Validation of building maintenance performance model for Malaysian universities

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ABSTRACT

This paper is part of an ongoing research on the development of systemic maintenance management model for Malaysian university buildings. In order to achieve this aim, there is a need to develop a performance model against which services are measure. Measuring performance is a significant part of systemic maintenance management service delivery. Maintenance organization needs to know where they are in order to provide user-driven services and to enhance productivity. Through "hypothetico-deductive" theory, this paper developed a 10 points matrix for the university maintenance organizations for measuring and improving their service delivery. The aim of this paper is to present the validated maintenance management model for Malaysian university maintenance organizations. The model is to guide and facilitate value added service delivery through initiating maintenance according to user value system rather than mainly on the condition of the building

Introduction

There are many complaints in the media and research literature that many of the university buildings in Malaysia are not performing optimally due to poor management philosophy. Put in another words, the maintenance organizations are not providing value added services. While there are many causes for this poor performance, it is debatable that there are lacks of performance indicators against which these organizations measure their outputs. Granted there could be problem of in-sufficient funds. But the main issue is due to poor management philosophy and principles. Therefore, this paper emerges based on the hypothesis that the presence and applications of maintenance metric is positively correlated with the maintenance services provided by the organization. The lack of these metrics would means that the maintenance organization would not be able to locate where they are. In other words, there will be problems of whether they are productive or not, how productive they are and if their users are satisfy with the services or not. Poor maintenance management systems will lead to unnecessary increase in maintenance costs and poor user satisfactions and low productivity, however. The objective of this present paper is to present the validated model of maintenance performance model. The remainder of the paper is arranged as follows. The provide information on the research design. In section III, the maintenance of university buildings is discussed. In section IV, a critical review of maintenance performance metric is provided. Section V presents the results of data collected for the validation. The discussion of the validated model is provided in section VI. Finally, the paper conclusion is drawn and presented in section VII.

Research Design

The main research of which this paper forms part found that there are problems with the university maintenance organizations in Malaysia. A hypothesis of the main research is

concerns with lack of metric against which maintenance services are benchmarked. However, in order to establish whether the services are to the satisfactions of the users or not, there is a need to develop such benchmark-maintenance performance matrix or MPM. This paper reports the validation of the MPM developed by Olanrewaju, Khamidi and Arazi (Olanrewaju, Khamidi and Idrus, 2010). In order to achieve this aim, the model was addressed to the most senior officers in development division, facilities department or maintenance division or as the case may be. The data collection for the validation commenced in September, 2010 and lasted through to December 2010. The questionnaire was prepared in English. The participants were asked to comments and offer suggestions on each of the matrix. Although, the list may not be exhaustive, they are indicatives of the criteria of the user value systems.

Although, the validation collects both quantitative and qualitative data, it relied much on open ended information. Therefore it strength lies in the insights it provides toward validating the model.

However, the data collation and gathering does not follows the typical process often used for qualitative research. The approaches used for the validation ranged from structured, semi structured to the structured interview. It is instructive to stress that the data collection and data analysis stages were kept separate from each other. The two are intermittingly, on going and complementary process (Mei, 2002), however. There are number of points to note about the approaches adopted for the validations. Firstly, the consents of the participants were received prior to the validation. The validation is done to survey questionnaire. Participants were sent the copy of the questionnaire through email. They were reminded that the validation of the model is part of the main research they initial involved in which they made their intention known that they

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wish to be contacted in future. The completed questionnaires were returned by emailed or though hand delivery.

University Building Maintenance

Government aimed to transform Malaysia into a high-income nation. Simplify put, the government wants Malaysians to have a better quality of life through better payment. However, in order to achieve this aim, there are the imperative to produce quality human resource; that is producing well grounded graduates that can compete nationally and internationally. In that regards, there is the need for functional universities. A functional university involves functional assets. University assets are finance, technology, human, equipments and plant as well as the constructed facilities (i.e. buildings). University education being labour intensive, human resource is it most significant resources. However, apart, from the human resources building is the most significant resource of a university institution. University buildings are procured to create suitable, conducive, and adequate environment to support, stimulate and encourage learning, teaching, innovation and research (Olanrewaju, Khamidi and Idrus, 2010)

Therefore, any inadequacy with the building facilities is loss of values to the university institution, users and other stakeholders. From the one hand, it is not possible to replace or rebuilt all university's buildings at a time. This is an illustration. The replacement costs of 1960s buildings in English universities alone are estimated to cost £11 Bn (Rawlinson and Brett, 2009)]. From the one hand, buildings cannot remain new throughout their entire life. In fact, before a building is completed, a maintenance problem starts to creep in. Therefore, the need for maintenance will only intensive. Building maintenance constantly affects everyone's life because people's comfort and productivity is relative to the performance of the building they live, learn, conduct research and work in (e.g. home, offices, schools, university and markets). There are sufficient literature to conclude that the current maintenance practices failed to link building performance with organisation mission and vision [Olanrewaju, Khamidi and Idrus, Jones and Sharp, 2007 and de Marco, Ruffa and Mangano, 2010).

Consequently, there is the need for a value based maintenance management. Organization that put value at the heart of its mission statement means that the organization is viewing their processes and products from concept to application and disposal from both the consumers and providers perspectives. From the other hand, maintenance is treated as an engineering issue and likewise it management. However, maintenance management should be entrepreneur-led. The mission statement or MS (the underlying purposes and values) of maintenance department should be to enhance users satisfactions firstly and then to improve productivity. The MS must be translated into SMART (specific, measurable, achievable, realistic and time bound) objectives. The maintenance organization will need to provide high quality services to their customers. In order to provide service with high standards, maintenance organization must continually benchmark their services with users' expectations and perceptions internally and externally.

Through the performance indicators it is possible not only, to evaluate the quality of the process, but also to indicate the improvements that can be made in the processes (Lordsleem,and Rabbani, 2010). One of the main function of the maintenance management is the assessment of services of maintenance service provider be it for the in-source or outsource

organization. See also Hoffmann and Schumann (Hoffmann and Schumann, 2010). However, this can only be done if there is compressive metric to measure the performance of their services delivery. If there is no established performance metric, maintenance service cannot be systemically optimized. In this situation, it will be difficult to make improvement since improvements with user satisfactions and productivity cannot be measured or monitored. How can we know whether we are there or not, it there is not a mean of reference? (Cain, 2004). In other words target must be set for service delivery.

Customer intimacy demands that companies must have sufficient and adequate knowledge of their customers' needs and wants. The service provider must look far beyond the immediate objectives of the products or services to the users. The providers must provide service that has a wider ends than customers experience, perceptions and expectations [8]. Strictly, maintenance is business. The maintenance department should be seen as business unit. It should be strengthen by including it in the university strategic business units (or USBUs). Irrespective of the nomenclature given to the roles of the maintenance organization-maintenance department, property division, facilities department, administration department, centre management unit, logistic and building department or asset management department-the common aim is the same. The main aim is that one organization takes the overall control and responsibility for managing the activities of the various personal or unit in the organization.

Maintenance Performance Matrix

There are literatures on the development of performance measurement for new built (Lordsleem, and Rabbani, 2010) and Wadugodapitiya, Sandanayake, and Thurairajah, 2010) and maintenance services (Shohet, 2010). The theory behind performance measurement is that completed building or maintenance service should be measured based on outcomes. In other words, the fundamental issue is not about the input per se, rather with meeting the clients / users functional requirements. This theory emerges based on the philosophy and understanding that buildings are capital good. Therefore, maintenance services should be initiated based on the same theory and philosophy (Olanrewaju, 2010). However, there are evidences that the current performance measurements are not conclusive.

They do not in any way link maintenance expenditure with business performance and most importantly with users' satisfactions. However, there is shortage of literature on performance measurement for the maintenance organizations. Furthermore, a review of literature would suggest the existing performance measurements are not specific for the maintenance organizations and what more not for the university organizations. Additionally, the existing models are more with maintenance technology; whereas in this current study it is concerns with maintenance service delivery. The MPM relies on the users' satisfactions for initiating maintenance and improvement in services deliveries. This is crucial because customers' satisfaction is a significant performance measurement metric (Kärnä, Huovila and Nenonen (2010). From, the one hand, while some of the university maintenance organizations have developed their methods of managing maintenance services, on the other hand, the weaknesses of these methods have well documented. In that respects, there methods are objects of criticisms. These criticisms includes the mission connection of buildings with university corporate mission, focus of short term perspectives, disregards for user experience and

focus on building conditions and placing much attention to financial benefits.

Data Analysis and Results

This section present the result of data obtained from the respondents. But initially it reports the background on the information service providers and users from which the initial model was developed. The model was developed based on the information and knowledge garnered from survey questionnaire. The questionnaire was divided into two parts. Specifically, a part of the questionnaire was addressed to the maintenance managers (as the service providers) and the university building users. The questionnaires for the service providers were administered on 50 maintenance managers of recognized universities in Malaysia and five hundred and fifty university building users (i.e. students). The data for the building users is limited to 3 public universities and two private universities. Descriptive, inferential and illustrative statistics were produced.

The response rate for the maintenance organization is 66% (n=33). This is considered satisfactory for postal survey. However, this high response rate was possible because of the long survey duration and the numerous remainders sent to the respondents. In the case of the building users, it is 81%. It should be mentioned that the respondents of users is limited to only the students. Students are preferred because they are larger users of the buildings. 17 of the universities surveyed were private university while the remainder of 16 was publicly owned universities. The survey also revealed that about 50% of them possessed Bachelor degree and 21.9% had obtained MSc degrees. Nearly, 32% of the respondents were actually maintenance managers while about 19% were facilities managers. Substantial pats of the "other" are director of development or and maintenance "executive" (this is another title / term for maintenance manager).

From the analysis of the survey, 52% of the universities spent less than RM10 million each on maintenance annually while about 10% spent about RM30 million each on maintenance per annum. Majority (42%) of the buildings were about 15 years old while only about 10% were between 30 to 50 years old. With regards with the building users fifty four percent of the respondents were female, while the remaining (46%) were male. The analysis revealed that about 74% of the respondents were from publicly owned universities. 26% of the students were from private universities. The results of the survey indicate that majority (40%) of the students were in their third years or year three which follows closely with those in their second years. Many (19.1%) of the responding students were in their first year. Only 6.3% were in year four while less than 1% were in the fifty years. The results further revealed that 1.5% (n=7) of the students were doing either master or PhD degrees. On the average the respondents have spent more than a year on the campus. More than 70% of the students live on campus while the remainders stay of the campus. The next provide brief information of the participant involved in the validation of the model.

The developed model was sent through email to 40 maintenance managers or director of developments. By end of the cut-off of date, only nine of the returned their completed questionnaire. However, it is quite unusual to conduct a validation exercise using questionnaire survey. This is because it is more common to use interviews where face-to-face clarification may be provided to the respondents. However, because of time and financial constraints, this paper based the

validation on the survey questionnaire. However, in some cases, telephone conversations were employed to seek further clarifications. It should be mention that the model presented here a just small of the main research. Altogether, replies of nine participants on the validation were reported here. Three of the respondents were from the public universities while the other five were from the privately owned universities. From the outcomes, the total number of buildings in the portfolio of the nine respondents is 975 while the size of the floor area totaled 2, 150, 000 square meters.

Table 1 contains the 10 points proposed generic MPM for a university organization. Based on the targeted value, a weekly, monthly or quarterly achievement will be computed. Simple descriptive and illustrative statistics is sufficient for easy understanding and meaningful comparison. On the bases of the outcomes of periodic achievement computation, assessment is made whether the target is achieved or not. Detail explanations on the applications of model have been explained elsewhere (Olanrewaju, Khamidi and Idrus, 2010)

Discussions of the Results

All the participants agreed in affirmative that a minimum of 4 on a continuum scale of five is acceptable or reasonable enough for all the buildings (building fabrics, structure or / services). In another words, a good service should be provided to the extent that users will not be satisfied only to the level of less than 4 point. Similarly, most of the participants concurred that a maximum of 10 complaints (of defects) is good enough. Although one of them believed it should in fact be reduced to less 5 complaints per month in buildings. However, it interesting to also found, that a participant does not agree, to this respondent, 10 should be the minimum because it affects their KPI.

One respondent also made us to understand that the "number of complaint does not reflect actual performance but rather time for solving" the complaint should be of critical important. Though the nature on complaints should be taken into account, because the building users (the students in particular) sometime complaint even where it is not necessary. This observation could sometime be the made case with specific reference with female students. Female students more particular compare with their male counterpart regarding the condition and performance of their buildings. However, with regards to the "ceiling level" we set for the maximum complaints in month per building. The pattern of response is not very much different from the one on the minimum complaints. As an illustration, while some agreed that the 100 complaints we set is realistic, some believed the 100 it too much but the same time, one of the respondent argued vehemently that it is not realistic to achieved that target. The respondent doubt there could not be a maximum limit because; it might put them under high stress. However, there will be the need relate size complaints with perhaps floor areas in order to provide common comparison.

All participants agreed that the RTC (response time to complaint) is very critical in service delivery. This indicated in their response to this aspect of the model. Some believe, 85% is bit on the higher scale but some argued it is acceptable enough because of the criticality of maintenance. In fact all of those that made their interests known indicate that at least 70% of the complaints must be responded to within 30 minutes. However, in our model, we set that 85% of complaints for the academic and administrative buildings must be responded within 30 minutes and for the residence (i.e. student hostels), 80% of the

complaints must be responded within the same time scale. In another regards, the participants also agreed that all complaints must be responded with 48 hours. However, a particular participant argued that the 48 hours to respond to all complaints is not realistic. However, the participant failed his to provide a convince case to the total objection.

The turnaround time to resolve complaints we set, was found to be reasonable. In fact, some of the respondents believed that the 80% we set for the turnaround time to resolve complaints in academic and administrative buildings within the same day should be 100%. In another words, the participants held that all complaints must be resolved on same day. The participants also believed that the 40% we set for residence is too low. That it should be closed to the same scale with that of academic and administrative buildings. However, a participant suggests, that in general the turnaround to resolve complaints "shall be priorities based on urgency and plan works to avoid unnecessary maintenance cost". In another aspect, the entire participants concurred with high confidence that that the maximum recurrent complaints should not be more than 5% of the total work executed in the entire buildings category. Similarly, all the participants concurred that more than 90% of engineering service should be based on planned preventive maintenance. These results are not however unexpected. In fact, our undisclosed hypothesis was that all mechanical and electrical will be based on planned maintenance.

With regards to the efficiency of work, our target values of 90% for academic and administrative and 85% for residence are realistic enough. Yet a participant opined that it should be subjects to various factors including skill workforce, materials and availability of fund. That notwithstanding, some of the participants further believed that the figure should be 100% in actual reality. While it might not be possible to achieve 100% efficiency with all works executed, these figures should be kept at the barest minimum. To this, all the participants concurred that it should not exceed 5% of the total work executed. In another words, at least 95% of the works must be efficient. Though as expected, all the participants held that all repairs must be efficiently maintained within 60 days. In other words, the 5% (or less) of the repairs must be rectified within 60 day.

By way of whether university should out-source or in-house must of the maintenance service, of the universities seem to prefer outsource maintenance services. We had set the target 80% for in-sourcing while the remainder of 20% to be out-sourced. These do not go down well with a good number of the university organizations. As illustration a participant wrote: "Dependent on what type of business you are. For Education Sector shall maintain less staff to cut cost on salary and fringe benefit etc. Lab Unit shall be in house to build their own strength on Equipment & Experts. Out-source more to reduce manpower overhead cost. Further we don't keep unskilled workers".

The closets target value the participants agreed with is that 40% be should in-house while 60% outsource. In fact, one participant revises out target values. Meaning to say, 80% of the maintenance service should be outsourced. This aspect of the data is however the most interest, though it not unexpected. While there are sufficient literature on the shortcomings of the outsourcing, universities have failed to see these. However, though most of the participants commend the model, one of the participants believed to the contract: "Your performance matrix

is too high a standard-may be suitable for a hotel or similar, but not for a university"

Conclusion and Further Research

Specifically, the main research aimed to develop Value-based Maintenance Management Model or VbMMM. VbMMM is an emerging management philosophy that is touted by its proponents to help maintenance organization to deliver satisfactory to buildings users, reduce maintenance backlogs, reduced maintenance costs and increase maintenance organization's productivity. Simply explained, VbMMM entail making managerial decisions and organization practices taking into account the complex criteria that influence maintenance, behavioural issues and organization objectives. While the model is specifically of university organization, the model can be used for all organizations that have substantial buildings in there portfolio. While the paper presented the outcome of the initial validation process, efforts are vigorously ongoing towards improving its robustness. Furthermore, explanations of each of the matrix are on going which will be reported as soon as it is completed. The matrix was designed to be dynamic and flexible, since no tool, regardless of its sophistication may predict future absolutely. However, the matrix is not an end in itself rather it is a means towards better maintenance management. Universities must align maintenance objective and maintenance policy with their corporate mission and vision. These will align maintenance standard with organization corporate objectives. The matrix assist is minimizing the amount of responsive and corrective maintenance the university needs to undertake. Thus promoting good maintenance management practices and at same making a significant reduction on maintenance backlogs and improve user satisfactions.

Acknowledgment

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TABLE I MAINTENANCE PERFORMANCE MODEL (MPM)

S.No	Metric	Location	Target Value	Monthly Achievement	Remark
1	Customer Satisfaction Survey	Administrative, Academic and Residential	Rating of 3.00 Minimum of4 (on scale of 5)		
2	Customers Complaints	Academic and Administrative	Maximum of 5 complaints / building		
		Residential	Maximum of 10 complaints / building		
3	Response Time To Complaints	Academic and Administrative	85% of customer complaints responded within 30 minutes of complaint received		
		Residential	80% of customer complaints responded within 30 minutes of complaint received		
4	Response Time To Complaints	Academic and Administrative	100% of customer complaints responded within 48 hours of complaint received		
5	Turnaround Time to resolve complaint	Academic and Administrative	80% of customer complaints resolved within same day		
		Residential	40% of customer complaints resolved within same day		
6	Recurring Complaint	Administrative, Academic and Residential	Max of 5% of total work order		
7	Engineering System Stability	Administrative, Academic and Residential	Min 90% planned preventive maintenance executed		
8	Efficiency of work order execution	Academic and Administrative	Min 90% closed		
		Residential	Min 85% closed		
9	Poorly executed work	Administrative, Academic and Residential	Max 5% work order rated as poor		
10	Efficiency of work order execution within 60 days	Academic and Administrative	100% closed		
		Residential	100% closed		
11	Procurement of maintenance works	In-source	Not less than 80%		
		Out-source	Not more than 20%		
12	Other, please specify				