DEVELOPING A MOTIVATION FRAMEWORK FOR RETROFITTING BUILDINGS IN CONSTRUCTION INDUSTRY

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A project report submitted in partial fulfilment of the requirements for the award of Bachelor of Science (Hons.) Quantity Surveying

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DECLARATION

I hereby declare that this project report is based on my original work except for citations and quotations which have been duly acknowledged. I also declare that it has not been previously and concurrently submitted for any other degree or award at UTAR or other institutions.

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APPROVAL FOR SUBMISSION

I certify that this project report entitled **"DEVELOPING A MOTIVATION FRAMEWORK FOR RETROFITTING BUILDINGS IN CONSTRUCTION INDUSTRY"** was prepared by **SOO ZI HAO** has met the required standard for submission in partial fulfilment of the requirements for the award of Bachelor of Science (Hons.) Quantity Surveying at Universiti Tunku Abdul Rahman.

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ABSTRACT

Climate change is one of the biggest threat for future development which caused by the emission of greenhouse gas where construction industry is one of the contributors to the emission of greenhouse gas to the environment. "Green Building" is constructed to reduce the impact of buildings industry to the environment yet the impacts from the increasing number of old existing buildings in Malaysia did not resolve. Green retrofit is a potential solution to reduce the negative impacts of existing building to the environment. However, the practice of retrofitting the existing building is unpopular in Malaysia. Most of the previous studies mainly focused on the benefits and barriers on implementing green retrofit but limited studies research on the motivation factors required to influence the stakeholders to practise buildings retrofit. Hence, the main purpose of this study is to investigate the drivers to influence the execution buildings retrofit and develop a preliminary motivation framework to promote the practice in Malaysia. Literature review was carried out to determine the motives triggering the initiation of buildings retrofit in construction industry. The motives are grouped under four factors which are social, technical, environmental and economic. Questionnaires were designed and distributed to 120 buildings' owners and 120 buildings' occupants to identify the agreement level on the initiatives to pursue buildings retrofits. In return, 90 sets were collected from the respondents. The data collected were analysed by using Measure of Central Tendency to show the ranking of each motives. The findings revealed that social factor is the crucial motivation factor agreed by both buildings' owners and occupants to initiate green retrofit. The buildings' owners ranked **A3** = "improve corporate image", **C4 = "**attract higher occupancy rates" and **A1** = "improve occupant comfort and health" as the three highest motives whereas **A1** = "improve occupant comfort and health", **C4 = "**attract higher occupancy rates" and **C1** = "Increase property value" ranked as the three highest by the occupants. Mann-Whitney U Test showed that there was a significant difference between the buildings' owners and occupants on the intention to provoke the practice of retrofitting. A preliminary motivation framework was proposed in this research. The findings could be disseminate to the Malaysian Government, professional bodies and related green body to promote the practice of green retrofit.

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LIST OF SYMBOLS / ABBREVIATIONS

COP15	15th Conference of Parties
CSR	Corporate Social Responsibility
EPF	Employees Provident Fund
GBI	Green Building Index
ROI	Return on Investment
SPSS	Statistical Package for the Social Science
UBBL	Uniform Building ByLaws
UN	United Nations
$GtCO_2$	Gigatonnes of carbon dioxide
n	Sample size
N	Population size
e	Margin error
α	Cronbach's Alpha

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CHAPTER 1

INTRODUCTION

1.1 General Introduction

The first chapter presents an overview of this research which covered the background of study, problem statement, research aim, research objectives, research methodology and scope of this research.

1.2 Background of the Study

Climate change is often viewed as one of the threats for future development which is caused by the greenhouse gas emission (Earth Science Communications Team, 2018). According to Global Status Report 2017 by UN Environment and International Energy Agency (2017), construction industry accounted for 36 % of global final energy use and 39 % of energy-related carbon dioxide emissions. The report revealed that the carbon dioxide emissions from building industry grew from 3.1 gigatonnes of carbon dioxide ($GtCO_2$) in 2010 to 3.7 $GtCO_2$ in 2016. The environmental impact caused by building industry is startling. This further indicated that construction industry is one of the contributors of greenhouse gas emission to the environment. The construction process includes the manufacture, production and transportation of building materials, and commencement of constructing work on site. This construction process is an important contributor of greenhouse gas emission to the environment (Yan, et al., 2010). An extreme quantity of greenhouse gas may lead to climate change which is the biggest threat to the environment.

"Green Building" is constructed to reduce the negative impacts of construction activities and buildings to the environment. The development brings green effect throughout the project lifecycles from planning, design, construction and maintenance stages. In Malaysia, Green Building Index (GBI) is a recognized green rating tool for the assessment of green building (Green Building Index, 2019). GBI is developed based on the overseas rating tools such as the Singapore Green Mark and the Australian Green Star system. In order to classify a building as a green building, there are certain requirements to be achieved in different stages. Dwaikat and Ali (2018) discovered that the average annual energy saving of green building is around 412,533kW h/year which may equivalent to a cost saving of 41,327 $/year. Yet, the construction of new

green buildings is insufficient to minimize the building impacts to the environment. The building stock is dominance with existing buildings. The secondary building market is bigger than the primary market as buildings are durable and have long life cycle. Rahmat, Torrance and Ezanee (2003) stated that there was a phenomenon of increasing number of old existing buildings in Malaysia, therefore, retrofitting to existing buildings is a feasible way to reduce the environmental impact caused by the existing buildings.

Green retrofits are viewed as one of the potential solutions to enhance the performance and sustainability of the existing buildings in order to solve the environmental impacts caused by existing buildings (Li, et al., 2017). After a certain period of time, the existing buildings will experience tear and wear which require maintenance and repair. It often costs higher, thus, it is not an effective way to preserve the appearance and performance of the existing buildings in the long-term. Moreover, existing buildings are often not built sustainably. The energy and indoor performance of these existing buildings are not up to the current standard. Ahmed and Nayar (2008) articulated that the existing buildings with energy efficient practices in Malaysia can achieve 15-25 % reduction of energy consumption. It is important to upgrade the energy performance of the existing building in order to comply with the latest standards as current new build (Power, 2008).

The benefits of building retrofitting are enormous. Ma, et al. (2012) stated that retrofitting an existing building can achieve sustainability by reducing the consumption of energy and emission of greenhouse gas. Jin, et al. (2014) mentioned that green retrofit of existing building plays an important role to the environment protection in term of energy saving and emission of greenhouse gas. Retrofitting an existing building is both lower cost and lesser impact than demolition and constructing a new building from empty space (Power, 2008). Refurbish and retrofit the existing buildings can preserve the original structure of the buildings. The period for retrofitting is faster than new build because upgrading a building is faster than starting from scratch. Furthermore, retrofitting an existing building cost lesser than demolish and re-construct a new building (Jagarajan, et al., 2017) due to the shorter time needed to retrofit than re-construct.

In view of that, promoting the green retrofit on existing buildings is a potential way to reduce the negative impacts of existing buildings to the environment. Hence, this study dedicates the focus on the retrofitting of existing buildings.

1.3 Problem Statement

Retrofit an existing building not only beneficial to the environment and human health but also harvest many other advantages from the market and industry benefits such as reduce the vacancy period and growing demand by the tenants (Ashuri and Durmus-Pedini, 2010). Retrofit the existing buildings can tackle the global environmental issues and improve the value of the old existing buildings at the same time. A case study by Ferreira, Pinheiro and De Brito (2015) investigated the economic and environmental savings of retrofitting. The results indicated that retrofitting was more environmental friendly and had lesser competitive in cost than new-build.

In a paper published by Ma, et al. (2012) listed the generic building retrofit problems. One of the main problems is each of the buildings has different characteristics. It is important to study and explore before retrofitting. The measures used in one building may not suitable for another building (Hou, et al., 2016). Jagarajan, et al. (2017) articulated that green retrofitting of existing buildings has various challenges in the aspects of environmental, social and economic. On the other hand, Li, et al. (2017) stated there were a lot of inconsistent risks involved in the whole process of retrofitting. Often, the owner or developer and the contractor are the main parties to consider all the challenges and risks in the whole process of retrofitting of the existing building.

It is noticeable that most of the existing studies focused on the benefits of building retrofitting (Ashuri and Durmus-Pedini, 2010; Jin, et al., 2014; Jagarajan, et al., 2017) and barriers or challenges of building retrofitting (Ma, et al., 2012; Jagarajan, et al., 2017). However, limited studies focused on the motivations required in order to initiative green retrofit. Green retrofit is unpopular in the construction industry and Jagarajan, et al. (2017) articulated that the practice of retrofitting the existing buildings is still unclear among the stakeholders. The decision to initiative retrofit is very important in order to achieve sustainability in built environment. The different concerns or requirements especially from the owners and the occupants of the buildings have not been investigated in detail in order to magnify the proposal of green retrofitting to the existing buildings.

The owners and the occupants of the buildings have different perceptions and requirements on pursuing the retrofitting of the existing buildings. For instance, the building's occupants are the party who occupied the buildings and working or staying in the buildings. The condition and ambience of the existing buildings are well known

by the occupants. Contrastingly, most of the retrofit decisions made by the owners of the property. In order to initiative retrofit, the owners of the property have different considerations that need to be investigated in detail. Hence, different requirements of the owners and occupants can be analysed in detail before retrofitting. By doing this research, the motives required by the owners and occupants to pursue green retrofit can be identified in detailed and a strategy of motivation can be provided to promote the retrofitting of existing buildings.

1.4 Research Aim

The intention of this study is to develop a preliminary motivation framework for pursuing building retrofits.

1.5 Research Objectives

In order to achieve the research aim, three research objectives have been formulated.

(i) To identify a list of motives that can be used to encourage the building owners and occupants to initiate sustainable retrofit.

(ii) To compare the ranking of motives between building owners and occupants in commencing sustainable retrofit.

(iii) To propose a preliminary motivation framework which incorporating different motives for initiating sustainable building retrofit.

1.6 Research Methodology

This research begins with the review of previous researches related to the green retrofitting of existing buildings. A list of motivation factors was identified and grouped into 4 groups, which are social factor, environmental factor, economic factor and technical factor. Next, questionnaires were designed and distributed to two groups of respondents, which are property owners and occupants of commercial office buildings. The results were analysed by using Cronbach's Alpha Reliability Test, Measures of Central Tendency and Mann-Whitney U Test. The summary of the research approaches is presented in Figure 1.1.

Phase 1	**Phase 2**
Literature Review	Data Collection: Questionnaire Survey Distribution
Description: Objective 1 can be achieved by using literature review to identify the motives required by the stakeholders to initiate retrofitting.	**Description:** Objective 2 and 3 can be achieved through the analysis of responses from the respondents by collecting the questionnaires. The highest mean ranking showed the desired motives by the respondents. Mann-Whitney U Test indicates the statistical differences between the building's owners and occupants.

Figure 1.1: Summary of Research Approaches

1.7 Research Scope

This study focuses on the different perspectives and requirements of the building owners and occupants to initiate the sustainable retrofit in commercial buildings which are office buildings. Other types of buildings are not covered in this research.

Furthermore, this research is focused on the owners of commercial buildings such as the developers in Kuala Lumpur due to the time and cost constraint in conducting this research. Whereas, the buildings' occupants who stayed or worked in the commercial office buildings are focused at Cheras due to the dominance of old buildings in this area.

1.8 Chapter Outline

This research study consists of five chapters. Firstly, chapter one is the introduction part of the research. This chapter includes the background of the study, research problem, research aim, research objectives, research methodology, scope, outline of the chapter and the summary.

Chapter two provides a detailed discussion on buildings retrofitting. The motives required for the stakeholders to initiate buildings retrofit are defined based on the review of previous researches. The theory and framework regarding the motives affecting the intention are discussed in this chapter.

Chapter three describes how the study was designed and conducted to achieve the aim and objectives of the study. It includes research design, justification, strategy, data collection process and analysis methods.

Chapter four presented the results collected from questionnaire surveys. The findings were presented and compared with previous studies.

Lastly, chapter five concludes the research by declaring the achievements of the research objectives. The contribution of this research to the body of knowledge and the industry has defined. At the end of this chapter, research limitations and recommendations are proposed for future research.

1.9 Chapter Summary

To sum up this chapter, there was a gap knowledge on the initiatives and motives on pursuing the green retrofits which lead to the focus of this study. A research aim and three research objectives were proposed. Furthermore, the methodology of this research had been detailed in the subsection. Lastly, the chapter outline listed the main content of each chapter.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter compiles the review of relevant literatures on the significance of green retrofitting and the requirements for the owners and occupants of commercial buildings to pursue green retrofit.

2.2 Green Retrofitting

Green retrofitting is one of the methods to be used in green development. The main purpose of green retrofitting is to sustain the environment by applying the green features and improving the performance or functions of the existing buildings.

2.2.1 What is Green Retrofit?

Green building development was introduced to construction industry more than a decade ago (Ashuri and Durmus-Pedini, 2010). Green building development is a potential solution for the preservation and conservation of the environment. In the industry, the stakeholders are not having the same level of awareness about the green building practices. The lack of knowledge or the confusion between the stakeholders may affect the decision to initiate green development.

According to Ayyad and Fekry (2016), green 'retrofitability' is a latest term to explain the ability of the buildings to be greened. Green retrofit can also be defined as the incremental improvement of the function and performance of the existing buildings with the intention of improving the energy efficiency and carbon emission reduction (Liang, Peng and Shen, 2016). Modification or conversion works are involved in the retrofitting process. The modification may include the addition, deletion, rearrangement or replacement of one or more elements of the buildings. The main purpose of all the modification works is to lengthen the life span of the existing buildings and increase the sustainability to the environment.

2.2.2 Why Green Retrofit?

Building industry is responsible for an approximate a quarter of the total global carbon dioxide contribution, which will bring the impacts to the environment and affect the

health of human (Hong, et al., 2015). Hence, developing the green buildings for the reduction of energy consumption as well as protecting the environment is a serious task for the future generation.

In the construction industry, the building stocks consist of existing buildings and newly constructing projects where the aged existing building stocks contributed to the main portion of the total stocks. According to Ma, et al. (2012), the existing buildings will undergo degradation in terms of performance and functions after experience a certain period of life cycle. Some buildings were built without the sustainable considerations during the early period and may not achieve the standard performance requirements as compared to new buildings. In order to upgrade the aesthetic and performance functions of aged existing buildings, retrofitting the existing buildings is the key to a sustainable future. Therefore, green retrofit to the existing buildings should be focussed to achieve the sustainable development.

2.3 Review of Existing Theoretical Framework

This topic discusses the existing theories that can be used as a guide in the development of motivation framework for this research. Thaichon and Quach's Dark motives-counterfeit purchase framework is discussed in following sub-section.

2.3.1 Thaichon and Quach's Dark motives-counterfeit purchase framework

Thaichon and Quach's Dark motives-counterfeit purchase framework was developed as a motivation framework. It explained the motivation on buying through the online technology. The framework included the motives for the parties to buy the online products. The framework consists of 16 motives that can be related to stimulate people to purchase online which included nine external and seven internal drivers. Figure 2.1 shows the dark motives-counterfeit purchase framework by Thaichon and Quach (2016).

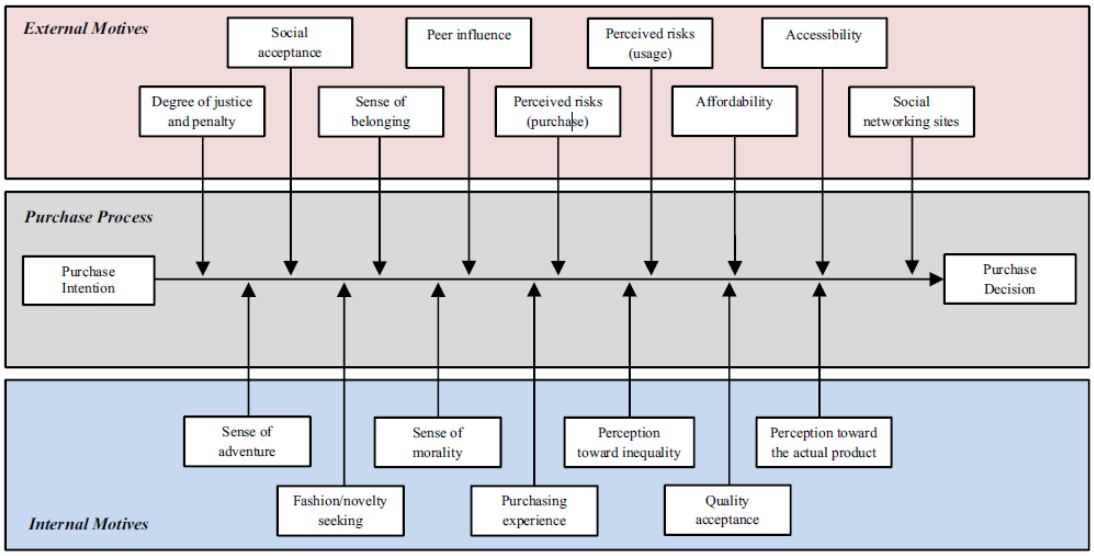

Figure 2.1: Dark Motives-counterfeit Purchase Framework

(Thaichon and Quach, 2016)

The framework was developed to capture and investigate the purchaser's internal and external motives to purchase those counterfeit goods by the online stage (Thaichon and Quach, 2016). This indicated that the intention must occur before making a decision. Also, the intention of a person may be affected by other factors or motives before making a decision. There was still a distance between the intention and the decision making stage, and the factors or motives affect the ending of the process whether to act or not. The purchase process in the framework can be used as a model to develop the motivation framework in this study because the intention to pursue retrofitting of buildings should exist prior to the decision making.

The purchase framework discussed is contributing in the development of motivation framework to pursue retrofitting of existing buildings. In the decision making process, the stakeholders are affected by different motives after having the intention to do so. This research aims to investigate the motives for the owners and occupants of the existing buildings to make a decision for pursuing retrofit of existing buildings. After the analysis, a motivation framework can be generated according to the results showing the main motives to interfere the stakeholders to make the decision.

2.4 Requirements and motives of owners and occupants

The stakeholders of green retrofit are the individuals who are directly or indirectly vested or financially gain as the result of a green retrofit project. Liang, Shen and Guo

(2015) stated that the owners and the occupiers of the existing buildings played an important role in the decision making for green retrofits. At the very early stage, the owners and the occupiers would involve to exchange and discuss the opinions regarding the operation of retrofitting. Due to the insufficient information and knowledge between the stakeholders, there is a perception or mind-set of the extremely high cost of green development would overweigh the benefits of this operation. In a nutshell, the stakeholders play an important role to kick-start the decision of green retrofitting.

The role of the owners normally can easily be understood whereas the role of the occupiers or the tenants normally will be underestimated. Juan, et al. (2009) indicated that the involvement of the occupiers is important but it makes the retrofit process more difficult and challenge. For the new-build project, the owners have the full decision making to decide whether to build or not. Contrastingly, the owner has to consider about the satisfaction of the occupiers because the satisfaction of the occupiers may affect the occupancy rate and rental of the building (Liang, Peng and Shen, 2016). At the beginning stage of deciding green retrofitting, the owners and occupants commonly are interrupted because most of them cannot reach to a resonate consensus. Ma, at al. (2012) presented that the early phase of deciding whether to retrofit a building. The analysis of the requirements and concerns between the owners and occupants is fundamental to determine whether to retrofit or not. The requirements for the owners and occupants to pursue green retrofit are different in terms of different aspects such as social, economic, environmental and technical. Hence, it requires a detailed study on it.

A list of motives which can be used as motivating force to encourage retrofitting among the owners and occupants were tabulated in Table 2.1. Table 2.1 tabulated a list of previous studies regarding the motives for the stakeholders to pursue green retrofit to the existing buildings and clarified the requirements and motives needed by the owners and occupants to practice green retrofit.

Table 2.1: List of Requirements or Motives on Pursuing Green Retrofit

No	Requirements or Motives	Previous Studies																			
		Ashuri and Durmus-Pedini (2010)	Eichholtz, Kok and Quigley (2010)	Miller and Buys (2011)	Leung (2018)	Ferreira, Pinheiro and De Brito (2015)	Khairi, Jaapar and Yahya (2017)	Zhou, et al. (2016)	Juan, Gao and Wang (2010)	Jiang, Huang and Wei (2010)	Li, et al. (2017)	Sun, Gou and Lau (2018)	Abdallah and El-Rayes (2015)	Regnier, et al. (2018)	Liu, et al. (2018)	Kontokosta (2016)	Li, Chen and Feng (2017)	Liang, Peng and Shen (2016)	Fuerst and McAllister (2011)	Entrop, Brouwers and Reinders (2010)	Chidiac, et al. (2011)	Menassa (2011)
1.	Social Factor																					
a)	Improve occupant comfort and health	/	/	/	/	/	/															
b)	Attract and retain employees	/	/	/																		
c)	Improve corporate image		/			/																
2.	Environmental Factor																					
a)	Reduce energy consumption		/				/	/	/	/	/	/	/	/	/	/	/					
b)	Minimize construction waste					/							/									

Table 2.1 (Continued)

3.	Economic Factor																					
a)	Increase property value	/	/			/									/							
b)	Operating cost reduction	/					/					/		/	/	/						
c)	Business expenses reduction	/																/				
d)	Attract higher occupancy rates		/			/										/			/			
e)	Increase return on investment (ROI)																			/	/	
f)	Reduce maintenance cost	/														/						
g)	Reduce building life cycle cost																			/		/
4.	Technical Factor																					
a)	Facilitate passive design											/										
b)	Reduce failure risk	/														/						
c)	Achieve regulatory requirements	/																				
d)	Comply with legistration policy	/																				

2.4.1 Social Factor

According to Organ, Proverbs and Squires (2013), social factor is one of the crucial factors that can be used to motivate the stakeholders to pursue retrofitting. Social factor covers the need of everyone, which included the occupants, tenants and workers (Harris & Holt, 1999). The social motives are discussed at the following sub-section.

2.4.1.1 Improve occupant comfort and health

Leung (2018) identified that the occupants of buildings have their expectations on the requirements of thermal, visual, acoustic comfort and indoor air quality. This indicated that the occupants are anticipated to work or stay at a comfortable and safe environment.

Ma, et al. (2012) stated that the existing buildings will undergo degradation after a period of time. The degradation of buildings leads to the fall of building quality. The failure of the building functions may bring the occupants to danger. For an example, the old wiring may cause fire to the buildings or the occupiers would have a high tendency to get an electric shock due to the unacceptable safety standard of degraded wiring. The quality of the building internal environmental condition can be improved due to the newly renovated operation (Ferreira, Pinheiro and De Brito, 2015).

2.4.1.2 Attract and retain employees

Ashuri and Durmus-Pedini (2010) indicated that improving the employee health is not only an ethical act but also directly lead to monetary value and affect the productivity and profit indirectly. The energy savings for the green building can be measured by a proper calculation but the relationship between the employees' productivity and the indoor environment quality is hidden and more complicated (Eichholtz, Kok and Quigley, 2010). The employees tend to work more effectively in a comfortable environment. Miller and Buys (2011) indicated that the staffs are more excited to work at the place which is attractive, pleasant and comfortable. This can directly affect the attendance of the employees and increase their work productivity. Thus, this can motivate the owners to retrofit the existing buildings in order to maximize their productivity.

2.4.1.3 Improve corporate image

The appearance of the commercial building would affect the reputation of the company. A favourable reputation of the organisation can attract more investors or charge a premium price to the clients (Eichholtz, Kok and Quigley, 2010). Hence, the corporate image or reputation describes the manner of the company by the outsiders. In this competitive world, many businesses are trying to create a better in order to attract more investors and customers. The investors or customers tend to invest in those companies with reputable views and images.

Sunway Putra Mall in Malaysia is a good example of the integrated development project with refurbishment. A complex called The Mall located at Jalan Putra was built in 1987 but after two decades, the mall has a new owner which is Sunway Group. Sunway Group decided to retrofit the complex to a newly integrated development. The retrofitting works were completed in February 2015 and reopened on 28 May 2015 (Samuel, 2016). After the retrofitting, Sunway Putra Mall won the award for the best Shopping Centre under Integrated Shopping Centre category (Retail Asia, 2018). The award was promoted Sunway Putra Mall to the public and tourists which increased the image of the shopping complex. Furthermore, the shopping mall had achieved to 90.2 % occupancy rate which attracted the international, regional and national retail brands and food and beverage outlets.

By retrofitting existing buildings, it does not only improve the appearance of the buildings but also the images for the companies. Sunway Group presented a good case that retrofitted The Mall to Sunway Putra Mall and coincidently, the image of the company affected due to the better performance and reputation which attracted more occupants, tourists and also investors.

2.4.2 Environmental Factor

Environmental factor can be identified to motivate the stakeholders to initiate green retrofit. The main purpose of the green development is to sustain and preserve the environment. This indicates that the condition of the environment needed to be considered in the operation.

2.4.2.1 Reduce energy consumption

Reduction of energy consumption is identified as one of the main purposes of pursuing green building development and green retrofitting. The investment in energy

efficiency during the retrofitting period can save the extra resources and cost expended on the energy usage and operating cost (Eichholtz, Kok and Quigley, 2010). The annual total electricity consumption of buildings after retrofitted for heating, cooling and lighting purposes was reduced (Zhou, et al., 2016). This condition allows the occupants and owners to enjoy the comfortable working environment with minimum energy consumption. One of the most sustainable and effective measures to create a sustainable building is improving the energy performance of the existing buildings (Juan, Gao and Wang, 2010). Jiang, Huang and Wei (2010) stated that the average reduction of energy usage in most large scale commercial buildings is generally over 30 %. Hence, retrofitting of the existing building can reduce the energy consumption and minimize the environmental impacts. This could be served as one of the motivations for the stakeholders to pursue retrofit.

2.4.2.2 Minimize construction waste

Construction industry generates a large amount of waste to the environment throughout the project life cycle. For instance, in United Kingdom, 200 million tonnes of waste were generated in 2012 and half of this percentage was contributed from the construction industry (Department for Environment Food & Rural Affairs, 2015). However, most of the construction wastes can be reused or recycled. If the existing building was demolished, the demolition wastes of the building would most probably send to landfills.

Furthermore, one of the main materials to produce concrete is cement. According to Greenspec (2018), cement production is emitting a high level of carbon dioxide as it contributed 4 to 5 % of the worldwide total emission of carbon dioxide. The lesser the use of cement, the lesser the production needed to supply the market. Thus, retrofitting an existing building consumes less raw material and thus, it will protect natural resources.

2.4.3 Economic Factor

Retrofitting of the existing buildings yield better than demolition (Power, 2008). However, the previous studies had proved that retrofitting is economically and environmentally positive as compared to re-construction (Ferreira, Pinheriro and De Brito, 2015). The following sub-section discusses the economic factors that may motivate the owners and occupants to initiate green retrofit.

2.4.3.1 Increase property value

Green retrofit could enhance the property value of the building. Eichholtz, Kok and Quigley (2010) expressed that improving an existing building to a green building can increase the capital value by approximate 16 %. This is due to the functions of the building had been improved to a higher standard through the retrofitting operation. The appearance and the performance of the building would affect the property value. There is a potential of property value increase due to the upgraded appearance of the building (Ferreira, Pinheiro and De Brito, 2015). Investors would invest in a building that has a better appearance as compared to those older buildings. Retrofitting an existing building brings future benefits to the building owner because it can have a higher sales value when the building is eventually sold in the future (Ashuri and Durmus-Pedini, 2010). This indicated that the owner can sell the building at a higher price after retrofitting.

2.4.3.2 Operating cost reduction

One of the motivation factors for initiating green retrofit is to reduce operating cost. Ashuri and Durmus-Pedini (2010) specified that the energy cost contributed 30 % to the operating cost of a building. The operating cost of a building can be reduced with effective energy performance. This potential can be achieved by having an adequate energy efficient practice.

Sun, Gou, and Lau (2018) discovered that there is an additional cost due to the green features designed for active energy efficiency but the initial investment cost can return to the owner in a longer payback period. For an instance, the better heat insulation from the window grazing can reduce the heat transmitted into the building from external area of the building. This can lead to a decrease of the operating cost on the air conditioner (Liu, et al, 2018). The cost saving from the better energy performance can allow the employer to invest in the other business aspects.

2.4.3.3 Business expenses reduction

Ashuri and Durmus-Pedini (2010) stated that 78 % of the total business expenses are employee wages and benefits. The employer should consider the working environment for the employees in order to reduce the absenteeism of employees or increase the employees' productivity. The absenteeism of employees would increase the expenses of the company because the absenteeism may decrease the productivity of the company.

The company need to bear with all the costs and expenses when the employees are not productive due to absent from work. However, buildings retrofit could improve the working environment and the internal comfort of buildings' occupants. It is indirectly reduces the business expenses.

Liang, Peng and Shen (2016) stated the income of the owner may come from the increase of building value, reduction of cost on energy consumption and cost saving on the maintenance. All of these benefits can be achieved by retrofitting of the existing buildings. The better performance of the building after retrofitting, the income of the owner may increase due to the abovementioned benefits.

2.4.3.4 Attract higher occupancy rates

Fuerst and McAllister (2011) indicated that the occupancy rate of a building is positively related to the green features of the building. The proper design of green features in the building can improve building occupants comfort.

The rental of the building may increase after retrofitted as the tenants are willing to pay an acceptable rent for the retrofitted existing buildings (Ferreira, Pinheiro and De Brito, 2015). As a result, occupancy rate increases due to the improvement in terms of appearance and internal environment of the buildings. Although the rental has increased, the tenants are willing to pay due to the good indoor environmental quality. Consequently, it enhances the productivity of the employees which directly increases the income of the business (Eichholtz, Kok and Quigley, 2010). Thus, this could encourage more stakeholders to retrofit the existing buildings.

2.4.3.5 Increase return on investment (ROI)

The cost of implementing the retrofit process is normally paid by using a loan from bank or other institution (Chidiac, et al., 2011). This can relate to the return on investment. The return on investment commonly emphasized in the payback period on each and every instalment of equipment or machinery. Chidiac, et al. (2011) stated that the energy retrofit measures such as improving the insulating system and lighting system applied to three buildings and the payback period were at the average of 9 years. This research indicated that the implementation of retrofit is effectively increased the return on investment.

Furthermore, Entrop, Brouwers and Reinders (2010) identified that the initial investment cost to retrofit a building may cost a fixed amount but the total gains

accumulated from year by year will keep growing as the property value increase and the decrease on energy consumption. The increase in the return on investment can also be concluded as one of the motivations to initiate the retrofit work.

2.4.3.6 Reduce maintenance cost

Building is longevity due to its long life span but this does not mean that building can escape from the phenomenon of aging. According to Jafari and Valentin (2017), one of the main costs incurred along the life cycle of building was the maintenance cost of the building. This indicated maintenance cost contributed a large amount to the life cycle cost. Building maintenance is a very expensive process in both financial and environmental aspects (Puķīte and Geipele, 2017). The maintenance of a building is mainly to maintain the anticipated functions and appropriate performance of a building for its whole life cycle.

By having retrofitting to the existing building, the overall maintenance cost of the building may decrease. This is because the function and performance of the element in the building would be improved after retrofitted. Kontokosta (2016) stated that the timing of repair to the equipment and building element of the building would be extended, this indicated that the cost for the maintenance can be reduced.

2.4.3.7 Reduce building life cycle cost

The service life range of a building is in between 30 to 70 years and this is subject to the design itself (Menassa and Baer, 2014). Life cycle cost includes the pre-construction cost, post-construction cost, operation and maintenance cost and also the demolition cost (Entrop, Brouwers and Reinders, 2010). After a certain age, the functions and performance of the building are started to drop. The life cycle cost increased due to the high repair, operation and maintenance cost. Contrastingly, after the evaluation by Menassa (2011), the life cycle cost of the building can be reduced. This is because the maintenance cost for most of the building equipment and machineries can be cut down after retrofitting.

Sustainable retrofit can also improve the performance and function of the building and at the same time increase the building life. In a nutshell, having a sustainable retrofit, the life cycle cost of the building can be reduced while the life span of the building increased. This can also be one of the motivations for the owners and occupants to pursue sustainable retrofit.

2.4.4 Technical Factor

Technical factor can be related to the current technology or the main condition of existing value. The improvement of technology can facilitate the green retrofit and motivate the stakeholders to pursue due to the high advantages and benefits from utilizing the technology.

2.4.4.1 Facilitate passive design

McGee (2013) stated that passive design is the design of the building which considers the advantages of the condition of climate to maintain a good internal comfort. For an instance, the sunlight can direct into the building through the glazing. This can reduce the electric consumption to light up the internal building during day times. On the other hand, the use of overhang and shading is important because they can help to reduce the overheating of internal building temperature instead of applying the air-conditioning system. A good insulation system can be applied at the roof to reduce the heat transmitted into the building.

Proper passive design can minimize the use of active features that consume more energy to maintain the internal condition of the building. The use of active features is contributed to the energy consumption. However, the climate variation among different countries should be analysed before the implementation of passive design. Sun, Gou and Lau (2018) specified that the passive design should be carefully used in existing building retrofit to consider the cost and effectiveness due to the climate and density. The research had further estimated that 46.8 % of energy saving can be obtained after retrofitting with proper passive design. As such, effective passive design can reduce the cost of energy consumption.

2.4.4.2 Reduce failure risk

Building is longevity but after experience deterioration, the performance of the building may drop. The performance of the existing building experience degradation or failure over time (Ma, et al., 2012) such as the old wiring may cause fire, old plumbing may cause leaking and old ceiling may collapse. After certain periods, there will be wear and tear and this condition affects the safety and health of the building users.

For instance, the Employees Provident Fund (EPF) building located in Jalan Gasing, Petaling Jaya was caught on fire due to poor safety issue (NST Online, 2018).

Zolkepli (2018) stated that the cladding panels on the exterior use of the EPF building did not meet the fire safety requirements after investigated by the Fire and Rescue Department. The material used in the cladding panel was polyethylene which is flammable, the hot weather and strong wind were also the contributors in the incident.

Whereas, a fire incident was occurred at a school in Malaysia due to electric short circuit with old wiring which killed 21 students and two adults (Ahmad, Woon and Sidhu, 2017). The victims could not escape from the building due to the sealed windows. One of the two fire exits had also been blocked by the renovations on the second floor.

Thus, in order to reduce the accident rates, retrofitting the existing building could reduce the risk of building failure. During the process of retrofitting, most of the functions of the building especially old wiring or fittings can be replaced or repaired. The functions and safety of the building can be inspected at the same time. After the repairing work and building inspection, the risk of failure can be reduced. By doing that, it can ensure the safety of the users and also save the owners from high maintenance cost.

2.4.4.3 Achieve regulatory requirements

As above incident mentioned, the EPF building had used the flammable material as the exterior cladding panel. Zolkepli (2018) stated that using flammable materials as the cladding panels is a clear breach of the Uniform Building Bylaws (UBBL). Based on the news record, the building was built and served as the EPF headquarter for 35 years in 1960. In 2004, it underwent a renovation (Board, 2018). Perimbanayagam and Sidek (2018) stated that the flammable material used as the cladding panel was approved during the renovation. This further indicated that the building built at the previous time is no longer accomplishing the latest and recent regulations. The Fire and Rescue Department will not renew the fire certificates for the buildings which not meeting the latest requirements of the regulations.

However, by conducting retrofitting, an inspection can be conducted and those materials that are not meeting the latest regulatory can be recognized and replaced with suitable items. The regulations may change over time, the previous requirements may not comply with the latest regulatory. Thus, retrofit of the buildings is a good way to ensure the building performance is complying and meet the latest regulatory.

2.4.4.4 Comply with legistration policy

In order to achieve sustainability, various countries have already made some initiatives. For example, Malaysian government had voluntarily declared a goal of reduction of carbon dioxide emission up to 40 % by 2020 during the 15th Conference of Parties (COP15) in the United Nations Framework Convention for Climate Change in 2009 (The Sun Daily, 2016). Moreover, 17 Sustainable Development Goals were introduced by the United Nations in 2015. Sustainable Development Goals provide a global blueprint for dignity and also peace for the people and Earth. The shared visions are translated by the governments as the national development plans for the countries. 13th Sustainable Development Goal is to take the urgent action to handle the climate change (United Nations, 2018) caused by the emission of greenhouse gases where Yan, et al. (2010) stated that construction industry is a major contributor to the greenhouse gas emission. Hence, green retrofit to the existing buildings can reduce the emission of greenhouse gas compared to new-build (Ma, et al., 2012). In order to contribute in the reduction of carbon dioxide emission and achieve the goal set by the Malaysian government and United Nations, green retrofit of existing buildings is a potential way.

2.5 Proposed Motivation Framework

Previous studies were reviewed and a list of drivers to inspire the practice of green retrofit was determined. A motivation framework to pursue green retrofitting is proposed as shown in Figure 2.2. The preliminary motivation framework was adapted and modified from the Dark motives-counterfeit purchase framework (see Figure 2.1) which developed by Thaichon and Quach (2016). According to Thaichon and Quach (2016), the intention of a person is affected by a list of motives before making a decision. In order to proceed from having an intention to decision making, the motivating forces can be investigated to boost the course.

For this study, a motivation framework is proposed which consisted of four main factors: social, technical, economic and environmental. Moreover, 16 criteria have been identified under each factor. These four factors and 16 criteria have been recognized as main motives which that be used to trigger the decision of construction stakeholders to practice green retrofitting.

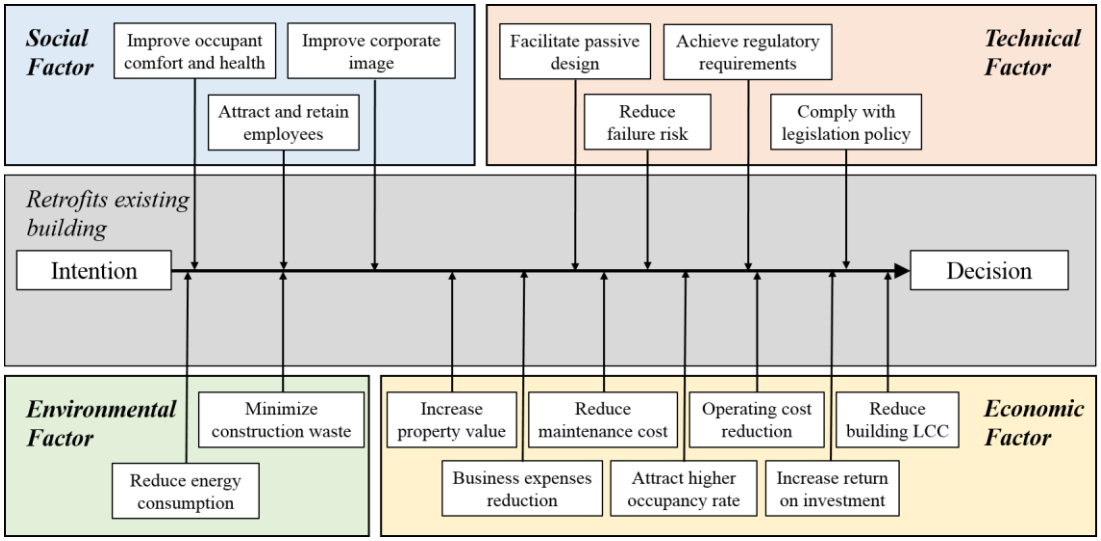

Figure 2.2: Proposed Motivation Framework to Pursue Green Retrofit

2.6 Conclusion

This chapter had explained the meaning of green retrofit and a few relevant theoretical theory in detail. The theoretical framework from previous research used to facilitate the development of motivation framework at the later stage was reviewed. Furthermore, the requirements or motives that may motivate the owners and occupants to initiate green retrofit were discussed in detail in this chapter.

CHAPTER 3

METHODOLOGY AND WORK PLAN

3.1 Introduction

This chapter describes the ways on how this research being carried out, encompassing the research method, process of literature review, data collection methods, formulation of questionnaire survey, sampling design and data analysis technique that been employed.

3.2 Research Method

The research design is a strategy to answer the questions of a research and different research will have different strategy to procure. The research design consists of the objectives from the research question, method of collecting data, analysis of the data collected and the limitations of the research study (Saunders, Lewis and Thornhill, 2009).

There are generally three types of research methods which are quantitative, qualitative and mixed method. Each method is likely to have different elements, processes and methods to achieve the objectives of the research. The nature of research study, method of collecting data and the availability of resources will affect the decision on choosing the types of method. Different research approaches will provide different directions and procedures in research design (Creswell, 2014).

3.2.1 Quantitative Research

Quantitative research focuses on the statistical analysis of the numerical data collected from the survey research (Saunders, Lewis and Thornhill, 2009). Quantitative research can be indicated as a deductive approach that using the statistical data to examine the theory. Some conditions which an inductive approach would be included by using the data to develop a theory.

Creswell (2009) stated that the quantitative approach involves complicated experiments with plenty of variables. Quantitative research observes the relationship between the variables. The variables are statistically measured and the data recorded is examined by using a wide range of graphical and statistical methods. The validity

of data has to be ensured and controlled. It is important to ensure all the respondents clearly understood the questions due to the data to be collected in a standard manner.

Quantitative research may use a single data collection technique such as distributing questionnaires and analyse the data collected. This method is recognized as a mono-method quantitative study. Whereas, a multi-method quantitative study is a quantitative research design that used more than one method for data collection.

One of the advantages of using the quantitative research method is the results generated by this method are reliable due to the participation of a large group of respondents. A numeric description is studied, provided with the sample of the population (Creswell, 2014). The sample of population must be counted in proper to ensure the reliability of data. The existing previous theories are examined by such large numbers of scale. The time taken for collecting the data is lesser due to the simple way or method for data collection such as distributing the questionnaire. Although a large number of people are being studied, the research data is easier to interpret.

There were some weaknesses of the quantitative research such as the existing theories or researches' theories may not able to reflect the actual understanding. The researchers may miss out the actual perception due to the fixed hypothesis and only focus on the theory they studied. The research result at the end might not be in-depth to the actual situation.

3.2.2 Qualitative Research

Qualitative research method requires the researchers to include the sense of subjective during the data collection process. This is interpretive due to the involvement of realistic, means the various perspective needed to be taken into account (Saunders, Lewis and Thornhill, 2009). Many researchers develop their theories with inductive approach and the natural perspectives would develop a new theory instead of the existing theory. On the other hand, there are also some researchers who proceed with deductive approach which will examine the existing theory by using qualitative data collection method.

The data collection method for qualitative method may vary according to the needs of research. All the data collection methods must consider the naturalistic and interactive of data. A single data collection method may be used for relevant research such as semi-structured interview or other analytical methods. This can be known as

mono-method qualitative method. A multi-method qualitative study will include more than one data collection technique.

Qualitative research method is a useful method for the exploratory research and this can generate a hypothesis. One of the benefits of this method is the data collected is natural. The individual's experience can be studied more in-depth. The participants can provide their data in their own expression and do not fixed with any restriction.

On the other hand, the process of analysing data collected would be longer due to the data overloaded. This is the main problem that should be considered for this method. The time consumed to analyse the data is subject to the data collected and is difficult to determine the validity of the data.

3.3 Justification of Selection

In this research, quantitative research method was chosen to determine the requirements or motives that may motivate the owners and occupants to pursue green retrofit. To achieve the aim, a large number of responses have to be obtained in order to determine the motives required by the owners and occupants. Thus, the collection of a large amount of the data can be done by using questionnaire surveys. By distributing the questionnaire, a large amount of the data can be collected in a shorter time from the sample of population. The more the data to be collected and analysed, the more reliable the results. This reflected that a large amount of responses needed to be collected from a population in order to determine the motives and also compare the motives between the owners and occupants. The results obtained can generalise to the whole population. A ranking method can be adopted and the main reasons for the owners and occupants to pursue retrofit to the existing buildings can be ranked from highest to the lowest. The higher ranking from the respondents will display their initiatives. After determining the motives, a framework can be developed according to the motives.

Qualitative research method is less suitable for this research. This is due to the time consuming to carry out the interviews. The interview process tends to take longer time if a large amount of responses are needed. There are two stakeholders involved in this research which are owners and occupants of the existing buildings. The research aims to determine the requirements of green retrofit between building owners and occupants. Hence, interview method is less suitable to be used to collect the perspectives of both respondents due to low number of respondents in interview

collection method as compared to quantitative survey. The results obtained from the interview cannot represent the views for the whole population. Hence, the findings obtained could not generalise to the whole population.

3.4 Literature Review

The topic of the research has to be identified before the review of literature. The review of literature is allowing the researchers to have a deeper knowledge on the topic. The fixed topic will become the central idea for the researchers to explore. This indicates that the review of literature should be conducted after determined the topic of the research. The conduct of literature review can increase the knowledge and allow the researchers to be confident in their ability and background (Neuman, 2013).

The literature review should be precise and summarise the major contents of the literature to the research questions. According to Creswell (2009), there is no single and fixed way to conduct a literature review but it depends on the researchers to decide how to conduct it. There are 7 steps in conducting a literature review as proposed by Creswell (2009). The process begins with the identification of the keywords. This is useful to identify and search the related literature from the library or any other sources. After identifying the keywords, step two is searching for appropriate literature. By using the key words identified in the first step, related literature from different sources such as library or online sources can be searched. Creswell (2009) recommended to focus on the journals or previous studies and books that are connected to the research topic. Around 50 reports of articles and journals needed to be located as suggested by Creswell (2009). After gathering all the books and articles that related to the topic, the researchers can conduct a screening and sort out the relevant and related literature. A visual picture can be used to group the ideas of literature such as literature map. This is to further clarify the patterns and attributes of the literature to the research topic. After drawing the literature map, a summary for the relevant literature can be drafted. All the summary can be gathered and re-organize may be required. The literature review can be ended with a summary of the major themes.

The literature review process conducted in this research was simplified into a simple diagram as shown in Figure 3.1.

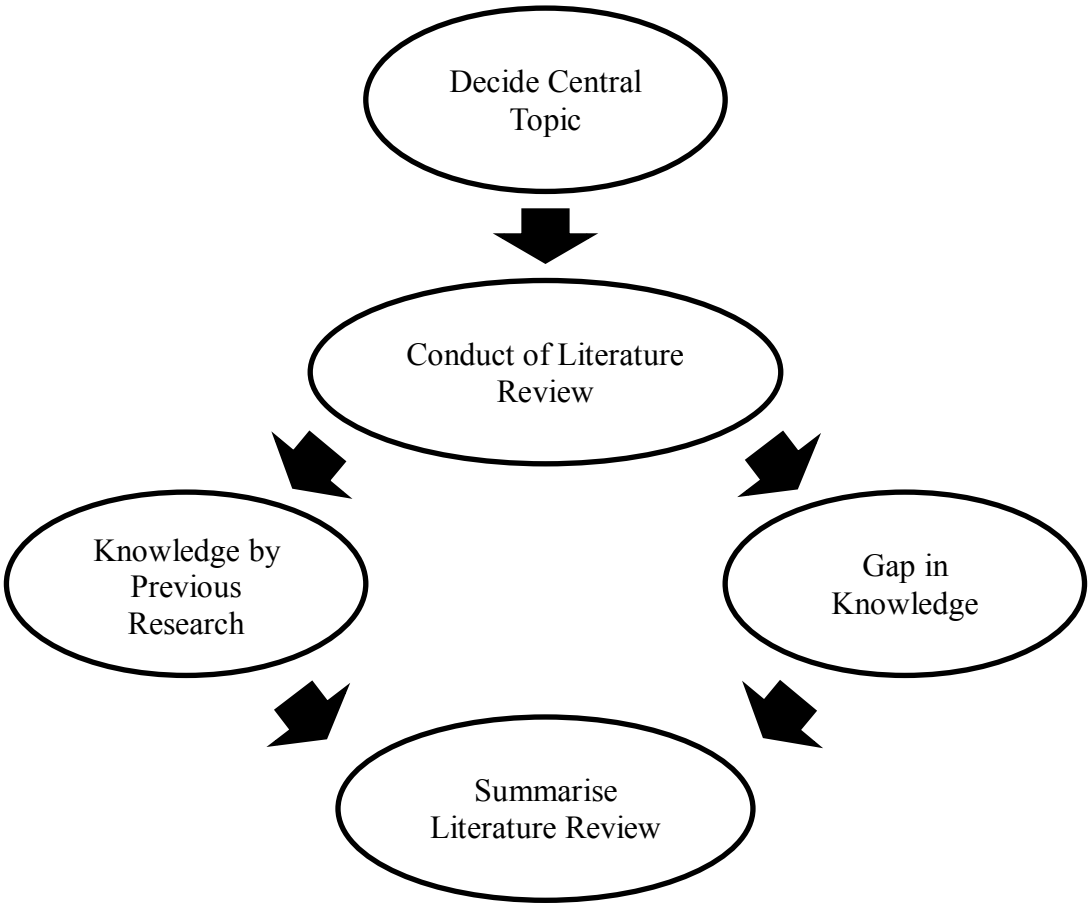

Figure 3.1: Summary of Literature Review Process

As shown in Figure 3.1, a central topic was decided as the green retrofitting of the existing buildings. In the previous chapter, the simple explanation of green retrofit was recorded. The related journals and articles were explored in order to get more information on the central topic. After the conduct of literature review, there were some knowledge areas were studied by previous researchers such as the benefits and barriers to initiate the retrofitting of existing buildings but there was a gap in knowledge on the motives of owners and occupants to pursue such action. The literature review had discussed the requirements and motives for the owners and occupants to pursue green retrofit of existing buildings. The motives were described in the literature review.

3.5 Quantitative Data Collection

There are two sources of obtaining the data which are primary and secondary sources (Sekaran and Bougie, 2009). The first-hand variables or data that can be obtained by researchers is primary data such as the responses from the respondents specifically

planned by the researchers on specific issues or questions. Distributing the questionnaire via the internet channel can also serve as the primary data. Secondary sources can also be a channel to get the data such as getting the data from company records, government publications, websites and the internet.

Quantitative research is generated by a large scale of data. The distribution of questionnaires or conduct a structured interview is the method that can be used for collecting data (Kumar, Talib and Ramayah, 2013). Structured interview can be conducted when the researchers knew what types of information needed. The researchers can list down the predetermined questions before the interview session. All the respondents are asked with the same set of questions and there might allow the researchers to identify some new factors. The researchers should note down the perception of the respondents.

In this research, the data were collected with both types of sources. First of all, the primary data is being collected in the form of distributing questionnaires. The development of questionnaires was selected in this research to collect a huge amount of data. The respondents can record or note down their answers on the questionnaire distributed by the researchers. Collecting data by using questionnaire is the most economical method to gather the sufficient amount of data. Contrastingly, secondary data also used in this research. The data collected from books, online journals, articles, websites did contributed to this research. The data collected helps to generate new understandings in this research.

3.5.1 Questionnaire Design

In the questionnaire design, there are three areas should be focussed which are the wording, the strategies and the appearance of the questionnaire. The wording is very important because when there is an inappropriate wording, this may lead to the respondents confused on the questions be asked.

The questions on the questionnaire can be grouped into open-ended and closed-ended question. Open-ended question allows the respondents to answer the question according to their perceptions such as asking the respondents to comment on scenario given. Contrastingly, the respondents have to choose among the alternative choices given on the questionnaire considered as the closed question. Closed question can assist the respondents to answer the questions in a shorter time and this is easier for the researchers to analyse the data collected.

Furthermore, a neat appearance of the questionnaire plays an important role in the development of questionnaire. An introduction stating the identity of the researchers and the purpose of the research is essential for a good questionnaire.

In the study of this research, close-ended structured question was applied in the construction of the questionnaire. Two sets of questionnaire were generated which distributed separately to the owners and occupants of the existing buildings. The respondents answered the questionnaire by selecting the answer from a series of provided choices.

Both sets of questionnaire consist of two sections. Section A was designed to collect the demographic profile of the respondents. The questions asked in Section A were distinct. In the questionnaire designed to the buildings' owners, the demographic section consists of the questions asking the position in the company, working experience, size of company and type of project the company specialized to. Contrastingly, the questionnaire to the occupants contains the questions such as the gender, age, position in the company, working experience, duration of company rent the building. Multiple choices were offered in this section and the respondents are requested to choose the answer matched to the respondents.

Section B for both sets of questionnaires was in the same design. Section B was designed with the variables of this research. The variables of the research were the motives that may trigger the owners and occupants to pursue retrofit of existing building. The evaluation of the respondents' motives to pursue the green retrofit to the existing buildings is gathered in this section. The evaluation from the respondents in Section B is in the 5-point Likert scale from very disagree, disagree, neutral, agree and very agree. There were 16 main criteria and 30 sub-criteria to be evaluated by the respondents. The respondents were requested to rank the sub-criteria according to their perspectives.

3.5.2 Sampling Determination

The population is too huge and it is very costly if study the entire population. Thus, sampling is important to identify the respondents to be studied in the research (Kumar, Talib and Ramayah, 2013). Sampling is a method to select a sufficient amount of respondents from the huge population. The size of the sample is very important in a research. If the sample size is insufficient, the result at the later stage may be inaccurate.

On the other hand, if the sample size is too big, this is a waste of money and time to conduct the research.

In this research, the research scope was limited to the developers or owners of buildings in Kuala Lumpur where the occupants were limited to Cheras area. Based on the data from REDHA (2018), there are 177 registered developers in Kuala Lumpur. In order to determine the sample size of the developers, Sloven's Formula was used for calculation. In the formula, a margin of error is allowed to include the probability of committing an error while selecting a small representative of the population of developer (Altares, et al., 2003). Slovin's formula is as shown as Figure 3.2.

$$n = \frac{N}{1 + Ne^2}$$

Figure 3.2: Slovin's Formula

(Altares, et al., 2003)

Where,

"n" = Sample size

"*N*" = Population size

"e" = Margin error

Altares, et al. (2013) stated that the margin of error could be in the range of 1 % to 10 % and depends on the desire of the researcher. In this research, 5 % of margin error was assumed because the size of population is limited and less error may occurr. After the applied of the margin of error, the sample size in this research was calculated as 123 respondents.

On the other hand, a non-probability sampling approach which is convenience sample method was used to determine the sample size of buildings' occupants. The researcher will select the respondents that are closet and conveniently available to provide it (Piaw, 2012). Convenience samples are the most unreliable design but the cheapest and easiest to process (Cooper and Schindler, 2014). This method is suitable to be adopted when time is limited, population is too huge or for the exploratory research purposes.

In this research, convenience sampling was found more suitable to design the sample size of buildings' occupants. Sekaran and Bougie (2009) explained that

convenience sampling is the fastest and efficient way to get the response and information for the research. Neuman (2013) stated that the data collected from convenience samples are informal, low cost and quick to obtain. In this research, the population of commercial office buildings' occupants in Cheras cannot be identified and estimated accurately during the conduct of this research. Therefore, probability sampling method is less suitable to be adopted. The sample size of the occupants was design to be 123 respondents as standardise with the sample size of owners.

3.5.3 Questionnaire Distribution

The different methods on distribution of questionnaire will affect the design of questionnaire. Self-completed questionnaire allows the respondents to access through the internet or web browser. The questionnaire can be delivered to the respondents via post and return to researchers by post after completing the questionnaire. Deliver the questionnaire to the respondents by hand is also one of the common ways to distribute the questionnaire. The response rate for each method is different. For an instance, the response rate for delivering the questionnaire to respondents by post may be lower because the respondents need to post back the questionnaire to the researcher after completion and the postage will charge to the respondents.

In this research, the questionnaire was created by using Google form and send to buildings' owners or developers by email. The questionnaire was sent to 120 registered developers via email. The reason to create online questionnaire is to increase the response rate without face-to-face interaction between the researcher and the respondents. The respondents can also answer the questionnaire anytime at their convenience. Furthermore, 20 sets of questionnaire were printed out and distributed to developers by hand. The purpose is to increase the response rate and the surveys can get back faster as compared to online surveys.

On the other hand, the questionnaire for building occupants was created by using Google form. The survey was sent to the 130 target respondents by email where email address of the target respondents can be obtained online. Due to the low response rate, 10 sets of questionnaire were printed and distributed face-by-face in order to improve the response rate. The duration for the data collection was four weeks.

3.6 Data Analysis

Analysing the data is the most important step in the survey process. The relationship between the data can be identified and help to reach the result of the survey. The number of variables and the size of sample to be examined will affect the choosing of method of data analysis. The suitable tests used in this research are Cronbach's Alpha Reliability Test, Measures of Central Tendency and Mann-Whitney U Test.

3.6.1 Cronbach's Alpha Reliability Test

Cronbach's alpha, α was developed to measure the reliability or internal consistency of the items (Institute for Digital Research and Education, n.d). Cronbach's alpha test is not a statistical test but only a reliability test. It can be showed in a function and the inter-correlation of the number of test items (Goforth, 2015).

When the number of items increased, the Cronbach's alpha will also increase. Furthermore, Cronbach's alpha increased when the average inter-item correlation increased. A general score of higher than 0.7 can be considered acceptable. The rule of thumb for indicating the result of alpha is displayed in Table 3.1.

Table 3.1: Rule of Thumb for Alpha Result

Cronbach's alpha	**Internal consistency**
$\alpha \geq 0.9$	Excellent
$0.9 \geq \alpha \geq 0.8$	Good
$0.8 \geq \alpha \geq 0.7$	Acceptable
$0.7 \geq \alpha \geq 0.6$	Questionable
$0.6 \geq \alpha \geq 0.5$	Poor
$0.5 \geq \alpha$	Unacceptable

(Stephanie, 2014)

When there is a high value of alpha, this indicates that the test is highly correlated. However, the alpha value is affected by the number of items in a test which a larger number of items tested can result in a larger alpha value. In general, an alpha score of more than 0.7 is usually acceptable but some other authors suggested higher values at 0.90 to 0.95 (Stephanie, 2014).

In this research, the reliability of multiple questions from the Likert scale surveys was tested by Cronbach's alpha reliability test. The main purpose of this test

is to examine the reliability of each motive to pursue retrofitting to the existing buildings.

3.6.2 Measures of Central Tendency

The information from the variables can be summarised into a single number with the three measures of central tendency which are mean, median and mode (Neuman, 2013). The mean is defined as arithmetic average and it is the most commonly used method. In the computation of the mean, the total scores are totalled up and divided by the number of scores. The mean would be affected when there is a change in an extreme value.

In this research, the mean is calculated in order to represent the overall average response regarding the motives for respondents to pursue green retrofit. The mean specifies the highest and lowest motives to be established by the buildings' owners and occupants to initiate buildings retrofit. The variable with the highest score indicated the motive is the highest motivation force to pursue building retrofitting. After the tabulation of mean, objective two can be achieved by comparing the score of the variables. The score ranked for each variable by the buildings' owners and occupants are varies because different parties have different intentions to initiate buildings retrofit. A comparison can be observed on the ranking of motivation factors between buildings' owners and occupants.

3.6.3 Mann-Whitney U Test

Mann-Whitney U Test is a technique used to examine the differences between two independent groups on a continuous measure. It is a non-parametric method to test for independent samples (Pallant and Manual, 2007). This method can be applied when the data is ordinal or it does not meet the assumptions of the t-test.

In this research, the motives between buildings' owners and occupants to pursue retrofitting to the existing buildings were compared and analysed by using this method. Different stakeholders standing at different positions have different perspectives and concerns which may affect the motives required to practise green retrofits to existing building. Thus, Mann-Whitney U Test can be used to determine whether there are statistical differences between the building's owners and occupants.

3.7 Conclusion

In a nutshell, this research is approached to a quantitative research method because a large amount of respond can determine the main perspectives from the respondents. The data collected was analysed by using the Statistical Package for the Social Science (SPSS) software. Cronbach's Alpha Reliability Test, measures of Central Tendency and Mann-Whitney U Test were proposed as data analysis methods. The results from the analysis will subsequently be discussed in next chapter.

CHAPTER 4

RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter outlines and discusses the results of data analysis to the motives for buildings' stakeholders to retrofit the existing buildings. This chapter begins with a summary of the background of the survey respondents. Furthermore, Cronbach's Alpha Reliability Test is used to determine the reliability of the collected data. The ranking of the initiatives that may trigger the stakeholders to pursue buildings retrofit are identified. Mann-Whitney U Test is adopted to determine whether there is a significant difference between the parties. A conclusion has been drawn to provide a summary of this chapter.

4.2 Survey Response Analysis

A total of 280 sets of questionnaires had been sent out to the targeted respondents which are buildings' owners and occupants through email and by hand. 140 sets of questionnaires were sent to buildings' owners in Kuala Lumpur and 140 sets of questionnaires were sent to buildings' occupants in Cheras respectively. The data collection process had been taken around 4 weeks from 4 February 2019 to 3 March 2019. 90 sets of questionnaires were completed and returned, 53 sets were from owners and 37 sets were from occupants. The response only signified with 32.1 % of valid response rate. Table 4.1 summarised the response rate of questionnaire survey for this research.

Table 4.1: Response Rate of Questionnaire Survey

Respondent	Total sent, Number	Total responded, Number	Response rate, %
Buildings' Owners	140	53	18.9
Buildings' Occupants	140	37	13.2
Total	**280**	**90**	**32.1**

4.3 General Information of Respondents

This research collected the responses from buildings' owners and occupants. The following sub-sections discuss the demographic data of buildings' owners and occupants collected by questionnaire surveys.

4.3.1 Demographic Data of Buildings' Owners

The demographic data of buildings' owners are summarised in Table 4.2. The data from 53 buildings' owners are collected. The table consists of the position of respondents in their company, working experience, size of their company and the types of project they are specialized.

Table 4.2: Demographics Profile of a Sample of 53 Buildings' Owners

Demographics Data	Categories	*n*	%
Position	Director	3	5.7
	Manager	22	41.5
	Team Leader	1	1.9
	Senior Executive	11	20.8
	Junior Executive	14	26.4
	Project Administrator	1	1.9
	Senior Planning Engineer	1	1.9
Working Experience	Less than 5 years	37	69.8
	6 - 10 years	10	18.9
	11 - 15 years	3	5.7
	16 - 20 years	2	3.8
	More than 20 years	1	1.9
Size of Company	Less than 5 people	0	0
	6 to 29 people	7	13.2
	30 to 75 people	6	11.3
	More than 75 people	40	75.5
Types of Project	Residential buildings	37	69.8
	Mix development	28	52.8
	Infrastructure works	26	49.1
	Non-residential buildings	25	47.2
	Industrial construction	13	24.5
	Social amenities	12	22.6
	Redevelopment	6	11.3
	Plantation development	1	1.9
	Oil and Gas	1	1.9

Based on Table 4.2, three respondents are Director and 22 respondents are Manager. There is only one Team Leader from the respondents. Furthermore, 11

respondents are Senior Executive and 14 are Junior Executive. There are also one Project Administrator and Senior Planning Engineer.

Regarding the working experience in the company, majority of the respondents are from the group of working experience "less than 5 years" and 10 respondents had the working experience of 6 - 10 years. There are three respondents have 11 - 15 years working experience followed by two respondents with 16 - 20 years working experience and only one worked for more than 20 years.

In term of company size, none of the respondents works in a company with a size of fewer than five people. There are seven respondents worked in the company under the group of "6 - 29 people" where six respondents worked in the company of 30 - 75 people. 40 respondents worked in the companies that are more than 75 people.

Based on Table 4.2, four common types of project that specialized by the buildings' owners are residential buildings, mixed development, infrastructure works and non-residential buildings. Out of 53 respondents, 37 are involved in the development of residential buildings. Residential buildings project includes the development of landed houses, apartments and condominiums. The demand for residential houses increased gradually and this motivates the developers to kick start the development. There are 28 respondents involved in mixed development project. 26 respondents specialized in infrastructure works which included the construction works for airport, train station, roads and bridges. There is only one respondent involved in the field of plantation development and oil and gas development.

4.3.2 Demographic Data of Buildings' Occupants

The demographic data of buildings' occupants are summarised in Table 4.3 respectively. There are 37 responses collected from the buildings' occupants. Table 4.3 displays the respondents' information in terms of gender, age group, position in their company and working experience of the respondents.

Table 4.3: Demographics Profile of a Sample of 37 Buildings' Occupants

Demographics Data	Categories	*n*	%
Gender	Male	19	51.4
	Female	18	48.6
Age Group	Less than 30 years old	31	83.8
	31 - 40 years old	3	8.1
	41 - 50 years old	1	2.7
	51 - 60 years old	2	5.3

Table 4.3 (Continued)

Position	Director	3	8.1
	Manager	6	16.2
	Team Leader	0	0
	Senior Executive	5	13.5
	Junior Executive	17	45.9
	Project Administrator	4	10.8
	Designer	2	5.4
Working Experience	Less than 5 years	28	75.7
	6 - 10 years	5	13.5
	11 - 15 years	1	2.7
	16 - 20 years	1	2.7
	More than 20 years	2	5.4

In the sample of buildings' occupants, there are 19 male and 18 female respondents which contributed to 51.4 % and 48.6 % respectively. The following data collected through the questionnaire survey is the age group of the respondents. 31 respondents are in the group of "Less than 30 years old" where three respondents' ages were within 31 - 40 years old. There is only one respondent at the age of 41 - 50 years old. Lastly, there are two respondents are in the age of 51 - 60 years old.

Based on Table 4.3, there are three respondents are Director and six are Manager. None of the respondents worked at the position as Team Leader. Five respondents are in the group of Senior Executive. Majority of the respondents are Junior Executive which made up of 17 respondents. Out of 37 respondents, three are Project Administrator and two respondents are worked as a Designer.

Majority of the respondents are from the group of working experience "less than 5 years" with the frequency of 28 respondents. Five respondents have the working experience of 6 - 10 years. There is only one respondent grouped into the group of "11 - 15 years" and "16 - 20 years" working experience. Lastly, there are two respondents worked for more than 20 years in the company.

4.4 Cronbach's Alpha Reliability Test

90 responses from both buildings' owners and occupants were calculated and analysed by SPSS. Cronbach's Alpha was tabulated based on 30 measures of motives that may affect the stakeholders to pursue green retrofitting. Table 4.4 shows the result of Cronbach's Alpha Reliability Test on 30 measures.

Table 4.4: Reliability Statistics of a List of Motives to Pursue Green Retrofit

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.932	.933	30

As shown in Table 4.4, the Cronbach's Alpha was calculated as 0.932 which higher than acceptable range from 0.70 - 0.79. Stephanie (2014) stated that the alpha score of more than 0.7 is usually acceptable and the data collected are reliable. Thus, the alpha score in this research as 0.932 indicates the data collected are considered reliable.

4.5 Mean Ranking of Motives

The main purpose of this section is to discuss the motives that may trigger the stakeholders to pursue buildings retrofit. The respondents are requested to rank their agreement level based on the sub-criteria.

4.5.1 Mean Ranking of Main Groups of Motive

Table 4.5 shows the overall mean ranking for four main groups of idea that stimulate the stakeholders to take part in buildings retrofit based on the perspective of buildings' owners and occupants.

Table 4.5: Mean Score of Main Groups of Criteria

Group	Descriptions	Mean	Ranking
A	Social Factor	3.88	1
B	Environmental Factor	3.70	2
C	Economic Factor	3.64	3
D	Technical Factor	3.63	4

The highest mean score represented the respondents are more satisfied with the selected group. According to Table 4.5, the highest ranking is the social factor followed by environmental factor and the lowest is the technical factor. Social factor ranked as the highest score because it is the crucial motivation factor to motivate the stakeholders to pursue retrofitting (Organ, Proverbs and Squires, 2013). The needs of the building users will be emphasized under the social factor (Harris & Holt, 1999).

Social factor ranked at the highest score due to the practice of Corporate Social Responsibility (CSR) by the building developers.

According to The University of Edinburgh (2017), Corporate Social Responsibility (CSR) is a concept aims to ensure that the companies proceed their business in an ethical way which considers their social, economic and environmental impacts to the stakeholders in the companies. It encourages the company to be more socially accountable, not only to itself but to its stakeholders and the public. This is an approach contributes to sustain the development by delivering the benefits to the stakeholders. Ulutaş Duman, Giritli, and McDermott (2016) stated that CSR had evolved many industries from businesses to strategic decisions. The importance of CSR had been aware by the construction companies. Caramela (2018) stated that consumers and customers are not only the main parties that concerned by the business but also the employees. Chen (2019) stated that the adoption of CSR activities can strengthen the bond between employee and corporation. The corporation takes into consideration for the needs of the employees and the occupants of the buildings. This can further tighten the relationship between the employees and employers. With the practice of CSR, the needs of the employees as the occupants of the buildings are an important factor to drive the corporate successful.

4.5.2 Mean Ranking of Criteria of Motive

There are 16 main criteria have been grouped under the four factors: social, environmental, economic and technical. Table 4.6 shows the codes and descriptions of the 16 criteria.

Table 4.6: Code and Description of Criteria

Group	Code	Criteria
Social		
	A1	Improve occupant comfort and health
	A2	Attract and retain employees
	A3	Improve corporate image
Environmental		
	B1	Reduce energy consumption
	B2	Minimize construction waste
Economic		
	C1	Increase property value

Table 4.6 (Continued)

	C2	Operating cost reduction
	C3	Business expenses reduction
	C4	Attract higher occupancy rates
	C5	Increase return on investment (ROI)
	C6	Reduce maintenance cost
	C7	Reduce building life cycle cost
Technical		
	D1	Facilitate passive design
	D2	Reduce failure risk
	D3	Achieve regulatory requirements
	D4	Comply with legistration policy

A mean test has been conducted on the 16 criteria to determine the agreement level based on the perception of buildings' owners and occupants for pursuing buildings retrofit. Table 4.7 shows the result of mean score for 16 criteria ranked by the buildings' owners and occupants. The ranking of each criterion was included in the table. The table was tabulated with the average score from both respondents and the score from buildings' owners and occupants separately.

Table 4.7: Mean Score of Criteria

	Overall		Owner		Occupant	
Code	Mean	Ranking	Mean	Ranking	Mean	Ranking
A1	**3.93**	**1**	**3.90**	**3**	**3.97**	**1**
A3	**3.90**	**2**	**3.97**	**1**	3.80	5
C4	**3.88**	**3**	**3.91**	**2**	**3.85**	**2**
C1	3.86	4	3.87	4	**3.84**	**3**
A2	3.80	5	3.82	5	3.77	6
B1	3.76	6	3.81	7	3.69	7
D2	3.73	7	3.80	8	3.62	8
C7	3.70	8	3.60	13	3.84	4
C2	3.66	9	3.75	9	3.54	11
D1	3.66	10	3.73	10	3.57	10
D3	3.64	11	3.81	6	3.41	15
B2	3.63	12	3.70	11	3.54	12
C5	3.54	13	3.51	15	3.59	9
C6	3.53	14	3.59	14	3.43	14
D4	3.52	15	3.63	12	3.35	16
C3	3.33	16	3.23	16	3.49	13

Note: **Bold** indicates the top three highest, underline indicates the lowest

Furthermore, there are 30 sub-criteria have been categorized in these 16 main criteria. The details of the codes and descriptions of 30 sub-criteria are attached as Table A-1 in Appendix A. Mean values for 30 sub-criteria were calculated and tabulated in Table 4.8. The highest mean rank represented the most agreed motivation factor to stimulate the stakeholders taking part in building retrofits.

Table 4.8: Mean Ranking of Sub-Criteria

	Overall		Owner		Occupant	
Code	Mean	Ranking	Mean	Ranking	Mean	Ranking
A3c	**4.12**	**1**	**4.13**	**1**	**4.11**	**1**
A2a	**4.01**	**2**	**4.11**	**2**	3.86	6
A1b	**3.94**	**3**	3.94	4	**3.95**	**3**
A1a	3.91	4	3.85	10	**4.00**	**2**
C4b	3.89	5	**3.96**	**3**	3.78	10
C4a	3.88	6	3.85	11	3.92	4
B1b	3.86	7	3.91	6	3.78	9
C1a	3.86	8	3.87	9	3.84	7
A3a	3.83	9	3.87	8	3.78	8
D2b	3.78	10	3.89	7	3.62	16
A3b	3.74	11	3.91	5	3.51	21
C7b	3.73	12	3.72	17	3.76	11
C2b	3.72	13	3.79	13	3.62	14
D2a	3.68	14	3.72	19	3.62	15
B1a	3.67	15	3.72	15	3.59	17
C7a	3.67	16	3.49	29	3.92	5
D1a	3.67	17	3.72	18	3.59	18
D1b	3.66	18	3.74	14	3.54	20
D3a	3.64	19	3.81	12	3.41	28
B2a	3.63	20	3.68	21	3.57	19
B2b	3.63	21	3.72	16	3.51	22
C2a	3.60	22	3.70	20	3.46	25
A2b	3.59	23	3.53	26	3.68	13
C5a	3.59	24	3.51	27	3.70	12
C6b	3.57	25	3.64	22	3.46	26
D4b	3.52	26	3.64	23	<u>3.35</u>	<u>30</u>
D4a	3.51	27	3.62	24	3.35	29
C5b	3.50	28	3.51	28	3.49	24
C6a	3.49	29	3.55	25	3.41	27
C3a	<u>3.33</u>	<u>30</u>	<u>3.23</u>	<u>30</u>	3.49	23

Note: **Bold** indicates the top three highest, <u>underline</u> indicates the lowest

Based on Table 4.7, an overall result shown combining the views from both buildings owners and occupants. The top three main criteria with the highest mean score are **A1** = "improve occupant comfort and health", **A3** = "improve corporate image" and **C4 =** "attract and retain employees" with mean value of 3.93, 3.90 and 3.88 respectively. The motive with the lowest mean score is **C3** = "business expenses reduction" with mean value of 3.33. According to Table 4.8, the top three sub-criteria ranked by both owners and occupants are **A3c** = "because retrofitting can improve the buildings' appearance" with mean score 4.12, **A2a** = "because a good working environment can enhance employees' working productivity" with mean score 4.01 and **A1b =** "because tenants anticipate to work at a safe condition" with mean score 3.94.

Referring to Table 4.7, the main criteria with three highest mean score from the perspective of buildings' owners are **A3** = "improve corporate image" with the mean score at 3.97, then followed by **C4 = "**attract higher occupancy rates" with the mean score at 3.91 and **A1** = "improve occupant comfort and health" with the mean score at 3.90.

A3 indicated the improvement of the corporate image after the retrofitting was the most agreed reason for the buildings' owners to pursue buildings retrofit. Eichholtz, Kok and Quigley (2010) stated that locating the corporate activities in a green building will improve the reputation of the company. The reputation has been recognized as the key foundation to make the organizational success (Verčič and Ćorić, 2018). The stakeholders of the organisation can receive their desired outcomes from a good reputation. This is the reason for the buildings' owners rated the highest score for improving the corporate image as a motive to stimulate the practice of buildings retrofit. As for criterion **A3**, it consists of three sub-criteria which are **A3a** = "because the company's reputation will be improved after retrofitted", **A3b** = "because more investors will be attracted after retrofitted" and **A3c** = "because retrofitting can improve the buildings' appearance". Referring to Table 4.8, **A3c** was ranked the highest mean score at 4.13 among the sub-criteria by the buildings' owners. This indicated that the improvement of buildings' appearance after retrofitting works was the most agreed sub-criteria for the buildings' owner to pursue retrofitting. A good case is shown by Sunway Group that retrofitted The Mall to Sunway Putra Mall which improved the appearance of the building after the operations (Samuel, 2016). After the re-development by Sunway Group, Sunway Putra Mall won an award and the image

of the organization improved which attracted more investors or gained public trust to the organization.

The second highest ranked among the main criteria by the buildings' owners was **C4** which indicated that the buildings' owners may retrofit the buildings due to the reason of improved occupancy rates after retrofitting. The green features of the retrofitted buildings show a positive impact to the occupancy rate of the building (Fuerst and McAllister, 2011). The building's owners can try to improve the building features and conditions in order to attract the tenants and customers. In the same case provided by Sunway Group, the occupancy rate had achieved 90.2 % after the re-development to Sunway Putra Mall (Retail Asia, 2018). The international, regional and national retail brands and food and beverage outlets were attracted to rent in Sunway Putra Mall. There were two sub-criteria grouped under **C4** which are **C4a** = "because after the building retrofitted, the occupancy rate of the building will be improved" and **C4b** = "because the rental value of the retrofitted building will be increased after retrofitting". The sub-criterion **C4b** has been ranked as the third highest among 30 sub-criteria at the mean score of 3.96. **C4b** specified that the rental value of the buildings can be improved after retrofitted. Ferreira, Pinheiro and De Brito (2015) stated that the tenants are willing to pay at a higher rental rate for the good environment provided by a retrofitted building. This is due to the tenants concerned about the improved appearance and the internal comfortable level inside the building. Thus, the higher rental rate after retrofitted could encourage the buildings' stakeholders to retrofit the existing buildings.

Subsequently, the third ranked of main criteria as stated in Table 4.7 was **A1**. The comfort and health of the occupants could be improved is an important factor to inspire the buildings' stakeholders retrofit the buildings. The occupants will have their expectations on the environment of the building (Leung, 2018), and the buildings' owners are motivated to retrofit the buildings in order to meet the acceptable expectation of the occupants. Sub-criteria **A1a** which indicated "because tenants anticipate to work at a comfortable environment" and **A1b** indicated "because tenants anticipate to work at a safe condition" were categorized in **A1**. The mean score ranked to **A1a** and **A1b** were 3.85 and 3.94 respectively.

Furthermore, **A2a** indicated that "because a good working environment can enhance employees' working productivity" ranked as the second highest among 30 sub-criteria. Ashuri and Durmus-Pedini (2010) stated that the improved of employee

health by a better working environment will affect the productivity of the employee. The comfortable working environment tends to motivate the employees to work more effeciently. The buildings' owner could be stimulated to retrofit the buildings in order to improve the productivity of the employees by providing a comfortable working environment.

On the other hand, **C3** indicated the reduction of business expenses was ranked with the lowest mean score at 3.23 by the buildings' owners. A sub-criterion, **C3a** = "because the cost for hiring more employee can be minimised by pursuing retrofitting" can further describe the application of **C3**. Majority of the business expenses consist of the salaries of employees where the absenteeism of the employees could increase the business expenses due to the unproductive works (Ashuri and Durmus-Pedini, 2010). Bernstein and Russo (2011) also agree that the percentage of total savings from the expenses is too small for most of the businesses. In commercial real estate, the factor such as the occupancy rate and the rental are easier to acknowledge. However, the reduction of business expenses after pursuing retrofitting would reduce the absenteeism of employees is minor and not easy to identify. Due to the ambiguous savings, the buildings' owners may be demotivated.

In the point of view expressed by the buildings' occupants, the highest top three criteria are **A1** = "improve occupant comfort and health" with the mean score of 3.97, followed by **C4 = "**attract higher occupancy rates" with the mean score of 3.85 and **C1** = "increase property value" at 3.84 as shown in Table 4.7.

A1 indicated the improvement of occupants' comfort and health was the most agreed criteria for the buildings' occupants to initiate retrofits of existing buildings. Moreover, **A1a** and **A1b** which specified "because tenants anticipate to work at a comfortable environment" and "because tenants anticipate to work at a safe condition" respectively were ranked as the second and third highest among the 30 sub-criteria. This signified that the buildings' occupants concerned more on the internal environment of the buildings. According to Ma, et al. (2012), the existing buildings will degrade and the building quality will fall after a period of time. Nimlyat (2018) stated that the indoor environmental quality will affect the health and productivity of the occupants. The buildings' occupants will emphasize more on the environment of the building because this may affect their health. Nimlyat (2018) pointed out that the indoor environment of a hospital is important which will affect the healing process of the patient and the working behaviour of the medical staff.

The criterion ranked by the buildings' occupants as the second highest was **C4** as shown in Table 4.7. The buildings' occupants have the same view with the buildings' owner which agreed that the stakeholders retrofit the existing buildings to increase the occupancy rates of the buildings. The occupants may stand on the side as tenants that concerning the condition of buildings. The tenants have their minimum requirements on the building or working place rented (Leung, 2018). Before they decide to rent the place, they are more concerning the internal comfort level. They are willing to pay the higher rental with the better environment for retrofitted buildings (Ferreira, Pinheiro and De Brito, 2015). Thus, the occupants of buildings ranked this intention higher to provoke the stakeholders to conduct building retrofits.

Next, the third highest ranked of main criteria by the buildings' occupants as shown in Table 4.7 is **C1** which expressed the increase of property value would motivate the stakeholders to initiate buildings retrofit. **C1** can be further detailed with **C1a =** "because the capital value of the building will be increased after retrofitted". This condition can be related to the theory of self-esteem. In psychology, a person's overall sense of self-worth or value can be described as the term self-esteem (Cherry, 2019). The increase of building value can influence the self-esteem of the occupants.

Moreover, **A3c** indicated that "because retrofitting can improve the buildings' appearance" ranked as the highest among 30 sub-criteria by the buildings' occupants. This sub-criterion was ranked by buildings' occupants and also owners as the highest reasons for the stakeholders to take part in retrofitting of existing buildings. This indicates that the buildings' owners and occupants concern about the building's appearance.

Contrastingly, **D4** indicated the initiative to comply with the legistration policy by retrofitting buildings was ranked with the lowest mean score at 3.35 by the buildings' occupants. As for criterion **D4,** it consists of two sub-criteria which are **D4a =** "because retrofitting can achieve national goal" and **D4b = "**because retrofitting can achieve United Nations (UN) Sustainable Development Goals". **D4b** ranked with the lowest mean score among 30 sub-criteria at 3.35. Malaysian government had declared that to participate in the effort to reduce the emission of carbon dioxide to solve the impact of climate change (The Sun Daily, 2006). The occupants did not rank this initiative as an important motivation. It may due to the public have less awareness on the environmental issue and did not know how to contribute to save the environment. The Local (2016) stated that people are aware of the need to save the environment but

unwilling to do something or do nothing to contribute. This indicates that the occupants have less awareness to contribute to achieve the goal declared by the government.

4.6 Mann-Whitney U Test

Mann-Whitney U test is used to identify the significant difference between buildings' owners and occupants on the sub-criteria to influence the stakeholders to pursue buildings retrofit. The p-value used in this test is 0.05.

Two hypothesis are generated for this test as below:
Null hypothesis (H_0): There is no significant difference between the buildings' owners and occupants on the motives to pursue buildings retrofit.
Therefore, the null hypothesis (H_0) is fail to reject when $p > 0.05$
Alternative hypothesis (H_1): There is a significant difference between the buildings' owners and occupants on the motives to pursue buildings retrofit.
Therefore, the alternative hypothesis (H_1) is accepted when $p \leq 0.05$

Table 4.9 summarized the result of Mann-Whitney U Test based on the different parties toward the agreement level on the motivational factors on pursuing green retrofits. The test revealed that there are two items show significant differences in perception of the reason to initiate retrofitting across the parties. The two items are **A3b** = "because more investors will be attracted after retrofitted" and **C7a** = "because after retrofitting, the life span of the building will be prolonged". The p-value of these two sub-criteria are less than 0.05 ($p \leq 0.05$). Whilst, the rest of the sub-criteria have the p-value which greater than 0.05 ($p > 0.05$), therefore, there is no significant difference between the buildings' owners and occupants on the sub-criteria to stimulate the practice of buildings retrofit. Hence, the alternative hypothesis (H_1) is accepted for **A3b** and **C7a.**

Table 4.9: Mann-Whitney U Test on Buildings' Owners and Occupants

Code	Descriptions	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
A3b	Because more investors will be attracted after retrofitted.	695.000	1398.000	-2.578	.010
C7a	Because after retrofitting, the life span of the building will be prolonged.	732.500	2163.500	-2.242	.025

In order to identify the degree of significance between the stakeholders and the agreement level on the motivating factors to practise building retrofits, Table 4.10 is tabulated to show the mean ranks of motives to initiate buildings retrofit.

Table 4.10: Mean Rank of Intention to Retrofit Buildings across Different Stakeholders

Code	Descriptions	Respondent	N	Mean Rank	Sum of Ranks
A3b	Because more investors will be attracted after retrofitted.	**Owner**	**53**	**50.89**	**2697.00**
		Occupant	37	37.78	1398.00
C7a	Because after retrofitting, the life span of the building will be prolonged.	Owner	53	40.82	2163.50
		Occupant	**37**	**52.20**	**1931.50**

Note: **Bold** indicates the highest mean rank for sub-criteria

As shown in Table 4.10, the most significant motive **A3b** has a mean rank at 50.89 for buildings' owners which higher than the mean rank for buildings' occupants at 37.78. This indicates that the buildings' owners have higher agreement level as compared to the occupants on the reason to influence the stakeholders to engage in buildings retrofit. The buildings' owners are more concerning to practise building retrofits in order to attract more investors. CrowdfundUp (2017) stated that land, capital and knowledge are the key for a property developer or owners to be successful but the capital is often the issue. A key challenge for all the property developers and owners is fund raising (Sutton, 2015). Although there are many ways to raise fund from commercial lenders, there is still a funding gap. A market of investors who

interested on property is an alternative to fulfil the gap. The Investor (2017) argued that the retrofit to existing buildings increases the potential of buildings to the investors. This indicates a retrofitted building with better condition and appearance can attract more investors to capitalize on the property's owner. **A3b** is ranked higher by the buildings' owners to inspire the stakeholders for retrofitting the existing buildings because attract more investors after building retrofitting can solve the funding problems met by the company.

Moreover, the second significant drive to retrofit buildings is **C7a**. The mean rank for buildings' occupants at 52.20 which higher than the buildings' occupants at 40.82. The result indicates that the buildings' occupants perceived it more important as compared to the buildings' owners. **C7a** indicates that the life span of the buildings can be prolonged after the retrofitting. As a result, the occupants can stay in the same workplace for a longer time. The occupants' inertia is not easy to break after staying long period in the office. Furthermore, the occupants are unwilling to relocate due to the high cost of relocation (Wyatt, 2013). It may be more profitable for the occupants to operate at a different location but due to the inertia and relocation cost, the occupants wanted to stay at the same working place. Thus, building occupants viewed this sub-criteria more important as compared to building owners.

4.7 Refined Proposed Motivation Framework

Figure 4.1 depicts the refined proposed motivation framework with the drivers to trigger the practice of retrofit to existing buildings after data analysis. In the preliminary proposed motivation framework in Chapter 2 (see Figure 2.2), the motives are grouped under four factors: social, technical, environmental and economic. The proposed motivation framework is refined with the level of agreement to the motivation factor from the respondents.

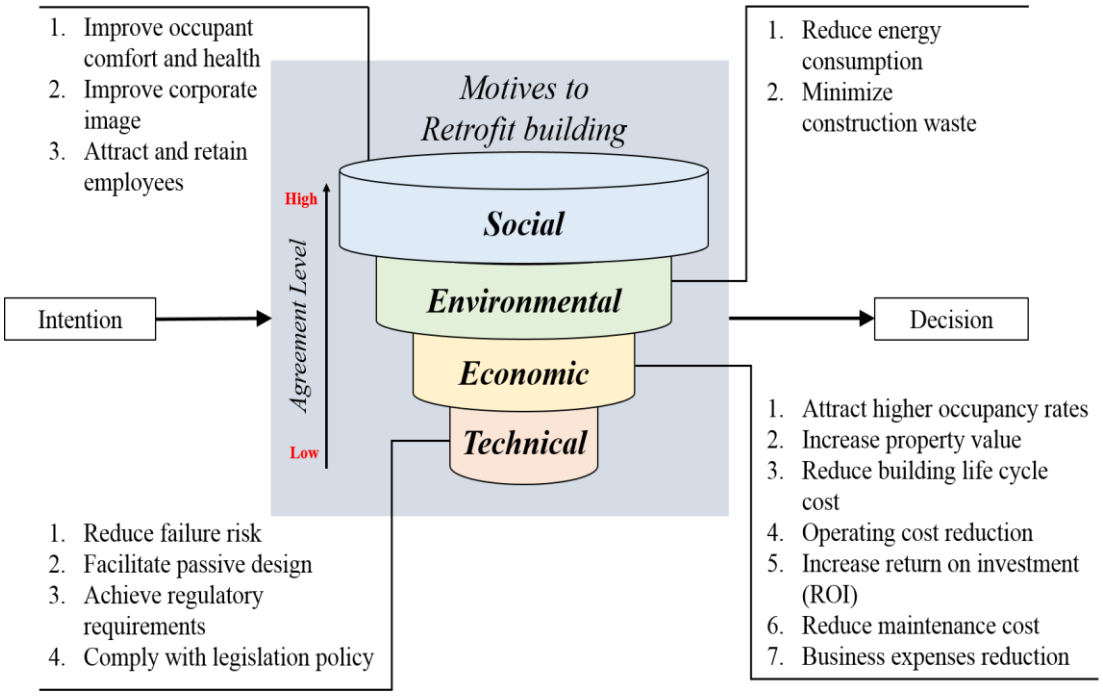

Figure 4.1: Refined Proposed Motivation Framework to Pursue Green Retrofit

There are 4 levels shown in Figure 4.1 and social factor located at the top with the highest mean value and technical factor located at the bottom with the lowest mean value. The results of the level of agreement are obtained from the mean ranking test which shows the social factor is the highest factor to stimulate the practice of building retrofits in construction industry, and it follows by environmental, economic, and technical factors. Referring to the proposed framework in Figure 4.1, the related professional bodies can identify and acknowledge the main factors to influence the stakeholders to engage in building retrofits to increase building retrofitting practices in the future.

4.8 Summary

This chapter has discussed in detail the motives to inspire the buildings' stakeholders to initiate buildings retrofit from the views of buildings' owners and occupants.

A total of 90 sets of questionnaire surveys were collected from the respondents where 53 sets from buildings' owners and 37 sets from buildings' occupants. The data collected were analysed by the method Cronbach's Alpha Reliability Test, Measures of Central Tendency and Mann-Whitney U Test. In order to developer a deeper understanding of the patterns from the groups of respondents, all the demographic data were tabulated in table form. The Cronbach's Alpha value obtained for the data were

tested and the results showed a good reliability in terms of internal consistency as the acceptable outcome.

The mean test showed that the top ranking of key motivating force was social factor where the lowest ranked was technical factor among 4 main groups of motive to stimulate the practice of buildings retrofit. A refined proposed motivation framework was proposed based on the results from the mean test.

In addition, the Mann-Whitney U Test was conducted to find out whether there is any significant difference on the intention to retrofit existing buildings across different parties. The result findings showed that the buildings' owners are perceived **A3b** = "because more investors will be attracted after retrofitted" is more important as compared to the view of buildings' occupants. Contrastingly, the buildings' owners have a higher agreement to **C7a =** "because after retrofitting, the life span of the building will be prolonged" as compared to the owners.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This is the finale chapter that summarizes the research. The chapter begins with the summary of the overall chapters. The findings and results obtained from each chapter to achieve the objectives of the research are included in the following section. The limitations of this research are detailed and some recommendations are pointed out to improve for future research. Lastly, this chapter is ended with a brief discussion of the contribution from this research to the industry and body of knowledge.

5.2 Overall Chapters Summary

Chapter one described the background of this study and the problem statement related to the motives to stimulate the practice of buildings retrofit in construction industry. Buildings are longevity and the increasing number of existing buildings in Malaysia (Rahmat, Torrance and Ezanee, 2003) brought impacts to the environment. Green retrofit is a viable solution to reduce the building impacts to the environment by enhancing the function and sustainability of the existing buildings (Li, et al., 2017). There were many researchers focused on the benefits and challenges to practise buildings retrofit but not the drivers to stimulate the practice in construction industry. Therefore, there is a need to conduct a research to study the main motives that may provoke the practice of green retrofit. The research aim and three objectives had been identified in chapter one. The research scope was limited to the respondents from the buildings' owners in Kuala Lumpur and buildings' occupants in Cheras.

Chapter two briefly described the definition of green retrofit. The related journals and articles were reviewed and most of the researchers studied the benefits and barriers to initiate buildings retrofit. There was a gap in knowledge identified which was the main motivation factors needed by the stakeholders to conduct the retrofit of existing buildings. Hence, this study focused on the motivation factors to stimulate the practice of retrofitting the existing buildings. Dark motives-counterfeit purchase framework was referred as the basic concept which stating that the intention of a person is affected by a series of motives before the decision is made. A preliminary

proposed motivation framework was integrated from Dark motives-counterfeit purchase framework by substituting the findings from the literature review.

Chapter three presented the methodology used to conduct this research. Quantitative research method was adopted in this research to determine the intentions or motives to inspire the stakeholders to pursue buildings retrofit. Questionnaire surveys were designed and distributed to the respondents via email and by hand delivery. There were 140 sets of questionnaire sent to buildings' owners and 140 sets sent to buildings' occupants respectively. In return, there were a total of 90 sets of questionnaire collected from the buildings' owners and occupants which signified to 32.1 % of response rate. The data analysis methods proposed in this research were Cronbach's Alpha Reliability Test, Measures of Central Tendency and Mann-Whitney U Test. The reliability of the data collected was tested by Cronbach's Alpha Reliability Test. The Measures of Central Tendency which was the mean analysis used to determine the mean ranking of motivation factors by the respondents. Last but not least, Mann-Whitney U Test was used to test whether there is a significant difference between the different parties of respondents which are buildings' owners and occupants.

Chapter four discussed the results and findings based on the data collected from the questionnaire surveys. The mean test from the Measure of Central Tendency showed that social factor was the top ranking of key motivation whereas technical factor was ranked as the lowest. Besides, the results from Mann-Whitney U Test showed that buildings' owners are perceived to attract more investor after retrofitting where buildings' occupants have higher agreement to prolong the life span of building as the motive to pursue buildings retrofit. The results were discussed with the support of secondary data. A refined proposed motivation framework was proposed with the findings analysed in this chapter.

Lastly, chapter five summarised the findings of this research. The objectives of this research had achieved successfully. The limitations of this study were described and recommendations for future improvement were stated. The contributions of this research were pointed out before this chapter ended.

5.2.1 Objective 1: To identify a list of motives that can be used to encourage the building owners and occupants to initiate sustainable retrofits.

The first objective was achieved by reviewing secondary sources of information such as journal articles, books, newspapers, the internet, websites and government publications. From the literature review, there were four main groups of motive had been identified which are social factor, environmental factor, economic factor and technical factor. There were a total of 16 criteria categorised in the four main groups which are improve occupant comfort and health, attract and retain employees, improve corporate image, reduce energy consumption, minimize construction waste, increase property value, operating cost reduction, business expenses reduction, attract higher occupancy rates, increase return on investment (ROI), reduce maintenance cost, reduce building life cycle cost, facilitate passive design, reduce failure risk, achieve regulatory requirements and comply with legistration policy. There were 30 sub-criteria that can further describe the 16 criteria.

5.2.2 Objective 2: To compare the ranking of motives between building owners and occupants in commencing sustainable retrofits.

Mean analysis was calculated and used to represent the overall responses regarding the motives for respondents to pursue green retrofit. The highest and lowest mean score specified the highest and lowest motives to stimulate the decision to retrofit the existing buildings. Table 5.1 shows the ranking of four main groups of motive to promote the practise of retrofit.

Table 5.1: Ranking of Main Groups of Criteria

Group	Descriptions	Ranking
A	Social Factor	1
B	Environmental Factor	2
C	Economic Factor	3
D	Technical Factor	4

The buildings' owners and occupants ranked the social factor as the highest to motivate the practice of buildings retrofit in construction industry. The main criteria ranked by the buildings' owners as the three highest are **A3** = "improve corporate image", **C4 = "**attract higher occupancy rates" and **A1** = "improve occupant comfort

and health". Contrastingly, buildings' occupants have different views with the owners where the occupants ranked **A1** = "improve occupant comfort and health", **C4 = "**attract higher occupancy rates" and **C1** = "increase property value" as the top three motives to pursue green retrofit.

Moreover, Mann-Whitney U Test was used to determine whether there is a significant difference between buildings' owners and occupants. Based on the results, there were 2 sub-criteria showed there is significant difference between the owners and occupants. The motives are **A3b =** "because more investors will be attracted after retrofitted" and **C7a** = "because after retrofitting, the life span of the building will be prolonged". According to the findings, the buildings' owners were more perceived to **A3b** than the occupants where the occupants were more perceived on **C7a** than the buildings' owners.

5.2.3 Objective 3: To propose a preliminary motivation framework which incorporating different motives for initiating sustainable building retrofits.

A motivation framework to promote the practice of buildings retrofit in construction industry had been proposed to achieve objective three. Figure 5.1 shows the proposed motivation framework to pursue green retrofits which consist of social, environmental, economic and technical factors.

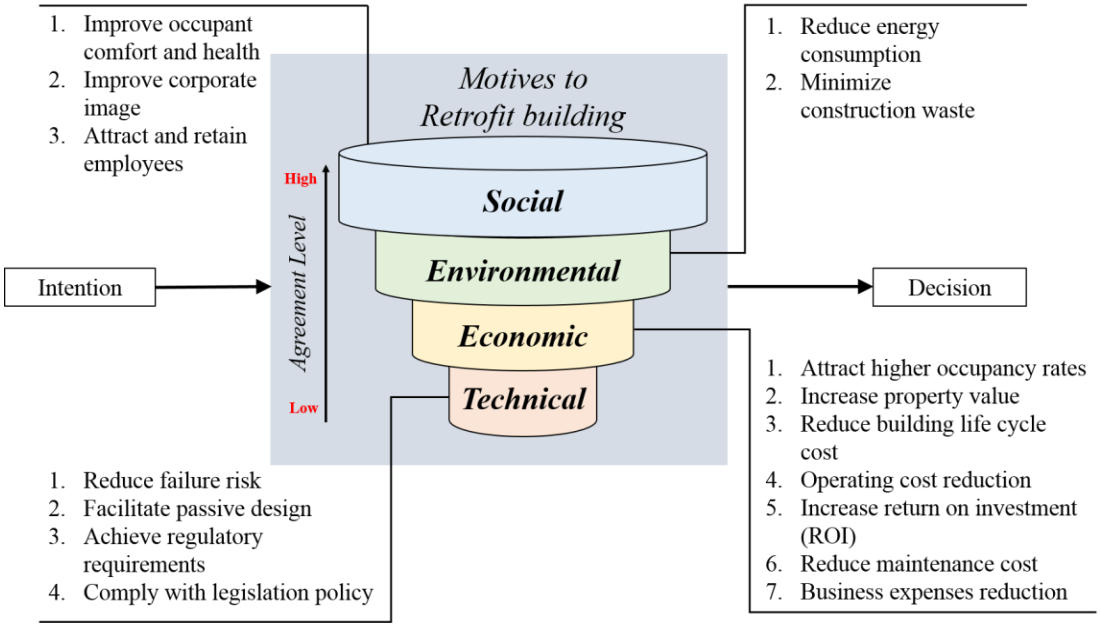

Figure 5.1: Refined Proposed Motivation Framework to Pursue Green Retrofit

This framework was modified from Dark motives-counterfeit purchase framework (Thaichon and Quach, 2016) which utilizing the concept of the motives affect the intention before the decision making. The proposed framework was modified by showing the level of agreement obtained from the mean analysis. Social factor located at the top of the hierarchy which indicated that social factor is the main factor to stimulate the practice of buildings retrofit in construction industry. Contrastingly, technical factor located at the lowest of the hierarchy.

5.3 Research Limitations

There are a few limitations in this research needed to be considered. First, the response rate of getting back the questionnaire surveys was too low. In this research, the response rate was 32.1 % which indicated that a total of 280 sets of questionnaire were sent to the respondents via email and by hand delivery but the collected questionnaires were only 90 sets. When distributing the questionnaires to the targeted respondents via email, the targeted respondents were not entertained and cannot ensure that the questionnaire was delivered successfully to the right person. On the other hand, while distributing the questionnaire by hand delivery, it was less effective due to the targeted respondents were refused to spend time to answer the survey. The low response rate may affect the result of Mann-Whitney U test in the research.

Moreover, the respondents had not sufficient understanding in retrofitting the existing buildings. The practice of green retrofit is still very new in Malaysia and the respondents are not familiar with this term. One example can be pointed out that, the questionnaire was distributed to an experienced project manager by hand delivery, the project manager has no idea on the meaning of retrofit. The gap knowledge of respondents to retrofit the existing buildings may affect the results.

In addition, there was an unbalanced distribution of respondents. According to the table tabulated with the demographic data of respondents (see Table 4.2 and Table 4.3), most of the respondents were from the group of working experience less than 5 years. A balanced distribution of respondents should be obtained in order to get a balanced perception from different level of position.

Subsequently, the proposed motivation framework cannot be verified and validated during conducting this research. There is another limitation on the research in which quantitative research method is approached within this study. As compared to qualitative research, quantitative research does not include the in-depth explanation

from the respondents. This indicated that the respondents were unable to provide more detailed responses to contribute in the data collection process. The potential variables could be leave out in the study.

Besides, convenience sampling method was used to collect the response from the buildings' occupants. This sampling method has a few limitations such as the samples are the most unreliable and less control to ensure the precision in the study. The results cannot generalise to the whole population as this sampling method is a non-probability method. However, convenience sampling was the most suitable to design the sample size of buildings' occupants for this research because the population of buildings' occupants were not able to identify accurately during the conduct of this research.

5.4 Research Recommendations

There are some recommendations suggested to overcome the limitations. First, the scope of the research can be wider to a broader area in order to obtain a more reliable result. The respondents for future research can include the respondents from different types of building because different perceptions may obtain from different backgrounds of people.

Furthermore, mixed research method is recommended to be adopted for future research. The motives can be identified from the review of previous studies but the previous studies from different countries may not be applicable in Malaysia due to geographical and cultural differences. Thus, interviews are suggested to carry out after the literature review in order to filter the list of motives to ensure it is applicable in the Malaysia context. By using interviews, interviewees who are experienced or have sufficient knowledge in building retrofitting can be selected. This will ensure the reliability of the results as one of the weaknesses of quantitative data collection is less control on the respondents' selection. Besides, it also allows new motives to be generated which could not be identified from the literature review and some that are not relevant can be omitted out through interview sessions. Apart from that, case studies could be conducted at the end in order to validate the framework proposed in the research to justify the applicability in the construction industry.

For future research, a similar study can be conducted by grouping the motives into internal and external motives. The motivation factors can be in internal and external. The external motivation is the inspiration force that triggers a person to

achieve the goals where the internal motivation is the force that lead a person to achieve the goal due to the personal satisfaction and desire (Team, 2017). Thus, the framework can be modified and enhanced by dividing the motives into different groups.

5.5 Research Contribution

The main findings of this research which is the proposed motivation framework could be disseminated to the Malaysian Government, professional bodies such as Green Building Index Sdn Bhd and related green body associations. Some required actions can be taken by the professional bodies to increase the awareness of pursuing green retrofit instead of demolish and new-build to the public. By referring the proposed motivation framework, the professional bodies are able to identify the motives that could trigger the stakeholders to practise green retrofit in construction industry. The intention to retrofit the existing buildings can be promoted to increase the execution of buildings retrofit in construction industry. This in turn could increase the building retrofit practices in Malaysia.

Additionally, the findings of this research could be contributed to the existing literature. The proposed motivation framework can be used for future research by adding more motives that related to green retrofitting in order to further refine the framework.

The nations around the world are focusing to limit climate change by numerous plans (World Wildlife Fund, 2019) and retrofitting the existing buildings could be a solution to reduce the impacts to the environment. The framework can be referred by other countries and researchers in developing a motivation framework that applicable to their countries by considering geographical, economic and cultural differences. The public awareness to retrofit the existing buildings could be increased with the signals of governments.

5.6 Chapter Summary

To conclude this chapter, all the findings have been summarised in this chapter. The limitations that could affect the results of the research were explained. Some recommendations were detailed to improve the quality of future research. Last but not least, the research contribution was identified in the research.

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APPENDICES

APPENDIX A: Codes and Descriptions of 30 Sub-Criteria

Table A-1: Codes and Descriptions of 30 Sub-criteria

Code	Description
A1a	Because tenants anticipate to work at a comfortable environment.
A1b	Because tenants anticipate to work at a safe condition.
A2a	Because a good working environment can enhance employees' working productivity.
A2b	Because a good working environment can improve employees' attendance.
A3a	Because the company's reputation will be improved after retrofitted.
A3b	Because more investors will be attracted after retrofitted.
A3c	Because retrofitting can improve the buildings' appearance.
B1a	Because energy usage of the building can be reduced after retrofitted.
B1b	Because tenants enjoy better visual and thermal comfort in the building after retrofitted.
B2a	Because construction waste can be reduced by pursuing retrofit as compared to new-build or demolition.
B2b	Because retrofitting can reduce land filling compared to new-build or demolition (example: lesser waste produced by retrofitting compared to new-build/demolition).
C1a	Because the capital value of the building will be increased after retrofitted.
C2a	Because after retrofitting, the energy/electricity cost of the building will be reduced.
C2b	Because the energy performance of the building will be improved after pursuing retrofitting (example: a higher energy efficiency would be installed after retrofitted).
C3a	Because the cost for hiring more employee can be minimised by pursuing retrofitting (example: a better working environment provided after pursuing retrofitting would reduce the absenteeism of employees).
C4a	Because after the building retrofitted, the occupancy rate of the building will be improved (example: better environment attract more tenant and customer).
C4b	Because the rental value of the retrofitted building will be increased after retrofitting.
C5a	Because the investment on retrofitting have a shorter payback period compared to new-build or demolition of existing buildings.
C5b	Because the total gains accumulated year by year more than initial investment amount of retrofitting.
C6a	Because the maintenance cost of the retrofitted building will be reduced.
C6b	Because the timing for maintenance of the retrofitted building will be extended (example: the frequency for maintenance of retrofitted building will be reduced).

Table A-1 (Continued)

Code	Description
C7a	Because after retrofitting, the life span of the building will be prolonged.
C7b	Because the function of the retrofitted building will be improved after the retrofitting (example: the building structural and energy efficiency will be improved).
D1a	Because after retrofitting, natural lighting system can be promoted to reduce the demand of artificial lighting system.
D1b	Because after retrofitting, natural ventilation system can be promoted to reduce the consumption of air conditioner.
D2a	Because the safety of the occupants in the building will be improved after the retrofit.
D2b	Because after retrofitting, the accident happened related to the failure of the building can be reduced (example: electric short circuit with old wiring).
D3a	Because retrofitting of existing old buildings could meet the current and latest regulatory requirements listed.
D4a	Because retrofitting can achieve national goal (example: Malaysia has committed to achieve a reduction of carbon emission up to 45% by 2030).
D4b	Because retrofitting can achieve United Nations (UN) Sustainable Development Goals (13th of UN Sustainable Development goals is take the urgent action to combat climate change and its impacts).

APPENDIX B: Questionnaire for Buildings' Owners

Dear Sir/Madam,

I am Soo Zi Hao, a final year student from Lee Kong Chian Faculty of Engineering & Science (LKC FES) at Universiti Tunku Abdul Rahman (UTAR). Currently, I am conducting a survey for my Final Year Project entitled "A Comparison of Motivation To Retrofit Existing Buildings Between Building's Owners and Occupants", a partial fulfillment of my Bachelor of Science Degree program in Quantity Surveying. The purpose of this research is to identify and compare the motives required by the tenants and owner to initiate sustainable retrofits.

I believe that you have the relevant experience and expertise to assist this research. Your participation in this survey will significantly contribute to this study and will add a significant value to the Construction Industry.

It will be highly appreciated if you could spend 5 minutes of your valuable time to fill up this survey. Your responses will be kept confidential and used solely for academic purposes.

If you have any questions about this survey, please do not hesitate to contact me for further information.

Student name: Soo Zi Hao
Contact number: 010-3195525
E-mail: zihaosoo@1utar.my

Thank you for your participation and time.

Section A: Demographic Section (Owner/Developer)

Please tick (✓) in the appropriate box.

What is your position in this company?

- o Director
- o Manager
- o Team Leader
- o Senior Executive
- o Junior Executive
- o Project Administrator
- o Other, please specify _____

How long have you been working in this company?

- o Less than 5 years
- o 6 - 10 years
- o 11 - 15 years
- o 16 - 20 years
- o More than 20 years

How many employees in your company?

- o Less than 5 people
- o From 6 to 29 people
- o From 30 to 75 people
- o More than 75 people

What are the types of building that your company specialised to? (you may tick more than one choice)

- o Residential buildings (Landed houses, Apartment, Condominium)
- o Non-residential buildings (Commercial buildings, Offices)
- o Mix development
- o Social amenities (Hospital, Clinic, School, Sport centers)
- o Infrastructure works (Airport, Train Station, Roads, Bridges)
- o Industrial construction (Power plant, Factories)
- o Re-positioning/Redevelopment (Redevelop existing buildings)
- o Plantation development (Forest, Agriculture)
- o Other, please specify _____

Section B: Motives to Pursue Green Retrofits of Existing Buildings

This section is intended to evaluate your **MOTIVES** to pursue the green retrofit to the existing buildings. Please rank each question by ticking (✓) one of the following.

Reasons to Retrofit Existing Old Buildings	*Very Disagree* 1	*Disagree* 2	*Neutral* 3	*Agree* 4	*Very Agree* 5
Because tenants anticipate to work at a comfortable environment.	☐	☐	☐	☐	☐
Because tenants anticipate to work at a safe condition.	☐	☐	☐	☐	☐
Because a good working environment can enhance employees' working productivity.	☐	☐	☐	☐	☐
Because a good working environment can improve employees' attendance.	☐	☐	☐	☐	☐
Because the company's reputation will be improved after retrofitted.	☐	☐	☐	☐	☐
Because more investors will be attracted after retrofitted.	☐	☐	☐	☐	☐
Because retrofitting can improve the buildings' appearance.	☐	☐	☐	☐	☐

Because energy usage of the building can be reduced after retrofitted.	☐	☐	☐	☐	☐
Because tenants enjoy better visual and thermal comfort in the building after retrofitted.	☐	☐	☐	☐	☐
Because construction waste can be reduced by pursuing retrofit as compared to new-build or demolition.	☐	☐	☐	☐	☐
Because retrofitting can reduce land filling compared to new-build or demolition (example: lesser waste produced by retrofitting compared to new-build/demolition).	☐	☐	☐	☐	☐
Because the capital value of the building will be increased after retrofitted.	☐	☐	☐	☐	☐
Because after retrofitting, the energy/electricity cost of the building will be reduced.	☐	☐	☐	☐	☐
Because the energy performance of the building will be improved after pursuing retrofitting (example: a higher energy efficiency	☐	☐	☐	☐	☐

would be installed after retrofitted).					
Because the cost for hiring more employee can be minimised by pursuing retrofitting (example: a better working environment provided after pursuing retrofitting would reduce the absenteeism of employees).	☐	☐	☐	☐	☐
Because after the building retrofitted, the occupancy rate of the building will be improved (example: better environment attract more tenant and customer).	☐	☐	☐	☐	☐
Because the rental value of the retrofitted building will be increased after retrofitting.	☐	☐	☐	☐	☐
Because the investment on retrofitting have a shorter payback period compared to new-build or demolition of existing buildings.	☐	☐	☐	☐	☐
Because the total gains accumulated year by year more than initial	☐	☐	☐	☐	☐

investment amount of retrofitting.					
Because the maintenance cost of the retrofitted building will be reduced.	☐	☐	☐	☐	☐
Because the timing for maintenance of the retrofitted building will be extended (example: the frequency for maintenance of retrofitted building will be reduced).	☐	☐	☐	☐	☐
Because after retrofitting, the life span of the building will be prolonged.	☐	☐	☐	☐	☐
Because the function of the retrofitted building will be improved after the retrofitting (example: the building structural and energy efficiency will be improved).	☐	☐	☐	☐	☐
Because after retrofitting, natural lighting system can be promoted to reduce the demand of artificial lighting system.	☐	☐	☐	☐	☐
Because after retrofitting, natural ventilation system can be promoted to reduce the	☐	☐	☐	☐	☐

consumption of air conditioner.					
Because the safety of the occupants in the building will be improved after the retrofit.	☐	☐	☐	☐	☐
Because after retrofitting, the accident happened related to the failure of the building can be reduced (example: electric short circuit with old wiring).	☐	☐	☐	☐	☐
Because retrofitting of existing old buildings could meet the current and latest regulatory requirements listed.	☐	☐	☐	☐	☐
Because retrofitting can achieve national goal (example: Malaysia has committed to achieve a reduction of carbon emission up to 45% by 2030).	☐	☐	☐	☐	☐
Because retrofitting can achieve United Nations (UN) Sustainable Development Goals (13th of UN Sustainable Development goals is take the urgent action to	☐	☐	☐	☐	☐

combat climate change and its impacts).

APPENDIX C: Questionnaire for Buildings' Occupants

Dear Sir/Madam,

I am Soo Zi Hao, a final year student from Lee Kong Chian Faculty of Engineering & Science (LKC FES) at Universiti Tunku Abdul Rahman (UTAR). Currently, I am conducting a survey for my Final Year Project entitled "A Comparison of Motivation To Retrofit Existing Buildings Between Building's Owners and Occupants", a partial fulfillment of my Bachelor of Science Degree program in Quantity Surveying. The purpose of this research is to identify and compare the motives required by the tenants and owner to initiate sustainable retrofits.

I believe that you have the relevant experience and expertise to assist this research. Your participation in this survey will significantly contribute to this study and will add a significant value to the Construction Industry.

It will be highly appreciated if you could spend 5 minutes of your valuable time to fill up this survey. Your responses will be kept confidential and used solely for academic purposes.

If you have any questions about this survey, please do not hesitate to contact me for further information.

Student name: Soo Zi Hao
Contact number: 010-3195525
E-mail: zihaosoo@1utar.my

Thank you for your participation and time.

Section A: Demographic Section (Occupants)

Please tick (✓) in the appropriate box.
What is your gender?

- Male
- Female

What is your age group?

- Less than 30 years old
- 31- 40 years old
- 41- 50 years old
- 51- 60 years old

What is your position in this company?

- Director
- Manager
- Team Leader
- Senior Executive
- Junior Executive
- Project Administrator
- Other, please specify _____

How long have you been working in this company?

- Less than 5 years
- 6 - 10 years
- 11 - 15 years
- 16 - 20 years
- More than 20 years

How long has this company rent this building as working place?

- Less than 5 years
- 6 - 10 years
- 11 - 15 years
- 16 - 20 years
- More than 20 years

Section B: Motives to Pursue Green Retrofits of Existing Buildings

This section is intended to evaluate your **MOTIVES** to pursue the green retrofit to the existing buildings. Please rank each question by ticking (✓) one of the following.

Reasons to Retrofit Existing Old Buildings	*Very Disagree* 1	*Disagree* 2	*Neutral* 3	*Agree* 4	*Very Agree* 5
Because tenants anticipate to work at a comfortable environment.	☐	☐	☐	☐	☐
Because tenants anticipate to work at a safe condition.	☐	☐	☐	☐	☐
Because a good working environment can enhance employees' working productivity.	☐	☐	☐	☐	☐
Because a good working environment can improve employees' attendance.	☐	☐	☐	☐	☐
Because the company's reputation will be improved after retrofitted.	☐	☐	☐	☐	☐
Because more investors will be attracted after retrofitted.	☐	☐	☐	☐	☐
Because retrofitting can improve the buildings' appearance.	☐	☐	☐	☐	☐

Because energy usage of the building can be reduced after retrofitted.	☐	☐	☐	☐	☐
Because tenants enjoy better visual and thermal comfort in the building after retrofitted.	☐	☐	☐	☐	☐
Because construction waste can be reduced by pursuing retrofit as compared to new-build or demolition.	☐	☐	☐	☐	☐
Because retrofitting can reduce land filling compared to new-build or demolition (example: lesser waste produced by retrofitting compared to new-build/demolition).	☐	☐	☐	☐	☐
Because the capital value of the building will be increased after retrofitted.	☐	☐	☐	☐	☐
Because after retrofitting, the energy/electricity cost of the building will be reduced.	☐	☐	☐	☐	☐
Because the energy performance of the building will be improved after pursuing retrofitting (example: a higher energy efficiency	☐	☐	☐	☐	☐

would be installed after retrofitted).					
Because the cost for hiring more employee can be minimised by pursuing retrofitting (example: a better working environment provided after pursuing retrofitting would reduce the absenteeism of employees).	☐	☐	☐	☐	☐
Because after the building retrofitted, the occupancy rate of the building will be improved (example: better environment attract more tenant and customer).	☐	☐	☐	☐	☐
Because the rental value of the retrofitted building will be increased after retrofitting.	☐	☐	☐	☐	☐
Because the investment on retrofitting have a shorter payback period compared to new-build or demolition of existing buildings.	☐	☐	☐	☐	☐
Because the total gains accumulated year by year more than initial	☐	☐	☐	☐	☐

investment amount of retrofitting.					
Because the maintenance cost of the retrofitted building will be reduced.	☐	☐	☐	☐	☐
Because the timing for maintenance of the retrofitted building will be extended (example: the frequency for maintenance of retrofitted building will be reduced).	☐	☐	☐	☐	☐
Because after retrofitting, the life span of the building will be prolonged.	☐	☐	☐	☐	☐
Because the function of the retrofitted building will be improved after the retrofitting (example: the building structural and energy efficiency will be improved).	☐	☐	☐	☐	☐
Because after retrofitting, natural lighting system can be promoted to reduce the demand of artificial lighting system.	☐	☐	☐	☐	☐
Because after retrofitting, natural ventilation system can be promoted to reduce the	☐	☐	☐	☐	☐

consumption of air conditioner.					
Because the safety of the occupants in the building will be improved after the retrofit.	☐	☐	☐	☐	☐
Because after retrofitting, the accident happened related to the failure of the building can be reduced (example: electric short circuit with old wiring).	☐	☐	☐	☐	☐
Because retrofitting of existing old buildings could meet the current and latest regulatory requirements listed.	☐	☐	☐	☐	☐
Because retrofitting can achieve national goal (example: Malaysia has committed to achieve a reduction of carbon emission up to 45% by 2030).	☐	☐	☐	☐	☐
Because retrofitting can achieve United Nations (UN) Sustainable Development Goals (13th of UN Sustainable Development goals is take the urgent action to	☐	☐	☐	☐	☐

combat climate change and its impacts).