Original Article

Quantitative analysis of defects in Malaysian university buildings: Providers' perspective

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ABSTRACT Facilities management is taking centre stage in the discourse of academic institutions because of its relevance to facilitating learning, teaching and conducting research. University buildings are an important part of these facilities and considerable resources are committed to their design, construction and maintenance. This article is based on the premise that if there is information on the criteria that influence the maintenance of university buildings, the characteristics of defects in university buildings and the criteria within the users' value system, the maintenance and management of the university buildings will be initiated and implemented more effectively and efficiently compared with how it is currently executed. The main aim of the present research, however, is to determine the kind and nature of defects in university buildings in Malaysia. The article reviews the related literature and presents the outcome of a questionnaire survey. The questionnaires were administered to 50 university maintenance organisations. With a 66 per cent response rate, the findings suggest that some defects require maintenance more urgently than others. On this basis it is concluded that resources should be directed to the more urgent areas whereas less urgent ones can be included in the next planned maintenance programme. The research found that

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lift failure, faulty electrical systems and roof damage were defects that respondents considered highly critical and that required urgent maintenance intervention.

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INTRODUCTION

Facilities may be defined as property where people are accommodated and work, or where an organisation conducts its business (Seeley, 1987). For a university organisation, facilities are places where people live, work, learn, teach and conduct research. According to Amaratunga, Baldry and Sarshar (2000), facilities management involves the management of all the services that support the core business of an organisation. Therefore, facilities management involves the coordination of the physical workplace (that is commercial and institution buildings), study place (that is university buildings) and the users (that is students, technicians and lecturers). The importance of facilities management cannot be emphasised enough. Organisations are gradually recognising that sustaining facilities efficiency is critical to the success of their business, as facilities can contribute significantly to the enhancement of the productivity, profitability and service quality of an organisation.

The prime objective of maintenance is to ensure, as far as practicable, the continued optimal performance of the building throughout its design life, thereby contributing to an organisation's profit-generating function. Maintenance is a process. As a process it converts input (that is materials and labour) into output. Part of the inputs is tangible whereas the other part is intangible. Similarly, part of the output is tangible whereas the other part is intangible. Maintenance management facilitates efficient and effective conversion of input into optimum output. However, the needs of maintenance continue to grow whereas maintenance resources may not be growing at the same pace. Therefore it is up to all the stakeholders to change the way in which maintenance is managed. It is contended that the information on the criteria that influence maintenance practices, the characteristics of defects and criteria within the user's value system will go a long way in facilitating effectiveness and efficiency in the maintenance management system. Finding alternative courses of action is certainly the way forward. This article reports a part of ongoing research on the maintenance management system of university institutions in Malaysia. The main research seeks to develop a systemic university building maintenance management approach in Malaysia. This research collected primary data through a questionnaire survey. The objectives of this article are to identify, evaluate and analyse defects in university buildings that contribute to poor user satisfaction, maintenance backlogs and unnecessary increases in maintenance costs. Data obtained were analysed using the Statistics Package for the Social Sciences and Microsoft Excel to produce descriptive statistics. The major conclusion drawn from the survey was that although there are many different defects, some actually require more urgent attention than others. Essentially, the

research is to facilitate a more efficient and effective maintenance management system taking into account the nature of building defects that require urgent consideration in order to achieve user satisfaction.

THEORETICAL FRAMEWORK AND BACKGROUND

University buildings are a factor of production. They are procured to create a suitable, conducive and adequate environment that can support, stimulate and encourage learning, teaching and innovation and research activities. Universities contain unique, complex and sophisticated buildings that are used to perform various types of activities and functions. It is in these university buildings that future leaders, captains of industry, entrepreneurs, professionals and scientists are produced (Mat *et al*, 2009). Therefore, if there is any inadequacy with the facilities, the primary objective of the university will be difficult, if not impossible, to achieve. A failure in the supply of the required services is a loss in value to the university institution, the community, the students, staff and other stakeholders. However, as soon as a building is completed, maintenance begins. About 70 per cent of the building operating costs is attributed to maintenance (Booty, 2006; Rendeau *et al*, 2006) and about 90 per cent of the lifetime of building projects requires maintenance work (Mills, 1994; Zavadskas and Vilutiene, 2006). Maintenance is essentially required to delay the appearance of defects to ensure that buildings perform optimally throughout their life cycle.

The term 'defect' has been defined differently by different authors. To some, it means the shortcomings in the design and construction practices, while to others, it implies the inadequacies that arise from normal wear and tear. Design and construction defects are those that are caused due to wrong methods of construction, poor materials and bad labour practices. Wear and tear is depreciation, reduction or fall in the functional performance or value of a building or services, which arises as a result of normal or fair use. It can also be caused as a result of the age of the building or services or due to natural weather conditions and, in fact, a combination of the three. Defective building means a building that is not performing according to design. Buildings and the associated engineering services will depreciate in functional performance no matter how proficiently they are used. Wear and tear does not mean that a building will require any more than basic maintenance except if used in excess, is neglected or is vandalised or there is a combination of these problems. While it is acknowledged that the primary causes of building defects are inevitably interconnected, the focus of this article is on the need for maintenance caused by wear and tear. The design and construction defects constitute another area for specialist study that is beyond the scope of this article. There are sufficient studies (for example Ishak *et al*, 2007) on how building defects can be reduced through a maintenance brief, design and the programming process.

There is no clear definition of wear and tear in the construction literature. Even architecture and construction dictionaries (Bucher, 1996; Ching, 1997; Fleming *et al*, 1999; Curl, 1999; Cowan and Smith, 2004; Harris, 2005 and Comerma, 2007) fail to define the concept. Wear and tear is a combination of two separate words: wear (phrasal verbs: wear

down, wear in, wear off, wear on and wear out) and tear (phrasal verbs: tear apart, tear at, tear away, tear down, tear into and tear up). According to *Collins Cobouild Advanced Learner's English Dictionary* (2006), wear and tear 'is the damage or change that is caused to something when it is being used normally'. The *Webster's New Explorer Encyclopedic Dictionary* (2006) defines wear and tear as 'the loss, injury or stress to which something is subjected by or in the course of use; especially: normal depreciation'. In other words, wear and tear is depreciation, reduction or fall in the functional performance or value of a building or engineering service, which arises as a result of normal or fair use. Contributing to the normal use phenomenon are the age of the buildings/services, natural weather conditions and inadequate maintenance. Except if a building wears out, is excessively neglected or vandalised, maintenance is all that is required to restore the building to operational fitness. Otherwise, the building will have to be refurbished, converted, altered or reconstructed.

Words including deficiency, damage, default, deterioration and decay are often used to describe defects. In this article, however, all the terms are synonymous with defect and are sometimes used interchangeably. In this article, defect is defined as 'a failing or shortcoming in the function, performance, statutory, or user requirement of a building' (Watt, 1999) in the building's operation. In other words, a defect is an undesirable or inadequate condition in the buildings that affects the serviceability, performance, structural condition or appearance of the buildings. According to Watt, a defect can manifest itself within the structure, fabric, services and other facilities of the defective building (Watt, 1999). Some obvious examples of a defect are cracked, damaged or deteriorated brick/block walls, rotten timber, a sagging roof, clogged water closet and faulty lift, faulty windows and doors, leaking showers and sagging ceilings. Defects reduce the durability, functional performance and user satisfaction of the buildings. Therefore, a more efficient practice through a proactive and holistic understanding of the nature and kind of specific defects will focus the maintenance organisations on the user value system vis-à-vis their maintenance requirements (Ilozor *et al*, 2004). Consequently, instead of focusing attention on defects that are not very essential in the users' value systems, organisational resources can be directed towards defects that affect user satisfaction–user care. Maintenance is actually about users' well-being and not necessarily about the building itself as a building is not procured for its own sake but for the services (that is comfort, protection and esteem) it offer to the users.

Building users are the entity or group of individuals or the organisation, who are interested in the adequate functioning of the building. They have the potential and capability to take action or a decision if they are not satisfied with the performance of the buildings (see also April and Abran, 2008). They are affected by the performance of the building and the building is also affected by the activities of its 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, then the building can be said to be a source of value creation to the required service of

accommodating, learning, teaching and doing research. According to Chanter and Swallow (2007), building defects account for about 20 per cent of building maintenance cost. Therefore, proper consideration of the defects in total maintenance management cannot be emphasised enough if meaningful efficiency is paramount.

Building defects can be identified by the users themselves or through an inspection of the facilities by those concerned with facilities management. Practitioners have the capability to identify defects that are not yet obvious, at least to the users. An appraisal of defects is usually undertaken through a sequence of site procedures that provide the necessary information on which to make an assessment as to the condition and fitness for the purposes for which the facility is acquired (Watt, 1999). However, the essence of this article is not to describe the building survey processes. Readers interested in a detailed approach to the detection of defects through diagnosis and prognosis can refer to Watt (1999) and Williams (1993). The fundamental essence of this article is to identify the defects in university buildings through questionnaires that require considerable attention on the part of the maintenance organisation based on the providers' perspectives. Some defects are caused by the designers (latent defects), while some are caused by the constructor (patent defects); yet others are caused due to normal wear and tear and lack of maintenance. Latent and patent defects are often in relation to new buildings. The severity of a particular defect will be judged against the effect that defect has, as well as those that it will have on the building and the associated services (Watt, 1999). Consequently, the influence that a defect will have on a building if it is not maintained will depend on factors including the nature of the defect, the building integrity, the user needs and wants and the successive maintenance programme.

The effect of defects on the condition, appearance and performance of a building depends on the functional requirements of the buildings. For instance, a condition that might be acceptable for a residential building may require immediate maintenance in the case of university buildings. The degree of defects in buildings is one measure for evaluating the functional performance of the buildings. Defects often hinder the functional performance of the building and its services. Although building defects can generally be attributed to the lack of good construction practices, they are often caused and, in fact, aggravated due to the lack of good maintenance practices and usage (Gahlot and Sharma, 2006). The unique consequence of the defects in a building is that it affects the building's capability to function optimally technically, aesthetically and even otherwise. Building users are becoming more vocal about their requirements, and they develop a cognitive map of what they want and often this is in variance with the maintenance organisation's perceptions. This accounts for the rise of the Facilities Management profession. Defects cause inner psychological tension in the users, if the defect is not rectified (see Sommerville and McCosh, 2006) in terms of quality and time. University building users most especially are curious and worry about the quality of maintenance services as well as the time it takes the maintenance organisation to respond to their call and carry out the necessary maintenance.

Expenditure to correct defects in Malaysia is large and unabated. In Malaysia, for instance, in 2001, 238 maintenance contracts were awarded whereas this figure increased to 272 in 2002 (CIDB Malaysia, 2003). This marked an increase of 14.3 per cent in the number of maintenance contracts awarded. In terms of financial value, expenditure on maintenance amounted to about RM2 billion in 2 years (CIDB Malaysia, 2003). This represents about 6 per cent of the total construction contract awarded in this period. Under the various successive Malaysian Plans there were increases in allocations to the maintenance sector. For instance, under the Seventh Malaysian Plan, the sum of RM203.2 million was allocated to the sector; under the Eighth Malaysian Plan it was RM214.5 million and this rose to RM1079 million under the Ninth Malaysian Plan (Government, 2001 and Government of Malaysia, 2006). The consistent increase in expenditure in the sector was attributed to increases in maintenance backlogs. As a result, under the Ninth Plan, the Government has pledged to give more attention to the maintenance of buildings and other infrastructural facilities (Government of Malaysia, 2006). It is unclear whether increases in allocation and expenditure will ever improve the situation as, even if there is an increase in allocation, maintenance could only be given tactical/technical attention rather than proactive and systematic consideration. However, it is affirmed that information on the nature, degree and kind of defects will determine when the repair work is to be undertaken and allow future work to be programmed and financed as part of the maintenance rolling programme.

RESEARCH DESIGN AND METHOD OF DATA ANALYSIS

A questionnaire survey approach was used for collecting primary data in well-established universities in Malaysia. The questionnaire was divided into three parts. The first part is to capture the respondents' profiles whereas the second part focuses on background information. The third part provides feedback on the defects associated with university buildings in Malaysia. The questionnaire was addressed to the senior officers in the maintenance organisations. The questionnaires were given to all the 50 recognised universities in Malaysia. Although it was not the intention of the research study to carry out a census, all the universities were involved in order to enhance the response rate. The questionnaire was developed from the studies of authors including Wood (1999), Zavadskas *et al* (1998), Jones *et al* (2007), Seeley (1987) and Horner *et al* (1997) and a series of discussions with those concerned with university building maintenance in Malaysia. Twenty-eight defects in buildings were identified and addressed by the respondents. Data collection and collation commenced in July 2009 and lasted until October 2009.

It is believed that the 'maintenance managers' in the university maintenance organisation are the appropriate people to respond to the questionnaire because they are the people who are actually involved in the decision-making processes. This characteristic would afford them the opportunity to provide valid, factual and unbiased information. The managers are not only involved in establishing the goals and objectives of

the organisations but they also set goals for specific area/units in the organisation and also make sure that the day-to-day operations run smoothly.

Respondents were asked, based on their current experience, to tick the rate of urgency at which they agreed that each of the defects influences maintenance management to improve user satisfaction with respect to the university buildings on a 5-point continuum:

- (a) Not at all urgent; if the respondent does not agree that the particular defect requires any urgency to maintain at all
- (b) Not very urgent; if the respondent does not agree that the particular defect requires very urgent consideration
- (c) Urgent; if the respondent agrees that the particular defect requires a moderate degree of urgency to maintain
- (d) Very urgent; if the respondent agrees that the particular defect is very urgent to maintain
- (e) Extremely urgent; if the respondent agrees that the particular defect is extremely urgent

Data analysis was performed using two different computer packages: Statistical Package for the Social Sciences and Microsoft Excel Windows. The mean technique was used to calculate the average degree of defects in the buildings. The mean is the sum of values in a data set divided by the frequency. It is used to calculate the average of observations (Muijs, 2004). The degree of urgency of each of the defects will be determined by the frequency of the respondents that agreed with each of the defects. For instance, where the mean score falls between 1.0 and 1.5 the defect will be considered as not urgent at all. See Table 1 for other distributions. This cut-off point is used because the lowest possible mean score is 1. However, it was understood that a natural scale should originate from 0, which in this case is not required. Missing data (that is where the respondent refused to tick where applicable or there are multiple entries), could impact negatively on the outcome of the findings; however, such an effect could be improved during data analysis by either replacing the missing data with the mode or mean of the data. However, in this article, the missing data will not be treated as such; instead, we would prefer to leave the data raw so that the outcomes will not in any way be influenced by the authors. This tends not to be a problem in the study as nearly all the questions were answered by the respondents.

Table 1: Average index evaluation metric

<i>Scale</i>	<i>Evaluation</i>
1.00–1.50	Not urgent at all
1.51–2.50	Not very urgent
2.51–3.50	Urgent
3.51–4.50	Very urgent
4.51–5.00	Extremely urgent

DATA ANALYSIS AND DISCUSSION OF OUTCOME

Respondents' profiles

A total of 50 questionnaires were sent out to the maintenance organisations of universities in Malaysia by post. Thirty-three questionnaires were returned and analysed for this study. This is response rate of 66 per cent. This is considered satisfactory for a postal survey. According to some authors, including Muijs (2004) and Sekeran (2004), 30 per cent is the common response rate for a postal survey, apart from the fact that administering questionnaires in Malaysia is a daunting task. However, this high response rate was possible because of the long survey duration and the numerous reminders sent to the respondents. The data are considered very reliable (Cronbach's α : 0.930). An analysis of the outcome of the survey shows that most of the respondents possessed sound academic qualifications. The survey revealed that about 50 per cent of them possessed Bachelor's degrees and 21.9 per cent had obtained Master's degrees. The survey revealed that most of the respondents held strategic positions. Nearly 32 per cent of the respondents were actually maintenance managers while about 19 per cent were facilities managers. A substantial number of the 'others' were directors of development and/or maintenance 'executives' (this is another title/term for maintenance manager). These backgrounds provide the respondents with wide experience to provide independent and unbiased opinion on information that was addressed to them.

From the analysis of the survey, 52 per cent of the survey universities spent less than RM10 million each for maintenance annually (Table 2). The table also indicates that 3.2 per cent of the universities spent between RM20 million and RM30 million each. At the same time, 6.5 per cent spent amount ranging between RM30 million and RM40 million each. Similarly, about 22 per cent of the survey universities occupied less than 280 000 m² built up area whereas more than 40 per cent occupied more than 1 400 000 m² built up area (Table 3). The majority (42 per cent) of the buildings were about 15 years old whereas only about 10 per cent were between 30 and 50 years old (Table 3). From this information it could be inferred that most of the university buildings were not that old *per se*, yet considerable amounts of money are invested in their maintenance even though there is a considerable number of complaints about university maintenance practices. Most of the universities employed fewer than 30 employees each on a full-time basis. Only 16 per cent of them actually employed 140–170 full-time employees

Table 2: Annual maintenance budget and respondent working experience

Size of the university's annual budget for maintenance			Respondent's working experience		
Budget	Frequency	Percentage	Experience	Frequency	Percentage
Less than 10	16	51.6	Less than 5 years	15	46.9
10–20	12	38.7	5–10 years	7	21.9
20–30	1	3.2	10–15 years	5	15.6
30–40	2	6.5	15 years and above	5	15.6
Total	31	100.0	Total	32	100.0

Table 3: University built-up area and average age of buildings

Size of the university built-up area			Age of buildings		
Size (m ²)	Frequency	Percentage	Age (in years)	Frequency	Percentage
Less than 40 000	7	21.9	Less than 10	10	32.3
40 000–50 000	5	15.6	10–20	13	41.9
60 000–70 000	2	6.2	20–30	5	16.1
70 000–80 000	1	3.1	30–40	1	3.2
90 000–100 000	3	9.4	40–50	2	6.5
100 000 and above	14	43.8	Total	31	100.0
Total	32	100.0			

even though 6.2 per cent of the organisations have 60–90 and 110–140 on their full-time payrolls, respectively.

Urgency of defects in university buildings

The outcomes for the degree of urgency of the different defects are depicted in Table 4. The table shows an overview of the data obtained, the level of urgency identified, variability and mean scores. The mean score indicates the degree of urgency for each of the defects. The average mean score is 3.45. Fifty per cent of the defects have an individual mean score greater than the average mean score. In general, most (31.82 per cent) of the survey respondents considered all the defects as urgent while a considerable percentage of them (23.62 per cent) considered the defects as extremely urgent. Few respondents viewed the defects as not at all urgent (2.83 per cent). Lift failure was the most extremely rated defect (1), followed by faulty electrical equipment, whereas the least considered defect was faulty towel rails (28) after bad soap holders (27). In fact, nearly 64 per cent of the respondents considered faulty lifts as extremely urgent, whereas 54 per cent of the respondents considered faulty electrical equipment as extremely urgent. None of the respondents considered a faulty lift and faulty electrical equipment as not urgent at all. Although a proportion of the respondents ($n=2$) considered lift failure as not very urgent, only one respondent did not consider faulty electrical equipment as very urgent. On the other hand, many (27.3 per cent) of the respondents did not consider the maintenance of faulty towel rails as urgent at all while most of the respondents also considered them as not very urgent to maintain.

Similarly, most of the respondents (45.5 per cent) did not consider the maintenance of soap holders as urgent at all even though many of them (27.3 per cent) considered their maintenance as urgent; yet a considerable part (18.2 per cent) of the respondents consider them as not urgent at all to maintain. Although most (37.5 per cent) of the respondents considered the maintenance of washing machines as not very urgent, quite a number (15.6 per cent) of them see these faults as not requiring urgent maintenance. Although many (18.2 per cent) of the respondents consider the maintenance of windows as extremely urgent, yet many (15.2 per cent) of them also see it not very urgent, whereas none of the respondents considered it as not urgent at all. The majority (36.4 per cent) of the respondents considered the maintenance of faulty door locks as very urgent; 33.3 per cent of the respondents perceived it as urgent and a

Table 4: Distribution of urgency of defects in university buildings

Defect	Frequency of respondents on degree of agreements (%)				Descriptive statistics		
	Not at all urgent	Not very urgent	Urgent	Very urgent	Extremely urgent	Mean	SD
Damaged window	0	15.2	48.5	18.2	18.2	3.39	0.9661
Clogged water closet	0	3.1	25	37.5	34.4	4.03	0.861
Floor tile failure	0	48.5	39.4	9.1	3	2.67	0.777
Wall tile failure	0	48.5	45.5	6.1	0	2.58	0.614
Faulty shower	0	33.3	39.4	18.2	9.1	3.03	0.952
Faulty fan	0	21.1	51.5	24.2	3	3.09	0.756
Damaged ceiling	0	30.3	39.4	21.1	9.1	3.09	0.947
Faulty door locks	0	6.1	33.3	36.4	24.2	3.79	0.983
Faulty towel rail	27.3	39.4	21.2	6.1	6.1	2.24	1.12
Faulty water dispenser	3	39.4	42.4	12.1	3	2.72	0.839
Faulty bulbs	0	6.1	54.5	21.2	18.2	3.52	0.870
Faulty air conditioning system	0	3	27.3	27.7	42.4	4.09	0.914
Faulty electrical circuit	0	3	12.1	30.3	54.50	4.36	0.822
Lift failures	0	6.1	9.1	21.2	63.6	4.42	0.902
Faulty taps	0	15.6	40.6	31.2	12.5	3.41	0.911
Damaged roof structure	3	3	15.2	24.4	54.5	4.24	1.03
Collapsed drains	0	18.2	33.3	27.3	21.2	3.52	1.03
Faulty communications appliances	3	3	33.3	24.2	36.4	3.88	1.05
Failed furniture and fittings	0	9.1	33.3	39.4	18.2	3.06	1.09
Faulty doors	0	12.1	45.5	21.2	21.2	3.52	0.972
Sink leakage/blockage	0	6.1	39.4	30.3	24.2	3.72	0.911
Bad soap holders	18.2	45.5	27.3	9.1	0	2.27	0.876
Pipe leakage	3	6.1	33.3	21.2	36.4	3.82	1.10
Cracked and faulty walls	15.6	37.5	28.1	6.2	12.5	2.63	1.21
Faulty fire alarm	3	15.2	15.2	30.3	45.5	4.09	1.07
Faulty heat extractor	3.1	28.1	25	21.8	21.9	3.31	1.2
Faulty fire extinguisher	3	15.2	15.2	36.4	30.3	3.76	1.15
Faulty smoke detector	0	6.5	19.4	38.7	35.5	4.03	0.912
Total average index	2.83%	18.02%	31.82%	23.73%	23.62%	3.45	0.96

Significance: U indicates that overall, most of the respondents measured all the 28 criteria "U"rgent.

further 24.2 per cent considered it as extremely urgent. Nearly 46 per cent of the respondents considered faulty doors as urgent but a considerable number of them (21.2 per cent each) considered their maintenance as very urgent and extremely urgent, respectively. Most (39.4 per cent) of the respondents considered the maintenance of sink leakage and clogged sinks as urgent with many (30.3 per cent) of them considering it as very urgent, whereas 24.2 per cent believed that these defects required extremely urgent attention.

Discussions of the outcomes of the survey

There are about 1.5 million students in Malaysian universities out of a population of approximately 28 million people, in an academic year. This represents about 5.4 per cent of the entire population. The climate in Malaysia is tropical with temperature ranging between 22°C and 33°C. University buildings in Malaysia are characterised by framework structures, solid bricks, cement and sand mortar bed and joints. The windows and doors are of metal and/or glass and aluminium, timber and steel joinery. The buildings are predominantly roofed in brick slate or aluminium sheets. The floors are mainly finished in ceramic and marble tiles on a screeded bed. The sanitary appliances and fittings are predominantly ceramic. The administrative and academic buildings are mainly with split air conditioners whereas hostels are fitted with three-blade fans. In Malaysia, the maintenance managers of universities manage an extensive array of buildings such as residential (hostels and staff apartments), administrative, academic and religious (for example Mosques) buildings. Defects influence maintenance costs and user satisfaction. In order to ensure the performance of buildings, defects must be effectively and efficiently managed. The user value system needs to serve as a basis for maintenance initiation and execution. From the survey, it will be observed that 50 per cent of the defects have their individual mean scores that are greater than the average mean scores. What this implies is that the 14 defects should be given priority during maintenance. A brief discussion on the survey outcome will be presented below.

It is interesting to find that respondents ranked lift failure as the top priority defect, closely followed by faulty electrical system and damaged roof structure, air conditioning and fire-fighting equipment. This could be interpreted as meaning that user safety and user well-being are of paramount consideration. Access to all parts of buildings is a fundamental requirement (particularly for university buildings where students with varying needs are present). To the disabled, lift failure could be a major inconvenience as the disabled might not be able to access some parts of the building and the facilities. Without doubt, faulty electrical systems are a very serious defect as they can also lead to death. Defective roofing can allow water penetration into a building and cause substantial damage including structural damage to timbers, household items, fittings and furniture, sick building syndrome, indoor air quality and so on. Faulty air conditioning systems could lead to discomfort, the growth of mould leading to sick building syndrome and pathogenic diseases associated with the faulty air conditioning. Faulty air conditioning also facilitates water seepage.

Water closets are also ranked high. Clogged water closets could be very disruptive. In addition to not being able to be used, they cause offensive odour. Concurrently, pipe leakage is ranked high by the respondents. Damaged windows will undoubtedly leave the occupiers unprotected from burglars, rapists and thieves. Faulty windows could allow dangerous insects like aedes mosquitoes, which can cause dengue fever, in the buildings. Faulty communication appliances are also considered very urgent. Today, classes could be changed and the same communicated to the students effectively. There are some instances when students cannot attend classes due to faulty locks awaiting repair. Fire outbreaks in education buildings are gradually becoming commonplace and there is a call for the active maintenance of fire extinguishers. It was, however, interesting to find that cracked or faulty walls were rated very low. Could this be interpreted to mean that wall defects are not common defects in Malaysian university campuses? Alternatively, could be as a result of measurement error?

CONCLUSION

This study has identified and evaluated defects in university buildings in Malaysia. Twenty-one defects were ranked as very urgent or extremely urgent. Defect classification is a very strategic function of the maintenance managers. It is recommended that efforts are directed to the extremely urgent defects, then the very urgent and finally those that are not very urgent. It is only in this way that funds will be spent effectively and acceptable user satisfaction can be achieved and maximised. However, defect degree in term of urgency ought to be evaluated by the users themselves. This research was carried out in the reverse order in order to understand the providers' perspectives. Further work is ongoing to achieve this objective. Solutions to address wear and tear problems that involve drastic changing of the physical form and use are not regarded as a maintenance-related issue. The defects addressed in this article do not include defects that relate to substructure work (foundations cracking, foundation bowing and foundation settlement). Although the list of the 28 defects may not be exhaustive owing to the vast nature of the building maintenance concurrent with the problem of nomenclature, the list covers common defects pertaining to university buildings that users are mostly concerned about.

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