>
</tr>
</tbody>
</table>

a. Variable(s) entered on step 1: Manager.
b. Variable(s) entered on step 2: ServiceProvider.

Overall, the involvement of all key stakeholders in maintenance management is critical to assure maintenance effectiveness. Thus, the findings reject the null hypothesis of the research and support the alternate hypothesis. The involvement of maintenance manager and service provider are significant predictors to the variance of maintenance effectiveness. Thus, the degree of all key stakeholders’ involvement was examined through ranking analysis. Table 4 shows the ranking analysis on the involvement level of key stakeholders in maintenance management. The mean score ranges from one (1) to five (5), which represents very low degree to very high degree of involvement respectively.

Table 4: Involvement level of the key stakeholders in maintenance management

<table>
<thead>
<tr>
<th>Rank</th>
<th>Variable</th>
<th>Mean (N=132)</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Manager</td>
<td>3.41</td>
<td>.980</td>
</tr>
<tr>
<td>2</td>
<td>Maintenance Staff</td>
<td>3.36</td>
<td>1.161</td>
</tr>
<tr>
<td>3</td>
<td>Organisation</td>
<td>3.34</td>
<td>.995</td>
</tr>
<tr>
<td>4</td>
<td>User</td>
<td>2.90</td>
<td>.987</td>
</tr>
<tr>
<td>5</td>
<td>Service Provider</td>
<td>2.90</td>
<td>.956</td>
</tr>
</tbody>
</table>

The involvement level of maintenance manager, maintenance staff, and organisation were satisfactory, with the mean score of 3.41, 3.36, and 3.34 respectively. Inevitably, the maintenance manager and staff involve themselves in maintenance management because this is the main scope of work for their job position; while the organisations always involve themselves in maintenance management to ensure their building is well maintained and hence able to support the organisation’s core activities.

On the other hand, the involvements of building user and maintenance service provider in maintenance management were less satisfactory and required improvement, where both indicated the mean score of 2.90. The building users of office buildings are usually the organisation staff or organisation customers. They do not have the sense of
belonging towards the buildings. Moreover, most of the maintenance work usually will not have a direct impact towards them. Thus, they are ignorant about the maintenance of the buildings.

Also, the maintenance service providers always try to avoid the maintenance involvement to a particular building as much as they could. Commonly, they have a service contract or agreement with many buildings or organisations. Unfortunately, there is no clear-cut statement about the degree of their involvement in the contract. The majority of them will only attend the maintenance inspections or tasks upon request by the organisations or the in-house maintenance personnel. They always perform minimal responsibility so that they have more time and opportunity to get more service contracts with other organisations.

Various actions are necessary to increase the involvement of key stakeholders, specifically the building users and maintenance service providers. First, the maintenance team should encourage the involvement of building users with an appropriate approach such as the post-occupancy evaluation (POE). Göçek et al. (2015) and Preiser and Vischer (2005) defined POE as a process of rigorously assessing the performance of buildings after the buildings have been constructed and occupied. According to Preiser and Vischer (2005), the evaluation takes into consideration the users’ feedbacks and opinions about the quality of maintenance, such as:

- Health, safety, and security,
- Functionality and efficiency of workflow,
- Visual aesthetic quality and satisfaction (social, psychological and cultural performance and fit).

The insufficiency of a service contract is one of the issues that lead to low involvement of the maintenance service providers in maintenance management. Indeed, selection of procurement methods for maintenance services is critical to ensure the best quality of provided maintenance services (Chua et al., 2015). Thus, the selection of procurement method and draft of agreement content must include the degree of involvement of the service providers in maintenance management. For example, the contract may cover the attendance of the service providers to the maintenance meeting organised by the organisations or in-house maintenance personnel.

To achieve an effective maintenance management system, the practitioners must encourage and promote the involvement of key stakeholders. Close communication among the key stakeholders is the medium to improve their involvement. In summary, the high
involvement of key stakeholders like maintenance manager and staff, organisations, building users, and maintenance service providers improve the effectiveness of maintenance.

**Conclusion**

The findings of the present research have proven that there is a significant relationship between building maintenance key stakeholders and maintenance performance in term of productivity and effectiveness. The key stakeholders, which include manager, maintenance staff, organisation, user, and service provider, are significantly correlated to the maintenance effectiveness, which supported the alternate hypothesis of the research. Moreover, the result highlighted the involvement of maintenance manager and service provider as the significant predictors of maintenance effectiveness. However, the study also revealed that there was a lack of involvement of building user and maintenance service provider in maintenance management. The maintenance team and organisation should create awareness among the building users of the importance of building maintenance and their role in maintaining a building. Also, all key stakeholders should be aware of their responsibilities in creating a better workplace. Without effective building maintenance management, the organisation’s goal might not be achieved. Improving the building maintenance management by having integration among the key stakeholders is essential to achieve optimum maintenance in term of cost effectiveness, service quality, work performance, and customer satisfaction. Therefore, it is vital for the government, building industry practitioners and Malaysian society as a whole to acknowledge the significant influence of key stakeholders participation and involvement in the maintenance management system so as to inculcate a better maintenance culture throughout the nation.

**References**


