Original Article

Appraisal of the building maintenance management practices of Malaysian universities

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ABSTRACT This article presents the results of a questionnaire survey conducted on the background information of an ongoing research. The article describes the characteristics, size and strategies of university maintenance departments. Questionnaires were administered on 50 university maintenance organizations. With a 66 per cent response rate, the findings suggest that though the expenditure on maintenance is inadequate, poor management of the resource and maintenance services are also contributing greatly to the poor service delivery, the spate of maintenance backlogs and poor user satisfaction. On the basis of the outcomes of the questionnaire survey and a literature review, a schematic value maintenance management model is proposed for university maintenance organization. The maintenance department should be regarded as a business unit. The significant impact it has on the university institution can be illustrated by reviewing it in terms of characteristics. It should be strengthened by including it as one of the university strategic business units. This will also make it more attractive and competitive. The department should not be seen as an engineering-led unit, but as a business-led unit so that it can be creative, innovative and competitive.

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INTRODUCTION

This article is part of an ongoing research that has, however, taken on a life of its own. There are many complaints in the media and research literature that many of the university buildings are not in an optimally operable condition. Although the factors leading to the poor building performance are varied and interconnected, much of the problems concern with the structure of maintenance organization. In fact, studies have shown that the maintenance departments are contributing to, among other things, unnecessary increases in maintenance costs, poor user satisfaction and increases in maintenance backlogs. Therefore, this study aims to examine the university maintenance organization in order to identify and assess the constraints, strategies and methods of the maintenance organization. In order to achieve this aim, the article has combined a literature review and the survey method. The questionnaire instrument was used for collecting primary data. Data obtained were analyzed by SPSS and Microsoft Excel for windows. The remaining part of the article is structured in four sections as follows. It begins with a literature review and theoretical framework in the following section. The next section provides a review of the significance of university buildings and the essence of maintenance, as well as the need for a major review of the way in which maintenance is managed. The subsequent section presents the research design and method of data analysis adopted for this study. In the section after that, the results and discussion of the analysis of primary data are presented. The penultimate section presents a proposed value maintenance management model. The article is concluded in the last section, which presents the summary and conclusion to the major findings and observations. The article argues for the need for radical changes in the maintenance management systems.

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

The Government aimed to transform Malaysia into a high-income nation. Simply put, the government wants the Malaysians to have a better quality of life through better payment. However, in order to achieve this aim, there is an urgent need to produce quality human resource; that is, producing well-grounded graduates who can compete nationally and internationally. On the other hand, apart from the faculty members, building is the most significant resource of the university institutions. The building provides values not only to the university organization, but also to the students, faculty members, parents, and other users and stakeholders. University buildings are procured to create a suitable, conducive and adequate environment to support, stimulate and encourage learning, teaching, innovation and research activities. There are sufficient studies to conclude that the performance of educational buildings has a significant impact on both student performance and faculty members' productivity (Fleming and Storr, 1999; Amaratunga and Baldry, 2000; Price *et al*, 2003; Green and Turrell, 2005; Leung and Fung, 2005; Pikutis and Seduikyte, 2006; Wong *et al*, 2006; Fianchini, 2007; and Lavy and Bilbo, 2009). Although new buildings help to upgrade educational facilities and provide better quality education, buildings cannot remain new throughout their life span.

Given that buildings cannot remain new throughout their entire life, a new building also requires maintenance. In fact, before a building is completed, maintenance problems start to creep in. Furthermore, it is not possible to replace or rebuild all buildings of an organization at one time. An illustration of this is replacement costs of the 1960s buildings in English universities alone, which is estimated to be in the range of £11 billion (Rawlinson and Brett, 2009). The value of a building decreases unless maintenance is carried out on the building. Therefore, the need for maintenance will only intensify. Building maintenance constantly affects everyone's life, because people's comfort and productivity are related

to the performance of the buildings they live, learn, conduct research and work in (for example, homes, offices, schools, universities and markets). University buildings are long-lived resources, with a duration of 100 years or more being common. Several studies have indicated the need to balance capital costs against the subsequent maintenance costs of the buildings, because a perceived saving today could lead to high maintenance costs in the future (Seeley, 1987).

Various definitions have been proposed for the term 'maintenance'. An example of a conclusive one is 'a processes and services to preserve, repair, protect and care for a building's fabric and engineering services after completion, repair, refurbishment or replacement to current standards to enable it to serve its intended functions throughout its entire life span without drastically upsetting its basic features and use' (Olanrewaju, 2010). From this definition, maintenance is not about the building *per se*; rather, it is about the building's occupants or users. This is the case because buildings are procured for the sake of the services (that is, comfort, protection, accommodation, security and esteem) they offer to the users. It is the correct functioning of the building that the users desire, not the physical condition of the building. To the extent that the building is capable of allowing the users to perform their functions, the building is a source of value creation to the required service of accommodating, learning, teaching and doing research with specific reference to university buildings. Naturally, this is where the definition of maintenance should stem from. Unfortunately, this is not often the case; instead, building fabric is assumed to be the object or mission of maintenance. Optimum building performance is the most desirable pre-requisite in any maintenance process.

The size and scope of university building maintenance in Malaysia is huge and at the same time is on the increase. From the available data, however, it can be seen that the annual government allocation for the maintenance of university buildings is only 1 per cent of the total allocation for the education sector. This is, indeed, inadequate to cater for the maintenance backlogs and to provide value-added services. In contrast, it may not be possible to proffer any lasting solution for the reduction of maintenance backlogs without a significant corresponding increase in the maintenance allocation. However, that will only address tactical issues rather than strategic issues. An improvement in maintenance management processes is what is really required. There is a need for shift from maintenance management principle to value-based initiative. Increasing the allocation without improving the management systems is just a tactical and false way out that will not create or add value to the investment. An increase in the allocation could only possibly reduce the size of maintenance backlogs, but it certainly would not increase productivity, service delivery and user satisfaction. The existing practice, whereby emphasis is focused on the (physical) building as the objective of maintenance, is unfortunate as it cannot ensure efficiency in resource utilization.

The building performances are related or determined by the maintenance strategy the organization apply. The performance of the building corresponds to the user's satisfaction. Selecting the appropriate maintenance procurement method is critical if there is an organizational desire to provide better service to the users and at same time increase the organization's productivity. Regardless of the nomenclature given to the roles of the maintenance manager (maintenance executive, property manager or general manager) or the maintenance organizations (asset management, facility management, administration department or development division), the intent is the same. The main issue is that an individual or organization should take the overall control and responsibility for managing the activities of the various personnel or departments.

RESEARCH DESIGN AND METHOD OF DATA ANALYSIS

A questionnaire survey approach was used to collect primary data. The questionnaire was developed on the basis of extensive literature reviews and a series of discussions with those concerned with university building management in Malaysia. The questionnaires were distributed to 50 universities in Malaysia. The sample size was initially drawn from a published data based on the Ministry of Higher Education (MOHE), but supplemented with information from the media (national newspapers) and catalogues. This is necessary as data from MOHE were not current. Although it was not the intention of the research to carry out a census, all the universities were involved in order to enhance the response rate.

A cover letter and the questionnaire were specifically addressed to the 'maintenance managers' of the universities. A set of questionnaires with the letter is posted to all respondents on the same day. A self-addressed, prepaid envelope was provided to facilitate return. Before the primary data collection, a pre-tested study was conducted to test the wording, ambiguities and ease of understanding of the questions. Data were analyzed with two types of software: SPSS and Microsoft excel for windows. Whereas SPSS was used to produce descriptive and inferential statistics, Microsoft excel was used for illustrative statistics. The data collection and collation commenced on July 2009 and lasted through to October 2009. This long period was a result of the respondents' inability to complete and return the questionnaires on time. The survey was initially intended to last for 1 month. But by the cut-off date, only 9 of the 50 had returned their completed questionnaires. Missing data (that is, where the respondent refused to tick where applicable or there was a multiple entry) could have negative impact on the outcome of the findings. However, such an effect could be improved during data analysis by replacing the missing data with either the mode or mean of the data. However, in this article, the missing data were not treated as such. Instead, the authors preferred to leave the data raw, as they were, so that the outcomes would not in any way be influenced by the authors. In the next section, the results and discussion of the primary data are presented, which is the outcome of the primary survey.

RESULTS AND DISCUSSION OF THE PRIMARY DATA

From the 50 surveyed universities, 33 responded. This represents a 66 per cent response rate. This is an excellent rate for a postal survey (Sekaran and Bougie, 2010). The survey responses were differentiated into two categories depending on whether they are from private or public universities. From the data analysis, 17 or 51.5 per cent are the private universities and 16 or 48.5 per cent are from publicly owned universities. The data analyses found that a majority (54.5 per cent) of the respondents who had completed the questionnaires were engineers (Figure 1). The respondents have sound academic backgrounds. Nearly 70 per cent of the respondents were degree holders (Figure 2). In fact, close to half of the respondents hold Bachelor's degrees, whereas more than 21 per cent of the respondents hold a Master of Science degree. None of the respondents holds a doctoral degree (PhD). A considerable (10.30 per cent) proportion of the respondents hold other qualifications.

Table 1 contains the cross-tabulation between the professional background and academic qualification. From the analysis, it is found that most of those possessing a Master's degree are engineers. Similarly, most of those who had obtained a Bachelor's degree are engineers. Many (42.9 per cent) of those who have Master's degrees are facility managers.

On the basis of the respondents' position, most (42.4 per cent) of the respondents belong to 'other' positions (Figure 3). Those from the other positions indicated that their

Figure 1: Distribution of respondents' professional background.

Figure 2: Distribution of respondents' highest academic qualifications.

Table 1: Cross-tabulation between professional background and highest academic qualification

Professional background	Respondent's highest academic qualification			Total (%)
	Bachelor's degree (%)	Master's degree (%)	Other (%)	
Quantity surveying	6.3	0.0	0.0	3.0
Engineering	43.8	57.1	70.0	54.5
Building surveying	6.3	0.0	0.0	3.0
Facility management	31.3	42.9	20.0	30.0
Other	12.5	0.0	10.0	9.1
Total	100.0	100.0	100.0	100.0

positions were those of director of development and maintenance executives. Many of the respondents were maintenance managers ($n=10$). Table 2 shows the work experience of the respondents. More than half of the respondents have been working for more than 5 years (54.4 per cent). The remaining 46 per cent have less than 5 years of work experience. More specifically, nearly 20 per cent of the respondents have more than 15 years of work experience. Therefore, it could be inferred that the majority of the respondents have satisfactory work experience to provide the required information.

Cross-tabulation analysis was performed on the professional background and position of the respondents. The results are shown in Table 3. The table reveals that 10 of the 14 respondents who hold other positions had an engineering background. Interestingly, a majority ($n=4$) of the facilities managers had a professional background in facilities

Figure 3: Distribution of respondents' position.

Table 2: Distribution of respondents' work experience

Work experience (years)	Frequency	Percentage
Less than 5	15	45.5
5–10	7	21.2
10–15	5	15.2
15 and above	6	18.2
Total	33	100.0

Table 3: Distribution of cross-tabulation between professional background and position of respondent

Respondent's latest professional background	Respondent's current position					Total
	Facilities manager	Maintenance manager	General manager	Administration manager	Other	
Quantity surveying	0	0	0	0	1	1
Engineering	2	4	2	0	10	18
Building surveying	0	0	0	0	1	1
Facility management	4	4	0	0	2	10
Other	0	2	0	1	0	3
Total	6	10	2	1	14	33

management. Most ($n=4$) of the maintenance managers had a background in engineering. In addition, all ($n=2$) those holding the position of general managers were engineers. Many ($n=2$) of those occupying other positions had a background in facility management. The only respondent holding the position of administration manager belonged to the other professional background category. The results were, however, surprising, theoretically. It was expected that those who claimed to be maintenance managers would have backgrounds in maintenance management or, at best, in either facilities or asset management. With these, their experience in maintenance would be in doubt. Maintenance management is not yet a core course for the engineering programmes, at least at the undergraduate degree level. However, it is possible for the respondents to have attended some short courses or vocational training to complement their backgrounds.

Table 4: Distribution of ANOVA test

Source	Type III sum of squares	df	Mean square	F	Sig.	Partial eta squared
Corrected model	45.922	9	5.102	1.154	0.368	0.311
Intercept	208.685	1	208.685	47.189	0.000	0.672
Qualification	0.672	2	0.336	0.076	0.927	0.007
Background	33.555	4	8.389	1.897	0.145	0.248
Qualification and background	8.407	3	2.802	0.634	0.601	0.076
Error	101.714	23	4.422	—	—	—
Total	584.000	33	—	—	—	—
Corrected total	147.636	32	—	—	—	—

Table 5: Distribution of size of the university built area

Built-up area (m ²)	Frequency	Percentage
Less than 40 000	7	21.2
40 000–50 000	5	15.2
60 000–70 000	2	6.1
70 000–80 000	1	3.0
90 000–100 000	3	9.1
100 000 and above	15	45.5
Total	33	100.0

The ANOVA test was performed to determine whether the respondent's position depends on their academic qualification and professional background. The results of the tests are shown in Table 4. The results indicated that there were no relationships between the variables. In other words, the positions of the respondents are not determined by their academic qualifications and professional backgrounds. However, there is a moderate relationship between the three variables. This is indicated by the *Partial eta* value of 0.311. The value for the within-group sum of squares (intercept) is 0.672, which means that there is considerable variance in the respondents' positions.

From the result shown in Table 5, nearly 50 per cent of the universities that participated in the survey occupied more than 100 000 m² built floor area. Many (15.2 per cent) of the universities occupied about 45 000 m². About 21 per cent of the university actually occupied less than 40 000 m². The mean score for the floor area is 5.18 and the standard deviation is 3.1. The standard deviation indicates that some of the university floor areas were relatively small whereas others were large. From the mean score value, a university covered about 80 000 m² floor area on the average. The standard deviation implies that a large university could occupy as much as 320 000 m² floor area. From Figure 4, it is gathered that 50 per cent ($n=16$) of the universities spent less than RM10 000 000 annually each on maintenance (USD1=RM3.15). Many (40.6 per cent, $n=13$) of them spend about RM15 000 000 to maintain the buildings. Although one of the universities spent between RM20 000 000 and RM30 000 000, only two indicated spending between RM30 000 000 and RM40 000 000 on maintenance. The mean score for the budget was found to be 1.66 and the standard deviation was found to be 0.83. From the mean score value, it was gathered that, on average, a university spent close to RM20 million a year on maintenance over the past 5 years.

ANOVA was carried out to determine whether a relationship exists between the annual maintenance and size of the university built-up area. It would be expected that universities with large built-up areas spend more on maintenance. The results of the ANOVA test are contained in Table 6. Although the post test was not performed for the size of the built-up

Figure 4: Annual maintenance budget (RM).

Table 6: Distribution of ANOVA on annual budget and built-up area

Source	Type III sum of squares	df	Mean square	F	Sig.
Corrected model	0.871	5	0.174	0.223	0.949
Intercept	43.219	1	43.219	55.225	0.000
Size	0.871	5	0.174	0.223	0.949
Error	20.348	26	0.783	—	—
Total	109.000	32	—	—	—
Corrected total	21.219	31	—	—	—

area because one of the criteria has fewer than two cases, unexpectedly the results indicate that there is no relation between built-up area and budget. However, could the insignificance be a result of measurement errors? Perhaps could it be due to the effect of the sample size? Could it be that the buildings were newer, built with high-quality materials and/or good workmanship was used for their construction (and design)? Theoretically, it is expected that significance exists. However, a likely reason for this outcome is the sample size. The 33 per cent response rate might be inadequate to provide the required effect for the test. This is because it could be expected that a university with a large floor area would absorb more funds on maintenance as compared to those that occupy a small floor area. However, this might not be so in the case of the buildings in large university being newer and competently built, and using quality materials and components. This is not evidence to conclude this. However, older buildings constructed of well-established materials and components and using well-tried and tested techniques (and which in all probability have been updated and improved) may not be subjected to heavy maintenance works or expenditure. Nonetheless, considering the previous information, the last arguments might not be plausible.

Respondents were asked about the methods used for estimating their maintenance budget. The results are shown in Table 7. From the results, most (45 per cent) of the universities estimate their maintenance budget for the next year, by determining how much was spent this year and add a certain percentage, often in the range of 10–30 per cent, to the succeeding budget. Many of the universities also carry out inspections to identify defects, on the basis of which the budget estimate is established. A considerable number also based their estimates on how much the university actually gets. Private universities in Malaysia are owned by corporate organizations that have other chains of businesses. However, maintenance expenditure for public universities is actually catered for by MOHE, Malaysia. Maintenance expenditure does not depend on university allocation in the real sense; however, it is worth pointing out that many of the universities carried out

Table 7: Distribution of method of estimating annual maintenance budget

<i>Method</i>	<i>Yes (%)</i>
Based on previous expenditure	45
Based on inspection	29
Based on university budget	20
Other methods	6
Total	100

Table 8: Distribution of maintenance procurement strategy

<i>Method</i>	<i>Frequency</i>	<i>Percentage</i>
In-house	3	9.1
Outsource	7	21.2
In-house and outsource	22	66.7
Other	1	3.0
Total	33	100.0

Table 9: Distribution of cross-tabulation between ages of buildings maintenance procurement system

<i>Average age of buildings (years)</i>	<i>Maintenance procurement system preferred by a respondent</i>				<i>Total</i>
	<i>In-house</i>	<i>Outsource</i>	<i>In-house and outsource</i>	<i>Other</i>	
Less than 10	1	1	7	1	10
10–20	1	4	8	0	13
20–30	0	2	4	0	6
30–40	1	0	1	0	2
40–50	0	0	2	0	2
Total	3	7	22	1	33

inspection for the determination of their maintenance budgets, although the details of the inspection process are not evident. It is, however, unfortunate that most based their budget estimate on the previous year's budget plus allowances for the coming year's budget. This approach is a 'recipe for disaster' (Buys and Nkado, 2006).

Table 8 displays the maintenance strategies of the responding universities. On the basis of the results on the age of the buildings in the university assets portfolio, most (40.6 per cent) of their buildings are about 15 years old. This is followed with less than 10 years old (31.3 per cent), and a sizeable proportion are between 10 and 20 years old. Fewer than 7 per cent of the buildings are between 40 and 50 years old. The standard deviation was 1.11 and the mean score value for age of the building was 2.1. These results were interpreted to imply that in reality some buildings are older, whereas some are relatively new. The mean score value shows that on average the age of all the buildings ranges between 20 and 30 years (that is, 25 years).

Seven of the 10 universities with buildings less than 10 years old combined outsourcing and in-house strategies (Table 9). Similarly, 8 of the 13 universities with buildings about 15 years old (10–20) also combined their procurement system. The same also goes for universities with buildings between 20 and 30 years old. However, most ($n=4$) of the universities that outsource all their maintenance services were universities with buildings aged between 10 and 20 years old. One of the universities also claimed that it used another method to procure its maintenance service, although the university in question failed to indicate the name of the method. It is interesting to observe that universities with

Table 10: Distribution of full-time employees

<i>Employees</i>	<i>Frequency</i>	<i>Percentage</i>
Less than 30	19	59.4
30–60	3	9.4
60–90	2	6.3
110–140	2	6.3
140–170	6	18.8
Total	32	100.0

Table 11: Cross-tabulation of full-time employees and age of buildings

<i>Size of full-time employees</i>	<i>Age of buildings (years)</i>					<i>Total</i>
	<i>Less than 10</i>	<i>10–20</i>	<i>20–30</i>	<i>30–40</i>	<i>40–50</i>	
Less than 30	8	10	1	0	0	19
30–60	1	1	0	0	1	3
60–90	0	1	1	0	0	2
110–140	0	0	1	0	1	2
140–170	1	1	3	1	0	6
Total	10	13	6	1	2	32

buildings older than 30 years do not outsource all their maintenance services. It could be interpreted that the older universities have over the years developed their maintenance organization. In other words, based on their experience, in-house maintenance is their preferred choice. However, from the ANOVA test results, there is no statistical evidence to conclude that the age of buildings depends on procurement ($F(4, 1) = 0.728$, $P = 0.581$) or procurement systems depend on the age of buildings ($F(2, 1) = 0.373$, $P = 0.773$).

A question was designed to capture proportion of the full-time employees in the maintenance organization. The results are displayed in Table 10. From the mean score values (2.41) and the standard deviation (2.05), it was determined that, on an average, a university employed 75 staff and operatives in their maintenance department. However, taking into account the size of the built-up areas, these outcomes can be interpreted to mean that most of the universities actually outsourced most of their maintenance service rather than insourcing them. Alternatively, this argument can be supported considering the annual maintenance expenditure. More than 70 per cent of the universities spent more than RM5 million each on building maintenance annually. In fact, half of the universities spent more than RM10 million each on maintenance. If maintenance services were to be procured through insourcing, there is no way that the 75 full-time employees would be able to prudently use this amount. The amount is too much for that small workforce to manage prudently under an in-house procurement system. Therefore, it can be concluded that it is very likely that outsourcing is the most frequently/commonly used procurement strategy.

The ages of the buildings were also crossed with the number of the full-time employees in the maintenance organizations. The cross-tabulation results are shown in Table 11. The Majority of the universities actually outsourced larger parts of their maintenance services to contractors. These results could not be unexpected considering the outcomes of the size of the full-time employees.

Furthermore, to determine whether statistical evidence exists to establish a relationship between age of buildings and number of full-time employees in the maintenance organizations, ANOVA was carried out (Table 12). The results revealed that there is a relationship between the ages of buildings and full-time employees in the maintenance

Table 12: Distribution of the ANOVA test between number of employees and age of buildings

<i>Source</i>	<i>Type III sum of squares</i>	<i>df</i>	<i>Mean square</i>	<i>F</i>	<i>Sig.</i>	<i>Partial eta squared</i>
Corrected Model	56.242	4	14.060	5.167	0.003	0.434
Intercept	160.757	1	160.757	59.072	0.000	0.686
Age of building	56.242	4	14.060	5.167	0.003	0.434
Error	73.477	27	2.721	—	—	—
Total	315.000	32	—	—	—	—
Corrected Total	129.719	31	—	—	—	—

Table 13: Distribution of university maintenance practices

<i>Maintenance practice</i>	<i>Yes (%)</i>
Corrective/reactive based	25
Cyclical/planned based	22
Condition/inspection based	36.5
Performance based	16.5
Other	0
Total	100

organizations (0.003). The effect is moderate (0.434). Simply put, the age of the buildings significantly explains about 40 per cent of the number of the employees in the maintenance organizations surveyed. However, results need to be cautiously interpreted. These results could be a result of the sample size. The 33 respondents might be too small to produce meaningful statistical results. Theoretically, it could be expected that older buildings require more maintenance, which of course requires more workforce. Nonetheless, this justification is only valid if the insource workforce is used. Another meaning to these results is that most of the universities prefer to outsource the maintenance sources.

Table 13 shows the university maintenance practices. Most of their maintenance practice is condition/inspection based. Many also based their maintenance practice on corrective methods. Many also prefer cyclical maintenance. The results revealed that the most common maintenance is condition-based, whereas the practice is only limited to some specialised/major mechanical and electrical equipment (that is, lift). The building fabrics and most of the engineering services are completely based on corrective maintenance. The cyclical- and condition-based maintenance involve inspecting the equipment bearings, greasing, checking power load for motors and cleaning the filter of the air-handling units every 2 months. This outcome actually confirmed the authors' undisclosed hypothesis that the maintenance practices among the Malaysian universities were corrective-, cyclical- and inspection-based, respectively.

The outcome of the survey indicates that two of the three universities that prefer insourcing all their maintenance services rated their current practice as very good and good, respectively. None of those that outsource all their maintenance services rated their procurement systems as very good. However, the majority ($n=21$) of those that combined insourcing with outsourcing rated their system as good ($n=11$) and fairly good ($n=10$). One of the universities claimed that they prefer another procurement system for maintenance, although the university does not mention the procurement.

The research also seeks to determine how maintenance complaints are reported to the maintenance organizations. The outcome is depicted in Table 14. The outcomes are, however, expected. It is just natural for users (that is, students in particular) to communicate their complaints through phone calls and personal visits. Those methods are perhaps

Table 14: Distribution of method of receiving maintenance complaints

<i>Method</i>	<i>Yes (%)</i>
Telephone	26
Email	23
Fax	8
Personal visit	19
Postal mail	4
Web request	16
Other	4
Total	100

easier than sending messages by fax and post. Web-based methods of reporting are undoubtedly not widely practiced yet. For this method to succeed, there is a need for the users to be connected to the Internet. Many of the users do not have access to the Internet in their rooms and many do not even own computers. It is not likely that building users could be expected to use cyber cafes to lodge their maintenance complaints, as this would be cumbersome and crude.

University maintenance organizations must look into the way maintenance complaints are lodged and the response time to complaints by the maintenance organization. Users prefer one point of communication and do not like complications. They want someone to talk to if a problem arises. A situation where time is wasted in an attempt to contact the maintenance organization can only further frustrate users. Users want to be able to report their complaints conveniently. The contact address (phone numbers) of those concerned with specific items of maintenance should be supplied to the buildings users. This will also facilitate easy reporting and communication, and a free toll phone can be provided for even easier access so that users will not need to pay for the complaint they are making. This will go a long way to increasing the satisfaction of the users with the service delivery. The behavioral aspects of maintenance management are critical.

The findings from the survey also revealed that a majority of the universities actually prefer to outsource the larger part of the maintenance services. This is, indeed, unfortunate. It is high time that university organizations accepted the responsibility for and took care of their buildings (*vis-à-vis* the maintenance practices) efficiently. A university requires functional buildings to be in business. Almost certainly, without building, university business objective might not be met. Even the virtual university whose scope of service is limited requires some minimum amount of conducive space to carry out basic tasks. The buildings require comprehensive attention. The continuous performance is critical to the users. The building provides values not only to the university organization, but also to the students, faculty members, parents, and other users and stakeholders. Maintenance should be positively planned, strategically organized, proactively led, holistically controlled and dynamically implemented if best value is critical. Thus, there is the need 'for ready to fight' workforce at all time. Outsourcing the maintenance function reduces maintenance to corrective maintenance. There are also some proprietary data that the university would not like to expose to external parties. Outsourcing maintenance services has received substantial criticism. External maintenance organizations could hold their clients to ransom. It also renders the in-house maintenance organization staff less competent and inactive because of redundancy.

Therefore, universities should invest in training their maintenance staff as they would for their academic staff. Substantial commitment is required for continuous professional programmes for the maintenance operatives. Maintenance staff must be motivated. This

is very pertinent, considering the enormous resources committed to the procurement of the buildings. In fact, it is a failing on the part of the university management to consider the management of the buildings as non-core activities. Maintenance is a core activity of the university organization. Universities must take care of their interrelated assets, namely buildings, technology and the human resource. Therefore, it would be more profitable if universities could carry out most of their maintenance services in-house.

The survey also revealed that most of the respondents have qualifications in the engineering field. Further analysis made it clear that those with engineering backgrounds are predominantly civil engineers, whereas the bulk of the works that are under their purview are building works. Civil engineers are more experienced with public projects (for example, transportation, water treatment airports and train stations), not building projects. They would require additional qualifications in building and maintenance-related disciplines to offer services. With these qualifications, their professional competencies might be questioned. Those occupying the positions of maintenance managers might need to return to college to obtain maintenance-related degrees. Alternatively, they could enroll on short courses, seminars and sandwich programmes to enhance their qualifications. This is probably because only the engineers would be in a better position to be effective in their present role. However, currently, there is no evidence to suggest that this is being critically considered.

PROPOSED VALUE-BASED MAINTENANCE MANAGEMENT MODEL

On the basis of the empirical findings of the main research together with the review of related theory and discussions with those concerned with the management of university buildings, a 5 × 5 graphical model of value maintenance management was proposed (Figure 5). The model is the entire series of organizational processes that add 'value' at each stop, beginning with the process of resources to the finished services. The model is a unification of the criteria that influence maintenance management, criteria within the user value system, procedures involved in reporting maintenance complaints, as well as the

Figure 5: Proposed schematic diagram of the value-based maintenance management model.

maintenance demand procedure. Sequentially, the blocks drive in value-added services and drive out unnecessary increases in maintenance costs and poor building performance through collaboration. With this, maintenance will be recognized as a profit-generating function by incorporating maintenance into the university's corporate mission and vision. In this way, maintenance will receive the attention it deserves at the top management level. Thus, it will not be viewed as a mere tactical operation and as a burden as it used to be. Universities' organizations must consider and accept maintenance as a factor of production that requires strategic attention like the other resources of the organization.

SUMMARY AND CONCLUSIONS

This article has been able to provide an insight into how a university maintenance department is organized. The procurement systems are mixed and methods of channeling complaints are not user-friendly. A promising way out of the current maintenance management crisis has been outlined. The conventional building maintenance management has been altered. It is pertinent that the way buildings are maintained has changed. The roles of buildings to facilitate quality of education are of great importance. It cannot be argued that the building performance is not closely related to the students' IQ. The corporate objectives of a university place building performance in a strategic position. Therefore, in that regard, in order to improve and sustain productivity, service delivery and satisfaction of the users, maintenance must be positively and strategically managed. Building maintenance is a big business, and its management requires a radical change in order to improve service delivery and productivity.

A proposed value maintenance management model was introduced. The model emphasized the active inclusion of user value criteria in maintenance management if meaningful service delivery is deemed significant. Nonetheless, while this initial model is presented, efforts are vigorously being made to improve its robustness. Further explanations of each of the blocks are ongoing and will be reported as soon as they are completed. The model was designed to be dynamic and flexible, because no tool, regardless of its sophistication, can predict the future absolutely. The model assists in minimizing the amount of responsive and corrective maintenance that the university needs to undertake, thus promoting good maintenance management practices and, at the same time, bringing about a significant reduction in the maintenance backlogs and improving user satisfaction. These steps may not be prescriptive; they are simply intended to illustrate how the conceptual model translates into value-added services.

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