

BEST PRACTICES FOR PUBLIC UNIVERSITIES BUILDING MAINTENANCE

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## **DEDICATION**

This thesis is dedicated to my amazing husband,  
my father and mother,  
my parents in law and my siblings,  
who have always been a source of support,  
who always care for me,  
and for being the cheerleading squad that I ever needed,  
made it possible for me to complete this thesis.

Last but not least,  
to my very supportive supervisor,  
Assoc. Prof. Sr Dr Mohd Saidin Bin Misnan,  
thank you for everything.

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## **ABSTRACT**

A university's main function is to produce quality graduates, and in doing so, university buildings do play significant roles and are considered to be vital assets and resources. Hence, to prolong a university building lifecycle to ensure all university activities to continue performing at an optimum level, building maintenance management is central. Even though several previous studies have been conducted in this area, university buildings maintenance is still viewed as insignificant. The objectives of this research are to identify the current practices in building maintenance management for public university buildings, to identify the factors that contribute to public universities building maintenance costs and to determine the best practices for effective building maintenance management for public university buildings. Five public universities namely Universiti Teknologi Malaysia (UTM), Universiti Malaya (UM), Universiti Kebangsaan Malaysia (UKM), Universiti Malaysia Sarawak (UNIMAS) and Universiti Teknikal Malaysia (UTeM) were chosen as case studies. The data was collected through interviewing ten building maintenance experts. Subsequently, the data was then analysed using single-case analysis and cross-case analysis. Based on the findings, current practices employed by the university maintenance department are prioritize maintenance, planned maintenance, preventive maintenance and corrective maintenance. Furthermore, based on the findings, factors contributing to building maintenance costs are fund allocation, technology, mechanical and electrical factors, aging of buildings, environmental factors and vandalism. Best practices, as suggested by the participants involved in this study, are preventive maintenance, prioritize maintenance, and planned maintenance.

## ABSTRAK

Fungsi utama universiti adalah untuk menghasilkan graduan yang berkualiti, dan untuk itu, bangunan universiti dianggap berperanan sebagai aset dan sumber penting. Oleh itu, untuk memanjangkan kitaran hayat bangunan universiti bagi memastikan semua aktiviti universiti terus berprestasi pada tahap yang optimum, pengurusan penyelenggaraan bangunan adalah penting. Walaupun beberapa kajian terdahulu telah dijalankan tentang penyelenggaraan universiti, penyelenggaraan bangunan universiti masih dilihat sebagai tidak penting. Objektif kajian ini adalah untuk mengenal pasti amalan semasa pengurusan penyelenggaraan bangunan universiti awam, untuk mengenal pasti faktor-faktor yang menyumbang kepada kos penyelenggaraan universiti awam dan untuk menentukan amalan terbaik pengurusan penyelenggaraan bangunan yang berkesan bagi bangunan universiti awam. Lima buah universiti awam, iaitu Universiti Teknologi Malaysia (UTM), Universiti Malaya (UM), Universiti Kebangsaan Malaysia (UKM), Universiti Malaysia Sarawak (UNIMAS) dan Universiti Teknikal Malaysia (UTeM) telah dipilih sebagai kajian kes. Data tersebut dikumpulkan melalui temu bual dengan sepuluh orang pakar dalam bidang penyelenggaraan bangunan. Seterusnya, data tersebut dianalisis menggunakan kaedah analisis kes tunggal dan analisis rentas kes. Berdasarkan dapatan kajian, amalan semasa yang digunakan oleh jabatan penyelenggaraan universiti adalah penyelenggaraan keutamaan, penyelenggaraan yang dirancang, penyelenggaraan pencegahan dan penyelenggaraan pembetulan. Selain itu, berdasarkan dapatan kajian, faktor yang menyumbang kepada kos penyelenggaraan bangunan universiti adalah peruntukan dana, teknologi, faktor mekanikal dan elektrik, penuaan bangunan, faktor persekitaran dan vandalisme. Amalan terbaik, seperti yang dicadangkan oleh pihak yang terlibat dalam kajian ini adalah penyelenggaraan pencegahan, penyelenggaraan keutamaan dan penyelenggaraan yang dirancang.

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## LIST OF ABBREVIATIONS

AUKU	-	Akta Universiti dan Kolej Universiti
CMMS	-	Computerised Maintenance Management Systems
HEIs	-	Higher Education Institutions
HVAC	-	Heating, Ventilating and Air Conditioning
M&E	-	Mechanical and Electrical
MOHE	-	Ministry of Higher Education
RM	-	Ringgit Malaysia
UIAM	-	Universiti Islam Antarabangsa Malaysia
UiTM	-	Universiti Teknologi Mara
UKM	-	Universiti Kebangsaan Malaysia
UM	-	Universiti Malaya
UMK	-	Universiti Malaysia Kelantan
UMP	-	Universiti Malaysia Pahang
UMS	-	Universiti Malaysia Sabah
UMT	-	Universiti Malaysia Terengganu
UMTC	-	University of Minnesota Twin Cities
UniMAP	-	Universiti Malaysia Perlis
UNIMAS	-	Universiti Malaysia Sarawak
UniSZA	-	Universiti Sultan Zainal Abidin
UPM	-	Universiti Putra Malaysia
UPNM	-	Universiti Pertahanan Nasional Malaysia
UPSI	-	Universiti Pendidikan Sultan Idris
USIM	-	Universiti Sains Islam Malaysia
USM	-	Universiti Sains Malaysia
UTeM	-	Universiti Teknikal Malaysia Melaka
UTHM	-	Universiti Tun Hussein Onn Malaysia
UTM	-	Universiti Teknologi Malaysia
UUM	-	Universiti Utara Malaysia

## LIST OF SYMBOLS

%	-	Percent
&	-	and

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# CHAPTER 1

## INTRODUCTION

### 1.1 Introduction

This chapter will represent an overall thesis structure for the study. It will also explain in details regard to the background of the study, problems that lead to the study besides explaining the research objectives of the study. Then, this chapter will explain the scope of the study, limitations of the study, and the significance of the study.

### 1.2 Background of the Study

To churn out experts in all fields, universities have a critical role to play because their core function is the education and training of students who will graduate into experts that will drive the future of the country to prosperity. It is the expectation of any country that a significant contribution is made by universities, especially in driving the country towards high income status (Olanrewaju et al., 2015).

This role of higher institution of learning has been proven that universities are making it possible for country to develop and produce the intellectuals as well as the working culture and attitude that is needed to spearhead the development of a country. Also, universities are major drivers of the country's economy and plays an important role in innovation and competitiveness of the country globally (Olanrewaju et al., 2015).

The Malaysia government has recognised the role that universities play in the economy of the country, especially in steering innovation that is key to driving the country to a high-income economy. This role and recognition have contributed to the

significant growth of the Malaysian higher education system. In the last decade, Malaysian universities have experienced increased enrolment of students, global recognition on key dimensions such as patents, institutional quality and research publications (Olanrewaju & Abdul Aziz, 2015).

Furthermore, Malaysia universities have become a top destination for international students to further their study. Statistic from 2010 to 2013 indicated an increment of international student enrolment to Malaysia public universities. Thus, this indicates that public universities are a major provider of higher education in the country, as illustrated in Figure 1.1 (Malaysia, 2016).

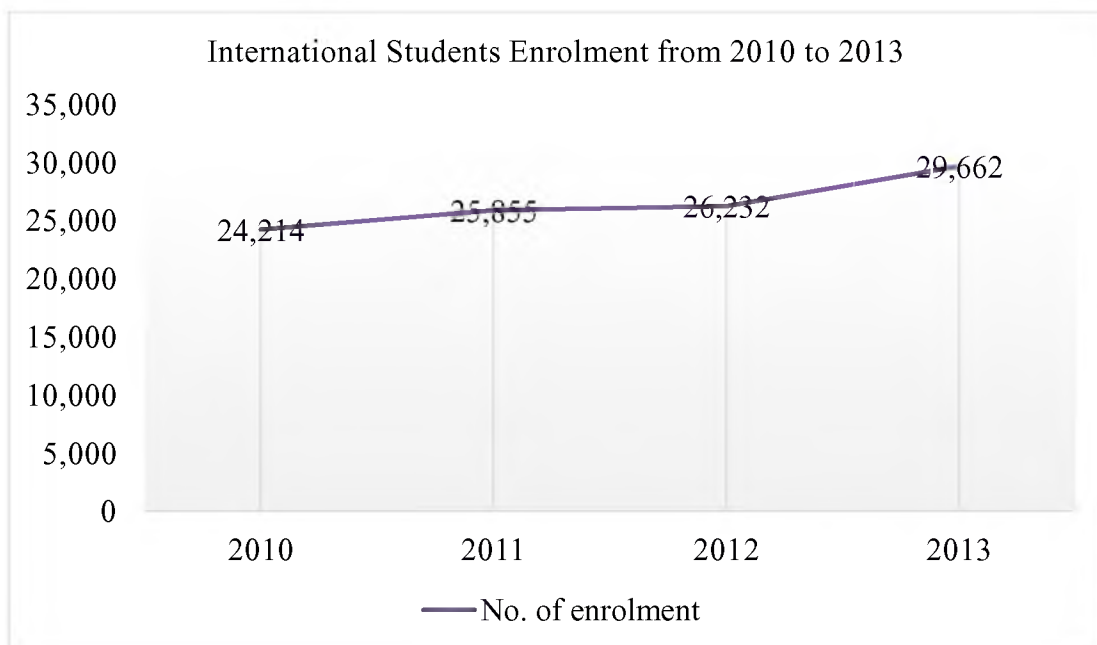


Figure 1.1 International Students Enrolment in Malaysia Public Universities (2000 -2013) (Malaysia Government Report, 2016).

The main purpose of universities is to conduct educational activities that include, but not limited to teaching, learning and research work. For these activities to be conducted in an effective and efficient manner, public universities need good facilities and a conducive environment. This environment can only be provided by buildings that are in good condition, as well as quality that assure comfort for users, and therefore promote educational values in the minds of users. With this in mind, the management of university buildings maintenance works should be taken as an asset as

opposed to being a liability. Moreover, the quality of maintenance works as performed by different universities dictates the value of their buildings (Lateef et al., 2010; Olanrewaju et al., 2015).

### **1.3 Problem Statement**

University building life cycle starts from the design stage to construction, operation, and demolitions. The operation phase entails using the building for academic activities in which the building may be used as a classroom, laboratory, workshop or any other academic activity specific to an institution. The operation phase is when a building requires a lot of maintenance activities as it develops various defects or gets damaged by the user (Lateef et al., 2010; Olanrewaju et al., 2015). Hence, proper maintenance of the building is indeed a crucial factor that needs to be put into considerations of university management.

Nevertheless, despite the fact that university building requires maintenance especially during the operational phase, yet some university management unable to adheres to the requirement. Some existing universities do not observe strict maintenance schedules exposing their facilities to defects, that accelerate the decay of the various building members which eventually calls for the construction of new buildings and/or the demolition of the existing facilities. Although, according to Lateef et.al (2011), the construction of new building helps to upgrade educational facilities and provide a better quality of education yet, maintaining existing building should be the priorities to ensure the existing environments is conducive and adequate for learning. Besides, demolition is usually a technical or economical aspect (Lateef et. al., 2010; Zulkarnain et. al., 2011; Olanrewaju et al., 2015). Hence, it requires more financial supports compared to maintaining the existing building.

Besides that, although regular building maintenance able to identify the various defects on time and helps in reducing maintenance cost (Peng Au-Yong et. al., 2014; Aras et. al., 2016). Yet, if it is neglected, it could lead to high maintenance cost in the future (Lateef et.al 2011). Defects or damages on a building occur from time as the

building is exposed to all kinds of changes of weather including rain, sun, wind, and other natural events which affect the various parts of the building especially the exterior of a building, followed with the interior in the long run and subsequently this will affect the satisfaction of the users of the building and therefore defeat the purpose of the building (Zulkarnain et. al., 2011). Hence, as stated by Zulkarnain et. al (2011), building inspection that finds these defects in the process of determining the performance of the building are justified and must be addressed as there no shortcuts when it comes to the safety of the building.

Apart from that, as compared to demolition or/and construction of the new building, according to Sightlines (2014) and Lateef et. al. (2011), universities have two waves of building construction and maintenance. The first wave is that for buildings over 50 years, however, university budgets are not growing at the same rate as space requirements with existing spaces not being given enough attention with cases of deferred maintenance being on the rise management need usually will be outstripping budget and resource availability. Besides, in Malaysia, most of the public university is pressure to be self-funding (Lateef et.al. 2011) and this situation added to the existing difficulties in maintaining the existing building or improving existing facilities for the learning environment. Hence, often building management was neglected.

Besides that, based on several past studies, there are several issues arise in the current practice of universities management regard to building maintenance as highlighted in summary as in Table 1.1:

Table 1.1 Building Maintenance Issues in Malaysia Public Universities

Categories	Issues
Management system	<p>Inadequate management system approaches (Lateef et. al, 2010)</p> <p>System in addressing complaints and work are outdated (Olanrewaju and Abdul Aziz, 2015)</p> <p>The reporting system is fragmented and complicated (Lateef et. al, 2010)</p> <p>There is no feedback mechanism on users' satisfactions (Lateef et. al, 2011)</p>
Financial constraint	<p>Small budget allocations (Olanrewaju and Abdul Aziz, 2015)</p>
Operation and management	<p>Department are understaff (Olanrewaju and Abdul Aziz, 2015)</p> <p>Staff inadequate qualified (Olanrewaju and Abdul Aziz, 2015)</p> <p>The outsourcing approach is very rudimentary and hazard (Lateef et. al, 2010)</p> <p>The technicians were merely performing clerical functions, leading to under utilizations of staff (Lateef et. al, 2010)</p>

Moreover, according to Suwaibatul et. al. (2012) and Olanrewaju and Abdul Aziz (2015), buildings in public universities in Malaysia are poorly maintained and maintenance is seen as an unimportant activity, hence increased demand among the users of university buildings for better building maintenance. Yet, despite the current condition of buildings and demand for better building maintenance in public

universities in Malaysia, Malaysia higher education institutions (HEIs) budgetary allocation for 2017 was reduced by about 20% for 20 public universities in Malaysia (Ministry of Higher Education, 2017). The budget dropped to RM6.12 billion in 2017 from RM7.57 billion in 2016 (Ministry of Higher Education, 2017). These reductions are shown in Figure 1.2.



Figure 1.2 Public Universities Operating Expenditure in Budget 2016 and 2017 (MOHE, 2017)

Figure 1.2 shows that most public universities in Malaysia suffered huge budget cuts. Given that public universities were established by the government and therefore solely depended on budget allocation from the government, these cut will have a huge effect on public universities in Malaysia and an area that is likely to suffer most is the building maintenance budget (Olanrewaju & Abdul Aziz, 2015). Though public universities might find innovative solutions to generate more revenue, one barrier to this is that they are not autonomous bodies by themselves. Hence, it create difficulties not only in improving existing learning programmed, but at the same time reduce current public university capabilities to improved and maintaining the existing building for better learning environments, Thus, according to Lateef et.al (2010), maintenance of the university in Malaysia are budget-driven rather than needs-driven, where maintenance of public university building in Malaysia are initiated subject to availability of funds and in many cases cyclical maintenance was held until the adequate fund is available where this actions indirectly put dangers for currents user and lead to poor user satisfaction.

Though few strategies have been implemented by several universities in Malaysia to address their financial issues, for instance, UTM strategies to adopt a concept that prioritizes the safety and security aspect in managing the operations and maintenance of building in 2017 (UTM News, 2017) yet, in real practice, building maintenance is something that most people and institutions do not pay close attention to. For instance, the allocation for maintenance work in 2017 by UTM decreased by almost 40 percent compared to 2016 which saw no provision for refurbishment, renovation, and upgrading of buildings, maintenance and purchase of furniture in UTM even after their new strategies' implementations (UTM News, 2017).

Furthermore, '*Ad-hoc*' maintenance practices are usually applied in real practice and if the building is considered to be capable of weathering the various elements that may reduce its service life, maintenance is usually delayed or postponed (Mydin, 2015). Nevertheless, delaying or postponing of maintenance works on building increase risk to the user and building itself. Besides, unlike other organizations, a universities core objective is to offer a stimulating and favourable environment to support teaching, learning, and activities related to academics, and

therefore its buildings are expected to be different and diverse and thus requiring higher maintenance needs. However, without buildings or poor maintenance of existing universities building and facilities, the key goals of a university will not be attained. Hence, proper understanding regard to the need for building maintenance especially among public universities is indeed crucial to being addressed in detail.

Apart from that, there is a correlation between the user academic achievement and the conditions of the university buildings as well as the environment. Studies by Ricci (2018) showed that there is a significant relationship between architectural design and human psychology. Hence, it is not surprised Marcus (2016) indicate that public universities today are investing in new buildings to attract new and more students because besides attracting student, condition of the building has also been shown to affect the mental health of the users (Reynolds, 2016). Besides, several past studies indicate the relationship between the building and human behaviour, for instance, Winston Churchill in 1943 indicated noted that we shape our buildings, and afterward our buildings shape us (Bond, 2017).

Other than that, according to the Suwaibatul et. al. (2012) and Olanrewaju & Abdul Aziz (2015), successful maintenance of universities buildings if it meets or satisfies the needs of the users, it is therefore likely to affect the users positively and this may be illustrated by higher academic achievements of the users. Thus, maintaining public universities building is also likely to shape students behavior at the same time capable of improving university performance and reputations.

Hence, for the above reason, proper university buildings maintenance should be implemented on a continuous basis and need to be understood in details regard to the importance of building maintenance, as building increases yearly with defects and damage occurring from time to time. The selection of maintenance practices should be done well to reduce or minimize the building maintenance cost while optimizing performance. It is essential to ensure that universities buildings are managed and maintained well so that it is capable to provide support to the lifestyle of the building and maintains the value of the asset of the country for a long period. Although the efficiency of building maintenance system is a contributor to the income of the



institution, many stakeholders do not realize this. Thus, for universities buildings to serve the functions and offer long service, it needs to be in good condition, and this can be achieved by using effective building maintenance practices.

#### **1.4 Research Questions**

The research questions for this research are:

- i. How maintenance of buildings in public universities is currently being practices?
- ii. What factors that contribute to public universities building maintenance costs?
- iii. What practices are considered the best in the maintenance of buildings in public universities?

#### **1.5 Research Aim and Objectives**

The aim of this research is to determine the best practices that are used by public universities in Malaysia to maintain their buildings. This research aim will be realized through achieving the following objectives:

- i. To identify the current practices in building maintenance management for public university buildings.
- ii. To identify the factors that contribute to public universities building maintenance costs.
- iii. To determine the best practices for building maintenance management in public university buildings.

## **1.6 Scope of Study and Limitation**

This study is carried out to determine the current practices employed by public universities in the maintenance of their buildings as well as looking into the factors that affect the cost for maintaining buildings in public university. In another section, practices that are considered to be the best in the maintenance of buildings in public universities in Malaysia will be identified. Therefore, the focus of this research is Malaysia public universities. However, literature will focus on all public universities in the world. The researcher has limited time for carrying out this study and therefore it is difficult for all buildings in Malaysian public universities to be researched. As such, this research focussed on five public universities that will form the case study for this study.

## **1.7 Research Gap**

Since existing Malaysia Property Management Standard has yet included proper instructions on suitable ways in handling university building, this study aim to fill the gap since not much of study focus on providing proper framework in maintaining university building especially public university and aims to provides knowledge regard to the areas. Besides, it focus solely on public university. This study also aims to focus on highlighting best practices from perspectives of university maintenance departments compare to past study that focus on problem and solutions based on user perspectives.

## **1.8 Significance of Study**

For a university, buildings are very important as they provide space for holding education facilities as well as where the users learn, teach and research. The researcher aims to determining best practices in public university building maintenance through the findings of this study. The researcher hopes that the findings of this research will be helpful to public university maintenance teams and help them to enhance their

strategies for the maintenance of their buildings. Besides, at the same times capable of improving current universities reputations in facilities and maintenance services at the same time capable to act as promotional tools in attracting future student from both local and international. Apart from that, shareholder and management of the university in Malaysia hoped to gain an advantage with the increase of students' intake due to proper building and facilities maintenance. Moreover, it is with hopes to capable of stimulating student interest in learning and creating a more conducive and reliable study environment. Hence, based on the finding, it is with hope that public universities in Malaysia capable in providing more conducive educational environments and capable in maintaining universities building comprehensively.

## **1.9 Thesis Structure**

This research is structured into five chapters that will be organised one after the other. Each chapter will present various information important to the constitution of this research. A brief summary for every chapter is provided in the following subsections:

### **1.9.1 Chapter 1: Introduction**

Chapter 1 briefly provides the background of study, problem statement, research questions, aim and objectives, scope of study and limitation and significance of study.

### **1.9.2 Chapter 2: Literature Review**

In chapter 2, the researcher presents a detailed review of literature on building maintenance management practices by providing an introduction on the subject. This chapter present the literature review with the aim of identifying building maintenance

problems in Malaysian public universities and aspects of maintenance management practices that can be improved.

### **1.9.3 Chapter 3: Research Methodology**

This chapter of thesis elaborates on data collection and the methods applied in conducting this research. A list of the public university as participants as part of the data collection of this research with a brief background will also be presented.

### **1.9.4 Chapter 4: Data Analysis and Findings**

This chapter presents the findings and the outcome of data analysis from selected case studies. The findings are used to disclose the building maintenance management issues and best practices. The outcome of this chapter helps in answering research question as well as achieving the final objective and the overall aim of this research.

### **1.9.5 Chapter 5: Conclusions and Recommendations**

In this chapter, the researcher proposes and recommends the best practices for building maintenance management based on the findings. The outcome of this chapter helps in answering research question as well as achieving the final objective and the overall aim of this research. This chapter also provides an overall summary of the research findings with relation to the overall aim and objectives. It will also elaborate on the limitations to this study and offers recommendations for future research relevant to this research topic.

## **1.10 Chapter Summary**

Hence, as a conclusion, this chapter has explained in details regard to the problem in current universities maintenance in Malaysia which leads to the study. It also highlighted the objectives of the research and explain in details research structure for this study. Next chapter will explain in details regard to the variables in this study.

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