CHAPTER ONE

INTRODUCTION

1.1   RESEARCH BACKGROUND

In the developed parts of the world, office building is now developing in our country to improve the economy and also create more job opportunities. Indoor environmental quality refers to the quality of a building's environment in relation to the health and wellbeing of those who occupy space within it (NIOSH, 2013). However, indoor environmental quality have a relationship towards to occupant's productivity in office's building. According to Kamaruzzaman (2011), people spend almost 90% of their time indoors at their office than outdoors. The risks to health posed by exposure to indoor air pollution may be greater than those posed by outdoor air pollution. Indoor conditions have important implications for their health, general well-being and performance (Frontczak, 2012). This is because their health condition will affect their work performance and it will affect the organisation's performance. The indoor environment quality raises to the performance of a building in providing an indoor environment to its occupants that meets the opportunities of keeping the occupants' health, wellbeing, and productivity. Providing optimal or at least comfortable environment that can satisfy a majority of occupants is deemed to be important and has been the primary goal of conventional facilities management practice, particularly in the context of commercial office environments in which individual occupant's control over their surrounding environments is usually restricted (Kim, 2013). Thermal comfort, lighting quality, acoustical quality and air quality are the most important factors indoor environment quality towards productivity occupants in office building (Naziatul Mahbob et. al, 2011).

1.2   PROBLEM STATEMENT

The federal government is the largest owner of public buildings and facilities in Malaysia. The maintenance management of the public buildings is not been emphasized clearly and systematically which result in over budget costing for maintenance and remedial work (Zakaria and Hamzah, 2007). According to Natasha Khalil and Husrul Husin (2009), Disruption of indoor environment may constitute to reduce occupants' efficiency and work productivity. Occupants will feel uncomfortable to make their work with unhealthy environment. However, many previous researches have conducted in the similar research setting, there is a deficiency of the research to find out the relationship between Indoor Environment Quality factors and occupants' productivity improvements (Mallawaarachchi, 2016). According to Monika Frontczak (2012), to give the best quality in indoor environment, standards dealing with indoor environmental quality have been developed to define the acceptable ranges of these parameters. Even though the requirements of these standards are met but not all building occupants are satisfied with the indoor environment (Kamaruzzaman, 2011). Therefore, this research to determine occupant's satisfaction in terms of indoor environment such as level of cleanliness, visual comfort, thermal comfort, air movement, and noise pollution.

1.3 RESEARCH AIM

To achieve this research, a research aim was created for to introduce building indoor environment quality framework for office building.

1.4 CENTRAL RESEARCH QUESTION

What are the barriers to achieve building indoor environment quality framework for office building?

1.5 RESEARCH QUESTION

i.   What are the variables that influence the occupant satisfaction towards Indoor Environment Quality in office building.
ii. What are the relationships between variables of occupant satisfaction towards Indoor Environment Quality in office building.
iii. What are the key factors that affecting the occupant satisfaction towards Indoor Environment Quality in office building.

1.6 RESEARCH OBJECTIVES

i.   To identify the variables that influence the occupant satisfaction towards Indoor Environment Quality in office building.
ii. To analyse the relationship between variables of occupant satisfaction towards Indoor Environment Quality in office building.
iii. To determine key factors affecting the occupant satisfaction towards Indoor Environment Quality in office building.

1.7   RESEARCH SCOPE

To obtain the required details, the scope and limitations of the study are as follows, research will be conducted in the government's building at Putrajaya but focusing on ministry of education and ministry of tourism, arts and culture. The target of the respondents is the staff of the building ministry of education and ministry of tourism, arts and culture. The reason choosing staff in this building rather than visitor because they was occupy in this building from morning until working hours.

1.8   SIGNIFICANCE OF RESEARCH

Since the personnel costs of salaries and benefits typically surpass operating costs of an office building, strategies that improve employees' health and productivity over the extensive run can have a large return on investment. Indoor Environment Quality goals often focus on providing stimulating and comfortable environments for occupants and minimizing the risk of building related health problems. This is because the comfort of the indoor environment is an important aspect of increasing employee productivity to achieve organizational goals.

Indoor Environment Quality as a satisfactory condition of environment such as lighting, temperature, and air quality which play important roles in improving occupant's satisfaction towards work environments. In providing professional services in facilities management, facilities management are responsible for ensuring that all aspects of the system in the building are efficient towards productivity of occupants.

A better indoor environmental quality can enhance the wellbeing of building occupants and help decrease the amount of sick building syndrome and building related illness. It can also lead to a decrease in worker complaints and absenteeism which in turn can to improve productivity.

CHAPTER TWO

LITERATURE REVIEW

2.1   INTRODUCTION

The literature shows an increasing state of consciousness concerning Indoor Environment Quality and its related effects on the satisfaction, health and performance of occupants. Indoor environment performance is considered a major factor of "sustainable" buildings and has been increasingly studied in the past decade. The mission of the alliance Indoor Environment Quality is to provide an acceptable indoor environmental quality such as thermal environment, indoor air quality, lighting, acoustic to occupants in buildings and places of work around the world and to make sure the knowledge from research on IEQ gets implemented in practice (ASHRAE, 2010). Indoor environmental quality (IEQ) refers to the quality of a building's environment in relation to the health and wellbeing of those who occupy space within it. Workers are often concerned that they have symptoms or health conditions from exposures to contaminants in the buildings where they work (Niosh, 2013).

2.2   INDOOR ENVIRONMENT QUALITY

The term "indoor environmental quality" (IEQ) represents a domain that encompasses diverse sub-domains that affect the human life inside a building (Mujeebu, 2018). According to Almeida (2015), these include indoor air quality (IAQ), lighting, thermal comfort, acoustics, drinking water, ergonomics, electromagnetic radiation, and many related factors. Enhanced environmental quality can improve the quality of life of the occupants, increase the resale value of the building and minimize the penalties on building owners. The IEQ refers to the performance of a building in delivering an indoor environment to its occupants that meets the expectations of keeping the occupants' health, wellbeing, and productivity (Liang et al., 2014). They also stated to explore the impacts of acoustic quality, lighting, thermal comfort, indoor air quality (IAQ) and overall on the safety and productivity of building occupants. The IEQ was evaluated by the performance of the building in the acoustics, lighting, ventilation, and materials used in interior construction, with the aim being to facilitate an indoor environment that was healthful and comfortable to the occupants (Liang et al., 2014).

2.3   EXPECTED CONFIRMATION THEORY

Expected confirmation theory substantial theory that can measure customer satisfaction from perceived quality of products or services in order to measure the customer's satisfaction (Spreng, 2003). According to Naeimeh Elkhani and Aryati Bakri (2012), Expectation or desire is related to the pre purchase time period that a customer has initial expectation or desire about a specific performance such as quality of products or services. Experience or perceived performance is related to the after purchase time period that the customer gets the experience after perceiving a real performance such as quality of a specific product or service. Expectation Disconfirmation Theory was applied by many researchers in different fields for a better understanding of the customer's expectations and requirements for attracting their satisfaction (Diehl et. al, (2010).
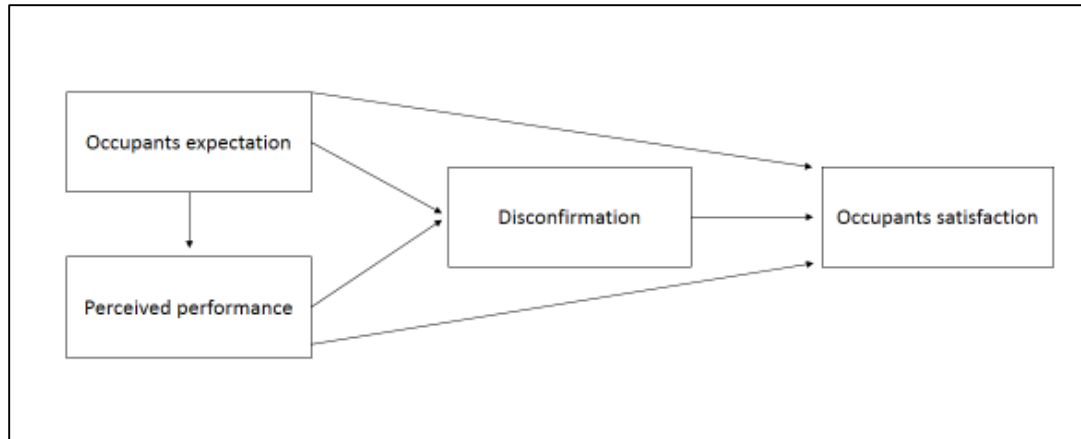
Figure 2.1: Expectation Disconfirmation Theory

The four main constructs in the model are expectations, performance, disconfirmation, and satisfaction. Expectations define the customer's expectations about performance of products and services (Finn et. al, 2009). According from researches, expectations refer to the attributes or characteristics that a person anticipates or predicts will be associated with an entity such as a product, service, or technology artifact. Expectations-confirmation theory categorized that expectations attached with perceived performance and lead to post-purchase satisfaction. This effect is refereed through positive or negative disconfirmation between expectations and performance. If a product outperforms expectations (positive disconfirmation) post-purchase satisfaction will result. If a product falls short of expectations (negative disconfirmation) the consumer is likely to be dissatisfied (Oliver, 1980; Spreng et al. 1996).

2.3.1 Perceived Performance

Performance is defined here as the customers' perceived level of product or service quality relative to the price they pay (Johnson and Fornell 1996). According to expectation confirmation theory, perceptions of performance are directly influenced by pre-purchase or pre-adoption expectations and in turn directly influence disconfirmation

of beliefs and post-purchase or post-adoption satisfaction. According to Nitin Seth and Deshmukh (2004), technical quality is the quality of what occupants actually receives as a result of their interaction with the service firm and is important to them and to their evaluation of the quality of service. Functional quality is how occupants gets the technical outcome. This is important to occupants views of service their received.

2.3.2 Disconfirmation

Disconfirmation is defined as the difference between the customer's initial expectation and observed actual performance (Bhattacherjee et.al, 2004). According to Naeimeh Elkhani and Aryati Bakri (2012), disconfirmation is divided to three types including positive disconfirmation, negative disconfirmation and simple disconfirmation. When actual performance of a specific product or service cannot meet the customer's expectation, negative disconfirmation will occur and leads to customer's dissatisfaction. Positive disconfirmation leads to the customer's satisfaction, if perceived performance of a specific product or service is able to exceed customer's satisfaction. Disconfirmation is hypothesized to affect satisfaction, with positive disconfirmation leading to satisfaction and negative disconfirmation leading to dissatisfaction.

2.3.3 Customer Satisfaction

Customer satisfaction is a function of perceived quality and disconfirmation to which perceived quality fails to match repurchase expectations. Customers compare the perceived performance of a product (service and goods) with some performance standard (Sami Karna, 2004). Also according to her, customers are satisfied when the perceived performance is greater than the standard (positively disconfirmed), whereas dissatisfaction occurs when the performance falls short of the standard (negatively disconfirmed).

2.4   CONCEPTUAL FRAMEWORK

Conceptual framework mainly covers the concepts those structure form a prime reason reason for the whole research. A construct in which each concept plays an integral role rather than of collection of concept. According to (Miles and Huberman, 1994), a conceptual framework spreads out the key elements, factor, construct or variables and presume relationships among them.

Therefore, building occupant satisfaction model determine based on Expectation Confirmation Theory. This model provides the rationale for variables based on Expectation Confirmation Theory background and combines further literary additions on the use of building occupant satisfaction towards Indoor Environment Quality in office building. Moreover, for this conceptual framework study has modified the construct for the building occupant satisfaction towards Indoor Environment Quality in office building shown in figure 2.2.
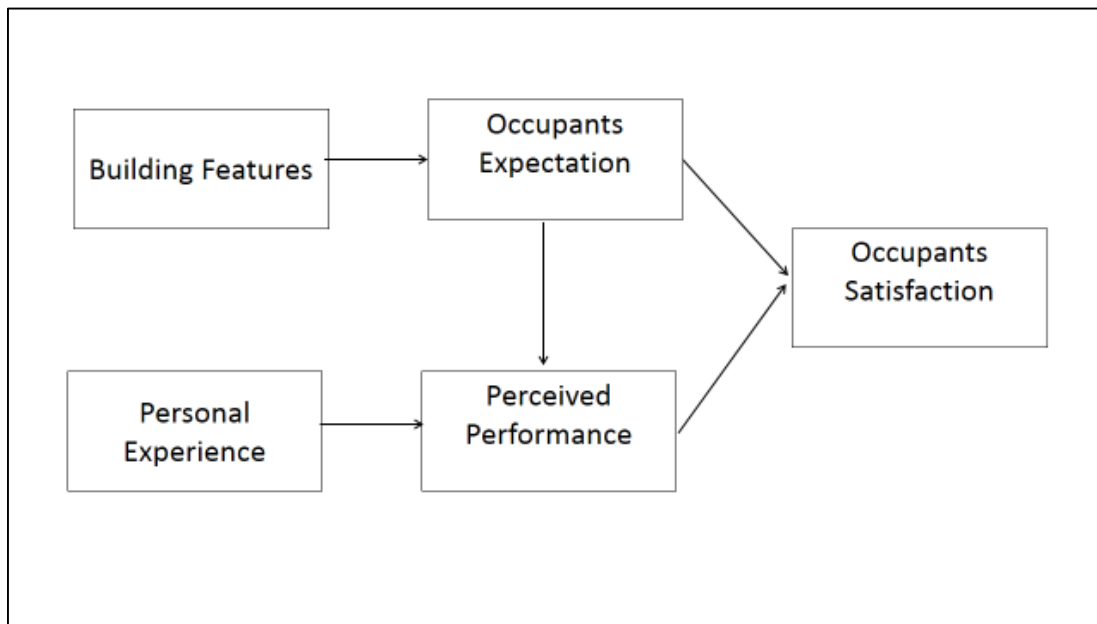

Figure 2.2: Framework IEQ Towards Customer Satisfaction (Modified From Expectation Confirmation Theory 1977)

2.4.1 Building Features

A building is a structure with a roof and walls standing more or less permanently in one place such as a house or factory. Building features refers to the various elements or smaller details that are used for functional or design purpose within building (Sahar, 2014). Buildings come in a variety of sizes, shapes, and functions and have been adapted throughout past for a wide number of factors from building materials available, to weather conditions, land prices, ground conditions, specific uses, and aesthetic reasons. Buildings serve several societal needs primarily as shelter from weather, security, living space, privacy, to store belongings and to comfortably live and work. A building as a shelter represents a physical division of the human habitat such as a place of comfort and safety and the outside for example a place that at times may be harsh and harmful.

Indoor Environmental Quality (IEQ) encompasses the conditions inside a building such as air quality, lighting, thermal conditions, acoustic and their effects on occupants (Alyssa, 2014). Strategies for addressing IEQ include those that protect human health, improve quality of life, and reduce stress and potential injuries (Hodgson, 2006). Better indoor environmental quality can enhance the lives of building occupants and increase the resale value of the building to reduce liability for building owners.

2.4.1.1   Indoor Air Quality

Air quality in offices is quite important because of crowded working spaces. Air quality problems like inadequate ventilation, chemical contaminants from indoor and outdoor sources, bio- logical contaminants are major factors to causing SBS (Sick Building Syndrome) symptoms (Öz & Ergönül, 2015). A study indicates that every 10% decrease in the proportion dissatisfied with the air quality below the air quality level causing 70% to be dissatisfied can improve the performance of typing by 1.4%, of addition by 1.1% and of proof-reading by 2.3% (Kosonen and Tan, 2004). Many researchers has accepted that a high percentage of people are comfortable in sedentary (office) occupations, where the effective draught temperature is between -1.5 and +1K and the air velocity is less than 0.35m/s (Palmer A. and Rawlings R.,2002).

2.4.1.2   Acoustic Control

Good acoustics are a crucial element of a satisfactory and productive office experience and are considered in some green building rating tools. At first thought, there may not appear to be a close link between acoustics and strategies to reduce energy and resource use but in fact there are numerous crucial areas of overlap.

Background sound levels need to drown out unwanted distraction but not be too loud to cause stress. Extra noise or noise pollution in offices can also cause a reduction in productivity in a certain type of work and also it has a direct effect on occupants' health and psychology as a result it can bring stress for workers especially in open offices (Evans and Johnson, 2000). In open plan offices a lot of extraneous foreground noise can be expected, therefore a background sound level of 45dBA is recommended (Dalilah Dahlan, 2009). The extra noise is produced by different sources as outside noise, the mechanical system in building, occupants, and customers (Noweir, 1984).

2.4.1.3   Thermal Comfort

Thermal quality in offices is closely related to employees comfort and wellbeing. According to Frontczak and Wargocki (2011), thermal environment is generally considered to be most important factor achieving overall indoor environmental quality. Thermal quality not only affects health and well-being but also productivity of employees (Öz & Ergönül, 2015). The researcher also stated that an important factor affecting employee satisfaction about thermal comfort is control and adjustment of temperature. According to Abbaszadeh et. al (2006), center for the Built Environment (CBE) conducted indicates that 76% of all occupants with a thermostat were satisfied with the temperature in their workspace as compared to 56% satisfaction for those without a thermostat.

Another fundamental factor of Indoor Environment Quality is indoor temperature. It has a huge effect on human psychology and physical condition as a result it can affect workers' behaviour and productivity (Stanton et al., 2004). For example, a meta-analysis of studies of temperature and productivity found that temperature between 21-22 °C will increase productivity, and as the temperature goes up between 23 – 24 °C productivity starts to relatively decrease. When the temperature reaches 30 °C only 91.1 % of relative productivity is observed. Hence, it would suggest that the optimal temperature for relative productivity is achieved between 21 – 24 °C (Seppanen et al., 2006).

2.4.1.4   Lighting

Lighting is an important requirement that can improve the comfort in the modern office environment. With wages representing the majority of costs in offices, enhancing the user comfort by improving the light is a more efficient strategy to limit the costs (Tom, 2008). As stated by Veitch and Newsham (2017), limiting the energy use often driven by energy codes and standards, can be counter effective as this can cause significant discomfort. In order to performance and comfort, lighting can also affect alertness, wellbeing, health and sleep quality (van Bommel and van Beld, 2004). Two types of light effects can be distinguished: image forming effects and non-image forming effects. The image forming effects relate to the rods and cones within the eye, enabling vision. Additionally, in the early 2000s, a new photoreceptor, which is non-image forming, was found that affects the human health and wellbeing (P. Khademagha et. al, 2016).

Lighting quality, a term related to the image forming effects of light, is one of the least understood aspects in the building lighting field (Kruisselbrink et al., 2018). Leadership in Energy and Environmental Design (Leed) rewards indoor lighting quality by access to daylight and outdoor views, controllability and energy performance (Kruisselbrink et al., 2018). However, occupant visual comfort and eye health is up to many other parameters like illuminance and luminance, control of glare, distribution, uniformity and light source color (Hwang and Jeong, 2011). According to Chung and Burnett (2000), the quality of lighting in a space not only depends on the lighting installation itself, but also on many other non-photometric factors such as the layout of the furniture, color of the room and furniture surfaces, the occupants and how the space is used. Hwang and Kim (2011) describe a standard lighting environment as visible- safe and able to work effectively has clear working view and visually comfortable has a suitable mood for work and able to work happily and comfortably. Nevertheless, day lighting can also cause some problems in a working place. Successful daylight must prevent or reduce glare and thermal discomforts that arise from windows and direct sunlight (Sharp et al., 2014).

Controllability is another important issue for both green certification and occupant satisfaction. According to Heerwagen (2000), personal control over ambient conditions is especially important to reduce discomfort coping and to achieve conditions appropriate to personal preferences and task needs. Lighting controllability is significant because of the diversified tasks that require different lighting conditions in an office environment. Task lighting as desk lamps, reading lamps and under-cabinet lights are very useful to adjust lighting conditions according to personal needs (Öz and Ergönül, 2015). Manual controls also provide remarkable energy savings.

According to Naharuddin and Sadegi (2013), proved that natural light with good quality is able to enhance offices performance and other suggested it can improve health, productivity, well-being and satisfaction. The previous research declared that improvement in office achievement was correlated to good lighting quality. One significant rule with the lighting system is that it has to save energy and brings comfort for occupants, and subsequently both productivity and sustainability will preserve together (Loftness et al., 2003).

2.4.1.5   Cleanliness Quality

Cleaning quality implicitly affects air quality because of dust, bad odors, and harmful particles in the air in case of inadequate cleaning. Especially in crowded offices which are possible to contain many viruses and microbes, regular cleaning service is substantial. To ease cleaning services, furniture and carpeting must be easy effaceable, antidust and antiallergic (Öz & Ergönül, 2015).

2.4.2 Personal Experienced

Personal experience is people effect or influence of an event or subject through involvement in or exposure to it. According Frontczak (2012), Occupants' satisfaction with the indoor environment is directly related to the amount of comfort they experience within the environment. Occupants spend 7 to 10 hours each workday indoors and surroundings such as air quality, temperature and lighting, have a significant impact on their health, wellness and productivity. It is essential for these buildings to have a good IEQ as it affects the productivity and health of the occupants of the building (Nizam et al., 2011). High concentrations of chemicals, presence of asbestos or radon, old carpet, dirty air ducts or a poorly designed or inefficient HVAC system are common causes sick building syndroms (Deepinder Singh, 2012).

Productivity with regard to individual worker performance seems to be considered as personal experience in office building. Numerous study have found that occupants comfort with the environment has a direct impact on their workplace satisfaction which highly influence their productivity (Horr et al., 2016).The effects of physical work environments on office workers has been undertaken with an interest in worker subjective experience of the workplace and response to the environment (Woo, 2010).

Work performance is defined as synonymous with work behavior. Performance is behaviour with an evaluative component and can be distinguished from effectiveness or productivity (Woo, 2010). It is important to focus on behaviour instead of results because the result of an individual's performance does not represent his or her own contribution to organisational goals (Motowidlo et al., 1997). Studies of physical environment in the workplace including temperature, indoor air quality, lighting, noise and the presence of windows have demonstrated that the physical environment influences workers attitude, behaviour, satisfaction and performance (Woo, 2010).

2.4.3 Occupants Expectation

The term expectation refers to what occupants believe they should and will receive from service provided through the services (Naziah et. al., 2016). They form a satisfaction level based on their confirmation and their expectation. Numerous studies have explored how building users perceive the indoor environment and which condition are considered to be comfortable (Frontczak and Wargocki, 2010). According to Zalejska and Wilhelmsson's (2013), comfort perception presents a variation through important personal characteristics such as age, gender, and occupants' lifestyle. Many studies stated that high indoor environment is the major expectation of building occupants as it is directly affected on their health, well-being and the productivity. According to Lee et. al., 2009, the current standards and guidelines for indoor environments were predominantly developed based on experiments involving human subjects in environmental chamber conditions without consideration of these modern office variables.

Some also admitted that they had refurbished the building without referring to the guidelines from the local authority and might as well invited some contaminations and organics effluences such as polluted gases, mold and fungi into the building (Salleh et al., 2016). Previous researches has found that Indoor Air Quality should more attentions regarding design and services. According to Masoud et. al., (2017), IAQ should earn more attention from designer and project managers because it received a lot of dissatisfaction from occupants. Construction clients are demanding assurance of their buildings' long-term economics, environmental performance and costs. The problem for the best environmentally friendly buildings is that the environmental attributes are often invisible and only appreciated once the building is occupied and in use (Bartlett and Howard, 2000). Types of work in the office building also can contribute influenced occupants expectation towards indoor environment quality in office building. According to Nakano et. al., (2002), the latter type of work forces mental stress during working hours, and bodily movements resulting from stress or stress itself might well have influenced the perception of the thermal environment.

2.4.4 Perceived performance

Perceived performance had directly influences occupants satisfaction. According to Jochen (2001), it has been empirically shown that direct causal links from perceived performance to satisfaction can significantly increase the proportion of explained variance in satisfaction. Psychological factors have an influence on occupant perception of the environment apart from physical factors. Occupant perception is the mediator of the relationships between objective measurements of the environmental components and subjective evaluations of the social environment. In this process, people judge their environments with a subjective and intuitive averaging process. While IAQ conventionally includes the measurements of carbon dioxide (CO_2) levels, chemical pollutants, respirable particulates and moulds as well as ventilation rates.

People judge IAQ according to their subjective evaluations whether air is fresh or stale whether outdoor exist or not (Vischer, 2005). As a result, there are differences between objective measurements and occupant perceptions. For example, numerous office workers consider their work environments to be thermally uncomfortable although the work environments actually measured are usually within thermal comfort requirements. This example demonstrates that the methodology of environmental comfort research needs to include the discipline of environmental psychology in order to fully measure IEQ (De Dear, 2004). The perception of different aspects of indoor environment is of great importance since it influences both occupant's behaviour and comfort. Brunswik (1956) emphasised the importance of subjective or perceived environment as a determinant of behaviour. The combination of physical and psychological factors however adds to the complexity of defining IEQ affecting physiological symptoms. Engvall et al. (2004) stress that perceptions and medical symptoms are not only related to physical indoor environment but also influenced by social and cultural impacts, organisational aspects, lifestyle and other individual factors.

2.4.5 Building Occupant Satisfaction

Building occupants are a valuable source of information about indoor environmental quality (IEQ) and its effects on comfort, satisfaction, self-reported performance, and building performance. According to Peretti & Schiavon (2015), occupant satisfaction and perception of the environment may provide feedback for architects, designers, and building owners to assess building features and technologies. The results of occupants expectation help facility managers improve the performance of existing management methods and provide better delivery of appropriate services to meet specific customer requirements (Yang Cao et. al, 2015). According to Biljana Angelova and Jusuf Zekiri (2011), occupant's satisfaction is the outcome felt by those that have experienced a company's performance that have fulfilled their expectations. The researcher also stated that occupant's satisfaction has a positive effect on organizational's profitability.

Currently all companies are realizing the significance of delivering and managing service quality which leads to occupant satisfaction. According to Hansemark and Albinson (2004), satisfaction is an overall occupant's attitude towards a service provider or an emotional reaction to the difference between what customers anticipate and what they receive regarding the fulfillment of some needs, goals or desire.

2.5   SUMMARY OF THE CHAPTER

In this chapter covers the review of the previous research. Journals and previous research are adopted to construct the theoretical framework and the findings of past researchers are used to support relationship between those variables. Therefore this chapter provide an overview of the most frequently asked questions and answer to those and illustrate the research conceptual framework on building occupant satisfaction towards Indoor Environment Quality in office building and use theories mentioned in the literature review to measure the building occupant satisfaction towards Indoor Environment Quality in office building. Furthermore, explanation of research methodology such as research design, data collection methods, population and sample size, sampling design and data analysis will be presented in the next chapter.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1   INTRODUCTION

This chapter describes the methods used to collect data related to the study. It contains the design of the study, explaining the methods and procedures for data collection, analysis and abstraction that will be used throughout this chapter. This research approach will be the concept and direction to achieve all the objectives in this study.

3.2   PHILOSOPHY AND RESEARCH APPROACH

Pragmatism argues that concepts are only relevant in that they support action. This means that the most important determinant of the position at each connection with the research is the one position question that may be more appropriate than the other to answer a question. The pragmatism approach is a theory based on the concept of its use. According to James (1907), the term "pragmatism" is derived from the Greek word "pragma" which means action or practice or activity from which in the words "practical" have been derived.

According to Gava (2014), pragmatism is the mediator between empirical (experiential) and idealistic traditions, and connects something very meaningful in both. Pragmatism is an attitude, method and philosophy that adopts practical consequences of mind and belief as a measure of determining truth (Mikko Martela, 2009). In pragmatism there are three methods used are deductive, inductive and abductive approaches.

3.2.1 Research Approach

In the research, there are three types of research approaches that are often used by researchers. The most commonly used research approaches are:

3.2.1.1 *Deductive*

Deductive approaches are those that use logic to draw quantitative conclusions. The study was conducted to test a theory proposal through a research strategy specifically designed to achieve that goal. The highlights of the previous research will show how researchers highlight the theory used and interpret abstract research problems into basic variables to express field data collection methods.

3.2.1.2 *Inductive*

This study was conducted as a refinement of theory or knowledge through empirical observation. It involves qualitative-inductive ones that often lack a clearer scheme than quantitative-deductive research. Inductive approaches are based on past researcher's experience in developing research procedures that are reviewed and are referred to as guidelines. This is due to the method for data collection to explain the phenomenon from one study to another.

3.2.1.3 *Abductive*

This approach is used for the study of phenomena, to identify terms, to explain the structure of a phenomenon to form a new theory through statistical analysis. Abductive approaches are studies that use a combination of quantitative and qualitative approaches or mixed methods.

Therefore, in order to achieve the aim of this study, an abductive approach is the appropriate method. This study observes the occupant satisfaction with the indoor environment quality in office buildings. This research is a combination of quantitative and qualitative approaches (mixed method) to analyze and draw conclusions at the end of this research.

3.3   RESEARCH DESIGN

The description of the research design is based on Maxwell (2012) in the following diagram:
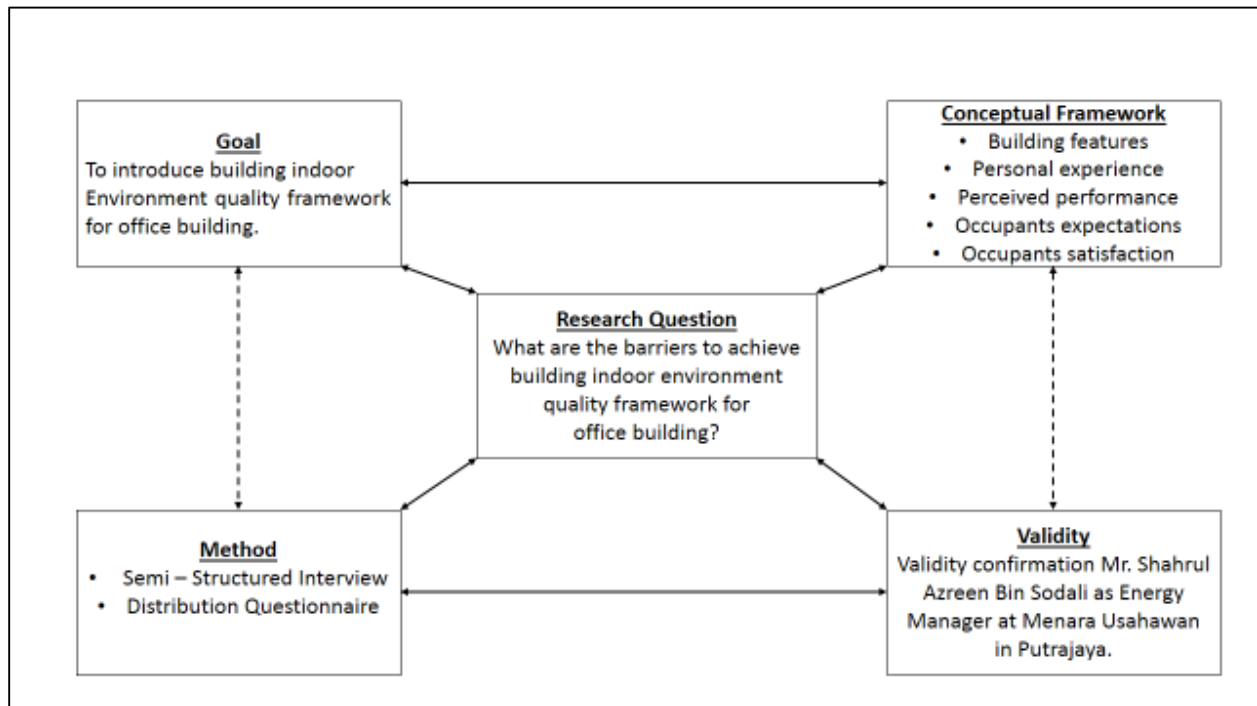
Figure 3.1: Research Design (Maxwell, 2012)

3.3.1 Research Goal

The aim of this research is to analyze building occupant satisfaction towards indoor environment quality in government's office building. This research to identify how well the occupant satisfaction towards Indoor Environment Quality in government's office building.

3.3.2 Conceptual Framework

Conceptual framework that has been established specifically for the purpose of this research. Each concept or element studied by the researcher in the conceptual framework is based on scientific sources. While the conceptual framework developed on the basis of the research objectives and the selected element to identify the variables that occupant satisfaction towards indoor environmental quality in office building.
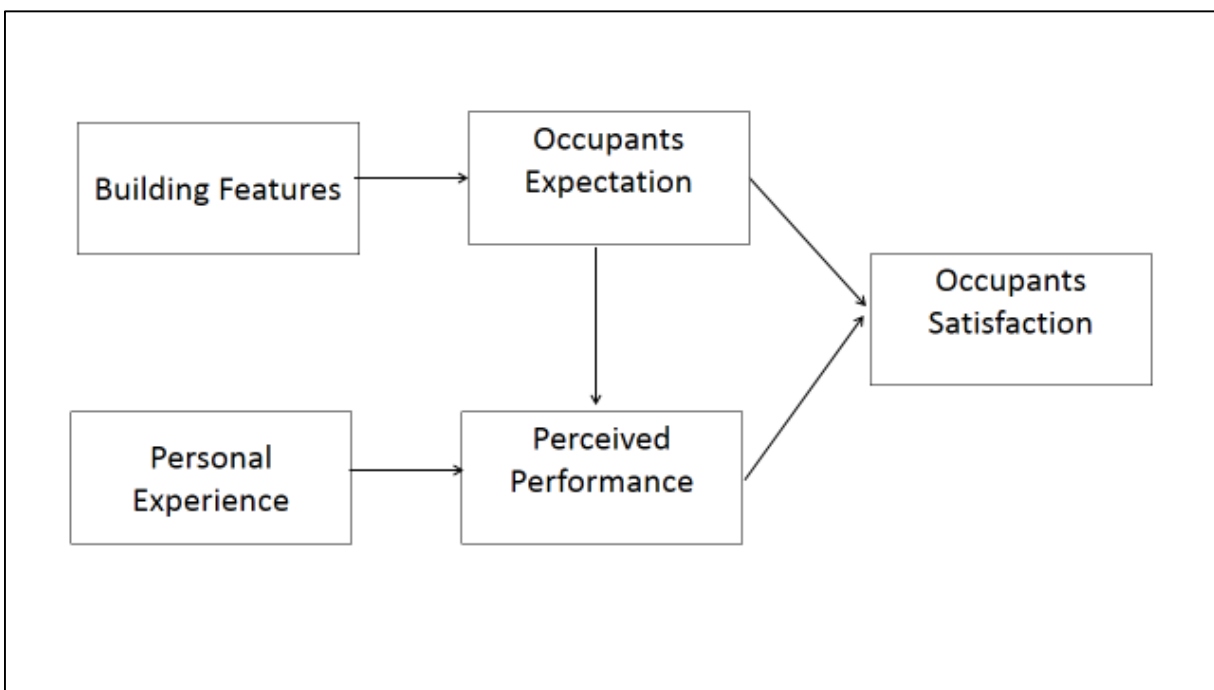
Figure 3.2: Conceptual Framework IEQ Towards Customer Satisfaction (Modified From Expectation Confirmation Theory 1977)

3.3.3 Research Question

Research questions play an important role in this research. A research question is the fundamental core of a research project, study, or review of literature. It focuses the study, determines the methodology, and guides all stages of inquiry, analysis, and reporting. It is important to understand the relationship between these research questions with the research goals and its conceptual framework. The central research question directly interacts with the aim of the research. This studies form one central research question title on "What are the barriers to achieve building indoor environment quality framework for office building?" While the three secondary research question are:

i.   What are the variables that influence the occupant satisfaction towards Indoor Environment Quality in office building.

ii. What are the relationships between variables of occupant satisfaction towards Indoor Environment Quality in office building.

iii. What are the key factors that affecting the occupant satisfaction towards Indoor Environment Quality in office building.

3.3.4 Method

In this research, the researchers used Mixed-method design, which is the results are based on both observations in qualitative and quantitative data. In doing so, the researcher chooses to conduct semi-structured interviews and a questionnaire survey. The results of the questionnaire will be collected and analyzed to get an overview of the research. The results of the questionnaire will be collected and analyzed to determine the factors that influence the occupant satisfaction towards indoor environment quality in government's office building.

3.3.4.1   Semi-Structured Interview

In this research, researchers conducted semi-structured interviews because these types are more likely to meet the needs of the topics made in research and to get familiarisation of the setting and to verify the measurement instruments that will be used during the survey. According to Zainuddin and Noor (2012), semi-structured interviews were conducted to answer the main questions provided. The interviewer prepares a set of the same questions to be answered by all interviewees, however, additional questions might be asked during interviews to clarify or further expand certain issues regarding occupant satisfaction in office building and indoor environment quality.

3.3.4.2   Questionaire

For this research, the researcher has set up a set of questionnaire that looks into the occupant satisfaction towards indoor environment quality in office building. Questionnaire has the advantage of taking it to a wider audience compared to interviews. Moreover, the questionnaire used in the study was provided by the researchers entirely. According to L.R.Gay (2014), the questionnaire is an instrument for collecting data that illustrates one or more characteristics of a particular population. The number of respondents varies depending on the place and population of the building occupant.

The questionnaire adopted the self-completed questionnaire approach for data collection. Self-completed questionnaire is a technique where the questions are directly completed by the respondents without any involvement from the researcher or other third parties (Saunders et al, 2012). The questionnaire is developed to measure constructs.

3.3.5 Validity

The terms of the validity should meet certain criteria to achieve the aim of research. In this study, the validity involved must have experience and knowledge of indoor environment quality to gain occupant satisfaction in office building. Validity confirmation by Mr. Shahrul Azreen Bin Sodali as Energy Manager at Menara Usahawan in Putrajaya. Moreover, he also had experienced in government's office building in Putrajaya to give satisfaction towards indoor environmental quality.

3.4   SUMMARY OF THE CHAPTER

The research methodology undertaken in this research describes the approach of the research to help researchers to gain the data and information needed to obtain the results of the research. Moreover, through the research of abductive approach explains studies chosen by the researchers. The research design selects is Interactive Research Design by Maxwell, 2013. The researcher adopted the pragmatism as the philosophy of the study. Data were collected using the semi structured interview and the questionnaire survey.

CHAPTER 4

DATA COLLECTION

4.1   INTRODUCTION

This chapter describes in detail the method of data collection used in this study. The data was collected to obtain the information needed in order to achieve the purpose of research. This is because good results begin with the start of the study conducted at each stage from the initial process until the conclusion process is carried out on this study. The data collection described in this chapter is the sampling design chosen by the researcher, the sample size and the data collection instrument used by researchers in this study. As discussed in the chapter one of these studies has three objectives. The researcher using the sampling design developed by Saunders (2012), describes two types of sampling probability sampling and non-probability sampling.

In this study, the researcher chooses stratified random sampling which is under probability sampling. Since this study uses SPSS, the researcher selected the sample size developed by Krejcie & Morgan (1970). In this chapter will also be explained about the purpose of each item used in the research instrument. The whole chapter will discuss the methods of data collection to conduct the study.

4.2   SAMPLING

4.2.1 Sampling Design

Sample design is a process for identifying sample population used as respondents (Chua, 2012). Sample size design is determined based on the purpose of the study, the required sample size, the cost and time allocated by the study (Sabitha, 2006). Therefore, this sampling is to obtain research information from respondents or a number of populations. In addition, in order to ensure that the research process is working smoothly, the researchers have designed the necessary sample designs which in turn identify the purpose of the study the size of the sample used and the amount required by the researcher to carry out this study.

Sampling can be explained as a specific principle used to select members of the population to be included in the study. Sampling size can be divided into probability and non-probability sampling. Probability sampling implies that each one in the population has an equal chance to get involved in the sample (Corbetta, 2003). Probability sampling is often related with the survey and experimental research strategies. While a non-probability reflects that the chances of each person to be chosen in the sample is unknown but the features of the population are used as the main measure for selection. In the probability sampling, it has four techniques which are simple random, stratified random, systematic random and cluster random while the non-probability consist of four techniques which is quota, purposive, volunteer and haphazard.

Table 4.1 Definition Probability and Non-Probability Sampling

PROBABILITY SAMPLING

No	Technique	Definition
1	Simple random	Sample group members are selected in a random manner.
2	Stratified random	Representation of specific subgroup or strata.
3	Systematic random	Systematic sampling involves you selecting the sample at regular intervals from the sampling frame
4	Cluster random	Cluster of participants representing population are identified as sample group members
5	Multistage	Sampling conducted in several stages

NON-PROBABILITY SAMPLING

NO	TECHNIQUE	DEFINITION
1	Quota	It is entirely non-random and it is normally used for interview surveys.
2	Purposive Sampling	Purposive or judgemental sampling enables you to use your judgment to select cases that will best enable you to answer your research question(s) and to meet your objectives.
3	Volunteer	A voluntary sample is made up of people who self-select into the survey.
4	Haphazard	Sampling method that may lead to create bias because of the possibility of gaining unrelated participant.

Source: Saunders, Lewis and Thornhill.

4.2.2 Sample Size

To determine the sample size, this study implemented research based on table Krejcie & Morgan (1970). This research has use stratified random sampling to get the respondent based on population from research scope.

In order to achieve the objectives of study, the population for four office building that selected in Putrajaya is 4580 occupants. The researcher use table Krejcie & Morgan (1970) to get the sample size for distribute the questionnaire. Based on the table 4.2, the researcher used 354 respondents as the sample size. All questionnaires will be distributed to the respondents at office building that researcher selected in research scope.

Table 4.2: The Population And Size Sample Of This Study

Building	Total Of Occupant	Percentage %	Size Sample
Menara Seri Wilayah, Precint 2	647	14	50
Ministry Of Education, Precint 6	2037	44	156
Ministry of Domestic Trade and Consumer Affairs Malaysia (KPDNHEP), Precint 2	850	19	67
Menara Usahawan, Precint 2	1046	23	81
Total	4580	100	354 (Krejcie & Morgan)

Table 4.3: The Table Krejcie & Morgan to Make The Size Sample (1977)

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

Source: Krejcie & Morgan (1970)

4.3   DATA COLLECTION INSTRUMENT

4.3.1 Semi Structured Interview

Semi- structured interview was conducted with the Semi – structured question. The respondent selected are Facility Manager and Energy Manager in Facilites Management Office Building.

4.3.2 Questionnaire Survey

Questionnaire survey implemented the self-completed questionnaire approach for data collection. Self-completed questionnaire is a technique where the questions are directly completed by the respondents without any involvement from the researcher (Saunders et al, 2012). The questionnaire is divided into six sections:

1) Section A : Respondent Profile
2) Section B : Building Features
3) Section C : Personal Experienced
4) Section D : Occupants Expectation
5) Section E : Perceive Performance
6) Section F : Occupants Satisfaction

All items within the questionnaire are bilingual (English and Bahasa Malaysia). Section A combines a few open ended questions but most of the questions are structured. Almost all items in Section B to F are structured questions implementing a five-point numerical Likert Scale and all data are in the form of Ordinal data. According to Steven (1946), Ordinal scale is typically measured of non-numeric concepts like satisfaction, happiness, discomfort, etc.

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Table 4.4: Items Related To Building Features

Item label	Purposes
B1	To measure whether Indoor Air Quality in office building approriate
B2	To measure whether thermal comfort is sufficient
B3	To measure whether acoustic arrangement is adequate
B4	To measure whether lighting condition in workplace is acceptable
B5	To measure whether cleanliness services in workplace is sufficient

Table 4.5: Items Related To Personal Experience

Item label	Purpose
C1	To measure wether respondent feel Indoor Air Quality in office building appropriate.
C2	To measure wether respondent feel thermal comfort is sufficient.
C3	To measure wether respondent feel acoustic arrangement is adequate.
C4	To measure wether respondent feel lighting condition in workplace is acceptable.
C5	To measure wether respondent feel that cleanliness services in workplace is sufficient

Table 4.6: Item Related To Occupant Expectation

Item label	Purpose
D1	To measure wether respondent belief that IEQ is important and can affect occupants' health issues and they will frequently take a sick leave.
D2	To measure wether respondent belief that sustainable office building should have better performance of IEQ criteria.
D3	To measure wether respondent belief that a poor (IEQ) can create stressful feelings on the occupants' expectation of the environment.
D4	To measure wether respondent belief that personal or psychosocial factors beyond environmental parameters influence occupants' expectation of the quality of indoor environment.
D5	To measure wether respondent belief that if types of workforces in office building influenced occupants' expectation towards IEQ.

Table 4.7: Item Related To Perceived Performance

Item Label	Purposes
E1	To measure wether respondent belief that good IEQ can help occupants be more productivity at workplace and improve work performance.
E2	To measure wether respondent belief that available standard guidelines of IEQ is to improve satisfaction of occupants in the office building.
E3	To measure wether respondent belief that IEQ influenced social, organizational aspect, lifestyle and individual factors in the office building.

E4   To measure wether respondent belief that good IEQ in an office building can help employees reduce their sick leave due to workplace health problem.

E5   To measure wether respondent belief that IEQ would help employees improve their work performance in the office.

Table 4.8: Item Related To Occupant Satisfaction

Item label	Purposes
F1	To measure wether respondent satisfied with the Indoor Environment Quality in my office building.
F2	To measure wether respondent factor of indoor environment quality in my office building influenced my productivity, health and wellbeing.
F3	To measure wether IEQ in office building can affect to respondent
F4	To measure wether respondent satisfy with performance IEQ regarding to their perceived work performance.

4.4   SUMMARY OF THE CHAPTER

As a conclusion, this chapter includes of the comprehensive structure of the data collection method. Start from the sampling design, sample size and the data collection instrument. The analysis of data will be explained and showed at the chapter five.

CHAPTER FIVE

DATA ANALYSIS AND DISCUSSION

5.1 INTRODUCTION

In this chapter, the researcher will analyse the data obtained from the distribution of the questionnaire at four office building in Putrajaya. This chapter will discuss more about the finding of the data which include the measurement analysis on the research objectives which use to identify the variables that influence the occupant satisfaction towards Indoor Environment Quality in office building, to analyse the relationship between variables of occupant satisfaction towards Indoor Environment Quality in office building and to determine key factors affecting the occupant satisfaction towards Indoor Environment Quality in office building. A total number of questionnaire was distributing to respondents is 354, however only 192 questionnaires been return. The results were generated by SPSS version 25 for all construct variables.

From this chapter, the descriptive statistics analysis will be analysed and used to measures the respondents and some tables are used to represent the particulars of the respondents.

5.2 DESCRIPTIVE DATA ANALYSIS

Descriptive statistics analysis is used to define the basic features of the data in study. They used to measure the respondents and provide simple summaries about the sample. Therefore, in this study descriptive statistics determine name of building, gender, age, work position, field experience, work area, and hour spends in office each day.

5.3 DEMOGRAPHIC PROFILE

5.3.1 Name of Building

Table 5.1 Respondent by Building

Name of building	Respondent	Percentage %
Ministry Of Domestic Trade, Co-Operatives And Consumerism (KPDNHEP)	48	25.1
Menara usahawan	55	28.8
Ministry of Education (KPT)	49	25.7
Menara Seri Wilayah	40	20.4
Total	192	100
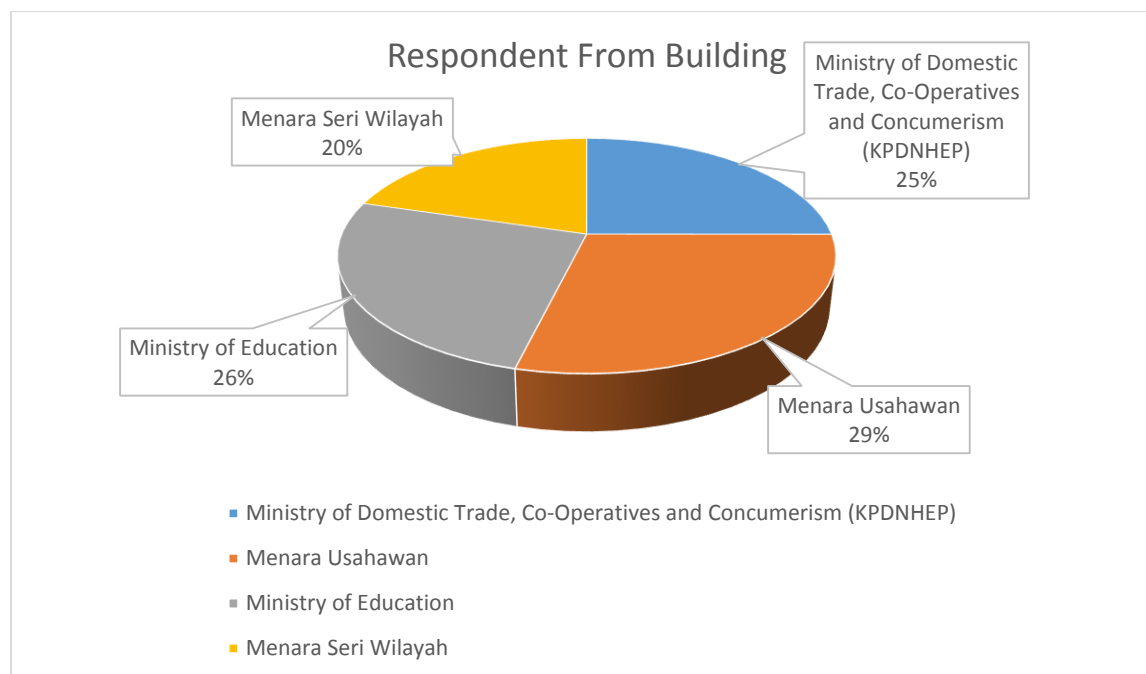
Figure 5.1 Respondents by Building

Based on table 5.1 and figure 5.1, the researcher able to identify the number of respondents who answered the questionnaire from four building. It can be seen number of respondents in building Menara Usahawan recorded a higher percentage 29% with 55 respondents compared to the other building. Furthermore, ministry of education (KPT) achieve 26% with 49 respondents. Meanwhile, Ministry of domestic trade, co-operatives and consumerism (KPDNHEP) recorded 25% with 48 respondents and Menara seri Wilayah achieve 20% with 39 respondents.

5.3.2 Gender

Data analysis on gender was taken to determine the population by gender of for four building collected

Table 5.2: The Total Number Of Respondents By Gender From Four Buildings.

Gender	Total respondent	Percentage %
Male	95	49
Female	97	51
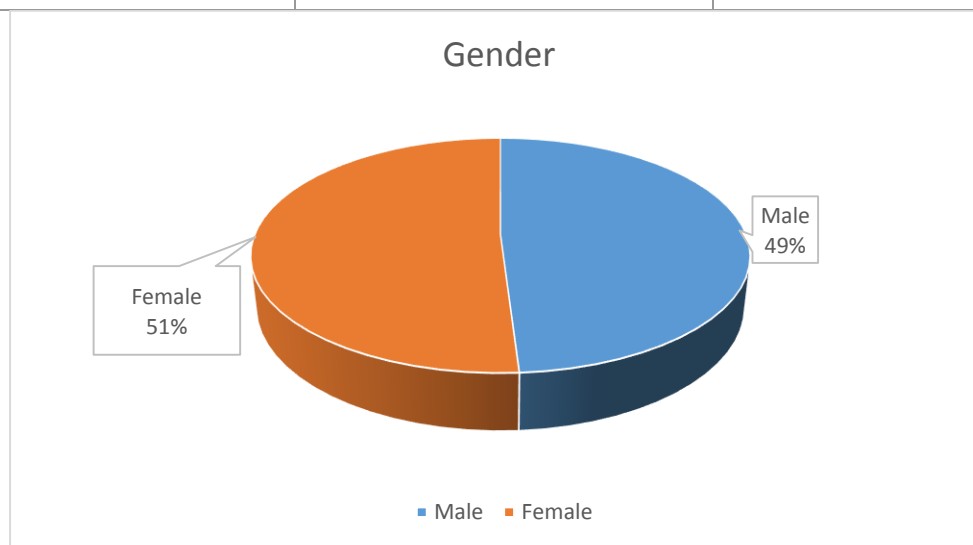
Figure 5.2 Respondents By Gender From Four Building.

Based on table 5.2 and figure 5.2, it can be seen the number of respondents by gender from four building selected. The highest proportion of gender was from female 51% with 97 respondent and the remaining are male 49% with 95 respondent.

5.3.3 Age

Respondents' age data are collected to determine the respondent's age range for for four building involved in this research.

Table 5.3 Show Total Number Of Classification Of Age By Respondents

Age	Frequency	Percentage (%)
Less than 26 years old	39	20.4
26 – 30 years old	46	24.1
31 – 40 years old	74	38.7
41 – 50 years old	25	13.1
More than 50 years old	8	4.2
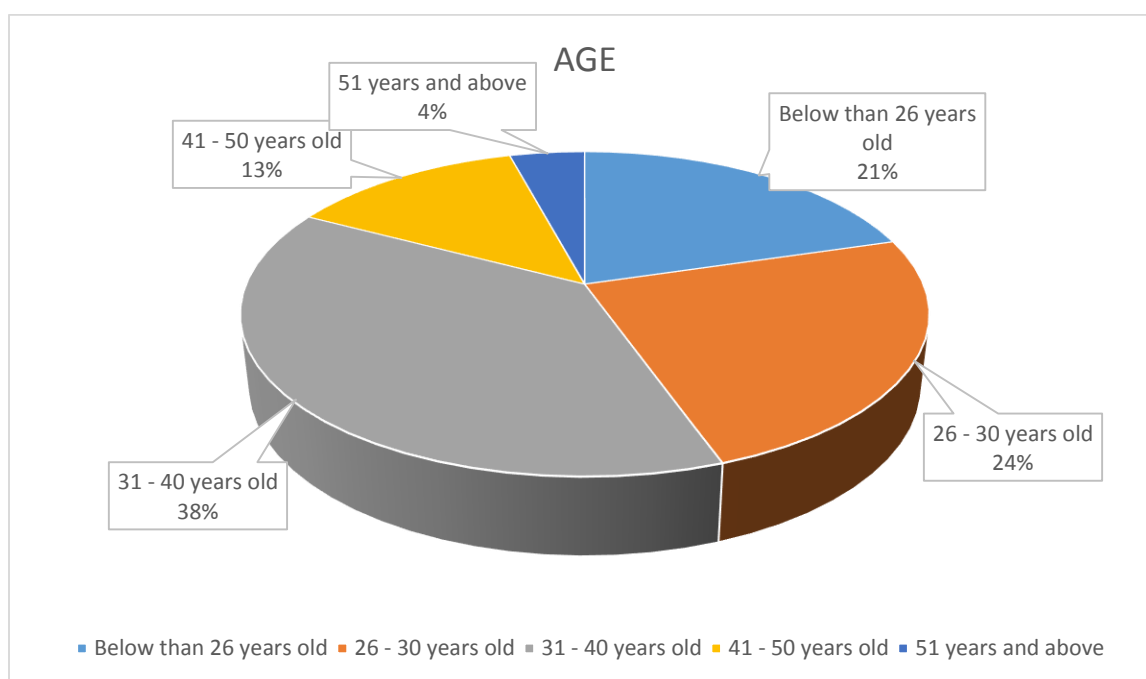
Figure 5.3 Classification Of Age By Respondents

Table 5.3 and figure 5.3 show the classification age by respondent by four building questionnaire collected. It can be seen that highest age percentage are 31 – 40 years old with 38% involving 74 respondents. Moreover, the age 26 – 30 years old has a moderate

rule of 24% involving 46 respondents. Meanwhile, the age below than 26 years old showed with 21% involving 39 respondents. Furthermore, the age 41 – 50 years old represented a percentage of 13% for 25 respondents. For age 51 years and above showed that low percentage with 4% involving 8 respondents.

5.3.4 Field Experience

Data on the duration of the work experience was also used to enable the researcher to determine the average work experience of each respondent for for four buildings.

Table 5.4 Show The Field Experience By Respondent By For Four Building

Field experienced	Frequency	Percentage %
Less than 3 year	58	30.7
More than 3 year but not more 5 year	85	45
More than 5 year but not more 10 year	46	24.3

Field Experienced

More than 5 year but
not more 10 year
24%

Less than 3 year
31%

More than 3 year but
not more 5 year
45%

■ Less than 3 year ■ More than 3 year but not more 5 year ■ More than 5 year but not more 10 year ■
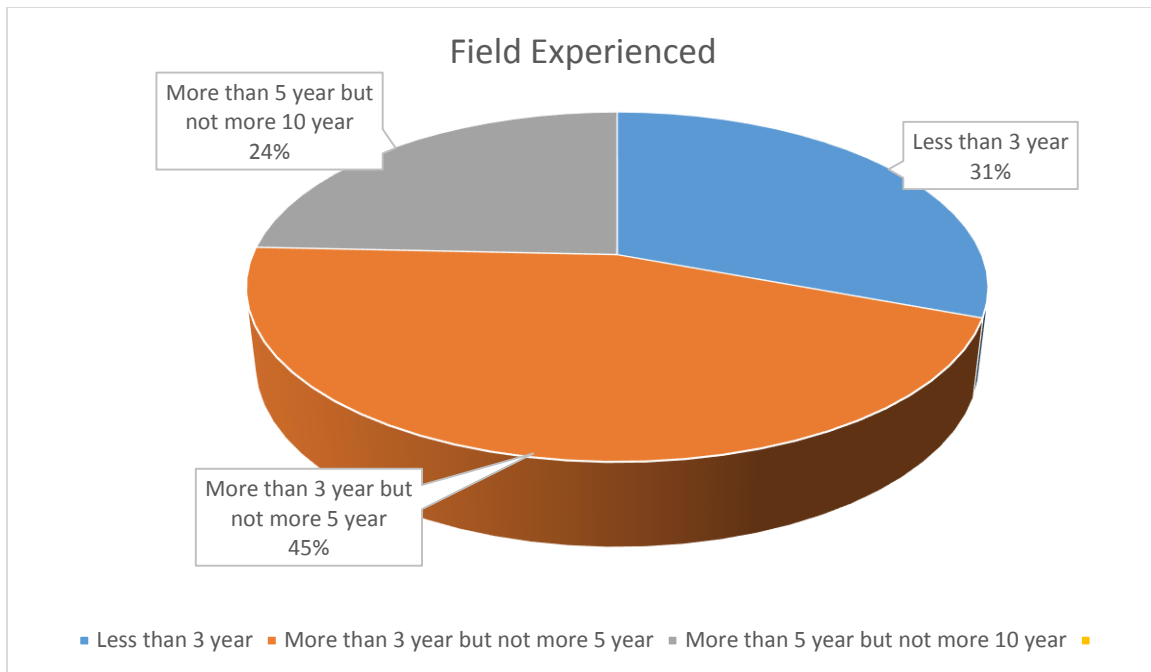
Figure 5.4 Field Experience By Respondent From For Four Building

For the field experience in table 5.4 and figure 5.4, it can be seen that highest percentage of field experienced more than 3 year but not more 5 year with 45% involving 85 respondents. Meanwhile, less than 3 year with 31% involving 58 respondents. Furthermore, a lower percentage for field experience more than 5 year but not more 10 year with 24% achieve 46 respondents.

5.3.5 Designation

Data on the designantion were taken to simplify to determine of scope of work of each respondent for for four building.

Table 5.5 Show Designation Of Respondent By For Four Building

Designation	Frequency	Percentage %
Managerial	14	7.5
Professional	56	29.9
Administrative	71	38
technical	41	21.9
Others:	5	2.6
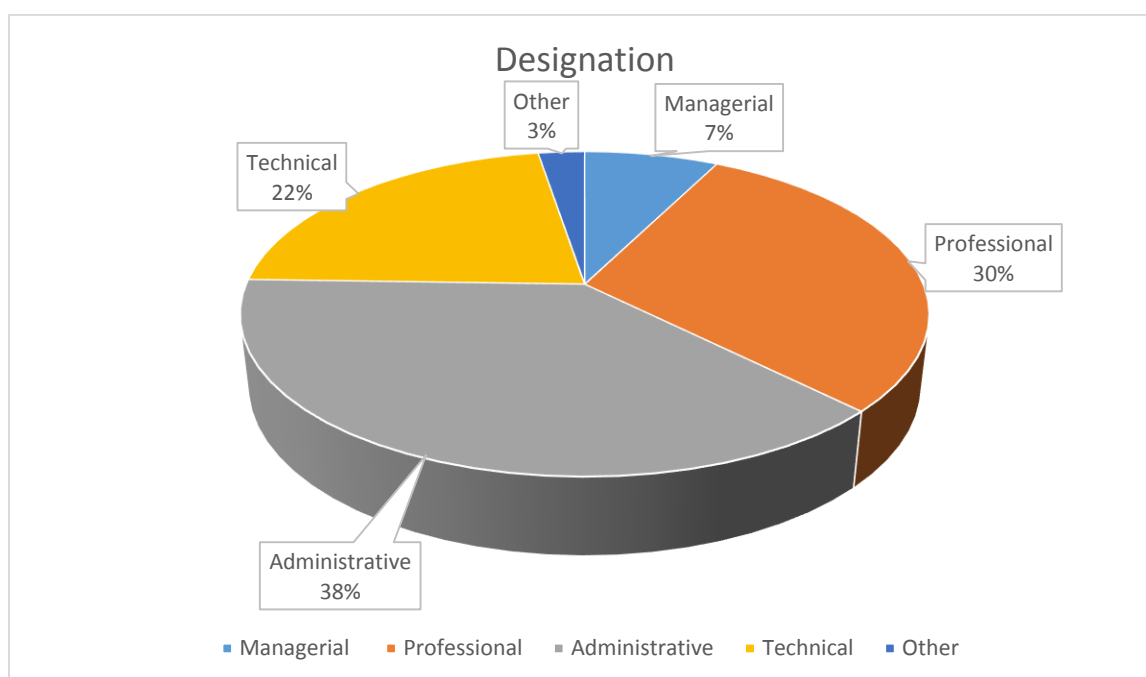
Figure 5.5 Designation Of Respondent By For Four Building

For table 5.5 and figure 5.5, the data shows that designation of occupant in the building. The highest percentage of designation administrative with 38% represented 71 respondents. Meanwhile, for designation professional with 30% involving 56 respondents.

Furthermore, the percentage designation technical with 22% collected 41 respondents. The designation managerial recorded with 7% with the number of respondent 14. Lastly, the lower percentage designation others including security, intern students and services respondent with 3% response rate of 5 respondent.

5.3.6 Work Area

Table 5.6 Show The Types Of Work Area Of Respondent For Four Building.

Types of work area	Frequency	Percentage %
Private office room	48	25.4
Private office room share with other occupant	76	40.2
Open plan office	68	35
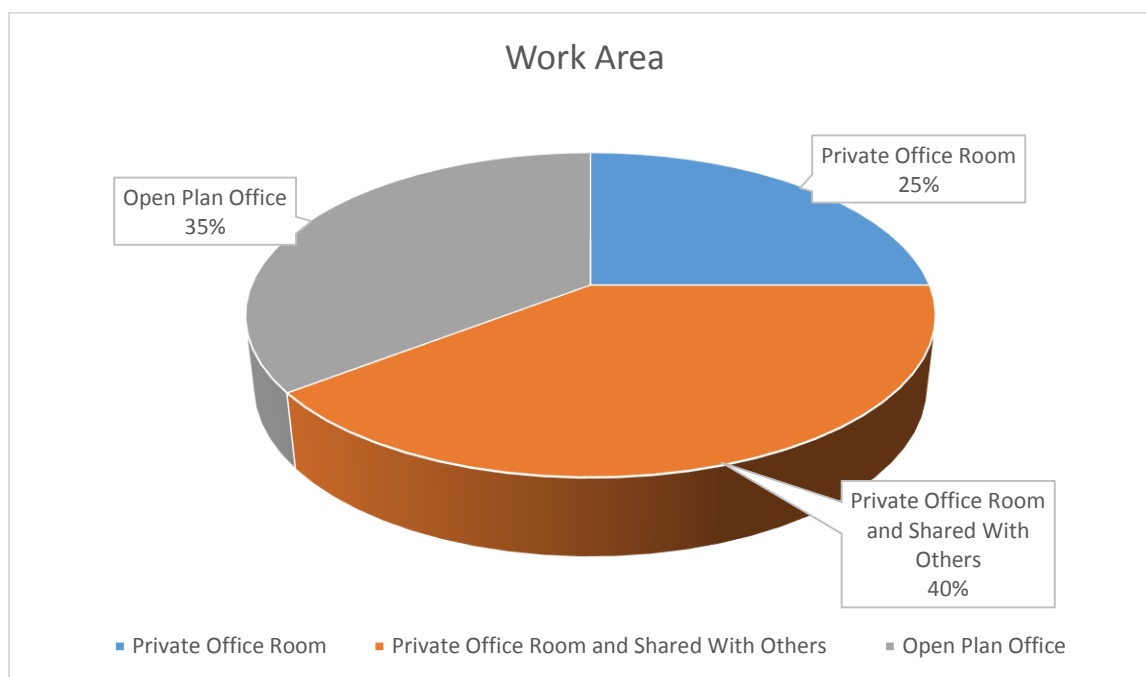
Figure 5.6 Types Of Work Area Of Respondent For For Four Building

Based on table 5.6 and figure 5.6, it can be seen that private office room and shared with others recorded with 40% of 76 respondents. Furthermore, the percentage of open plan office with 35% of 68 respondents. Meanwhile, the percentage of private office room recorded as a lower percentage with 25% of 48 respondents.

5.3.7 Hours Spend In Office

Table 5.7 Show That Hours Spend By Respondent For Four Building.

Hours spend	Frequency	Percentage %
Less than 8 hour	30	15.6
More than 8 hour	162	84.4
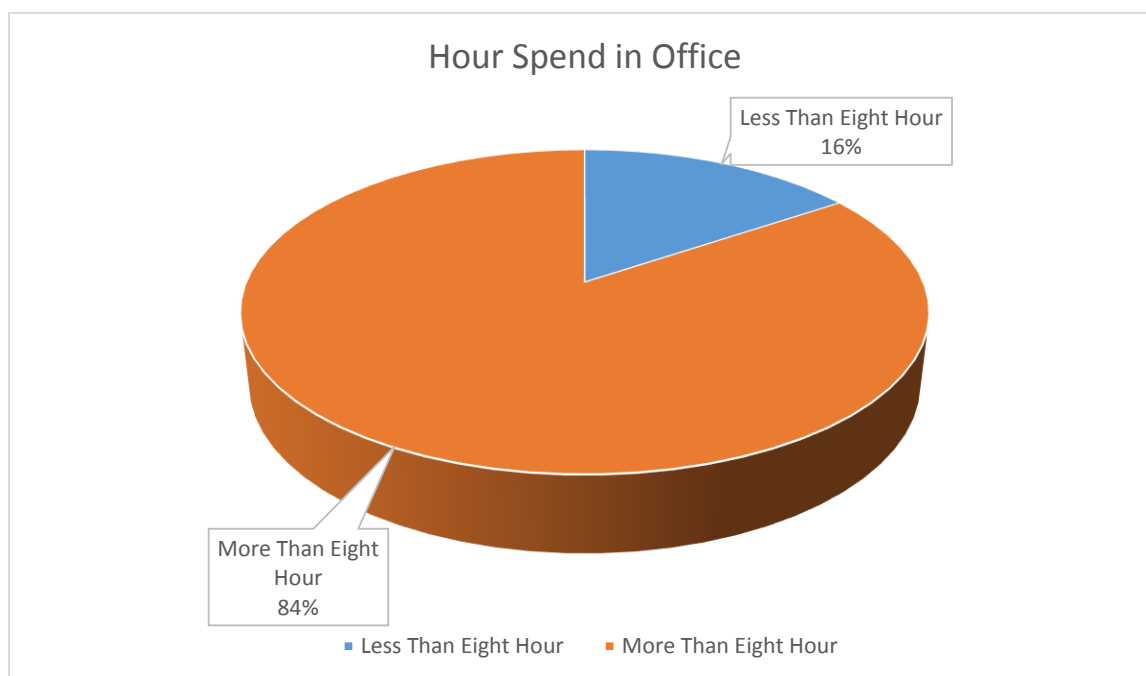
Figure 5.7 Hour Spend By Respondent For Four Building

Based on table 5.7 and figure 5.7, it showed that hour spend by respondent in the building. The highest percentage hour spend more than eight hour with 84% of 162 respondents. Meanwhile, the lower percentage hour spend less than eight hour recorded with 16% of 30 respondents.

5.4   THE FINDING OF THE RESEARCH FOR THE FIRST OBJECTIVE

The first objective of this study is to identify the variable that influence the occupant satisfaction towards indoor environment quality. A variable is type of category the researcher are trying to measure.

Besides that, to achieve this objective the researcher has obtained information through the questionnaire form which has been distributed to the respondents of the study. The questionnaire was constructed based on conceptual framework that include building features, personal experienced, occupants expectation, perceived performance, occupant satisfaction.

Moreover, to identify variables that influence the occupant satisfaction towards Indoor Environment Quality, the data already collected from four building study areas will be analyzed concurrently based on study construct using Cronbach's Alpha Method. A conceptual research model for Building Occupant Satisfaction Towards Indoor Environment Quality in Office Building and have been analysed the variable influencing of occupant satisfaction using the proposed research conceptual framework as shown in figure 5.8. Cronbach's alpha was used to assess the reliability of the scales.
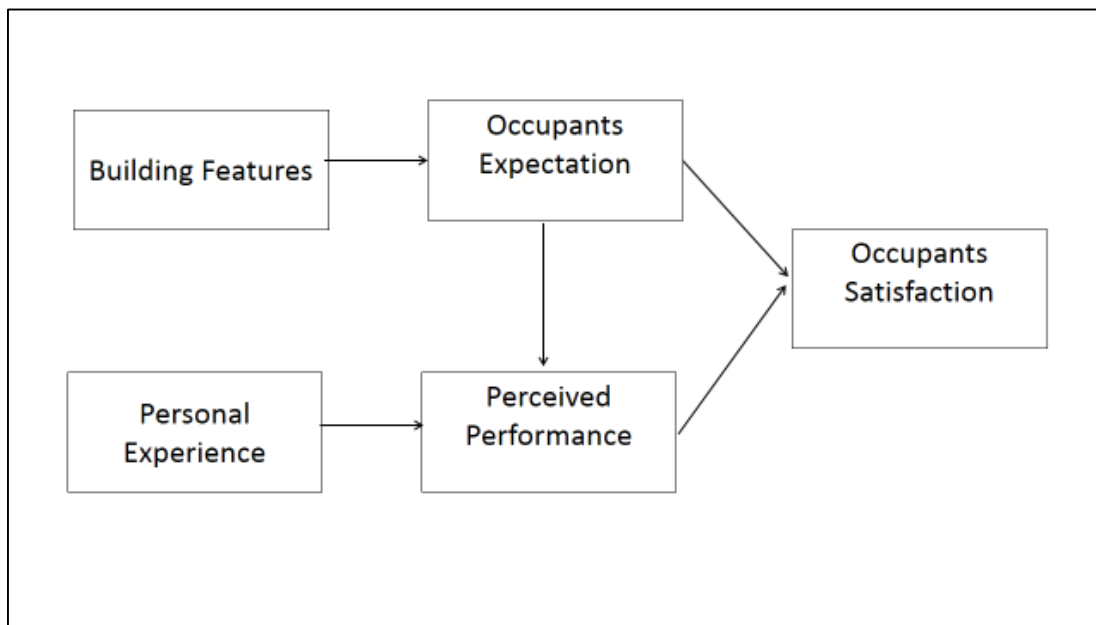
Figure 5.8 Framework IEQ Towards Customer Satisfaction (Modified From Expectation Confirmation Theory 1977)

5.4.1 Reliability Test

Reliability analysis is used to determine the internal consistency of the scale for building occupant satisfaction towards Indoor Environment Quality in office building by using the Cronbach's Alpha. According to Sekaran (2003), it shows that if the coefficient of reliability is in the range of 0.70 then it is considered as acceptable and those reliability that over the range of 0.80 are considered as good. However, if there is a reliability result that is less than 0.60 then it should be considered as poor.

Table 5.8: Reliability Statistic Of The Variable

Variable	Item	Cronbach's Alpha
Building Features	5	0.865
Personal Experience	5	0.877
Occupants Expectation	5	0.800
Perceived Performance	5	0.753
Occupants Satisfaction	4	0.756

Table 5.8 shows that the Cronbach's Alpha reliability test result through all the variables. In this study, building features, personal experience and occupants expectation have a very good reliability which is more than 0.8 Alpha coefficients with the result 0.865, 0.877 and 0.800. On the other hand, perceived performance and occupants satisfaction have a good reliability which is more than 0.7 Alpha coefficients with the result 0.753 and 0.756. As can be seen from the table, all of the reliability tests show the variables are highly reliable indicating that it is reliable for further analysis.

5.4.2 MEAN AND STANDARD DEVIATION FOR FOUR VARIABLES

5.4.2.1   Building Features

Table 5.9 Building Features

Statements	Mean	Std Deviation
The movement of air regarding Indoor Air Quality in my workplace is very appropriate	3.82	.856
The standard temperature set in my workplace is sufficient	3.72	.900
The acoustic arrangement in my office is very satisfying and adequate	3.70	.838
The lighting conditions in my workplace in terms of brightness and color are very acceptable	3.83	.795
The cleanliness service in my workplace is very sufficient	3.98	.862

From Table 5.9, it represents the percentage of responses on the building features. The top ranking mean is "The cleanliness service in my workplace is very sufficient" with 3.98 and continue by "The lighting conditions in my workplace in terms of brightness and color are very acceptable" with 3.83, "The movement of air regarding Indoor Air Quality in my workplace is very appropriate" with 3.82, "The standard temperature set in my workplace is sufficient" with 3.72. Lastly, the "The acoustic arrangement in my office is very satisfying and adequate" with mean of 3.70.

5.4.2.2   Personal Experience

Table 5.10 Personal Experience

Statement	Mean	Std. Deviation
I satisfied with the air quality of my workplace in the office	3.97	.853
I satisfied with temperature ambient at my workspace in office	3.83	.974
I satisfied with my office layout in office regarding noise privacy and easy to communicate	3.71	.824
I feel comfortable with the amount of light and visibility at my workspace in office	3.81	.854
I satisfied with the frequency collection of waste container at my workspace in office	4.06	.832

Referring Table 5.10, it shows the percentage of responses on the personal experience. The top ranking mean is "I satisfied with the frequency collection of waste container at my workspace in office" with 4.06 and continue by "I satisfied with the air quality of my workplace in the office" with 3.97, "I satisfied with temperature ambient at my workspace in office" with 3.83, "I feel comfortable with the amount of light and visibility at my workspace in office" with 3.81. Lastly, the "I satisfied with my office layout in office regarding noise privacy and easy to communicate" with mean of 3.71.

5.4.2.3   Occupant Expectation

Table 5.11 Occupant Expectation

Statement	Mean	Std. Deviation
Indoor environment quality is important, because if not, I expect it can affect occupants' health issues and they will frequently take a sick leave	4.30	.616
Sustainable office building should have better performance of all Indoor Environment Quality criteria I expected	4.35	.709
A poor (IEQ) can create stressful feelings on the occupants' expectation of the environment	4.28	.608
Personal or psychosocial factors beyond environmental parameters influence occupants' expectation of the quality of indoor environment	4.14	.713
Types of workforces in office building influenced occupants' expectation towards Indoor Environment Quality	4.16	.724

Referring Table 5.11, it shows the percentage of responses on the occupant expectation. The top ranking mean is "Sustainable office building should have better performance of all Indoor Environment Quality criteria I expected" with 4.35 and continue by "Indoor environment quality is important, because if not, I expect it can affect occupants' health issues and they will frequently take a sick leave" with 4.30, "A poor (IEQ) can create stressful feelings on the occupants' expectation of the environment" with 4.28, "Types of workforces in office building influenced occupants' expectation towards Indoor Environment Quality" with 4.16. Lastly, the "Personal or psychosocial factors beyond environmental parameters influence occupants' expectation of the quality of indoor environment" with mean of 4.14.

5.4.2.4   Perceived Performance

Table 5.12 Perceived Performance

Statement	Mean	Std. Deviation
Good Indoor Environment Quality can help occupants be more productivity at workspace and improve work performance	4.28	.609
The available standard guidelines of indoor environment quality is to improve satisfaction of occupants in the office building	4.13	.789
Indoor environment quality influenced social, organizational aspect, lifestyle and individual factors in the office building	4.20	.706
A good indoor environment quality in an office building can help employees reduce their sick leave due to workplace health problem	4.21	.695
Indoor Environment Quality would help employees improve their work performance in the office	4.29	.685

Referring Table 5.12, it shows the percentage of responses on the perceived performance. The top ranking mean is "Indoor Environment Quality would help employees improve their work performance in the office" with 4.29 and continue by "Good Indoor Environment Quality can help occupants be more productivity at workspace and improve work performance" with 4.28, "A good indoor environment quality in an office building can help employees reduce their sick leave due to workplace health problem" with 4.21, "Indoor environment quality influenced social, organizational aspect, lifestyle and individual factors in the office building" with 4.20. Lastly, the "The available standard guidelines of indoor environment quality is to improve satisfaction of occupants in the office building" with mean of 4.13.

5.4.2.5   Occupant Satisfaction

Table 5.13 Occupant Satisfaction

Statement	Mean	Std. Deviation
I satisfied with the Indoor Environment Quality in my office building	4.18	.779
I believed factor of indoor environment quality in my office building influenced my productivity, health and wellbeing.	4.28	.632
I believe that factors Indoor Environment Quality in office building affect the productivity, health and wellbeing of the occupants in the building.	4.34	.567
According to my overall experience in the office building, I personally satisfied with performance Indoor Environment Quality regarding to my perceive work performance	4.15	.701

From the Table 5.13, it shows the percentage of responses on the occupant satisfaction. The top ranking mean is "I believe that factors Indoor Environment Quality in office building affect the productivity, health and wellbeing of the occupants in the building" with 4.34 and continue by "I believed factor of indoor environment quality in my office building influenced my productivity, health and wellbeing." with 4.28, "I satisfied with the Indoor Environment Quality in my office building" with 4.18. Lastly, the "According to my overall experience in the office building, I personally satisfied with performance Indoor Environment Quality regarding to my perceive work performance" with mean of 4.15.

5.5   THE FINDING OF THE RESEARCH FOR THE SECOND OBJECTIVE

This section aims to analyze data aimed at achieving the second objective to analyse the relationship between variables of occupant satisfaction towards Indoor Environment Quality. To achieve this objective, a questionnaire has been distributed to occupant at four building selected based on scope of research which is Menara Usahawan, Menara Seri Wilayah, Ministry Of Education (KPT) and Ministry Of Domestic Trade, Co-operatives and Consumerism (KPDNHEP) as an instrument to collect the data.

5.5.1. Correlation between All Variables.

Table 5.14 Correlation between All Variables

		Building Features	Personal Experience	Occupants Expectation	Perceived Performance	Occupants Satisfaction
Building Features	Pearson Correlation	1	.879**	.496**	.455**	.687**
	Sig. (2-tailed)		.000	.000	.002	.000
	N	192	192	192	192	192
Personal Experience	Pearson Correlation	.879**	1	.478**	.418**	.716**
	Sig. (2-tailed)	.000		.000	.002	.000
	N	192	192	192	192	192
Occupants Expectation	Pearson Correlation	.496**	.478**	1	.690**	.522**
	Sig. (2-tailed)	.000	.000		.000	.000
	N	192	192	192	192	192
Perceived Performance	Pearson Correlation	.455**	.418**	.690**	1	.589**
	Sig. (2-tailed)	.002	.002	.000		.000
	N	192	192	192	192	192
Occupants Satisfaction	Pearson Correlation	.687**	.716**	.522**	.589**	1
	Sig. (2-tailed)	.000	.000	.000	.000	
	N	192	192	192	192	192

**.Correlation is significant at 0.10 level (2-tailed)

Table 5.14, analyzed the correlation between occupants satisfaction on Indoor Environment Quality with building features, personal experience, occupants expectation and perceived performance. Based on the result, it shows that personal experience (r = 0.716) has high correlation and marked relationship with occupants satisfaction. Meanwhile, the result of the building features, perceived performance and occupants expectation (r = 0.687) (r = 0.589) (r = 0.522) has moderate correlation and substantial relationship with occupants satisfaction. The variable of building features, personal experience, occupants expectation and perceived performance has a significant relationship at the level of 0.10.

5.5.2   Multiple Linear Regression Analysis

Multiple linear regression analysis is conducted to examine the significant relationship and the influence of all the variables which is building features, personal experience, occupants expectation and perceived performance of occupants satisfaction toward Indoor Environment Quality (IEQ) in order to test the research hypothesis.

Table 5.15: Path Coefficient Of The Variables

Relationship	Path Coefficient	t-Value	p-value
Building Features -> Occupant Expectation	0.496	7.865	.000
Personal Experience -> Perceived Performance	0.418	6.334	.000
Occupant Expectation -> Perceived Performance	0.690	13.137	.000
Occupant Expectation -> Occupant Satisfaction	0.522	8.440	.000
Perceived Performance -> Occupant Satisfaction	0.589	10.053	.000

5.5.3 Hypothesis for Indoor Environment Quality.

The hypothesis in this research is based on the Table 5.15.

5.5.3.1 Hypothesis 1: Building Features and Occupant Expectation

Ho1: There is no significant relationship between Building Features and Occupant Expectation on Indoor Environment Quality.

Ha1: There is a significant relationship between Building Features and Occupant Expectation on Indoor Environment Quality.

FINDING: There is a positive significant relationship between Building Features and Occupant Expectation. The magnitude of the relationship is very strong where the p-Value is less than 0.10 (path coefficient is 0.496). The t-Value is 7.865.

5.5.3.2 Hypothesis 2: Personal Experience and Perceived Performance

Ho2: There is no significant relationship between Personal Experience and Perceived Performance on Indoor Environment Quality.

Ha2: There is a significant relationship between Personal Experience and Perceived Performance on Indoor Environment Quality.

FINDING: There is a positive significance relationship between Personal Experience and Perceived Performance. The magnitude of the relationship is very strong where p-Value is less than 0.10 (path coefficient is 0.418). The t-Value is 6.334.

5.5.3.3 Hypothesis 3: Occupants Expectation and Perceived Performance

Ho3: There is no significant relationship between Occupants Expectation and Perceived Performance on Indoor Environment Quality.

Ha3: There is a significant relationship between Occupants Expectation and Perceived Performance on Indoor Environment Quality.

FINDING: There is a positive significance relationship between Occupant Expectation and Perceived Performance. The magnitude of the relationship is very strong where p-Value is less than 0.10 (path coefficient is 0.690). The t-Value is 13.137.

5.5.3.4 Hypothesis 4: Occupant Expectation and Occupant Satisfaction

Ho4: There is no significant relationship between Occupant Expectation and Occupant Satisfaction on Indoor Environment Quality.

Ha4: There is a significant relationship between Occupant Expectation and Occupant Satisfaction on Indoor Environment Quality.

FINDING: There is a positive significant relationship between Occupant Expectation and Occupant Satisfaction. The magnitude of the relationship is very strong where the p-Value is less than 0.10 (path coefficient is 0.522). The t-Value is 8.440.

5.5.3.5 Hypothesis 5: Perceived Performance and Occupant Satisfaction

Ho5: There is no significant relationship between Perceived Performance and Occupant Satisfaction on Indoor Environment Quality.

Ha5: There is a significant relationship between Perceived Performance and Occupant Satisfaction on Indoor Environment Quality.

FINDING: There is a positive significant relationship between Perceived Performance and Occupant Satisfaction. The magnitude of the relationship is very strong where the p-Value is less than 0.10 (path coefficient is 0.589). The t-Value is 10.053.

Positive relationship indicates the increase in independent variable will increase the dependent variable. On the other hand, the negative relationship indicates that the increase in independent variable will decrease the dependent variable.

Based on the result of the hypothesis test on the relationship between of the variables of occupant satisfaction towards indoor environment quality show that Building Features has the most significant and large impact on Occupant Expectation where path coefficient is 0.496. Besides that, Personal Experience has a significant impact on Perceived Performance where the path coefficient is 0.418.

The results of the hypothesis test on Occupant Expectation, Perceived Performance and Occupant Satisfaction shows that Occupant Expectation has the most significant and large impact on Perceive Performance where path coefficient is 0.690. Furthermore, Occupant Satisfaction has a significant impact on Occupant Satisfaction where path coefficient is 0.522. Finally, Perceive Performance has significant impact on Occupant Satisfaction where path coefficient is 0.589. Figure 5.9, show hypothesis between variables. Value besides arrow between constructs indicates the path coefficient of the relationship.
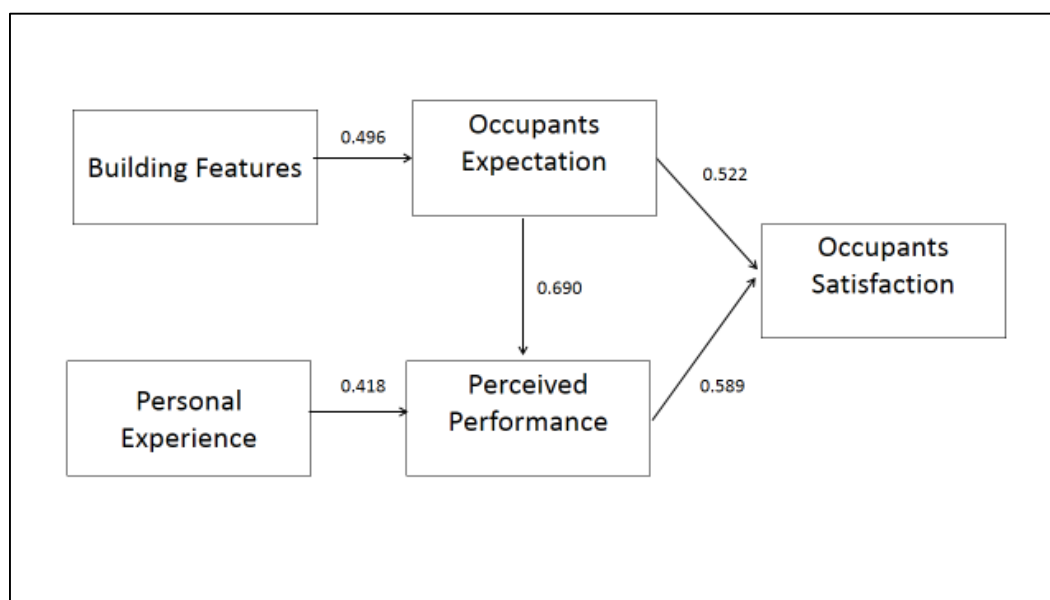
Figure 5.9: Path coefficient all variables.

5.6 THE FINDING OF THE RESEARCH FOR THIRD OBJECTIVE

The third objective of this study is to determine key factors affecting the Occupant satisfaction towards Indoor Environment Quality. This model identifies factors affecting building occupant satisfaction from a building features, personal experience, occupant expectation, perceived performance and analyses relationships between the factors. Based on the results path coefficient of the hypothesis test on the relationship of the variables, the key factors affecting the occupant satisfaction towards Indoor Environment Quality show that Occupant Expectation has the most significant and largest impact on Perceived Performance where the path coefficient is 0.690, as shown in table 5.15

Table 5.16 Key Factors Affecting The Occupant Satisfaction

Relationship	Path Coefficient	t-Value	p-value
Occupant Expectation -> Perceived Performance	0.690	13.137	.000

5.6.1 Coefficient of Determination(R)

Table 5.17 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.786a	.618	.610	.32682

a. Predictors: (Constant), TPP, TBF, TOE, TPE

b. Dependent Variable: TOS

Under this regression equation, it explains the relationship between the building features, personal experience, occupants expectation and perceived performance in indoor environment quality (IEQ) towards occupants satisfaction.

From the analysis in table 5.17, the coefficient of determination, R2, is 0.618. It shows that 61.80% of the total variations in occupants satisfaction can be explained by total variations in all independent variables. In contrast, there is a 38.20% variation in occupants satisfaction is not explained by the independent variables in this study.

Therefore, this can be explained that there are other independent variables which are not included in this study and also important could further in interpreting the occupants satisfaction.

CHAPTER SIX

CONCLUSION

6.1   INTRODUCTION

This chapter concludes the results and findings that derived from the analysis that conducted on the previous chapter to summarize this research. First, a brief discussion of the research is presented which includes all the issues of research objectives, framework and research methodology. Subsequently, some recommendation or ideas of the current research are also be presented in order to give a direction to future researchers to examine building occupant satisfaction towards Indoor Environment Quality in office building.

This chapter is also the last chapter in this study, all the findings of the study will be summarized and formulated to achieve the three objectives that have been set up in the previous chapter. Therefore, as a cover for this study, this chapter will briefly explain conclusion and study limitation and suggestions for improvements for building occupant satisfaction towards Indoor Environment Quality in office building.

6.2   CONCLUSION

The conclusion is based on the finding that researchers had done while conducting this study in measure the building occupant satisfaction towards indoor environment quality in office building and the relationship within the construct. The researcher come out with factor; building features, personal experience, occupant expectation, perceived performance and occupant satisfaction. Furthermore, total of questionnaire distribute is 354 and only 192 return.

Furthermore, this study conducts correlation analysis between independent variables which is building features, personal experience, occupant expectation and perceived performance and the dependent variables which is occupants satisfaction. Personal experience has high correlation and marked relationship with occupants

satisfaction. Meanwhile, the building features, perceived performance and occupants expectation has moderate correlation and substantial relationship with occupants satisfaction.

From this study, the key factors affecting the occupant satisfaction towards Indoor Environment Quality show that Occupant Expectation has the most significant and largest impact on Perceived Performance where the path coefficient is 0.690.

6.2.1 Secondary Research Question 1

What are the variables that influence the occupant satisfaction towards Indoor Environment Quality in office building.

The findings of this study is based on proven research model, Expectation Confirmation Theory where the variable that influence the occupants satisfaction towards Indoor Environment Quality in office building. To identify variables that influence the occupant satisfaction towards Indoor Environment Quality, the data already collected from four building study areas will be analyzed concurrently based on study construct using Cronbach's Alpha Method. A conceptual research model for Building Occupant Satisfaction Towards Indoor Environment Quality in Office Building and have been analysed the variable influencing of occupant satisfaction using the proposed research conceptual framework as shown in figure 5.8. Cronbach's alpha was used to assess the reliability of the scales. As can be seen from the table, all of the reliability tests show the variables are highly reliable indicating that it is reliable for further analysis.

6.2.2 Secondary Research Question 2

What are the relationships between variables of occupant satisfaction towards Indoor Environment Quality in office building.

Based on the results of the hypothesis test on the relationship of the variables that impact building occupants satisfaction towards Indoor Environment Quality show that a researcher has found that there is a significant positive relationship exist between the variables. The hypothesis test on the relationship between of the variables of occupant satisfaction towards indoor environment quality show that Building Features has the most significant and large impact on Occupant Expectation where path coefficient is 0.496. Besides that, Personal Experience has a significant impact on Perceived Performance where the path coefficient is 0.418.

The results of the hypothesis test on Occupant Expectation, Perceived Performance and Occupant Satisfaction shows that Occupant Expectation has the most significant and large impact on Perceive Performance where path coefficient is 0.690. Furthermore, Occupant Satisfaction has a significant impact on Occupant Satisfaction where path coefficient is 0.522. Finally, Perceive Performance has significant impact on Occupant Satisfaction where path coefficient is 0.589.

6.2.3 Secondary Research Question 3

What are the key factors that affecting the occupant satisfaction towards Indoor Environment Quality in office building.

This model identifies factors affecting the occupant satisfaction towards Indoor Environment Quality in office building and analyses relationships between the factors. Based on the results of the hypothesis test on the relationship of the variables, the key factors affecting the occupant satisfaction towards Indoor Environment Quality in office building that Occupant Expectation has the most significant and largest impact on

Perceived Performance where the path coefficient is 0.690. Based on coefficient of determination, it shows that 61.80% of the total variations in occupants satisfaction can be explained by total variations in all independent variables. In contrast, there is a 38.20% variation in occupants satisfaction is not explained by the independent variables in this study.

6.3   LIMITATION

This research was only conducted in building at Putrajaya only about satisfaction towards Indoor Environment Quality in building. However, some of respondents have different perception and expectation towards Indoor Environment Quality in their building. To increase the occupant satisfaction towards Indoor Environment Quality in office building, others perspective should be focus.

6.4   SUGGESTION FOR IMPROVEMENT IN FUTURE RESEARCH

Future researcher may do improve the persistent improvement of the research model by adding various factors and perceptions related to building occupant satisfaction towards Indoor Environment Quality in office building. It is to ensure that the researcher will gain more different result from both different types of respondents. Furthermore, by having more respondents, the findings would be more accurate and relevant output. By doing this method, accurate and precise findings in the result can be achieved.

For future research should be carried out more office building regarding Indoor Environment Quality satisfaction. Moreover, it is to ensure that the researcher will gain more different result from both different types in office building. Besides that, the findings from the different office building will produce a comparison of the how strong the relationship between variables towards building occupant satisfaction towards Indoor Environment Quality in office building.

Based on the interviews with Mr. Shahrul Azreen Bin Sodali, Energy Manager Menara Usahawan, Putrajaya. For building features, the interviewer would suggest that improvements in terms of the quality of system operation in the building need further improvement as well as ensuring the assets in the building are in good condition to make sure that occupants gain satisfaction regarding Indoor Environment Quality.

According to Mr. Fareez Bin Abdul Majid, Energy Manager Ministry of Education (KPT), Putrajaya. Indoor Environment Quality management needs to make improvement further enhanced to provide comfort to building occupants in carrying out daily tasks such as give the planning of Indoor Environment Quality audit to monitor the productivity and wellbeing of occupants.

According to Mr. Naufal bin Azahar, former Faciltiy Manager Menara Usahawan, Putrajaya. To give a better condition of Indoor Environent Quality in office building, it should continuous monitoring for maintenance work in particular as well as improvements to the operation of existing systems in the building. Moreover, Customer Satisfaction Index (CSI) customer satisfaction index that received a response from the occupants based on their experience, it can make the Indoor Environment Quality management

planning appropriate solution further to increase the satisfaction of the occupants in the building. This statement were support by Mr. Shahrul and Mr. Fareez as Energy Manager to give a better quality of indoor environment and increase the satisfaction of occupants.

6.5   CONCLUDING REMARKS

This study has been successfully implemented as all questions are possible. The findings of the study are based on situation of the study and to enhance Building Occupant Satisfaction Towards Indoor Environment Quality in Office Building.

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APPENDIX A

QUESTIONNAIRE FORM

POLITEKNIK
MALAYSIA
SULTAN SALAHUDDIN ABDUL AZIZ SHAH

<u>**FEEDBACK FORM**</u>

RESEARCH TITLE:

BUILDING OCCUPANT SATISFACTION TOWARDS INDOOR ENVIRONMENT QUALITY IN OFFICE BUILDING

Dear respondents,

I am final year students of Bachelor of Technology (Hons) in Facility Management from Politeknik Sultan Salahuddin Abdul Aziz Shah in Shah Alam. I am conducting a research on the topic "Building Occupant Satisfaction towards Indoor Environment Quality in Office Building." I would be so appreciative if you could spend a few minutes to fill in this questionnaire. This survey is solely for academic purpose and all information will be kept confidential. Thank you for your cooperation and participation to response this survey.

Kepada responden,

Saya adalah pelajar tahun akhir Sarjana Muda Teknologi (Kepujian) Pengurusan Fasiliti dari Politeknik Sultan Salahuddin Abdul Aziz Shah in Shah Alam. Saya sedang menjalankan kajian mengenai topik "Kepuasan Penghuni Bangunan terhadap Kualiti Persekitaran Dalaman di Bangunan Pejabat." Saya amat menghargai sekiranya anda boleh meluangkan sedikit masa untuk menjawab soal selidik ini. Penyelidikan ini semata-mata untuk tujuan akademik dan segala maklumat akan dirahsiakan. Terima kasih atas kerjasama dan penyertaan anda untuk menjawab kaji selidik ini.

OBJECTIVE

i. To identify the variables that influence the occupant satisfaction towards Indoor Environment Quality. */ Untuk mengenalpasti pemboleh ubah yang mempengaruhi kepuasan penghuni bangunan terhadap Kualiti Persekitaran Dalaman.*

ii. To analyse the relationship between variables of occupant satisfaction towards Indoor Environment Quality. */ Untuk menganalisa hubungan di antara pemboleh ubah kepuasan penghuni bangunan terhadap Kualiti Persekitaran Dalaman.*

iii. To determine key factors affecting the occupant satisfaction towards Indoor Environment Quality. */ Untuk menentukan faktor utama yang mempengaruhi kepuasan penghuni bangunan terhadap Kualiti Persekitaran Dalaman.*

PART 1

SECTION A: RESPONDENT PROFILE / MAKLUMAT RESPONDEN

INSTRUCTIONS: Please tick ✓ on your preference.

A1   Name of Building / *Nama Bangunan*:

    i.   Ministry of Domestic Trade, Co-operatives and Consumerism (KPDNHEP)

    ii.   Menara Usahawan

    iii.   Ministry Of Education (KPM)

    iv.   Menara Seri Wilayah

A2   Gender / *Jantina*:

    Male / Lelaki

    Female / Wanita

A3   Age / *Umur*:

Less than 26 years old ☐

26 – 30 years old ☐

31 – 40 years old ☐

41 – 50 years old ☐

More than 50 years old ☐

A4   What is your position?
/ *Pangkat anda?*

Managerial ☐

Professional ☐

Administrative ☐

Technical ☐

Others (please specify):

A5   How long is your field experience? /
Berapa lama pengalaman bekerja?

Less than 3 year ☐

More than 3 year but not more 5 year ☐

More than 5 year but not more 10 year ☐

A6   What is your work area? / *Ruang pekerjaan anda?*

Private office room ☐

Private office room share with other occupant ☐

Open plan office ☐

A7   How many hours do you spend in office each day? / *Berapa lamakah anda menghabiskan masa setiap hari di pejabat?*

Less than 8 hour ☐

More than 8 hour ☐

PART 2

INSTRUCTION: Please read the statement and tick in the box based on level of your argument. The numbers below have the following meaning:

Please tick ✓ guided by the below scale

1	2	3	4	5
Strongly Disagree	**Disagree**	**Normal**	**Agree**	**Strongly Agree**

SECTION B: BUILDING FEATURES / *CIRI-CIRI BANGUNAN*

		1	2	3	4	5
B1	The movement of air regarding Indoor Air Quality in my workplace is very appropriate / *Pergerakan udara berkaitan Kualiti Udara Dalaman di tempat kerja saya sangat sesuai*					
B2	The standard temperature set in my workplace is sufficient / *Suhu standard yang ditetapkan di tempat kerja saya mencukupi*					
B3	The acoustic arrangement in my office is very satisfying and adequate / *Gaya penyusunan tempat di pejabat saya sangat memuaskan dan mencukupi*					
B4	The lighting conditions in my workplace in terms of brightness and color are very acceptable / *Keadaan pencahayaan di tempat kerja saya dari segi kecerahan dan warna sangat berpatutan*					
B5	The cleanliness service in my workplace is very sufficient / *Perkhidmatan kebersihan di tempat kerja saya sangat mencukupi*					

SECTION C: PERSONAL EXPERIENCED / *PENGALAMAN SENDIRI*

		1	2	3	4	5
C1	I satisfied with the air quality of my workplace in the office / *Saya berpuas hati dengan kualiti udara tempat kerja saya di pejabat*					
C2	I satisfied with temperature ambient at my workspace in office / *Saya berpuas hati dengan suhu persekitaran di ruang kerja saya di pejabat*					
C3	I satisfied with my office layout in office regarding noise privacy and easy to communicate / *Saya berpuas hati dengan susun atur kedudukan di pejabat berkaitan privasi kebisingan dan ia mudah untuk berkomunikasi*					
C4	I feel comfortable with the amount of light and visibility at my workspace in office / *Saya berasa selesa dengan jumlah cahaya dan jarak penglihatan di ruang kerja saya di pejabat*					
C5	I satisfied with the frequency collection of waste container at my workspace in office / *Saya berpuas hati dengan kekerapan pengutipan bekas sampah di ruang kerja saya di pejabat*					

SECTION D: OCCUPANTS EXPECTATION / *JANGKAAN PENGHUNI*

		1	2	3	4	5
D1	Indoor environment quality is important, because if not, I expect it can affect occupants' health issues and they will frequently take a sick leave / *Kualiti Persekitaran Dalaman amat penting. Sekiranya tidak, saya jangkakan ia boleh mempengaruhi masalah kesihatan penghuni dan sering mengambil cuti sakit*					
D2	Sustainable office building should have better performance of all Indoor Environment Quality criteria I expected / *Bangunan pejabat yang lestari harus mempunyai prestasi yang lebih baik untuk semua kriteria Kualiti Persekitaran Dalaman yang saya harapkan*					
D3	A poor (IEQ) can create stressful feelings on the occupants' expectation of the environment / *(IEQ) yang lemah dapat menimbulkan perasaan tertekan pihak penghuni terhadap jangkaan mereka kepada persekitaran tersebut*					
D4	Personal or psychosocial factors beyond environmental parameters influence occupants' expectation of the quality of indoor environment / *Faktor peribadi atau psikososial di luar parameter persekitaran mempengaruhi jangkaan penghuni terhadap Kualiti Persekitaran Dalaman*					
D5	Types of workforces in office building influenced occupants' expectation towards Indoor Environment Quality / *Jenis-jenis tenaga kerja di bangunan pejabat juga mempengaruhi jangkaan penghuni terhadap Kualiti Persekitaran Dalaman*					

SECTION E: PERCEIVED PERFORMANCE / *PRESTASI YANG DIALAMI*

		1	2	3	4	5
E1	Good Indoor Environment Quality can help occupants be more productivity at workspace and improve work performance / *Kualiti Persekitaran Dalaman yang Baik dapat membantu penghuni menjadi lebih produktiviti di ruang kerja dan meningkatkan prestasi kerja*					
E2	The available standard guidelines of indoor environment quality is to improve satisfaction of occupants in the office building / *Garis panduan standard Kualiti Persekitaran Dalaman yang tersedia adalah untuk meningkatkan kepuasan penghuni di bangunan pejabat*					
E3	Indoor environment quality influenced social, organizational aspect, lifestyle and individual factors in the office building / *Kualiti Persekitaran Dalaman mempengaruhi aspek sosial, organisasi, gaya hidup dan faktor individu di bangunan pejabat*					
E4	A good indoor environment quality in an office building can help employees reduce their sick leave due to workplace health problem / *Kualiti Persekitaran Dalaman yang baik di bangunan pejabat dapat membantu pekerja mengurangkan cuti sakit mereka kerana masalah kesihatan di tempat kerja*					
E5	Indoor Environment Quality would help employees improve their work performance in the office / *Kualiti Persekitaran Dalaman akan membantu pekerja meningkatkan prestasi kerja mereka di pejabat*					

SECTION F: OCCUPANTS SATISFACTION / *KEPUASAN PENGHUNI*

		1	2	3	4	5
F1	I satisfied with the Indoor Environment Quality in my office building / *Saya berpuas hati dengan Kualiti Persekitaran Dalaman di bangunan pejabat saya*					
F2	I believed factor of indoor environment quality in my office building influenced my productivity, health and wellbeing / *Saya percaya factor-faktor Kualiti Persekitaran Dalaman bangunan pejabat saya mempengaruhi produktiviti, kesihatan dan kesejahteraan saya*					
F3	I believe that factors Indoor Environment Quality in office building affect the productivity, health and wellbeing of the occupants in the building / *Saya percaya bahawa faktor-faktor Kualiti Persekitaran Dalaman bangunan pejabat memberi kesan kepada produktiviti, kesihatan dan kesejahteraan penghuni di bangunan tersebut.*					
F4	According to my overall experience in the office building, I personally satisfied with performance Indoor Environment Quality regarding to my perceive work performance / *Berdasarkan keseluruhan pengalaman saya di bangunan pejabat, saya berpuas hati dengan prestasi Kualiti Persekitaran Dalaman berkaitan dengan prestasi kerja saya*					

APPENDIX B

SEMI-STRUCTURED QUESTION FORM

JABATAN KEJURUTERAAN AWAM

POLITEKNIK SULTAN SALAHUDDIN ABDUL AZIZ SHAH,

SHAH ALAM, SELANGOR.

TUJUAN:

Temu bual ini adalah bertujuan untuk mendapatkan maklumbalas dalam mengenalpasti objektif-objektif kajian seperti berikut:

1) Untuk mengenalpasti pemboleh ubah yang mempengaruhi kepuasan penghuni bangunan terhadap Kualiti Persekitaran Dalaman.
2) Untuk menganalisa hubungan di antara pemboleh ubah kepuasan penghuni bangunan terhadap Kualiti Persekitaran Dalaman.
3) Untuk menentukan faktor utama yang mempengaruhi kepuasan penghuni bangunan terhadap Kualiti Persekitaran Dalaman.

TAJUK: Kepuasan Penghuni Bangunan terhadap Kualiti Persekitaran Dalaman di Bangunan Pejabat.

Temu bual ini berdasarkan satu pelaksanaan kaji selidik Sarjana Muda. Matlamat kajian ini adalah untuk memperkenalkan kerangka kualiti persekitaran dalaman bangunan untuk bangunan pejabat.

ARAHAN: sila jawab soalan berikut berdasarkan pengetahuan dan pengalaman anda.

1. Kualiti persekitaran dalaman (IEQ) merujuk kepada kualiti persekitaran bangunan yang berkaitan dengan kesihatan dan kesejahteraan penghuni yang mendiami di dalam bangunan. Berdasarkan pemahaman anda, apakah kepentingan Kualiti Persekitaran Dalaman (IEQ) di dalam bangunan?

2. Ciri bangunan adalah salah satu faktor yang mempengaruhi IEQ yang baik di setiap bangunan. Justeru itu, apakah perancangan anda dalam meningkatkan IEQ di bangunan ini dari semasa ke semasa?

3. Dari pengalaman peribadi anda, Sejauh manakah sistem pengurusan IEQ di bangunan ini?

4. Sebagai penghuni yang telah lama bekerja di bangunan ini, apakah harapan anda terhadap IEQ di bangunan ini?

_____

_____

_____

_____

5. IEQ yang lemah boleh mempengaruhi prestasi & produktiviti kerja penghuni kerana persekitaran yang tidak sihat. Oleh itu, apakah cadangan anda untuk mengatasi masalah yang disebutkan?

_____

_____

_____

_____

6. Apakah bentuk garis panduan IEQ dalam bangunan ini? dan adakah garis panduan yang sedia ada ini membantu IEQ dalam meningkatkan kepuasan penghuni dalam bangunan ini?

_____

_____

_____

_____

DEMOGRAFIK :

Nama: **Pengalaman Kerja Dalam Bidang:**

Jawatan: **Tarikh:**

Nama Syarikat: **Masa:**

APPENDIX C

SPSS RESULT

i. Demographic Profile

```
DATASET ACTIVATE DataSet1.
DATASET ACTIVATE DataSet1.

SAVE OUTFILE='C:\Users\USER\Desktop\spss data\real data\Untitled7.sav'
  /COMPRESSED.
DATASET ACTIVATE DataSet2.
DATASET CLOSE DataSet1.
FREQUENCIES VARIABLES=A1NameofBuildingNamabangunan A2GenderJantina A3AgeUmur
  A4YourworkpositionPosisipekerjaananda A5YourfieldexperienceBerapalamapengalamanpekerjaananda
  A6YourworkareaKawasanandabekerja A7HowmanyhoursdoyouspendinofficeeachdayBerapajamandamenghabiskan
  /NTILES=4
  /STATISTICS=STDDEV MEAN MEDIAN
  /ORDER=ANALYSIS.
```

Frequencies

Statistics

		A1 - Name of Building / Nama bangunan	A2 - Gender / Jantina	A3 - Age / Umur	A4 - Your work position / Posisi pekerjaan anda	A5 - Your field experience / Berapa lama pengalaman pekerjaan anda	A6 - Your work area / Kawasan anda bekerja	A7 - How many hours do you spend in office each day / Berapa jam anda menghabiskan masa di pejabat setiap hari ?
N	Valid	192	192	192	192	192	192	192
	Missing	0	0	0	0	0	0	0

Frequency Table

A1 - Name of Building / Nama bangunan

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Kementerian Pengajian Tinggi (KPT)	49	25.5	25.5	25.5
	Kementerian Perdagangan Dalam Negeri Dan Hal Ehwal Pengguna(KPDNHEP)	48	25.0	25.0	50.5
	Menara Seri Wilayah	40	20.8	20.8	71.4
	Menara Usahawan	55	28.6	28.6	100.0
	Total	192	100.0	100.0	

A2 - Gender / Jantina

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female / Perempuan	97	50.5	50.5	50.5
	Male / Lelaki	95	49.5	49.5	100.0
	Total	192	100.0	100.0	

A3 - Age / Umur

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	26 - 30 years old	45	23.4	23.4	23.4
	31 - 40 years old	74	38.5	38.5	62.0
	41 - 50 years old	26	13.5	13.5	75.5
	51 years and above	8	4.2	4.2	79.7
	Below than 26 years old	38	19.8	19.8	99.5
	Below than 26 years old, 26 - 30 years old	1	.5	.5	100.0
	Total	192	100.0	100.0	

A4 - Your work position / Posisi pekerjaan anda

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Administrative	71	37.0	37.0	37.0
	Managerial	14	7.3	7.3	44.3
	Others	8	4.2	4.2	48.4
	Professional	57	29.7	29.7	78.1
	Reservation	1	.5	.5	78.6
	Technical	41	21.4	21.4	100.0
	Total	192	100.0	100.0	

A5 - Your field experience / Berapa lama pengalaman pekerjaan anda

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 3 years / Kurang dari 3 tahun	58	30.2	30.2	30.2
	More than 3 years but not more than 5 years / Lebih dari 3 tahun tapi tidak lebih dari 5 tahun	85	44.3	44.3	74.5
	More than 5 years but not more than 10 years / Lebih dari 5 tahun tapi tidak lebih dari 10 tahun	49	25.5	25.5	100.0
	Total	192	100.0	100.0	

A6 - Your work area / Kawasan anda bekerja

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Open plan office	66	34.4	34.4	34.4
	Private office room	50	26.0	26.0	60.4
	Private office room and share with other occupant	74	38.5	38.5	99.0
	Private office room and share with other occupant, Open plan office	1	.5	.5	99.5
	Private office room, Private office room and share with other occupant, Open plan office	1	.5	.5	100.0
	Total	192	100.0	100.0	

A7 - How many hours do you spend in office each day / Berapa jam anda menghabiskan masa di pejabat setiap hari ?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 8 hours / Kurang dari 8 jam	30	15.6	15.6	15.6
	More than 8 hours / Lebih dari 8 jam	162	84.4	84.4	100.0
	Total	192	100.0	100.0	

ii. Mean and Standard Deviation of All Variable

```
DESCRIPTIVES VARIABLES=B1ThemovementofairregardingIndoorAirQualityinmyworkplaceisapprop
    B2ThestandardtemperaturesetinmyworkplaceissufficientSuhustandard
    B3Theacousticarrangementinmyofficeisverysatisfyingandadequate.Ga
    B4Thelightingconditionsinmyworkplaceintermsofbrightnessandcolora
    B5ThecleanlinessserviceinmyworkplaceisverysufficientPerkhidmatan
  /STATISTICS=MEAN STDDEV MIN MAX.
```

Descriptives

Building Features

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
B1 - The movement of air regarding Indoor Air Quality in my workplace is appropriate / Pergerakan udara berkaitan Kualiti Udara Dalaman di tempat kerja saya sangat sesuai	192	1	5	3.82	.856

86

B2 - The standard temperature set in my workplace is sufficient / Suhu standard yang ditetapkan di tempat kerja saya mencukupi	192	2	5	3.72	.900
B3 - The acoustic arrangement in my office is very satisfying and adequate. / Gaya penyusunan tempat di pejabat saya sangat memuaskan dan mencukupi	192	1	5	3.70	.838
B4 - The lighting conditions in my workplace in terms of brightness and color are very acceptable / Keadaan pencahayaan di tempat kerja saya dari segi kecerahan dan warna sangat berpatutan	192	2	5	3.83	.795
B5 - The cleanliness service in my workplace is very sufficient / Perkhidmatan kebersihan di tempat kerja saya sangat mencukupi	192	1	5	3.98	.862
Valid N (listwise)	192				

Personal Experience

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
C1 - I satisfied with air quality in my workplace in office / Saya berpuas hati dengan kualiti udara tempat kerja saya di pejabat	192	1	5	3.97	.853
C2 - I satisfied with temperature ambient at my workspace in office / Saya berpuas hati dengan suhu persekitaran di ruang kerja saya di pejabat	192	1	5	3.83	.974
C3 - I satisfied with my office layout in office regarding noise privacy and easy to communicate / Saya berpuas hati dengan susun atur kedudukan di pejabat berkaitan privasi kebisingan dan ia mudah untuk berkomunikasi	192	1	5	3.71	.824
C4 - I feel comfortable with amount of light and visibility at my work space in office / Saya berasa selesa dengan jumlah cahaya dan jarak penglihatan di ruang kerja saya di pejabat	192	1	5	3.81	.854

	N	Minimum	Maximum	Mean	Std. Deviation
C5 -I satisfied with frequency of waste container at my workspace in office / Saya berpuas hati dengan kekerapan pengutipan bekas sampah di ruang kerja saya di pejabat	192	1	5	4.06	.832
Valid N (listwise)	192				

Occupant Expectation

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
D1 - Indoor environment quality is very important. Because if not, I expect it can affect occupants' health issues and they will frequently take a sick leave. / Kualiti Persekitaran Dalaman amat penting. Sekiranya tidak, saya jangkakan ia boleh mempengaruhi masalah kesihatan penghuni dan sering mengambil cuti sakit	192	2	5	4.30	.616
D2 - Sustainable office building should have better performance of all Indoor Environment Quality criteria I expected / Bangunan pejabat yang lestari harus mempunyai prestasi yang lebih baik untuk semua kriteria Kualiti Persekitaran Dalaman yang saya harapkan	192	1	5	4.35	.709

D3 - A poor (IEQ) can create stressful feelings on the occupants' expectation of the environment/ (IEQ) yang lemah dapat menimbulkan perasaan tertekan pihak penghuni terhadap jangkaan mereka kepada persekitaran tersebut	192	2	5	4.28	.680
D4 - Personal or psychosocial factors beyond environmental parameters influence occupants' expectation of the quality of indoor environment/ Faktor peribadi atau psikososial di luar parameter persekitaran mempengaruhi jangkaan penghuni terhadap Kualiti Persekitaran Dalaman	192	2	5	4.14	.713
D5 - Types of work forces in office building influenced occupants' expectation towards Indoor Environment Quality/ Jenis-jenis tenaga kerja di bangunan pejabat juga mempengaruhi jangkaan penghuni terhadap Kualiti Persekitaran Dalaman	192	2	5	4.16	.724
Valid N (listwise)	192				

Perceived Performance

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
E1 - Good Indoor Environment Quality can help occupants be more productivity at workspace and improve work performance / Kualiti Persekitaran Dalaman yang baik dapat membantu penghuni menjadi lebih produktiviti di ruang kerja dan meningkatkan prestasi kerja	192	3	5	4.28	.609
E2 - The available standard guidelines of indoor environment quality to improve satisfaction of occupants in the office building / Garis panduan standard Kualiti Persekitaran Dalaman yang tersedia adalah untuk meningkatkan kepuasan penghuni di bangunan pejabat	192	2	5	4.13	.789
E3 - Indoor environment quality influenced social, organizational aspect, lifestyle and individual factor in office building / Kualiti Persekitaran Dalaman mempengaruhi aspek sosial, organisasi, gaya hidup dan faktor individu di bangunan pejabat	192	2	5	4.20	.706

E4 - A good indoor environment quality in office building can help employees reduce their sick leave due to workplace health problem / Kualiti Persekitaran Dalaman yang baik di bangunan pejabat dapat membantu pekerja mengurangkan cuti sakit mereka kerana masalah kesihatan di tempat kerja	192	2	5	4.21	.695
E5 - Indoor Environment Quality should help employees improve their work performance in the office / Kualiti Persekitaran Dalaman akan membantu pekerja meningkatkan prestasi kerja mereka di pejabat	192	2	5	4.29	.685
Valid N (listwise)	192				

Occupant Satisfaction

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
F1 - I satisfied overall Indoor Environment Quality in my office building / Saya berpuas hati dengan Kualiti Persekitaran Dalaman di bangunan pejabat saya	192	1	5	4.18	.779
F2 - I believed factor of indoor environment quality in my office building influenced my productivity, health and wellbeing / Saya percaya factor-faktor Kualiti Persekitaran Dalaman bangunan pejabat saya mempengaruhi produktiviti, kesihatan dan kesejahteraan saya	192	3	5	4.28	.632
F3 - I believe that factors Indoor Environment Quality in office building affect the productivity, health and wellbeing of the occupants in the building / Saya percaya bahawa faktor-faktor Kualiti Persekitaran Dalaman bangunan pejabat memberi kesan kepada produktiviti, kesihatan dan kesejahteraan penghuni di bangunan tersebut.	192	3	5	4.34	.567

F4 - According to my overall experience in the office building, I personally satisfied with performance Indoor Environment Quality regarding to my perceive work performance / Berdasarkan keseluruhan pengalaman saya di bangunan pejabat, saya berpuas hati dengan prestasi Kualiti Persekitaran Dalaman berkaitan dengan prestasi kerja saya	192	1	5	4.15	.701
Valid N (listwise)	192				

iii.   Reliability Test

      Building Features

```
RELIABILITY
  /VARIABLES=B1ThemovementofairregardingIndoorAirQualityinmyworkplaceisapprop
    B2ThestandardtemperaturesetinmyworkplaceissufficientSuhustandard
    B3Theacousticarrangementinmyofficeisverysatisfyingandadequate.Ga
    B4Thelightingconditionsinmyworkplaceintermsofbrightnessandcolora
    B5ThecleanlinessserviceinmyworkplaceisverysufficientPerkhidmatan
  /SCALE('ALL VARIABLES') ALL
  /MODEL=ALPHA
  /STATISTICS=DESCRIPTIVE SCALE
  /SUMMARY=TOTAL.
```

Reliability

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	192	100.0
	Excluded[a]	0	.0
	Total	192	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.865	5

Reliability

Scale: PERSONAL EXPERIENCE

Case Processing Summary

		N	%
Cases	Valid	192	100.0
	Excluded[a]	0	.0
	Total	192	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.877	5

Reliability

Scale: OCCUPANTS EXPECTATION

Case Processing Summary

		N	%
Cases	Valid	192	100.0
	Excluded[a]	0	.0
	Total	192	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.800	5

Reliability

Scale: PERCEIVED PERFORMANCE

Case Processing Summary

		N	%
Cases	Valid	192	100.0
	Excluded[a]	0	.0
	Total	192	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.753	5

Reliability

Scale: OCCUPANTS SATISFACTION

Case Processing Summary

		N	%
Cases	Valid	192	100.0
	Excluded[a]	0	.0
	Total	192	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.756	4

iv.   Correlation Analysis

Correlations

Correlations

		TBF	TPEX	TOE	TPP	TOS
TBF	Pearson Correlation	1	.879**	.496**	.455**	.687**
	Sig. (2-tailed)		.000	.000	.000	.000
	N	192	192	192	192	192
TPEX	Pearson Correlation	.879**	1	.478**	.418**	.716**
	Sig. (2-tailed)	.000		.000	.000	.000
	N	192	192	192	192	192
TOE	Pearson Correlation	.496**	.478**	1	.690**	.522**
	Sig. (2-tailed)	.000	.000		.000	.000
	N	192	192	192	192	192
TPP	Pearson Correlation	.455**	.418**	.690**	1	.589**
	Sig. (2-tailed)	.000	.000	.000		.000
	N	192	192	192	192	192
TOS	Pearson Correlation	.687**	.716**	.522**	.589**	1
	Sig. (2-tailed)	.000	.000	.000	.000	
	N	192	192	192	192	192

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

v.   Regression Model Analysis

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	.876	.229		3.822	.000
	TBF	.091	.074	.120	1.233	.219
	TPEX	.343	.070	.467	4.895	.000
	TOE	.010	.068	.010	.153	.878
	TPP	.373	.071	.333	5.241	.000

a. Dependent Variable: TOS

a) Building Features and Occupant Expectation

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	2.855	.180		15.835	.000
	TBF	.366	.047	.496	7.865	.000
a. Dependent Variable: TOE						

b) Personal Experience and Perceive Performance

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	3.209	.171		18.815	.000
	TPEX	.274	.043	.418	6.334	.000
a. Dependent Variable: TPP						

c) Occupant Expectation and Perceived Performance

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.566	.207		7.551	.000
	TOE	.636	.048	.690	13.137	.000
a. Dependent Variable: TPP						

d) Occupant Expectation and Occupant Satisfaction

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.898	.274		6.936	.000
	TOE	.539	.064	.522	8.440	.000
a. Dependent Variable: TOS						

e) Perceived Performance and Occupant Satisfaction

Coefficients[a]

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	1.373	.282		4.866	.000
	TPP	.660	.066	.589	10.053	.000

a. Dependent Variable: TOS

```
REGRESSION
  /MISSING LISTWISE
  /STATISTICS COEFF OUTS R ANOVA
  /CRITERIA=PIN(.05) POUT(.10)
  /NOORIGIN
  /DEPENDENT TOS
  /METHOD=ENTER TBF TPEX TOE TPP
  /SCATTERPLOT=(*ZRESID ,*ZPRED)
  /RESIDUALS NORMPROB(ZRESID).
```

Regression

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	TPP, TPEX, TOE, TBF[b]	.	Enter

a. Dependent Variable: TOS

b. All requested variables entered.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.786[a]	.618	.610	.32682

a. Predictors: (Constant), TPP, TPEX, TOE, TBF

b. Dependent Variable: TOS