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A Pilot Study of User-requirements for Building Maintenance Systems in Malaysian Higher Education Institutions

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Abstract - Worldwide, the investment in building maintenance is huge as it represents almost 50% of the total turnover of construction activities. Building maintenance is also categorised as the commonest function listed in facilities management activities. This pilot study explores the current practice of building maintenance management in higher education institutions in Malaysia. Information gathered from semi-structured interviews focuses on different areas of building maintenance practices. The main issue is to identify the user-requirements. The areas of study are to cover the objectives of maintenance departments, maintenance reporting processes, maintenance verification processes and other associated tasks. In addition, this study also looks into the contributions of Information Technology (IT) facilities to maintenance practices. Based on the findings, there will be differences in the maintenance practices among the four universities; empirically, of the 57 elements studied only 30% were similar. Some strengths and weaknesses in the maintenance practices were identified and ways in which IT facilities could help to improve the situation. In the future it is envisioned that good building maintenance practices would be the norm in Malaysia to maximise the benefits that users could expect from their buildings and facilities.

Introduction and background

The European Committee for Standardisation (CEN) - ratified by the British Standard Institution (BSI) building maintenance code of practice - play a major role in facilities management activities as they help organizations to develop agreed services for buildings which support and improve the effectiveness of their primary activities [1]. In Malaysia the increasing awareness of the importance of a proper building maintenance and management system becomes the main contributing factor for the development of facilities management activities [2]. There are five main management issues in managing Malaysian government-owned property. Those issues are: lack of a proper property unit/department within a ministry, lack of expertise, lack of proper strategies, lack of proper management procedures and lack of IT usage [3]. A study of the maintenance practices in Malaysian higher education institutions found that the maintenance management systems are not IT-based and mainly carry out corrective and cyclical maintenance work. There are also no clear key performance indicators, maintenance tends to be budget-driven rather than needs-driven and is understaffed by inadequately qualified personnel [4]. This study is also influenced by the growth of mobile devices in recent years, that has transformed the way in which people and organisations communicate. It has also revolutionised the construction industry in the way in which information is exchanged and viewed [5] [6]. Before conducting a detailed study of all twenty Malaysian higher education institutions, this preliminary analysis involved four selected universities (20%) as a pilot study. The main objective of this pilot study is to discover the user-requirements for effective building maintenance practices in Malaysian higher education institutions. As the main agenda, these user-requirements must be clearly identified and will be manipulated to form the main criteria

for developing a mobile application later in this research. The four selected higher education institutions each have different criteria in terms of size, age and categories (Research University, Comprehensive University and Focused University). The results collected from this pilot study will identify the user-requirements and technology to be adopted. These user-requirements are very important in understanding the needs and concepts to be proposed in future research. The following sections discuss the methodology adopted in the pilot study, the maintenance practices in universities and user-requirements in building maintenance management processes followed by a cross-analysis, discussion and conclusion.

Methodology

The semi-structured interview was conducted with the officer directly involved in maintenance management practices under the maintenance department in each of the four selected higher education institutions. Four campuses out of the twenty Malaysian higher education institutions is an ideal number as a previous study recommended only 10% from the final study size [7][8]. The respondents could provide reliable and comparable qualitative data, which is among the advantages of conducting the semi-structured interviews [9]. These interviews benefit the researcher in many ways includes providing an opportunity to generate rich data that can be analysed in different ways. It also allows informants the freedom to express their views in their own terms [10] [11]. It was pre-agreed during the interview that the information would be confidential and that the name of the university would not be revealed. Thus, the higher education institutions are named as either University A, B, C or D.

Maintenance Practice in Malaysian Higher Education Institutions

Table 1 provides details about the maintenance practices, the supporting information and technology system followed by a cross-analysis of user-requirements in the maintenance management process in each university.

Table 1: Maintenance Practice in Universities A, B, C and D

University	University A	University B	University C	University D
Maintenance Department	Development and Maintenance Department	Facilities Management Office	Office of Asset & Development	Development and Maintenance Department
Building Maintenance Implementation	Electronic Feedback and Complaint System (eFACT)	E-Aduan supported by Archibus under package Web Central, Space Management and Building Operation Management	Electronic Customers Support (eCS)	Manual
Form of report	Walk-in, phone call & website	Walk-in, phone call & website	Phone call & website	Walk-in, formal letter, phone call, fax and email

User-requirements in the Building Maintenance Management Process

A cross-analysis method is used to compare the implementation of standard procedures being imposed in those selected universities. The comparisons show the similarities and distinguish the differences between them. Indeed, it is possible to determine the user-requirements in the building maintenance management process, which meets the main objective of this study. In order to make the analysis visible, the user-requirements for the building maintenance management process have been divided into five different stages, which are medium of request, requestor information, defect or failure information, information to maintenance staff and the post-maintenance process. Users in each stage might be different as the requestor might be a layman while the maintenance staff may have a good technical background. All information related to these five stages was then collected and analysed as shown in Table 2, following.

Table 2: Cross-analysis of User-requirements in the Building Maintenance Management Process.

Item Description	University A	University B	University C	University D
Medium of Request				
Fax / Email / Letter / Request Form				x
Website / Online	x	x	x	
Walk in	x	x	x	x
Telephone	x	x	x	x
Smartphone Application (WhatsApp)			x	
Requestor Information				
Name	x	x	x	x
ID Number		x	x	
Witness	x			
Position			x	
Date & Time	x			x
Faculty / Department	x	x	x	x
Building ID, Room ID, Floor ID			x	
Telephone number	x	x	x	x
Email		x	x	
Defect or Failure Information				
State / Campus / Space		x		
Name of Building (List Provided Yes/No)	Yes	No	Yes	No
Block (List Provided Yes/No)	Yes	No	Yes	No
Level (List Provided Yes/No)	Yes	No	Yes	No
Location (Description)	x			x
No. of Room (List Provided Yes/No)	No	No	Yes	No
Category of Defect or Failure (List Provided Yes/No)	Yes	Yes	Yes	No
Type of Defect or Failure (List Provided Yes/No)	Yes	Yes	Yes	Yes
Description	x	x	x	x
Information to Maintenance Staff				
Reference Number / Service ID	x	x	x	x
Work Request ID / Work Order ID			x	
Name of Staff	x	x	x	x
Staff Contact Number / Job Position		x		
Scope of Work	x	x		x
Name of Contractor	x	x	x	x
Status of Job	x	x	x	
Verification		x	x	x
Date Start	x	x	x	x
Time Start	x	x	x	x
Date & Time Finish	x		x	
Total Hours	x		x	
Work Description	x	x	x	x
Cause of Defect or failure	x			
Name, Quantity and Price of Spare Parts	x			
Total Cost	x			
Post Maintenance Process				
Client Feedback	x	x	x	x
Survey Form		x	x	
Job Statistics/ Job Status/ Job Category	x	x	x	x

Discussion

The main discussion of the cross-analysis results is focused on the similarities between the building maintenance management processes in all four selected universities. These similarities show the important user-requirements needed for building maintenance management practices. An analysis of 57 elements from the five sub-topics is shown in Table 3 and identifies 17 (30%) of the elements that have similar aspects.

Table 3: The Similar Aspects in Building Maintenance Management Elements

Medium of Request	**Defect or Failure Information**	**Information to Maintenance Staff**
Walk in	Types of defect or failure	Reference number / service ID
Telephone	Descriptions	Name of staff
		Name of contractor
Requestor Information	**Post-maintenance Process**	Date start
Name	Client feedback	Time start
Faculty / Department	Job status	Work description
Telephone number	Job categories	
	Job statistics	

Seventeen (17) out of fifty seven (57) elements can be considered as basic elements or minimum requirements as they are essential to ensure that the maintenance management process could be implemented by using a computer application or manually. 42% of the elements are found to be complicated or with only a single application throughout the maintenance management processes of the four universities as shown in Table 4, following:

Table 4: The Single Application Elements Throughout the Maintenance Management Processes

Medium of Request	**Defect or Failure Information**	**Information to Maintenance Staff**
Fax	State	Work request ID
Email	Campus	Work order ID
Smartphone applications	Space	Staff contact number
Letter		Job position
Request form	**Requestor Information**	Cause of Defect or Failure
	Witness	Name of Spare Parts
Post Maintenance Process	Position	Quantity
Survey form	Building ID	Price of Spare Part
	Room ID	Total Cost
	Floor ID	

From the result of the pilot study it could be suggested that 24 aspects which have been considered to be complicated have become surplus to the elements of the maintenance management processes as they only support the available basic elements. However, each of the universities has its own reasons for having these elements in their maintenance practices. For example, University D carries out its maintenance practices manually, thus they need fax, email, letter and request forms as their medium of request. Meanwhile, University C has proper building data, thus they request such details as Building ID, Room ID and Floor ID in order to ensure the accuracy of the work being carried out. As for University B, the huge number of campuses all over Malaysia requires the detail of state, campus and space on their defect or failure information. In University A, the details on aspects of the causes of defect or failure, name of spare parts, quantity of spare parts, price of spare parts and total cost are for their own records.

Conclusion

All higher education institutions share common criteria of good practices in building maintenance although the different practices allow them to be flexible in implementing the building maintenance process. The cross-analysis has shown that all the participating universities share some important criteria while implementing building maintenance management processes. Even though there is some gap between the universities during the implementation, the core business remains the same. It can also be concluded that with the great effort required to develop such systems may lead to a high-end and sophisticated well-maintained building environment. Finally, the user-requirements from this pilot study will be a stepping stone in developing an efficient method of managing the building maintenance with customisable elements that suit each organisation and bring benefits to the stakeholders. From this pilot study, all data regarding user-requirements will be analysed to support an extensive study involving all Malaysian higher education institutions.

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References

[1] (UK) British Standards Institution, BS 8536:2010 Facility Management Briefing. Code of Practice. Published October 2010.

[2] Mustapa, S. A. H. S. and Adnan, H. (2008) Facility Management Challenges and Opportunities in the Malaysian Property Sector. Journal of Sustainable Development, 1, (2): pp. 79-85.

[3] Abdullah, S. (2011) Managing Government Property Assets: The Main Issues from the Malaysian Perspective, Journal of Techno-Social | ISSN 2229-8940 | Vol. 3 No. 1 April.

[4] Lateef, O. A., Khamidi, M. F. and Idrus, A. (2010) 'Building maintenance management in a Malaysian university campuses**:** a case study', Australasian Journal of Construction Economics and Building, 10 (1/2) 76-89.

[5] Löfgren, A. (2007) Mobility In-site: Implementing Mobile Computing in a Construction Enterprise. The Communications of the Association for Information Systems, 20 (37), 1-12.

[6] Šuman, N. & Pšunder, M. (2008) Mobile Computing Changing the Traditional Ways of Organizing the Construction Company. American Journal of Applied Sciences, 5 (1), 42-47.

[7] Nieswiadomy, R.M. (2002). Foundations of nursing research (4th ed.). Upper Saddle River, NJ: Pearson Education.

[8] Lackey, N.R. &Wingate, A.L. (1998). The pilot study: One key to research success. In P.J. Brink & M.J. Wood (Eds.), Advanced design in nursing research (2nd ed.). Thousand Oaks, CA: Sage.

[9] Cohen, D., Crabtree, B. (2006). "Qualitative Research Guidelines Project." Retrieved online at http://www.qualres.org/HomeSemi-3629.html. Accessed 25th August 2014.

[10] Newton, N. (2010). The use of semi-structured interviews in qualitative research: strengths and weaknesses. Paper submitted in part completion of the requirements of the degree of Doctor of Philosophy, University of Bristol. Retrieved online at http://www.academia.edu/1561689/ Accessed 25th August 2014.

[11] Banfield, G. (2004). 'What's Really Wrong with Ethnography?' International Education Journal 4(2): 53-63.