POLITEKNIK SULTAN SALAHUDDIN ABDUL AZIZ SHAH

THE IMPLEMENTATION OF ENERGY EFFICIENCY PRACTICES IN GREEN OFFICE BUILDING AT KUALA LUMPUR

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ABSTRACT

Green building construction was adopted as a strategy to reduce energy consumption and the overall impact of the built environment on our natural environment. However, in Malaysia, previous studies have reaffirmed that green office buildings consume a substantial amount of energy, compared to another countries. Moreover, there is still a significant performance gap between predicted energy measurements and actual operational energy consumption of green office buildings in Malaysia, due to management, awareness of occupants and technology. Therefore, the purpose of this paper is to improve energy efficiency practices of green office buildings in Malaysia. The developed practices integrate technology, role management, and occupants' behavioral strategies, in order to reduce the energy consumption of green office buildings in Malaysia. Methodology or approach to achieve the research goal, a mixed (quantitative and qualitative) research method was used to collect data from the research population. In total, 61 respondents working in a green office building in Kuala Lumpur Malaysia were surveyed using a questionnaire. Additionally, two energy manager of green office building were interviewed. The study adopted convenience sampling technique in selecting the research respondents. The data from the questionnaire were analyzed using SPSS software while the interview data were analyzed via thematic content analysis. The findings suggest that the of technological strategy (switching to LED Lighting.) management strategy (establish energy management system) and occupants' behavioral strategy (training, awareness, occupants energy efficiency guide) will critically reduce energy consumption of green office buildings in Malaysia.

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CHAPTER ONE
INTRODUCTION

1.1 RESEARCH BACKGROUND

Buildings globally consume about 40% of total electricity made and emit concerning 30% greenhouse emission carbon dioxide (JKR and CIDB,2016). However, intensive analysis and development are done to improve the quality building performance through energy simulations and “green” building concept. Green buildings are created using resource-efficient and environmentally accountable process throughout the building’s life cycle, to mitigate energy consumption, greenhouse emission, etc. (EPA, 2016). In addition, different rating tools for practices have been received by different countries, to discover whether the green building meets certain standard. In the USA, there is Leadership in Energy & Environmental Design (LEED). In the UK, the Building Research establish Environmental Assessment Method (BREEAM) was established. The green building index (GBI) is one of the green building rating tools in Malaysia.

Due to the need for resource efficiency and enhanced workers output, several offices are adopting the green building concept. Adoption of green office building practices provides the triple-bottom-line benefits of sustainable development, in terms of environmental, economic, and social aspect (Nilashi *et al.*, 2015). Some of the environmental benefits include: air and water quality improvement; waste reduction; and natural resource conservation CIDB, 2016).

So, a strategy is needed to measure and evaluate the green office building occupants. This paper identifies recommended strategies to develop an energy efficiency guideline based on the literature. The effectiveness of energy efficiency practice needs to be evaluated to develop an effective strategy for implementing in Kuala Lumpur green office building.

Energy efficiency in green design is the key to ensuring sustainability in green building. Reducing the energy use in construction is starting to become a significant improvement chance for many organizations. According to International Energy Agency (IEA) (2015), energy efficiency refers to the lesser energy usage to provide the same quality of service. Green building is known as sustainable building (Samari, Godrati, Esmaeilifar, Olfat, & Mohd Shafiei, 2013) or “high performance” building (Howe, 2010).

1.2 PROBLEM STATEMENT

The actual energy consumption by green office buildings in Malaysia is higher than the predicted energy used due to occupants’ behavioral discrepancies. (Ashuri, 2010; Zaid and Kiani, 2016). Occupants’ behavioural discrepancy contributes to performance gap between simulated energy and actual energy performance of green office buildings in Malaysia (Zaid et al. 2017 and Hong et al. 2016).

Based on previous study by (Zaid et al. 2017) confirmed that green office buildings in Malaysia utilize more energy than conventional office buildings. It causes several factors are from lack if information, poor management policies, and occupants’ comfort criteria (Zhou et al. 2013).

Based on previous research, lack of awareness in energy saving design by building users; overcomplex and/or poor positioning of energy saving strategies that are hard to access by building user; bad energy saving/efficient design that do not understand user behaviour (Herrando et al., 2016; Niu et al.,

2016).

So that, this study was conducted to find out effective energy efficiency practices in two office green buildings of Kuala Lumpur.

1.3 CENTRAL RESEARCH QUESTION

The main research question is how to recommend energy efficiency practices in green office buildings at Kuala Lumpur? This question helps us to formulate the aim of this study? Although there is a practice of energy efficiency applied in those buildings, a strategic need to be developed to enhance energy management efficiency.

1.4 RESEARCH AIM

An aim was created to meet the finding of the research that is to promote the energy efficiency practices in green office buildings at Kuala Lumpur. At the end of this research, an appropriate recommendation will be produced to implementing effective energy efficiency practice according to the data collected.

1.5 SECONDARY RESEARCH QUESTION

From the concerns raised, there are a number of issues that are fundamental to the overall implementation of this study. The purpose of this study is to obtain results from the following research questions:

1. What is the factor of energy efficiency practices implemented in green office building?
2. What is level awareness of energy efficiency practices on occupants in green office building?
3. What is best approaches that able to improve energy efficiency practices in green office building?

1.6 RESEARCH OBJECTIVES

In order to achieve the aim of the study and to answer the research question, several specific objectives have been identified:

1. To identify the factor influence of energy efficiency practices in green office building.
2. To analyse awareness of energy efficiency practices on occupants in green office building.
3. To recommend improvements the energy efficiency practices in green office building.

1.7 SCOPE OF RESEARCH

In order to compare energy efficiency practices among residents, three case study buildings were selected. The study was focused on two office buildings in Kuala Lumpur. Green Office buildings were chosen as they represent well used buildings that have large numbers of permanent building users. To achieve this research objective, two case studies were selected to meet the research requirements and enable researchers to evaluate the effectiveness of energy efficiency practices. Both case studies selected have similar building characteristics.

The table below describes the characteristics of the selected building.

Table 1.1: Description of the selected building

Description	Case study 1: Q sentral Tower	Case study 2: Celcom Tower
Level office	29	25
Start operating	2015	2017
GBI	GOLD	GOLD

1.8 SIGNIFICANT OF RESEARCH

It is hoped that this study will achieve the aims and objectives of the research. Moreover, energy efficiency practices improvement recommended will assist facilities management to identify strengths and weaknesses in their organizations to achieve energy efficiency performance. In addition, this study can also inform management and consumers about the importance of efficient energy management and establish a self-discipline to be more responsible in their day-to-day activities without wasting energy and exemplifying future generations in energy management.

The outcome of this research can be a tool to creating an energy efficiency practices for occupants of green office buildings at Kuala Lumpur. This research can identify the energy efficiency that practices in office building and we can develop plans to improve energy management moving forward. Other than that, we can eliminate these problems in the future when we can identify and develop new method.

1.9 SUMMARY OF THE CHAPTER

This chapter has explained the current issue related to energy efficiency in green building office, problem statement, objectives, and scope of the research. The research focuses on energy efficiency in office building. In the next chapter, the research will provide further explanation on literature review about energy efficiency in facilities management company.

CHAPTER TWO
LITERETURE REVIEW

2.1 INTRODUCTION

Aspects of energy efficiency should be given due attention in every management carried out on a building today. This is to ensure that energy consumption is at the optimum level and level of comfort that can be felt by the users of the building especially for green building. Energy efficiency is a benchmark of energy utilized for providing a service. By enhancing energy efficiency, public will receive and save more energy from that energy (Department of Energy and Climate Change, 2012). Energy efficiency used smaller amount of energy to achieve or produce more works or activities. Moreover, production with energy efficiency must be seen as a speedy and low-cost source of new energy provide as the cost of supplying energy can be reduced a number of cost (Oyedepo, 2012). According to Department of Energy and Climate Change (2012), stated the benefits of energy efficiency consist of help in economic development, investment in energy efficiency technology can decrease the cost of innovation, reduce the gas emission, and create a sustainable energy system.

2.2 ENERGY EFFICIENCY

Energy efficiency is an investment, it is an investment in reducing kWh to meet rising energy demands. Energy effiency has a focus on reducing energy waste. In the words of Edward Vine of Lawrence Berkeley National Laboratory, has considered EE (Energy effiency) as the least cost strategy to help meet

resource adequacy and transmission expansion needs. EE reduces greenhouse gas emissions by decreasing consumption and peak demand, thereby delaying or avoiding capacity upgrades.

The energy efficiency practices carried out must have objectives such as identifying and correcting errors, providing consumption targets, motivating users to use energy optimally and avoid wastage. In addition, energy management should also have a strategic energy efficiency plan to reduce energy consumption costs in the organization being run. Energy efficiency also take a role to strengthen in practices and thus can reduce the energy use to supply more services such as lighting, heating, ventilation, and air conditioning (HVAC) and so on. Improving the energy efficiency of functional buildings is an important step in minimizing the environmental effect soft the green buildings.

2.3 CONCEPT OF GREEN OFFICE BUILDING IN MALAYSIA

The green office building concept in Malaysia is a developing market, and there are currently are still few green office buildings in Malaysia. According to the GBI (2018) certified buildings summary report, a total of 300 green buildings were certified in Malaysia by March 2017 and majority of the buildings were commercial buildings (offices, malls, airport, etc.). Due to the significance of green office building, the Malaysian government and several other agencies such as the Work Department Malaysia (PWD), Construction Industry Development Board (CIDB), the Ministry of Energy, etc. These initiatives, including the National Green Energy Strategy, Low carbon Cities system, green building rating tools aim to promote the adoption of energy efficient measures in the Malaysian construction industry. (Razak, 2011;Suhaida et al., 2013).

In Malaysia, different green building rating tools exist such as the Green Performance Assessment System, Penarafan Hijau, Green Real Estate, and GBI (Lim et al., 2016). GBI is the Malaysia's first comprehensive rating system, developed by Malaysian Institute of Architects/Pertubuhan Arkitek Malaysia

and the Association of Consulting Engineers Malaysia, to facilitate the accomplishment of sustainable development goals in Malaysia (GBI, 2018). GBI evaluates the environmental design and performance of green buildings in Malaysia based on six main criteria: sustainable site planning & management, materials & resources, water efficiency, indoor environment quality, innovation, and energy efficiency (GBI, 2018). The EE criterion of GBI is given the most priority, accumulating 35 points out of the total of 100 points.

Irrespective of the emphasis on EE, GBI is lacking in terms of energy management strategies, compared to its South East Asian counterpart like Green Mark Singapore and BERDE Philippines (Zaid *et al.*, 2017). According to Mokhtar Azizi *et al.* (2012), the inability of GBI tool to manage energy at the operational phase has resulted in substantial energy consumption of GBI-rated green office buildings in Malaysia.

2.4 RESEARCH CONCEPTUAL FRAMEWORK

The tittle of the research is effectiveness of energy efficiency practices in green office building at Kuala Lumpur. There are 4 constructs formed in the framework of this study. The research framework is as below.

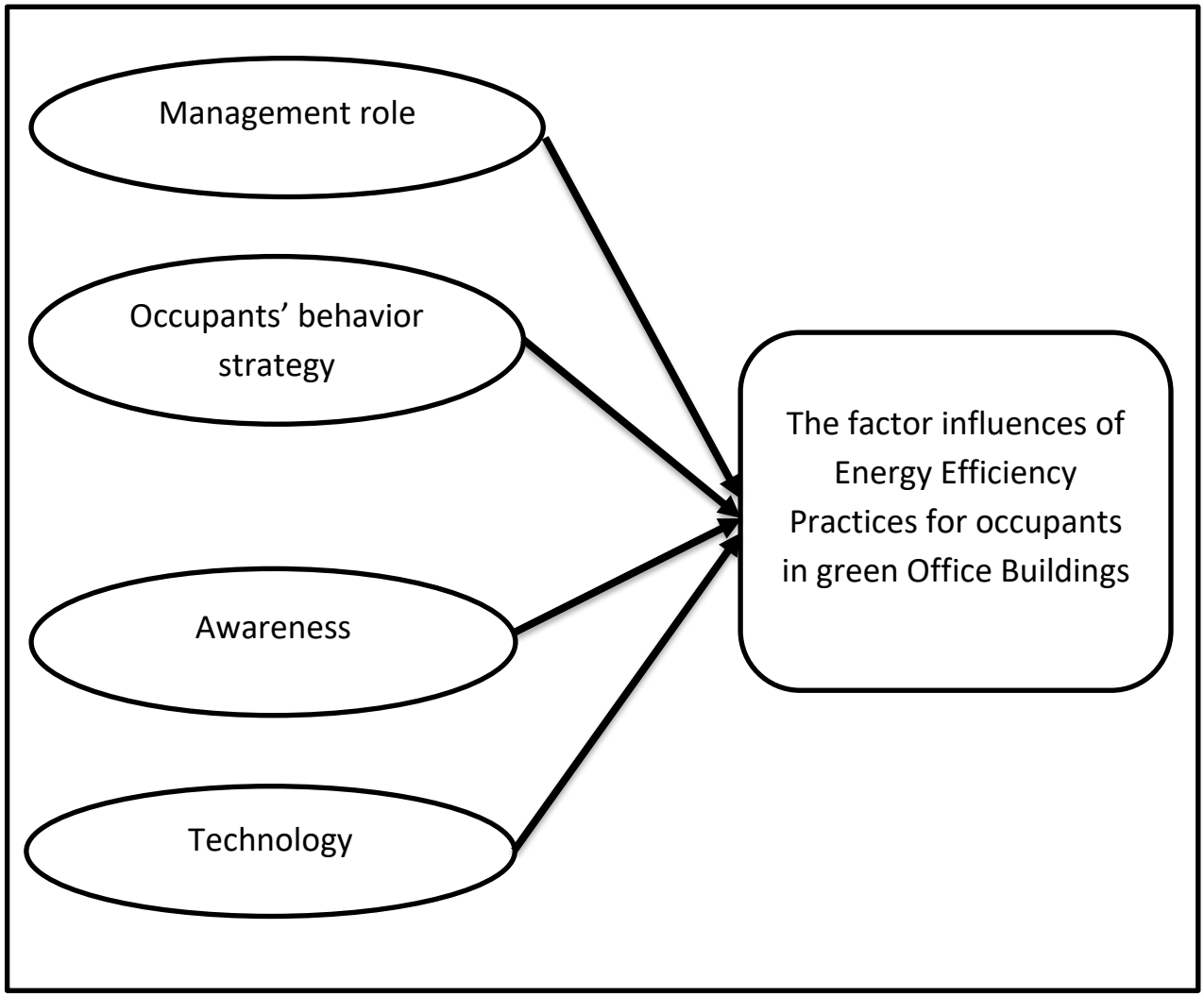

Figure 2.1: Conceptual Framework

2.4.1 Management

In Malaysia, there are limited literature on energy efficiency (EE) practices for green office building occupants. Nevertheless, few researchers such as (Hassan *et al.* 2015), (Aghili *et al.* 2016) and (Zaid *et al.* 2017) conducted studies on EE management strategies for green building in general. Establish energy efficient management strategies for green building in Malaysia energy efficient management strategies for green building in Malaysia such as created five key practices for efficient management of green buildings (Aghili et al. 2016) and established management practices for enhanced energy performance of green office buildings (Zaid et al.2017).

In addition, Facilities managers are in the forefront of delivering sustainable management in practice (Elmualim et al., 2010). They can make a significant difference by applying sustainable management in many areas of their responsibility (British Institute of Facilities Management, 2013).

2.4.2 Occupants Behaviour Strategy

Previous studies have shown that occupant behaviour has great potential against energy saving in green buildings focused on several studies in Malaysia targeting occupants comfort criteria (Huat ,2013). Providing occupants with all the necessary information related to EE practices, conducting efficient energy training and workshops for occupants regularly, establishing desired strategies for occupant behavioural change, and giving incentives to occupants with energy-oriented behaviours (Chukwuka and Wallace, 2018). Previous studies have identified that, buildings that caters to a customer-base who spend considerable time on- site have a high likelihood of displaying energy inefficiencies (BunkJ and YoungD, 2008). Therefore, it is important to move beyond the technical changes and explore alternative approaches such as behavioral changes to achieve superior energy performance (Janda KB, 2014).

Moreover, cooperative efforts are required to establish energy efficiency culture, identify opportunities for low-carbon opera- tions and to execute proposed solutions by the management (Pitts A, 2008). Occupants often have to decide between several behavioural options in order to reach the underlying goal. Such goals could be one or more out of reducing thermal stress, increasing air quality or improving visual aspects of the indoor environment or another aspect completely unrelated to the indoor environment. Understanding the factors involved in and influencing such decisions must be seen of outmost importance with respect to energy efficiency in buildings, because they often impact on the energy use.

Increase the attitudes of occupants against energy usage, provide occupants with all the necessary information relevant to EE activities, implement efficient energy instruction and daily seminars for occupants, create appropriate methods for improving occupants ' behaviour, and provide opportunities for occupants with energy-oriented behaviour. Upon leaving the office, this

technique allows occupants to shut off all electrical, illumination, and HVAC equipment. Information, exchange ideas and share information with other users online. (Aghaei et al., 2012).

2.4.3 Awareness and Training

Management may play an important role by actively supporting sustainability management activities such as initiatives for energy savings, conferences, lectures or basic opportunities to conserve resources (Tahir et.al 2016). Such activities must involve the participation of all levels of employees within the organization. Moreover, most property managers, building owners, and tenants typically do not grasp preservation or environmental efficiency well. Building owners or tenants often have little information about the impact of their actions on the use and pollution of carbon. Some owners of buildings also have the perception that investment in energy efficiency would not yield a return. Instead, some consumers treat the energy efficiency requirement as compliance and cost burden. (Thomas, 2015; Achtnicht & Madlener, 2014; Caputo & Pasetti, 2015; Castleberry et al., 2016; Ernst & Young, 2015). Though fully aware of the energy-efficient system, certain building owners are not interested in improving the quality of their buildings unless the machinery is about to fail or there is a high level of vacancies that reduces their rental income. (Climate Policy Initiative, 2013; Marquez et al., 2012; Thomas, 2015; Weiss et al., 2012; Achtnicht & Madlener, 2014).

The production of appropriate educational materials is the number one priority for raising awareness among the employees of the department about the potential benefits of energy efficiency. Some of the forms the participants listed was creating blogs with information required, showcasing the successful projects, presenting latest research and information, and awareness training initiative supported by the government (Morshed Alama, Patrick X.W. Zoua,, Rodney A. Stewartb, 2018)

Introducing energy efficiency and energy conservation awareness programs to the organization can actually generate significant energy savings. Intensive awareness programs such as campaigns for energy savings or simple incentives for energy management will be conducted regularly as it would be an incentive to strengthen the culture of energy efficiency. The effectiveness of the projects, however, relies on the participation of all senior and middle management workers in both office buildings.

2.4.4 Technology

Use of experienced project team, modern technology such as BIM, and sustainable building materials and components is the first step towards energy efficiency in green office buildings. (LIM et al. 2016). Other than that, The energy use of commercial buildings relies to a significant extent on how specific technologies are brought together as structures utilizing equipment such as fans, lamps, chillers, pumps and heaters, rather than relying on the efficiencies of the individual devices. (Hartley, 2013). Light Emitting Diodes (LEDs) have recently entered the lighting market as an energy efficient alternative to traditional light sources such as incandescent and fluorescent bulbs. LEDs are the future technology highly promoted for their low energy consumption, long life, efficiency, reliability, and ease of use in improved and innovative designs and having potential to save energy (Ayesha, 2017)

The GBI method addresses the improvement of upgrades to ensure the major energy-using structures of a building are restored, managed, and efficiently controlled in order to optimize efficiency. One of the core steps listed in Carbon Trust, Energy Trust, and EECA maintenance is that lighting diffusers and shades need to be cleaned or maintained on a regular schedule.

2.5 SUMMARY

Therefore, this study aims to develop comprehensive EE practices that will positively influence the way green occupants interact with their electrical appliances, so as to reduce energy use of green office buildings in Malaysia. This will be achieved by integrating technology, management policy, occupants' behavioural strategies, and awareness of users in order to reduce the energy consumption of green office buildings in Malaysia. Thereby closing the energy performance gap that exists between predicted energy and actual energy use.

In this literature study, the researcher has described some basic knowledge of the research being carried out such as the details of the definition, the background of the study. At the beginning of this chapter, the researcher provided some basic knowledge of the topic of the study conducted on the basis of data collection regarding the effectiveness of energy efficiency practices in green office buildings. Literature review helps researchers identify the research gap that needs a solution. In addition, the literature review from the previous study helped to formulate a study of the framework to achieve the research objective.

CHAPTER THREE
RESEARCH METHOLDOGY

3.1 INTRODUCTION

The chapter explains the techniques used to conduct the study's modus operandi in more depth. Methodology is a method used in response to research questions to collect data more efficiently. This research method is a key element in the study and implementation of a structure that consists of data collection procedures and guidelines to complete the analysis for the whole study.

The methodology in the study should be properly designed and applied so that the data collection process is carried out without any constraints in conducting this study. In addition, the aspects discussed include study design, variable measurement, instrumentation, studies design, validity and data analysis. In this study, the researcher chose a mixed method to obtain the study data. The mixed method will refer to the methodology emerging in the systematic study involving qualitative and quantitative data through research. This method also helps the researcher in the process of analyzing and interpreting the results of the research.

Therefore, the methodology in the study should be designed and applied in a comprehensive and accurate manner so that the process before and during the study can be carried out without hindrances that may affect this study.

3.2 RESEARCH PHILOSOPHY AND STUDY APPROACH

The term philosophical research refers to beliefs and assumptions about knowledge development. While this may sound profound, it is the right thing to do when starting research: developing knowledge in a particular field. The knowledge of development are working on may not be as dramatic as the new theory of human motivation, but it will also the specific issues within a particular organization. Whether you are consciously aware or not, every stage in research you will make a number of types of speculation (Burrell and Morgan 1979).

Besides that, research philosophy is a belief about how data about a phenomenon should be gathered, analyses and used. The term epistemology is meaning what is known to be true, as opposed to doxology mean what is believed to be true and encompasses the various philosophies of the research approach. The purpose is the process of transforming things believed in things known in the philosophy that have four major research philosophies that have been identified such as positivism, realism, interpretivesm, and pragmatism.

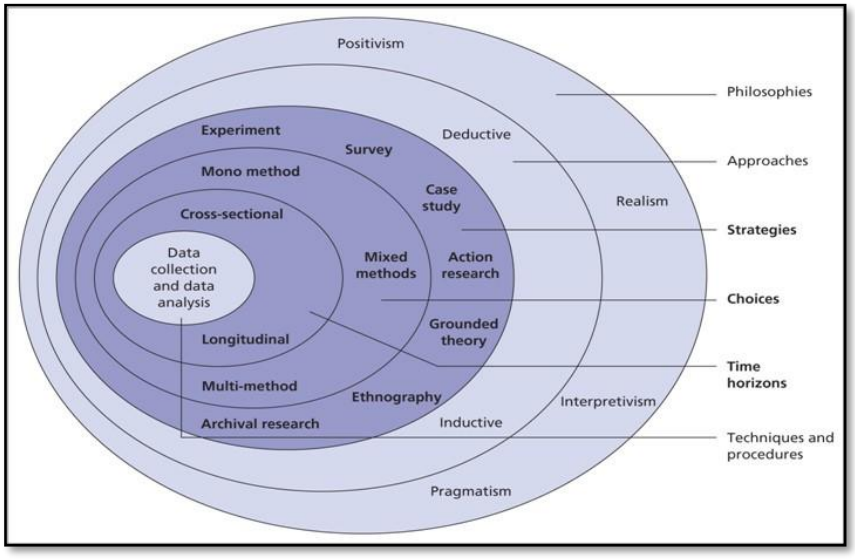

Figure 3.1: The ‘Research Onion' design (Source by Mark Saunders, Philip Lewis and Adrian Thornhill, 2008)

In the dissertation, the researcher used pragmatism a realistic research. The importance of the study is finding realistic outcomes. Pragmatism is the continuum decided via study quires which direct methodological picks in obtaining advantage information from the research supply. However, this does not imply that pragmatist record series are achieved, pragmatism considers that no single viewpoint can and that includes perhaps multiple realities. Therefore, the researcher always used a couple of technique and analysis procedures. Pragmatics combines both positivism and interpretivism in single research is consistent with the research question.

Pragmatism is one of the philosophies used in research, for the study approach will explain more detail on three main points on approach such as deduction, induction and abduction

Table 3.1: Reason to research (Source by from Mark Saunders, Philip Lewis and Adrian Thornhill, 2019)

	Deduction	**Induction**	**Abduction**
Logic	In a deductive inference, when the premises are true, the conclusion must also be true	In an inductive inference, known premises are used to generate untested conclusions	In an abductive inference, known premises are used to generate testable conclusions
Generalizability	Generalising from the general to the specific	Generalising from the specific to the general	Generalising from the interactions between the specific and the general
Use of data	Data collection is used to evaluate propositions or hypotheses related to an existing theory	Data collection is used to explore a phenomenon, identify themes and patterns and create a conceptual framework	Data collection is used to explore a phenomenon, identify themes and patterns, locate these in a conceptual framework and test this through subsequent data collection and so forth
Theory	Theory falsification or verification	Theory generation and building	Theory generation or modification; incorporating existing theory where appropriate, to build new theory or modify existing theory

a. Deduction

Deduction is what would think of a scientific research. It involved the development of a theory that is then subjected to test through a series of proposition. According to blaikie, 2010 have six deductive approach will progress

1. Put the tentative idea, premise or hypothesis is a detestable proposition about two relationships, more concept or variable.
2. Existing literature review, by specifying the condition under which the theory is expected to hold. Deduction a testable proposition or number of propositions
3. Examine the logic of the argument that produced them, comparing.
4. Test the idea by collecting appropriate data to measure the concepts and analysis them.
5. If the results of the analysis are not consistent with the premises. The theory is false and must either be rejected or modified.
6. If the results of the analysis are consistent with the premises and the theory is corroborated.

b. Induction

The induction will also criticize the deduction for its tendency to develop a methodology that does not allow for alternative explanations of what's going on. In that sense, there is an end to the choice of theory and definition of the hypothesis. Alternative theory may be suggested by deduction. However, these would be within the limits set by the highly structured research design and significant characteristic

c. Abductive

Instead of moving from deduction or induction, abductive approach move back and forth. Effect combining the deduction and induction (Suddaby,2016). According from Van Maanen et al on 2017, the theories can account for what is note that some reasonable theories can explain what is absorbed better than others and these theories will help to uncover more 'surprise the fact'. The abductive approach is sometimes called 'retroduction'. In fact, reproduction is believed to be the original label for what is known as abduction through corruption misunderstanding for older philosophical texts (Peirce, 1896).

Therefore, the abductive is the selection for using in this research because related to qualitative. The research based used the framework and also using the abductive can help to achieve a research goal.

3.3 RESEARCH DESIGN

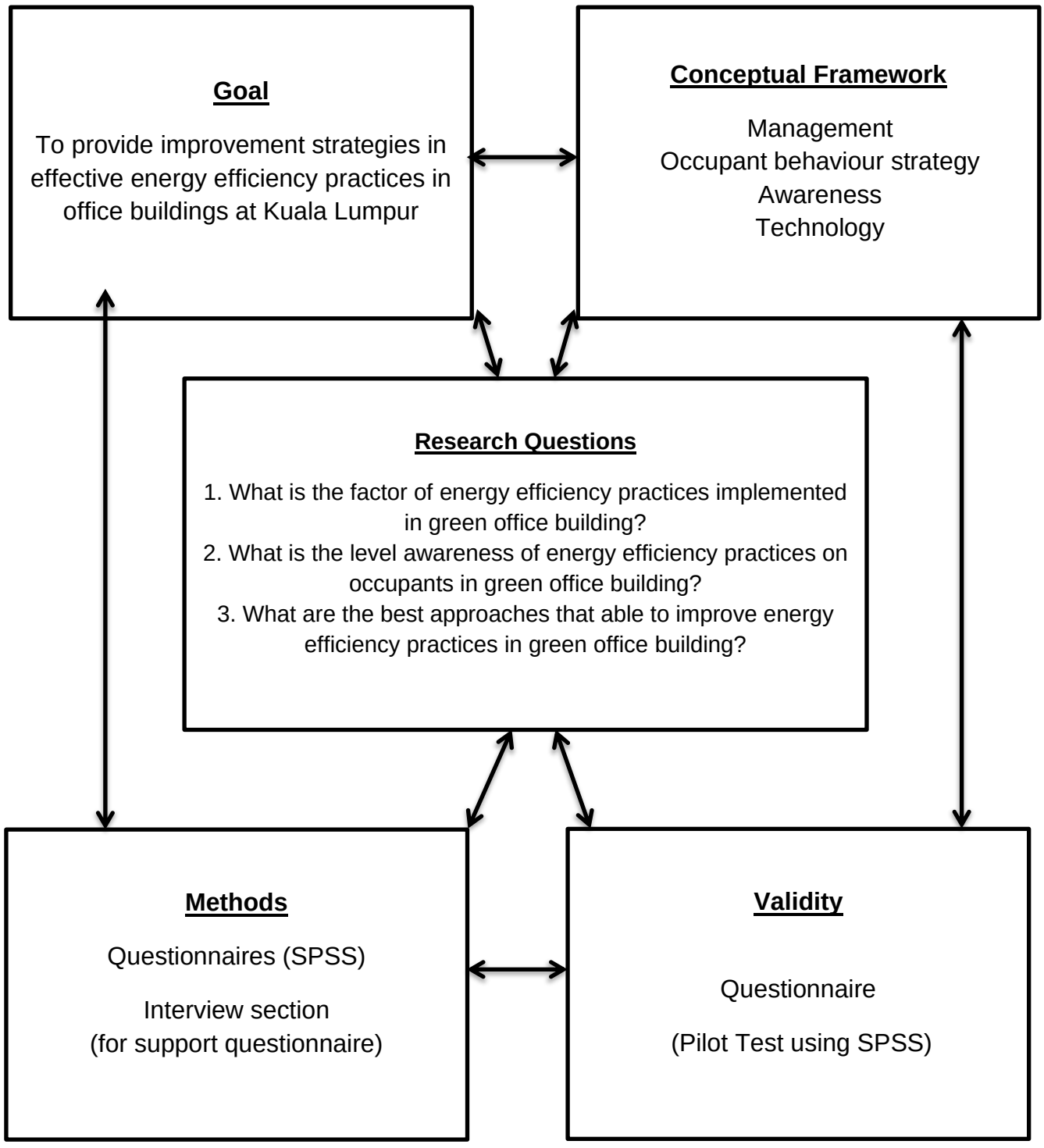

Figure 3.2: Research Design (Source by Maxwell, 2013)

Study design is the structure used by a research to analyze data, according to Bryman (2008). Study design aims to turn research questions into projects involving objectives, hypotheses, study issues, methodology and sampling techniques, Robinson (2011). Meanwhile, Creswell (2009) pointed that plan is a study program or concept requiring contact with theory of science, research policy and research methodology. In addition, the design is used to determine the strategy and appropriateness of selecting a statistical test to analyze the study data. Based on Figure 3.3, the study design consists of five components that are based on Maxwell's theory of 2012. Through his study design which shows the relationship between the five components: goals, conceptual frameworks, study design, method and validity. The research question is considered a central point and in other words all of these components can answer all the research questions for the research that have been made. In addition, the components of this study are related to the conceptual framework and methods of study because the purpose of this study will be to develop a conceptual framework while at the same time it will determine the appropriate method of obtaining research information and answering questions.

Validity has a relationship between objectives, conceptual frameworks, methods and questions of research. Both elements must be checked either through authorization and formal expert interviews or through the use of a system software commonly used by most researchers to show the study's validity and reliability.

3.4 METHODS OF DATA COLLECTION

The data collection method used by the researcher is a mixed method. Work on hybrid approaches is a work methodology of philosophical assumptions and forensic techniques.

As a technique, in a single study or sequence of experiments, it includes methodological principles that govern the course of data collection and analysis and the combination of qualitative and quantitative results. The central premise is that the application of the use of quantitative and qualitative methods provides a better view of issues in study that either method alone. Creswell and Plano Clark (2007: 5) Therefore, to achieve the aim of this study, abductive emphasis will be used where this study is a combination of quantitative and qualitative approaches. Therefore, abductive emphasis is used to achieve the goals of this study. Abductive is a combination of quantitative and qualitative approaches.

3.5 RESEARCH INSTRUMENT

In conducting the research, the research instrument needs to be defined first. There are several research instruments that can be used for the data collection process for the study:

3.5.1 Instrument one: Interview

Interviews are a two-way communication process for getting real information Chua (2006). Interview consists of the three types of structured interviews, semi-structured interviews and unstructured interviews. Structured interviews are a form of questionnaire that is delivered orally. Throughout structured interviews, the interviewer is given a set of pre-determined questions. During the interview, the questions will not be modified, and no

follow-up questions will be asked for a clarification of the answer given. Unstructured interviews are usually described as purpose-driven interactions – capturing research study results. Such interviews have the least number of questions because they focus more on a standard yet underlying subject discussion.

Semi-structured interviews provide the interviewer with substantial leeway to evaluate the respondents as well as preserving the basic structure of the interview. Even though this is a directed dialogue between researchers and interviewees, the researchers are given tremendous versatility. Thus, the semi-structured interview method was used to achieve the goals in this study.

3.5.2 Instrument two : Questionnaire

Using questionnaires as a more practical and effective tool can help reduce the expense, time and energy of data collection Mohd Majid Konting (1998). Questionnaire is a form of instrument for obtaining facts about a current situation and practice. It is also used to study attitudes and opinions Deobold B. Van Dalen (1962). In the study, the researchers used questionnaires to obtain information from building users. Because the majority of building occupants are regular communities, data collection methods through questionnaires can help you get the right data.

3.6 VALIDITY

The validity of this study is to test the extent to which the instruments used in the research include content relevant to the purpose of this research Miller (1994). Therefore, the validity test is performed to see how far the instrument is being used to measure what should be measured.

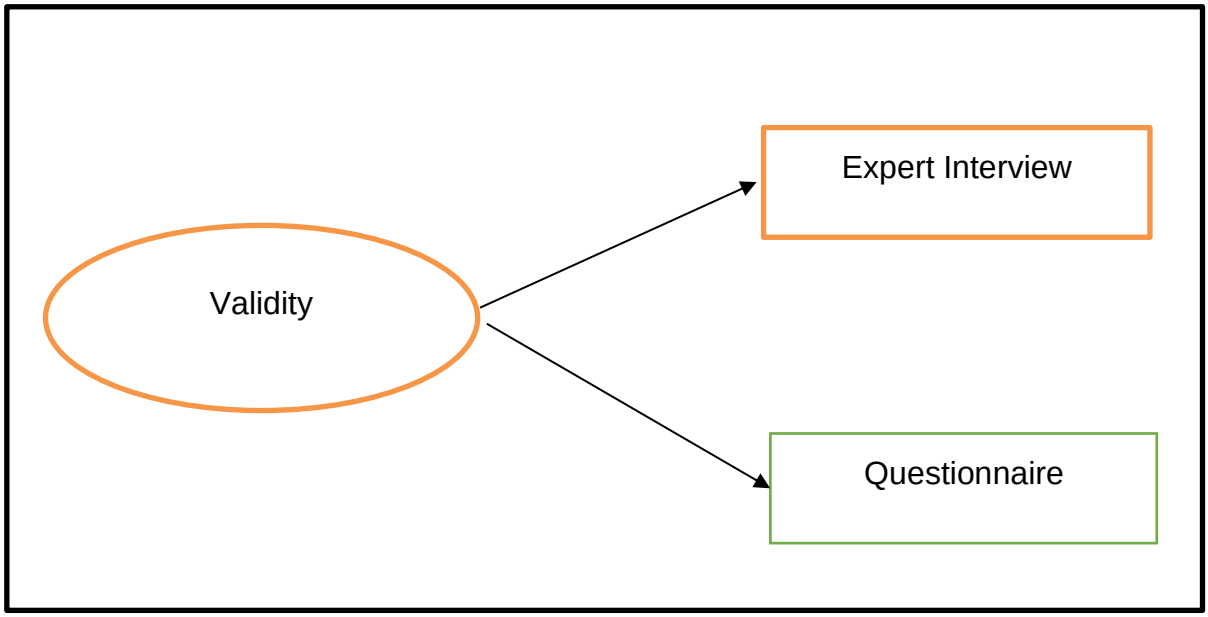

Figure 3.3: Research validation techniques

The validation process in this study involves two steps to the validity of this study, the researcher divides the validity into two phases: the literature search phase and the data analysis.

3.6.1 Literature review search phase

Search comprehensive reviews of literature reviews for all the possible uses as a gauge. Further, in the construction of conceptual frameworks and indicators in the study. Therefore, the aspects of the verification process described in the questionnaire design as a pilot study as well as the main study and semi-structured interviews. In search of literary highlights it is necessary to answer the objectives of this study.

3.6.2 Document analysis phase

Prior to the process of analyzing the workforce, the researcher conducted a series of interviews and questionnaires to ensure that the data obtained from management and building users were similar to the data obtained by the energy management of the two green office buildings in this study

3.7 RESEARCH SAMPLING

Sampling is the process of selecting a group of people, institutions, places, or phenomena from a large group or research. In this study, the researcher selected several samples to be grouped in semi-structured interviews. The sample in this study consisted of experts with experience in energy efficiency practices. In addition, the researcher selected two samples that were directly involved in energy management The Energy Management Committee of the green office and the building occupants. The purpose of this sampling is to obtain more detailed and detailed information on energy efficiency practices.

Furthermore, the use of sampling is intended to enable the researcher to determine the appropriate and specific respondents for the purpose of the study. There are also some researchers who use this sampling in the early stages and the beginning of their research solely for specific purposes such as testing the questionnaire or obtaining quick feedback. However, the findings from the study using this sample do not represent a specific population but at least provide a preliminary picture of the field of Syed Arabi Idid (1998); Wimmer & Dominick, 1997).

In addition, sampling is also related to the process of selecting subjects from a population to be the respondents of the study. Improper use of samples will reduce the validity and reliability of the study. Proper sampling design facilitates data collection, minimizes measurement error and saves time and expenses Sabitha (2006). The design of the sample is determined based on the purpose of the study, the sample size required, the cost and time allotted by the study. Research using samples provides opportunities for research to get more detailed and accurate information about populations.

3.8 SUMMARY OF THE CHAPTER

It could be re-emphasized here that researchers are not restricted only to different methods of data collection instruments and their classification as presented in this paper. However, the choice of which method to apply depends on the researcher as well the nature or problem to be investigated and prevailing circumstances at the time of carrying out the study. Thus, researchers are free to use any method they deem fit for their research.

CHAPTER FOUR
DATA COLLECTION

4.1 INTRODUCTION

Data Collection is a mechanism through which the researcher collects the knowledge from all available sources to find solutions to the study question, test the hypothesis and analyze the findings. Furthermore, the responses to questions where the researcher asks how, where and where the data is to be obtained.

The choice of methods for gathering data depends on the research issue under analysis, the nature of the research and the knowledge collected about the component. . The strategies for gathering data may be narrowly divided into two categories:

a. primary data collection method
b. secondary data collection method

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4.2.1 Sampling Design

According to Sabitha (2006), the sample design is calculated based on the research objective, the sample size needed, the expense and the time allotted.In general, sampling techniques can be divided into two types:

4.2.1.1 Probability sampling

Sampling of probability means that each item within the population has an equal chance of being included in the sample. One way to perform random sampling would be to build a sampling frame first and then use a random number generation computer program to collect a sample from the sampling frame (Zikmund, 2002). Probability or random sampling provides the greatest independence from bias but may reflect the most time- and energy-consuming survey with a specified degree of sampling error (Brown, 1947). Probability sampling methods include simple, stratified systematic, multistage, and cluster sampling methods.

4.2.1.2 Non-probability sampling

Non-probability sampling is also connected with the nature of research paper studies and qualitative analysis. As for the above, research papers appear to rely on limited populations and are meant to examine a particular world event, not to draw statistical inferences in comparison to the larger population (Yin, 2003).

The basic random sample implies that the likelihood of inclusion in the survey is equivalent for each population scenario. Simple random sampling related drawbacks include (Ghauri and Gronhaug, 2005). Non-probability sampling methods include purposive, quota, convenience and snowball sampling methods.

Table 4.1: Probability Sampling

Probability Sampling Techniques	Explanation
Simple Random	Used to ensure that each unit or subject in the population has the same opportunity to be selected as the respondent of the study
Systematic	Every unit or subject in the population has the opportunity to be selected as the respondent
Cluster	For a population that involves a large area and a large number of subjects in the population
Randomly layered	Separate random selection for each subgroup in a population

Table 4.2: Non probability sampling

Non probability Sampling Techniques	Explanation
Dimensional	For small cases where there is only a small subset of subjects with special characteristics that the researcher is interested in
Quota	Sample group members are selected on the basis of specific criteria
Coincidentally	The researcher selects any subject that is found
Purposive	A group of subjects with specific characteristics were selected
Snowball	The study respondents were asked to suggest other subjects with

	characteristics that are suitable for the study
General variance	Individuals or groups of individuals are selected to represent the lowest and highest levels of a characteristic
Critical case	Specific cases involving strange, unusual or rare behaviour.

In this study the researcher selected the probability sampling as a sample. The researcher selects individuals from the pollutants that can represent the population. the probability sampling procedure is performed by randomly selecting the sample subject, where the subject in the sample has all the characteristics of the study population before the probability sampling procedure is performed, the researcher needs to identify the population size and get a list of subjects in the population. For this study, the population consist of building occupants from two different office building which are Q Sentral Tower and Celcom Tower at Kuala Lumpur.

4.2.2 Sample size

According to Abdul Ghafar (2003), population is a group of people with similar characteristics. The study population refers to the target group of the study activities. In a given study, the researcher was not able to use all available populations but only to use the sample to represent the sample being studied. Whereas according to Abbott (2002), the sample was a small number of individuals from the population included in the study. According to Krejcie and Morgan (1970), samples can represent population size. The use of samples from the population is intended to facilitate the work of researchers (Gafar 1998).

Table 4.3: Krejcie and Morgan

N	*S*	*N*	*S*	*N*	*S*
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	1000000	384

Note.—*N* is population size. *S* is sample size.

Source: Krejcie & Morgan, 1970

Table 4.4: Total sample size required

No	Facilities Management Organization	Total Population	Total Sample Size Required	Sample Size
1	Q SENTRAL TOWER	35	70	35
2	CELCOM TOWER	35		35
Total		70		70

4.3 DATA COLLECTION INSTRUMENTS

Data collection instruments need to be determined before the study is conducted. There are several research instruments that can be used for the data collection process. A questionnaire survey and a semi-structured interview were used to collecting data.

4.3.1 Questionnaire

A questionnaire is the principal means of collecting key quantitative results. A questionnaire allows the collection of quantitative data in a standardized manner, so that the data is internally consistent and coherent for analysis. Questionnaires should always have a definite purpose related to the research goals, and it must be clear from the beginning how the findings will be used. (Roopa & Mani, 2012). Close ended questionnaire was used by the researcher to collect data from the respondent. The respondent will be provided a set of present answers to pick their answer from. The collection of responses will contain any conceivable answer which does not conflict with the context of the responses. An example of a similar survey query will be, "Please score how strongly you agree with the following statement or disagree with it: 'I feel comfortable about my work on the job.' Do you strongly agree, somewhat agree, neither agree nor disagree, somewhat disagree, or strongly disagree?" A Likert scale, used in the above example, is a widely used collection of answers for closed-ended questions.

4.3.1.1 Survey questions

Section A: Respondent demographic

This section was created to find out the socio-economic information of the respondents who will answer the questionnaire. Demographics include:

- Academic qualification
- Position
- Years in working experience
- Building information

Section B: Identify things about energy efficiency practices in green building.

Items	Statement	Scale				
		1	2	3	4	5

B1	Management building conducts energy audits to monitor energy use in the workplace.					
B2	Management building brings a huge impact on energy efficiency to building.					
B3	Changing behaviors towards energy consumption may have a great impact on the building energy efficiency.					
B4	Providing occupants with information related to energy efficiency practices such as conducting efficient energy training and workshops for occupants regularly.					
B5	Install solar system to save electricity to building.					
B6	Install energy efficient equipment such as LED lights can save energy consumption.					
B7	Install sensor system or automated lighting system to avoid the unnecessary or waste of usage of lighting system					
B8	Investing more money in technology (Building information management) can improve energy efficiency to building.					

Table 4.5: Question for Section B

This section is used to obtain information from building occupants based on management role constructs. The findings of this section are analyzed using SPSS software and will be discussed to answer objectives one and two.

Section C: Analyze of awareness of energy efficiency practices on occupants in green office building.

Items	Statement	Scale				
		1	2	3	4	5
C1	I apply the energy management training given in the operation of daily work activities in the building.					
C2	I always turn off all appliances before leaving the office					
C3	I always turn off lights and use a natural light when adequate					
C4	Energy saving awareness briefing helped me towards energy saving.					
C5	Guidance from energy management on energy efficiency can help improve the energy use performance of buildings.					
C6	Green building can help occupants achieve the energy efficiency performance.					
C7	Awareness notices of the importance of saving electricity and water are provided in the workplace.					
C8	The energy management training provided, helped me do energy saving.					
C9	Energy efficiency can reduce energy use, costs and lower emissions.					
C10	When occupants understand how they can improve energy efficiency at work, they will learn how to cut their usage and costs at home too.					

Table 4.6: Question for Section C

This section is used to obtain information from building occupants based on operational control constructs. The findings of this section are analyzed using SPSS software and will be discussed to answer objectives one and two.

4.3.2 Interview

4.3.2.1 Semi structured interview

Interviews are performed mainly in qualitative studies, which arise when researchers ask broad, open-ended questions to one or more subjects which document their answers. Audiotapes are also used to facilitate more accurate transcriptions (Creswell, 2012). Semi structured interview was used by the researcher to collect data from the respondent. Semi-structured interviews are those in-depth interviews in which subjects have to address open-ended questions in advance and are thus commonly used in their study by practitioners. Semi-structured, in-depth interviews can be used widely as a method for interviewing a person or even a community at times. (Corbin J, Strauss A, 2018). Semi-structured interviews include the characteristics of both structured interviews and unstructured. In semi-structured interviews, the moderator presents a series of same questions for all interviewees to respond. Around the same time, supplementary questions could be posed during interviews to explain and/or extend any concerns further.

Qualitative data involves the interview section. This research interview using just to support the questionnaire to get a stronger answer and interview section target to top management on the facility management company. These instruments were used to help the researcher to understand more about the research being conducted. Respondents to provide any extra information they consider to be relevant, as well as their impressions of the interview (McNamara, 1999) Therefore it needs to be done to reinforce the view on the Internet of Things (IoT) on the facility management company. The interview using unstructured format so for the question interview based on the questionnaire and question additional depend on the questionnaire and their knowledge about energy efficiency practices.

4.4 PILOT TEST

This validity test needs to be done by the researcher to obtain the authenticity, accuracy and usability of the questionnaire that has been formed to achieve the objectives of the study. The purpose of this pilot test conducted is to measure the reliability of the statement in the questionnaire used. Table 4.5 shows the Cronbach's Alpha readings obtained with a total of 10 respondents.

Table 4.7: Cronbach's Alpha Value for pilot test

Section	Cronbach's Alpha Value	Item
B	0.75	8
C	0.79	10
Total	0.78	19

Based on table 4.4, the researchers recorded the Cronbach; s Alpha for reading of the questionnaire and validity tests were performed for sections B and C using the Likert scale. Data from the pilot test obtained will be analyzed and problematic items will be corrected. Referring to Sekaran 1992, Cronbach's Alpha values of 0.60 - 0.80 are good and readings above 0.80 are excellent readings. Even readings less than 0.6 require improvement, unacceptable and invalid. Researchers have obtained a Cronbach's Alpha value of 0.70 and above for each section. This proves that this questionnaire exceeds the stated level. Further can be used to obtain actual data for the research.

4.5 SUMMARY OF THE CHAPTER

The conclusion of chapter 4, the compilation of data, involves the sampling and the instruments applied. Sampling split into two, which were the probability and non-probability table used by Krejcie & Morgan (1970) to determine the sample size questionnaire for instruments used to collect data and results.

Questionnaire divides into four sections, and is distributed to the respondents selected. Chapter five, cover the analysis and discussion of data, and all collection data on the study must be clarified in the article. Chapter five includes the review and discussion of all section questionnaires.

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CHAPTER FIVE
DATA ANALYSIS AND DISCUSSION

5.1 INTRODUCTION

This chapter is the most important part of the research, where this chapter will describe the findings of the research because of the mixed method that has been used to collect data. This chapter will also give the results of the study from the data collection that has been done. The data collected is analyzed to answer the research questions as well as help achieve the objectives of the study built through the problem statements that have been identified. Both instruments that have been selected by the researcher help in achieving all three objectives. The analysis performed gives clear processing and will justify the objectives of the study. Every aspect related to energy management practices applied in the two selected office buildings will be described in this section.

To obtain data on energy efficiency practices in green office buildings, survey forms were distributed to building occupants the majority of whom are building manage working there and are permanent building occupants. A total of 35 questionnaires were distributed to each building, namely Celcom Tower and Q Sentral. Each of the 35 respondents selected is an employee who manages an office building consisting of facilities management. The number and representative of respondents are selected according to the recommendations from the customer service division of each building responsible for managing the building. For the semi-structured interview method, energy managers from both buildings were selected to obtain data. Researchers have interviewed the two energy managers face to face to obtain data and information on energy practices.

The results of the study analysis obtained will be shown in the form of tables and diagrams. The data obtained from questionnaire survey will be analyzed

using SPSS software (26.0). The analysis method used is in the form of percentage, mean and standard deviation obtained through SPSS software

The results from question need transfer to Excel Microsoft and from Excel Microsoft convert to Statistical Package Social Science (SPSS) to get the specific for support research. The data obtained will be analysed using SPSS and data from SPSS will be explained through charts and tables. Three types of analysis methods will be used in the analysis description among percentage, mean, and frequency.

5.2 DEMOGRAPHIC

Demographics of these respondents provide an explanation of the background of the individual who has answered the questionnaire. A total of 70 questionnaires were distributed to respondents from both office buildings to achieve the objectives of the research. Socioeconomic characteristics of respondents comprising of:

- Academic Qualification
- Position
- Working experience in the building
- Name of Building

Demographic information of each respondent that has been received through questionnaires is explained in the form of diagrams to facilitate understanding.

5.2.1 Analysis of respondents based on academic qualification

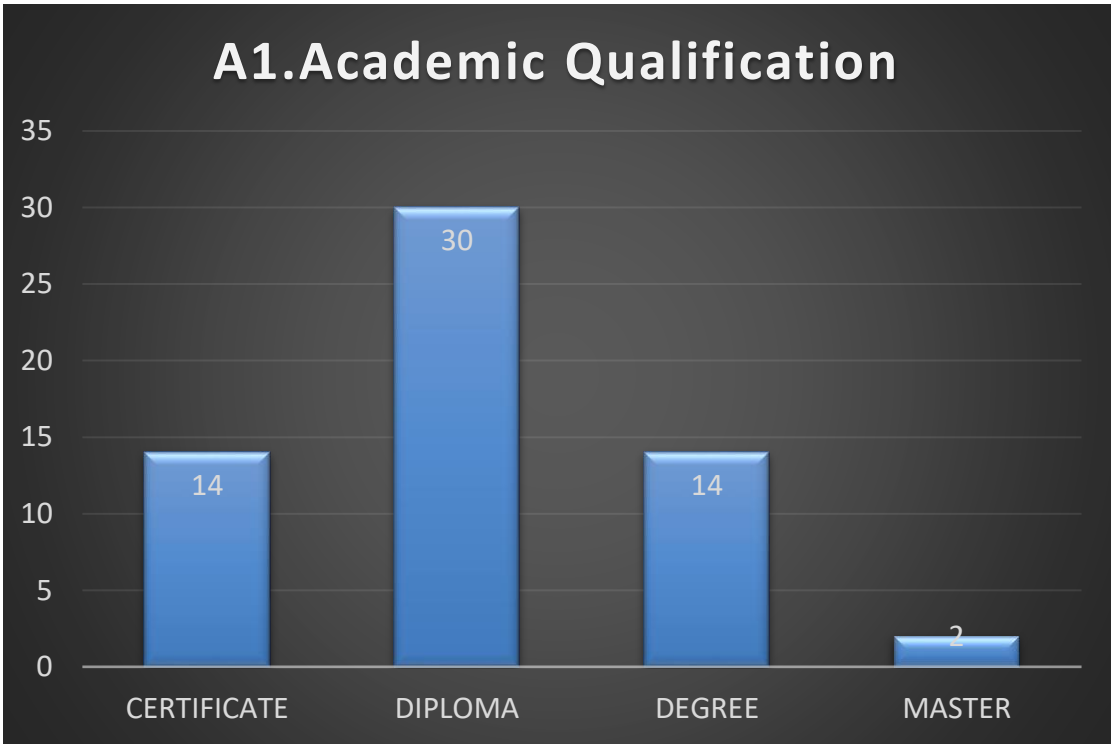

Figure 5.1: Academic Certificate Level

As shown in Figure 5.1, four levels of educations have been obtained among the Certificate, Diploma, Bachelor's Degree, and Master's Degree. Refer to the pie chart above, the level of Diploma education got the first highest choice. Percentage for the number of Diploma holder are 48% equivalent to 30 respondents.

The second-highest result is a bachelor's degree where the percentage are 28% equivalent to 16 respondents. The third highest is Certificate, which shows are total of respondents is 14. Where the percentage are 23%. Lastly is the master bachelor where the total number is 2 people equivalent to 2%.

5.2.2. Analysis of respondents based on position in the company

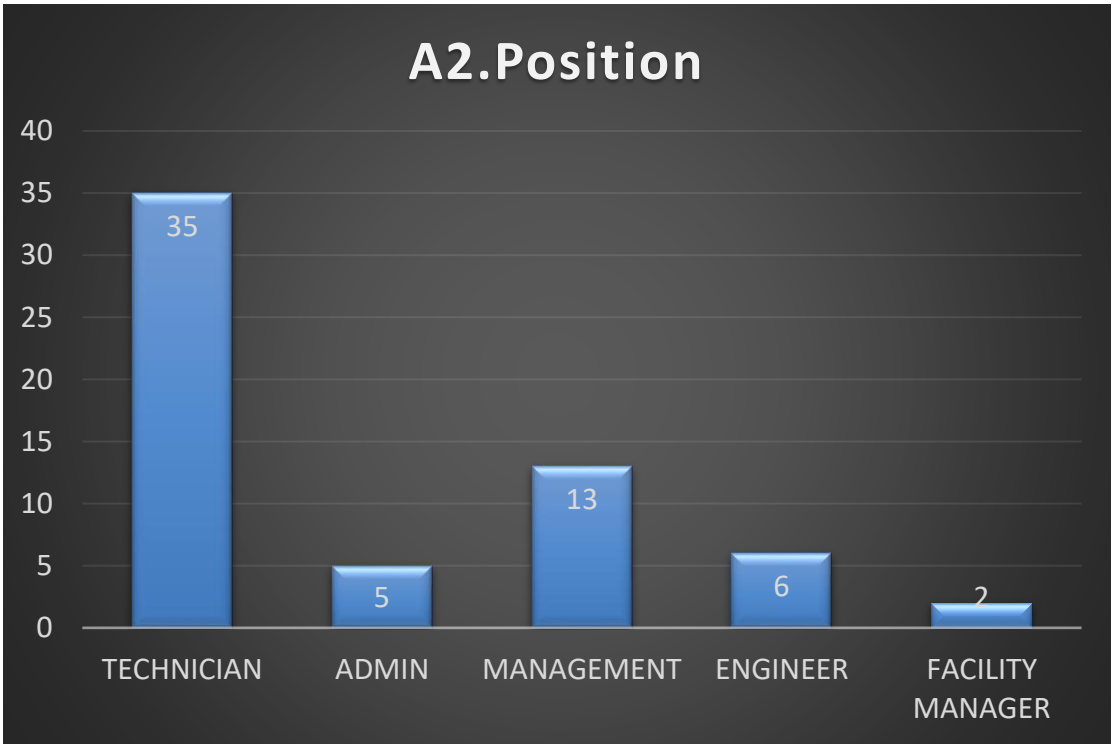

Figure 5.2: The respondent's designation.

The diagram 5.2 shows the respondent designation which is inside Facility Management Company and there have 5 positions that have been filled by respondents. The feedback obtained found that the position of the technician got the first highest answering by the respondents from the research questions.

The position of technicians got the highest percentage are 58% because each facility management company has a large number of technicians compared to other positions. The management got second with percentage are 21%. Next, the total percentage of engineer are 10% and admin are 8%. Lastly, the facility manager position has a total of 2 respondents equivalent to 3%.

5.2.3 Analysis of respondents based on work experience in the building

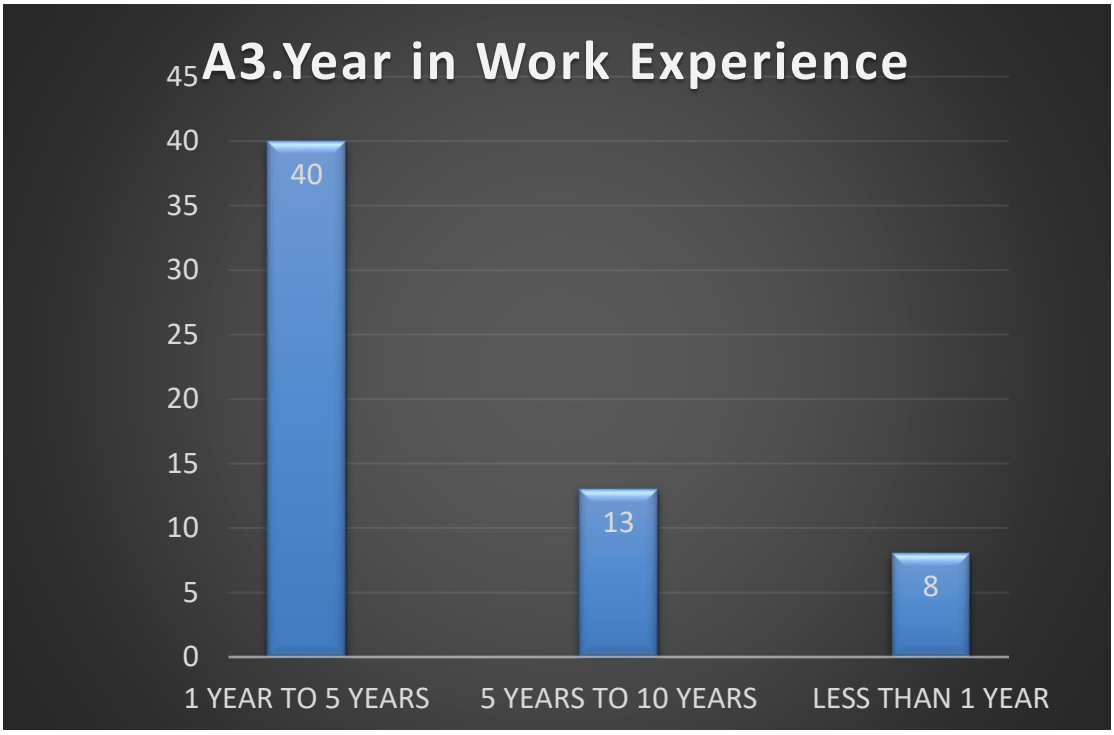

Figure 5.3: Experience respondents.

The diagram 5.3 shows the distribution of data according to the experience of respondents working in both green buildings. The researcher selects the permanent occupants of the building to answer the questionnaire because it plays an important role in analyzing the findings of the study. Therefore, the experience of working in a building plays a very important role in measuring and the questions and objectives of the study. The majority of respondents who answered this questionnaire had work experience between 1 to 5 years equivalent to 66%. Next 21% of respondents have work experience between 5 to 10 years. 13% respondents have work experience for less than 1 year. Respondents who have 1 to 5 years of experience and above play a very important role because in studying effective energy efficiency practices in both office buildings.

5.2.4 Analysis of respondents based on place of service

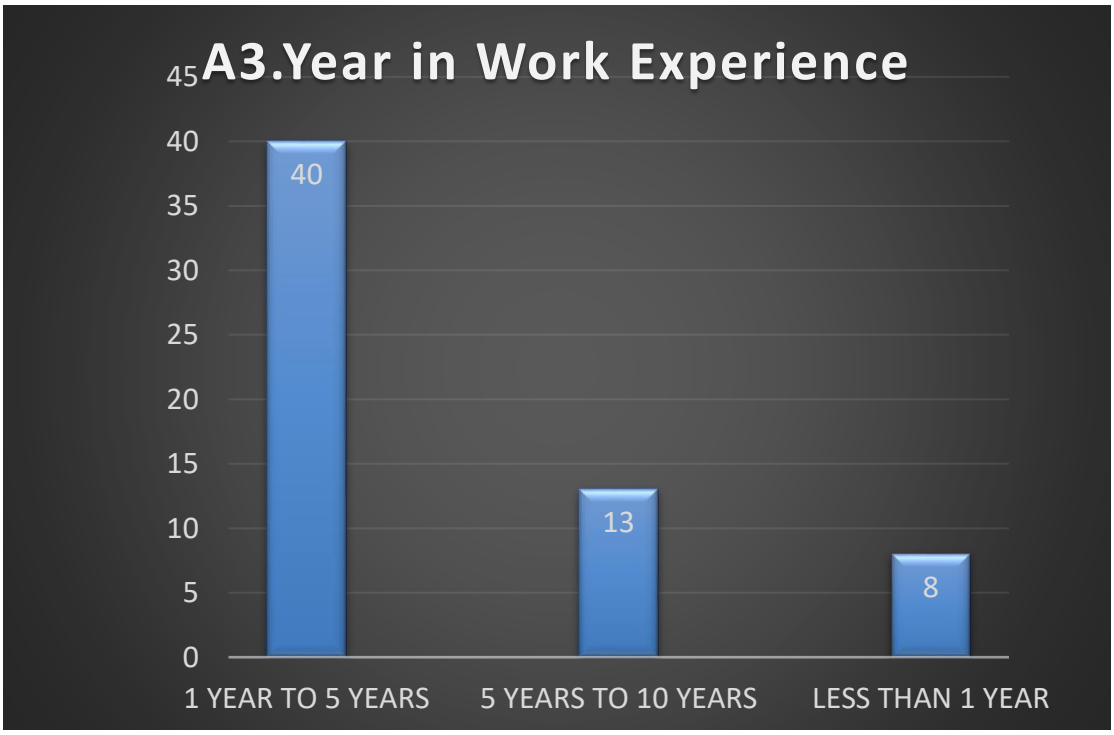

Figure 5.4: Workplace respondents.

The diagram 5.4 shows the distribution of the building of the selected respondents serving. These two commercial green building are selected based on several criteria that have similarities in terms of gross area, building age, function, building structure and so on. Respondents from both buildings are permanent occupants of the building. They have significant experience and role in energy management in the building. They are very suitable respondents to study the practice of energy efficiency in the building.

5.3 FINDING THE OBJECTIVE ONE: TO IDENTIFY THE FACTOR INFLUENCE OF ENERGY EFFICIENCY PRACTICES IN GREEN OFFICE BUILDING

This section aims for the researcher to analyze the data to achieve the first objective of the study that is to identify the factor influence of energy efficiency practices in green office building. The data obtained through the first instrument of data collection method which is questionnaire distributed to the building management at each selected green building is categorized as quantitative data. Data obtained from questionnaires were analyzed using SPSS software.

The process of validity of the content of the variable construction was performed to achieve the first objective in the study. Thus, a more comprehensive reading, evaluation and discussion process is made of the variables in the constructs previously discussed by the researcher. Other than that, researcher used mean analysis to answer the objective. Mean is defined as the sum in the distribution divided by the actual total score. By performing a mean analysis, the researcher can identify the average value generated from a set of data. Average analysis is used for statement in the questionnaire that influences the first objective which is to identify the factor influence of energy efficiency practices in green office building

5.3.1 Reliability analysis

Validity and reliability are two important concepts in affecting measurement and evaluation procedures (Johnson & Christensen, 2008). It is also an important element in determining the effectiveness of the data collection process. The pilot study involved the determination of the surface validity of the measuring instrument used before the test instrument used before the test measuring instrument to a group of

selected study samples. Face validity is an estimate of whether a test seems to measure a criterion to be measured (Norain, 2010).

Reliability usually refers to the degree of consistency of an instrument or procedure to which it is measured. It also measures consistently and consistently (Khan, 2006). Reliability is explained by the correlation between the total score and the item score. If the data collected uses a Likert scale, then the method used to measure reliability is Cronbach Alpha. The value of this alpha coefficient exceeding 0.70, indicates that the item has high reliability and low error effect. (Gay.et. Al, 2009)

Table 5.1: Cronbach Alpha score

Cronbach Alpha score	Reliability
0.90 – 1.00	Very good and effective with a high degree of consistency
0.70 – 0.80	Good and acceptable
0.60 – 0.70	Acceptable
<0.60	Items need to be repaired
>0.60	Items need to be dropped

With this study, the reliability of the research instrument was checked by analyzing the items in the questionnaire using SPSS program to obtain the coefficient value of the coefficient showing the Cronbach Alpha value for each construct used in the study on identity factor energy efficiency in green office building.

In general, this section will provide an explanation to identify energy management practices, applied in commercial office buildings in the Kuala Lumpur area based on construct.

The first objective is to evaluate the factor influencing the implementation of the energy efficiency practices at building management that selected. Refer to table 5.2, displays the statistics of reliability for assessing the level of the Cronbach Alpha technique. This method has shown that these variables' reliability is 0.887, which means the results for objective one are valid and reliable to proceed for the next objective.

Table 5.2: Reliability Statistics for Section B

Reliability Statistics	
Cronbach's Alpha	N of Items
0.887	8

Table 5.3: mean score for objective 1

No.	Statement	Sample	Mean
B1	Management building using energy more efficiently is to save money, reduce greenhouse gas emissions, and reduce energy demand.	61	3.98
B2	Management building brings a huge impact on energy efficiency to building.	61	4.18
B3	Changing behaviors towards energy consumption may have a great impact on the building energy efficiency.	61	4.13
B4	Providing occupants with information related to energy efficiency practices such as conducting efficient energy training and workshops for occupants regularly.	61	4.21
B5	Install solar system to save electricity to building.	61	4.43

B6	Install energy efficient equipment such as LED lights can save energy consumption.	61	4.51
B7	Install sensor system or automated lighting system to avoid the unnecessary or waste of usage of lighting system	61	4.39
B8	Investing more money in technology (Building information management) can improve energy efficiency to building.	61	4.05
Mean average		61	4.23

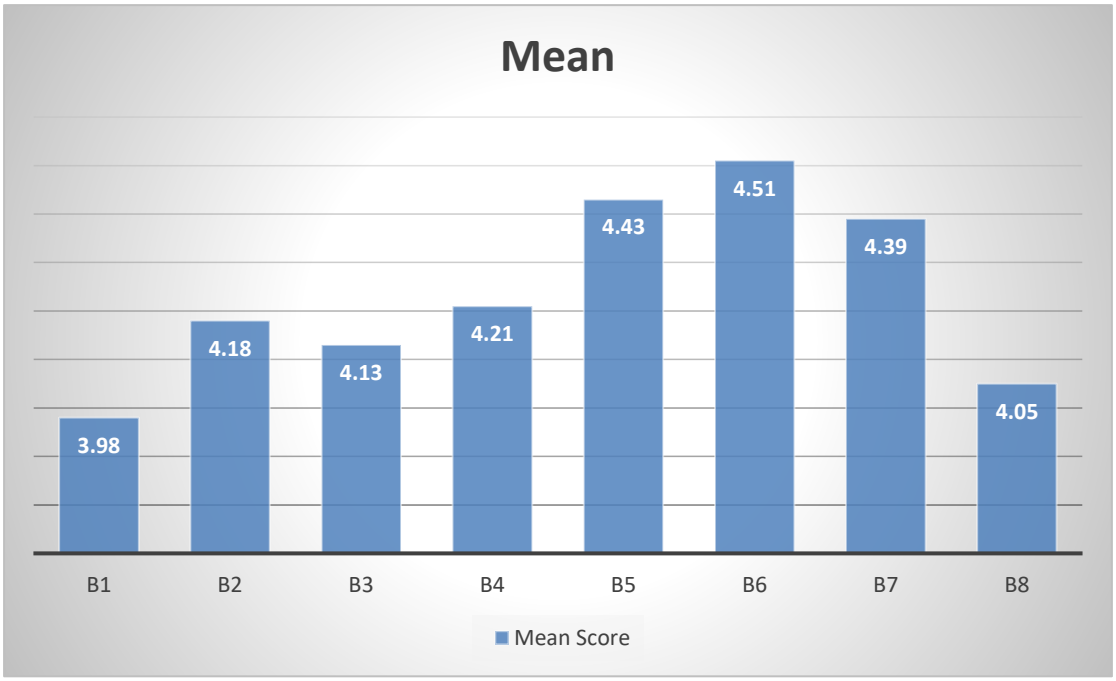

Figure 5.5: Mean score bar chart for objective 1

Table 5.4 shows the results of the questionnaire that was sent to the respondents. Looking at the table, the percentage result answering by respondents is to choose Likert scaling from 3 to 5 where it represents are not sure, Agree, and strongly agree. Mostly respondent answer strongly agrees.

Referring to the graph picture above shows the total mean for the two locations for each question. First of all, question B1 is the management building using energy more efficiently is to save money, reduce greenhouse gas emissions, and reduce energy demand. The total mean for this question is 3.98.

Second, question B2 is the management building brings a huge impact on energy efficiency to building. The total mean for this question is 4.18. The third is question B3 the question asks about the changing behaviors towards energy consumption may have a great impact on the building energy efficiency. The mean reading that has been shown for the two study locations is 4.13 for both green building.

Fourth, question B4 is related to Providing occupants with information related to energy efficiency practices such as conducting efficient energy training and workshops for occupants regularly. The mean reading shows is 4.21. The fifth shows question B5 related to Install solar system to save electricity to building. The mean reading obtained is 4.43.

Question B6 is to install energy efficient equipment such as LED lights can save energy consumption. The total mean for this question is 4.51. The seventh is question B7 the question asks about to install sensor system or automated lighting system to avoid the unnecessary or waste of usage of lighting system The mean reading that has been shown for the two study locations is 4.39 for both green building. Finally, question B8 asks questions related to the Investing more money in technology (Building information management) can improve energy efficiency to building. The mean reading obtained is 4.05.

The conclusion of finding from objective 1, found that the collection for all question shows that the highest respondent is question B6 which states that the to install energy efficient equipment such as LED lights can save energy consumption and respondent supporting these influence factor of energy efficient. Most respondents strongly agree with the question and the total number obtained "strongly agree" is 35 people and “agree” is 23 people. As stated in literature review the Light Emitting Diodes (LEDs) have recently

entered the lighting market as an energy efficient alternative to traditional light sources such as incandescent and fluorescent bulbs. LEDs are the future technology highly promoted for their low energy consumption, long life, efficiency, reliability, and ease of use in improved and innovative designs and having potential to save energy (Ayesha, 2017).

5.4 FINDING THE OBJECTIVE TWO: TO ANALYSE THE LEVEL OF AWARENESS OF ENERGY EFFICIENCY PRACTICES ON OCCUPANTS IN GREEN OFFICE BUILDING

This section aims for the researcher to analyze the data to achieve the second objective of the study that is to analyze awareness of energy efficiency practices on occupants in green office building. The data obtained through the first instrument of data collection method which is questionnaire distributed to the building management at each selected green building is categorized as quantitative data. Data obtained from questionnaires were analyzed using SPSS software.

Through the method used, the researcher analyzes the data received to answer the second objective and describes the findings obtained. Researcher has analyzed each item in the construct using mean scores to obtain the effectiveness of energy management practices. By performing a mean analysis, the researcher can identify the average value generated from a set of data. Likert scale used in this questionnaire is scale 1 to 5. Scale 1 - strongly disagree, scale 2 - disagree, scale 3 - moderate, scale 4 - agree and scale 5 - strongly agree. With this, the researcher can see which level of construct is the highest and lowest based on each item that has been prepared according to the construct.

The second objective of this research is to analyse the level of awareness among facility management companies to implement internet of things. The finding of the second objective is to show, how the respondents aware with internet of things technology. As shown to table 5.5, displays the statistics of reliability for assessing the level of the Cronbach Alpha technique. This method has shown that these variables' reliability is 0.904, which means the results for objective two are valid and reliable to proceed for the next objective

Table 5.4: Reliability Statistics for Section C

Reliability Statistics	
Cronbach's Alpha	N of Items
0.904	10

Table 5.5: Mean score of objectives 2

No.	Statement	Sample	Mean
C1	I will apply the energy management training given in the operation of daily work activities in the building.	61	3.49
C2	I always turn off all appliances before leaving the office	61	3.74
C3	I always turn off lights and use a natural light when adequate	61	3.70
C4	Energy saving awareness briefing helped me towards energy saving.	61	4.07
C5	Guidance from energy management on energy efficiency can help improve the energy use performance of buildings.	61	4.15
C6	Green building can help occupants achieve the energy efficiency performance.	61	4.26
C7	Awareness notices of the importance of saving electricity and water are provided in the workplace.	61	4.08
C8	The energy management training provided, helped me do energy saving.	61	4.45
C9	Energy efficiency can reduce energy use, costs and lower emissions.	61	4.16
C10	When occupants understand how they can improve energy efficiency at work, they will learn how to cut their usage and costs at home too.	61	4.13
Mean average		61	4.05

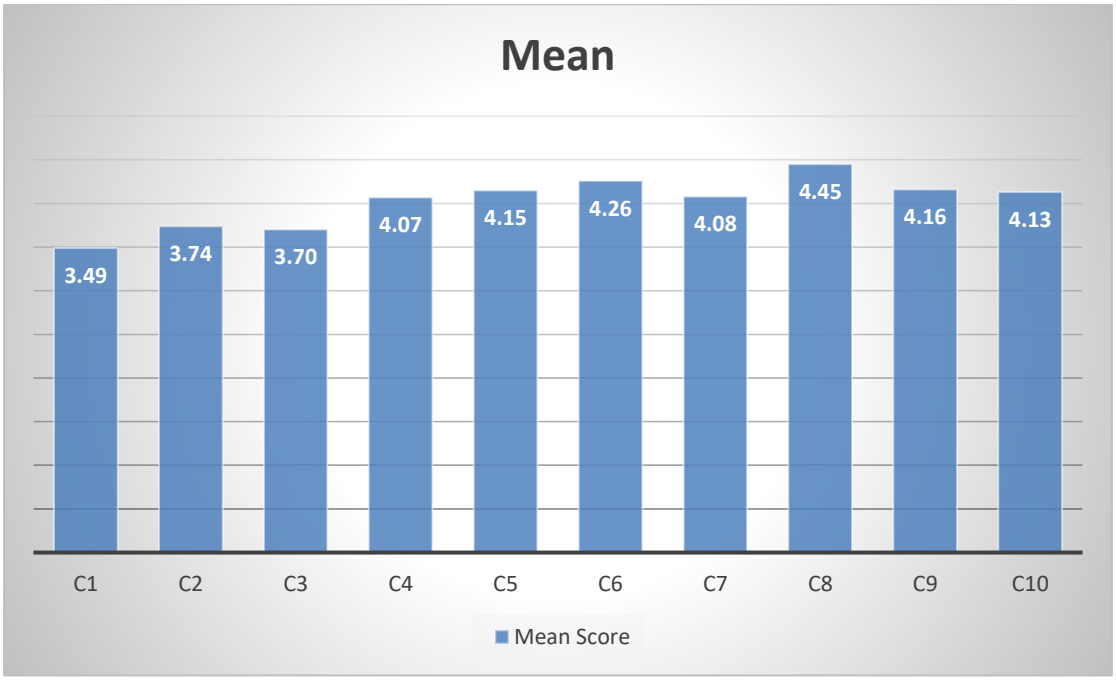

Figure 5.6: Mean score bar chart for Objective 2

Referring to the graph above was shows the total mean obtained from SPSS for each location and questions that have been distributed by the researcher. Refer to the two locations found that the results obtained different especially from the total mean and rank. Objective 2 is regarding analyzing the level of awareness of energy efficiency practices on occupants in green office building. The questions have given is related to training energy, the energy practices awareness, and guidance from management building.

The result shows that the highest mean amount obtained is Question C8, which states that the building management must be provide training energy it could helped do energy saving. The mean reading for that question is 4.45. The result showed most of the respondents answer “Strongly Agree” it means most of the respondents agree training can help the building to be effective. According (Morshed Alama, Patrick X.W. Zoua,, Rodney A. Stewartb, 2018) , Some of the forms the participants listed was creating blogs with information required, showcasing the successful projects, presenting latest research and information, and awareness training initiative supported by the government.

First of all, question C1 is will apply the energy management training given in the operation of daily work activities in the building. The total mean for this question is 3.49. Second, question C2 is always turn off all appliances before leaving the office. The total mean for this question is 3.74. The third is question C3 the question asks about always turn off lights and use a natural light when adequate. The mean reading that has been shown for the two study locations is 3.70 for both green building.

Fourth, question C4 is related the energy saving awareness briefing helped me towards energy saving. The mean reading shows is 4.07. The fifth shows question C5 related to guidance from energy management on energy efficiency can help improve the energy use performance of buildings. The mean reading obtained is 4.15.Question B6 is the Green building can help occupants achieve the energy efficiency performance. The total mean for this question is 4.26.

The seventh is question C7 the question asks about the awareness notices of the importance of saving electricity and water are provided in the workplace. The mean reading that has been shown for the two study locations is 4.08 for both green building. Question C8 asks questions related to the the energy management training provided, helped me do energy saving. The mean reading obtained is 4.45. The ninth is question C9 the question asks about the energy efficiency can reduce energy use, costs and lower emissions. The mean reading obtained is 4.16. Lastly, question C10 asks question related when occupants understand how they can improve energy efficiency at work, they will learn how to cut their usage and costs at home too. The mean reading obtained is 4.13.

In conclusion, all respondents had a clear view while answering this survey question. The researcher found that the majority of respondents chose the agree answer which was deemed to be a careful answer and there were also questions that were answered on the neutral answer choice. Therefore, the researcher has provided some views in each of the questions described above. Overall, the factors of management, responsibility, awareness and knowledge

as well as expenditure that are the mainstay of this survey question has provided a comprehensive view of the answers answered by the respondents.

5.5 FINDING THE OBJECTIVE THREE: TO PROPOSE THE IMPROVEMENT IN IMPLEMENTATION OF ENERGY EFFICIENCY PRACTICES IN GREEN OFFICE BUILDINGS

This section aims for the researcher to analyze the data to achieve the third objective of the research that is to recommend improvements to energy efficiency practices in Q Sentral Tower and Celcom Tower. The researcher conducted a semi-structured interview from two respondents from both buildings to get suggestions for improvement.

5.5.1Research findings based on the second instrument: Semi structured Interview

5.5.1.1 Respondent profile

Table 5.6: Respondent Demographic

Company	Name	Position	Building
Semasa Services Sdn Bhd	Muhammad Amar Bin Ramli	Energy Manager	Celcom Tower
Semasa Services Sdn Bhd	Muhamad Fikri Bin Asri	Energy Manager	Q Sentral Tower

One respondent from each building was selected to conduct a semi-structured interview. Respondents are energy managers and one of them is facilities engineer in their respective buildings from the same facility management company. They have extensive experience in energy management.

5.5.1.2 Respondent 1: Muhammad Amar Bin Ramli

- Suggestions of improvement of energy efficiency practices in green office buildings

Energy efficiency in the building is implemented according to the manual of the energy management system that has been provided by the Malaysian standard (1525:2019) through the Department of Standard Malaysia. The manual contains guidelines for creating and implementing Energy efficiency and use of renewable energy for non-residential buildings. The energy practices performed in this building include the following aspects :

Establish an Energy Management System (EMS)

Conducting energy audit is a good starting point to understand the building energy consumption baseline. To benefit fully from this activity and make use of the data, it is very much recommended to the management to consider setting up an Energy Management System.

EMS is the process of managing the energy consumption in any organization to assure that energy has been efficiently consumed. It covers all aspects of energy consumption and involves not only machines or equipment that consumes energy but also establishes the best operation practices for the users. All employees are to be educated and motivated to reduce energy. Incentives could be offered to motivate people to think and develop with brilliant or creative ideas.

To set up an effective energy management, it should start from the very top to bottom. An organization structure and policy that support the energy management activities are the most important component of a successful energy management process. Apart fromthat, an energy manager who will be assigned the task is responsible to facilitate and drive the organization to get

the best results. With good organization structure and policy, the energy manager will be able to achieve his/her energy management goals through efficient energy management, implementation of appropriate technologies and a sustainable maintenance system.

The occupants of the building need to give a high commitment to any planning done by the management. For example, attending awareness briefing, applying the training provided efficiently and in accordance with the standard operating procedures (SOP) provided. This compliance is expected to make a significant difference to the measurements of BEI taken each month.

5.5.1.3 Respondent 2: Muhamad Fikri Bin Asri

- Suggestions of improvement of energy efficiency practices in green office buildings

To improve energy efficiency practices, Mr. Fikri thinks that conducting awareness campaigns more efficiently. Previously, awareness campaigns were conducted using mediums such as awareness notices, brochures and via email. As this building plays a role in managing the affairs of government ministries, the occupants of the building who are mostly government employees are difficult to gather for awareness briefings. Therefore, this medium is still not effective enough to give awareness to the occupants of the building. He proposed to implement earth day. Where on that day all the occupants of the building engage to raise awareness. Through the implementation of earth day, the management is able to execute plans regarding energy management.

In terms of technology, switching to LED lighting. One way to instantly save energy and make a property more efficient is by choosing LED lighting. In general, LED lights consume 70-90% less energy than a standard incandescent or CFL bulb. So just replacing one bulb already delivers significant savings.

In addition, the top management needs to select representatives for each level to conduct regular monitoring of the practice that has been executed. Each department can also do planning such as selecting one person on a daily basis in turn to check the use of electronic equipment, to ensure the lights are turned off in unused areas and responsible for advising others to do so.FM organizations should be made to understand through education and communication strategies that initial investment in energy saving practices through finance and time will eventually result in profits and cost saving in future. Management buy-in should be the goal of the facilities manager for the success of such initiatives.

5.7 SUMMARY OF THE CHAPTER

Based on the interviews that have been conducted, the findings of the study for objectives 1 and 2 have similarities with the findings using the questionnaire instrument. Similarities in terms of management practices performed effectiveness of practices performed. Findings for objective 3 using questionnaire instruments are more to the responsibility of management. While the findings for the third objective of using interview instruments include the management and occupants of the building.

As a whole, the results of the study obtained using questionnaire instruments and semi-structured interview instruments have been analyzed in this chapter to achieve the three previously stated objectives. SPSS software helps validate the data that has been collected by the researcher. While the interviews have strengthened and provided more detailed data to achieve the objectives of the study. Data taken in the two buildings help researchers to analyze effective energy management practices.

CHAPTER 6
CONCLUSION

6.1 INTRODUCTION

This chapter presents a summary of the research aims and objectives, followed by recapitulation of findings and discussion of results based on the empirical examinations of the theatrical framework of the study. Conclusions will be focused on the study as a whole by including conclusions and implications that can be translated from this research. In addition, strategic improvements in energy management practices will be recommended to Q Sentral Tower and Celcom tower management to practice effective energy efficiency practices through this study.

Moreover, this chapter is the last chapter of this study. All the findings of the study will be formulated to achieve the objectives that have been formed previously. The findings that have been collected as a result of mix method using questionnaire instruments and semi-structured interviews were used to analyze and discuss the objectives of the study. Therefore, this chapter will briefly and thoroughly explain the findings of the 3 research questions, research implications, research limitations and further suggestions for the improvement of effective energy efficiency practices in both office buildings.

6.2 SUMARRY OF RESEARH QUESTION FINDINGS

This study aims to find out the extent of effective energy efficiency practices performed in green office buildings. In addition, researchers have also reviewed the energy management methods practiced ensuring the extent to which effective energy efficiency practices are practiced.

6.2.1 Research question 1

What is the factor of energy efficiency practices implemented in green office building?

Based on the analysis that has been done by the researcher from the literature highlights, questionnaire instruments and interviews, several methods have been identified in the effective energy management practices in the two office buildings. Further allowing research question 1 to be answered. Through the data collection and discussion that has been done in chapter 5, the objectives that answer the first question can be achieved. The research has been successfully reviewed the factor of the energy efficiency practices. The research found that the factors to implement in the Facility Management Company. Energy efficiency methods practiced in both buildings based on the Malaysian standard (1525:2019) through the Department of Standard Malaysia. Key aspects that include energy practices are management, technology, training and awareness and existing system planning. Average mean for implement the factor gained from the data is 4.23

6.2.2 Research question 2

What is the level awareness of energy efficiency practices on occupants in green office building?

In this question, the researcher can issue an objective to answer this question which is to analyze the level of awareness for energy efficiency practices towards occupants. To answer this question as well, the researcher prepared several survey questions that have five indicators for each question construct that have been provided to the respondents. Referring to objective two found that respondents realized that energy efficiency practices were important because they chose to agree when asked about training and awareness. For the whole of this second question, it can be concluded that all respondents agree and strongly agree about energy efficiency practices in green buildings. Respondents assumed that awareness of this practice should be known as it has an impact on environment.

6.2.3 Research question 3

What are the best approaches that able to improve energy efficiency practices in green office building?

To achieve the third research question, the findings discussed in chapter 5 are in the form of improvement of energy efficiency practices in green office buildings. The method used by the researcher to achieve the third objective is through questionnaires and semi-structured interviews. This semi-structured interview was conducted with two parties, namely the facility management energy manager for the green office building to find out more about the effective energy efficiency practices that can be practiced in the building. Energy manager is the party responsible for carrying out all the planning that has been done in accordance with the cooperation of the Energy Commission of Malaysia and guided by the energy management system manual.

6.3 RESEARCH IMPLICATION

Referring to the conceptual framework that has been built at the beginning of the study based on the literature review of previous studies, the study shows that the findings obtained can contribute a lot in various aspects. Based on the empirical evidence that has been discussed. Findings from the results of the analysis and discussions conducted have resulted in some suggestions for improvement that can be used as a reference, guidelines, considered and applied by the energy management in the office building. In addition, this study can also be used as a guide to building management to improve energy efficiency practices to improve effective energy efficiency practices in office buildings. Thus being able to avoid wasting energy, becoming a 5 star energy rating building and becomes an example to other green office buildings. In addition, the contribution to the contextual aspects, this study also provides contributions and implications for the following:

- Contributions to theory and model construction. Findings from the results of data analysis in this study can make a significant contribution to the efforts to strengthen the theory and highlight the literature of the study in terms of effective energy efficiency practices practiced in the green office building.
- Contribution to the formation of instruments for analyze energy efficiency practices used in the green office building. In terms methodology, this study has contributed from the aspect the formation of instruments give improvement to energy efficiency methods practiced in the Kuala Lumpur green office building.

6.4 RESEARCH LIMITATION

The conclusion of this study takes into account some of the limitations of the study that exist. The limitations faced by researchers in conducting this study are in terms of limiting the scope of the study from selecting three office buildings to two office buildings. This was due to the Covid-19 outbreak which caused the state government to issue a movement control order. Therefore the researcher had to choose an office building that has energy management from the same company to facilitate obtaining information at that time.

The second limitation faced by the researcher is the difficulty in obtaining feedback from respondents to obtain data through questionnaires that have been distributed in the form of google form. Therefore, this study took time to obtain information for analysis. This study also conducted a semi-structured interview session with the energy management from both buildings to obtain information. Both interview respondents had time constraints and were busy with responsibilities as a manager especially during the movement control order. Dates had to be shifted to get an appointment for an interview.

6.5 SUGGESTED IMPROVEMENT STRATEGY

Through the findings of this study, researchers have identified the driving factors in effective energy efficiency practices in green office buildings. Therefore, the researcher provides strategies for improvement in effective practices in the office building such as:

6.5.1 Training and awareness

- Energy Efficiency and Energy Conservation Awareness Programs

The intensive awareness programs such as energy savings campaign or simple energy management incentives shall be conducted regularly as it would be an encouragement to strengthen energy efficiency culture. However the success of the programs depends on the involvement of every staff top and middle management in both office buildings. Therefore, the building management can introduce a day dedicated to running energy-related programs. Programs like these provide very deep awareness compared to online awareness programs. Every occupant of the building will have the opportunity to get involved in the program. At the same time provide an opportunity for building users to share their ideas to improve energy management practices. This will directly change the culture of building users to practice savings. Al last will enhance to strengthen the training and awareness construct-based practice.

6.5.2 Management role

- Establish an Energy Management System (EMS)

EMS is the process of managing the energy consumption in any organization to assure that energy has been efficiently consumed. It covers all aspects of energy consumption and involves not only machines or equipment that consumes energy but also establishes the best operation practices for the users. To set up an effective energy management, it should start from the very top to bottom. An organization structure and policy that support the energy management activities are the most important component of a successful energy management process. Apart fromthat, an energy manager who will be assigned the task is responsible to facilitate and drive the organization to get the best results. With good organization structure and policy, the energy manager

will be able to achieve his/her energy management goals through efficient energy management, implementation of appropriate technologies anda sustainable maintenance system.

6.5.3 Technology

- Switching to LED lighting and lighting Control

  One way to instantly save energy and make a property more efficient is by choosing LED lighting. In general, LED lights consume 70-90% less energy than a standard incandescent or CFL bulb. So just replacing one bulb already delivers significant savings. Motion detectors and daylight sensors can avoid occurrence of energy wastage and to optimize usage of daylight. Motion sensor lights are only installed in a few places. With budget allocation, the sensor can be installed in places where it is needed to reduce the use of electricity. In addition, it will also help management to increase the use of energy efficient equipment.

6.6 RECOMMENDATIONS AND SCOPE OF FURTHER STUDY

This study only focuses on the energy efficiency practices. After this study is made and analyzed, the building management conducted is in line with the National Energy Policy, but energy management practices need to be reviewed to achieve a BEI star rating according to the Energy Commission of Malaysia. In addition, the weaknesses found in this study can be used as a guide in studying the same thing in the future. Energy consumption should be monitored continuously to avoid wastage of energy.

Besides that, energy waste can also increase high energy costs. As such, effective energy efficiency practices should be given due emphasis to avoid wastage. There are several research factors that can be developed by the next researcher in further improving the conceptual framework model in the study that has been produced by the researcher.

In conclusion, good research results should be extended in the future to increase the effectiveness of energy efficiency practices in green office buildings. The implementation of the best energy management is the responsibility of all parties for an organization to maintain sustainability.

6.7 RESEARCH SUMMARY

Overall, this study was successfully implemented because all the questions constructed by the researcher were answered perfectly. The findings of the study are based on the current situation of this study and can be utilized to the energy management of the green office building. This study also proves that effective energy efficiency practices can help an organization in avoiding waste. Nowadays, effective energy management is very important because population growth and high demand cause excessive use of energy resources. Energy efficient theory is still new in this country which requires a lot of research and attention, therefore the results of this study can contribute to the development of the field of energy management. In addition, the energy conservation in the green office building in Kuala Lumpur can practice the results of discussions and suggestions that have been produced by researchers in practicing effective energy management.

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