

**ISSUES AND CHALLENGES IN SELECTION OF
MAINTENANCE STRATEGIES: THE CASE OF GOVERNMENT
OFFICE BUILDINGS IN KOTA KINABALU**

DG BADARIAH BINTI AG ALI

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(HONS) in Bachelor of Building Surveying"

Department of Building Surveying
Faculty of Built Environment
University of Malaya

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Disclaimer

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December 2015

December 2015

Date

DG BADARIAH BINTI AG ALI

Author's Name

BEB120003

Matric Number

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Tuntutan Pihak Ketiga

Projek Ilmiah ini disediakan bagi memenuhi sebahagian daripada syarat keperluan bagi pengijazahan Sarjana Muda Ukur Bangunan oleh Universiti Malaya. Pihak Jabatan Ukur Bangunan, Fakulti Alam Bina, Universiti Malaya, tidak bertanggungjawab atas sebarang tuntutan dari pihak ketiga yang berhubung kait dalam penyediaan Projek Ilmiah ini.

Disember 2015

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Dedication

*Specially dedicated to Dad, Mum,
Abang, Baby and Haffiz*

ACKNOWLEDGEMENT

Dedication

Alhamdulillah, thanks to Allah S.W.T, with His willing I am able to complete this dissertation. I will definitely not able to finish my dissertation without the support and guidance from my supervisor.

*Specially dedicated to Dad, Mum,
Abang, Baby and Haffiz*

First and foremost, I would like to express my sincere appreciation to my supervisor, Prof. Dr. Sri Azien Shah bin Ali for the continuous guidance, patience and motivation to supervising my undergraduate research. His criticism has helped me a lot throughout my research. His disapproval, however, I could not imagine having a better supervisor as a mentor for my undergraduate research.

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I would also like to extend my thanks to the building managers of Federal House of Kota Kinabalu, Tun Mustapha Tower and Wisma Innoprise who has helped me and giving a permission to conduct my research in their building. Without the permission granted, I will not be able to complete this research on time. Besides, not to forget, the representatives from Ministry of Public Works and Public Works Department of Kota Kinabalu for the cooperation and patience given. Not to be forgotten, thanks to all of the respondents that engaged to my research for sharing their opinion and knowledge during the survey session.

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ABSTRACT

In Malaysia, most of the building managers faced a problem in conducting the maintenance operation as a result from an unclear planned and unsystematic approach for the maintenance works. Improper maintenance management and practices could affect the performance levels of the maintenance works and the productivity of the building users. This dissertation aims to examine the issues and challenges faced by building managers of government office building in selecting the suitable maintenance strategies to be practised. Three government office buildings in Kota Kinabalu were selected as the case study building for this research. Both quantitative and qualitative methods are being used in the process of data collection. Structured interview were carried out with the building maintenance managers of the building and 200 questionnaires were distributed to the buildings occupants of the selected buildings. From the questionnaires received, 135 were found out to be useful and to be used in data analysis process. SPSS software was used in the analysis stage for both descriptive and inferential statistics. The data obtained are then analysed and discussed to study the issues and challenges faced by the building managers and the performance levels of the maintenance operation. The results show that there are significant correlations between the frequency of services breakdown and the productivity of the buildings users. Based on the data obtained, the performance level of building maintenance services are analysed using three selected performance indicators. Besides, the issues and challenges faced by building managers also were analysed by calculating the mean values. From the findings, the relationship between the issues faced by building managers and the performance levels of the maintenance strategy practised are then identified in this study.

ABSTRAK

Di Malaysia, kebanyakan pengurus bangunan menghadapi masalah dalam menjalankan operasi penyenggaraan akibat daripada sistem perancangan yang kurang jelas dan tidak sistematik bagi kerja-kerja penyenggaraan. Pengurusan dan amalan penyenggaraan yang tidak betul boleh menjejaskan tahap prestasi kerja-kerja penyenggaraan dan produktiviti pengguna bangunan. Disertasi ini bertujuan untuk meneliti isu dan cabaran yang dihadapi dengan oleh pengurus bangunan pejabat kerajaan dalam memilih strategi penyenggaraan yang sesuai untuk diamalkan. Tiga bangunan pejabat kerajaan di Kota Kinabalu telah dipilih sebagai bangunan kajian selidik dalam kajian ini. Kedua-dua kaedah kuantitatif dan kualitatif digunakan dalam proses pengumpulan data. Sesi temu bual secara berstruktur telah dijalankan dengan pengurus penyenggaraan bangunan yang dipilih dan 200 set borang soal selidik telah diedarkan kepada bangunan penghuni bangunan. Sebanyak 135 daripada soal selidik yang diterima didapati bermanfaat dan digunakan dalam proses analisis data. Perisian SPSS telah digunakan dalam peringkat analisis untuk mendapatkan maklumat secara statistik deskriptif dan inferens. Data yang diperolehi daripada proses pengumpulan maklumat telah dianalisis dan dibincangkan untuk mengkaji isu dan cabaran yang dihadapi oleh pengurus bangunan dan tahap prestasi operasi penyenggaraan. Hasil kajian menunjukkan terdapat hubungan yang signifikan antara kekerapan kegagalan servis dalam bangunan dan produktiviti pengguna bangunan. Berdasarkan data yang diperolehi, tahap prestasi perkhidmatan penyenggaraan bangunan dianalisis menggunakan tiga petunjuk prestasi dipilih. Selain itu, isu dan cabaran yang dihadapi oleh pengurus bangunan juga telah dianalisis dengan pengiraan nilai purata. Berdasarkan daripada hasil kajian, hubungan antara isu yang dihadapi oleh pengurus bangunan dan tahap pelaksanaan strategi penyenggaraan yang diamalkan kemudiannya dikenal pasti dalam kajian ini.

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LIST OF ABBREVIATIONS

BS3811	British Standard 3811 (1984) – Glossary of General Terms Used in Maintenance Organisation
MESA	Maintenance Engineering Society of Australia
RICS	Royal Institutional Chartered of Surveyor
MEI	Maintenance efficiency indicator
MSD	Manpower sources diagram
MSC	Managerial span of control
MUI	Manpower utilisation index
PMR	Preventive maintenance ratio
URI	Urgent repair request indicator
GRI	General repair request indicator
ATTR	Average time to repair
BPI	Building performance indicator
UBBL	Uniform Building By-Laws 1984
IBC	International Building Code
SPSS	Statistical Package for Social Sciences software
YSG	Yayasan Sabah Group
ICSB	Innoprise Corporation Sdn Bhd

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INTRODUCTION

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1.2 Research Background

The major problem in construction scope is always related to bad maintenance work in building. According to Loh et al (2008), the maintenance work always often over budget due to the high amount of money needed to ensure the maintenance is performed. However, building owner may not hesitate if they find unacceptably bad and cause serious problems to the building occupants and the productivity of an organisation. Thus, a proper maintenance strategy can be a tool to overcome the issue (Farmer, El-Hachimi and Hurns, 1997).

CHAPTER 1

INTRODUCTION

1.1 Introduction

An overview and brief of the research study were explained in this chapter. In this chapter, it will covers in the background of the research, the problem statement, aim and objectives of the research, the scope and limitation of the study and also the methodology of the research.

1.2 Research Background

The major issue faced in construction scope is always related to bad maintenance works of a building. According to Lateef (2008), the maintenance works always been overlooked due to the high amount of money needed to ensure the maintenance to be performed. However, building breakdown might happen at any time unknowingly and will cause serious problems to the building occupants also the productivity of an organisation. Thus, a proper maintenance strategy can be a tool to overcome the issue (Horner, El-Haram and Munns, 1997).

There is a various type of works can be carried out in maintenance process even though sometimes it can be complex. The management of maintenance works shall be evaluated strategically as in the design and construction process (Riley & Cotgrave, 2005). An effective maintenance strategy shall be planned to avoid any unwanted situation happen that might risk the performance of a building. It is important to establish the organisation's standpoint towards the maintenance as it will affect the policy outlined for the maintenance operations that will be conducted. (Chanter & Swallow, 1996). The existence of a maintenance manager in an organisation is basically influenced by the objectives of the organisation and the significant of it to the building condition.

In order to ensure the correct maintenance strategies are practised in a comprehensive way and optimised, the performance of the maintenance strategies should be measured to describe the current performance levels and recommend any necessary action in order to improve it. Besides, the issues and problems faced in maintenance works need to be identified and overcome to ensure the right maintenance strategies are implemented in a building. Therefore, the life cycle of a building can be increased by having a proper maintenance management strategy.

1.3 Problem Statement

Maintenance is an essential component in the construction industry and shall be handled practically. Every different type of building with different functions will have a different approach of maintenance management conducted for its. According to Mohd Noor et al. (2011) quoted from Horner, El-Haram and Munns (1997), maintenance works is always conducted not according to its actual needs as it is influenced by the budget allocation. However, over-spending in maintenance and remedial works for building and facilities maintenance management in Malaysia occur due to unclear planned and unsystematic approach for maintenance practices

(Zakaria and Hamzah, 2007). Hence, suitable maintenance strategies selected to be implemented will help in optimising the building performance and value of money.

Lee and Scott (2009) pointed out that maintenance strategy is practised in order to extend the building life cycles and its services. However, the most difficult task faced by maintenance manager is to find an appropriate maintenance strategy in order to reduce the financial expenditure (Horner, El-Haram and Munns, 1997). In selecting the maintenance strategy, some strategic options and alternative decisions need to be taken into account by the management. The allocation of maintenance resources plays big roles to allow the maintenance manager choosing the maintenance strategy. Besides, Lee and Scott (2009) quoted from Burns (1997), stated that ground rules shall be made to ensure the allocation for maintenance resources are available for the maintenance management. Failure in the planning of maintenance strategies has brought to the low quality of maintenance works that happened due to several aspects such as lack of knowledge in maintenance works, fails in providing advice during the design and planning stage and inadequate performance standard (Au-Yong, 2013). As a consequence, many buildings in Malaysia do not meet their standard requirement and function.

Thus, this research is being carried out to identify the issues and challenges that faced by building manager in maintenance works. The problems and issues emerged should be pointed out and solves so that the suitable maintenance strategies will be practised by the maintenance management in Malaysia.

1.7 Scope of Study

1.4 Aim

To investigate the issues and challenges in selecting the appropriate maintenance strategies for government offices building.

1.5 Objectives

This research is designed to meet the following objectives:

- 1) To identify the problems faced by building managers in implementing the maintenance strategy.
- 2) To evaluate the performance levels of the maintenance strategies carried out for the government offices building.
- 3) To establish a relationship between the problems faced by the building managers and the performance of the maintenance strategies.

1.6 Justification of Study

This research is carried out with the hope that the findings will bring benefits to the parties involved in maintaining the building including the government agencies such as Ministry of Works Malaysia and Public Works Department. Other than that, this research is conducted to fulfil the academic requirement and increasing the knowledge understanding.

1.7 Scope of Study

The scope of this dissertation comprise the maintenance strategies, the issues related to maintenance strategies and the challenges faced by the building manager in selecting the proper maintenance strategies for a building. In addition, the performance of the maintenance strategies practised in a building will be evaluated

as well as to assess the efficiency of the maintenance strategies. There are three case studies located in Kota Kinabalu which operated as a government offices building. The three case studies buildings selected in this study are Federal House of Kota Kinabalu, Tun Mustapha Tower and Wisma Innoprise.

1.8 Limitation of Study

This research was conducted by focusing on the building function and used as a government office only. The findings in this study were gained from the interview sessions with the building maintenance managers and the questionnaire survey due to the time constraint. A process of collecting samples in a bigger scope was could not be conducted as a limitation of time.

1.9 Research Methodologies

In conducting this study, both qualitative and quantitative approach were used to obtain all the related and valid information. Figure 1.1 shows the flow of the methodology process for this research.

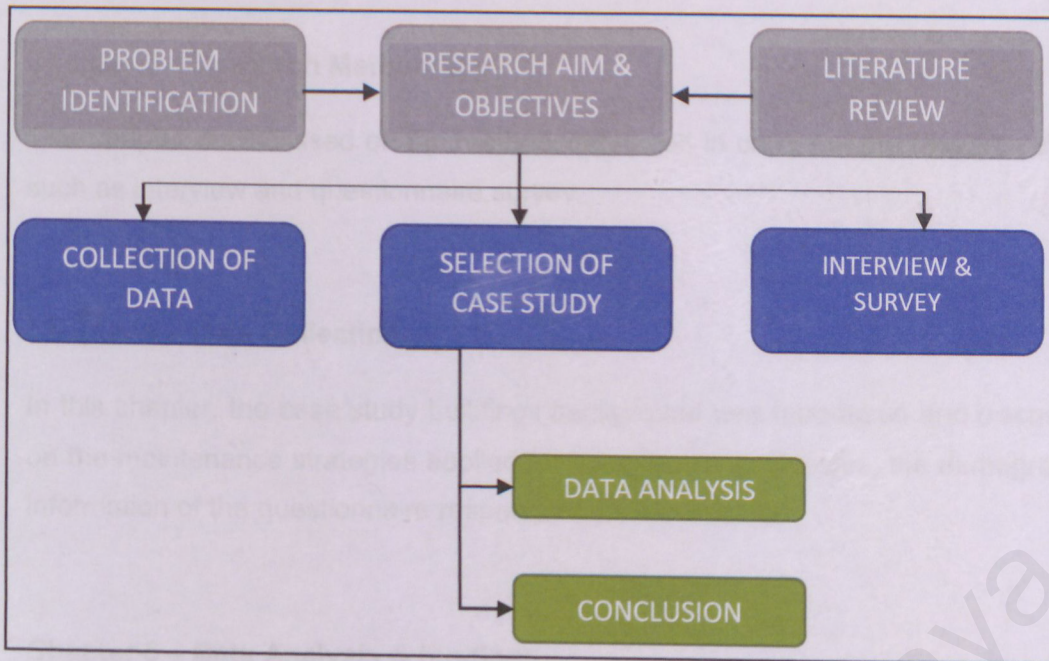


Figure 1.1: Flow of research methodology

1.10 Research Outline

In general, there are six chapters for this research project. The outline of this report are as follows:

Chapter 1 – Introduction

In this chapter, the introduction of the research, aim and objectives, the methodology and scope of the research are discussed.

Chapter 2 – Literature Review

In this chapter, a general overview of the building maintenance and maintenance strategies are prepared in order to give an information on the research scope.

Chapter 3 – Research Methodology

This chapter is discussed on the methodology used in carry out the research study such as interview and questionnaire survey.

Chapter 4 – Data Collection

In this chapter, the case study buildings background was introduced and discussed on the maintenance strategies applied for every building. Besides, the demographic information of the questionnaire respondents is represented.

Chapter 5 – Data Analysis & Findings

This chapter contains the analysis of the data collected from the research. All of the information gathered are represented and discussed in this section.

Chapter 6 – Conclusion and Recommendation

In this chapter, all of the information obtained either from the literature review or field works were concluded. In addition, a recommendation for any further study is provided.

1.11 Summary

In summary, the importance of maintenance strategies selected for a building has been highlighted in this chapter. Besides, the problem in building maintenance and the research objectives were also discussed. Hence, the discussion on the literature review of this research is discussed in the following chapter.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In this chapter, the general overview of maintenance strategies will be discussed to give a wider understanding and knowledge on the scope of the research. All of the data and information obtained and provided in this chapter are mostly gathered from the academic journals and books.

2.2 Building Maintenance

2.2.1 Definition of Maintenance

According to BS3811:1984 – Glossary of General Terms Used In Maintenance Organisation, the word 'maintenance' can be defined as the integration of all technical and associated administrative operations that aimed to retain or restore an item to a condition in which it is available to perform its intended function. In order to meet the standard statutory requirements, the action carried out for maintenance works shall not below than those necessary.

The Maintenance Engineering Society of Australia (MESA) have a different opinion regarding the definition of maintenance. The MESA states that maintenance should be defined in a broad interpretation and they explain it as the necessary decisions and actions implemented to make sure the system are able to operate within the range of the levels of the performance in many aspects including the quality, rate and responsive aspects (Chua, 2011).

The maintenance term does have many differences definition, but all of the definitions do share similar themes. According to RICS iConsult (2013), maintenance can be understood as the combination of all management and technical actions that carried out to keep an asset or preserving it into a suitable standard to ensure the asset can perform its intended function to the optimal phase.

While the term of 'building maintenance' can be understood as the work conducted to ensure every part of a building, the services inside the building and its surrounding be kept, restored or improved to an acceptable standard and to retain the utility and the value of building (Seeley, 1987). This supported by Ali et al. (2010), which described the building maintenance terms as the technical and management work combined that been implemented to retain or repair the elements and items in a building to an acceptable standard to ensure it is functioning as intended.

According to Pintelon, Pinjala and Vereecke (2006), 'maintenance strategy' can be looked from the viewpoint of maintenance policies. While, Kevin and Penlesky (1988), described maintenance strategy as a combination of elements such as maintenance policies, backing up equipment and upgrading equipment. Maintenance strategies also viewed as the verification, resource allocation and implementation of decisions for repair, replacement and inspection works (Kelly, 1997).

The performance and life cycle of equipment can be maximised with a strategic maintenance decision were taken that includes the selection of the suitable care and

repair methods. Besides, it also will reduce the cost invested for the maintenance works. Therefore, according to Sondalini (2004), to ensure the successful of the maintenance strategy applied for an asset could be achieved by understanding the fundamental of the equipment failure.

A maintenance strategy is applied to extend the life cycle of buildings and its services (Lee & Scott 2009). Different maintenance strategies will be implemented based on the availability of the maintenance resources.

2.2.2 The Importance of Building Maintenance

The aim of building maintenance is to protect the value of the building in order to meet the client's requirement and reducing the accident from occurring caused by the failure of building components. In the other hand, the objective of building maintenance is to guarantee the components of the building or the services in a good condition. According to Edwards (1972), building maintenance will provide a better environment to the occupants.

There is a various type of works can be carried out in maintenance process even though sometimes it is complex. The management of maintenance works shall be evaluated strategically as in the design and construction process (Riley & Cotgrave, 2005). An effective maintenance strategy shall be planned to avoid any unwanted situation happen that might risk the performance of a building. According to Chudley (1981), building deterioration will take place if the maintenance works do not perform to an acceptable standard.

2.3 Types of Maintenance Strategies

2.3.1 Introduction of Maintenance Strategies

Maintenance works divided into two categories according to BS3811 which are planned maintenance and unplanned maintenance. Figure 2.1 shows the subdivision of maintenance strategy.

According to Horner, El-Haram and Munns (1997), building maintenance strategies can be grouped into three: Corrective, Preventive and Condition-based. While Swanson (2001) splits the types of maintenance strategies as: Reactive strategy, Proactive strategy and Aggressive strategy.

In contrast with Pintelon, Pinjala and Vereecke (2006), maintenance strategy can be seen as corrective or breakdown maintenance, preventive maintenance and predictive maintenance from the perspective of maintenance policies. Chan, Lee and Burnett (2001) categorised maintenance strategy into five types which are time-based, performance-based, breakdown-based, renovation-based and integration-based. However, all of that strategy were developed from the three basic of maintenance strategies (corrective, preventive and condition-based).

Generally, the maintenance scope can be categorised into two main points which are the planned maintenance and unplanned maintenance. In planned maintenance, the works can be subdivided into another two groups: preventive maintenance and corrective maintenance. Under the preventive maintenance, it consists of scheduled maintenance and the condition-based maintenance. On the other side, the scope of unplanned maintenance is only focused on the corrective maintenance. Figure 2.1 shows the illustration of maintenance scope.

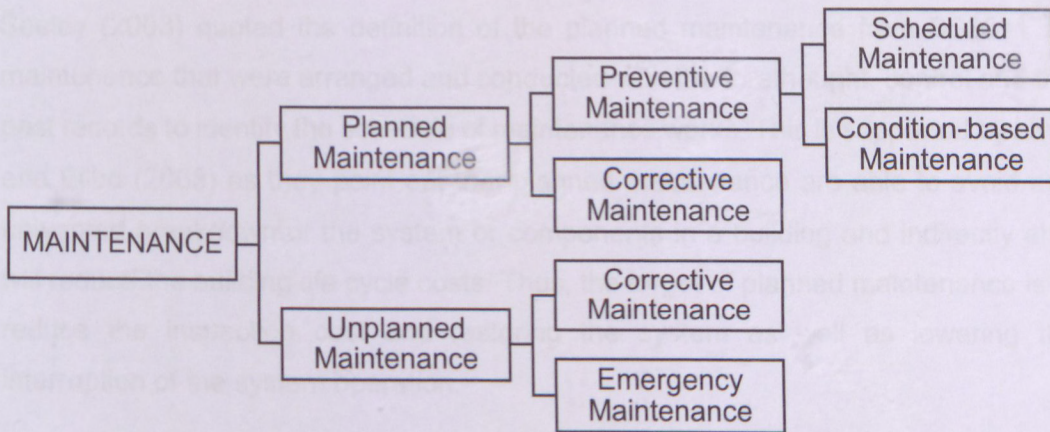


Figure 2.1: Types of maintenance strategies
(Source: BS3811)

2.3.2 Planned Maintenance Strategies

Planned maintenance normally also known as the predictive maintenance or the preventive maintenance. This type of maintenance usually conducted with refers to the plan or schedule that has been set up even though the items or components of the assets does not show any abnormal condition (Pann and Gibb, 2009). This is supported by Walls, Thomas and Brady (1999), expressed that planned maintenance was carried out based on the predetermined scheduled of maintenance.

According to Walker (1999) and Wireman (1998), the planned maintenance operation is always scheduled and there will be a person or an organisation that is responsible for ensuring the maintenance works are recorded and necessary works have been carried out in order to repair or manage any problem that arise. Furthermore, the procedures and manuals that show how the maintenance works shall be operated should be provided and available all the time.

Seeley (2003) quoted the definition of the planned maintenance from BS3811 as maintenance that were arranged and conducted with the forethought, control and the past records to identify the schedule of maintenance works. This is supported by Lavy and Bilbo (2008) as they point out that planned maintenance are able to avoid any unwanted breakdown of the system or components in a building and indirectly also will reduce the building life cycle costs. Thus, the target of planned maintenance is to reduce the inspection cost and restoring the system as well as lowering the interruption of the system operation.

a) Preventive Maintenance

The improvement, calibration as well as fixing up actions that performed in objectives to rectify or prevent any failures occurs can be called as preventive maintenance (Kelly, 1997). The tasks in this maintenance strategy were planned to be performed in a regular time or fixed periods such as daily, weekly or yearly. The frequencies of maintenance works conducted are unfixed because it are often construct based on the details gained from the manufacturers' or based on the experience and knowledge of the maintenance people. This type of strategy was established to get over the problem in corrective maintenance strategy (Horner, El-Haram and Munns, 1997).

Preventive maintenance was described by Mostafa (2004) as the operation that implemented before the tools breakdown which consist of planned, scheduled and corrective actions. Bevilacqua and Braglia (2000) also highlighted that in preventive maintenance, the most crucial actions that must be carried out is the inspection as the abnormal behaviour can be detected and repair work are able to be performed earlier.

Based on Wood (2003), the word of 'preventive' can be understood as an element or item that be replaced even if it still in a good condition and having a residual life. In

addition, the main concept of preventive maintenance to be performed is to avoid any failures to occur as it will lead to a serious problem and it was unacceptable. Besides, inspection is not the only action that should be taken for preventive maintenance activities. It includes the routine supervision, routine check and preventive replacement. Therefore, there must be no such failures happened in implementing preventive maintenance approach.

b) Scheduled Maintenance

According to BS3811, scheduled maintenance is works conducted in a specific period of time, the number of works and milestone that have been planned before. Basically, scheduled maintenance is almost similar to the preventive maintenance but the works conducted in scheduled maintenance have been decided earlier and it has to be carried out according to the working schedule.

This is supported by Mishra et al (2006), where they defined scheduled maintenance as a periodic replacement of building elements or components based on a period of time. The replacement of the components will be conducted based on the schedule planned either in monthly or weekly gaps. The determination of the scheduled maintenance works is planned according to the records of past failure of the system.

Forster and Kayan (2009) stated that the optimal strategy to be applied in a building maintenance works is the scheduled maintenance. The best way to optimise the building and its services is by repairing the services or replacing them according to the predetermined scheduled with a fixed interval (Horner et al, 2007; Flores-Colen and de Briito, 2010).

c) Condition-based Maintenance

Condition-based maintenance describes as the action executed in respond to any notable failure in an element based on the result of monitoring process of the

status and performance of the element (Kelly and Harris, 1978). According to Robson, MacIntyre and Trimble (2013), condition-based maintenance is applied to survey the health condition of a machine upon a time, while Slack, Chambers and Johnston (2010) describe it as a triggers interference to an equipment or services that happened when it's in need only.

For this type of strategy, inspection works are required to be conducted to check the status of the elements in order for the maintenance job be carried out. Changes in building performance or the elements condition are the fundamental reason for the maintenance to be performed. The duration of maintenance works to be executed for each and every element will be figure out according to the inspection result (Horner, El-Haram and Munns, 1997). Therefore, the service of a machine can be fully utilised and interruption of the machine operation also can be lowered.

The advantage of implementing condition-based maintenance is it can reduce the failures that probably can happen due to frequent maintenance works which may also influence the others element performance. But the bad side of condition-based maintenance, the operation of the machine still have to be stopped during the maintenance works performed (Robson, MacIntyre and Trimble, 2013). Kelly (1997) stated that condition-based maintenance does have limitation. It needs a control device to monitor the performance or any changes of the building facilities.

Furthermore, the critical part in condition-based maintenance is it has to get an experience or expertise person to examine any changes or detecting a malfunction of the machine (Robson, MacIntyre and Trimble, 2013). It does rely on the sharp attention of the operator to recognise any unusual things such as overheating and loud noise of the machine. The inspections carried out for this type of maintenance are vary from the other types of inspection. Lots of inspection tools and techniques do be used under the condition-based maintenance strategy such as vibration

analysis, the oil debris analysis, the infrared thermography, corrosion detection and crack detection (Horner, El-Haram and Munns, 1997).

2.3.3 Unplanned Maintenance Strategies

Unplanned maintenance is an ad-hoc maintenance where the maintenance works conducted is does not exist in the initial plan (BS3811).

a) Corrective Maintenance

Horner, El-Haram and Munns (1997) describe corrective maintenance as the straightforward type of approach. This means that the entire component in the building will operate until it not functioning well. According to David and Arthur (1989), corrective maintenance always took place in responding to any breaks down of services or based on the demand of the user. It also can be described as a maintenance work that carried out based on the failure of an element or unplanned maintenance.

This type of maintenance can be very costly as the part that failed to operate also affected the others element in a building such as missing of roof tiles that will lead to damage on the roof structure, the ceiling and the inside part of a building. Corrective maintenance also might be so expensive when the failure happened at the unsuitable time. It will influence the productivity of the building user and also the building management, hence, the maintenance activity will need extra manpower and the cost of obtaining the spare elements will be extremely challenging (Horner, El-Haram and Munns, 1997).

b) Emergency Maintenance

Emergency maintenance can be referred as an action taken to rectify an unexpected fault of a system or device in order to ensure the operation can be resumed and minimising the loss (Huawei, 2009). According to Salo and Klein (2002), a situation that required an immediate attention due to the failure that may lead to significant damage to the building, system or equipment is called as emergency maintenance. The effects from emergency situation could create a dangerous condition that would expose a person to any possibility of harm. Besides, the emergency situation also may happen unexpectedly and cause a fault. Schokry (2011) stated that emergency maintenance is a work conducted as fast as possible that intended to ensure the breakdown is fixed and safely to be operated.

2.4 Measurement of Maintenance Performance

The productivity of maintenance can be defined as a ratio of a building condition and the maintenance cost that will be used in maintenance policy justification and the budget allocation (Roka-Madarasz, 2011). The indicator of maintenance performance also operated to compare several maintenance policies on costs and building maintenance condition.

Improvement of performance can be carried out by getting the performance feedback and able to measure the performance (Inman, 2015). The measurement of system productivity can be applied for strategic and day-to-day operations to control or improving the performance. The concept of measuring the maintenance performance is not a new trend as it has been around a while. It is vital for the performance measurement system having a clear briefing towards the organisational strategy (Bernspang and Kali, 2011).

The measurement that can produce a quantified value to show the performance level either by using a single or multiple aspects is known as a performance indicator (PI). According to Bernspang and Kali (2011), a set of metrics is used in performance indicator to determine the efficiency and the effectiveness of the system performance. The metrics show an analysis of critical parameters or key processes of the system and it is essential in order to establish the goals and measuring the performance (Smith, n.d).

There are lots of performance indicators can be used to measure the maintenance performance and their cost effectiveness. According to Bernspang and Kali (2011), maintenance performance indicators can be divided into three categories which are equipment performance, cost performance and process performance. The equipment performance can be measured by looking into the availability, reliability and overall effectiveness of the equipment while the cost performance can be measured by considering the material and labour costs. Measurement of the process performance can be done by comparing the ratio between planned and unplanned maintenance work that have been carried out.

According to Roka-Madarasz (2011) based on research of Pati et al. (2009), the existing indicators to measure the maintenance are as following:

- Maintenance efficiency indicator (MEI)
- Manpower sources diagram (MSD)
- Managerial span of control (MSC)
- Business availability in percentage
- Manpower utilisation index (MUI)
- Preventive maintenance ratio (PMR)
- Urgent repair request indicator (URI) or General repair request indicator (GRI)
- Average time to repair (ATTR)
- Building performance indicator (BPI)
- Benchmarking
- Balanced scorecard

2.4.1 Maintenance Efficiency Indicator (MEI)

Maintenance efficiency indicator does examine the building maintenance inputs by calculating the annual maintenance expenditure. The expenditure for the maintenance operation will be calculated by referring to the physical and performance state of the asset. Based on Lavy and Shobet (2010), MEI does aim to determine the efficiency of the practice maintenance activities.

2.4.2 Manpower Sources Diagram (MSD)

The ratio of in-house expenditures will be compared with the expenditure for outsourcing works in manpower sources diagram (Enshassi and El Shorafa, 2015).

2.4.3 Managerial Span of Control (MSC)

Based on the research of Enshassi and El Shorafa (2015), the ratio between the management of a manager to subordinated personnel or sub-contractor will be compared for a managerial span of control.

2.4.4 Business Availability in Percentage

According to Enshassi and El Shorafa (2015), the business availability in percentage indicator will analyse the availability function of a floor area over an entire floor area of a building over a year.

2.4.5 Manpower Utilisation Index (MUI)

The existing performance indicator that comparing the working hours spent by the maintenance team for carrying out maintenance works over the total available working hours is called as manpower utilisation index (Enshassi and El Shorafa, 2015). In simple words, this indicator analysing the normal working hours for a person with the duration of maintenance works being carry out for a building.

2.4.6 Preventive Maintenance Ratio (PMR)

In preventive maintenance ratio, the ratio between a total of working hours spent for performing preventive maintenance and the total working hours that used for maintenance works are compared (Enshassi and El Shorafa, 2015).

2.4.7 Urgent Repair Request Indicator (URI)/ General Repair Request Indicator (GRI)

According to Enshassi and El Shorafa (2015), in order to review the performance of the maintenance management using the urgent repair request indicator (URI), the manager have to use the URI formula which is:

$$URI = \frac{UR}{UR + GR}$$

Where:

UR – number of urgent repair requests submitted by the building occupants

GR – number of general requests for repair of the building facilities

The number of URs can be reduced if the maintenance staffs can perform the maintenance works according to the scheduled by keeping the equipment and the systems in a good condition. If the URI values are high, it means that lots of urgent repairs that need to be faced by the maintenance staffs and their performance and schedule are distracted. Hence, the scheduled preventive and corrective maintenance are unable to be carried out on time. In the long term duration, the building performance will be influenced by the high value of URI which leads into the loss of business and prestige (Enshassi and El Shorafa, 2015).

2.4.8 Average Time to Repair (ATTR)

Average time to repair can be understood as the duration took by the building maintenance staff to perform the repair work in an hour (Enshassi and El Shorafa, 2015). It also can be defined as a total number of units repaired by the maintenance staff in an hour.

2.4.9 Building Performance Indicator (BPI)

Based on the study of Lavy and Shohet (2010), building performance indicator (BPI) aims to calculate the actual physical performance score of every system installed in a building. BPI does take into the account of the design parameters and the development of construction technology in a building. Besides, BPI provides a new perspective view for the building manager that creates a concurrent link between the physical performance score and the financial issues of the building components.

This indicator evaluates the overall condition of a building based on the performance of the building components and the systems. According to Enshassi and El Shorafa (2015), the building's condition and the systems inside the building are rated by using a scale, between 0 and 100.

2.4.10 Benchmarking

Benchmarking can be viewed as an important tool or process for evaluating the effectiveness and efficiency of the maintenance operation (Roka-Madarasz, 2011). Nowadays, benchmarking has become a trend in maintenance management by analysing the facilities and the costs. According to Kumar et al. (2013), benchmarks can be categorised into two categories which are checklists and surveys. The checklist does give a quick and rapid approach, but it does rough insight as to determine the ideal value for benchmarking is quite difficult. While, survey are normally applied for specific industrial sectors and commonly it will comprise of maintenance cost.

2.4.11 Balanced Scorecard

The balanced scorecard is also one of the indicators that can be used to measure the performance level of the maintenance works. The concept of balanced scorecard was developed by Kaplan and Norton in 1992 as a tool to measure performance (Hillstrom, 2015). It consists of a holistic framework in order to establish performance management systems. The basic of balanced scorecard requires the managers to view their operation from four different perspectives which are from the view of customer, internal operation, innovation and development and the financial or shareholder perspective.

Basically, balanced scorecard functions as a benchmark of an organisation success (Bernspang and Kali, 2011). According to Enshassi and El Shorafa (2015), the balanced scorecard does provides a balanced perspective of performance and guides strategic decisions that can be functioned as a monitoring tool of the productivity indicators showing the performance level.

2.5 Issues and Challenges in Selecting Maintenance Strategies

According to Abdul Rahman et al. (2012), the implementation of good maintenance is failed to be practised due to some significant issues and problems. These factors have become a common problem faced by the building manager in maintaining a building. Al shehri, Motawa and Ogunlana (2015) and Abdul Rahman et al. (2012) classified the issues and challenges faced by the building manager in three main categories of top management problems, human resources problems and technical problems.

2.5.1 Top Management Problems

Top management problems can be understood as the problem related to the management of the maintenance process, the performance and execution of the management throughout the maintenance process. According to Lee and Scott (2009), most of the maintenance personnel do not understand the management and operational situations as they are too depending with the technology development. The details of top management problems are as following:

a) Lack of knowledge in maintenance scope

A good quality of maintenance operations can be achieved by having an effective maintenance management, especially from the top management. According to Abdul Rahman et al. (2012), it is crucial for a maintenance works to have a proper management and leadership of people as it will reflect the successful of the maintenance process. Al shehri, Motawa and Ogunlana (2015) stated that the maintenance personnel background, education level and experience in maintenance scope plays an important role as it will influence the management system of a building.

b) Procurement management

Based on the research by Al shehri, Motawa and Ogunlana (2015), the procurement system for government projects normally required three different quotations from three different contractors or suppliers. The quotation will be selected and given to the contractor or supplier with the lowest price. In order to carry out the maintenance jobs, the main concern of the contractor is to gain profit and reduce the cost of the project. Hence, they do not really take into the consideration regarding on other issues especially the quality of the works and time consuming.

c) Unqualified maintenance contractor

According to Ali and Chua (n.d.) by referring to Lee and Scott (2008), most of the maintenance personnel do not understand the management and operational framework in maintenance process and they are too relying on technology. Besides, Al shehri, Motawa and Ogunlana (2015) find out that most of the worker appointed by the maintenance contractors for maintenance works are a foreign worker with the level of experience in maintenance ranged from unskilled to skilled workers but most of them are unskilled workers. It also very often that the contractors do not provide an excellent and skilled worker to perform the works where it will cause waste of time and effort.

d) Government regulations and rules

The policy of government also does influence the decision of top management in selecting the suitable maintenance approach as they have to offer the maintenance contract to the lowest bidder. Based on the research of Al shehri, Motawa and Ogunlana (2015), the disadvantages of appointing contractor with the lowest bid is it did not consider the economy fluctuations and the age of the building. Usually, the maintenance works required for an old building is more complicated and the price of spare parts and expertise labour for the works will increase along with the rise of living standard.

e) Stakeholder communication

In every maintenance works, communication is a crucial thing as a good communication will ensure the department's goal, objectives and plans are carried out as intended (Al shehri, Motawa and Ogunlana, 2015). Every staffs and contractor in maintenance department should be exposed and briefed the objectives of the building management to achieve the standard quality in maintenance operations.

f) Financial issues

According to Abdul Rahman et al. (2012), financial problem is a problem associated with the budget planning that aims to control and plan the allocation of budget and resources in order to achieve the management objectives. The allocation of maintenance budget is usually planned based on the previous year's budget, but the building manager often faced difficulties in determining the quantity and the accurate cost for maintenance works. Therefore, the building managers will face overruns or underestimates of the budget due to the difficulties in assessing the exact quantity (Al shehri, Motawa and Ogunlana, 2015). In addition, from the study of Ali and Chua (n.d.) according to Tse (2002), it stated that there will be an argument with the operational maintenance team regarding the allocation of budget for maintenance works is always below the needs and requirements. While, in the other hand, the top management always criticises the quality and productivity of the maintenance works which is ineffective and useless. As a result from the ineffectiveness of maintenance approach, the budget allocation for maintenance works becomes more difficult to obtain. El-Haram and Horner (2002) mentioned that the insufficient budget allocated for maintenance works will cause a delay in performing the maintenance works as to cover the needs for maintenance requires high costs.

2.5.2 Human Resource Problems

The weaknesses and human error in making a decision are categorised under the human resource problems. According to Abdul Rahman et al. (2012), the experience of the building manager and their attitudes in understanding the scope of maintenance works are factors that lead to human resource problems. The future discussion on human resource problems are discussed below:

a) Lack of supervision from maintenance team

Based on the study by Al shehri, Motawa and Ogunlana (2015), the role of supervision is found out to be a most important role compared to the others in the maintenance department. The common problem happened in the public sector is the appointed supervisors will only performing their job as supervisors but do not know anything in technical about the maintenance works and they just signed the maintenance report submitted by the contractor. According to Ali and Chua (n.d.), most of the supervisor is a lack in understanding the management and operational framework which lead to negligence of works.

b) Lack of engineers and specialist

Indifferent with construction works, every different scope of works in maintenance does require different manpower to carry out the works as some of the services or nature of works need a specialist and skilled workers (Al shehri, Motawa and Ogunlana, 2015). Some of the maintenance works will be timed consuming as the availability of the expertise for the works are unavailable locally and will be dependent on other countries. Therefore, it is very vital creating a work that can be carried out by the available manpower in our country when needed.

c) Unclear job description and department structure

From the research conducted by Al shehri, Motawa and Ogunlana (2015), it has been noted that most of the maintenance departments does not have a proper approach improving the maintenance operations. Sometimes, the building maintenance organisation was also unclear and has different names such as support services, service management and service centre. According to Abdul Rahman et al. (2012), this problem also happened due to lack of coordination between the top management team and the operational team.

d) Lack of awareness

In maintenance operations, it is important for the maintenance worker understanding the needs of maintenance to ensure the building occupants are able to perform their activities and the business continuity (Al shehri, Motawa and Ogunlana, 2015). The building managers should know the maintenance works that need to be carried out for the building as they need to plan the budget and finance the maintenance works in order to keep the building to an acceptable condition. Besides, the building manager also needs to aware with the maintenance works carry out to prevent any breakdown and failure of the system.

2.5.3 Technical Problems

Abdul Rahman et al. (2012) defined technical problems as a problem that associated with technical scopes in maintaining a building from the beginning to the end of building life cycle. It can be divided as follows:

a) Lack of maintenance software tool

An effective software system that describes the operation, maintenance and renovation of a building helps the maintenance department in making the decision for

budget allocation (Al shehri, Motawa and Ogunlana, 2015). By having the maintenance software, it will help the building managers in planning the maintenance by distributing the budget accordingly and determine the effective total life period of a system.

b) Shortage of spare parts

The decision of maintenance personnel in selecting the maintenance strategies that should be carried out in a building are relying on the availability of the maintenance resources. According to Lee and Scott (2009), although the maintenance strategies conducted are aimed to enhance the sustainability of a building but due to the limited resources, it has been neglected. This is supported by Ali (2009), where he pointed out that the budget allocation for maintenance works influenced the quality of maintenance works performed. Furthermore, from the study conducted by Al shehri, Motawa and Ogunlana (2015), it is quite hard to find suitable spare parts in the local market especially for an old system or machine. This will lead to complicated of maintenance process as the spare parts need to be purchased from the outside market. The process of ordering the replacement parts from the outside market also will increase the maintenance cost and delaying the maintenance process. Besides, the worst situation that may happen due to unavailability of the spare parts is it will stop the whole process of maintenance and building operation.

c) Failure of preventive maintenance/ maintenance strategies

According to Ali and Chua (n.d.), the building owner does claim the maintenance strategies applied is ineffective and failed to optimise the building function and system installed. This is supported by Lee and Scott (2008) as some of the maintenance strategies are planned earlier where the unnecessary replacement will be carried out according to the task description. While Al shehri, Motawa and Ogunlana (2015) stated that preventive maintenance does not carry out according to a schedule where it does requires daily, weekly, monthly and yearly inspection as the maintenance team are busy performing the emergency breakdown maintenance.

d) Development of new technologies

There is a various type of works can be carried out in maintenance process and sometimes it is complex. According to Baek (2007), the rapid growth of modern technologies has leads to the complexity of the products thus required better quality and higher reliability. Sometimes, the condition of the building does not fit with the installation of new technology system. Al shehri, Motawa and Ogunlana (2015) stated that renewing or replacing an old system inside a building will require more maintenance works and maintenance cost.

2.6 Office Building

2.6.1 Office Building

According to UTHM (2012), an office building can be described as a property that functions as a space to be engaged in services and not as a place of selling goods or manufacturing. Basically, the office building was used as a place where business relating to administration, consultation and other services which are not related to retail sales. Besides, an office building can be occupied by a single or multiple firms at one time. Normally, office buildings will have its own maintenance management organisation to take care of the building conditions and managed by the building managers or maintenance managers (Zawawi and Kamaruzzaman, 2009).

2.6.2 Government Building

Department of Housing and Public Works of Queensland (n. d.) defined a government building as a building owned by a government upon its completion. In Malaysia, the ownership of government building is divided into two categorised, the

government buildings under the federal secretary and the government buildings under the state secretary.

2.6.3 High Rise Building

The definition of a high-rise building in Uniform Building By-Laws 1984 (UBBL) is a building that have more than seven storeys or the top floor of the building is more than 30.5 m. According to the National Fire Protection Association (2015), a high-rise building can be classified as a building that higher than 75 feet (23 m) or 7 stories building. Besides, high rise building also can be understood as a structure with a height that could have a serious problem in evacuation (High Rise Building Definition, Development and Use, 2009). In addition, the International Building Code (IBC) defined a high rise building as a building with a height of more than 75 feet from the lowest level of the fire rescue department vehicle.

2.6.4 Effects of Building Services Breakdown in Office Building

According to Min et al., (2010), the breakdown of services influenced the emotional of the occupants. Besides, the failure of recovering the breakdowns will lead to more dissatisfied feeling on the occupants of a building rather than the mistake itself. From the breakdowns of any services in a building, it does cause the building user to feel emotionally upset and loss of control. Based on the research conducted by Au-Yong, Ali and Ahmad (2014), it is vital for the maintenance personnel of a building to increase the effectiveness of maintenance management in order to increase the user satisfaction.

Madelin (2016), stated that the disruption of the building services system such as the fire alarm, water supplies and excessive or inadequate temperatures does influence the satisfaction level of the building occupants. This is supported by the Approved

Code of Practice where, it is important to ensure the usage of the provided services functioning as it will allow everyone at work to use them without undue disruption.

However, with the presence of any backup system to recover the failure of a service system in a building does allow the building user to conduct their activities as normal. The research conducted by Min et al., (2010) shows that there are no differences on the impact from services breakdown in a building if the function of the service system was replaced by any similar system that cater the same function. But if a service breakdown was not replaced or recovered as fast as possible, it does give a strongly significant negative impact on the user satisfaction level.

3.1 Introduction

2.7 Summary

In this chapter, the types of research methodology used for the dissertation writing will be discussed. Several angles of the study have been carried out.

An overview of building maintenance and the maintenance strategies has been included in this chapter. Basically, the strategies of maintaining a building can be categorised into two main types which are the planned maintenance and unplanned maintenance. Besides, there are some issues and challenges need to be taken into consideration in selecting a maintenance strategy to be practised. With a proper literature review, it will help in providing a general knowledge of the research perspective. In the upcoming chapter, the research methodology used in conducting this study was discussed.

3.2 Research Design

This study is aimed to provide the comprehensive research on the issues and challenges faced in selecting the suitable maintenance strategies by using both quantitative and qualitative approach. The quantitative data analysis is an approach that systematically investigates the numerical data collected and/or the data collected

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

In this chapter, the types of research methodology been used for the dissertation writing will be discussed. Several stages of technique have been carried out in this study such as literature reviews, collecting data and information, evaluate the data and conclude the findings to meet the research objectives.

Both qualitative and quantitative approaches are used in this study to obtain all the related and valid information. The methods are exercised to ensure the research results are solid and strong enough to be applied.

3.2 Research Design

This study is aimed to obtain the comprehensive research on the issues and challenges faced in selecting the suitable maintenance strategies by using both quantitative and qualitative approach. The quantitative data analysis is an approach that systematically investigates the numerical data collected and/or the data collected

converted into a numerical data. This method involves the measuring or counting activities. The quantitative approach is carried out to find the evidence either to support or contradict with the idea or hypothesis of the study.

In contrast with a quantitative approach, qualitative data analysis is an approach that requires the activities of recording the people's attitudes, feeling and behaviours. In a qualitative approach, there are several types of activity that can be conducted to gather the research information such as observations and interviews. According to Denzin and Lincoln (1994), the qualitative approach involves the study of use and collection of a several of empirical materials, for example, the case study and personal experience that may describe the routine and problematic moments in lives. Both of the approaches are important in this study as it will help to meet the objectives of the research.

The methodology used in this study were consists of three stages which lead the research process run smoothly. Figure 3.1 show the stages of methodology conducted for this study.

Figure 3.1. The stages of research methodology

Primarily, the problems that arise related to the scope of research will be identified and taken into the consideration during the research studies progress. The study then continues with identifying the aim and the objectives of the research. All of the values

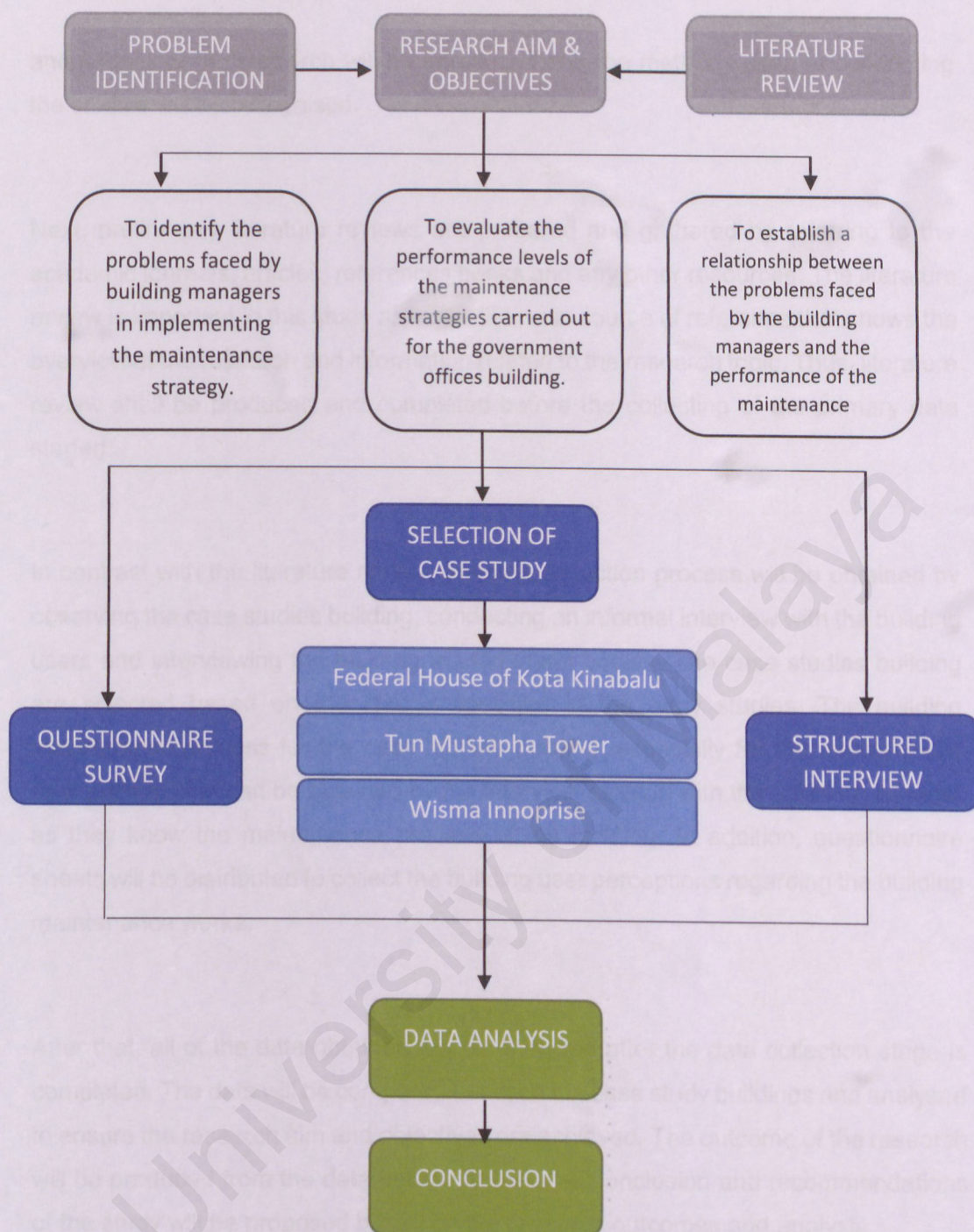


Figure 3.1: The stages of research methodology

Primarily, the problems that arise related to the scope of research will be identified and taken into the consideration during the research studies progress. The study then continues with identifying the aim and the objectives of the research. All of the values

and scopes of the research will be introduced and the methods used in conducting the studies will be recognised.

Next, preliminary literature reviews are prepared and gathered by referring to the academic journals, articles, references books and any other resources. The literature review is important in this study as it was the main source of reference that shows the overview of the research and information related to the research topic. Thus, literature review shall be produced and completed before the collecting of the primary data started.

In contrast with the literature review, the data collection process will be obtained by observing the case studies building, conducting an informal interview with the building users and interviewing the building management bodies. The case studies building are selected based on the criteria specified in the early studies. The building maintenance process for the case studies building, especially for the maintenance strategies aspect can be obtained by the interview session with the building manager as they know the maintenance process of the building. In addition, questionnaire sheets will be distributed to collect the building user perceptions regarding the building maintenance works.

After that, all of the data obtained will be analysed after the data collection stage is completed. The data will be compared between the case study buildings and analysed to ensure the research aim and objectives are achieved. The outcome of the research will be produced from the data obtain. At the end, conclusion and recommendations of the study will be proposed based on the research outcomes and analysis.

3.3 Sample Frame

In selecting the samples for this study, the purposive sampling method is used in order to minimise the scope of the sample population. The sampling frame for this study focused on the high rise buildings which function as a government offices building. The targeted population in this study is focused on the buildings located in the capital of Sabah which is Kota Kinabalu. The validity of the building status was confirmed by checking with the Ministry of Works and Public Works Department, Kota Kinabalu on the purpose of the buildings before being selected as research samples. Table 3.1 shows the information gathered from Ministry of Works and Public Works Department, Kota Kinabalu.

Table 3.1: List of government office buildings in Kota Kinabalu

NO.	NAME OF BUILDING	USED BY	MAINTAINED BY
1	Federal House of Kota Kinabalu	Federal Departments	Ministry of Works
2	Kota Kinabalu Government Complex	Federal Departments	Ministry of Works
3	Wisma Dang Bandang	Federal Departments	Ministry of Works
4	Tun Mustapha Tower	State Departments	Public Works Department
5	Wisma Innoprise	State Departments	Public Works Department
6	Wisma Perindustrian	Federal and State Departments	Public Works Department

3.3.1 Sampling Technique

Based on the technique of purposive sampling, only three buildings will be used for the final samples out of the six buildings from the original sample. The samples need to have at least three similar criteria to be selected as the final samples. Kota Kinabalu Government Complex need to be excluded from the sample as it has a different characteristic from the other samples. Besides, Wisma Dang Bandang and Wisma Perindustrian also have to be excluded due to the limitation of getting the information from the building manager. Hence, three buildings were only left to be used as the research samples which are:

- a) Federal House of Kota Kinabalu
- b) Tun Mustapha Tower
- c) Wisma Innoprise

The buildings selected as the final samples are having three similar criteria which are:

- Building function: Office building
- Building age: 35 – 40 years
- Categories of building: High rise building

3.4 Data Collection

In general, there are two types of data collection which are the primary data collection and secondary data collection. Primary data can be defined as the data collected by the researcher while secondary data is the data obtained from other parties in order to help the researcher understand and support the research (McNabb, 2008).

For this study, both of the data collection types were used to gather the data required. The main method used for this research is the interview with the building manager as it allows more flexible communication with the interviewees as they will have a great deal of leeways on how to point out their own opinions and perspectives. Besides, a set of questionnaires surveys also been distributed to the building occupants in order to obtain the perspectives of the user on the performance of the maintenance management of the buildings.

3.3.1 Primary Data

Primary data can be understood as the data collected by the researcher himself/herself specific on the problem under the scope of the study. There are several elements need to be taken into account in collecting the primary data information for this research which includes the interview questions structures, the targeted group and equipment used. The further discussions on primary data are as follows:

a) Interviews

In this research, some interviews session are carried out by interviewing the building manager, the maintenance manager, the building technicians or the building owner to find out their opinion on the maintenance works that have been conducted to the building, especially for the maintenance strategies aspect. Besides, from the interview session, the current and past maintenance strategies that have been used for the building will be identified.

The questions asked for the interview session are divided into four main part such as below:-

Part 1: Background of the interviewee's

Part 2: General information of the building and the maintenance plans for the building

Part 3: The performance of maintenance works conducted

Part 4: Challenges and issues faced in implementing the maintenance strategies

In Part 1, the questions asked are with regard to the background of the respondent such as the job position of the respondent, his or her working experience for the current position and his or her experience in the fields of maintenance work.

For the second part of the interview questions, the information regarding the building will be asked such as the building history, the building background, the building users and the core business of the building as stated in Chapter 4 of this research. In addition, the maintenance works performed for the building also will be questioned to get the information on how the maintenance works were conducted in the building. Indirect types of questions will be asked to the interviewee to avoid from bias answer regarding the maintenance works performed in the building.

The questions in Part 3 are to recognise the level of the maintenance works applied in the building. Basically, the performance levels of the maintenance works conducted in the building are queried. The maintenance costs of the building are also required in order to evaluate the effectiveness of the maintenance strategies implemented on that building. In addition, the number of complaints on the building services every month also will be asked to measure the level of the maintenance works in the building and how they managed the complaints. Three types of performance indicators are used in order to analyse the performance of maintenance strategies implemented. The performance levels of maintenance strategies practised for the case study buildings were analysed individually using the Likert scale rating of 1 (Very poor) until 5 (Excellent).

Lastly, the Part 4 questions are focused on the challenges and issues deal by the maintenance team in performing the maintenance strategies and how does the building manager handling the problem. From the issues and challenges pointed out by the interviewees', they will have to rate the problem by using the Likert scale rating of 1 (Not at all) until 5 (Very high). The arrangement of the interview questions is organised in orderly to ensure the interview session run progressively.

b) Questionnaire survey

A set of questionnaire form will be distributed to the building users and the building management bodies. The questionnaire is aimed to seek out the building users' perception regarding the services performance and the maintenance works that have been conducted on the respective buildings. Besides, the distributed questionnaire form also intended to know the user level of understanding in connection to the scope of maintenance works generally and maintenance strategies specifically. The structures of the questionnaire form are divided into three main parts which are:-

Part 1: Respondent's particular

Part 2: General knowledge about maintenance and the building

Part 3: Effects of defective of maintenance works

The first part of the questionnaire is aimed to obtain the background information of the respondents such as the gender, ages, occupational status and their frequency of visiting the building.

The second part of the questionnaire will ask the respondents knowledge and understanding on the maintenance works. Besides, the satisfaction level of the user regarding the services performance and the respond of the complaint submitted will be asked.

In the third part of the questionnaire, the effects of the defective elements of the building will be questioned. Moreover, in this section also, will be asked whether the maintenance works performed for the building disturbing the user activities or not. Three types of Likert scale rating with different description were used in the questionnaire to analyse each and every different variable. For the question of services breakdown frequency, a Likert scale rating of 1 (Very rare) until 5 (Very frequently) was used while for the effects of the services breakdown on the respondent's activities were analysed by the rating of 1 (Not at all) until 5 (Very high). In the other way, the overall quality and performance of the maintenance services for the building were analysed by using the Likert scale rating of 1 (Very poor) until 5 (Excellent).

c) Observations

A rough observation will be organised for the case studies buildings to evaluate the maintenance works that were conducted on that buildings. The performance of the building also can be obtained and evaluated from the observation process. The building performance will reflect the effectiveness of the maintenance strategies implemented on the building.

3.3.2 Secondary Data

The secondary data can be divided into two types of the source which are the printed materials and an electrical source. Literature reviews that related to the research topic are one of the secondary data for this research. Besides, the past data of the maintenance records for the buildings are also reviewed to support the data obtained from the primary data.

a) Literature Reviews

A literature review is a preliminary process in a research study. All of the information is gathered by referring to the academic journals, books, newspapers and online websites. Basically, the information gathered are encompassed from the reading materials and will be assessed and evaluated critically.

This process will be conducted first before the primary data were collected as the literature reviews will give an overview and principles of the research topic. A clear understanding of the research scope carried out by the researcher will be obtained by having the literature reviews stage. Most of the journals referred in this study were related to the management, maintenance and facilities management scope. This is to ensure the data obtained are correctly related to the study interest.

b) Analysis of Past Documents and Reports

The maintenance organisation of the selected case study buildings will be met up to obtain the documents of past maintenance works of the buildings. All of the information regarding the past maintenance strategies performed on the buildings will be gathered and analyse accordingly. The past maintenance works will be looked out thoroughly and classified into the class of maintenance strategies. Besides, the suitability of the maintenance strategies conducted also will be identified based on the reports and the building performance.

From the past maintenance strategies that have been planned and carried out for the building, we can figure out either the maintenance works structured for the building are appropriate with the building functions and meet the user satisfaction or not. Besides, the performances levels of the maintenance strategies implemented also can be analysed with referring to the maintenance log books or reports.

3.4 Data Analysis

In completing this research, the data obtained were analysed quantitatively and qualitatively. All of the information gathered from the observation, questionnaire sheets and interview session will be analysed critically using suitable measures to conclude the research work. In order to achieve the research objectives, the data collected will be processed and discussed analytically. The technique chosen to be used in analysing the data depends on the types and number of variables being studied. The discussion of data analysis process is as follows:

3.4.1 Quantitative

The quantitative approach involves a statistical method in gathering and analysing the data. It consists of an accurate statistical comparison of the data collected. This kind of approach is more accurate and reliable in compare with a qualitative approach. Thus, the data collected for the study must be sufficient and large enough to represent the opinion of the respondent.

a) Questionnaire analysis

The data obtained from the questionnaires sheet are analysed by using the software of Statistical Package for Social Sciences (SPSS) version 20th. All of the data collected were key-in and the result was tabulated by the software. The data collected were analysed and represented in percentage values. As stated previously in Section 3.3.1(b), there are three types of Likert scale with different description were used to analyse the Part 3 of the questionnaire. Based on the scale used in this study, the overall mean values were calculated and described with the appropriate description value as indicated in Table 3.2.

Table 3.2: Mean values description used for Part 3 of the questionnaire

(Q 3.1) Service breakdown	(Q 3.2) Effects of breakdown	(Q 3.3 & 3.4) Overall quality and performance of the maintenance services	Mean Value
Very rare	Not at all	Very poor	0.01 – 1.00
Rarely	Small	Poor	1.01 – 2.00
Occasionally	Fair	Fair	2.01 – 3.00
Frequently	High	Good	3.01 – 4.00
Very frequently	Very high	Excellent	4.01 – 5.00

b) Interviews analysis

The interview sessions conducted with the building managers was aimed to gather the information on the building background and their experiences and actions taken in maintaining the building. Besides, the performance levels of the maintenance strategies applied for the building and issues and challenges that have been faced by the building managers were also obtained from the interviews.

As the buildings performance levels were evaluated by using three performance indicators, the mean values of the performance are calculated and describes with the appropriate description value as indicated in Table 3.3 based on the scale used in this study.

Table 3.3: Mean values description used for the building performance levels

Rating	Mean Value
Very poor	0.01 – 1.00
Poor	1.01 – 2.00
Fair	2.01 – 3.00
Good	3.01 – 4.00
Excellent	4.01 – 5.00

While for the issues and challenges faced by building manager in implementing the maintenance strategies, the building managers were asked to evaluate the problems by using the scale of 1 (Not at all) until 5 (Very high) as the parameter. The overall mean values of the issues and challenges are calculated and describes as follows:

Table 3.4: Mean values description used for the issues and challenges faced by building manager

Rating	Mean Value
Not at all	0.01 – 1.00
Small	1.01 – 2.00
Fair	2.01 – 3.00
High	3.01 – 4.00
Very high	4.01 – 5.00

The data was then produced in statistical and tabular format where appropriate for better summarization and the findings are presented in Chapter 4 of this research.

3.2.2 Qualitative

The qualitative approach consists of data collected and evaluated based on the personal and subjective judgement. This approach also includes the collection of data through reading materials such as journals, books and newspapers. The data collected from the interview sessions was also observed and compared to the findings from the reading in order to ensure the continuity between the literature reviews and findings. Finally, all of the information collected from the research approaches will be analysed and discussed critically.

3.6 Summary

In conducting the research, the problems that arise related to the research topic is identified. Literature reviews and background study related to the research scope were produced in the qualitative method in order to get a better idea regarding the research. A structured questionnaires sheets and interview questions were established for the data collection process. The information regarding with the building background and the maintenance works carried out for the building are obtained from the interview session with the building maintenance organisation. This research continued with the next chapter, Chapter 4 which represented the background of the case study buildings and the demographic information of the questionnaire respondents.

CHAPTER 4

DATA COLLECTION

4.1 Introduction

In any types of study, data collection is a crucial aspect as the data collected will generate the result of the research. The accuracy of the data collected plays a major role in the study conducted as it will impact the results of the study and ultimately lead to the successfulness of the research.

For this research, most of the data collected are from the primary data sources and referred to the secondary data sources to support the research findings. All of the data obtained from the structured interviews conducted are analysed according to the respective parts as stated in the interview questions.

4.2 Introduction of Case Study Buildings

The data collected from the structured interview are represented in this section where it focused on the background of the case study buildings. The buildings selected as the research samples have a similar function which is as an office

building. Three buildings selected for this study is as followings; Federal House of Kota Kinabalu, Tun Mustapha Tower and Wisma Innoprise.

4.2.1 Federal House of Kota Kinabalu

a) Building Background

Federal House of Kota Kinabalu was built in 1973 and completed in 1975. This building is owned by Prime Minister's Department and maintained by Gemilang Maintenance Sdn Bhd. It is an 8 storey building comprises of office space, cafeteria, prayer room and open car parking area.

This 107, 030.01 ft² area of the building was rented by six government departments which are the Sabah State Health Department, Sabah Federal Treasury, Department of Director General of Lands and Mines, National Civics Bureau, Sabah Education Department and Malaysia Civil Defence Department.



Figure 4.1: Federal House of Kota Kinabalu building
(Source: Gemilang Maintenance Sdn Bhd, 2015)

Table 4.1: Summary of Federal House background

NAME OF BUILDING	Federal House of Kota Kinabalu (Rumah Persekutuan Kota Kinabalu)
LOCATION	Jalan Mat Salleh, 88100, Kota Kinabalu, Sabah
ARCHITECT	-
NO OF STOREY	8 including lobby
YEAR OF CONSTRUCTION	1973
YEAR OF COMPLETED	1975
TYPE OF BUILDING	Office building
MAINTENANCE OPERATOR	Gemilang Maintenance Sdn Bhd
BUILDING OWNER	Sabah Federal Secretary

b) Maintenance Strategy Used

Based on the interview session with the building manager, Mr Marcellinus Alexander, the background and details of the maintenance strategy were obtained. Mr Marcellinus stated that the maintenance strategy practised for the building is planned preventive maintenance. This strategy has been used by the Gemilang Maintenance Sdn Bhd in maintaining the building for 15 years and they have not faced any serious emergency breakdown yet. The company objective was to ensure the maintenance operations for the building is 95% from planned maintenance and only 5% in unplanned maintenance.

According to Mr Marcellinus, the maintenance works were performed by the in-house staffs of the company and they only used outsource contractor for a specialist works that need to be certified by a competent person such as electrical calibration and air conditioning system as it is still under the warranty period. The maintenance works for the building was scheduled to have a daily inspection on the building components and systems. Every day the building manager will appoint a staff to conduct the

inspection and will be verified by him. The inspection report needs to be key in on the online system and send to the company headquarter.

4.2.2 Tun Mustapha Tower

a) Building Background

Tun Mustapha Tower is the fourth building in the world constructed with column free floors with a central core and the floors are hanging on the steel brackets that supporting every level of the floor. This building was constructed in 1976 and completed in 1979. It was named after the name of a former Chief Minister of Sabah, Tun Datu Mustapha.

The 72 sided polygon building installed with solar-reflective glass with 30 storey floor level was formerly known as Sabah Foundation Building (Bangunan Yayasan Sabah). This building was managed and maintained by the Innoprise Corporation Sdn Bhd, a holding company of Yayasan Sabah Group (YSG) under the authority of the Sabah State government (Yayasan Sabah Group, 2015). The tower houses theatre hall, rotating restaurant, conference hall, office spaces, podium, exhibition foyer, cafeteria, basement and covered car park and library. Most of the office spaces are rented or used by the subsidiary company of YSG.

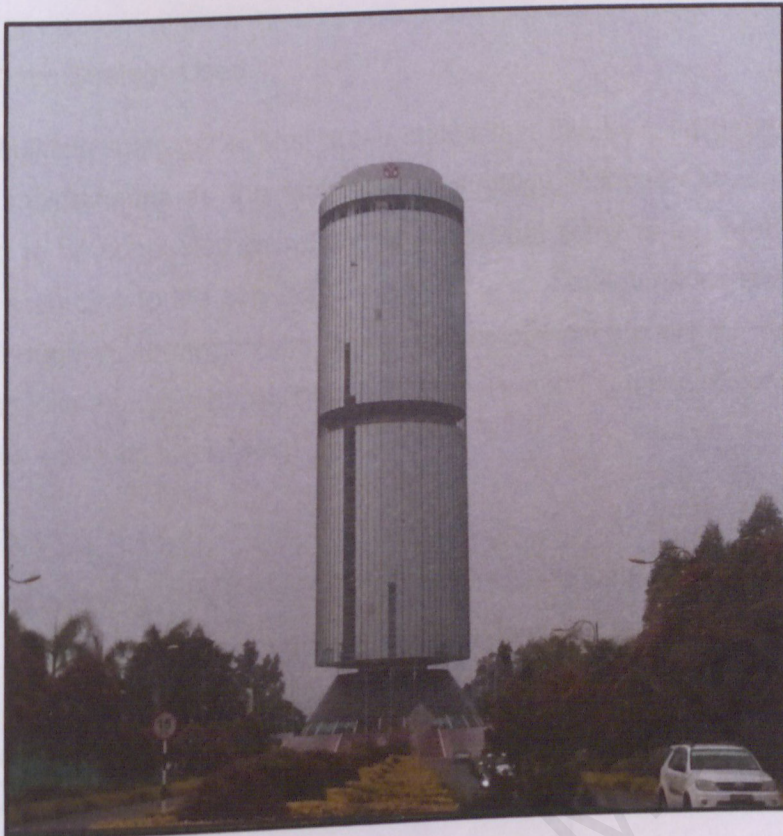


Figure 4.2: Tun Mustapha Tower building
(Source: Fieldwork, 2015)

Table 4.2: Summary of Tun Mustapha Tower background

NAME OF BUILDING	Tun Mustapha Tower (Menara Tun Mustapha) Also known as Menara Yayasan Sabah
LOCATION	Teluk Likas, 88400, Kota Kinabalu, Sabah
ARCHITECT	James Ferrie & Partners, Singapore and Kota Kinabalu
NO OF STOREY	30 storey floor with a basement carpark
YEAR OF CONSTRUCTION	1976
YEAR OF COMPLETED	1979
TYPE OF BUILDING	Office building with conference hall and exhibition foyer
MAINTENANCE OPERATOR	Innoprise Corporation Sdn Bhd
BUILDING OWNER	Yayasan Sabah Group

b) Maintenance Strategy Used

The building manager's, Mrs Ismah stated that this building used a planned preventive maintenance as the maintenance strategy. Although the maintenance works need to be conducted was planned earlier, but some of the works were not performed according to the schedule as the number of maintenance staffs was not sufficient enough. According to Mrs Ismah, the maintenance staffs for the 30 storey building was less than 20 people, therefore, they were not capable of conducting the maintenance works as scheduled.

Based on the interview, Mrs Ismah told that maintenance works for the building were conducted by the in-house management and they only will outsource the job to any competent contractor if the in-house staff incapable of performing it. As the maintenance operation was not a priority to the top management, therefore they have to utilise their performance to ensure the allocated maintenance budget are sufficient for all of the maintenance works.

4.2.3 Wisma Innoprise

a) Building Background

Wisma Innoprise is a building constructed by Innoprise Corporation Sdn Bhd (ICSB) for the Sabah State government. This building was built in 1977 and catered as the Sabah Ministers offices including the Chief Minister of Sabah and some of the subsidiary company of the YSG. It is consist of 18 storeys with a basement carpark and managed by the ICSB.

The state secretariat building was occupied by Forestry Department, Administration and Finance Department, Yayasan Sabah Shipping Group, Sabah Softwoods Berhad, Senior Company Secretary, Benta Wawasan Sdn Bhd and Juwitabah Sdn Bhd. The facility provided in this building was the cafeteria at the first floor.



Figure 4.3: Wisma Innoprise building
(Source: Fieldwork, 2015)

Table 4.3: Summary of Wisma Innoprise background

NAME OF BUILDING	Wisma Innoprise
LOCATION	Jalan Sulaman, Teluk Likas, 88400, Kota Kinabalu, Sabah
ARCHITECT	-
NO OF STOREY	18 storey of floor with basement carpark
YEAR OF CONSTRUCTION	1977
YEAR OF COMPLETED	-
TYPE OF BUILDING	Office building
MAINTENANCE OPERATOR	Innoprise Corporation Sdn Bhd
BUILDING OWNER	Yayasan Sabah Group

b) Maintenance Strategy Used

An interview session has been conducted with the building manager, Mr Suhaili in order to obtain the information on maintenance strategies practised for the building. According to Mr Suhaili, planned preventive maintenance was selected to be used in the building but they do not conduct the maintenance as scheduled. As the maintenance department of the building only has 18 staffs, therefore they were unable to cope with the daily inspection as planned. Hence, they only perform the weekly, monthly and yearly inspection for the building.

Besides, Mr Suhaili also stated that the maintenance works was prioritised to be conducted by the in-house staff but if the staff was not competent enough to perform the job, then they will outsource the job by tendering process to any contractor.

4.3 Demographic Information

A total of 200 questionnaires have been distributed at the respective case study buildings and received 135 copies of returns. From the feedback, 30.4% of it are respondents of Tun Mustapha Tower and the other 67.6% are respondents of Federal House and Wisma Innoprise building respectively. Figure 4.4 below show the distribution of the questionnaires responded according to the case study buildings.

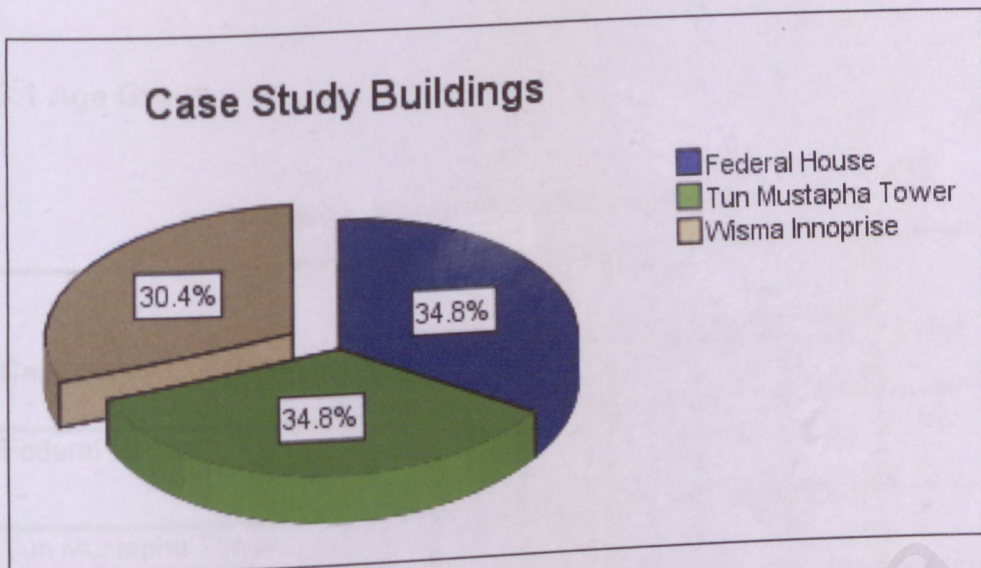


Figure 4.4: The distribution of questionnaire respondents

Table 4.4: Distribution of questionnaire respondents

Case Study Buildings	N	Percentage (%)
Federal House	47	34.8
Yayasan Sabah	47	34.8
Wisma Innoprise	41	30.4
Total	135	100

The respondent particulars are obtained by analysing the data collected from Part A of the questionnaires which are the age group, gender, occupation and working experiences of the respondents. The results of the findings are critically analysed as followings:

4.3.1 Age Group

Table 4.5: The age group of the respondents

Case Study Buildings	Age Group						Total
	<20	20-30	30-40	40-50	50-60	>60	
Federal House	1	11	18	8	7	2	47
Tun Mustapha Tower	0	6	14	11	15	1	47
Wisma Innoprise	0	9	10	18	4	0	41
Total	1	26	42	37	26	3	135
Percentage (%)	0.7	19.3	31.1	27.4	19.3	2.2	100

From the data collected, it shows that most of the respondents are between the group ages of 30 to 40 years old with 31.1% and followed with 27.4% of the respondents with the group ages of 40 to 50 years old. The group age with the lowest number of respondents is from the group of below than 20 years old which is only one respondent (0.7%) that working at the Federal House building. The number of group age between 50 to 60 years old in Tun Mustapha Tower are slightly higher than the other buildings which are about 15 respondents. Besides, there are 2.2% of the respondents ages are more than 60 years old working at the Federal House building and the Tun Mustapha Tower building. Figure 4.5 below show the data obtained from the analysis of the respondents' age group for every case study buildings.

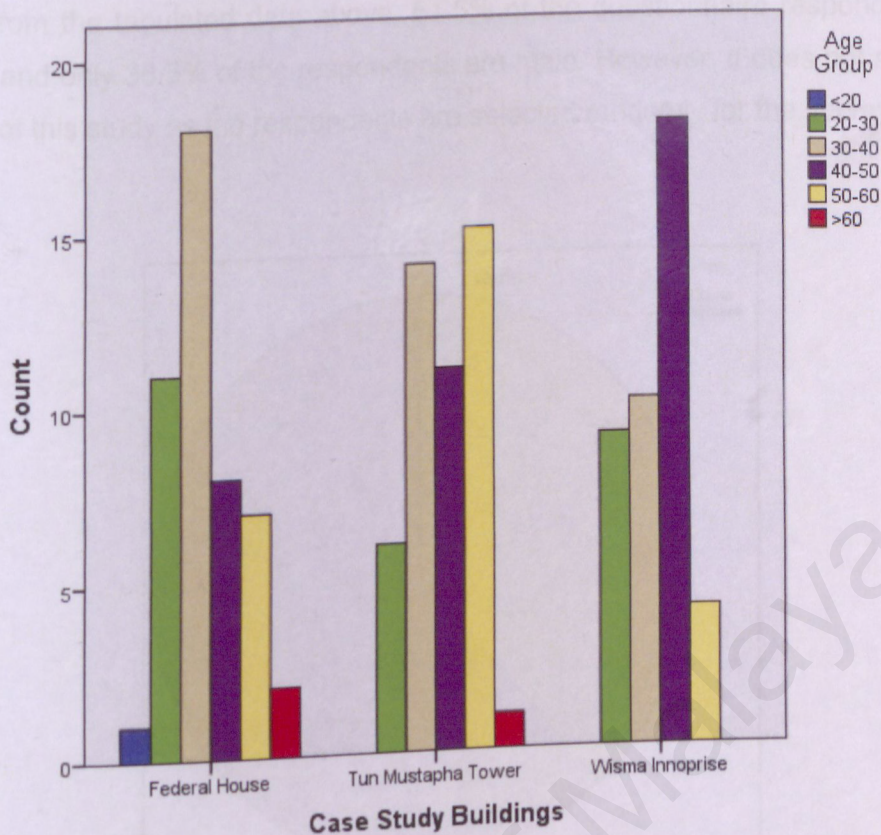


Figure 4.5: The age group of the respondents

4.3.2 Gender

Table 4.6: Gender of the respondents

Case Study Buildings	Gender		Total
	Male	Female	
Federal House	19	28	47
Tun Mustapha Tower	21	26	47
Wisma Innoprise	12	29	41
Total (N)	52	83	135
Percentage (%)	38.5	61.5	100.0

From the tabulated data above, 61.5% of the questionnaire respondents are female and only 38.5% of the respondents are male. However, it does not affect the results of this study as the respondents are selected randomly for the survey.

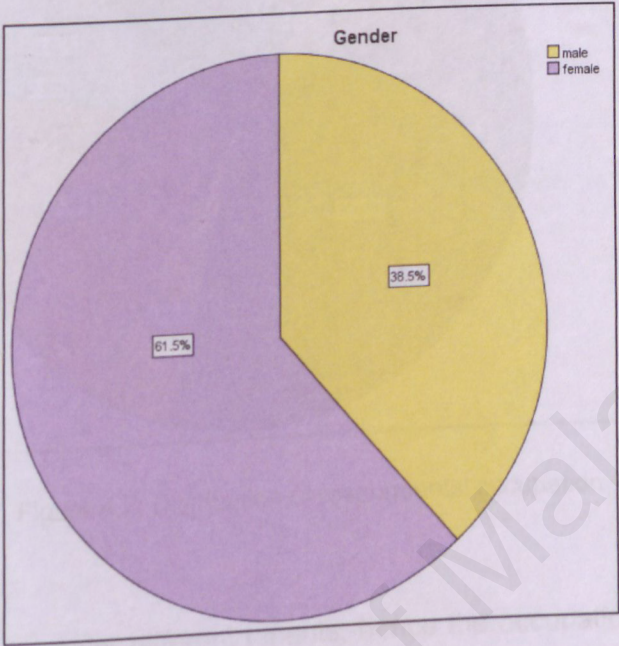


Figure 4.6: Percentages of respondents' gender

4.3.3 Occupation

Based on the data obtained from the questionnaires, 87 out of 135 of the respondents do answer their type of works while the other 48 are missing data. From the data, most of the respondents are working as clerk which is around 37.9% and followed by the officer about 18.4%.

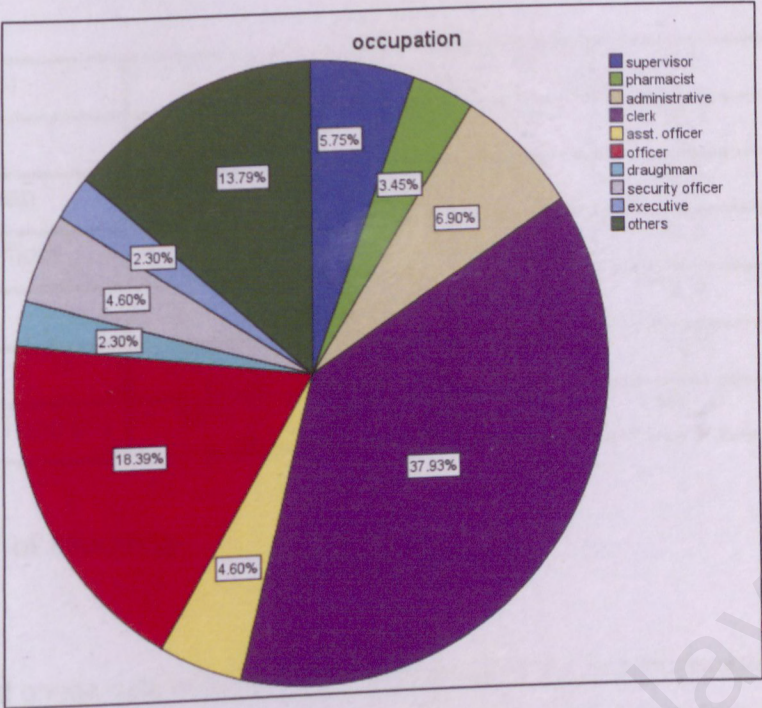


Figure 4.7: Distribution of respondents' occupation

As different buildings cater different tenants, hence the occupation groups of every building differ. Most of the Federal House building and Tun Mustapha Tower building differ. Most of the Federal House building and Tun Mustapha Tower respondents are working as a clerk while, for Wisma Innoprise buildings, the highest group of respondents are working as an officer as the building used by the Sabah Ministers offices. Details of the occupation groups for every building are represented in Table 4.7.

Table 4.7: Details of respondents' occupation by building

Occupation	Case Study Buildings			Percentage (%)	Total
	Federal House	Tun Mustapha Tower	Wisma Innoprise		
Supervisor	4	1	0	5.7	5
Pharmacist	3	0	0	3.4	3
Administrative	2	4	0	6.9	6
Clerk	19	9	5	37.9	33

Asst. Officer	2	2	0	4.6	4
Officer	0	4	12	18.4	16
Draughtsman	0	2	0	2.3	2
Security Officer	0	2	2	4.6	4
Executive	0	0	2	2.3	2
Others	4	7	1	13.8	12
Total (N)	34	31	22	100.0	87

4.3.4 Year of Working

Based on the data obtained, the respondents of the questionnaires have come from a variety of year of working in the buildings. The result shows that 49.6% of the respondents have works in the buildings more than eight years and followed with 10.4% of them have works for less than a year.

Table 4.8: Respondents' year of working in the building

Years of Working	N	Percentage (%)
<1	14	10.4
1-2	12	9.0
2-4	11	8.2
4-6	15	11.2
6-8	15	11.2
>8	67	50.0
Total	135	100.0

4.3.5 Time spend in the building

The time used by the respondents in a typical working day were asked in the questionnaires form. The result from the data collected shows that 52.6% of the respondents spend around six to eight hours in the building. Besides, there is about

44.4% of the respondents stay in the building for more than eight hours in a typical working day. Only 1.4% of the respondents spend less than six hours in the buildings.

Table 4.9: The time spends by the respondents in the building

Hours spend	N	Percentage (%)
<1	1	0.8
4-6	1	0.8
6-8	71	53.4
>8	60	45.1
Total	135	100.0

4.4 Summary

Background of the case study buildings had been discussed in this chapter together with the demographic information of the respondents. This provides some basic understanding and knowledge on the case study buildings. This chapter also discussed the maintenance strategies applied for the case study buildings. The findings will be further discussed in the next chapter.

CHAPTER 5

DATA ANALYSIS AND DISCUSSION

5.1 Introduction

In order to produce a conclusion and study the relationship between the variables of a research, statistical analysis is necessary needed. The data obtained in this study will be analysed quantitatively and qualitatively to view the patterns of the findings through the data collection phase. The data obtained from the questionnaires form are been analysed accordingly with the aid of the SPSS software. Thus, the data collected and the summary of the findings analysis are discussed in this chapter.

5.2 Analysis of Knowledge on Maintenance Aspect

Based on the interview sessions with the building managers, the knowledge of the building manager on maintenance aspect from their perspective was obtained. Table 5.1 show the summary of the knowledge on maintenance aspect of the case study building managers.

Table 5.1: Summary of building managers knowledge in maintenance

	Federal House	Tun Mustapha Tower	Wisma Innoprise
Working experience in maintenance industry	15 years	4 years	1 ½ years
Educational background in maintenance field	Background study in management	Diploma in Mechanical and Electrical Engineering	None
Overall knowledge on maintenance aspect	Excellent	Major in mechanical and electrical system	Well known in lift system and operation

The knowledge of the respondents regarding the maintenance aspect and the building are reviewed in Part 2 of the questionnaires. Based on the data collected, the correlation between the respondents knowledge on the responsible person for building maintenance works and the responsible person that should carry out the maintenance works are represented in Table 5.2.

Table 5.2: Analysis of respondents' knowledge in maintenance

Spearman's Rho		Knowledge on responsible person for maintenance	Responsible person conducting maintenance for a building
Knowledge on responsible person for maintenance	Correlation Coefficient	1.000	0.187*
	Sig. (2-tailed)		0.038
	N	123	123
Responsible person conducting maintenance for a building	Correlation Coefficient	0.187*	1
	Sig. (2-tailed)	0.038	
	N	123	123

*. Correlation is significant at the 0.05 level (2-tailed).

With referring to the table, the sample size for the respondent knowledge on the responsible person for maintenance works is 133 while the sample size for the responsible person that should conduct the maintenance works is 123. The different between both of the sample sizes happen due to some missing data. Therefore, the valid sample size that counted is 123 only. From Table 5.2, the Pearson correlation coefficient for the knowledge and the responsible person is 0.187, which is significant ($p < 0.05$) based on 123 complete data. Therefore, the respondents' knowledge on the responsible person for maintenance works in a building and their answer for the responsible person that should conduct the maintenance works does have a statistically significant linear relationship ($p < 0.05$).

Table 5.3: Knowledge on responsible person conducting maintenance

Responsible person conducting maintenance	Knowledge on responsible person for maintenance		Total
	Yes	No	
JKR	5	3	8
DBKK	4	0	4
Appointed Contractor	68	14	82
Building Owner	8	1	9
Maintenance Department	5	0	5
Management Unit	2	0	2
Fire Department	1	0	1
JKR and Appointed Contractor	3	0	3
DBKK and Appointed Contractor	1	0	1
Appointed Contractor and Maintenance Unit	3	0	3
Appointed Contractor and Building Owner	2	0	2
JKR, Appointed Contractor and Building Owner	3	0	3
Total	105	18	123

Based on the data obtained, 105 out of 123 respondents know the responsible person that carrying out maintenance works for their building and only 18 respondents does not know the building responsible person for maintenance works. From the total of 123 respondents, 82 of them stated that the appointed contractor is the one who shall carry out the maintenance works for their building.

5.3 Respondents Satisfaction on Maintenance Works

The satisfaction level toward the maintenance works performed for the case study buildings are discussed in this section. From the survey conducted, the satisfaction level of the respondents for the services system in the building are analysed and compared with the effects of the breakdown of the system towards their daily activities. Besides, the quality of the maintenance services provided and the overall satisfaction of the respondents on maintenance services also discussed.

5.3.1 The breakdown and their effects

A survey for the frequency of the services system confronts breakdown for the case study buildings are asked in the questionnaire. The frequency of the services breakdown and their effects towards the occupants daily activities are analysed by calculating the mean value. Based on the scale used in this study, all mean values are described with appropriate description value as indicated in Table 3.2 in Chapter 3, Section 3.4.1(a). The services system that been review are the lift system, air conditioning system, ventilation system, electrical system, plumbing system and firefighting system.

Based on the survey conducted, most of the services for the case study buildings are rated as frequently facing breakdown. The results of the survey can be referred in Table 5.4.

Table 5.4: Statistics of service breakdown

Services	N	Mean
Lift	81	3.30
Air conditioning	132	3.23
Ventilation	130	3.33
Electrical	130	3.54
Plumbing	132	3.31
Firefighting	131	3.51

For the effects from the services breakdown towards the user daily activities in the building, the statistics of the data is shown in Table 5.5. Based on the survey, the result shows that breakdown of lift system, air conditioning system, ventilation system, electrical system and plumbing system does give a high impact on the user daily activities inside the respective building. In the other side, the breakdown of the firefighting system gives a fair impact on their daily activities. An appropriate description of the mean values for the effects of services breakdown are indicated as in Chapter 3, Section 3.4.1(a).

Table 5.5: Statistics of the effects of services breakdown

Services	N	Mean
Lift	91	3.55
Air conditioning	129	3.71
Ventilation	125	3.45
Electrical	123	3.18
Plumbing	129	3.21
Firefighting	125	2.90

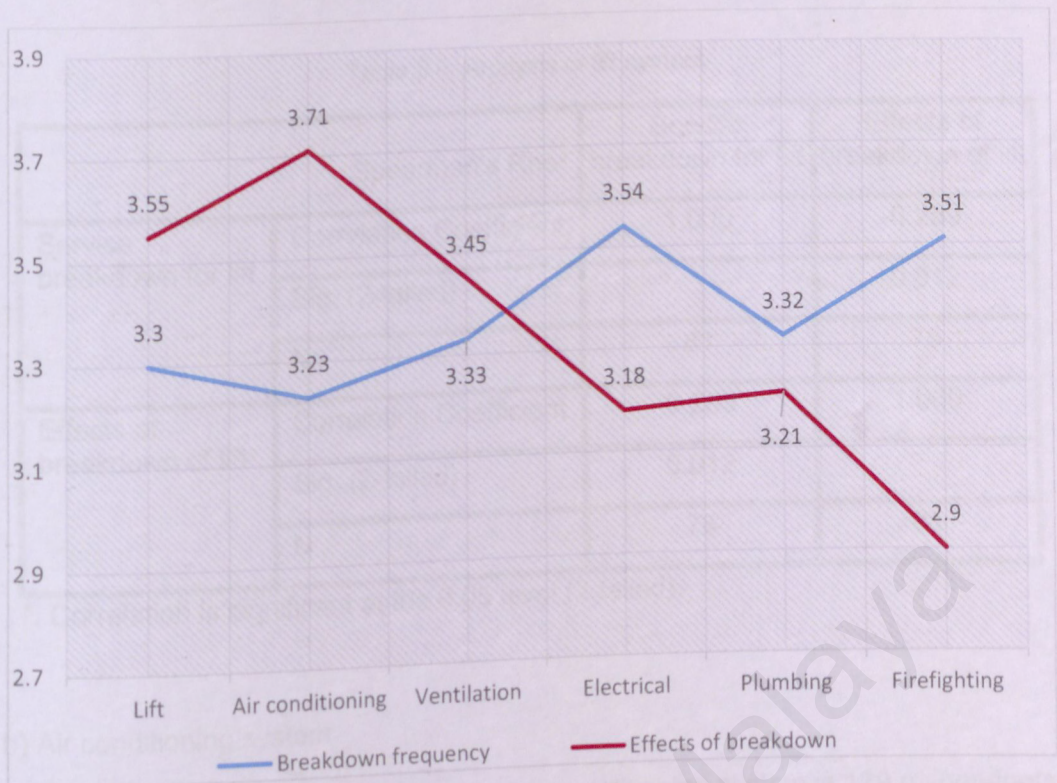


Figure 5.1: The relationship between the services breakdown frequency and their effects on daily activities

Besides, the data from the survey are also analysed with comparing the frequent of the services breakdown against the effects of the breakdown in influencing the occupants' daily activities. A Spearman's correlation was used in analysing the variables. The results of the analysis are discussed below.

a) Lift system

A Spearman's correlation was conducted to study on the relationship between the frequent of the lift service breakdown and the effects of the breakdown to the occupants' activities. The number for complete pairwise observations for lift system is 75 out of 135 respondents. There are some missing data for the service breakdown information than the effects of the breakdown. Hence, the observation calculation was based on the complete respondents only. There was a strong negative correlation between the breakdown frequency and the effects of lift breakdown, which was statistically significant, $r_s = -0.289$, $p = 0.012$.

Table 5.6: Analysis of lift system

Spearman's Rho		Service breakdown for lift	Effects of breakdown of lift
Service breakdown for lift	Correlation Coefficient	1.000	-0.289*
	Sig. (2-tailed)		0.012
	N	81	75
Effects of breakdown of lift	Correlation Coefficient	-0.289*	1.000
	Sig. (2-tailed)	0.012	
	N	75	81

*. Correlation is significant at the 0.05 level (2-tailed).

b) Air conditioning system

The sample size for the analysis of air conditioning system is 129 respondents. From the data obtained, the correlations between the frequency of service breakdown and their effects on users daily activities are strongly negative correlation with the r_s value of -0.293 and the significant value of correlation coefficient are 0.001 ($p < 0.01$ for a two-tailed test). Table 5.7 show the results of the analysis.

Table 5.7: Analysis of air conditioning system

Spearman's Rho		Service breakdown for air conditioning	Effects of breakdown of air conditioning
Service breakdown for air conditioning	Correlation Coefficient	1.000	-0.293**
	Sig. (2-tailed)		0.001
	N	129	129
Effects of breakdown of air conditioning	Correlation Coefficient	-0.293**	1.000
	Sig. (2-tailed)	0.001	
	N	129	129

** Correlation is significant at the 0.01 level (2-tailed).

c) Ventilation system

The correlation of the ventilation system is analysed based on 124 numbers of samples. From the analysis, the correlation coefficient value of the relationship between the frequent of ventilation system service breakdown and the effects of the breakdown is -0.373 with the significant value of p is 0 ($p < 0.01$ for a two-tailed test). This mean, the direction of the relationship between the variables is strong negatively correlate. The details of the results are shown in Table 5.8.

Table 5.8: Analysis of ventilation system

Spearman's Rho		Service breakdown for ventilation	Effects of breakdown of ventilation
Service breakdown for ventilation system	Correlation Coefficient	1.000	-0.373**
	Sig. (2-tailed)		0.000
	N	124	124
Effects of breakdown of ventilation	Correlation Coefficient	-0.373**	1.000
	Sig. (2-tailed)	0.000	
	N	124	124

** . Correlation is significant at the 0.01 level (2-tailed).

d) Electrical system

The number for complete pairwise observations for electrical system is 121 out of 135 respondents. The observation calculation was conducted based on the complete respondents only. The analysis of the service breakdown frequency and the effects of the breakdown shows the correlation value between the variable is -0.100 where the relationship is not significantly correlate. The details of the analysis are shown in Table 5.9.

Table 5.9: Analysis of electrical system

Spearman's Rho		Service breakdown for electrical	Effects of breakdown of electrical
Service breakdown for electrical	Correlation Coefficient	1.000	-0.100
	Sig. (2-tailed)		0.275
	N	123	121
Effects of breakdown of electrical	Correlation Coefficient	-0.100	1.000
	Sig. (2-tailed)	0.275	
	N	121	123

e) Plumbing system

Based on 129 sizes of samples, the relationship between service breakdown for plumbing system and their effects on the users' activities are analysed. The results show that both of the variables have a strongly negative relationship with the correlation coefficient of -0.249 with the significant value of 0.004 ($p < 0.01$ for a two-tailed test). The results of the analysis are shown in Table 5.10.

Table 5.10: Analysis of plumbing system

Spearman's Rho		Service breakdown for plumbing	Effects of breakdown of plumbing
Service breakdown for plumbing	Correlation Coefficient	1.000	-0.249**
	Sig. (2-tailed)		0.004
	N	129	129
Effects of breakdown of plumbing	Correlation Coefficient	-0.249**	1.000
	Sig. (2-tailed)	0.004	
	N	129	129

** . Correlation is significant at the 0.01 level (2-tailed).

f) Firefighting system

The results from the analysis of firefighting system for the case study building show that the Spearman correlation coefficient for both the service breakdown and their effects on the users is -0.242, where the significant value of 0.007 as $p < 0.01$ for a two-tailed test. The sample size for the firefighting system analysis is 125 only. Therefore, both of the variables do have a strong negative correlation relationship.

Table 5.11: Analysis of firefighting system

Spearman's Rho		Service breakdown for firefighting	Effects of breakdown of firefighting
Service breakdown for firefighting	Correlation Coefficient	1.000	-0.242**
	Sig. (2-tailed)		0.007
	N	125	125
Effects of breakdown of firefighting	Correlation Coefficient	-0.242**	1.000
	Sig. (2-tailed)	0.007	
	N	125	125

** . Correlation is significant at the 0.01 level (2-tailed).

The result of the analysis on the correlation between the frequent of the services breakdown and the effects of the breakdown towards building users shows that the relationship between both of the variables was significantly strong negative correlated except for the electrical system. The relationship between the variables can be understood as, if the services system in a building was frequently breakdown then the effects of breakdown on the building user are less. But if the services system in a building is rarely breakdown, hence the breakdown does give a high impact to the user.

Based on the literature findings in Section 2.6.4, the breakdown of services does influence the satisfaction and emotional level of the building user. But if the failure of any services system were replaced with any similar system that operate the same function, the impact of the failure on user satisfaction level will be no difference. Therefore, the result of the negative correlation relationship in this findings was influenced by the present of the other services system that cater the same functions.

5.3.2 Feedback from the complaint reported

From the questionnaires data, 60 out of 131 of the respondents from all of the case study buildings does have experience in submitting a complaint regarding the services in their building for the past 12 months. Table 5.12 and Figure 5.2 show the data of the respondents experience in submitting a complaint.

Table 5.12: Statistics of respondents experience in submitting complaint

	Percentage
Yes	45.8%
No	54.2%
Total	100%
Missing	4
Total (N)	135

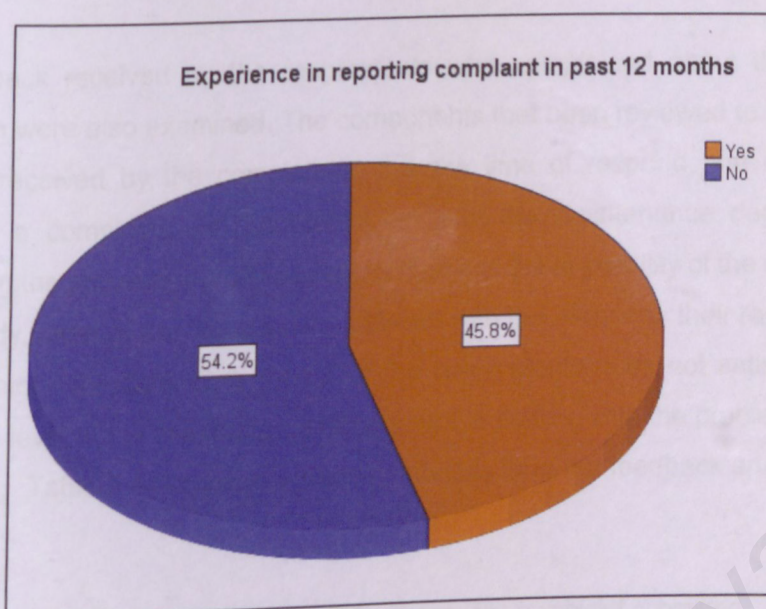


Figure 5.2: Experience in submitting complaint in past 12 months

Based from the data obtained, there are nine elements in the buildings that have complained in the past 12 months. From all of the complaints, the most frequent element been reported is the electrical system with 38 complaints for the past 12 months. The second highest of complaint been reported are the plumbing and air conditioning system with 18 complaints respectively. The details of the complaints submitted can be referred in Table 5.13.

Table 5.13: Statistics of complaints submitted

Types of Services	N
Electrical	38
Plumbing	18
Air conditioning	18
Lift	6
Telephone and cable	5
Structure	4
Road	4
Door	4
Fire System	3

The feedback received by the respondents who complained about the services breakdown were also examined. The components that been reviewed to analyse the feedback received by the complainers are the time of respond, the medium for submitting a complaint, the knowledge level of the maintenance department in overcoming the problem, the attitude of the staff and the availability of the staff. Based on the study, most of the complainers satisfied with the response their received from the complaint submitted. Only 24.1% of the respondents does not satisfy with the knowledge level of the maintenance department in dealing with the problem faced by the building. Table 5.14 represent the result details from the feedback analysis.

Table 5.14: Summary of feedback from the complaint submitted

Feedback	Yes	Percent	No	Percent
Respond of complaint in a timely manner	47	78.3	13	21.7
Medium of complaint is effective	50	86.2	8	13.8
Satisfaction on knowledge of maintenance department	44	75.9	14	24.1
Attitude of maintenance staff	51	87.9	7	12.1
Availability of maintenance department	48	81.4	11	18.6
Satisfaction on service received in the building	105	87.5	15	12.5

From the survey conducted, about 87.5% of the respondents satisfy with the services that they received from the maintenance department in the building while another 12.5% of the respondents does not satisfy with the services.

5.3.3 Quality of the maintenance management provided

In order to achieve the objective of the study, the quality of the maintenance services provided for the case study buildings was analysed. A survey has been conducted to obtain the building users' perception regarding the services installed and

the maintenance management carried out for the building. Based on the data received, it shows that the quality of the maintenance management performed in the building is labelled as 'Good' by the users. This rank is achieved by calculating the mean value of the data collected. Based on the scale used, an appropriate description of the mean values for the quality of maintenance management of the buildings was indicated as in Chapter 3, Section 3.4.1(a). Table 5.15 show the statistic of the data from the questionnaire and the results from the questionnaires are represented in Figure 5.3.

Table 5.15: Quality of maintenance management

Frequency (N)	131
Mean	3.47
Median	4.00
Mode	4
Std. Deviation	0.778
Sum	455

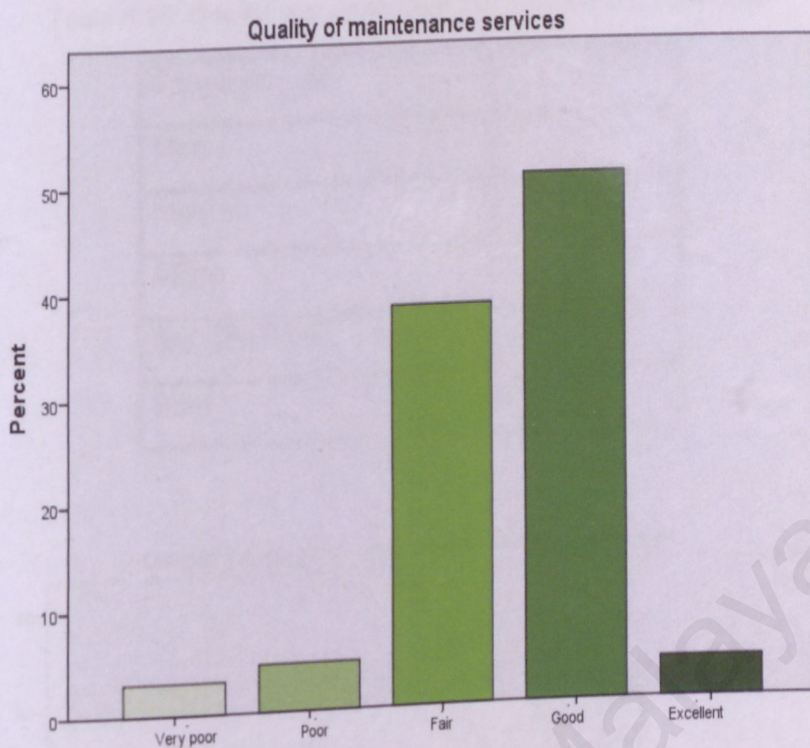


Figure 5.3: The quality of maintenance services

5.3.4 Overall satisfaction level of the respondents

The overall satisfaction of the respondents towards the building services provided and the maintenance services carried out for the case study buildings are analysed based on the data obtained from the survey. The data were analysed using the Likert scale method by calculating the mean value of the findings. Based on the questionnaires, the mean value of the respondents overall satisfaction is 3.53 and labelled as 'Good'. The mean values of the overall satisfaction level of the respondents were described by referring to the appropriate description in Table 3.2 as stated in Chapter 3, Section 3.4.1(a). Table 5.16 below show the details of the findings for the overall satisfaction level of the respondents towards the maintenance services of the buildings while Figure 5.4 shows the data of the questionnaires.

Table 5.16: Overall satisfaction level on maintenance services

Frequency (N)	131
Mean	3.53
Median	4.00
Mode	4
Std. Deviation	0.788
Sum	462

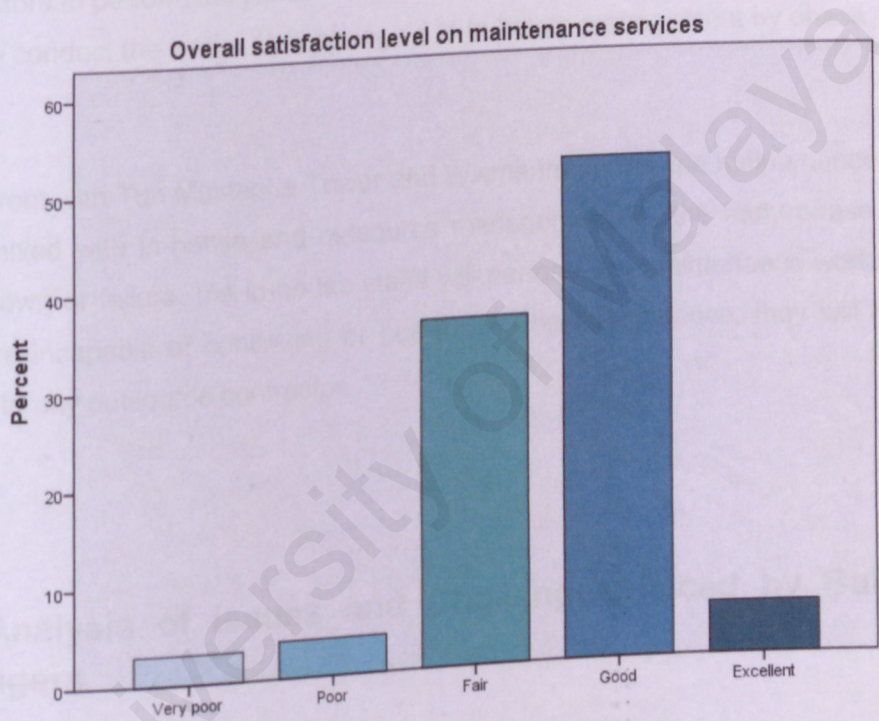


Figure 5.4: Overall satisfaction level on building maintenance services

5.4 Analysis of Maintenance Strategies Practised

From the interview sessions with the building managers of the case study buildings, all of the building was using planned preventive maintenance for their

maintenance operations. The annual budget for maintenance works has been planned earlier and submitted to the top management for approval. According to the building managers', normally they will plan and estimate the budget of the maintenance works by referring to the previous year report.

The maintenance operations in Federal House building were totally carried out by the in-house staff except for the electrical calibration and air conditioning system. Previously they do outsource some of the maintenance works to any competent contractors to perform the job but once the management has become stable and can cope to conduct the works, they change it to in-house management by phase.

In different with Tun Mustapha Tower and Wisma Innoprise, the maintenance works were mixed with in-house and outsource management. At the early phase of the breakdown or failure, the in-house staffs will perform the maintenance works but if they are incapable of continuing or performing the maintenance, they will open a tender to any outsource contractor.

5.5 Analysis of Issues and Challenges Faced by Building Managers

The maintenance unit of the selected case study buildings in Kota Kinabalu has been interviewed in order to analyse the issues and challenges faced by the building managers in selecting the suitable maintenance approach. These buildings are selected as the three buildings do have a similar functionality which is an office building. There are three types of main problems faced by the building managers in implementing the maintenance strategies for a building which are the top management problem, human resource problem and technical problem. The issues and challenges faced by the building managers are analysed by calculating the mean

value for every type of problem. All of the mean values calculated were described by using an appropriate description in Table 3.3 as indicated in Chapter 3, Section 3.4.1(b).

Based on the interviews, there are several issues and challenges mentioned by the building managers in selecting the suitable maintenance strategies which are as follows:

5.5.1 Top Management Problem

Results from the analysis of the issue in top management show that the problem faced by the building manager of Tun Mustapha Tower is rate as high followed by Wisma Innoprise building with a fair rating and the Federal House building with the lowest rating. Abdul Rahman et al. (2012) described top management problem as issues that relate with the ways of maintenance risk being manage, plan, organise and execute. A poor management process will lead to the problem in implementing the maintenance strategies for a building. Table 5.17 show the mean values for every building in the aspect of the top management problems.

Table 5.17: Mean values of top management problems

	Federal House	Tun Mustapha Tower	Wisma Innoprise
Top Management Problem	1.80	4.00	2.80
	Small	High	Fair

From the interviews conducted, the findings show that the top management issues faced by building manager in every building differ from one another. The discussions of the findings are discussed below:

a) Lack of knowledge in maintenance scope

This issue was faced by the building manager in Federal House building and Tun Mustapha Tower. Both of the building managers stated they have zero knowledge regarding on maintenance scope and their background study and expertise also was not in maintenance aspects. According to the building manager for Tun Mustapha Tower, the building manager was transferred from doing office works to maintenance works in order to fulfil the vacancy in maintenance department while in the other ways, the building manager in Federal House building started getting involves in maintenance industry by applying a job vacancy in maintenance field at hospital. In contrast with Wisma Innoprise building, the building manager does have knowledge on maintenance aspect as he previously studying in maintenance management.

The knowledge level of the top management in maintenance departments are influencing the productivity of works as they play an important role in managing the flows of maintenance works. The absence of management and leadership of the top management will lead to the delay of works and failure of maintenance works. Hence, the educational background and experience of the building manager are very crucial in order to implement the maintenance strategies for a building.

b) Unqualified maintenance contractor

In order to maintain a government office building, the maintenance contracts normally are given to the lowest price in competitive bidding. Normally, the contractor will try to run the maintenance operations at a minimum price to ensure they gained profit from the project. Based on the interviews conducted, both of the building managers in Tun Mustapha Tower and Wisma Innoprise stated that most of the maintenance works performed by the outsource contractor does not meet the expected target especially in a timely manner. As the payment of the maintenance operations is lower, the contractors usually will provide an unskilled worker to perform the maintenance works as the wage for unskilled worker were lower. As a result from that, it will lead to waste of time and effort in maintenance operations for a building.

Besides, in Tun Mustapha Tower, most of the in-house maintenance staffs are unfamiliar with maintenance works as they are not qualified in maintenance fields.

c) Government regulations and rules

According to the building manager at Federal House, although they can perform all of the maintenance operations by using in-house force but they still have to outsource some of the maintenance works as it was a requirement from the Ministry of Public Works. Maintenance works that need competent person especially for electrical calibration, they need to outsource it to a qualified contractor and submit the maintenance report to the Ministry as a proof of compliance. Besides, the Ministry also encourage them to outsource the maintenance works for any system that are still under warranty to the specialist company.

According to the building managers in Tun Mustapha Tower and Wisma Innoprise, both of the buildings do have too many procedures to be followed for the maintenance aspects. The building managers need to prepare paperwork for every maintenance works that need to be outsourced. Both, the preparation and the approval of the paperwork will take a long time than scheduled in order to ensure the works can be carried out. Thus, the maintenance process is delayed especially for major maintenance works.

d) Stakeholders communication

Communication is an important aspect in performing a maintenance work as the workers will get a clear understanding on the objectives and goals for every work carried out. Findings from the interview session with the building managers reflected that both the managers of Tun Mustapha Tower and Wisma Innoprise do not get the actual plans and objectives for the maintenance works that should be performed for their building. Without a good communication between the top management and the maintenance departments, the implementation of maintenance strategies by the building manager will become more difficult.

e) Financial issues

This issue was faced by the building manager at Tun Mustapha Tower and Wisma Innoprise building. According to the manager, maintenance works was not a prior work for the building in compare to 15 years before. The allocation for maintenance works is often been reduced for every year. As a result, the building manager will face difficulties in executing the maintenance works due to the underestimate of cost.

5.5.2 Human Resource Problem

Based on the interviews conducted, the results show that the human resource aspect does give a very high influence for the building manager of Tun Mustapha Tower and high influence for the building manager of Wisma Innoprise in implementing and selecting the suitable maintenance strategies for their building. On the other hand, the building manager actions in selecting the maintenance strategy for Federal House building does not distract by the human resource problem. The details of the analysis were shown in Table 5.18.

Table 5.18: Mean values of human resource problem

	Federal House	Tun Mustapha Tower	Wisma Innoprise
Human Resource Problem	1.80	4.20	3.60
	Small	Very High	High

The human resource problem is the problems that arise from weaknesses and human error such as the working experience and the attitudes in maintenance works (Abdul Rahman et al., 2012). The details of the findings from the interviews are as following:

a) Lack of supervision from maintenance team

According to the building managers of the case study buildings, all of the buildings are implementing the planned preventive maintenance strategy for the maintenance operation. The building manager in Federal House building considers it was his responsibilities to appoint and supervise the maintenance works for the building. Normally, the building manager fixes any failure or breakdown happened inside the building without waiting for any complaint submitted. This is supported by Al shehri, Motawa and Ogunlana (2015), where some parties think the supervision role is the most important duty to be carried out in the maintenance department.

In contrast, with the other two buildings, where the building manager for Tun Mustapha Tower will only perform the maintenance works according to the complaint submitted by the building users as the maintenance team for the building is not sufficient enough to carry out the maintenance inspections. As for the Wisma Innoprise, the building managers cannot cope with the daily routines of the maintenance schedule, hence, the inspection for maintenance works only performed based on the weekly, monthly and yearly routines. Al shehri, Motawa and Ogunlana (2015), stated that the maintenance team in public sector usually does not know about the technical operation in maintenance works, therefore, they will only receive and signed the maintenance report submitted from the contractor.

b) Lack of engineers and specialist

The requirement of manpower for every maintenance works for a building usually, will differ according to the type of works and services. In the process of maintenance operations, it is crucial for the maintenance department to have a personnel with expertise and competent for every scope of maintenance works (Al shehri, Motawa and Ogunlana, 2015). According to the building managers, some parts of the maintenance jobs need to be outsourced to any specialist contractor as they did not have a competent person to conduct the maintenance especially for the

electrical, air conditioning and lift system. Even though the in-house workers are able to perform the maintenance jobs, yet the worker does not have a qualified certificate to carry out the works. Hence, there will be some amendment in carrying out the maintenance operations as the building managers need to outsource the works that can be done by the in-house staff to any competent contractors.

c) Training and motivation

Based on the survey, both of the building managers of Tun Mustapha Tower and Wisma Innoprise stated that the encouragement from the management to the maintenance staffs to attend any training course are unfavourable as maintenance was not a priority in the building management. This is supported by Al shehri, Motawa and Ogunlana (2015), where there is a lack of encouragement from the top management for the workers to participate in maintenance and operation field. In differing with the management in Federal House building, motivation from the management are so impressively for the maintenance staff to join any training for maintenance field but they will not support the fees for registration of any certificate of competency.

d) Unclear job description and department structure

From the interviews, it has been noted that the maintenance department for Tun Mustapha Tower and Wisma Innoprise does not receive a clear briefing of the goals and objectives of the management for the maintenance operation. In addition, the building manager also does not have structured approaches in order to improve the maintenance process. Besides, the building manager in Tun Mustapha Tower also stated that the maintenance department also needs to cater or organise every function carried out at the building especially at the exhibition foyer which is actual not the scope of works for the maintenance department. In contrast to Federal House building, the building manager was told the objectives of the management where they want to reduce any emergency maintenance to 5% and applying the planned

preventive maintenance for 95%. Hence, the building manager will brief and arrange the works every day to the maintenance staff.

e) Lack of awareness

Based on the study conducted, the awareness of building maintenance operations for Tun Mustapha Tower is very low as the management of the building assume the maintenance works are not important for the building. According to Al shehri, Motawa and Ogunlana (2015), it is vital for the building manager and the management to understand the necessary of building maintenance to facilitate the building function and the occupants. While, for the Wisma Innoprise building, the building manager aware on the important of building maintenance but the maintenance works conducted are based on the situation and priority. The building manager will conduct the maintenance for any complaint or breakdown that happened at the Ministers' office or room in advance than the other space inside the building. Besides, the maintenance operation also will be conducted if the system breakdown or failure will influence all of the building occupants.

5.5.3 Technical problem

The study finds out that both, Tun Mustapha Tower and Wisma Innoprise building managers faced a high influenced of the technical problem in selecting the suitable maintenance strategies for the building. For the Federal House building, the influences from technical problem toward the action of the building manager in selecting the appropriate maintenance strategies are just a fair impact. Table 5.19 represent the results from the interviews conducted.

Table 5.19: Mean values of technical problem

	Federal House	Tun Mustapha Tower	Wisma Innoprise
Technical Problem	2.33	4.00	3.67
	Fair	High	High

According to Abdul Rahman et al. (2012), technical problem in maintenance works can be described as the issues associated with technical aspects in conserving a property from the early life until the end cycle of the property. The problems that faced by the building managers are as follows:

a) Shortage of spare parts

Based on the building manager of Federal House building, the problem of lack of spare parts for maintenance works is rarely being faced by them as they always ordered the parts earlier and kept it inside the store. But, sometimes they do face this problem especially for the parts that require a big space to be kept such as the equipment for air conditioning and cooling tower. In addition, the unavailability of the spare parts also arises as some of the parts are not available in the local market and need to be ordered from outside market.

While for Tun Mustapha Tower and Wisma Innoprise, the building manager stated that the only spare part that available at the maintenance department is only for replacement of the light bulb. Thus, the other system that needs to be replaced will take a longer time as the absence of the spare parts in the storage. In order to purchase the suitable spare parts, the building manager needs to prepare paperwork and provide the details to the top management. Hence, this procedure will delay the maintenance operation and the productivity of the maintenance department.

b) Failure of preventive maintenance

It has been noted throughout the interview that the selected maintenance for Federal House building is meet the management objectives to implement 95% of the maintenance operation as preventive maintenance and the other 5% is as emergency maintenance. From the interview carried out, the building manager of Federal House stated that the biggest issue that he thinks that he will face in selecting the suitable maintenance strategies for the building is to handle the major breakdown which may lead to the emergency maintenance. According to the building manager, every year he will try to reduce the probability of any emergency maintenance to be carried out for the building.

Based on the interview session with building manager of Tun Mustapha Tower, the maintenance strategy applied for the building is preventive maintenance but most of the planned maintenance was not carried out properly as the limitation of the budget in maintenance works. Besides, the building manager also stated that they are facing lots of problems to carry out the maintenance works according to the planned maintenance as the maintenance staff for the building is only less than 20 peoples. Sometimes the complaint submitted to the maintenance department is repeated as the team was unable to perform the maintenance within the targeted time.

While for Wisma Innoprise building, the building manager stated that the maintenance department is unable to cope with the daily maintenance inspection as scheduled for the maintenance strategy as they did not have enough staff to perform the inspection. Besides, some of the in-house maintenance also sometimes will be passed to the outsource contractor if the in-house maintenance team failed to solve the failure. The maintenance department also was incapable of doing the planned preventive maintenance perfectly as the team are sometimes busy with the action maintenance.

c) Development of new technologies

Based on the study conducted, the findings show that all of the case study buildings were aged between 35 to 40 years; therefore, most of the systems operated inside the building are the outdated system. The development of new technologies in the market does influence the maintenance process carried out for a building. This is because, sometimes the spare parts for the old system was hard to find especially in the local market. Besides, the replacement of the old system with new technology will need lots of procedures to be followed and the building manager will have to prepare paperwork for the replacement. According to the building managers for all of the case study buildings, they cannot simply replace system inside the building as they need to ensure the new system is suitable and fit for the building.

Table 5.20 below shows the overall rating of the issues and challenges faced by the building managers in implementing the maintenance strategies.

Table 5.20: The overall rating of the issues and challenges faced by building managers

Issues	Federal House	Tun Mustapha Tower	Wisma Innoprise
TOP MANAGEMENT PROBLEM			
1) Lack of knowledge in maintenance scope	2	5	1
2) Procurement management	-	-	-
3) Unqualified maintenance contractor	1	3	3
4) Government regulations and rules	4	3	3
5) Stakeholder communication	1	4	4
6) Financial issues	1	5	3
Mean value	3.00	4.00	3.25
HUMAN RESOURCE PROBLEM			
1) Lack of supervision from maintenance team	1	4	4

2) Lack of engineers and specialist	4	4	4
3) Training and motivation	2	4	4
4) Unclear job description and department structure	1	4	3
5) Lack of awareness	1	5	3
Mean value	1.80	4.20	3.60
TECHNICAL PROBLEM			
1) Lack of maintenance software tool	-	-	-
2) Shortage of spare parts	2	4	4
3) Failure of preventive maintenance/ maintenance strategies	1	4	5
4) Development of new technologies	4	4	2
Mean value	2.33	3.67	3.67
Overall Mean Value	2.37	3.95	3.51

5.6 Analysis of the Performance Levels of Maintenance Strategies Practised

Based on the interviews session with building managers, the performance levels of maintenance strategies practices in the case study buildings were analysed. The performance level of maintenance approach practised are evaluated by using three types of indicators out of eleven indicators found out from the literature review.

The selection of performance indicators in this study is selected based on the information obtained from the interview session with the building maintenance managers. The selected performance level indicators for this research are the

maintenance efficiency indicator (MEI), urgent repair request indicator (URI) or general repair request indicator (GRI) and building performance indicator (BPI).

The mean value of maintenance strategies performance for the case study buildings are evaluated by using the Likert scale method and the mean value of the performance level of maintenance indicators are calculated. The description of the mean value used in evaluating the performance levels described appropriately as indicated in Table 3.3 of Chapter 3, Section 3.4.1(b).

From the data collected, the results show that the maintenance performance for Federal House building is categorised as 'Excellent' followed by Wisma Innoprise as 'Good' and Tun Mustapha Tower as 'Average'. The results from the interviews session are shown in Table 5.21. Future discussions of the findings are discussed as below:

Table 5.21: The maintenance performance

Performance Indicator	Federal House	Tun Mustapha Tower	Wisma Innoprise
MEI	5	3	3
URI/GRI	5	3	4
BPI	4	4	4
Mean Value	4.67	3.33	3.67
	Excellent	Fair	Good

5.6.1 Maintenance efficiency indicator (MEI)

The annual maintenance expenditure for the case study buildings was taking into consideration in order to measure the performance levels of the maintenance strategies practised. Based on the interviews session, the annual expenditure in maintenance scope was obtained. The building manager for Federal House building stated that maintenance cost used by the building is around RM80, 000. In the other

hand, the maintenance expenditure for Tun Mustapha Tower is around RM2 million and Wisma Innoprise is RM1.2 million. According to building manager of Tun Mustapha Tower and Wisma Innoprise, sometimes the planned maintenance expenditure for the building were not enough and they have to request additional budget from the management. Most of the additional budget was used for the payment of outsourcing works and breakdown repairs. Besides, the maintenance cost estimated for the building also does not sufficient to carry out the planned maintenance works thus the maintenance operation is delayed until the approval of the additional maintenance budget.

5.6.2 Urgent repair request indicator (URI)/ General repair request indicator (GRI)

The performance level of maintenance works conducted in the case study buildings was reviewed by using the URI. According to Enshassi and El Shorafa (2015), a formula needs to be used in order to evaluate the maintenance performance. The URI formula is:

$$URI = \frac{UR}{UR + GR}$$

where:

UR – number of urgent repair requests submitted by the building occupants

GR – number of general requests for repair of the building facilities

a) Federal House

According to the building manager, they rarely received complaints from the building occupants in a month and sometimes the number of complaints received by them is only three complaints per year. In addition, the maintenance department staffs are encouraged to detect any failure of the breakdown earlier and take immediate

action to overcome the failure. The URI value of Federal House building per month is as follow:

$$\begin{aligned} \text{URI} &= \frac{1}{1 + 10} \\ \text{URI} &= 0.0909 \end{aligned}$$

b) Tun Mustapha Tower

Building manager of Tun Mustapha Tower stated that the number of complaints they received in a month is usually between 20 to 30 complaints and sometimes the complaints submitted is redundant. In addition, there is a lack of maintenance staffs for the building; therefore, most of the maintenance operations are not conducted according to the schedule. The maintenance staffs also unable to perform any repair works as the number of urgent repairs need to be done is high. Below is the calculation of the URI for Tun Mustapha Tower:

$$\begin{aligned} \text{URI} &= \frac{30}{30 + 5} \\ \text{URI} &= 0.857 \end{aligned}$$

c) Wisma Innoprise

Basically, the maintenance department for Wisma Innoprise received around 15 to 30 number of complaints in a month. According to the manager's, usually they will put the priority of maintenance works at the Minister offices especially in Chief Minister's office. Therefore, the maintenance works at Ministers' offices will be carried out earlier without waiting for any complaints submitted. The maintenance staffs in Wisma Innoprise also were not enough as they are lack in number to perform the maintenance works according to the schedule. The calculation of URI value for Wisma Innoprise is as follow:

$$\begin{aligned} \text{URI} &= \frac{25}{25 + 7} \\ \text{URI} &= 0.781 \end{aligned}$$

From the calculations of the URI value, the results show that the value of URI for Tun Mustapha Tower and Wisma Innoprise are quite high in compared to Federal House building. According to Enshassi and El Shorafa (2015), the higher value of URI shows that the performance and schedule of works of the maintenance staffs are distracted by lots of urgent repairs submitted. The urgent repairs requested by the building occupants does cause a delay in performing general maintenance works and also will affecting the business continuity. The UR's number can be minimised by ensuring the maintenance staffs conducted the maintenance works as in scheduled.

5.6.3 Building performance indicator (BPI)

The overall condition of the case study buildings was evaluated by looking into the components and systems performance. Based on the interviews, all of the building managers evaluate the building performance is in a 'Good' condition. According to Lavy and Shohet (2010), a new perspective view has been provided by BPI to the building managers where the performance of building components or systems were analysed together with the financial management.

5.7 Discussion

Based on the data obtained, the relationship between issues and challenges faced by the building manager in performing the maintenance strategies and the

performance levels of the maintenance strategies practised are analysed. The result shows that the relationship between the variables has a significant correlation between each other as the less issues and challenges faced by the building manager in maintaining the building, the better the performance levels of the maintenance strategies carried out in the building. Table 5.22 show the mean value of the issues and challenges faced by building manager and the performance levels of the maintenance strategies.

Table 5.22: The mean values of the issues and challenges faced by building managers and the maintenance performance

	Issues and Challenges faced by building manager	Performance levels of maintenance strategies
Federal House	2.37	4.67
Tun Mustapha Tower	3.95	3.33
Wisma Innoprise	3.51	3.67

From all of the case study buildings, the lowest problem faced by the building manager in selecting the maintenance approach is in Federal House building. Hence, the performance level of the maintenance operations inside the building is at an excellent level. In contrast with Tun Mustapha Tower, the building manager faced a high number of problems in selecting the maintenance strategies for that building, therefore, the performance levels of the maintenance operations carried out for the building is on an average level. The data show in Table 5.22 was illustrated in Figure 5.5 below.

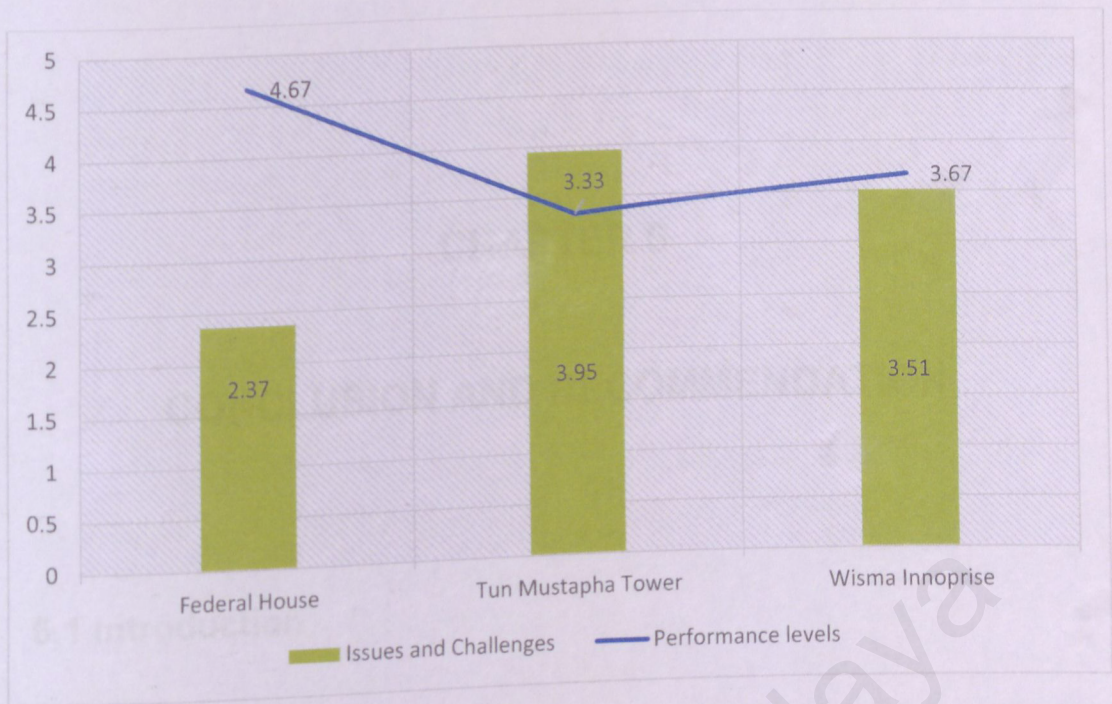


Figure 5.5: Relationship between issues and challenges faced by building managers and the maintenance performance

CHAPTER 6

CONCLUSION AND RECOMMENDATION

6.1 Introduction

In this chapter, a conclusion will be derived based on the findings. The research findings will be compared with the research objectives in order to ensure the objectives are achieved. Besides, some recommendations will be proposed for the issues and challenges faced by the building managers as well as a recommendation for any future study.

6.2 Conclusion

As a conclusion, this study has been fulfilled the designated research objectives throughout the literature review and the data analysis process. The research objectives formulated for this study are as follow:

- 1) To identify the problems faced by building managers in implementing the maintenance strategies.

Implementation of good maintenance strategies in Malaysia was affected by a significant issues and problems which cause the failure of the practices. These objectives have been designed to point out the factor that leads to these issues. The process of data analysis in Chapter 5 has met the research objective. From the case study buildings, there a few issues and challenges have been identified faced by the building managers in performing the maintenance strategies for the buildings.

The management system is a crucial aspect in arranging a maintenance strategy for a building. Without good management process, maintenance operation in a building will not be carried out properly as planned and meet the expected target. The management, planning, organisation and execution of maintenance risk shall be conducted by top management. Hence, the top management people shall have a good knowledge in maintenance scope to ensure the maintenance strategies applied was suitable for the building

Furthermore, a manager with good working experience and attitudes in maintenance works also needed in selecting the appropriate maintenance strategies for a building. If the maintenance personnel do not have adequate knowledge and experience in maintenance works, selection of maintenance strategies will become tougher especially for any emergency maintenance. Besides, the maintenance personnel tend to perform the works according to their capability without following the proper procedure. Therefore, the maintenance personnel should aware of his/her scope of works and the building needs.

In addition, technical problems always happened in selecting the appropriate maintenance strategies especially to conserve the property from the beginning until the optimum life cycle of the building. The rapid growth of technologies has led to the difficulties in the process of finding the spare parts for a component. Besides, some maintenance personnel tend to select the unsuitable maintenance strategies for a building based on the availability of the budget. Therefore, all of the issues and

challenges need to be overcome in order to ensure the selected maintenance strategies by the building managers successful.

2) To evaluate the performance levels of the maintenance strategies carried out for the government offices building.

Improvement of maintenance approach can be done by measuring the performance of current maintenance strategies carried out for a building. Besides, measurement of performance levels also will optimise the performance of the strategies and increase the efficiency. The performance of maintenance strategies can be measured by using any types of performance indicators.

The second objectives for this research were achieved by using three types of indicators to measure the performance levels of maintenance strategies for the case study buildings which are the maintenance efficiency indicator (MEI), urgent repair request indicator (URI) and building performance indicator (BPI). The measurement of maintenance works is conducted by reviewing the overall performance of the building components and systems. A number of complaints about any urgent repairs submitted to the maintenance departments for every case study buildings also measured. Besides, the maintenance expenditure for the buildings also been evaluated by looking into the planned and actual maintenance costs.

3) To establish a relationship between the problems faced by the building managers and the performance of the maintenance strategies.

This objective is achieved by comparing the results from the findings between the issues and challenges faced by building managers and the performance levels of maintenance strategies selected of the case study buildings. Based on the findings, it is proved that the issues and challenges do affect the performance levels of the maintenance strategies. In contrast, if the building managers do not face too many issues and challenges in implementing the maintenance strategies then the maintenance strategies will perform in a satisfied and good level.

6.3 Recommendation

From the research findings, the recommendation that suggested for any future research regarding this topic are as follows:

- 1) Select a few specific issues and challenges faced by the building managers in selecting the maintenance strategies for their buildings to be studied.
- 2) Propose a recommendation for the building managers in overcome the issues and challenges faced by them.
- 3) Conduct a study on privately owned building and compared the issues and challenges faced by the building managers of public and private owned building.
- 4) Widening the sample size by conduct a study on the knowledge and working experience of the building maintenance staffs.

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APPENDIX A

Interview Question for the Building Maintenance Department/ Contractor

Part 1: Background of the interviewee's

- 1) What is your job title? *(Apakah jawatan anda?)*
- 2) How long have you working here? *(Berapa lamakah anda telah bekerja di sini?)*
- 3) Experience and knowledge in maintenance industry *(Tahap pengalaman dan pengetahuan dalam bidang penyelenggaraan)*
- 4) How long have you involved in building maintenance industry? *(Berapa lamakah anda telah terlibat dalam bidang penyenggaraan?)*

Part 2: General information of the building and the maintenance plans for the building

- 1) What are the status of the ownership of the offices in the building? *(Apakah status pemilikan pejabat dalam bangunan ini?)*
- 2) How old are the building? *(Berapakah umur bangunan ini?)*
- 3) What is the annual maintenance cost for maintenance works of the building? *(Berapakah kos perbelanjaan bagi kerja penyelenggaraan bagi bangunan ini setahun?)*
- 4) What is the type of maintenance strategy used for the building? *(Apakah jenis strategi penyelenggaraan yang digunakan bagi bangunan ini?)*
- 5) What are the interval for maintenance works carried out for every service in this building? *(Berpakah selang masa bagi kerja penyenggaraan dilaksanakan bagi setiap servis dalam bangunan ini?)*

Part 3: The performance of maintenance works conducted

1) The maintenance works carried out: in-house/ outsource? (*Kerja penyenggaraan yang dilaksanakan: in-house/ outsource?*)

If outsource (*Sekiranya outsource*):

- Why does not used in-house? (*Kenapa tidak menggunakan tenaga in-house bagi kerja penyenggaraan tersebut?*)
- How does the contractor being appointed? What are the criteria? (*Bagaimanakah kontraktor tersebut dipilih? Apakah kriteria pemilihan?*)
- Does the maintenance work carried out promptly and according to the agreed timescale? (*Adakah kerja penyenggaraan tersebut dilaksanakan mengikut tempoh masa yang ditetapkan?*)
- How was the overall quality of the service provided by the contractors? (*Secara keseluruhan, bagaimanakah kualiti servis yang diberikan oleh kontraktor yang dilantik?*)
- Do you feel that the contractors work represents value of money? Does it meet the expectation? (*Adakah anda rasa kerja yang diberikan oleh kontraktor yang dilantik setimpal dengan perbelanjaan yang dikeluarkan? Adakah servis tersebut seperti yang dijangkakan?*)

If in-house (*Sekiranya in-house*):

- Why does not used outsource? (*Kenapa tidak menggunakan tenaga outsource bagi kerja penyenggaraan tersebut?*)
- How was the overall quality of the services provided? (*Secara keseluruhan, bagaimanakah kualiti servis yang diberikan?*)

- Does the maintenance work carried out promptly and according to the agreed timescale? (*Adakah kerja penyenggaraan tersebut dilaksanakan mengikut tempoh masa yang ditetapkan?*)

2) Does any guidelines/ regulations followed or referred to in carrying the maintenance works? Why does it used/ applied? (*Adakah terdapat sebarang panduan/ undang-undang yang diikuti atau dirujuk dalam melaksanakan kerja penyenggaraan? Kenapakah panduan/ undang-undang tersebut digunakan?*)

3) What are the level of effectiveness of the guidelines/ regulation for the maintenance works? (*Apakah tahap keberkesanan panduan/ undang-undang berkenaan kerja penyenggaraan yang disediakan?*)

4) How many complaint do you received in a week? (*Berapa banyak aduan yang anda terima dalam seminggu?*)

5) How do you respond to the complaint? (priority/ budget/ situation etc.)

Bagaimanakah anda bertindak balas/ respon terhadap aduan yang diterima? (*Keutamaan/ bajet/ keadaan dll.*)

6) Which part of the building components that always be complaint? (*Apakah perkara yang sering mendapat aduan?*)

Part 4: Challenges and issues faced in implementing the maintenance strategies

1) What are the biggest challenges and issues faced in selecting the maintenance strategies? (*Apakah cabaran atau isu terbesar yang dihadapi dalam memilih strategi penyenggaraan?*)

2) How do you faced the issues and challenges? (*Bagaimanakah anda menghadapi isu dan cabaran tersebut?*)

APPENDIX B

Reference No: _____
SURVEY ON MAINTENANCE STRATEGY OF THE SELECTED
BUILDING
UNIVERSITY OF MALAYA
FACULTY OF BUILT ENVIRONMENT
STUDENT ID: BEB120003

Arahan (Instruction):

Sila jawab kesemua soalan dengan mengisi jawapan anda di ruang yang disediakan. Segala maklumat dan identiti akan dirahsiakan. Maklumat yang diperoleh akan digunakan bagi tujuan penyelidikan sahaja. (Please answer all questions by ticking in appropriate space/ bracket. Your identity and related information will remain strictly confidential to us. All the information gathered will be used for research purposed only.

Bahagian 1: Latar Belakang Responden
(Part 1: Respondent's particular)

1) Umur dalam tahun (Age in year)

☐ < 20	☐ 30 – 40	☐ 50 – 60
☐ 20 – 30	☐ 40 – 50	☐ > 60

2) Jantina (Gender)

☐ Lelaki (Male)	☐ Perempuan (Female)
--	---

3) Pekerjaan (Occupation)

.....

4) Dalam sehari, berapa lamakah tempoh (jam) anda berada dalam bangunan ini?
(In a typical week, how many hours do you spend in the building for a day?)

☐ < 1	☐ 2 – 4	☐ 6 – 8
☐ 1 – 2	☐ 4 – 6	☐ > 8

5) Berapa tahunkah anda telah bekerja di bangunan ini?
(How many years have you been working in this building?)

☐ < 1	☐ 2 – 4	☐ 6 – 8
☐ 1 – 2	☐ 4 – 6	☐ > 8

Bahagian 2: Pengetahuan am berkaitan penyelenggaraan dan bangunan
(Part 2: General knowledge about maintenance and the building)

1) Adakah anda tahu siapakah pihak yang bertanggung jawab untuk menguruskan penyelenggaraan bagi bangunan ini? (Do you know who is responsible to do maintenance management for this building?)

☐ Ya (Yes) ☐ Tidak (No)

Jika jawapan anda adalah 'YA', sila nyatakan (If your answer was 'YES', please state)

2) Pada pendapat anda, siapakah pihak yang bertanggungjawab dalam melaksanakan tugas penyelenggaraan sistem perkhidmatan bagi bangunan ini? (In your opinion, who is responsible to conduct the maintenance of the services system in this building?)

☐ JKR (PWD)
☐ DBKK (DBKK)
☐ Lain-lain (Others):

☐ Penyewa bangunan (Building tenant)
☐ Kontraktor yang dilantik (Appointed contractor)
.....

3) Adakah anda tahu bagaimana untuk melaporkan sebarang aduan berkaitan dengan kerosakan/ ketidak fungsian perkhidmatan servis dalam bangunan? (Do you know how to report a complaint related to services failure/ breakdown in this building?)

☐ Ya (Yes) ☐ Tidak (No)

4) Dalam tempoh 12 bulan yang lepas, pernahkah anda melaporkan sebarang kerosakan sistem perkhidmatan bangunan? (Have you reported any complaint regarding building services system in the past 12 months?)

☐ Ya (Yes) ☐ Tidak (No)

Anda boleh melangkau bahagian ini sekiranya jawapan anda adalah 'TIDAK'
(You may skipped questions below if you answer 'NO')

4.1) Apakah kerosakan yang anda laporkan? (What are the complaint about?)
.....

4.2)	Ya (Yes)	Tidak (No)
i) Adakah aduan yang anda laporkan mendapat maklum balas dengan tempoh masa yang segera? (Is the respond to the complaint in a timely manner)		
ii) Adakah anda rasa saluran untuk laporan kerosakan yang disediakan adalah efektif? (Do you think that the complaint medium are effective)		
iii) Tahap pengetahuan Bahagian Penyelenggaraan untuk		

menjawab dan memberi maklumbalas segala pertanyaan berkaitan kerosakan servis bangunan adalah pada tahap memuaskan hati. (<i>Knowledge of the maintenance department to answer or respond to the inquiries are satisfy</i>)		
iv) Tingkah laku, penampilan dan profesionalisma bagi kakitangan Bahagian Penyelenggaraan adalah baik. (<i>Attitude, appearance and professionalism of the maintenance staff are good</i>)		
v) Secara keseluruhan, tahap kesediaan bahagian senggaraan dalam melaksanakan penyelenggaraan servis adalah memuaskan. (<i>The overall availability of maintenance department in conducting maintenance services are satisfied.</i>)		

5) Adakah anda menerima servis yang anda harapkan/ jangkakan dalam bangunan ini? (*Did you receive the service you expected in this building?*)

☐ Yes (Ya)

☐ No (Tidak)

Jika jawapan anda adalah 'TIDAK', sila nyatakan: (If your answer was 'NO', please state why)

6) Adakah anda rasa Bahagian Penyelenggaraan Bangunan mempunyai prosedur operasi standard yang sesuai bagi mengatasi masalah kerosakan kecemasan? (Cth: Kerosakan lif, penghawa dingin dll.)

Do you feel that the building maintenance department has standard operating procedure when dealing with emergencies situation (Eg: Lift breakdown, Air-cond. failure etc.)

☐ Ya (Yes)

☐ Tidak (No)

Bahagian 3: Kesan daripada kerja penyelenggaraan kurang efisien (Part 3: Effects of defective of maintenance works)

1) Berapa kerapkah servis sistem dalam bangunan ini mengalami kerosakan? (Sila nilaikan)

How occasionally does the building services system faced breakdown? (Please rate)

		Very rare	Rarely	Occasionally	Frequently	Very frequently
a	Lif (Lift)					
b	Sistem penghawa dingin (Airconditioning)					
c	Sistem pengudaraan					

	(Ventilation system)					
d	Sistem pengcahayaan (Lighting system)					
e	Tandas/ Sistem perpaipan (Toilet/ Plumbing system)					
f	Sistem pencegahan kebakaran (Firefighting system)					
g	Lain-lain (Others):					

2) Adakah kerosakan servis tersebut mengganggu aktiviti kerja anda? (Sila nilaikan)
Does the breakdown of the services system affecting your daily activities? (Please rate)

		Tidak langsung (Not at all)	Hanya sedikit (Small)	Sederhana (Fair)	Mengganggu (High)	Terlalu mengganggu (Very high)
a	Lif (Lift)					
b	Sistem penghawa dingin (Air conditioning)					
c	Sistem pengudaraan (Ventilation system)					
d	Sistem pengcahayaan (Lighting system)					
e	Tandas/ Sistem perpaipan (Toilet/ Plumbing system)					
f	Sistem pencegahan kebakaran					

	(Firefighting system)					
g	Lain-lain (Others):					

3) Bagaimanakah kualiti penyenggaraan servis dalam bangunan ini? (Sila nilai)
How was the quality of the maintenance services in this building? (Please rate)

Lemah (Poor)	Wajar (Fair)	Sederhana (Average)	Baik (Good)	Cemerlang (Excellent)

4) Secara keseluruhan, apakah tahap kepuasan anda terhadap servis penyenggaraan bagi bangunan ini? (What are your overall level of satisfaction of the maintenance services for this building?)

Lemah (Poor)	Wajar (Fair)	Sederhana (Average)	Baik (Good)	Cemerlang (Excellent)

5) Jika terdapat sebarang pendapat/ komen berkenaan soalan kaji selidik ataupun topik kajian, anda boleh kemukakan pendapat/ komen anda di ruang yang disediakan di bawah.
(If you have any comment concerning the questionnaire or the research topic, please write on the space below):

.....

.....

.....

.....

.....

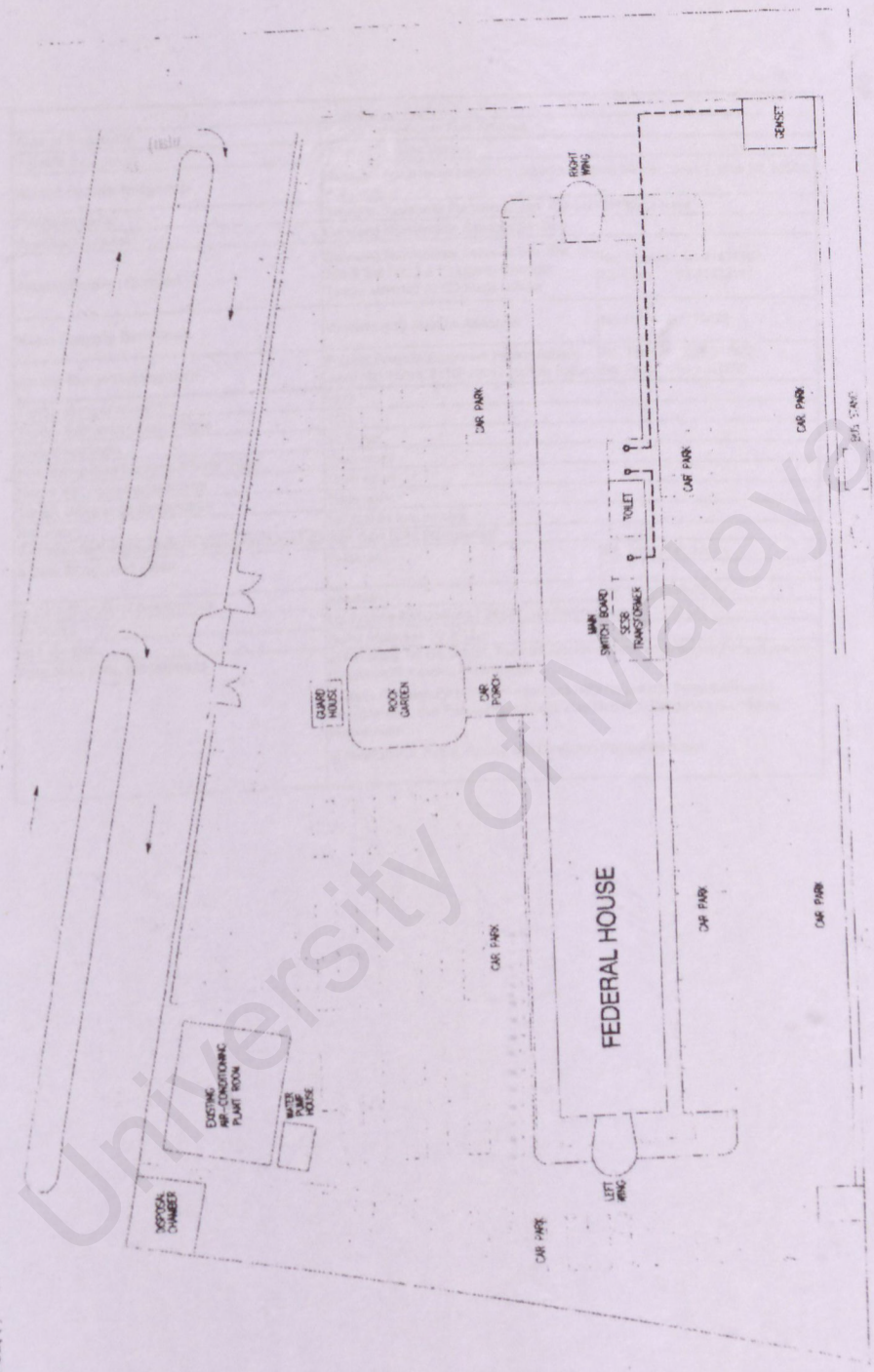
TERIMA KASIH KERANA TERLIBAT DALAM KAJI SELIDIK INI.
THANK YOU VERY MUCH FOR TAKING PART IN THIS SURVEY.

Jika anda ingin mendapatkan rumusan daripada kaji selidik ini (secara percuma), sila isikan emel anda di bawah. *If you would like the summary of this **research results**, free of charge, please enter your email address below.*

E-mel (E-mail):

APPENDIX C

REK Layout
P.T.N: Mr Ibrahim



1:1000 Scale

TAMBAH BANGUNAN		
Alamat Bangunan	Rumah Persekutuan Kota Kinabalu	
Pemilik Bangunan	Jabatan Perdana Menteri	
Alamat Pemilik Bangunan	Bahagian Pengurusan Hartanah, Jabatan Perdana Menteri, Ares 7, Blok B3, 62502, Putrajaya	
Pengawalselia	Bahagian Kawalselia Penyelenggaraan, Kementerian Kerja Raya	
Syarikat Konsesi	Gemilang Maintenance Services Sdn Bhd.	
Alamat Syarikat Konsesi	Gemilang Maintenance Services Sdn. Bhd. No 308 & 309 (Tkt 2 & 3) Lorong Selangor Taman Melawati 53100 Kuala Lumpur.	No. Telefon : 03-41474197 No. Faks : 03-41475197
Nama Penyelia Bangunan	Marcollinus @ Masliux Alexander	No. HP: 019-7774222
Alamat Penyelia Bangunan	Pejabat Penyelia Bangunan Tingkat Bawah, Jalan Mat Salleh, 88100 Kota Kinabalu Sabah	No. Telefon : 088-318532 No. Faks : 088-318532
Tarikh Bangunan dibina	1973	
Tarikh Bangunan siap dibina	1975	
Usia Bangunan	30 Tahun	
Kos Bangunan semasa dibina (RM)	Tiada rekod	
Nama VIP yang merasmikan	Tiada rekod	
Tarikh Bangunan dirasmikan	107,030 01 kaki persegi	
Keluasan	Kemudahan-kemudahan yang terdapat dalam dan luar bangunan	
i) Bilik Mesyuarat (N/A)	Keluasan :-	Bil. Tempat duduk :-
ii) Bilik Gerakan / Auditorium	Keluasan :-	Bil. Tempat duduk :-
iii) Parkir	Lot Parking Berbumbung : 34 Lot , Lot Parking Terbuka : 152 Lot	
iv) Lain-lain	Surau (Keluasan 50' X 12')	
Pekeliling yang dikuatkuasa	a) Pekeliling Am Bil. 1/2002, Peranan Jawatankuasa Penyelaras Penyelenggaraan Bangunan Gunasama Persekutuan b) Garis Panduan Permohonan Kelulusan Bagi Kerja-kerja Pengubahsuaian, Penaklitarafan, dan Pemasangan Fasiliti atau Ruang di Bangunan Gunasama Persekutuan c) Perintah Am, Bab E, Rumah dan Bangunan Pejabat Kerajaan	

Jawatankuasa Penyelarasan Penyenggaraan Bangunan Gunasama Persekutuan (JKPPBGP)			
i) Nama Pengerusi	Datuk Yusof Bin Haji Sarangit		
ii) Nama Timbalan Pengerusi	Ahmed Bin Asairi <i>En Hj Maimunah bt Sahabul</i>		
Jabatan Penghuni :-	6 Jabatan		
Nama Jabatan	Ketua Jabatan	No. Telefon	No. Faks
1. Jabatan Kesihatan Negeri Sabah	Dr. Christina Rundi	088-265960	088-223024
2. Perbendaharaan Malaysia Sabah	Datuk Yusof B. Hj. Sarangit	088-243993	088-240020
3. Jabatan Ketua Pengarah Tanah & Galian Persekutuan Negeri Sabah	<i>En. Humphrey J. Sulmin</i>	088-211122	088-210311
4. Biro Tata Negara	Datuk Ibrahim B. Saad.	088-218775	088-218993
5. Jabatan Pelajaran Negeri Sabah	En. Jame Alip	088-513552	088-513432
6. Jabatan Pertahanan Awam Malaysia	Lt. Kol (PA) Tuan Mulladi Al-Hamdi bin Ladin	088-264161	088-264160
JKPPBGP : Jawatankuasa Penyelarasan Penyenggaraan Bangunan Gunasama Persekutuan			

- Nama Bangunan : Rumah Persekutuan Kota Kinabalu
- Alamat Bangunan : Rumah Persekutuan Kota Kinabalu ,Pejabat Penyelia Bangunan Tingkat Bawah, Jalan Mat Salleh 88100 Kota Kinabalu Sabah.
- Pengawalselia : Bahagian Pengurusan Fasiliti Kementerian Kerja Raya Malaysia.
- Syarikat Konsesi : Gemilang Maintenance Services Sdn.Bhd.
- Eksekutif Bangunan : Marcellinus Alexander
- Tahun Dibina : 1973
- Tahun Diduduki : 1975
- Bilangan Blok : 1 Blok
- Keluasan Tanah : 2.22 ekar
- Usia Bangunan : 39 Tahun
- Keluasan Bangunan : 107,030.01 kaki persegi
- Jumlah Tingkat : 8 Tingkat
- Bilangan Jabatan : 6 Jabatan
- Bilangan Penghuni : 865 Orang
- Bil. Staf GMSSB : 5 orang
- Pengurusi Bangunan : Datuk Yusuf Bin Hj Sarangit
- Timbalan Pengurusi : Pn Hjh. Maimunah binti Suhaibul
- Jumlah Lot Parking Berhubung : 34
- Jumlah Lot Parking Terbuka : 152 Lot

OBJEKTIF KUALITI GMSSB

- Mengekalkan pensijilan sistem pengurusan kualiti sepanjang tempoh perjanjian kontrak.
- Memastikan purata aktiviti kerja secara dirancang dan secara tidak dirancang mengikut ketetapan Pihak Pengurusan GMSSB.
 - Kerja dirancang 95%
 - Kerja tidak dirancang 5%
- K arah mendapatkan kepuasan pelanggan ditahap yang lebih tinggi berbanding tahun sebelumnya berdasarkan maklum balas Kajian Kepuasan Pelanggan.
 - Kajian Kepuasan Pelanggan 80%
- Memastikan kos perbelanjaan sebenar di dalam lingkungan bajet yang ditetapkan.
- Jumlah aduan kerosakan mengikut ketetapan Pihak Pengurusan GMSSB.
 - Aduan kerosakan dikurangkan 15%

OBJEKTIF KUALITI BAHAGIAN OPERASI

- Memastikan prestasi kontraktor perkhidmatan am bangunan seperti Pencucian Bangunan, Pembersihan Kawasan & Sanitaman, Kawalan Serangga & Makhluk Perosak, Kawalan Keselamatan Dan Perkhidmatan Sanitari mengikut ketetapan Pihak Pengurusan GMSSB.
 - Prestasi kontraktor 90%
- Memastikan maklumbalas terhadap permohonan penghuni diambil tindakan dalam masa 3 (tiga) hari bekerja.
- Memastikan masa baikpulih (rectification time) untuk kerosakan adalah seperti yang dinyatakan dalam Pelan Kualiti.
- Memastikan masa tindakbalas (response time) untuk kerosakan dan aduan penghuni adalah seperti yang dinyatakan dalam Pelan Kualiti.
- Memastikan sasaran masa boleh guna (uptime target) untuk fasiliti kejuruteraan dan peralatan individu adalah seperti yang dinyatakan dalam Pelan Kualiti.

	MANUAL KUALITI	GMSSB/MK – 1
2.0 PROFAIL ORGANISASI		

✓ 2.2 PERKHIDMATAN YANG DIBERIKAN

2.2.1 Jenis perkhidmatan yang dikendalikan oleh GMSSB terdiri daripada:

- a. Penyelenggaraan Sistem Mekanikal
- b. Penyelenggaraan Sistem Elektrikal
- c. Penyelenggaraan Sivill, Struktur dan Arkitektural
- d. Penyelenggaraan Am iaitu Landskap, Kawalan Keselamatan, Kawalan Serangga Dan Makhluk Perosak, Sanitari Wanita dan Khidmat Kebersihan.
- e. Perkhidmatan Pengurusan dan Perundingan Projek Ubahsuai dan Naiktaraf

2.3 PROSES BISNES GMSSB

2.3.1 GMSSB mengambil pendekatan proses bilamana membangunkan, melaksanakan dan menambahbaik keberkesanan serta kecekapan sistem pengurusan kualiti untuk mematuhi keperluan yang ditetapkan dan meningkatkan kepuasan semua pihak yang berkaitan.

2.3.2 Pendekatan proses yang dilaksanakan dalam sistem pengurusan kualiti GMSSB menekankan kepentingan:

- Memahami dan memenuhi keperluan,
- Keperluan untuk mengambil kira perkara yang boleh meningkatkan nilai sesuatu proses,
- Mendapatkan keputusan prestasi dan keberkesanan proses, dan
- Penambahbaikan kepada proses yang berdasarkan kepada pengukuran yang objektif.

	MANUAL KUALITI	GMSSB/MK – 1
2.0 PROFAIL ORGANISASI		

✓ 2.1 GEMILANG MAINTENANCE SERVICES SDN. BHD. (GMSSB)

2.1.1 Peranan GMSSB adalah untuk mengawal dan memastikan aset pelanggan sentiasa dalam keadaan terurus, baik dan selamat serta pengurusan fasiliti bangunan yang terbaik di Malaysia.

✓ 2.1.2 Dalam menguruskan fasiliti bangunan kepada pemilik bangunan, Akta Dan Peraturan Bekalan Elektrik, Spesifikasi Piawaian JKR, Undang-undang Seragam Bangunan (Uniform Building By Law), 'Master Agreed Procedure' (MAP), 'Technical Requirements Performance Indicator' (TRPI), Undang-undang dan Peraturan oleh Jabatan Alam Sekitar, Akta Bomba 341, Peraturan Jabatan Keselamatan dan Kesihatan Pekerjaan (DOSH), Pihak Penguasa Tempatan dan lain-lain rujukan adalah keperluan yang mesti di patuhi.

Bangunan Gunasama Kerajaan Persekutuan Di Zon Utara dan Zon Sabah dan Wilayah Persekutuan Labuan yang diurus oleh GMSSB adalah seperti berikut :

1. Bangunan Persekutuan Teluk Intan, Perak
2. Bangunan Persekutuan Ipoh, Jalan Panglima Bukit Gantang Wahab, Ipoh, Perak
3. Bangunan Persekutuan Ipoh, Jalan Dato'Seri Ahmad Said, Ipoh, Perak
4. Bangunan Gunasama Persekutuan Sri Manjung, Perak
5. Wisma Persekutuan Taiping, Perak
6. Bangunan Gunasama Persekutuan Gerik, Perak
7. Bangunan Tuanku Syed Putra, Pulau Pinang
8. Pejabat Kerajaan Kompleks Tun Abdul Razak (Tingkat 36 – 42), Pulau Pinang
9. Bangunan Persekutuan Alor Star, Alor Star, Kedah
10. Wisma Persekutuan Alor Star, Alor Star, Kedah
11. Bangunan Tun Haji Abdul Razak, Kangar, Perlis
12. Bangunan Persekutuan Lama, Jalan Hospital, Kangar, Perlis
13. Bangunan Persekutuan Kangar, Persiaran Jubli Emas, Kangar, Perlis
14. Rumah Persekutuan Kota Kinabalu, Sabah
15. Wisma Dang Bandang, Kota Kinabalu, Sabah
16. Wisma Persekutuan Sandakan, Sabah
17. Wisma Persekutuan Tawau, Sabah
18. Rumah Persekutuan Keningau, Sabah
19. Rumah Persekutuan Beaufort, Sabah
20. Bangunan Persekutuan Kota Belud, Sabah
21. Bangunan Persekutuan Pulau Pinang
22. Kompleks Pentadbiran Kerajaan Persekutuan Sabah, Kota Kinabalu, Sabah
23. Kompleks Pentadbiran Kerajaan Persekutuan Bandar Muadzam Shah, Alor Setar, Kedah
24. Wisma Persekutuan Seberang Perai Utara, Pulau Pinang
25. Kompleks Pentadbiran Kerajaan Persekutuan Ranau, Sabah



GEMILANG MAINTENANCE SERVICES SDN.BHD
RUMAH PERSEKUTUAN KOTA KINABALU, SABAH

WORK ORDER FORM

KEUTAMAAN KERJA :

(E) SEGERA	(1) 8 Jam	(2) 72 jam	(3) 1 Minggu	(4) 1 Bulan
	✓			

Car No : 0101430
Reference No : 00215
Machine ID : SAEILRP00
Schedule No : -
Team : TF-PREL
Contractor ID : 20

Date Initiated : 05-05-2015
Time Initiated : 08:30
Date Started : 5-5-15
Time Started : 8:30
Date Complete : 5-5-15
Time Complete : 8:45
Hour Taken : 2.5
Material Cost : 11.40

MASALAH/ADUAN :

Didapati lampu di dalam Pej. Kesihatan tingkat 3 tidak menyala.

PUNCA KEROSAKAN :

Lampu rosak dan stakar rosak.

TINDAKAN (JOB DONE) :

mengganti lampu dan stakar baru
serta memasang kesihatan tingkat 3

ALAT GANTIAN :

1. 100-100 18W
2. Stakar 92
3.

BIL. UNIT :
BIL. UNIT :
BIL. UNIT :

1 pc
2 pcs

KOS (RM) :
KOS (RM) :
KOS (RM) :

7.00
4.40

TECHNICIAN : ABDUL KADIR MO. ISMAIL
GEMILANG MAINTENANCE SERVICES
SDN. BHD.

CHARGEMAN/SUPERVISOR :

TARIKH :

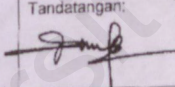
MASUDIN ALEXANDER
Ekskudif Kanan Bangunan
GEMILANG MAINTENANCE SERVICES
SDN. BHD.

05/05/15

	BORANG ADUAN KEROSAKAN
---	------------------------

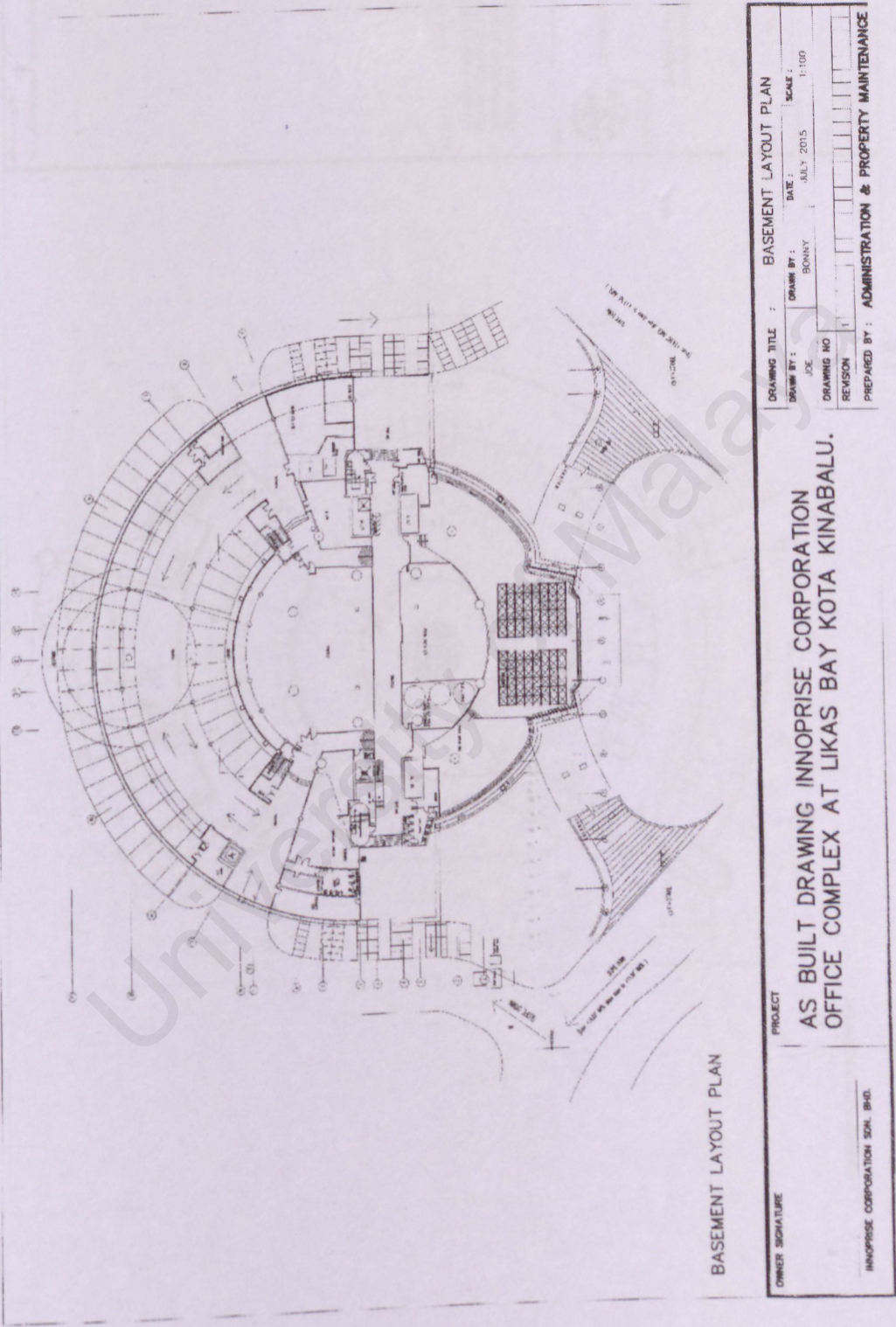
No. Aduan	002/15	No. RW	0101430
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BAHAGIAN ADUAN	
Nama Pengadu:	Norimah bt Matindang
Jawatan:	Pen. Pegawai Tadbir
Jabatan:	Jabatan Kerohan Negeri Sabah
Lokasi Kerosakan:	Unit Protokol JWS
Butiran Aduan - lampu tidak menyala.	
Tandatangan Pengadu:	Tarikh: 5/5/2015 Masa: 8.30 am.

BAHAGIAN PENERIMAAN		
Tindakan Yang Dilaksanakan oleh Penerima: Mengarahkan pengadu untuk membuat laporan perolehan.		
Penerima Aduan: ABDUL AMIN MD. ISMAIL Jurutera GEMILANG MAINTENANCE SERVICES SDN. BHD.	Tandatangan: 	Tarikh: 5-5-15 Masa: 8.30

PENGESAHAN SELESAI KERJA OLEH PENGADU		
Keputusan Pengadu Kepada Tindakan Yang Dilaksanakan:		
☒ Memuaskan ☐ Tidak Memuaskan ☐ Komen: _____		
Nama Pengadu: NORIMAH MATINDANG	Tandatangan: 	Tarikh: 5/5/2015 Masa: 8.45 am.

APPENDIX D



NOTES (ART NOTE)

* ALL MEASUREMENT TO BE VERIFIED ON SITE

PROJECT
YAYASAN SABAH HEADQUARTERS
AS-BUILT DRAWING AT MENARA
TUN MUSTAPHA JALAN SULAMAN
TELUK LUKAS KOTA KINABALU

OWNER



YAYASAN SABAH

DRAWING TITLE:

BASEMENT FLOOR PLAN
(as built drawing)

DRAWN BY

DATE

DRAWING NO.

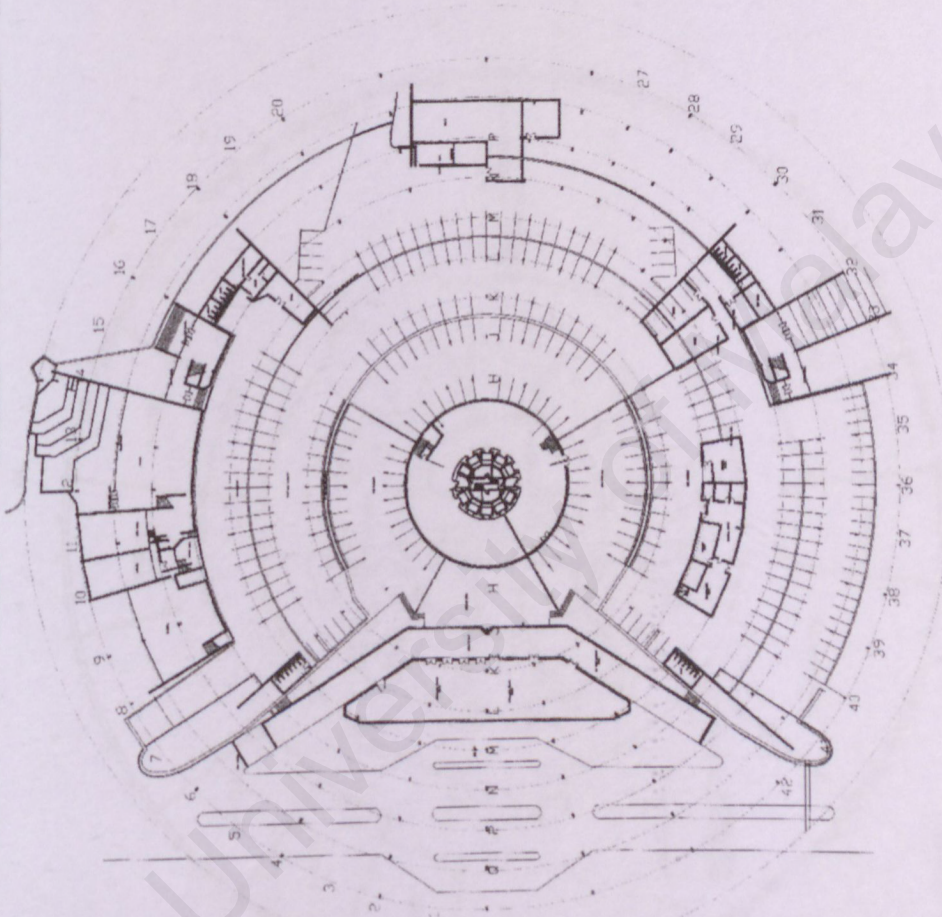
CHECKED BY

SCALE

REVISION

PREPARED BY

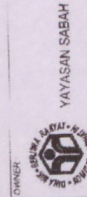
ADMINISTRATION UNIT & PROPERTY MAINTENANCE



BASEMENT LAYOUT FLOOR PLAN

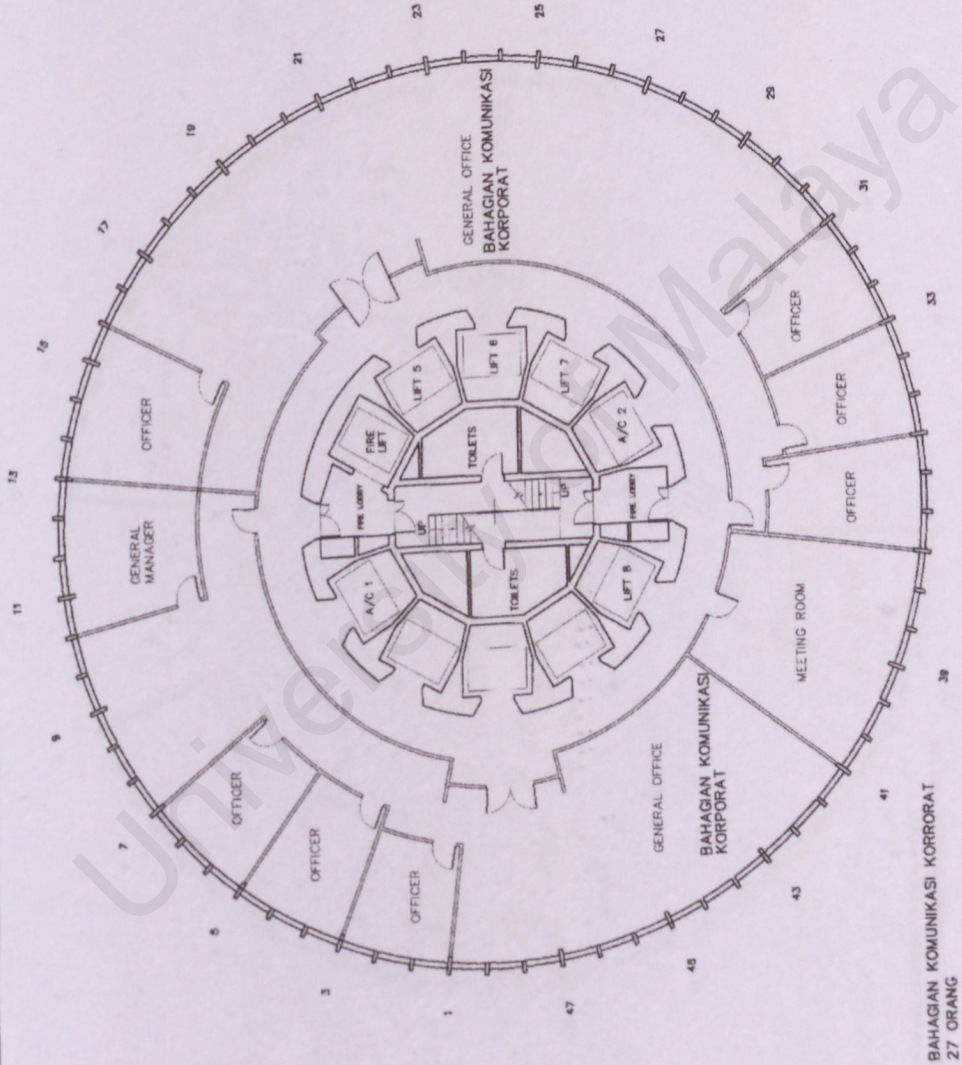
IMPORTANT NOTE
* ALL MEASUREMENT TO BE VERIFIED ON SITE

YAYASAN SABAH HEADQUARTERS
AS-BUILT DRAWING AT MENARA
TUN MISTAPHA JALAN SULAIMAN
TELUK LUKAS KOTA KINABALU



15th FLOOR PLAN
(as built drawing)
BAHAGIAN KOMUNIKASI KORPORAT

DRAWN BY:	JOE	CHECKED BY:	BA
DATE:	27/1	SCALE:	
DRAWING NO:			
REVISION:			
PREPARED BY:			
ADMINISTRATION UNIT & PROPERTY MAINTENANCE			



BAHAGIAN KOMUNIKASI KORPORAT
27 ORANG

MS ISO 9001:2008 JWT/YSG/AC/FM - 002



YAYASAN SABAH GROUP OF BUILDING
AIRCOND CLEANING SCHEDULE 2013

[illegible]

Eng. No. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 84

Prepared & arranged by: Name _____ Signature: _____ Date: _____

Verified by: Signature _____ Name _____ Date: _____

Approved by : Signature : _____ Name : _____ Date : _____

Legend
AHU : Air Handling Unit Split A/C : Split Air-cond Unit

 Servicing

JWT/ISO-PRO/02(46)
 NO. KELUARAN-01/NO. PINDAAN-00
 Tarikh Berkuatkuasa: 01.09.2012

MS ISO 9001:2008 JWT/YSG/AC/EM - 001

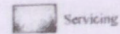


**YAYASAN SABAH GROUP OF BUILDING
 AIRCOND CLEANING SCHEDULE 2013**

LOCATION/MONTH	JAN					FEB					MAR					APR					MAY					JUN					JUL					AUG					SEPT					OCT					NOV					DEC				
WEEK	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5										
1) Wisma Innoprise																																																												
i) AHU Cleaning																																																												
ii) Split A/C Cleaning																																																												
2) Menara Tun Mustapha																																																												
i) AHU Cleaning																																																												
ii) Split A/C Cleaning																																																												
3) Sport Centre - Likas																																																												
i) Split A/C Cleaning																																																												
4) Tadika Ria - Likas																																																												
ii) Split A/C Cleaning																																																												

Yayasan Sabah Group of Building Aircond Cleaning Schedule 2013

Legend
 AHU Air Handling Unit Split A/C Split Air-cond Unit



Servicing

MS ISO 9001:2008 JWT/YSG/F/SCH - 001

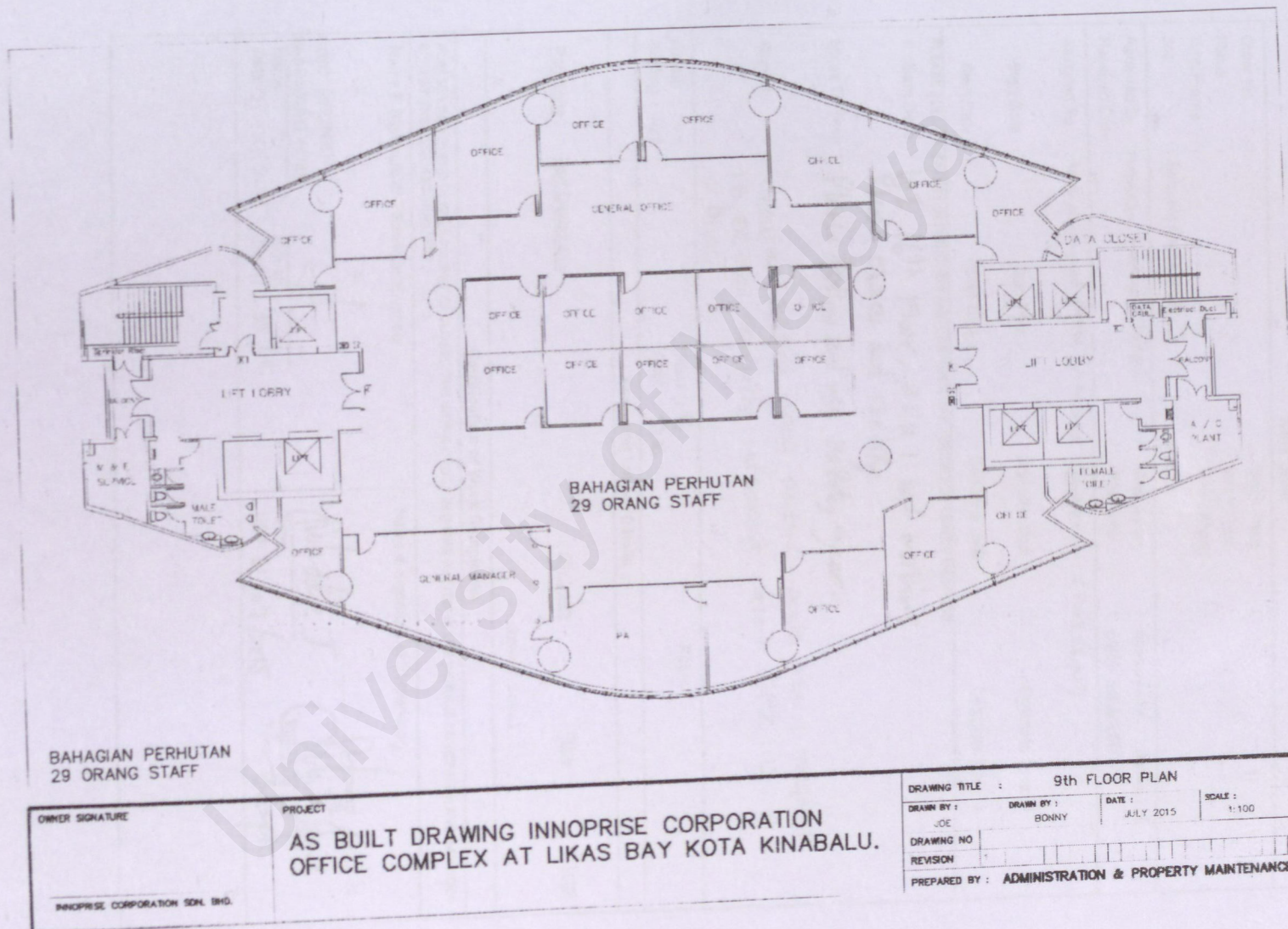


YAYASAN SABAH GROUP OF BUILDING
FIRE PROTECTION INSPECTION/TESTING SCHEDULE 2013

[illegible]

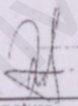
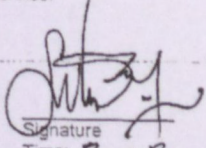
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Approved by Signature _____ Name _____ Date _____





ALL WORK ORDERS MUST BE RESPOND IN TWO WORKING DAYS.

Work Order			
Order No :		Work Trace :	
Status :		Work Type :	
Time Frame :		Work Priority :	
Job :	Request Maintenance		
Received By :	Ismael Mohd Yunus	Requestor :	Saheli Jahani
Received Date :		Phone No :	088-326360
Assigned To :	Mohammad Fitri / Mohd Syazreen (Praktikal)		
Start Date :	Start Time :	Complete Date :	Complete Time :
Start Date :	Start Time :	Complete Date :	Complete Time :
PLEASE FOLLOW SAFETY INSTRUCTION AND USE YOUR PPE TOOLS FOR SAFETY PROPOSE.			
Problem Desc : WI 16th Floor, AHU 1 not working. Please check and rectify			
Notes To Tech : Please follow and use safety gear.			
Remark : Menukar belting yang putus pada AHU 1 tingkat 16. Model belting tersebut ialah SPZ 112. 2 bauh.			
Region :	Floor : 16	Room :	
Building : 100	Dept : JKM		
Parts and Labour Details			
Part Code	Part Description	Qty Used	Price
			Total
			Grand Total
Certification of Work Completion			
PLEASE UPDATE AND CLICK REQUEST TO CLOSED THE WORK ORDER IN IPMS SYSTEM IF THE WORK IS DONE/FINISH AND HAS BEEN SIGN BY THE REQUESTOR/CLIENT			
Name & Signature of Technician/Engineer		Name & Signature of Supervisor	
MOHD SYAZREEN MOHAMMAD FITRI Name Date: 01.09.2015  Signature Time: 11.35 am		 Name Date: 01/09/2015 Signature Time: 3.00 pm	