
# FORMULATION OF MAINTENANCE COST FORECASTING MODEL AT PEJABAT PEMBANGUNAN UNIVERSITI TEKNIKAL MALAYSIA MELAKA (UTeM)

Submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for Bachelor Degree of Manufacturing Engineering

by

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# UNIVERSITI TEKNIKAL MALAYSIA MELAKA

## BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

Tajuk: **FORMULATION OF MAINTENANCE COST FORECASTING MODEL PEJABAT PEMBANGUNAN, UNIVERSITI TEKNIKAL MALAYSIA MELAKA (UTeM)**

Sesi Pengajian: **2017/2018 Semester 2**

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# DECLARATION

I hereby, declared this report entitled "Formulation of Maintenance Cost Forecasting Model at Pejabat Pembangunan Universiti Teknikal Malaysia Melaka UTeM" is the results of my own research except as cited in reference.

Signature : .....

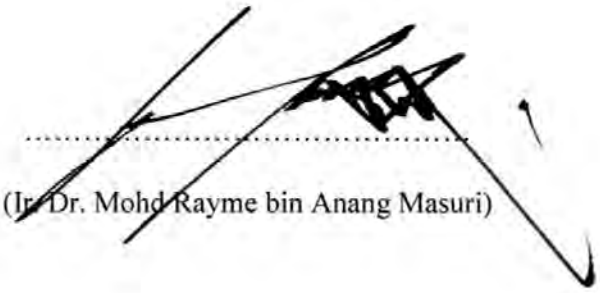
Author's Name : NUR'AIN SYAMIMI BINTI KARAMI

Date : 25th May 2018

# APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of Universiti Teknikal Malaysia Melaka as a partial fulfilment of the requirements for the degree of Bachelor of Manufacturing Engineering (Hons).

The supervisor is :



(Ir. Dr. Mohd Rayme bin Anang Masuri)

# ABSTRAK

Tujuan penyelidikan ini adalah untuk menghasilkan model dalam meramalkan kos penyelenggaraan yang boleh digunakan oleh Pejabat Pembangunan. Model yang dihasilkan akan dapat membantu untuk menyediakan anggaran kos penyelenggaraan yang tepat serta menghasilkan pelan penyelenggaraan ramalan. Masalah yang dihadapi oleh Pejabat Pembangunan UTeM adalah isu kualiti kerja yang menyebabkan pembiayaan yang terhad. Dalam laporan ini, percubaan dibuat untuk mengenal pasti skop kerja penyelenggaraan semasa, mengkaji pemboleh ubah yang mempengaruhi penyesuaian kos penyelenggaraan dan membangunkan model ramalan kos penyelenggaraan di Pejabat Pembangunan, UTeM. Terdapat dua ciri yang boleh dibentuk yang boleh menpengaruhi prestasi kos, ianya adalah penyelenggaraan pencegahan dan penyelenggaraan berjadual. Oleh itu, kajian telah dijalankan untuk mengkaji hubungan antara mereka, manakala model regresi dilakukan untuk menyediakan ramalan penyelenggaraan. Dalam kajian ini, data dikumpulkan dengan mengedarkan borang soal selidik kepada 120 orang staf di Pejabat Pembangunan UteM dan hanya 65 orang staf yang mengembalikan borang soal selidik untuk proses analisi seterusnya . Analisis data dijalankan dengan menggunakan teknik statistik descriptive dan inferential. Output daripada analisis data diperolehi melalui program perisian SPSS dan *Microsoft Excel* 2016. Analisis menunjukkan *Maintenance Expenditure Variance Ratio* adalah antara 0.91-1.00.

# ABSTRACT

The purpose of this research is to formulate a model in forecasting maintenance cost which can be utilized by the Pejabat Pembangunan to prepare an accurate estimation of maintenance cost as well as to produce predictive maintenance plan. The problem of Pejabat Pembangunan UTeM is efficient maintenance works due to insufficient budget. In this report, attempts are made to identify the current scope of maintenance work, study the variables that significantly influencing maintenance cost fluctuation, and develop a maintenance cost forecasting model at the Pejabat Pembangunan, UTeM. There are two characteristics that can be formed which can affect the cost performance; scheduled maintenance and maintenance based on the situation. Therefore, the study has been conducted to correlate the relationship between them. The regression model is also generated for the purpose of maintenance prediction. In this research, data were collected through questionnaire surveys distributed to 120 staff in Pejabat Pembangunan UTeM. Data analysis was carried out by applying both statistical descriptive and inferential techniques. The output from the data analysis was computed through SPSS software program and Microsoft Excel 2016. The analysis found that the Maintenance Expenditure Variance Ratio is between 0.91-1.00.

# DEDICATION

Only

my beloved father, Karami bin Awang

my beloved mother, Zailani binti Hamzah

my appreciated sisters and brothers, Asyraf, Amzar, Aiman, Syairah, Syazleen, Jannah, and Raudhah

for giving me moral and financial support, cooperation, encouragement and also understandings

Thank You So Much & Love You All Forever

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In the name of ALLAH, the most gracious, the most merciful, with the highest praise to Allah that I manage to complete this final year project successfully without difficulty.

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Last but not least, I would like to give a special thanks to my best friends who gave me much motivation and cooperation mentally in completing this report especially to, Siti Nur Athirah binti Basri and Ahmad Khalefa bin Salahudin. Thanks for the great friendship and advice.

Finally, I would like to thank everybody who was important to this FYP report, as well as expressing the apology that I could not mention personally each one of you.

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# CHAPTER 1:
# INTRODUCTION

The aim of this research is to produce a maintenance cost forecasting model which will benefit Pejabat Pembangunan UTeM. That will be the output of this project, which will also a contribution in improving maintenance works in Pejabat Pembangunan UTeM in the future.

In this chapter, the following sub-topics will explain the background of the study (Section 1.1) followed by the problem statement in Section 1.2 which justifying the needs of this research work to be carried out. The objectives in Section 1.3 describing the procedure for how this research needs to be conducted. Section 1.4 specifies the research scope while the importance of the study is explained thoroughly in Section 1.5. The final section of this thesis provides the outline of the thesis.

## 1.1 Background of Research

Maintenance cost is an important element in maintenance works planning. An efficient financial support is needed to ensure smooth maintenance operations. The agency should propose preliminary forecast and cost planning before starting a maintenance project. Furthermore, preparing competitive cost forecast in advance can ensure continuity in organizational management.

Substantial efforts have been made to address the costing of construction market. In construction industry, prediction of construction cost are currently available in practice

techniques such as probabilistic cost estimation, regression analysis, neural network (NN), fuzzy logic (FL), genetic algorithm (GA) and case-based reasoning (CBR). The relative merit and demerits of these techniques were analyzed by experts and are well documented (Alshamrani, 2017).

According to other research, a successful project means that the project has accomplished with satisfied technical performance, completed within schedule and within budgetary cost (Vasista, 2017). Mosadeghrad (2014) has identified that there are three major factors influence developmental costs. The factors are (i) more data cost for added collection and processing expenses (ii) more complex methods to require more highly trained people and more time analysis (iii) implementation for both analyst and user to gain confidence in the model, significant time and money must be invested.

In carrying out maintenance works are required coordination of various sources and factors. It needs to be managed systematically and this activity is referred to as maintenance management. The success or failure of maintenance of service facilities in the Pejabat Pembangunan depends on the effectiveness of its management including financial management.

Therefore, this research will identify an appropriate approach to measure the effectiveness of financial management in terms of anticipating the costing of maintenance works. The findings of this research can be used as a source for improvement of maintenance performed in the future.

## 1.2 Problem Statement

Maintenance works is an important element to sustain the performance of facility provided a budget is sufficiently allocated. However, the problem in Pejabat Pembangunan UTeM is that the cost of maintenance works exceed the allocated budget and the trend of maintenance expenditure is not statistically evaluated. This situation affected maintenance works performance in Pejabat Pembangunan UTeM. Budget allocation and expenditure will be the main topic of the discussion of the purpose of this research is to develop the model forecasting forecast maintenance cost model. Most research findings show that maintenance has led to high-cost activities due to unexpected breakdown. Therefore, it is vital for Pejabat Pembangunan to establish maintenance cost forecasting model in order to sustain an efficient maintenance works.

## 1.3 Objectives

The objectives of this research are:

a) To identify the current scope of maintenance work at the Pejabat Pembangunan, UTeM.
b) To study the variables that significantly influencing maintenance cost fluctuation at the Pejabat Pembangunan, UTeM.
c) To develop a maintenance cost forecasting model for Pejabat Pembangunan, UTeM.

## 1.4 Scopes of research

This scope of this research focuses on the overall prediction of maintenance cost in UTeM based on record available in Pejabat Pembangunan. The formation of maintenance cost forecasting models refers to schedule maintenance and condition-based maintenance.

Basically, the maintenance services provided in UTeM are cleaning and landscaping, general maintenance, lighting, air-conditioning, lifts, sanitary, signages, and parking and, safety and security.

## 1.5 Significant of Research

The main purpose of the study is to formulate a maintenance cost forecasting model by harnessing all the expenditure data in Pejabat Pembangunan UTeM.. A comprehensive analysis of various maintenance services will help the person-in-charge to anticipate the possible budget required each year.

The failure of maintenance service can negatively affect consumers based on the effectiveness of Pejabat Pembangunan in managing UTeM finances. A sufficient budget is fundamental for a successful maintenance works. Pejabat Pembangunan UTeM would benefit from this research. The model established can be applied in order to purpose an accurate maintenance budget.

## 1.6 Thesis Outline

This study has been written and compiled in accordance with the approved format as follows :

**Chapter 1- Introduction**

The author gives an overview of this study, the problem statement, the objectives, the scope of the study, the significance of the study and thesis outline.

**Chapter 2- Literature review**

Literature review consists of previous studies or research on the framework of measuring the effectiveness of maintenance management of service facilities.

**Chapter 3- Methodology**

This chapter will explain the steps and actions that need to be taken in carrying out this study. Description of how this study is carried out, including data collection which comprises the maintenance expenditure record, distribution and collection of questionnaire survey and analysis using a statistical approach.

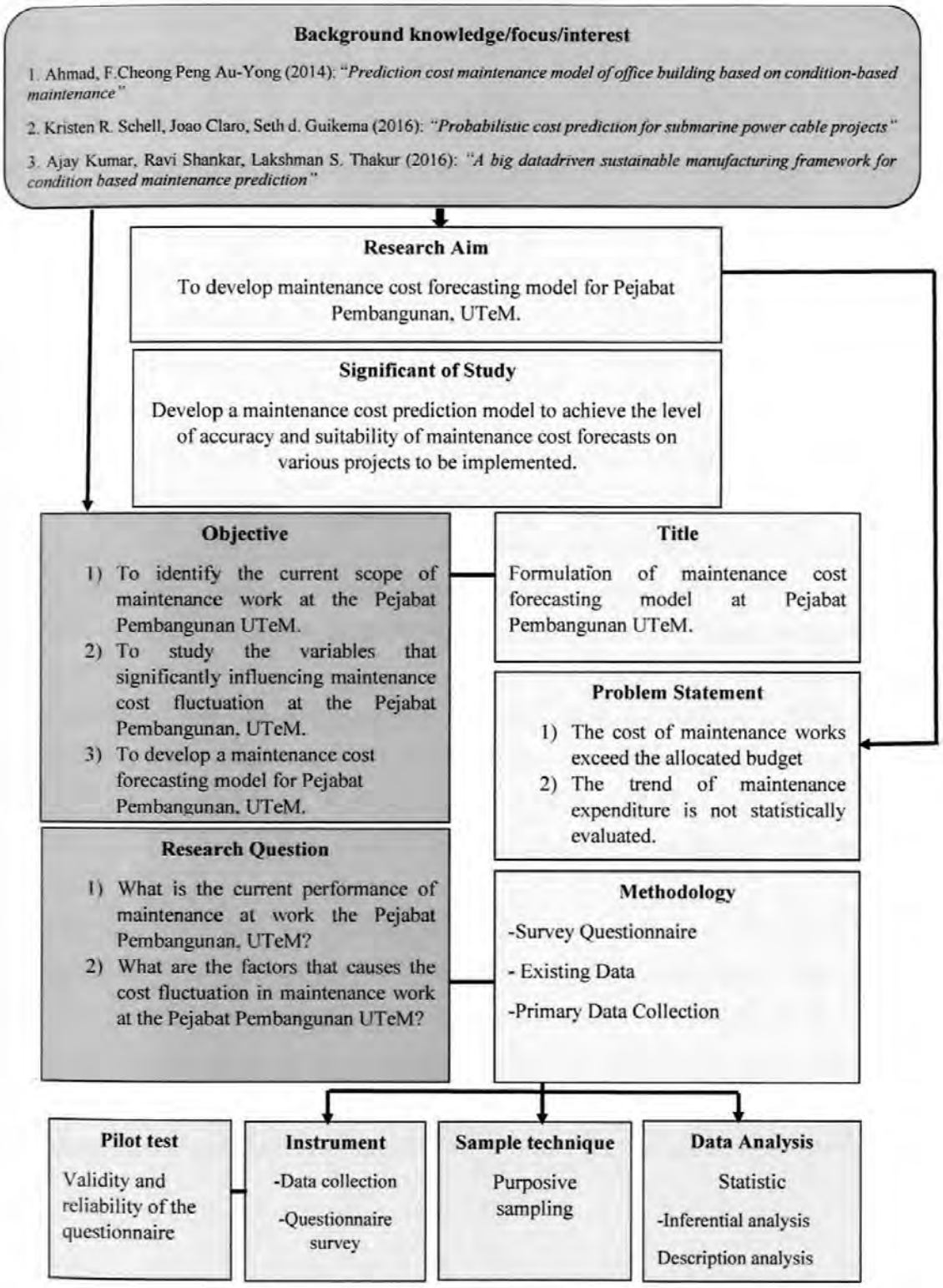
**Chapter 4- Result and Discussion**

This chapter discusses the analysis data. The maintenance cost forecasting model is established by utilizing the results obtained from the statistical analysis.

**Chapter 5- Conclusion and Recommendation**

This chapter summarized the project achievement and provide a recommendation for future works.

## 1.7 Framework of Research



# CHAPTER 2:
# LITERATURE REVIEW

## 2.1 Introduction

The importance of facilities and equipment is essential for users to their comfort and convenience. If the components and equipment are provided with failures, it will affect the owners and users. To ensure that all the above components and equipment are working and always usable, they should be kept and maintained at an acceptable standard. Failure and instability where components from functioning will give substantial impact on the output of service delivery to customers.

Alriwaimi and Zainal (2014) described that there are various that contribute to maintenance projects. The success is very meaningful to everyone involved in maintenance activities and management such as consumers, governments, and contractors communities The success of a construction project is mainly influenced by the performance of a contractor who has worked very well.

Maintenance is important to minimize disruption or abandoned of the services involved to operate daily work. Management by Pejabat Pembangunan UTeM needs to understand the importance, concepts, and techniques of how best maintenance can be utilized on their premises or building facilities. The knowledge and skills of maintenance will allow the facility managers to make an accurate planning in terms of business operations, costs, finances, customer satisfaction requirements and achievement of objectives and better organizational performance.

## 2.2 A Principle of Maintenance Cost

The cost of development work is lower than the cost of maintenance work due to few of the variables described below. Hence, planning is very important and priority for effective and rewarding management to achieve goals and objectives to better affect an organization.

a) Building operation will be disturbed and significantly affected because of the over-estimation of cost and cost overruns. Production maybe will not involve at all with this situation.
b) Maintenance work has been carried out guided into economies of a small scale continuously.
c) Maintenance work should be limited, owned or between places.
d) There is a need to set aside existing work by way of replacement or work before the repair or replacement work.

## 2.3 Maintenance Objective

Provide people with shelter and facilities for work and leisure very important for one of the most valuable of a nation to have buildings. Over the past five years in Hong Kong, the gross value of general trade has increased such as maintenance, decoration, repair, and construction work. The Chartered Institute of Building (CIOB) has defined that the building maintenance is about the work to undertake to keep, restore or improve every facility in every part of a building. Furthermore, the balance between the need and available resources has been determined its services and surrounds to be an agreed standard. The lowest total cost to the organization really requires for ensuring that the assets of the organization are planned, provided, maintained, operated and disposed of by all departments in an organization. According to Che-ghani *et al.* (2016), there are some of the objectives of maintenance management which are:

a) To ensure that the improvement of buildings and their related services are in a safe condition, appropriate for use and the condition of the building meets all legal requirements
b) To carry out the maintenance work required to maintain the value of physical assets of the building standard and maintain the quality of the building.

## 2.4 Types of Maintenance

There are two sorts of maintenance methodology that is a plan and unplanned strategy. Figure 2.1 illustrates the type of maintenance strategy.


Figure 2.1: Types of maintenance strategy

### 2.4.1 Unplanned maintenance strategy

When an emergency case occurs, it is the maintenance that causes high production costs, which is called emergency maintenance or reactive maintenance (Ahmad, 2014). Unplanned

maintenance occurs when emergency situations or maintenance contingencies happen suddenly without any designs set. Actions will carry out when there is a failure and damage effect, the maintenance work will be done immediately. Therefore, maintenance expenditure should be minimized when maintenance work is not planned to achieve optimum level.

### 2.4.2 Planned maintenance strategy

It is generally required in the management of the maintenance as it manages more accurate and systematic planning of work especially for those who are in charge of the violation of the work. It is reliable and accurate data to be persuaded for basic maintenance as reported by Rani *et al* (2015). Besides, Oseghale (2014) explains that planned maintenance also means as advance maintenance that contains the prediction of maintenance requirements. Scheduled tasks that are organized and implemented in advanced are one of the aspects of planned maintenance. Reducing or preventing damage to components or items is one of the means of maintenance actions. Before starting a maintenance activity, planned maintenance is a key activity that needs to be done to avoid frequent breakdowns and downtime. This is due to high maintenance costs to accommodate repairs and replacements for a building that analyzed by Ahmad (2014).

a) Pro-active maintenance

Proactive maintenance will occur when it can detect the failure of a building or facility from the source of the maintenance failure. Proactive maintenance has a positive impact to increase capacity production and extend the life equipment as well. Prevention and prediction maintenance is very difficult from proactively preserved as it is designed to extend the useful age of the equipment to achieve the level by practicing high levels of control over the precision operation.