A SUSTAINABILITY FRAMEWORK FOR AFFORDABLE HOUSING IN MALAYSIA

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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

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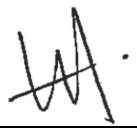
Signature : 

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ABSTRACT

The rise of industrial revolution, Industrial Revolution 4.0 especially, urges the development technologically and scientifically which leads to the surge of higher living standard among the people. Paradoxically, people struggle to live the higher living standard life due to the surging house price. Despite of the situation, the supply and development of sustainable affordable housing remains low regardless of the national sustainable development goal. Several studies were conducted to discover the factors affecting the demand of affordable housing and the impacts of sustainable affordable housing. Nevertheless, there are limited studies to identify and prioritise the criteria of sustainable affordable housings in Malaysia from housing purchasers' perspectives. Therefore, this study aims to identify the criteria for sustainable affordable housing and develop a sustainability framework for affordable housing purchasers in Malaysia. Literature review was carried out to determine the sustainable aspects by identifying the sustainable criteria for affordable housing. There are a total of twenty-seven (27) criteria identified and they are grouped under five (5) main sustainability groups which are, environmental, economic, social, cultural and technological. Quantitative method was conducted in this study, whereby questionnaires were designed and distributed to low-middle income earners to find out their agreement level on the importance of the twenty-seven criteria for sustainable affordable housing. In return, ninety-two (92) sets of questionnaires were collected from the respondents. The collected data were analyzed using Measure of Central Tendency to portray the ranking of each criteria. The results revealed that the economic aspect is the most important criteria to be considered for sustainable affordable housings. Mann-Whitney U Test was carried out to show the significant difference between the selection of ranking for criteria between male and female respondents; as well as between the respondents age less than 30 years old and over 30 years old. A preliminary motivation framework was proposed in this research. The proposed sustainability framework acts as a guideline for future potential affordable housing purchasers to consider the availability and importance of the sustainable criteria while considering to buying an affordable housing. The findings could be disseminated to the Malaysian Government, professional bodies and property developers in order to deliver more sustainable affordable housings in the future.

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LIST OF SYMBOLS / ABBREVIATIONS

LCH	Low Cost Housing
GHG	Green House Gases
SuDS	Sustainable Drainage System
IEQ	Internal Environmental Quality
SPSS	Statistical Package for the Social Science
n	Sample size
N	Population size
e	Margin error
α	Cronbach's Alpha

CHAPTER 1

INTRODUCTION

1.1 Introduction

The purpose of this chapter is to provide an overview of the research, which includes the background of the study, problem statement, research goal, research objectives, research methodology and the scope of work performed for this research.

1.2 Background

According to a research of smart city index carried out by the IMD World Competitiveness Center (2019), the citizens of the capital city of Malaysia, Kuala Lumpur, had chosen “affordable housing” as the second area that the respondents deemed to be urgent for their city, following by “road congestion” being the first in place among the fifteen (15) indicators. The percentage of responses per area for “affordable housing” is 61.8% while “road congestion” takes up 62.6%, and the percentage difference between the two areas is only 0.8%. This study showed that the community of the most advanced urban in Malaysia is treating the lack of affordable housing as an issue which require more attention on it. The demand for an owned shelter has increased considerably, especially for the low-middle-income community as housing price continues to grow (Leh, Mansor and Musthafa, 2016). Aside from facing difficulties in paying running cost of their housing, the low-middle income group does not stay and live in an environment that consumes lesser energy and good indoor air quality.

As recommended by the United Nations, World Bank and Havard University, in line with the method developed by Demographia International known as the “Median Multiple Methodology”, a housing unit is regarded as affordable if it worth less than three times of an individual’s annual household income (Bernama, 2019). Malaysia’s house price to annual household income ratio has rose over the years starting from the year of 2012 which has weakened the property buying power of the people. In view of that, the National Housing Policy (2018-2025) is one of the approaches developed by the Malaysia government so that all citizens will have the opportunity to gain a decent yet affordable house with relevant adequate facilities, especially for the lower-middle income communities (Ministry of Housing and Local

Government Malaysia [KPKT], 2018). In the next ten years (2018 – 2028), the Malaysia Local Government and Ministry of Housing are planning to construct one million units of affordable housing for the B40 community and the goal is to develop 100,000 units on an ongoing basis per year for more citizens to be able to own a house, particularly the low-income earners (Perimbanayagam, 2019). In addition, several strategies and development plans are introduced, such as the "National Home Ownership Campaign" that marketed about thirty thousand completed houses at a discounted rate, the application of "National Community Policy", the formation of "National Affordable Housing Council" along with the "National Affordable Housing Policy (DPMM)" and to widen the "Rent-to-Own (RTO) Scheme", in order to achieve the goals of the National Housing Policy. With the development of affordable housing for the low-income groups, the people have higher buying power for houses, housing stability and economic security will be increased, as well as energy usage. In the United States, there is a hundred of thousand citizens does not own a house and close to 19 million families spend more than 50% of their salary on mortgage or rental (Enterprise Community Partners Inc, 2014). Hence, the provision of affordable housing reduces the risk of vulnerable families losing their shelter.

With the rise of industrial revolution, Industrial Revolution 4.0 especially, urges the development technologically and scientifically, which leads to the surge of higher living standard among the people. Apart from that, the advancement and innovation of medical technology and living standards has accredited to the increase in birth rates and decrease in death rates (Wilde, 2020), which has led to a growth in the number of populations of a country. In search of advancement, the people, especially with the ease of accessing to the internet, will not just demand for higher quality life but also better civil rights, workers welfare as well as higher standards for the environment's protection. KPKT (2018) highlighted that the ways to deliver affordable and decent housing for the people is one of the threats faced by the housing industry players. Stakeholders from the housing industry have to be even more innovative and creative to discover new building materials and ecological building designs that promotes sustainability. Besides that, the organization also argues that the focal point should be given on quality housing instead of the quantity for that the people can have a higher living standard aligned with the nation's progress. As reported by the Minister of Housing and Local Government (KPKT), Zuraida Kamaruddin, the innovative, ecological and health technologies have to be integrated

into Malaysia's affordable public housing to promote and improve the safety, wellness and standard of living of its occupants (Ng, 2019).

However, the private sector has always been focusing on the development of medium or high-cost property since the profit margins is significantly higher as compared to the delivery of low-cost and affordable housing in the construction industry (KPKT, 2015). It is yet to be frequently seen that sustainable housing developments are marketed in affordable price ranges. Jamaludin, Mahayuddin and Hamid (2018) claimed that there was a rigidity in coordination of strategies to achieve the ambition of infusing both sustainability and affordability in housing development. Besides that, people tend to have low awareness on the sustainability concepts in the housing industry and usually overlook the benefits of sustainable affordable housing brings to the residents, which has become one of the stumbling block to the slow pursuit of sustainable methods (Olanrewaju, Tan and Aziz, 2018).

Based on previous studies, several key benefits of sustainable affordable housing to the people were identified. Looking from the economic perspective, it was found that residents' water bill (Williams and Dair, 2007) and electricity bills (Spiegel and Meadows, 2010) were reduced while the housing value was increased (Fowler and Lipscomb, 2010). From the social perspective, crime rate (Spiegel and Meadows, 2010) is believed to be reduced which leads to the improvement of neighborhood stability and occupant's status (Allen, et al., 2006). Environmentally, sustainable buildings are able to minimize the production of household waste (Spiegel and Meadows, 2010), reduce pollution (Hamilton, 2015) and to reduce the emission of Carbon Dioxide (CO_2) (Fowler and Lipscomb, 2010).

As a result, it is vital to infuse sustainability components into housing development from the environmental, economic and socio-psychological aspects. Measures such as the delivery of awareness of the long term advantages of sustainable affordable housing to project stakeholders and the implementation of laws and regulations in enforcing sustainable yet affordable housing were recommended by Jamaludin, Mahayuddin and Hamid (2018) as the commitments to seek for a better, sustainable living standard among the people. In view of that, it is possible to merge the two characteristics, which are sustainability and affordability, in housing development that is obtainable for the good of the people and the country. Hence, this study concentrates the focus on sustainable affordable housing.

1.3 Problem Statement

Jamaludin, Mahayuddin and Hamid (2018) explained that decent shelters should be built within a well-connected neighbourhood with adequate components of worthwhile and healthy living. However, it is a well-known fact that the price of land varies differently based on its location and sustainable features are high in cost. In spite of that, countries such as Hong Kong, Australia and the United Kingdom are still able to implement sustainable affordable housing despite the challenges faced (World Economic Forum, 2019).

Previously, there were studies carried out to identify the factors affecting the demand of affordable housing (Zainon, et al, 2017) and the impacts of sustainable affordable housing (Trachtenberg, et al., 2016; Enterprise Community Partners, 2014). A few of the studies carried out on sustainable affordable housing is related to the challenges to its implementation, such as studies carried out by Arman, et al. (2009), Coimbra and Almeida (2013) and Jamaludin, Mahayuddin and Hamid (2018). These studies mainly mentioned the barriers of integrating the elements of sustainability and affordability into the same development, such as the high costing of sustainable building materials, scarcity of local green products, lack of knowledge and awareness among purchasers, lack of technical skills and the lack of commitment and organisation.

Furthermore, the indicators of the performance of affordable and sustainable housing developments are defined by Pullen, et al. (2010) and the indicators are integrated in an interim assessment framework for the built industry experts. Besides, research carried out by Akadiri, Chinyio and Olomolaiye (2012) illustrated a conceptual framework for the construction design teams to implement sustainability in the industry. A multidimensional framework was created to test the extent to which certain housing projects make significant progress in creating sustainable housing and the reason why certain sustainable aspects were not applied in Massachusetts, United States (Turcotte and Geiser, 2015). Furthermore, researches on the Malaysian developers' (Abidin, 2010; Ibrahim, Wira and Shafiei, 2013) awareness and readiness towards sustainable construction of affordable housings was also carried out as the developers are the critical stakeholders in the promotion and initiation of sustainable affordable housing.

From a housing buyer's perspective, awareness and readiness towards affordable housing was measured by Ang, et al. (2017) through a research conducted.

On top of that, sustainability assessment framework for the residential construction sector and the indicators for sustainable housing development (Franca, 2012; Ng, Mohamad and Goh, 2017; Tupenaite, et al., 2017) have been developed over the years, and yet these studies only focuses on the sustainable indicators of a normal housing instead of affordable housing. With the rising awareness of sustainability, the assessment tools for sustainable housing affordability were also developed in respect to the affordability of housings in various regions such as Australia (Mulliner, Smallbone and Maliene, 2013), Nigeria (Saidu and Yeom, 2020) and India (Jana, et al., 2016). However, a sustainability framework to identify and prioritise the criteria of sustainable affordable housings in Malaysia from housing purchasers' perspectives can be merely found yet, which leads to the intention of this study.

Olanrewaju, Tan and Aziz (2018) claimed that in most of the countries including Malaysia, more than a percentage of seventy (70%) of housing is affordable housing. On the other hand, more than its 90% of the construction of affordable housing was not planned and built in compliance to sustainability requirements. The question is, why is there still a low supply and development of sustainable affordable housing despite having the national sustainable development goals specifically for construction industry? Hence, this research intends to discover the sustainable components that are suitable to be applied in affordable housing in Malaysia based on purchasers' perspective. Pullen, et al. (2010) highlighted that sustainability should be emphasized in the affordable housing sector for the benefits to lower-income households. As a result, it is necessary for such studies to be conducted as to explore the sustainable aspects which purchasers deem to be suitable and crucial. By doing that, this research aims to improve the environmental, social, economic condition of the middle to lower income groups along with the improvement of housing security.

1.4 Research Aim

This study intends to prioritise the sustainability criteria of affordable housing by developing a sustainability framework in order to achieve quality living standard of the affordable housing purchasers.

1.5 Research Objectives

To attain the research aim, three research objectives are constructed:

i. To explore the criteria for sustainable affordable housings in the environmental, economic, social, culture and technological sustainability aspects.
ii. To compare the ranking of criteria in choosing sustainable affordable housings from different age and gender groups among low-middle income earners.
iii. To propose a sustainability framework for affordable housings from housing purchasers' perspectives.

1.6 Research Methodology

First of all, the research problem was defined, and the previous literatures and studies related to the topic were reviewed. A collection of sustainable criteria has been identified and categorized into five groups which are social sustainability, economical sustainability, environmental sustainability, culture sustainability as well as technological sustainability. A list of questions related to the research was identified, developed and conducted through online questionnaire survey distribution as quantitative approach was applied. Then, the collected data was analysed using Cronbach's Alpha Reliability Test, Measures of Central Tendency and Mann-Whitney U Test and discussed in depth. Eventually, a sustainability framework was developed based on the results.

1.7 Research Scope

The research scope is narrowed down to Malaysian housing buyers within Klang Valley. The targeted respondents are low (<RM 4,360) to medium (RM 4,360 – RM 9,619) income group citizens.

1.8 Chapter Outline

This research study is inclusive of five chapters. The first chapter, the introduction of the research, outlines the context which includes the background of affordable housing and the benefits of its development. Then, the problem statement reviews the previous related studies and identifies the research gap and research problems. The research aim and objectives are also being determined in this chapter, along with the research scope and research methodology.

Chapter 2, the literature review, illustrates an overview of affordable housings and the sustainable components that can be applied in affordable housings. A framework of sustainable components is developed and discussed. Next, Chapter 3 demonstrates the approach and manner the research is conducted in order to meet the research aim and objectives, which is inclusive of the research design, rationalisation, strategic planning, process of data collection and methods of analysis.

Chapter 4, the results and discussion, presents the findings obtained through questionnaire surveys and interprets the results in detail. Lastly, Chapter 5 summarizes and concludes the entire research study with reference to respective research goals. The constraints in this research are examined and suggestions for future research are highlighted.

1.9 Chapter Summary

There was a gap in knowledge on the prioritised sustainable criteria of affordable housing from purchaser's perspectives that head to the focus of this study. The problem statement was identified and thus a research goal along with three objectives were proposed. Besides that, the methodology used to carry out this study and a chapter outline were formed under this chapter.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter assembles the review of related literature and studies on the various features and criteria that can be adopted in affordable housing to make it more sustainable.

2.2 Background of Malaysia Housing

The word 'housing' is combined with the word 'accommodation' under the Housing Development Act 1966 (Sulaiman and Ruddock, 2005). 'Accommodation' is added into the explanation of 'housing' to make it more precise for purchasers. The individuals who opt to buy a house' is known as a 'purchaser' by the meaning of 'every individual who purchases housing accommodation or has any relation with a licensed developer in respect to the purchase transaction of housing accommodation' under Part VI. Section 16A of Malaysia Housing Development Act (Act 118) 1966.

For many Malaysians, being able to buy and possess a residential property is a primary target and it is perceived as a privilege among individuals to be able to own a house in a well-organized neighbourhood (Tan, 2008). However, the increase in Malaysian house prices has outpaced the growth in income rates ever since 2012 (Cheah and Almeida, 2016) and the predominant median house prices are therefore out of the control of the ability of most Malaysians. Sulaiman, Ruddock and Baldry (2005) inferred that throughout Malaysia, a developing country, housing affordability has always become an issue and affected all people, especially those under the low-medium income group households. This issue was exacerbated by the issue of the high concentration in the development of higher-priced housing, leading to the undersupply of affordable housing (Cheah and Almeida, 2016).

Several schemes have been launched especially by the government to foster the growth of affordable housing development in both the private and government sector. Various policy thrusts were being introduced over the years in line with the National Plan. For example, the Housing and Local Government Ministry (KPKT) has launched the National Housing Policy for year 2018 to 2025, with the goal to put more emphasis on the bottom 40% income group citizens (B40) and to tackle the demand

and supply gap issue of affordable housings by assembling public and private sector resources. In view with that, Dastane (2017) proposed that developers are not the only party who decides on the prices of property unit, but it instead involves all parties regardless of the private or the public sector.

2.2.1 Affordable Housing

According to Cambridge Dictionary (2020), the word 'afford' means 'having the ability to carry out or buy something as someone has sufficient money or time' or 'being able to do something without causing any adverse consequences'. Cheah and Almeida (2016) recited Demographia International that according to the developed Median Multiple (MM) methodology, a house is known as affordable if the mean gross annual income of a family can finances the property within three times of its amount. In accordance to the criteria, Raj (2017) mentioned in his article that the Bank Negara Malaysia remarked that for a median income of RM4,585 and with the annual median income of around RM55,020, the affordable housing price shall be set in between RM165,000 to RM242,000. However, the stated prices are unlikely achievable as house prices were about four (4) times the median income while the condition was even worse in urban areas such as Kuala Lumpur and Selangor which was about 5 times higher. This statement is further supported by the research result carried out by Ismail (2019) from Khazanah Research Institute in Figure 2.1, which reflects the highly imbalanced proportion between the annual median income and median house price for year 2002 to 2016 in Malaysia. Especially in between year 2012 and 2014, the country's overall housing affordability had dropped dramatically when the median house price increased at a CAGR of roughly 23.5% from RM175,000 to RM280,000.

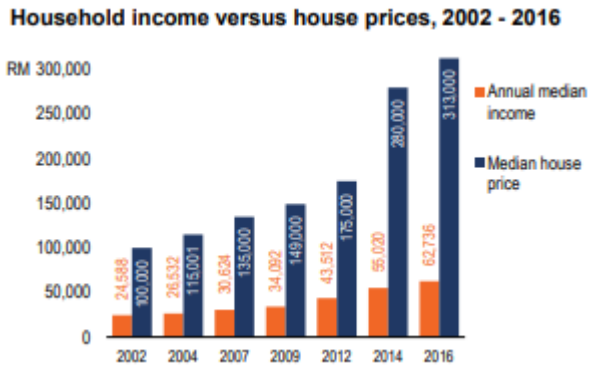

Figure 2.1: Household Income versus House Prices, 2002 – 2016.
(Source: Khazanah Research Institute, 2019)

One of the key goals of affordable housing is to boost the ability of low-middle income earners to own a house (Gan, et al., 2017). Berry, et. al. (2004) mentioned that the necessity to help out the lower to medium income households has become another interpretation for the phrase of 'affordable housing'. In Malaysian researcher's terms, housing units that are under the capability of the different income groups of individuals to pay for houses they wanted to own was the definition of "affordable housing" by Sulaiman, Ruddock and Baldry (2005). Households spending more than 30 per cent are deemed to be overloaded with the property loan repayment, as they m ay have the risk and fear of not getting adequate income for other basic needs such as food and healthcare. In other words, affordable housing, being simplified, is the property unit which is able to be bought and owned by low to medium income individuals without any risk or problems caused to the person. Among the human rights, 'affordability' is one of the rights that is deemed to be essential and also important to adequate housing (Sulaiman, Ruddock and Baldry, 2005).

2.2.2 Low Cost Housing (LCH)

Low Cost Housing (LCH), is always one of the national policies ever since Malaysia has gotten its independence, where it was officially implied in the First Malaysia Plan back in year 1966 to 1970, while the private sector only got their hands involved during the Second Malaysia Plan from year 1971 to 1975 (Salleh, 2008). In order to allow the low-middle income groups to own a house, the government sets ceiling prices for the different unit sizes of houses, control the financing costs of loan providers and at the same time monitors the housing market closely, clarifying the type of materials and design used during construction.

Even with the availability of a minimum budget, the four major aspects of housing which are safety, sufficient facilities, physical and mental wellbeing, and community, are ensured to be applied on the space and configuration and layout. All these efforts are carried out to secure the minimum standard of living for human habitation of the low-cost housings. One of the methods used by the National Housing Department to determine the qualified purchasers of LCH is by using the open registration system. This system managed to develop the Guidelines for Eligible House Buyers for Low Cost Housing which was filed and documented to increase the productivity of the selection of eligible buyers from developers for both public and private sectors.

2.2.3 The Income Groups in Malaysia

The classifications and official statistics data of income are constantly gathered by the Department of Statistics Malaysia (DOSM). The income groups in Malaysia are basically distributed into three main categories, which are the B40, M40 and T20. These are the terminology used to describe Malaysian household revenue and they are more of a common concept of the "40% bottom-class", "40% middle-class" and "20% upper class" that distinguishes the percentages of the groups at the same time. According to the Kaur (2020), such income comprises of cash and profits from investments, salary from work or inheritance. However, the standard of classification for every income level would be adjusted depending on the country's GDP every year. Table 2.1 shows the income range of T20, M40 and B40 respectively based on the report generated in 2016, where the income for B40 is less than RM 4,360, income for M40 is between RM 4,360 to RM 9, 619, while T20 group earns more than RM 9,619.

Table 2.1: Income Threshold for B40. M40 and T20
(Source: Department of Statistics Malaysia, 2017)

	Average (Mean)	Median (Middle Mean)	Range
Bottom 40% (B40)	RM 2,848	RM 3,000	<RM 4,360
Middle 40% (M40)	RM 6,502	RM 6,275	>RM 4, 360 – RM 9,619
Top 20% (T20)	RM 16,088	RM 13, 148	>RM 9,619

2.2.4 Gender's Preferences in House Purchasing

Purchasing a home is probably the largest investment that most people will make in their lives. However, the contrasting opinions that men and women have on homeownership are of special concern. According to the Consumer Outlook Survey carried out by Prudential Real Estate (2014), women and men do not inherently in the same agreement in terms of home ownership, and the sale and purchase of a house. Considering price, brand and quality as the three main factors, based on a study done by Pirlympou (2017), men's most preferred purchasing preference is quality, followed by the brand and the price.

While on the other hand, women also seemed to focus more on product quality and then followed by the price and the brand being the last. Some other factors which

influence purchasers' behaviour are technology, economy, globalization, climate, demographics, wellness and retail. Apart from the nature behavior, the amount of money earned also affects the way an individual spends. According to Hill (2016), full-time working women only earns roughly 78% of what men earn, despite both having the same type of work, skills and education. The pay gap might have also contributed to the difficulties of many women to cover bills and save up. Evidently, few researches have proven that many women items are frequently sold in higher price as compared to men's, which on average, they cost 7% more than men products (Hill, 2016). With higher monthly expenditure, there is a tendency for women to prefer cutting cost on some other needs such as transportation and shelter (Agensi Kaunseling dan Pengurusan [AKPK], 2018).

2.2.5 Age Preferences in House Purchasing

Demographics usually have connections to property buying activities (Majid, Said and Daud, 2012). Besides, housing demand can be measured from time to time using demographic information such as consumer's age which changes slowly in the demographic cycle within more than twenty years. According to Khan, et al. (2017), there is a likelihood that young generations with small households will consider buying a small house close to his place of employment. For example, it was found that in terms of price, durability and suitability, younger purchasers ranging from age 18 – 25 years old would prefer price as the main factor in purchasing an item.

On the other hand, purchasers in the range of 35-50 years old would consider the suitability of the product first before dropping their order. The age group of 65-74 years old would consider the durability instead (Herve and Mullet, 2009). Apart from that, in a study conducted by Aryani and Tu (2017), Indonesian residents between the ages of 20-35 prefer to choose minimalist constructions, 36-45 years old would actually prefer transitional housing, while residents over 45 years old tend to opt for Mediterranean buildings.

2.3 Sustainable Development

Sustainability is defined as the ability to maintain and satisfy current needs and avoid depleting the resources and needs of future generations by the World Commission on Environment and Development (Tapsir, 2005). On the other hand, sustainable building was identified as a structure that its service life exceeding the design life, while at the

same time meeting environmental requirements by not consuming the resources we have today abusively.

Throughout the world, the built environment is attributed for consuming over 40% of energy, which at the same time produces likely the same amount of wastes, using up to 16% of water during construction (World Business Council for Sustainable Development [WBCSD], 2009). Furthermore, about 6% of the global greenhouse gas emission is caused by the built environment sector which is mainly caused by the onsite energy generation and household fuel burning for daily activities (United States Environmental Protection Agency [EPA], 2019). According to the UNDP Communication Office (2007), the population of Malaysia citizens only stands less than 0.5% of the world's population, and yet the carbon dioxide gas (CO_2) emission exceeds 0.5% of the total global emissions, with an average of 7.5 tonne of CO_2 gas emission per person. Based on estimation, with the implementation and assistance of proven technologies found in the market, the potential to reduce buildings' consumption of energy by 30% to a maximum of 80% (EPA, 2019).

Aside from providing infrastructure and accommodation, the built environment indirectly and directly involved in global employment for about 10% as well as the economic exchanges (WBCSD, 2009). Hence it can be seen that the construction sector plays a vital part in sustainable development. Zaid and Graham (2011) suggested that since the government plays the major role in providing affordable housing, Malaysia has a higher capacity to adopt and apply energy efficient plans to reduce the energy consumption as well as carbon emission in buildings. Based on a study conducted by Abidin (2010), where the awareness level towards the implementation of sustainable concepts into construction among developers across Malaysia, only a small amount of efforts is given in the implementation even if the awareness of it has risen. Moreover, from the study, most of the developers recognized that sustainability only applied to environmental issues and its protection, without considering social and economic aspects.

Since people are paying more attention towards environmental issues and along with the rise of latest technologies, the equilibrium between quality and sustainability can be met in an effort to develop comfortable yet affordable residential housing. These three independent areas: social impacts, economic and environmental issues along with the cultural, and technological sustainability of a construction project have

to be safeguarded and taken into consideration as an integrated whole instead of treating them independently (Tapsir, 2005).

2.3.1 Sustainable-Affordable Environment

Figure 2.2 portrays the relationship between the five elements of sustainability as suggested by Nair, et al. (2005) with the support of policy programmes. Human communities should be planned, built and enhanced thoroughly in a way which the principles of sustainable development should be taken fully into account to improve and conserve the living ecosystem that promotes physical and psychological human wellbeing, meet shelter needs while at the same time maintaining the natural biodiversity for future generations, as highlighted by Nair, et al., (2005). Hence, a framework of priorities should be designed to identify the criteria and strategies to achieve sustainability in environmental, economic, societal and cultural aspects.

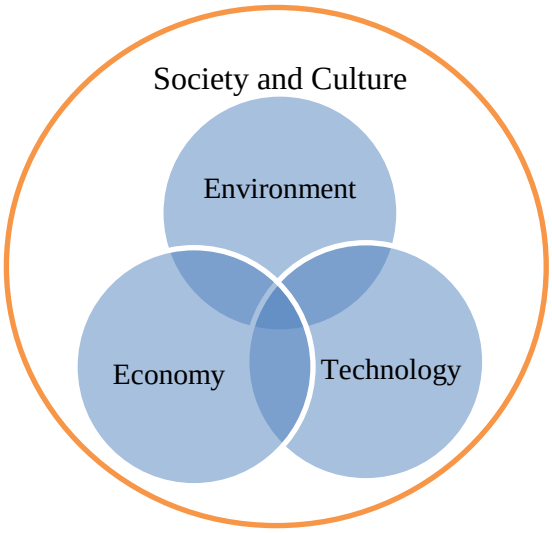

Figure 2.2: Sustainable Affordable Habitat (Source: Nair, et al., 2005)

Table 2.2 tabulated the criteria identified for sustainable affordable housing from the environmental, social, economic, cultural and technological aspects through previous studies.

Table 2.2: The Criteria of Sustainable Affordable Housing from the Environmental, Economic, Social, Cultural and Technological perspective.

Sustainability Aspects	Criteria	Sources
Environmental	Energy Efficiency	Mulliner and Maliene (2011); Wiesel, et al. (2012); Eizenberg and Jabareen (2017)
	Water Efficiency	Jamaludin and Bakar (2008); Ibem and Azuh (2011); Chan and Adabre (2019)
	Indoor Environmental Quality	Wiesel, et al. (2012); Tupenaite, et al. (2017)
	Waste Management Facilities	Tupenaite, et al. (2012); Saidu and Yeom (2020)
	Housing Density	Ibem and Azuh (2011); Eizenberg and Janbareen (2017)
	Land Use Efficiency	Hamid, Jamaludin and Mahayuddin (2018)
	Selection and Efficiency of Construction Materials	Tupenaite, et al. (2012); Saidu and Yeom (2020)
Economic	Housing Affordability	Ibem and Azuh (2011); Tupenaite, et al. (2017); Hamid, Jamaludin and Mahayuddin (2018).
	House Price or Rental Cost in Relation to Income	Mulliner, Smallbone and Maliene (2013); Severson and Vos (2018); Saidu and Yeom (2020)
	Mortgage and Interest Rate Charged by Banks	Mulliner, Malys and Maliene (2016); Tupenaite, et al. (2017)
	Housing Subsidy and Funding	Hamid, Jamaludin and Mahayuddin (2018); Saidu and Yeom (2020)
	Lifecycle Cost and Maintenance Cost	Ibem and Azuh (2011)
	Effective Building Management and Maintenance	Wiesel, et al. (2012); Saidu and Yeom (2020)
Social	Accessibility	
	Transportation Services	Jamaludin and Bakar (2008)
	Education Institutes	Idris, et al. (2011)

	Health Care Services	Maliene and Malys (2009)
	Leisure and Recreational Spots	The Economist (2020)
	Employment Opportunities	Mulliner and Maliene (2011)
	Social Inclusion	Nair, et al. (2017); Eizenberg and Jabareen (2017)
	Social Equity	Mulliner and Maliene (2011); Wiesel, et al. (2012)
	Housing Quality and Occupant's Quality of Life	Ibem and Azuh (2011); Mulliner, Smallbone and Maliene (2013); Tupenaite, et al. (2017)
	Safety and Security	Nair, et al. (2005); Hamid, Jamaludin and Mahayuddin (2018); Chan and Adabre (2019)
	Social Amenities	
Cultural	Cultural Infusion in Housing Design	Sazonova (2014)
	Religious Buildings	Geels (2020)
Technology	Building Technology in Construction	Musa, et al. (2005)
	Smart Home Technology	Chen (2020)

2.4 Environmental Sustainability

In the construction industry, energy is used most for the manufacturing and transportation of building construction materials, plants and machineries. Buildings are resource-intensive especially during the development and operation phases which at the same time produces a vast amount of waste at the point of demolition (Pitts, 2004). As claimed by Wiesel, et al. (2012), environmental sustainability in housing can be accomplished through the tackling of the limitation of natural resources through the efficient utilization of non-renewable energy, reducing the effect of waste materials and the minimize of the pollution caused by technology usage. Every country all over the world, be it the developed, developing or under-developed countries are encouraged to progress in tandem with the global deployment of new technologies that leads to less resource consuming and less harmful to the environment (Nair, et al., 2005).

2.4.1 Energy Efficiency

Proper housing service utility encourages and maintains the optimal usage of electricity and energy in buildings through the usage of renewable and sustainable form of energy supplies to mitigate the buildings' life cycle cost (Aribigloba, 2017; Saidu and Yeom, 2020). Furthermore, Maliene and Malys (2009) also reasoned that energy efficiency is a necessity in sustainable housing as higher energy efficiency will make a major difference to the quality of life, health and standard of living especially for poor households. The resources consumed in constructing and maintaining homes can be minimised through the design and construction of structures with the proper usage of building materials. One of the significant starting points for reaching high energy-efficiency standards in a building is the application of 'passive design' which is the inclusive of any practicable steps to minimize energy usage while taking any potential external source of energy into consideration to the design of a building's ventilation, cooling and lighting systems (Kilbert, 2016).

2.4.2 Water Efficiency

Halliday (2008) stated that the goal of sustainable water management is to achieve effective usage of water and reduce water pollution such that water can be restored to the ecosystem in a beneficial form. The matter of water efficiency should be addressed and paid attention to in the early design phase of a housing development as suggested by Li, Bae and Horton (2019), whereas energy and water assessment systems should be set up and adhered to as well (Marquez, et al., 2018). Without an effective water management, water shortages and long-term security of water supplies can be serious issues in future. Some of the systems that are introduced in order to achieve water efficiency are the installation of rainwater tanks for the purpose of vegetation or laundries and the reuse of grey water from showers (Wiesel, 2012), and the installation of Sustainable Drainage System (SuDS) which utilises permeable sheets and filter strips to trap rainwater run-off (Halliday, 2008).

2.4.3 Indoor Environmental Quality

Indoor environmental quality usually includes elements such as air quality, lighting comfort, and acoustic insulation. Wiesel, et al., (2012) highlighted that decisions concerning the building height, setbacks, orientation and the distance between each

building of new residential development are of primary importance especially for medium, high density and multi-unit projects.

The direction where the building is positioned and the design of the new building should aim at adjusting to the scope of the surrounding environment in order to reduce issues such as overshadowing, maintaining visual and acoustic privacy, optimum exposure of natural sunlight, and allowing cross ventilation to take place by natural breezes using the orientation of the building. Huo, et al. (2019) also emphasized the significance of the size and availability of windows to enhance indoor ventilation and light exposure in enhancing the health and wellbeing of occupants. Besides that, attempts should be taken to minimise the usage of long corridors to serve a vast number of residential units to maximise the access of natural light and to ensure appropriate ventilation (Wiesel, et al., 2012).

Acoustic disturbance can be caused by inadequate design of unit layout and construction materials, where one of the examples is the positioning of laundries next to bedrooms or study rooms, therefore, areas that are expected to be noisy should be placed together and away from areas that require calm and quiet atmosphere. Besides, Halliday (2008) also mentioned that dense construction materials such as concrete and screens such as trees and fences can be used as sound insulators.

2.4.4 Waste Management Facilities

Saidu and Yeom (2020) recognized that one household's wellbeing and health can be affected by improper management of solid and industrial waste. Waste and materials release a vast amount of Green House Gases (GHGs) that will affect climate change (Chen and Lin, 2008), and they actually provide a neglected opportunity to improve a building's sustainability (EPA, 2020). Household practices often lead to waste accumulation which will further pollute the environment. In addition to waste disposal, the emissions of GHG from waste management, storage, transportation and machinery operation can affect the environment significantly due to its heavy usage of fossil-based resources (Menikpura, Sang-Arun and Bengtsson, 2013). Even so, there must be awareness of the capacity for any possible indirect GHG reductions through materials and energy recovery from waste management as the emission of these harmful gases will increase without the presence of effective policy decisions on proper and adequate waste management. One of the approaches in managing waste appropriately is to monitor the amount of waste produced by the building and to utilize

the data collected for building performance benchmarking (EPA, 2020). With that, waste level tracking system can be installed as well to collect waste whenever the quota set in advanced is reached.

2.4.5 Housing Density

Newman and Kenworthy (2006) described density as the ratio of population or residential units to the area of property, which influences climate change through disparities in the usage of resources, energy, land for housing, and urban infrastructure. Pullen, et al. (2015) recommended that housing should be socially and economically versatile by maintaining reasonable density and residential size for pleasant habitation. However, housing with high density should be encouraged especially in urban areas as a way of addressing road congestion which is one of the major causes of air pollution due to heavy carbon emission (Poh, 2019). People tend to live near their offices or in easy reach to public transit services to reduce traffic congestion but the lack of connectivity from peoples' homes and offices to public transports made the usage of these transportation to remain low. It was also mentioned by Poh (2019) that high-density living can provide quality living as well as through neighborhood and building planning.

2.4.6 Land Use Efficiency

Urbanization has led to the growth of population which causes the rise of pressure in land development due to the increase in demand for housing and services. Jana, et al., (2016) indicated that land supply is one of the most important factors in the realization of sustainable and affordable housing. Asfour (2017) claimed that the cost of housing is directly affected by the availability and price of the land. Furthermore, Mondal and Das (2018) claimed that land zoning limitations for affordable housing projects such as the constraints on multi-family housing, compact development and low-rise residential housing do not promote the effective usage of land.

The living environment can be shaped into a "live, work, shop, play" community with proper design and planning, where a living residential area can also be filled with office spaces, retails and restaurants. One of the aims behind this concept is to build a city where a larger amount of people has access to the conveniences of affordable employment, retail shopping, quality healthcare, cultural services and entertainment channels, irrespective of socioeconomic background (Horbovetz, 2017).

Hence, a well-designed zoning of land use is crucial for housing developments as the provision of recreational and open space are able to affect inhabitants' living environment (Yakob, Yusof and Hamdan, 2012).

2.4.7 Selection and Efficiency of Construction Materials

Construction materials have to be chosen cautiously to improve the building's energy efficiency, durability and longevity. Energy performance can be improved by constructing structures that are durable and versatile to change, by reducing material consumption, eliminating materials with high degree of embodied carbon and waste by choosing materials that can be recycled or reused, and at the same time delivering goods with a minimum of transportation and processing (Kibert, 2016). In corresponding to that, Abdelsalam and Rihan (2013) also highlighted that the sustainability of construction materials depends on the utilisation of local resources and should be manufactured locally with skilled labour, making use of already accessible materials that does not require significant capital. Sustainable material selection allows the reduction of costs during construction which enables home purchasing to be more competitive and affordable while at the same time minimising negative impact to the external environment.

2.5 Economic Sustainability

Economic sustainability depicts the strategies to foster long-term economic development without adversely affecting the community, social and cultural context and the environment (University of Mary Washington, 2020). The development and sustainability of the economy is important, and it is the path to deliver the ability to meet the minimum necessary needs, alleviate poverty and create job opportunities. Economic sustainability in affordable housing simply proposes that the building's project income outweighs the expenses of the project, however, the position of the emerging industry has to be improved to boost its financial output for the maximisation of revenue (Wiesel, et al., 2012).

While housing issues emerge as a symbol of deprivation, pure financial aids normally do not help the low-middle income groups to fulfill their housing needs. In fact, in every region of the world, a typical household affordability relies on the allocation of various resources needed for housing and these resources must be distributed accordingly due priorities and considerations during any development

project planning (Nair, et al, 2005). Hence, economic sustainability in housing is related to yield maximizing and urging lower cost while at the same time coming up with strategies for economic growth to enhance household members' economic self-dependence.

2.5.1 Housing Affordability

The affordability of housing is commonly addressed as accommodation that is adequate in terms of price, quality and location, and it is not so pricey that it prohibits its residents from satisfying certain essential living needs (United Nations Human Settlements Programme [UNHABITAT], 2018). In terms of financial affordability, the UNHABITAT (2018) addressed that housing affordability is influenced by two (2) key components, which are the house purchasing cost and the amount of money needed to keep the house. Based on Figure 2.3, the cost to buy and keep a house is affected by the market property price, the sum of down payment needed, the capability to fund the property maintenance, and the ability to repay service loans.

With enhanced housing affordability, the lower-middle income groups are able to obtain housing of decent quality that they could not afford to buy in the private market previously. Besides that, Wiesel, et al. (2012) deduced that sustainable affordable housing decreases the burden and income stress of households, enabling families to invest their income more on other essentials such as health care, education and food. Saidu and Yeom (2020) suggested that the government should offer opportunities to reduce housing prices by providing incentives such as reduction of interest rate, subsidies, grants and adequate funding for the low to middle income groups.

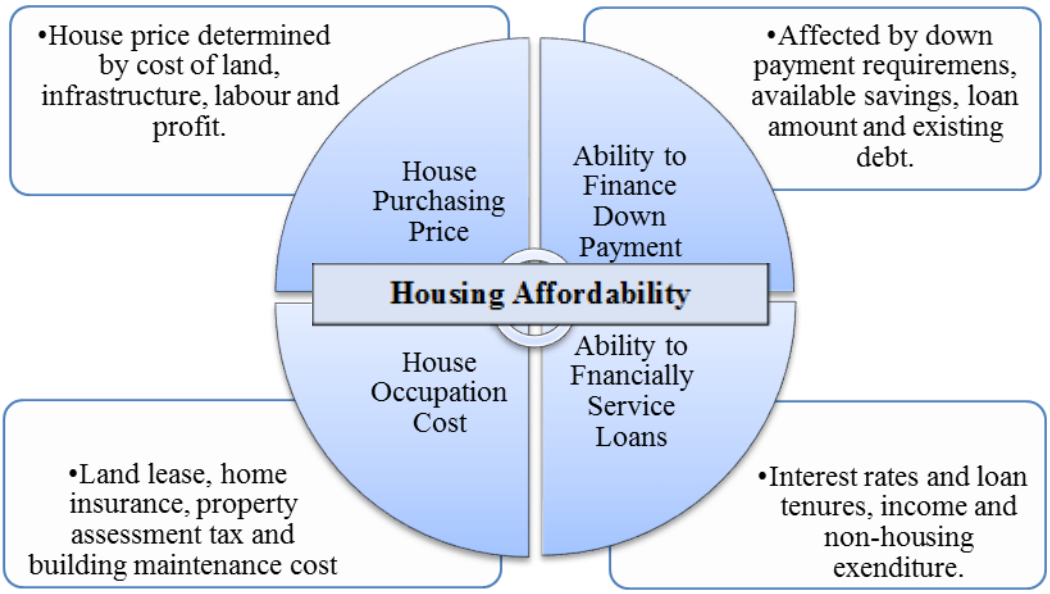

Figure 2.3: Basic Components of the Financial Affordability of Housing. (Source: UNHABITAT, 2018)

2.5.2 House Price or Rental Cost in Relation to Income

Chan and Adabre (2019) mentioned that an affordable house must consider whether a household has enough money left over for other certain needs of life after paying for their monthly rental or mortgage fees as the family will be known as 'shelter poor' if they are unable to afford other non-housing needs such as medical services, food, and entertainment. Wiesel, et al. (2012) inferred that organizations may follow various affordability standards and metrics which normally span from 25% to 30% of income to determine the rental rate for households of different amounts of incomes. However, while affordable housing schemes are typically more economical than private rentals, variances can occur between different projects and different categories of households.

Obeng-Odoom (2010) argued that although rent control laws are effective in regulating the inflation of housing rental prices, there might be a 'grey area' established which would contribute to the phenomenon of higher rents. By implementing measures that will mitigate inflation rate in the future, the sustainable pricing ensures a steady and reasonable home price in the longer term, which indicates that requirements such as housing purchases, housing costs, housing constructions and inflation rates have to be studied (Lorenz and Lutzkendorf, 2008).

2.5.3 Mortgage and Interest Rate Charged by Banks

Wiesel, et al. (2012) included mortgage payments as one of the expenditures under the interpretations of housing costs, aside from household insurance, taxes and maintenance cost. In a policy setting where minimal public incentives and financing schemes are pursued, the cost and conditions of any mortgages used to fund affordable housing production and refurbishment remain at the core of economic sustainability.

Low-income earners are primarily faced with the opportunity to access financial loans from banks as the key factor to consider when deciding on buying the desired house. People often attribute the initial down payment to the margin of financing and certain entry expenses such as legal bills, stamp duty, valuation fees which are also burdening to low-middle income earners when purchasing a house (Dastane, 2017). In making the decision to buy a house, one's income has to be taken into consideration in determining the price range of the property (Saw and Tan, 2014) as the ability to pay the monthly installments and interest rate of loan taken is of primary importance in order to prevent any future default payment.

2.5.4 Housing Subsidy and Funding

Stimulus should be offered by the government to the low-middle income groups to decrease housing prices and increase their buying power through the dispersion of incentives, subsidies, and appropriate amounts of funding (Adabre, et al, 2020). Besides, in the effort to promote sustainable affordable housing, the authority is obligated to participate and provide incentives such as making land price affordable for housing developers. Love, at al. (2011) pointed out that the government should develop and offer sufficient incentives as one of the main strategies to sustainable development.

2.5.5 Lifecycle Cost and Maintenance Cost

Sustainability is basically the consideration of long-term cost as constructing houses cheaply may generate more dwellings for money invested, but it may cost more over the long run. Building housing development pursuant to sustainability standards may cost more as in its capital investment in the short term, but will have a substantial downward impact on the general long term costs (Jamaludin and Bakar, 2008) as it lowers the daily demand of resources such as water and energy while durable

construction materials reduce the gradual maintenance cost of buildings (Wiesel, et al., 2012).

Reduced running and life cycle cost prohibits tradeoff in household budgets to fulfill other shelter needs to the downside of attaining other basic needs (Adabre, 2020). This statement is also supported by Abdelsalam and Rihan (2013) as the authors believed that buildings that operate well in an environmentally friendly way can make good economic sense on a life-cycle cost basis, despite being more costly during the construction stage, as compared to conventional buildings. For example, extra expenditure is used on the installation of energy efficiency technology systems which may require higher initial cost but there will be savings in running cost in the long term which will eventually exceed the initial extra initial cost.

2.5.6 Effective Building Management and Maintenance

Pukite, et al. (2017) described maintenance as a set of tasks performed to take care of a structure and facilities of a building in order to maintain the expected operations and optimum efficiency of a building lifecycle. The building management department is usually in charge of improving the satisfaction of inhabitants and the quality of the indoor environment by delivering various services. To retain the worth of a property, proper maintenance of the infrastructure and building have to be in place (Saidu and Yeom, 2020). Besides that, a proper building maintenance can keep a building in a state in which it manages to serve its function and ensure it provides an attractive exterior (Pukite, et al, 2017). In fact, a study conducted by Mulliner and Maliene (2014) showed that there is a necessity to increase the level of residential welfare and living standards to attain cultural, social and environmental sustainability in community development by prosecuting estate and project management of housing facilities effectively and efficiently.

2.6 Social Sustainability

According to Yu (2015), in housing, social sustainability means building inclusive, safe, and stable communities that are well integrated into larger urban structures, and it takes into account cultural values, norms and customs, as well as lifestyles and activities of people living there, in order to prepare for needs such as transportation, and social interaction. While Severson and Vos (2018) viewed that social sustainability was addressed with both primary and fundamental needs, such as the access to healthy,

nutritious food, secure and sustainable housing, as well as higher order needs, such as capacity and well-being, to enhance the quality of life for present generations without undermining future generations' ability to meet these needs. In the conceptualization of an affordable housing initiative, it is important to consider and plan complex problems in order to create socially viable homes.

Bostrom (2010) pointed out that in most developments where social sustainability is not achieved, issues such as reduced sense of ownership and identity, homes being vacated, mortgage defaults, and unsafe communities will rise. Social sustainability connects the physical environment design with how people live in and use a space related to each other and act as a group (Yu, 2015). Figure 2.4 illustrates the conceptual evaluation model of the social sustainability of accommodation housing along with the degree of neediness proposed by Ancell and Thompson-Fawcett (2008). What is deemed to be the most important need for an optimum community are the quality of neighborhood and healthy relationship among the community, while the intermediate needs are transportation and facilities and some of the fundamental needs are housing affordability and housing quality.

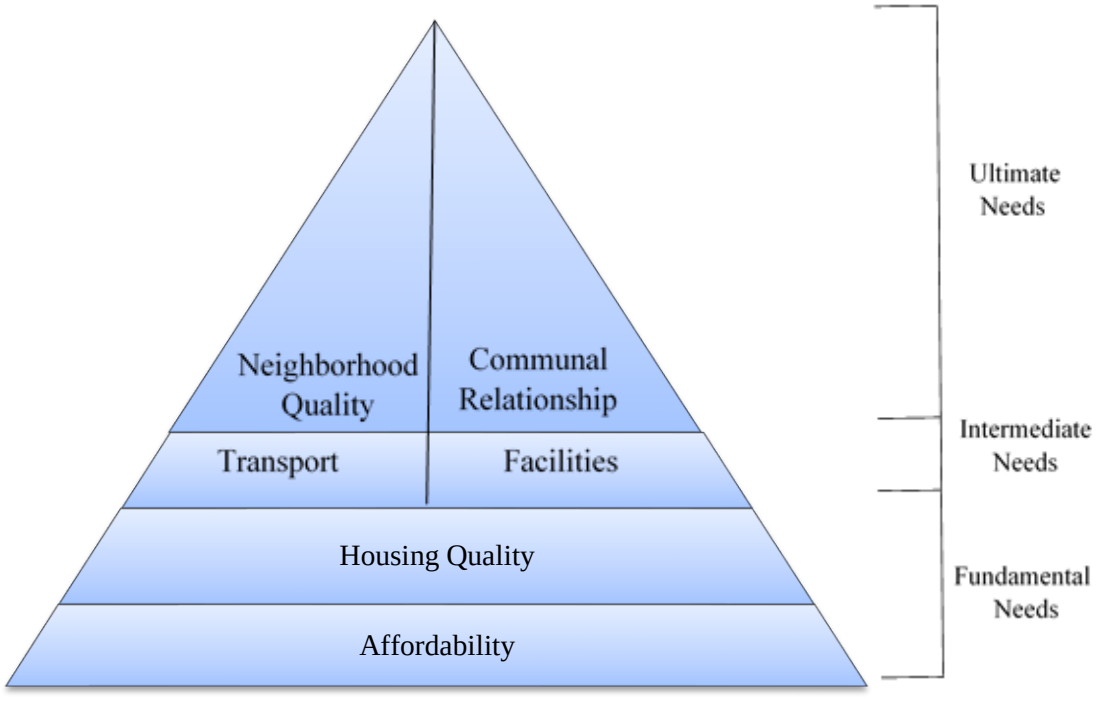

Figure 2.4: Conceptual Assessment Model of the Social Sustainability Housing (Source: Ancell and Thompson-Fawcett, 2008)

2.6.1 Accessibility

Accessibility, according to Merriam-Webster dictionary, is the capability of a location being reached by and to be easily used by individuals with disabilities. Accessibility can be categorized into many contexts, where transportation is one of it. The capacity and transport network system such as Mass Rapid Transit (MRT), Rapid Bus, highway, are the crucial factors in ensuring the accessibility of one area to another area or facilities such as schools, workplace, banks, hospitals and etc.

2.6.1.1 Transportation Services

Housing should be located close to the access to employment, stores, centres, primary health care services, and entertainment centres via public transport stations to be acknowledged as sustainable housing (Jamaluddin and Bakar, 2008; Winston, 2020). The availability of public transit is critical for car owners and car-free citizens to reach jobs and facilities and in a way to reduce the usage of cars and energy consumption as well as to reduce social inequality for those who are unable to drive (Wiesel, et al., 2012). Saidu and Yeom (2020) mentioned that the availability of reliable and serviceable transportation infrastructure such as walking pathways, bus lines, road networks and cycling tracks are essential in urban growth.

2.6.1.2 Education Institutes

Education generates knowledge and expertise to the population, as well as molding the character of the youth of a nation, that aids in the buildup of a country's economy and society (Idris, et al., 2011). Accessibility to good schools is one of the criteria people look at when picking on the places to stay (Fisher et al, 2009; Zhu et al, 2005). Mulliner and Maliene (2011) found out that the availability of quality education may also have a significant effect on an individual's career opportunities and standard of living. Idris, et al. (2011) also added that education is impactful on human development in enhancing their quality of life as education is typically seen as the pillar of a society that is able to bring social and economic prosperity and political stability. One can also increase his or her social status by obtaining education since education promotes individual capabilities in managing quality of life.

2.6.1.3 Health Care Services

Health care access is significant in making a region healthy to stay and for creating sustainable communities (Maliene and Malys, 2009). Accessibility to healthcare services is important as it affects the overall state of a person's social, physical and mental health status. More importantly, (Health Equity Brief [HEB], 2018) described that the access to a comprehensive health care system is important to preventing and managing diseases and reducing unnecessary disorders and premature death. The health care accessibility is normally affected by issues such as the availability of health care providers, cost of medical appointment, educational opportunities, stable income, discrimination, transportation and cultural competency (HEB, 2018). Besides that, it is crucial to acknowledge the factors that affect a person's health such as employment, housing, education, public safety and food access.

2.6.1.4 Leisure and Recreational Spots

Recreation, leisure and sports activities may involve individuals, small social groups, teams, or the whole community and are applicable to citizens of all ages and abilities. The variety of leisure and recreation activities differs greatly depending on local context, and they tend to be reflected upon the individual's or the social group's cultural values (O'Herlihy Access Consultancy [OHAC], 2015). The increased mobility for cultural or sports events also enables more people to engage positively within the community and spend time with their friends and families. This would also contribute to better health for those participating which in turn will reduce the demand of health care services (The Economist, 2020).

2.6.1.5 Employment Opportunities and Accessibility

Exposures to job prospects is one significant criterion to recognize the social sustainability of one housing development as it can directly affect household income (Mulliner and Maliene, 2011). The improvement of accessibility in the area of employment and recruitment creates more opportunities for the community including supplying companies with a larger pool of talent and reducing the reliance of people with disabilities on social welfare (OHAC, 2015). Having a few to no work prospects in a region can impose a growing pressure on the ability to afford housing, as well as the household income.

2.6.2 Social Inclusion

The main purpose of social inclusion is to develop a safer, fair and stable society for all, where every individual has rights and responsibilities United Nations Department of Economic and Social Affairs [UNDESA] (2020). Severson and Vos (2018) defined social inclusion as the opportunities and rights to be engaged and experience all aspects of a community life. Besides that, the author also distinguished that the 'feeling of belonging' is the key measure for social inclusion.

Furthermore, social inclusion promotes the opportunities for individuals, families, and neighbors to get access to resources for efficient involvement in the economic, social and political activities in a community (Adabre, et al., 2020). As such, this inclusive society overrides the differences of class, race, gender, geography and generation while at the same time promoting equal opportunities regardless of origin. Jamaludin and Bakar (2008) described that in order for a house to be a home it must be situated geographically so that its occupants can utilize it as a platform to blend into a community in general and it must promote social inclusion but not to be a tool of social exclusion.

2.6.3 Social Equity

Trudeau (2018) stated that social sustainability emphasizes the fair allocation and the use of housing resources as social development is essentially concerned with the distributive fairness or social equality as an integral part of creating a standard of living that is open to everyone. On the other hand, Severson and Vos (2018) explained social equity as the understanding towards the differing specific levels of support needed by different individuals in order to flourish and survive.

Over a society, everyone should be allowed to interact and participate equally despite their groups, classes and races (Nair, et al., 2005). The incorporation of social equity into the context of sustainable development relies on the involvement of agencies that promote social equity, which hires policies that emphasizes social equity at the beginning of the planning process and includes materials and discursive tools to sustain this goal (Trudeau, 2018). Furthermore, institutional leaders excel in convincingly portraying that a focus on social equity is compatible and consistent with, if not strengthening, the community values and cultures.

2.6.4 Housing Quality and Occupant's Quality of Life

Wellbeing is one 's personal feeling towards matters such as anxiety, a sense of life-satisfaction, self-reported feelings of 'happiness", and feeling if life is worthwhile. Nair, et al. (2005) highlighted that housing, aside from being a fundamental necessity, is a source of identity and has a profound impact on the occupants' overall psychological well-being as it functions as a pillar which reinforces the ties between family members and the community.

Housing of low quality dramatically reduces the quality of life of the occupants, and the evidence confirms (Gregory, et al., 2018) whereas issues such as humid, cold and low insulation from noise are some of the possible issues that stand out in respect to the quality of housing can have negative impacts on both mental and physical health and the role of housing can play in occupants' lifelong chances has been increasingly recognized (Thomson and Thomas, 2015). The type of home people stays matters. A research carried out by Gregory et. al (2018) suggested that landed houses were more favored as compared to apartments or flats, and that the difference of staying in a house and an apartment was the sense of well-being. Affordable housing tenants are less inclined to feel comfortable and safe in their homes, and therefore less likely to accept that other people would like to own a home like theirs.

2.6.5 Safety and Security

Nas (2015) defined safety as the state of being away from dangers and risks arising randomly from natural events or human mistakes, while security is the state of being away from hazards caused by man's specific intent to inflict harm. One of the critical factors to make a development a pleasant place to live is the safety (Fisher et al, 2009). Winton (2010) also supported that sustainable housing should be located in a residential environment that is safe. Sean (2014) noted that housing purchasers considerably associate community protection with neighbourhood environment as a high perceived community safety level draws more residents into a particular region. Lives and assets protection and security, as well as housing privacy are essential (Saidu and Yeom, 2020) as high rates of crime can trigger households to feel virtuous inside and outside their homes, which can adversely affect their sense of security (Mulliner and Maliene, 2011). Households living in high-crime areas may need to allocate additional money on defense and protective interventions as opposed to those residences living in low-crime areas.

2.6.6 Social Amenities

According to the Ministry of Rural Developxment (2020), social amenities which are also known as public amenities, are places, structures, and facilities which are to be gathering spots for the local residents. The availability of public spaces allows the promotion of cohesion and harmony (Maliene and Malys, 2009), and the enhancement of social activity frequency that leads to higher engagement rate (Weils, et al., 2012) among the community as such spaces encourage residents to be connected and communicate with each other. Every residential development should include well-built and complete social amenities for the benefits of all surrounding communities, which encourages the conduct of social functions and events that can form a harmonious, advanced, united and dynamic society eventually (Ministry of Rural Department, 2020). Moreover, residential development should include social amenities for all genders, elderly and the less fortunate in the society. Hence, green open spaces are important in creating a thriving community as well as sustainable housing (Winston, 2010).

2.7 Cultural Sustainability

Chiu (2004) has pointed out two definitions of cultural sustainability. The first one refers to the contribution of common beliefs, behaviours and perceptions in achieving sustainable growth. The second definition refers to the sustainability of a culture itself, and in this situation, culture is considered as a vital development aspect. Therefore, culture should adapt over time with socio-economic, and its developmental cycle should be recognized through the protection and conservation of the cultural heritage. Likewise, Thaman (2002) also argued that in order to achieve sustainable development, it must be embedded in the people's cultural values and indeed culture is the base of sustainable development. Culture is not static as it develops and changes over time with its own identity. Thus, Chiu (2004) argued that cultural sustainability shall not be associated with the static retention of culture, but instead it should be referred to the preservation and protection of cultural diversity while at the same time allowing it to evolve.

2.7.1 Cultural Infusion in Housing Design

The architecture and materials used for the house portray the occupants' living styles (Nair, et al., 2005). A study of cultural analysis of the upcoming urban development

and reconstruction policies should be carried out to identify the best option for transition, for example, urban development should consist of a holistic strategy in terms of cultural resilience which includes spatial planning and the cultural aspects (soft) of the environment that is related to the nature of societal structures and cultures (Sazonova, 2014). It is necessary to add that "soft" infrastructure or cultural dimensions should be taken into account for both local communities, connected to the site of transition, as well as broader civil concerns and the urban culture as a whole (Chiu, 2004). With this manner, culture can be recognized as the fourth component of sustainable development and be taken into consideration for urban development decisions alongside with social, environmental and economic aspects

2.7.2 Religious Buildings

Religious buildings have often played a vital role in community growth, aesthetics and direction, aside from acting as social and cultural centres. It is important to incorporate existing and new cultural and religious spaces into communities while at the same time being sensitive to all religions or contexts of faith, especially in a multiracial country. For example, the development of mosques, temples and churches in a residential area despite having only certain races of occupants being the majority. The integration of religious spaces within community planning is a comprehensive approach that deliberately integrates more facets of health that have a historical precedent in community building (Geels, 2020).

2.8 Technological Sustainability

In addition to the increase in building materials cost and the growing concern over environmental issues as the consequences of extensive usage of natural resources related to general construction, there is an urge to seek for alternative technologies. The Housing and Local Government (KPKT) Minister, Zuraida Kamaruddin also mentioned her intention in integrating sustainable yet smart technologies in affordable housing to improve occupants' wellbeing generally (Ng, 2019).

2.8.1 Building Technology in Construction

One of the major building technologies that can be deployed is the Industrialised Building Systems (IBS). IBS enhances the performance of residential developments

that are built on a wide scale, which improves the quality standard of building, ensures the project is on schedule and on budget that eventually leads to the reduction of building maintenance costs (Musa, et al., 2014). The application of technology in housing can be put in service through the implementation of modern technologies and inventions to create sustainable yet affordable housing schemes (Saidu and Yeom, 2020). The construction industry should attempt to apply smart technologies such as Building Information Modelling (BIM), Big Data and Artificial Intelligence (AI) to improve construction quality in respect to design, technical and human resource aspects.

The utilisation of smart technologies is able to contribute to the design precision and the industry's players coordination as described by Saidu and Yeom (2020) in handling personnel, finances, and material resources over a building's lifecycle and thus further boosting the effectiveness of project delivery and cost reduction. Substitutive green building materials and alternative building technologies to replace the traditional building construction method are able to mitigate natural resources loss and save energy generally (Nair, 2005). The basic necessities for technological sustainability are feasibility, functionality, durability and reliability.

2.8.2 Smart Home Technology

Smart Home Technology has been implemented in all around the world for more than a decade with the idea of introducing the concept of networking tools and appliances in houses. Robles and Kim (2010) defined smart home technology as the convergence of technologies and resources by means of home networking in seek of an improved standard of life. Applications in a smart home are connected via the internet, empowering the consumer to monitor features such as home monitoring entry, temperature, lighting and a home theatre remotely (Chen, 2020). Smart home environment is usually requested by home-owners in order to generate higher value for their property and to support the elderly and disabled individuals as smart home devices come with self-learning capabilities such that they can know the routines for the homeowner and make changes when required..

The convergence of the home systems enables them to be connected with each other via a home interface, whereby a pre-programmed single button and voice control of several home systems are enabled simultaneously. Some examples of the installation of smart home devices are automated flush toilet, automated lighting

system to control lighting from mobile devices, smart thermostat with voice control, smart alarm system, and smart lock.

2.9 Proposed Sustainability Framework for Affordable Housing

Boström (2010) argued that the sustainability of social, environmental and economy is best understood as a framework rather than a definition, which must be developed and clarified to be used as a tool to communicate, make decisions, and measure development. An assessment framework of sustainable affordable housing for low-middle income purchasers was proposed as shown in Figure 2.5. The framework has been modified and adapted from the conceptual framework for consumer decision-making (Dastan, 2017) and the policy framework for sustainable affordable habitat from Nair, et al. (2005).

The proposed assessment framework has included the five sustainable areas: environment, economic, social, culture and technology, alongside with the twenty-four (24) criteria that were identified to assist in the evaluation process of a sustainable affordable housing for low-middle income housing purchasers.

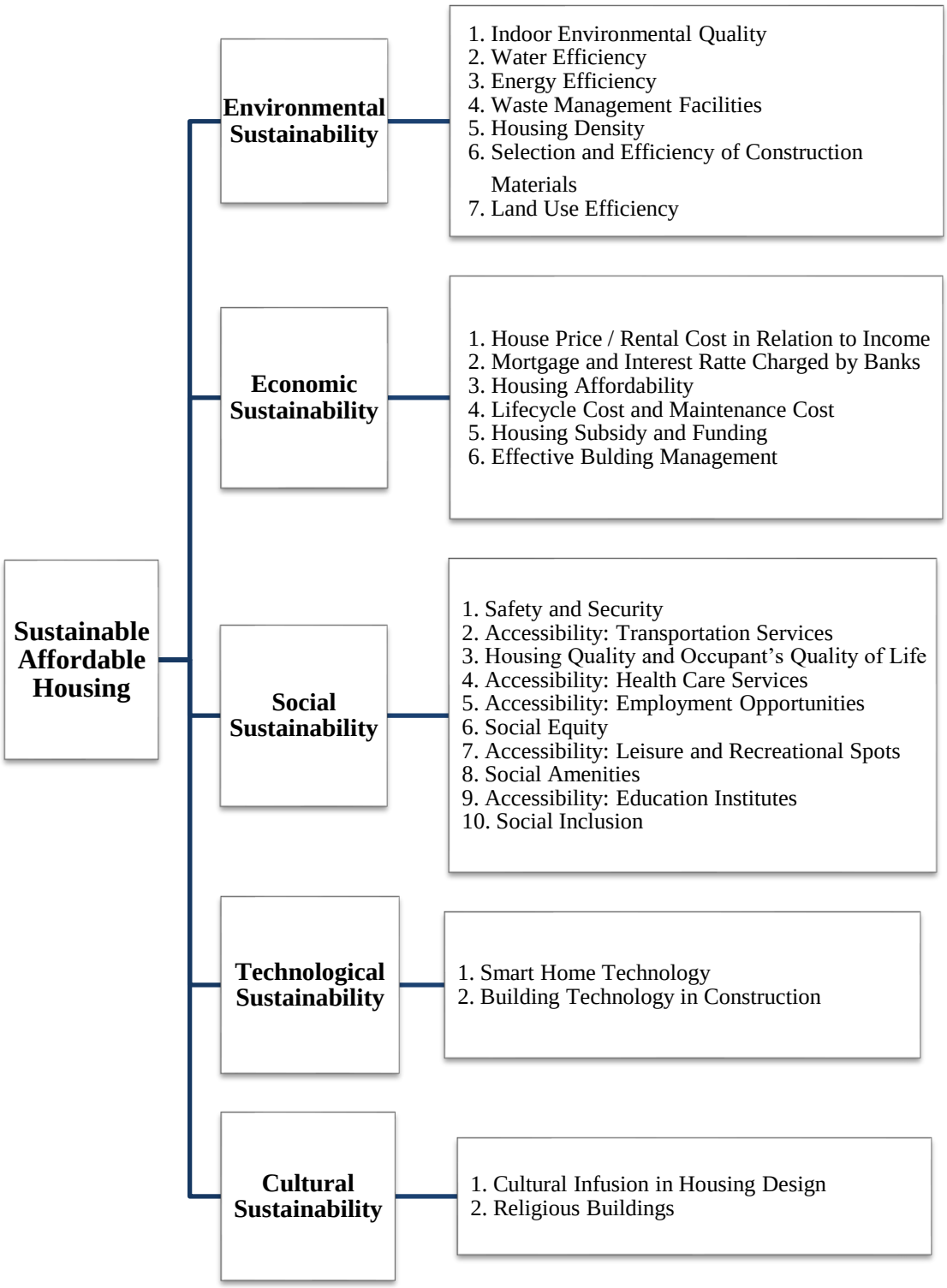

Figure 2.5: Proposed Sustainability Framework of Sustainable Affordable Housing for Low-Middle Income Purchasers.

2.10 Chapter Summary

In a nutshell, this chapter has described the housing development background in Malaysia and defined the meaning of affordable housing. A total of twenty-seven (27) criteria that can be used to identify and assess a sustainable housing had been listed and explained in more detailed based on previous studies. Lastly, an assessment framework on the sustainable affordable housing for the low-middle income purchasers was proposed. The conceptual frameworks on sustainable housings and affordable housings developed by previous researchers had contributed much in the criteria identification and to development of this assessment framework.

CHAPTER 3

METHODOLOGY AND WORK PLAN

3.1 Introduction

This chapter illustrates the data collection steps and procedures to carry out this research, comprising the method of research, approach in reviewing literature, ways of data collection, designation and distribution of questionnaire survey, identification of the design of sampling, and the method used for analyzing the data obtained.

3.2 Research Method

Research is a series of measures used in obtaining and evaluating relevant information and knowledge to improve the comprehension of a subject or problem (Creswell, 2014). Research is conducted to address and resolve emerging issues and relate them to available knowledge. Through research, insights are generated from studies to help answer questions, and with the collected results, a better understanding of the issues can be obtained. Besides, research is significant as it supports advancement for practice as new ideas and practices that have been tried in other situations can be gained (Creswell & Guetterman, 2019). There are generally three types of methods of research which are quantitative, qualitative and mixed. Each of the methods has its own approach, strengths, and weakness, and the suitability of research method depends on the nature of the research problem.

3.2.1 Quantitative Research Method

In quantitative research, the researcher recognizes a research issue based on the patterns in the sector, or the need to clarify the happening of the issue (Creswell and Guetterman, 2019). Quantitative research approaches focus on data compilation and analysis that is organized and can be numerically interpreted. Hence, it is very often used at discovering the “what” or “how: of a given event, where the questions asked in the survey are usually very straightforward and measurable (American Library Association [ALA], 2017). However, in some other quantitative research, the research issue actually requires an explanation on how one variable affects another, where the variables are the characteristics or traits of individuals studied (Creswell and Creswell,

2018). The relationship among the variables is studied to determine the influence of one variable to the other variables and vice versa.

In quantitative research questions, narrow and particular questions are asked in order to gain tangible and identifiable data on variables. The main statements and directional questions in a quantitative study are specific since only a few variables are defined to be reviewed (Creswell and Guetterman, 2019). While at the quantitative data collection stage, an instrument is used to evaluate the variables of the research. The instrument includes the specific questions appointed to survey participants and response possibilities that is created ahead of time of the study and as explained by Creswell (2014), an instrument is "a tool for measuring, observing, or documenting quantitative data". Some of the examples of instruments for this research method are standardized tests and survey questionnaires.

While for the analysis of collected data, mathematical procedures known as statistics is used instead. The analysis cycle always starts with data overviewing through looking at the mean, standard deviation, and the frequency of values. The individual results are then being compared based on groups and interpreted in view of previous studies or initial predictions. The interpretation is made to explain the causes to the results and to either support or refute the predictions made earlier in the study. This method is usually chosen as a way to collect data for the results obtained through surveys can be used to generalize the entire population, and the results can be broken down by socio-economic group for comparisons, however, it is deemed as wasteful for its huge dataset that never get in use and this method has the potential in sacrificing data that sis potentially useful through the process of aggregation (Hulme, 2007).

3.2.2 Qualitative Research Method

According to Shone (2020), qualitative research method is a way of understanding investigation focused on a systematic inquiry framework that studies a question that allows for the creation of a dynamic, realistic image, analyses words, presents comprehensive opinions of informants and performs the thesis in a natural setting. As suggested by Creswell and Guetterman (2019), in simpler words, a qualitative research method is more suitable in addressing a research problem where the variables are yet to be identified. In qualitative research, the purpose statement and research questions are important to be listed out for the research conductors to gain from the participants optimally (Creswell and Creswell, 2018). Data is collected from the participants to

develop forms, known as the protocols, for data recording as the analysis proceeds. While at the data analysis stage, typically a text database will be accumulated, and the texts will be distributed into smaller groups of sentences known as text segments, where each group of sentences carry different meanings. Words or images are being analyzed instead of the analysis of statistics to describe the main event of the study.

The few methodologies used to collecting and analyzing qualitative data are by biography or narrative research which collects the stories and experiences of people which affects their lives greatly, phenomenology which the researcher observes the happening of an event for the purpose of obtaining understanding instead of getting information from other people, grounded theory which is a method of research that develop new theories from data, and case study that includes researching a limited number of cases in considerable detail with the hope that meaningful insights can be provided into the process. Hulme (2007) mentioned that the strengths of qualitative method are its ability to provide a rich image of social phenomena in specific contexts, insights into intra-household relations, and deeper insights into causes and direction of causal processes. On the other hand, difficulties to demonstrate scientific rigor of the data collection exercise and low level of standardization are its weaknesses as the definitions by every researcher varies.

Shone (2020) argues that the splitting line between quantitative and qualitative methods are somehow unclear, however, the most distinct difference is the type of data collected. Quantitative research method focuses on the directly measurable while qualitative mainly collects recordable data such as text, audios and videos. Besides, the qualitative model is generally more associated with the context and background than figures, which allows it to present the richness of content that can be hardly achieved by quantitative research.

3.3 Justification of Selection

In this study, a quantitative research approach was selected instead of a qualitative research method to conduct the research. The focuses of this study are to identify the criteria of sustainable affordable housing and to distinguish the priority criteria that deem to be important upon the selection of sustainable affordable housing between different groups of respondents. Ultimately, a sustainability framework is developed based on the criteria evaluated by the respondents. The research problem of this study corresponds to the fact described by Creswell (2014), where a research problem

identified on the basis of the trends in the field is suitable to utilize quantitative research methods to seek for results. Describing a trend means the attempt to establish the general inclination of individuals' responses and to identify how these preferences differ among people. A large number of individual responses is needed in order to achieve the desired results and the collection of responses is carried out through the distribution of questionnaire surveys.

With this approach, a rather large amount of quantitative and numeric data can be collected within a shorter period of time. Polit (2010) highlighted that generalization requires the drawing of wide inferences from individual findings. The larger the data collected, the higher the reliability is the result. Hence, the survey questionnaires have to be distributed to a vast low to middle income groups to identify their top priorities in selecting affordable housing. A ranking system can be developed later on during data analysis to identify the importance of criteria among different group of respondents. With that, quantitative research method was selected and applied to accomplish the research's aim and objectives.

On the other hands, qualitative research method is less suitable to be applied in this study mainly due to the requirement of large participants involvement. This form of research method requires more time to be carried out as the interview process with the targeted respondents which large in numbers will take up a longer duration to complete. The targeted survey respondents in this study cover the people earning a range of low to middle income which makes it difficult to carry out interview sessions with each and every one of them. Besides, the findings obtained from individual interviews are unable to represent the whole population in general.

3.4 Research Design

Figure 3.1 illustrates the steps involved during the process of quantitative research. The research process was modified from the process suggested by Creswell and Guetterman (2019) and eventually these seven steps were tailored out.

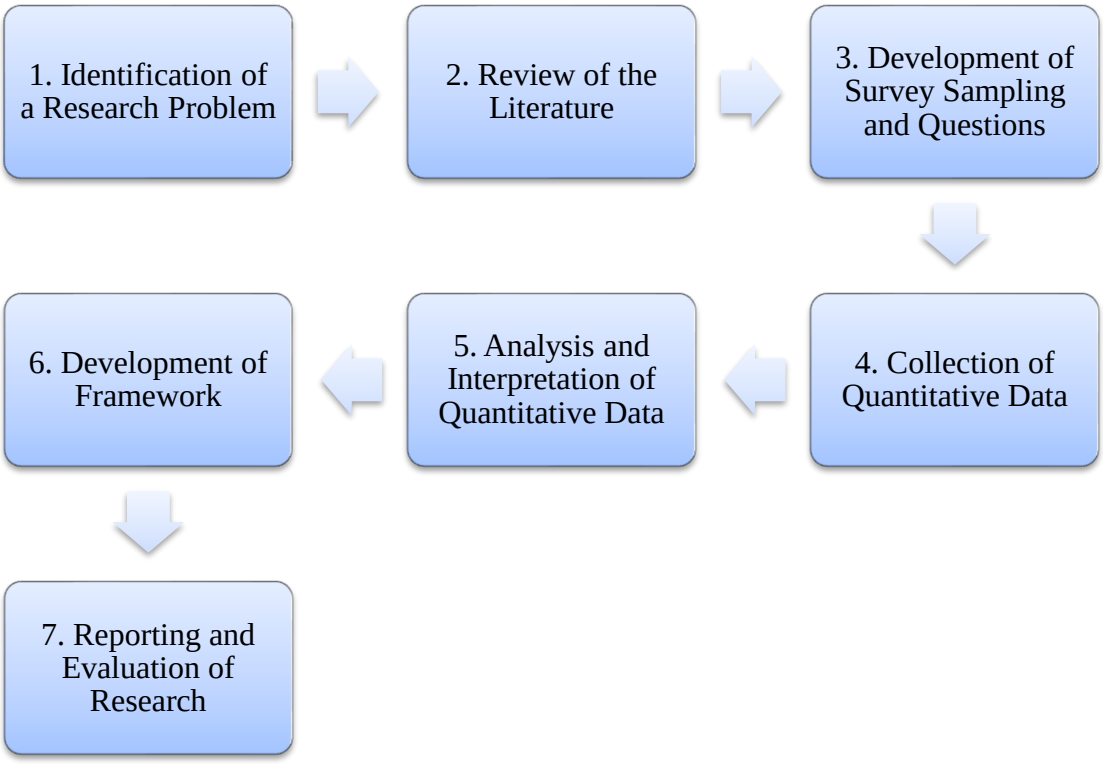

Figure 3.1: The Steps of a Research Process
(Source: Creswell and Guetterman, 2019)

To conduct a research, the research problem is first being addressed clearly **(step 1)**. A broad subject matter is addressed at first then the topic is narrowed down to address the general issue or concern, which is the research problem. Also, the research problem can also be a deficiency in the literature. Moving on to **step 2**, the literature of the topic is being reviewed after the problem of statement is written. Usually, the review is mainly based on research reported in journal articles, however, a review might also include other information drawn from books, news, conference papers, and government documents. The concept and theories of affordable housing and sustainable development in the housing industry are discussed. Besides, the components and criteria that comprise sustainable housing are found out. In line with the first and second step, the first objective of the study which is the exploration of the criteria for sustainable affordable housings in the environment, economic, social, culture and technology sector, is achieved.

The third step **(step 3)** is the development of research survey sampling and questionnaire. A sample size of respondent is customized from the population of targeted people before the issuance of survey questionnaire. In this study, the

stratification of population is involved as the characteristic (age and gender) of the population is represented in the sample and the true proportion in the population of individuals with respective characteristics is reflected in the sample, in order to achieve objective 2. Individuals from the low to middle income groups are selected randomly as to allow a representative sample from a population to be generalized as a whole and any bias will be equally distributed (Creswell, 2014). Next, in **step 4** which is data collection, the survey is developed on online survey system that contains the questions and sends surveys to participants' email or social media.

Step 5 is the analysis and interpretation of collected data. This step is only carried out after the quantitative data has been collected. A few interrelated steps are applied in the process of data analysis. First, the data has to be prepared before starting the analysis. Then the results are reported in either table or figure forms. Finally, the results are interpreted from the data analysis, which comprises of the result summary, results comparison, limitation advancement and future suggestions. The next step **(step 6)** is the development of a framework and it is created by infusing a list of sustainable criteria for affordable housing. The last step **(step 7)** is report writing and evaluation of results. This phase is a detailed discussion of the results obtained through each statistical test and is presented in an acceptable language. The research is then being concluded by summarizing the detailed results in a general statement.

3.5 Literature Review

A literature review is a description of published journal articles, books or other records that identify the research topic's history and present state of knowledge (Creswell, 2014). The review is necessary to decide whether the research topic is worth studying, and at the same time providing understandings and visions in which to limit the scope to a required area of study. Besides, it aims to share the findings of other closely related researches to the undertaken study that have been carried out previously and consequently develop a structure to demonstrate the importance of the initiated study. Literature also links a research to the literature's broader, continuing discourse, bringing in gaps and expanding previous studies (Neuman, 2013).

Creswell and Gutterman (2019) mentioned that there is no specific way to develop a literature review, however, there are six interrelated steps that are recommended as shown in Figure 3.2. The process starts off by identifying and discovering the key terms. This step is taken to narrow down the topic using short

phrases or several words. For this study, the key terms are “affordable housing in Malaysia”, “low-middle income groups” and “sustainable features”. In the second step, the identified terms are important to locate the literature in the search of information through the library or Internet. It is specified by Creswell and Guetterman (2019) that not all sources from the Internet are credible, hence the wise selection of sources is vital and academic literature databases or academic libraries are the more dependable sources in extracting information. In this research, most of the journal articles are retrieved from UTAR online library database know as Online Public Access Catalogue (OPAC), where most of the sources are journals from Science Direct and Researchgate. Hence, once the literature has been located, it is evaluated and selected critically if the resources chosen is accurate and relevant to undertaken study as the third step.

Then, the next step is to organize the literature for a review. This step requires the author to read, extract and take note on the literature to identify the relevance of the information and fit all into one whole. Moving on to the fifth step, the collected literature is synthesized by arranging them in accordance to their concept and importance, and then interrelate them. The aim of this step is to record the key themes related to the undertaken study and to simply describe the timeline of all studies to the topic. A literature map, an optical image of the literature, is developed as shown in Figure 2.7 to further amplify the concept and aids in the emergence of the pieces. After all the previous procedures, the last step is to write the literature review. This writing compiles all the summarized aspects of each study by providing respective studies a clear reference and applying specific writing strategies.

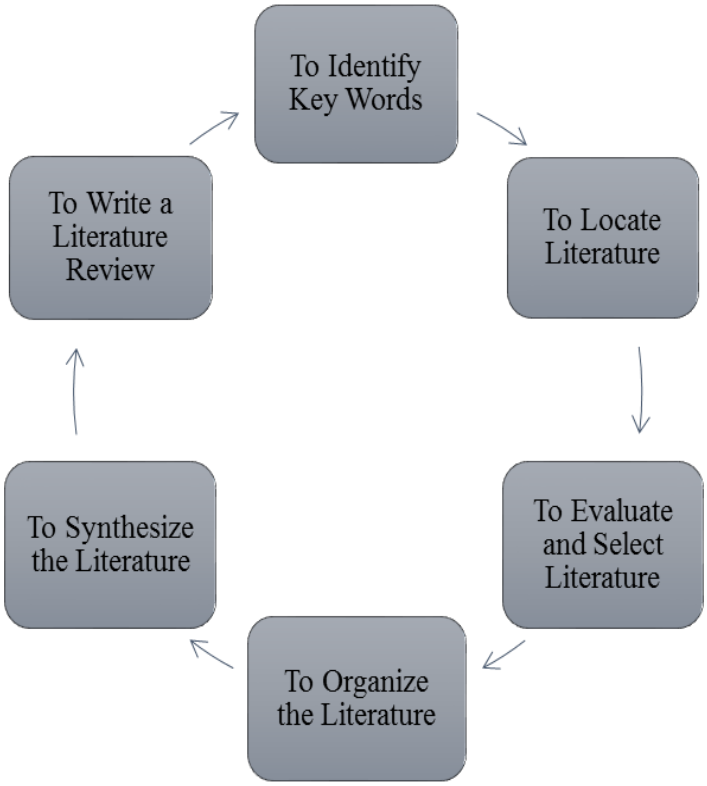

Figure 3.2: The Six-Steps Process to Conduct a Literature Review
(Source: Creswell and Guetterman, 2009)

3.6 Quantitative Data Collection

A tool designed to calculate, analyze or record quantitative data, known as an instrument, is used for the measurement of variables in a quantitative research study (Creswell and Guetterman, 2019). The instruments such as survey questionnaires, checklists, and standardized tests are distributed to the respondents and collect the data in the form of numbers. This process aims to generalize the results from a small quantity of people to a large number.

As mentioned by Kumar, Talib and Ramayah (2013), quantitative research will only be successful with a large pool data, hence, effective ways in collecting large amount of data in a stipulated timeframe are necessary. With that said, the distribution of survey questionnaire is chosen as the method to collect data in this survey among the primary sources. Data collection through survey questionnaire is the most economical and due to the collection of real time data. For secondary approach, which is also being applied in this research, the data is collected from articles, books, online journals and official websites to establish and furnish the research.

3.6.1 Questionnaire Design

Rowley (2014) mentioned that it is important to use understandable language in forming questions and being clear of the relationship between the variables. The language is essential to portray the context of the questions asked by the researchers are portrayed fully and at the same time to reduce respondents' confusion.

Survey questionnaires' questions can be mainly distributed into two groups which are open-ended and close-ended. Open-ended questions have to get the respondents to provide data or short comments while close-ended questions are usually followed by several options to be chosen from. For respondents, closed questions are usually faster to be completed and the responses to closed questions are easier to be coded and interpreted by the researcher which is especially useful if the number of questionnaires needed is high. When designing questions, it is important to identify the form of question that is appropriate for that particular context.

The questionnaire produced has to be presented neatly and a short introduction of the purpose of the research and the identity of researchers have to be attached as well to get the respondents clarified. In this study, close-ended structured questions were used in developing the questionnaire, and the respondents would need to answer the questions accordingly by selecting one answer only for each question. There was only one set of questionnaires to be distributed among respondents with the age of 21 years old and above.

The distributed questionnaire surveys mainly consisted of two (2) sections, named Section A and Section B. Multiple choice questions were used under Section A. This section was designed to collect respondents' demographic profile, such as their age group, income range, gender, and marital status, hence they would only require picking the answers that are relevant to themselves. This information is crucial as they would be needed in fulfilling Objective 2 of this research.

Section B of the questionnaire was developed with the variables of this research and with the purpose to fulfill Objective 1 and Objective 3. The five-point Likert scale ranging from the least important, less important, neutral, very important to the most important was applied under this section to act as the evaluation tool for respondents to rate the questions asked. This section mainly asked about respondents' opinion on the importance of the criteria required to be included in sustainable housings. There was a total of twenty-seven (27) criteria to be assessed, and the respondents were

requested to rate and rank them based on their perspectives. A sample of the questionnaire survey is attached in the Appendix.

3.6.2 Sampling Determination

Quantitative research method highlights the importance of generalization and reliability where the goal of it is to relate the relationship acquired between the variables to the public. In line with that, the choosing of sample representative of the population is hence very vital. When conducting a research, it is important to pay close attention to current information of the sample's characteristics which includes the details on sampling techniques that will encourage others to recreate the study (Delice, 2010). In this study, the scope of the research is set to people falling under the low to middle income groups in Klang Valley. To distribute the survey, convenience and purposive sampling approach were undertaken.

In this research, convenience sampling was carried out at the beginning as the questionnaire surveys were distributed to family, friends and citizen living in Klang Valley. Then, purposive sampling was conducted to filter the data obtained in order to produce a data that can represent the population while maintaining in the research scope boundary. In other words, all the returned survey from the respondent that has more than RM 9,619 income level will be eliminated and neglected as it falls under high income level. Purposive sampling is applied due to the selection of low and medium-income group only. With that in mind, only the survey responses where the income level was selected lower than RM 4,360 and income level range between RM 4,360 to RM 9,619 will be qualified for data analysis.

Central Limit Theorem (CLT) was applied in determining the sample size. McLeod (2019) specified that the central limit theorem in statistics claims that the sampling distribution of mean for a variable must represent a normal distribution, regardless of the dispersion of that variable in the population, given a sufficiently large sample size. Once the sample size is large enough, the sampling distribution tends to reflect the normal distribution as it presents a trend where the mean sum of the sample and standard deviations is equal to the mean population and standard deviation and is highly helpful in estimating the characteristics of populations effectively (Ganti, 2019).

To implement CLT in a research study, there are several assumptions that are needed to achieved such as, the collection of data should be sampled randomly, the samples should be independent and shall not affect other samples, the sample size

aimed should not be more than 10% of the population, and lastly, the sample size should be sufficiently huge. CLT was applied as this study has fulfilled the assumptions behind this sampling technique as per mentioned. Generally, when the population is symmetric, a sample size of 30 is deemed sufficient, which implies the distribution of the sample means is distributed relatively normally (Kwak and Kim, 2017). Hence, for this research, a sample size of 30 for each independent variable which were male and female, age group below 30 years old and age group above 30 years old were collected.

3.6.3 Questionnaire Distribution

After the completion of questionnaire designation and sampling determination, the questionnaires were distributed to the targeted respondents through emails and social media. The questionnaire was first created using Google Form and was later embedded as hyperlink in emails and link in social media. Along with the Google form, an official cover letter was attached as well to address identity and to clarify the aim of this survey.

About five (5) weeks were given in distributing and collecting the surveys from targeted respondents. Respondents were able to fill up the form anytime, anywhere by using online Google Form via mobile phones, tablets or laptops. The time to finish one survey form is estimated to be 10 to 15 minutes.

3.7 Data Analysis

The analysis of data includes procedures such as data preparation for analysis, running the analysis, reporting results and discussing them. Some of the accessible data analysis software systems are Statistical Package for the Social Science (SPSS), Statistical Analysis System (SAS), Microquest, Microsts, and many more but the more common ones are the SPSS and SAS (Lutabingwa and Auriacombe, 2007). They are likely able to analyze numerous variables at the same time and can generate a number of statistics. The quantity of variables and the sample size to be studied may influence the selection of data analytics tool. In this study, the software that is applied for data analysis is SPSS. The suitable statistical tests are the Measures of Central Tendency test that ranks the data based on the respondents' perspective and Mann-Whitney U Test to look for any significance different, while for reliability test Cronbach's Alpha Reliability Coefficient was chosen.

3.7.1 Cronbach's Alpha (α) Reliability Coefficient

Cronbach's alpha, a measure of reliability, is a statistic widely used by writers to prove that experiments and scales designed for research projects are appropriate for use. While conducting a study, it is expected to take into account the relevance of the instrument to the particular research questions and the quality of the instrument, where 'quality' is normally being understood with respect to the concept of validity and reliability (Taber, 2017). However, if an instrument is unable to provide accurate readings, it will cause difficulties to identify real changes in what one is trying to measure. Cronbach's alpha is a test that identifies if a designed test is measuring the variable of interest precisely (Stephanie, 2014). The alpha generated from the test is delicate to the number of objects in a test as the higher the number of items, the higher the alpha score. In this study, Cronbach's alpha test is used to examine the reliability of multiple questions from the Likert scale surveys for the survey questionnaire's Section B. The formula of Cronbach's Alpha is computed as follows:

$$\propto = \frac{N \times \bar{c}}{\bar{v} + (n-1) \times \bar{c}}$$

Where,

$N = number\ of\ scale\ items$

$\bar{c} = average\ of\ all\ covariances\ between\ items$

$\bar{v} = average\ variance\ of\ each\ item$

Table 3.1 indicates the rule of thumb to interpret the alpha obtained. Generally, it is considered average if the score is more than 0.7.

Table 3.1. Rule of Thumb for Alpha Score

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

(Source: Stephanie, 2014)

3.7.2 Measures of Central Tendency

The measures of central tendency are number that are summarized that portray a single value in a distribution of scores (Vogt and Johnson, 2016). The summary of numbers is expressed as the mean (average score), the median (middle of a set of scores) or the mode (most frequently occurring score).

In this research, the mean is generated under section B of the questionnaire survey to express the average response regarding the level of importance of sustainable criteria for affordable housing in general. The scores obtained by each variable varies as every individual has different needs and wants. By determining the mean scores, the criteria with the highest score indicates that it is the most important criteria for sustainable affordable housings. As such, by comparing the scores obtained by the variables, Objective 2 can be achieved.

3.7.3 Mann-Whitney U test

The Mann-Whitney U method is used to measure discrepancies between two different independent classes when the variable is either cumulative or ordinal. Besides that, this test is able to make various conclusions regarding the data collected depending on the assumptions made on the distribution of respective data whereas the conclusions made may vary from simply specifying whether two groups differ to evaluate if the median scores vary between respective groups (Lund Research Ltd, 2018). Such different assumptions depend on the structure of the data distributions. The formula of Mann -Whitney U test is computed as follows:

$$U_1 = R_1 - \frac{n_1(n_1 + 1)}{2}$$

$$U_2 = R_2 - \frac{n_2(n_2 + 1)}{2}$$

Where,

R_1= sum of ranks in sample 1

n_1= sample size for sample 1

R_2= sum of ranks in sample 2

n_2= sample size for sample 2

In this research, the level of importance of criteria for sustainable affordable housings among female and male, and among respondents aged below 30 and above 30 years old were analysed and compared by using this method. The respondents involved were all from the low to middle income group. Different individuals at different age and with different genders have different point of views and needs that could affect the level of importance for sustainable housing criteria. Thus, Mann-Whitney U Test can be used to determine whether statistical differences exist between different genders and age groups.

Two hypotheses were formulated in order to detect the significance differences on the importance of sustainability criteria between the two genders and between the age groups for this study:

Null hypothesis, (H_0) indicates there is no significant difference on the importance of sustainability criteria between the gender and age groups, whereas,

Alternative hypothesis (H_1) indicates there is a significant difference on the importance of sustainability criteria between the gender age groups

3.8 Chapter Summary

In a nutshell, this study applies quantitative research method to achieve its aim and objectives as quantitative approach allows the collection of large survey responses under limited time constraint. The data was collected using online survey questionnaires and analyzed using the Statistical Package for the Social Science (SPSS) software. To further analyze the results, Measures of Central Tendency and Mann-Whitney U Test were used and to measure its reliability, Cronbach's Alpha Reliability Test was undertaken.

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CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

This chapter summarizes the findings of data analysis and addresses the reasons for. This chapter begins with a brief description of the survey's respondents. The ranking of the importance of sustainable criteria was identified. Then, Cronbach's Alpha Reliability Test is applied to measure the internal consistency and reliability of the data obtained. Mann-Whitney U Test is introduced later to reveal the significance level of differences between variables. The chapter ends with a conclusion that portray the overall summary.

4.2 Survey Response Analysis

A total of 92 sets of questionnaires was completed and returned from targeted respondents which are the low-middle income groups around Klang Valley. The questionnaire survey forms were distributed through email and social media in Google forms. The data collection process had taken up roughly five (5) weeks which started from 1st July 2020 to 8th August 2020.

4.3 General Information of Respondents

The respondents targeted in this research are low-medium income earners, where they are later specifically grouped based on their gender and age group. The following sub-sections deduced the demographic data of the respondents that were collected.

4.3.1 Demographic Data of Low-Middle Income Respondents

The collected demographic data of the ninety-two (92) low-middle income respondents are summarized in Table 4.1. The table consists of the details of the respondents' gender, age, marital status, income level, affordable housing purchase history and potential, the reasons of buying or not buying affordable housing, and the amount of money willing to spend on the houses.

Table 4.1: Demographic Profile of the Collected Low-Middle Income Respondents

Demographic Details		Frequency (n)	Percentage (%)
Gender	Male	48	52.2
	Female	44	47.8
Age	Above 30 years old	54	58.7
	Below 30 years old	38	41.3
Marital Status	Married	54	58.7
	Single	38	41.3
Income Level	Below RM 3,000	20	21.7
	RM 3,000 to RM 4,359	34	37.0
	RM 4,360 to RM 6,999	28	30.4
	RM 7,000 to RM 9,619	10	10.9
	More than RM 9,619	-	-
Purchase History	No	80	87.0
	Yes	12	13.0
(IF) YES	The price of affordable housing is low and within budget.	9	20
	The location of affordable housing is strategic	7	15.6
	The housing is equipped with social amenities and facilities.	7	15.6
	The safety and security of affordable housing is satisfying.	6	13.3
	The sustainable features are applied.	5	11.1
	The density of affordable housing is within my comfortable zone.	5	11.1
	The lifecycle cost of affordable housing is low.	4	8.9
	The design of affordable housing is satisfying.	2	4.4
(IF) NO	The price of affordable housing is high and out of budget.	54	18.9
	The location of affordable housing is not strategic.	40	14.0
	The design of affordable housing is not satisfying.	36	12.6

(Table 4.1 continued)

Demographic Details		Frequency (n)	Percentage (%)
(IF) NO	The density of affordable housing is out of my comfortable zone.	35	12.2
	The safety and security of affordable housing is concerning.	35	12.2
	The life-cycle cost of affordable housing is high.	34	11.9
	The housing is lacking in social amenities and facilities	29	10.2
	The sustainable features are not applied.	23	8.0
Potential Buyer of Sustainable Affordable Housing	Very Unlikely	36	12.6
	Unlikely	35	12.2
	Neutral	35	12.2
	Likely	29	10.2
	Very Likely	27	29.3
Amount Willing to Pay	Less than RM 300,000	19	20.6
	RM 300,000 – RM 399,999	25	27.2
	RM 400,000 – RM 499,999	25	27.2
	RM 500,000 – RM 599,999	16	17.4
	More than RM 600,000	7	7.6

Looking at Table 4.1, it can be understood that there are forty-four (44) female and forty-eight (48) female respondents which takes up to 47.8% and 52.2% respectively. Among the ninety-two (92) respondents, thirty-eight (38) of them are under the age group of less than 30 years old while the rest of them are under the category of more than 30 years old. At the same time, fifty-four (54) of them are married with household while the rest of the thirty-eight (38) respondents are in single status.

All of the respondents are earning salary in the range of low to middle, where 21.7% of them earn less than RM 3,000.00; 37% earn in the range of RM 3,000 to RM 4, 359; 30.4% of them earn in between RM 4,360 to RM 6,999; and lastly 10% of the respondents earn around RM 7,000 to RM 9,619. Only 13% of the respondents have ever bought an affordable housing before. The top three characteristics of affordable

housing that make the respondents wanted to purchase one are “the price of affordable housing is low and within budget” with nine (9) votes, followed by “the location of affordable housing is strategic” and “the housing is equipped with social amenities and facilities” with seven (7) votes each. On the other hand, the three most cited reasons for the respondents not purchasing an affordable housing are, “the price of affordable housing is high and out of budget”, “the location of affordable housing is not strategic”, and “the design of affordable housing is not satisfying”, as they take up 18.9%, 14% and 12.6% respectively in general.

Twenty-seven (27) and thirty-four (34) of them are very likely and likely to buy affordable housing with sustainable features implemented respectively. It showed that majority of respondents are keen to purchase affordable housing with sustainable features. Twenty-two (22) of them remained neutral in this matter, and only seven (7) and two (2) of them are unlikely and very unlikely to consider buying sustainable affordable housing. From the data collected, it can be seen that majority of the low-middle income respondents are only willing to pay around RM 300,000 to RM 399,000 or from the range of RM 400,000 to RM 499,000 in buying an sustainable affordable housing, which contributes to 27.2% of the overall sample each. The least number of respondents (7 of them) are willing to pay more than RM 600,000 for the sustainable affordable housing.

4.4 Cronbach’s Alpha Reliability Test

There was a total of ninety-two (92) responses from the low-middle income group and the data gathered were analyzed by using SPSS. Cronbach’s Alpha Reliability Test was carried out using by tabulating the twenty-seven (27) sustainable criteria that deemed to be included in sustainable housings. The results of Cronbach’s Alpha Reliability are shown in Table 4.2.

Table 4.2: Reliability Statistics of the Criteria of Sustainable Housing

Cronbach’s Alpha	Cronbach’s Alpha based on Standardised Items	N of items
0.903	0.905	27

Based on Table 4.2, the Cronbach’s Alpha generated is 0.903, which is already higher than the acceptable range of 0.70 – 0.79. When the alpha score is higher than

0.70, the data collected data is acceptable and reliable, hence, the data collected in this research is deemed to be reliable as well.

4.5 Mean Ranking of Criteria

The aim of this section is to review the importance of sustainable criteria for sustainable housings from the perspectives of low-middle income groups in Malaysia. The respondents are required to rank their acknowledgement on the importance of the criteria.

4.5.1 Mean Ranking of Main Groups of Sustainable Criteria

Table 4.3 depicts the overall mean ranking for the five (5) main groups of sustainable criteria that contributes to the success of a sustainable housing based on the perspectives of low-middle income groups.

Table 4.3: Mean Score of Main Groups of Criteria

Group	Descriptions	Mean	Ranking
B	Economic Sustainability	4.42	1
A	Environmental Sustainability	4.07	2
C	Social Sustainability	3.97	3
E	Technological Sustainability	3.64	4
D	Cultural Sustainability	3.07	5

According to Table 4.3, the main group of criteria that earned the highest mean score is the economic sustainability aspect. This indicates that the respondents are more prone to thinking that the economic aspect is the most important among all, followed by the environmental aspect, social aspect, technological aspect and lastly the cultural aspect. The economic aspect is chosen as the highest importance as it is the most essential element for the low-middle income groups with only adequate or insufficient income while considering buying an affordable housing. Economic sustainability in affordable housing simply proposes that the building's project income outweighs the expenses of the project, however, the position of the emerging industry has to be improved to boost its financial output for the maximization of revenue (Wiesel, et al., 2012). The low-middle income groups are facing issues in purchasing houses as house prices were about four (4) times the median income of the specified

groups and the proportion between the annual median income to median house price is highly imbalanced (Ismail, 2019).

4.5.2 Mean Ranking of Criteria of Sustainable Housing

There is a total of twenty-seven (27) criteria being grouped under five (5) sustainability aspects, which are environmental, economic, social, cultural and technological. Table 4.4 tabulated the description for the codes representing of the twenty-seven (27) criteria.

Table 4.4: Code and Description of Criteria

Code	Description
Environmental Sustainability	
A1	Energy Efficiency
A2	Water Efficiency
A3	Indoor Environmental Quality
A4	Waste Management Facilities
A5	Housing Density
A6	Land Use Efficiency
A7	Selection and Efficiency of Construction Materials
Economical Sustainability	
B1	Housing Affordability
B2	House Price or Rental Cost in Relation to Income
B3	Mortgage and Interest Rate Charged by Banks
B4	Housing Subsidy and Funding
B5	Lifecycle Cost and Maintenance Cost
B6	Effective Building Management and Maintenance
Social Sustainability	
C1	Accessibility: Transportation Services
C2	Accessibility: Education Institutes
C3	Accessibility: Health Care Services
C4	Accessibility: Leisure and Recreational Spots
C5	Accessibility: Employment Opportunities
C6	Social Inclusion

(Table 4.4 Continued)

Code	Description
C7	Social Equity
C8	Housing Quality and Occupant's Quality of Life
C9	Safety and Security
C10	Social Amenities
Cultural Sustainability	
D1	Cultural Infusion in Housing Design
D2	Religious Buildings
Technology Sustainability	
E1	Building Technology in Construction
E2	Smart Home Technology

A mean test was carried out on the twenty-seven (27) criteria to determine the importance level of sustainable housing criteria based on low-middle income earners. Table 4.5 shows the mean score for the twenty-seven (27) criteria tabulated from the data collected by the respondents. The table was tabulated with the average score from five main categories, which are the overall mean, mean ranking for female respondents, male respondents, respondents below age group of <30 years old, as well as respondents falling under age group of >30 years old. The age of the respondents is further divided into two groups (less than 30 years old and more than 30 years old) in order to fulfil the central limit theorem which means at least 30 responses for each group.

Table 4.5: The Mean Score of Criteria

Code	Overall		Female		Male		<30 years old		≥30 years old	
	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank
B2	**4.55**	**1**	**4.75**	**1**	**4.34**	**3**	**4.50**	**1**	**4.59**	**3**
A3	**4.54**	**2**	4.63	6	**4.50**	**1**	4.29	4	**4.74**	**1**
C9	**4.52**	**3**	**4.68**	**2**	**4.38**	**2**	**4.50**	**1**	4.54	5
B3	4.47	4	**4.65**	**3**	4.32	6	4.29	5	**4.60**	**2**
B1	4.46	5	4.64	4	4.29	7	**4.37**	**3**	4.52	6

(Table 4.5 Continued)

B5	4.41	6	4.64	4	4.21	10	4.29	7	4.50	9
B4	4.39	7	4.57	7	4.23	9	4.16	9	4.56	4
A2	4.37	8	4.41	10	4.33	5	4.26	8	4.44	10
C1	4.36	9	4.48	9	4.25	8	4.13	10	4.52	7
A1	4.35	10	4.52	8	4.19	11	4.11	11	4.52	8
B6	4.24	11	4.14	12	4.33	4	4.29	6	4.20	11
C8	4.14	12	4.27	11	4.02	12	4.05	12	4.20	12
C3	4.00	13	4.09	14	3.92	14	3.97	13	4.02	15
C5	3.97	14	4.11	13	3.83	16	3.92	16	4.00	17
A4	3.90	15	3.98	16	3.83	17	3.71	19	4.04	14
C7	3.88	16	3.91	17	3.85	15	3.92	15	3.85	19
A5	3.88	17	4.05	15	3.73	20	3.63	20	4.06	13
C4	3.83	18	3.89	18	3.77	19	3.79	17	4.06	13
C10	3.80	19	3.77	21	3.83	18	3.76	18	3.83	21
C2	3.78	20	3.86	20	3.71	22	3.55	22	3.94	18
A7	3.76	21	3.57	23	3.94	13	3.95	14	3.63	24
E2	3.75	22	3.86	19	3.65	23	3.39	24	4.00	16
A6	3.68	23	3.66	22	3.71	21	3.58	21	3.76	22
E1	3.52	24	3.48	25	3.56	24	3.34	25	3.65	23
C6	3.43	25	3.48	24	3.40	26	3.42	23	3.44	25
D1	3.23	26	2.93	27	3.50	25	3.29	26	3.19	26
D2	2.91	27	2.98	26	2.85	27	2.79	27	3.00	27

Note: **Bold** figures indicate the top three highest, while the underlined indicating the lowest.

Looking at Table 4.5, the top three main criteria with the highest mean score in overall are **B2 =** "house price or rental cost in relation to income", **A3** = "indoor environmental quality" and **C9 =** "safety and security", with the value of 4.55, 4.54 and 4.52 respectively. At the same time, the criteria with the lowest mean score is **D2 =** "religious buildings" with the mean value of 2.91.

However, from the perspectives of female low-middle income earners, the top three important criteria are **B2** = "house price or rental price in relation to income"

with the score of 4.75, followed by **C9 =** "safety and security" with 4.68 mean score and lastly **B3 =** "mortgage and interest rate charged by banks" at the score of 4.64. The criteria that deemed to be the least important is **D1** = "cultural infusion in housing design", settled at the mean score of 2.93. On the other hand, from the perspectives of male low-middle income earners, **A3 =** "indoor environmental quality" with the mean score of 4.50 is the most important sustainable housing criteria for them, while **C9 =** "safety and security" with a score of 4.38 comes in second and **B2 =** "house price or rental cost in relation to income" with a score of 4.34. The least important criteria for male respondents are **D2** = "religious buildings" with a mean score of 2.85.

By looking at the scores for the two different age groups, the top three (3) criteria ranked by respondents aged less than 30 years old are **B2** = "house price or rental cost in relation to income" and **C9** = "safety and security" which both earned the same mean score of 4.50, and **B1** = "housing affordability" with the score of 4.37. On the contrary, the top three (3) criteria chosen by respondents aged more than 30 years old are **A3** = "indoor environmental quality", **B3** = "mortgage and interest rate charged by banks", **B2** = "house price or rental price in relation to income" with the mean score of 4.74, 4.60 and 4.59 respectively. The criteria that deemed to be the least important for both of the age groups is **D2** = "religious buildings", with mean scores of 2.79 and 3.00 respectively.

B2, the pricing of the house or the renal cost are related to income, implies the ratio of the amount of money needed to pay for housing mortgage or rental to the amount of money earned. An individual or a household especially, aside from allocating a portion of money earned in supporting a shelter, there are other basic needs required such as food, transportation, electricity as well to survive. Chan and Adabre (2019) stated that if one is unable to pay for other needs after paying for monthly rental or mortgage for housing then he or she will be considered as shelter poor. **B2** is ranked as the most important in general as well as by female respondents and respondents from age group less than 30 years old, while it ranked as the third important criteria for respondents who are male and respondents from age group more than 30 years old. Based on a Financial Behaviour Survey conducted by Agensi Kaunseling dan Pengurusan Kredit [AKPK] (2018), the top two reasons for working adults unable to save up extra money are the high cost of living and the unavailability of surplus income. According to the White House (Hill, 2016), full-time working women receive just around 78 percent of what their male peers do, which adds that there is a wage gap,

even after taking into account the kind of job people do, or skills like knowledge and experience. The problem is further compounded by the so-called "women taxes", where most women items are generally more expensive than men. Hence, the high cost of living along with the additional expenses incurred on women makes them to think that the ratio between house rent and price to their income as their first priority as compared to men who take it as the third important.

A3, the indoor environmental quality, indicating the quality of elements such as air, lighting, comfort and acoustic of a constrained place, is ranked as the second important criteria generally but it is prioritized first by male respondents. Apart from that, respondents who age more than 30 years old also ranked **A3** as the most important. The indoor environmental quality of a living shelter is at upmost important as it can strongly affect the occupants' general wellbeing and health. Most of the respondents who are more than 30 years old are mostly married and expected to have households, where the consideration of family's heath condition and wellbeing are prioritized. Affordable residential projects, especially with medium to high population density have to pay more attention to their design structure and building allocation (Wiesel, et al., 2012) to reduce additional cost to install extra lighting, air conditioners or air ventilator in future. Male respondents ranked indoor environmental quality of shelter as the most important as men mostly consider the quality and condition of products before the brand and price (Pirlympou, 2017). Men are more aware of the technical parts and the estimation of maintenance cost needed for those mechanical and electronic devices of a shelter. Hence, in order to minimize the cost to solve issues such as overshadowing, maintaining visual and acoustic privacy in future, men would prefer getting a house which the environmental condition is adequately certified rather than one with poor quality that requires additional maintenance cost.

C9, safety and security, is the state where the living environment is away from dangers and hazards. The criteria C9, safety and security, has become the third most important criteria for a sustainable affordable housing in general. Besides, it also stands as the second most important criteria for both female and male respondents, as well as those who aged less than 30 years old. Fisher, et al. (2009) specified that insurance of safety and security of an area is crucial in order to make the place pleasant to stay. It is always believed that households residing in high-crime areas need to allocate extra budget for security and safety measures, as contrasted to households living in low-crime risk areas. What is perceived to be the most critical requirement

for an ideal living environment is the quality and stability of the neighborhood and community, while the intermediate needs are transit and amenities and some of the essential needs are availability of housing and efficiency of the housing. Hence, looking at the score earned for this criterion, it shows that C9 is important for all respondents regardless of their gender and age.

B3, mortgage and interest rate charged by banks, are also one of the charges needed to be included as expenditures under housing costs. This criterion is ranked as the second most important criteria by female respondents as well as those whose age are more than 30 years old. **B3** is listed as people frequently refer the initial down payment to the borrowing margin and such admission costs such as legal costs, stamp duties, assessment fees that often affect low-income earners while buying a house (Dastane, 2017). Potential buyers are more likely to decide on the type and price of houses to buy depending on the interest rate and mortgage available for them to get. As what was mentioned earlier, women are likely to have higher expenditure per month as well as elder respondents as they might have a family to support. The amount of money left to pay for the mortgage and interest charged by banks after paying for other basic needs are much taken into consideration as the burden increases. For example, the amount of loan approved by the bank is also dependent on the monthly salary and the number of "burden" bare by the applicants such as car loan, insurance payment, and credit card debt.

B1, housing affordability, is expressed as the accommodation which is fair in terms of cost, reliability and location and which is not so costly that it forbids its occupants from fulfilling those basic living needs. Respondents from age group less than 30 years old have ranked housing affordability as the third important criteria in sustainable affordable housing. For a house to be affordable, it does not fully depend on the selling price, but also the cost required in keeping the house, such as down payment, maintenance cost and loan repayment. This criterion is deemed important especially by the low-middle income groups less than 30 years old as sustainable affordable housing is able to decrease the burden and income stress of the individual if its affordability is enhanced (Saidu and Yeom, 2020).

Based on Table**, D1** and **D2,** which are cultural infusion in housing design and religious buildings respectively, are categorized as the least important criteria by all of the different groups of respondents, despite the fact mentioned by Thaman (2002) that culture should be rooted in the community and act as the foundation of sustainable

development. However, **D1** is chosen as the infusion of cultural elements in building design is believed to add higher cost to the design and construction cost of the houses. For instance, the art of wall carving by the Chinese requires highly skilled professionals to complete and requires a long duration as well. Besides that, it is believed that religious buildings (**D2**) are deemed not so important around the living community as there is already a religious praying spot allocated in each house. For example, the Buddhists and Hindus would allocate a spot for the allocation of altars, while the Muslims would require an empty room that faces to the direction of Makkah. Hence, it is not necessary to travel to religious buildings anymore.

4.6 Mann-Whitney U Test

Mann-Whitney U test is applied to reveal the significant difference across the importance level of criteria ranked by male and female, as well as in between age group less than 30 years-old and more than 30 years-old respectively. The p-value used in this test is 0.05.

4.6.1 Gender Group

For gender group, two hypotheses are generated as below:

Null hypothesis (H_{01}): There is no significant difference between male and female low-middle income earners on the level of importance of criteria for sustainable housings.

Alternative hypothesis (H_1): There is a significant difference between the male and female low-middle income earners on the level of importance of criteria for sustainable housings.

Table 4.6 has summarized the results obtained from Mann-Whitney U Test based on the perspectives of different genders towards the importance level of the criteria for sustainable affordable housing. Looking at Table 4.6, the test indicates two (2) items that show significant differences in the perception of the level of importance of the criteria among male and female respondents.

The two (2) items that show differences are **A1** = “energy efficiency” and **B5** = “lifecycle cost and maintenance cost”. These items were identified as their p-value are less than 0.05 ($p \leq 0.05$). On the other hand, the remaining criteria’s p-value have scored more than 0.05 ($p > 0.05$), hence, there is no significant difference between male and female respondents in ranking the level of importance of the criteria for

sustainable affordable housing. With that, the alternative hypothesis (H_1) is accepted for **A1** and **B5.**

Table 4.6: Mann-Whitney U Test on Male and Female Low-Middle Income Earners

Code	Descriptions	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
A1	Energy Efficiency	842.00	2,067.00	-2.007	0.045
B5	Lifecycle Cost and Maintenance Cost	799.00	2,024.00	-2.236	0.025

Table 4.7 is tabulated to show the mean ranking of the criteria which are, **A1** and **B5** that have shown significant differences between male and female respondents. The purpose of tabulating it is to examine the degree of significance between the different gender samples on the importance level of criteria in sustainable housing.

Table 4.7: Mean Rank of Criteria A1 and B5 between Female and Male Respondents

Code	Descriptions	Respondent	N	Mean Rank	Sum of Ranks
A1	Energy Efficiency	**Female**	**43**	**51.34**	**2207.50**
		Male	49	42.26	2070.50
B5	Lifecycle Cost and Maintenance Cost	**Female**	**43**	**52.42**	**2254.00**
		Male	49	41.31	2024.00

Note: **Bold** indicates the higher mean rank for the criteria

According to Table 4.7, the criteria **A1** has a mean rank of 51.34 for female which is higher than male's mean rank of 42.26. The differences in the value of mean ranking shows that female has higher agreement level on the importance of energy efficiency as the criteria for sustainable affordable housing as compared to male. Reducing energy consumption is an important part of the shift to a low carbon, healthy environment and the targeting of domestic demand is generally regarded as the most successful way to speed up the process. MacGregor (2016) specified that the difference in gender with different daily activities contribute to the varying of energy consumption ratios. Women would consume more hours at home doing unpaid jobs than men in almost every country in the world, where the types of domestic work tend to be energy-intensive, for instance, laundry and cooking. Hence, this indirectly

indicates that women are likely to make the majority of choices on household consumption and are more inclined to make decisions for pro-social and pro-environmental concerns than men. With that, women are more prone to think that energy efficiency, **A1**, is important for saving household expenditure and housing life-cycle cost as a whole.

Moving on, the second criteria that impose significant difference between male and female is **B5**, the lifecycle cost and maintenance cost of housing. The reduction of operating and life-cycle costs is able to restrict tradeoff in household expenses to satisfy other shelter requirements to the detriment of other basic needs (Adabre, 2020). Jamaludin and Bakar (2008) mentioned that housing projects that are built in compliance with sustainability standards may cost more than its capital investment in the short term, however, it will have a significant downside effect on overall long-term costs as it decreases the daily demand for resources such as water and energy, as well as the maintenance costs of electrical appliances at home. As women tend to spend more time at home, they are more familiar with the consumption of energy, water, household expenditure, and the cost in replacing water filters or to even the service cost for laundry and kitchen. Thus, females are likely to consider this criterion, **B5**, as more important in contrast to men.

4.6.2 Age Group

For age group, two hypotheses are generated as below:

Null hypothesis (H_{02}): There is no significant difference between respondents age less than 30 years old and more than 30 years old of low-middle income earners on the level of importance of criteria for sustainable housings.

Alternative hypothesis (H_2): There is a significant difference between respondents age less than 30 years old and more than 30 years old for the importance of criteria for sustainable housings.

Looking at Table 4.8, the test exhibits three (3) items that show significant differences in the perception of the level of importance of the criteria for sustainable affordable housing among people under age group less than 30 years old and more than 30 years old. The items that show differences are **A3** = "indoor environmental quality", **A5** = "housing density" and **C2** = "accessibility: education institutes". These items were identified as their p-value are less than 0.05 ($p \leq 0.05$). On the other hand, the remaining criteria's p-value have scored more than 0.05 ($p > 0.05$), hence, there is

no significant difference between people under age group less than 30 years old and more than 30 years old in ranking the level of importance of the criteria for sustainable affordable housing. With that, the alternative hypothesis (H_2) is accepted for **A3, A5** and **C2.**

Table 4.8: Mann-Whitney U Test on Age Group <30 Years Old and ≥30 Years Old Low-Middle Income Earners

Code	Descriptions	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
A3	Indoor Environmental Quality	738.00	1,479.00	-2.572	0.006
A5	Housing Density	717.00	1,458.00	-2.564	0.010
C2	Accessibility: Education Institutes	744.00	1,485.00	-2.330	0.020

Table 4.9 is tabulated to reveal the mean ranking for **A3, A5** and **C2** that have shown significant differences between respondents of age less than 30 years old and respondents age more than 30 years old. The purpose of tabulating it is to examine the degree of significance between the different age groups on the importance level of criteria in sustainable housing.

Table 4.9: Mean Ranking of Criteria A3, A5 and C2 between Age Group <30 Years Old and ≥30 Years Old Low-Middle Income Earners

Code	Descriptions	Respondent's Age Group	N	Mean Rank	Sum of Ranks
A3	Indoor Environmental Quality	<30	38	38.92	1479.00
		≥30	**54**	**51.83**	**2799.00**
A5	Housing Density	<30	38	38.37	1458.00
		≥30	**54**	**52.22**	**2820.00**
C2	Accessibility: Education Institute	<30	38	39.08	1485.00
		≥30	**54**	**51.72**	**2793.00**

Note: **Bold** indicates the higher mean rank for the criteria

In reference to Table 4.9, the criteria that show significant differences are **A3** with mean rank of 51.83 for respondents age more than 30 years old. The value shows that those people whose age are more than 30 years old thinks that indoor environmental quality (IEQ) is important as a criterion for sustainable affordable housing as compared to those whose age are lesser than 30 years old. As the indoor environmental quality is closely connected to wellbeing, safety and overall productivity and with people spending most of the time inside premises, the quality of indoor environment in rather important. Andersson and Abramsson (2012) mentioned that as people age, they are more inclined to stay at home and neighborhood longer, hence they tend to move into more comfortable housing with minimum maintenance, which supports the results of more people from the age ≥30 years old group to choose IEQ as more important. Hence, it is deduced that the elder age group of people would take the quality of indoor environment, **A3**, such as air ventilation, lighting and sound insulation more seriously than the younger group.

Then, the next criteria, **A5** with a mean rank of 52.22 for age ≥30 years old group is higher than age <30 years old group with a mean rank of 38.37. **A5** indicates the maintenance of reasonable density and residential size for pleasant habitation. As people from the≥30 years old group are most likely married and with households, they will need more space in their house as due to lesser units per floor in a low-density residential building. Lower density housings are more ideal for those who has or planning to start on a family as higher density means higher population and with higher rate of external disturbance, and lesser sense of privacy (Lamudi, 2018). Hence, people in the higher age group tend to put housing density as an important criterion more than the younger group does.

The third criterion, **C2**, scores 51.72 for mean rank for age <30 years old group which is higher than the age ≥30 years old group at 39.08. **C2** indicates the availability of transportations such as Mass Rapid Transit or Rapid Busses to access to education institutions. Fisher, at al. (2009) mentioned that accessibility to good schools is one of the criteria people look at when picking on the places to stay. This happens even more frequently on households or family who have children or when both the parents are working parents. As mentioned earlier, people falling under the age group of more than 30 years old are most likely married and have had families. They find it handy to have education institutes ranging from primary to tertiary institutions located nearby their houses, however, is this is not achievable, at least the provision of accessibility

to education institutions would help in solving this issue as every children born in Malaysia is compulsory to attend school till secondary level at least.

4.7 Refined Proposed Sustainability Framework

Figure 4.1 shows the modified and refined proposed sustainability framework with the important criteria of sustainable affordable housing after undergoing data analysis. A preliminary proposed sustainability framework was illustrated in Chapter 2. The criteria are grouped under five major sustainability aspects which are environmental, economic, social, cultural and technological. The refined proposed sustainability framework is completed with the level of importance to the criteria for sustainable affordable housing from the perspectives of low-middle income groups.

Referring to Figure 4.1, the level of importance of the sustainability aspects and its criteria were aligned in a way that the higher its position, the higher is its importance. The results of the level of importance of the criteria were obtained from the mean test and the most important falls under the economic aspects. Moreover, Mann-Whitney U Test revealed that there is a significance between different gender and age groups toward the importance level of sustainability criteria. With the proposed framework in Figure 4.1, potential affordable housing buyers can identify and acknowledge the possible sustainable criteria for affordable housing before purchasing one.

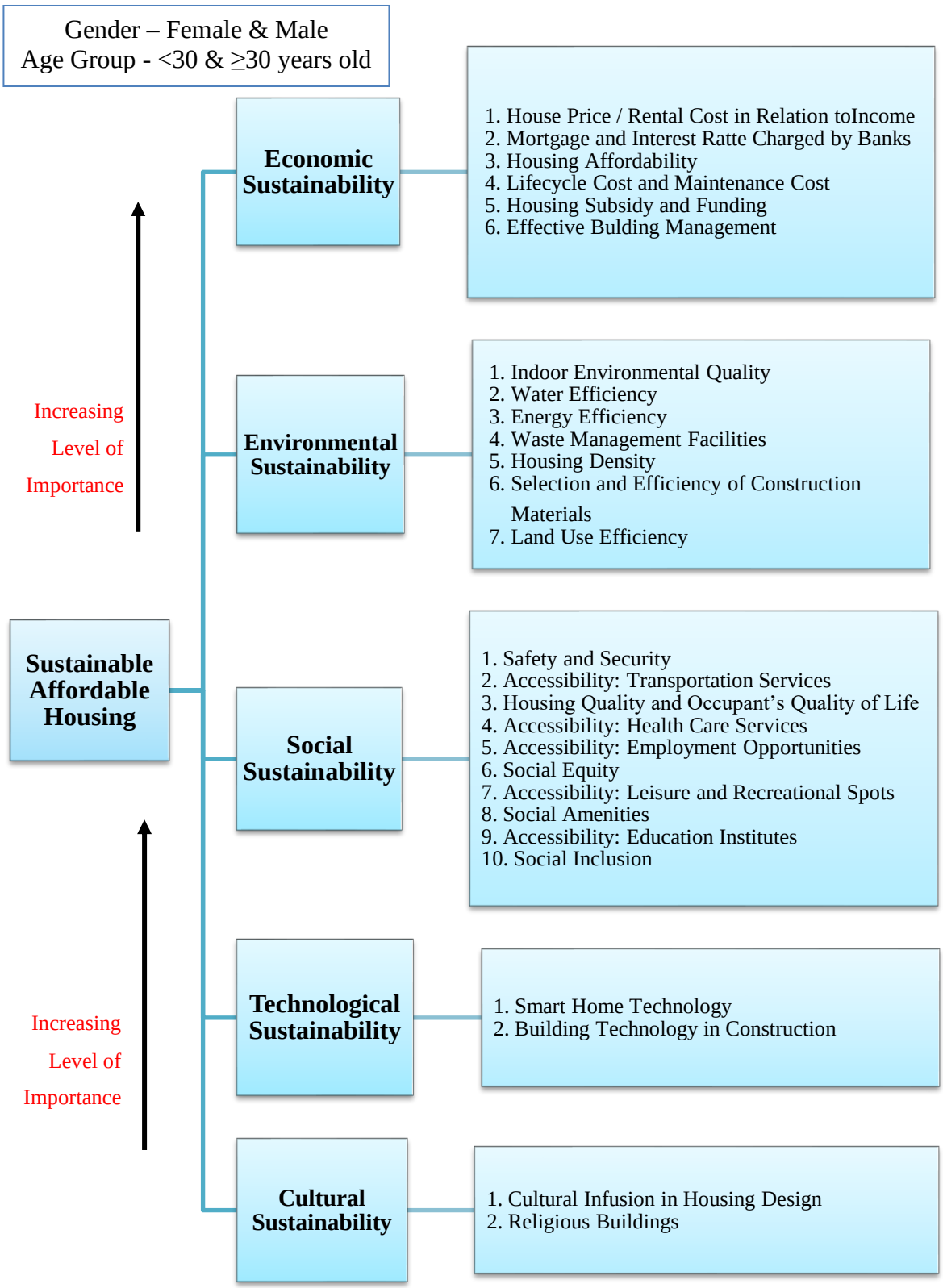

Figure 4.1: Refined Proposed Sustainability Framework for Sustainable Affordable Housing

4.8 Summary

This chapter has discussed the level of importance of the criteria of sustainable affordable housing from the perspectives of low-middle income groups based on their gender and age group respectively. The reasons behind their choice and possible motives of ranking are discussed as well. A total of ninety-two (92) sets of questionnaire surveys were returned and answered from respondents with low-middle income range. The data collected were analysed using several methods such as Cronbach's Alpha reliability Test, Measure of Central Tendency and Mann-Whitney U test. The results obtained are under good reliability based on the score obtained from the Cronbach's Test.

The most important sustainability aspect found after the test was the economic sustainability aspect whereas the least important is the cultural sustainability aspect from the perspectives of low-middle income earners. For Mann-Whitney U Test, under the comparison of male and female, two (2) criteria were identified with significant differences which are **A1** and **B5**; whereas between age <30 years old and 30 years old, three (3) criteria were identified with significant differences, which are **A3, A5** and **C2.** Then, a refined proposed sustainability framework in accordance to the level of importance was proposed

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

Chapter 5 is the final section which sums up the whole research. This chapter starts a brief introduction on the research objections and were followed by the accomplishment the research objective. Besides, the research limitations are identified and some recommendations to tackle are highlighted for better studies in future. Lastly, the research contributions are detailed.

5.2 Accomplishment of Research Objectives

An overview of this study is established by describing the background and problem statement relating to the sustainable criteria of affordable housing in the perception of low-middle income earners in Malaysia. Over the decade, this country's most advanced urban community, the citizens of Kuala Lumpur, has been treating the shortage of affordable housing as an issue that deserves more attention (IMD World Competitiveness Center, 2019). As house prices continue to increase, the demand for an owned shelter has increased significantly especially for the low-middle income groups (Leh, Mansor and Musthafa 2016). These groups of communities are struggling in paying for rents and mortgages, and on top of that, their living environment are not provided with technology and features that promote energy or water savings, nor adequate indoor environmental quality, which will increase the lifecycle cost of the house where the burden eventually falls back to them as house owners. The implementation of sustainable affordable housing is a viable solution in providing the low-middle income owners owned shelters with sustainable features.

Previously, many researchers have put their focuses on the barriers in the integration of sustainable elements in housings and the impacts of sustainable affordable housing (Trachtenberg, et al., 2016; Enterprise Community Partners, 2014). However, there is limited research done on the criteria of sustainable affordable housing and the low-middle income earners' demand on housing requirement. Therefore, this research aims to determine the sustainable criteria that should be included in affordable housings and to propose a sustainability framework to act as a guideline in search of affordable housings that provide higher living standard. With

that, the research scope is limited to only low-middle income earners in Klang Valley area. The accomplishment of three research objectives is discussed in details in the next section.

5.2.1 Objective 1: To explore the criteria for sustainable affordable housings in the environment, economic, social, cultural and technology sustainability aspects.

Objective 1 was accomplished by assessing through related books, journal articles, conference papers, internet sources, newspapers and government publications, all these data resources are also known as the secondary source of information. Five main groups of sustainability aspects were identified from the literature review, which were the environmental, economic, social, cultural and technological aspects. There were seven (7) criteria identified under the environmental sustainability aspect; six (6) criteria under the economic aspect; ten (10) criteria under the social aspect; two (2) criteria under the cultural and another two (2) under the technological aspect. These criteria added up to a total of twenty-seven (27) criteria for sustainable affordable housing.

5.2.2 Objective 2: To compare the ranking of criteria in choosing sustainable affordable housings from different age and gender groups among low-middle income home buyers.

Questionnaire survey was distributed to the low-middle income earners to rank on the level of importance of the criteria of sustainable affordable housing. With the collected data, mean test was used to calculate the mean ranking of these criteria in overall, among the different genders and among the two different age groups. The highest sustainability aspect that earned the highest mean score is area that deemed to be the most important in sustainable housing from the perspectives of the low-middle income earners. Table 5.1 shows the ranking of the five main groups of sustainable aspects after analysis.

Table 5.1: Ranking of Main Groups of Criteria

Group	Descriptions	Mean	Ranking
B	Economic Sustainability	4.42	1
A	Environmental Sustainability	4.07	2
C	Social Sustainability	3.97	3
E	Technological Sustainability	3.64	4
D	Cultural Sustainability	3.07	5

Generally, the economic sustainability earned the highest mean score and is the most important aspect among the respondents. For female respondents, the three most important criteria are **B2 =** "house price or rental cost in relation to income"**, C9 =** "safety and security" and **B3 =** "mortgage and interest rate charged by banks"; whereas for male respondents the top three are **A3 = "**indoor environmental quality", **C9 =** "safety and security" and **B2 =** "house price or rental cost in relation to income". On the other hand, for respondents aged less than 30 years old, they preferred **B2 =** "house price or rental cost in relation to income", **C9** = "safety and security" and **B1 =** "housing affordability"; while those who are more than 30 years old think that these **B2 = "**house price or rental cost in relation to income", **A3 = "**indoor environmental quality" and **C9 = "**safety and security are important".

On top of that, Mann-Whitney U Test was applied to determine the occurrences of significant differences between the criteria of selection among male and female; and among age group <30 years old and ≥30 years old. Among the variables of male and female, the criteria that show significant difference are **A1** = "energy efficiency" and **B5** = "lifecycle cost and maintenance cost". In contrary, among the two different age groups, there are three criteria that show significant difference, which are **A3** = "indoor environmental quality", **A5** = "housing density" and **C2** = "accessibility: education institutes".

5.2.3 Objective 3: To propose a sustainability framework for affordable housings from potential housing purchasers' perspectives.

A sustainability framework for affordable housings from the perspectives of housing purchasers who are also the low-middle income earners. The proposed framework was refined by arranging the level of importance of the criteria from the least important at

the bottom to the most important at the top. The sustainability aspect that is located as the first is the economic sustainability, followed by the environmental, social, technological and lastly, cultural sustainability.

5.3 Research Limitations

There are a couple of limitations that are observed during this research. Firstly, the questionnaire survey response rate was considered to be rather low. Each sample group was expected to receive a return of a minimum 30 sets each, totaling up to 120 sets, in this research. However, there were only 92 sets being received. The survey forms were distributed through online messaging platforms such as Whatsapp App and Facebook Messenger, hence, the accountability might be lesser as there are chances for participants to simply hitting the buttons to finish. The lower response rate could cause impact to the results of Mann-Whitney U Test during data analysis.

Moreover, the distribution of respondents was rather imbalanced for the two different age groups. According to the respondents' demographic table (see to refer Table 4.1), for age group less than 30 years old, there were only thirty-eight (38) responses while there were fifty-four (54) responses from participants age more than 30 years old. In order to get a consistent interpretation from differing stages of age, a balanced proportion of the respondents should be collected.

Moving on, the proposed sustainability framework is unable to be potentially validated and verified while this research is conducted. This study has yet another drawback, wherein this research follows quantitative analysis method. The collection of data through quantitative analysis only provides numerical descriptions and it does not include in-depth clarification and explanation by the respondents as opposed to qualitative research, thus resulting in the failure to collect more potential criteria from the respondents.

5.4 Research Recommendations

Several recommendations are suggested to overcome the limitations mentioned in Section 5.3. The research scope is recommended to be expanded in order to collect more data, for instance, the scope of research should expand to low-middle income earners outside Klang Valley area. To enhance the results of analysis, more data should be collected across the whole Malaysia as to have more thoughts from people living in different state. Besides that, mixed research method is suggested to be applied in future

research. The review and assessment of previous studies allow the determination of sustainability criteria, however, some of these studies were not carried out within Malaysia which have decreased its usability and credibility locally due to regional and ethic differences. Therefore, the integration of interview sessions allows the screening out of the criteria that seem to be irrelevant while at the same time integrating additional inputs given by the interviewees that could not be found in literature reviews.

Furthermore, with qualitative method, the participants for the survey can be first be filtered and pick those who have deeper understanding on sustainable development and affordable housings as this in another way ensures a higher data reliability. Moreover, in order to enhance validity of sustainability framework, further research and studies could be carried out. For instance, interviews with the Malaysian Housing Department officials, or case studies could be carried out to measure the applicability of the proposed framework within Malaysia.

5.5 Research Contributions

The proposed sustainability framework acts as a guideline for future potential affordable housing purchasers to consider the availability and importance of the sustainable criteria while considering to buying an affordable housing. By referring to the proposed sustainability framework, low-middle income earners are able to identify the sustainable criteria they should seek for in buying affordable housing. It is understandable that not all housing is able to fulfill all the criteria mentioned, however, the proposed framework is able to give the purchasers a guidance on the list of sequence of criteria they should be considering in order to enhance their standard of living.

Besides that, developers could adopt this framework to identify their potential consumers' need and desire while selecting and buying houses. With the rise of awareness towards sustainability nowadays, sustainable living is believed to be in the lead in no time. Hence, the developer could make this framework a good use by implementing the mentioned criteria into the design and construction of their future residential projects.

The findings of this research could also be contributing to the existing literature. For future research, the proposed sustainability framework could be refined by incorporating to more sustainability aspects or by altering it instead for normal housing assessment.

5.6 Overall Chapters Summary

In conclusion, all the findings and ways in achieving the research objectives were summarized in this chapter. The limitations faced throughout the study was explained, and several recommendations were proposed to benefit and enhance the quality of future research. Lastly, the research contributions were identified.

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APPENDICES

APPENDIX A: Codes and Descriptions of the 27 Criteria

Table A-1: Codes and Descriptions of Criteria

Code	Description
Environmental Sustainability	
A1	Energy Efficiency
A2	Water Efficiency
A3	Indoor Environmental Quality
A4	Waste Management Facilities
A5	Housing Density
A6	Land Use Efficiency
A7	Selection and Efficiency of Construction Materials
Economical Sustainability	
B1	Housing Affordability
B2	House Price or Rental Cost in Relation to Income
B3	Mortgage and Interest Rate Charged by Banks
B4	Housing Subsidy and Funding
B5	Lifecycle Cost and Maintenance Cost
B6	Effective Building Management and Maintenance
Social Sustainability	
C1	Accessibility: Transportation Services
C2	Accessibility: Education Institutes
C3	Accessibility: Health Care Services
C4	Accessibility: Leisure and Recreational Spots
C5	Accessibility: Employment Opportunities
C6	Social Inclusion
C7	Social Equity
C8	Housing Quality and Occupant’s Quality of Life
C9	Safety and Security
C10	Social Amenities
Cultural Sustainability	
D1	Cultural Infusion in Housing Design
D2	Religious Buildings
Technology Sustainability	
E1	Building Technology in Construction
E2	Smart Home Technology

APPENDIX B: Questionnaire for Low-middle Income Earners

Dear Sir/Madam,

I am Phoo Jing Yin, a final year student undertaking Bachelor of Science (Hons.) Quantity Surveying from Lee Kong Chian Faculty of Engineering & Science (LKCFES) at University Tunku Abdul Rahman (UTAR). I am currently conducting a survey for my Final Year Project entitled "A Sustainability Framework for Affordable Housing in Malaysia", a partial fulfilment of my Bachelor of Science degree program. With that, this survey aims to identify the level of importance of the criteria that should be included in sustainable affordable housings.

It would be highly appreciated if you could spend 5 minutes in completing this survey. Your responses will be kept confidential and used solely for academic purposes. Your opinion and participation in this survey will contribute to this study significantly and add a great value to the Property Industry at the same time. Shall you have any inquiries about this survey, please do not hesitate to contact me for further clarification and information.

Student name: Phoo Jing Yin

Contact number: 017-3785017

E-mail:phoojy.11@1utar.my

Thank you for your time and participation.

Section A: Respondent's Profile

Please tick (✓) in the appropriate checkbox.

1. Gender
   - □ Female
   - □ Male

2. Age Group
   - □ Below 20 years old
   - □ 20 – 29 years old
   - □ 30 – 39 years old
   - □ 40 - 49 years old
   - □ 50 – 59 years old
   - □ 60 years old and above

3. Marital Status
   - □ Single
   - □ Married

4. What is your current income level (per month)?
   - □ Below RM 3,000
   - □ RM 3,000 – RM 4,359
   - □ RM 4, 360 – RM 9,619
   - □ More than RM9,619

5. Have you ever purchased an affordable housing?
   - □ Yes (Please proceed to Question 6)
   - □ No (Please proceed to Question 7)

6. **(YES)** If you had ever purchased an affordable housing, what were the reasons that encourage you to own one? Because… (you can tick more than one (1) option)
   - □ The price of affordable housing is low and within budget.
   - □ The lifecycle cost of affordable housing is low (i.e. maintenance fees).
   - □ The sustainable features (i.e. energy/water efficient fittings or appliances) are applied
   - □ The location of affordable housing is strategic (i.e. high accessibility-transportation, health care, entertainment, etc).
   - □ The housing is equipped with social amenities and facilities.
   - □ The density of affordable housing is within my comfortable zone.
   - □ The safety and security of affordable housing is satisfying.
   - □ The design of affordable housing is satisfying.
   - □ Others: _____

7. **(NO)** If you had **never** purchased an affordable housing, what were the reasons that lead you not to own one? Because… (you can tick more than one (1) option)
   - The price of affordable housing is high and out of budget.
   - The lifecycle cost of affordable housing is high (i.e. maintenance fees).
   - The sustainable features (i.e. energy/water efficient fittings or appliances) are not applied.
   - The location of affordable housing is not strategic (i.e. far from city centre, poor accessibility and poor transportation connectivity).
   - The housing is lack of social amenities and facilities.
   - The density of affordable housing is out of my comfortable zone.
   - The safety and security of affordable housing is concerning.
   - The design of affordable housing is not satisfying.
   - Others: _____

8. If you are a potential buyer for affordable housing, how likely would you buy an affordable house with sustainable features?
   - Very Unlikely
   - Unlikely
   - Neutral
   - Likely
   - Very Likely

9. How much are you willing to pay for an affordable housing with sustainable features?
   - Less than RM300, 000
   - RM 300,000 – RM 399,000
   - RM 400,000 – RM 499,000
   - RM 500,000 – RM 599,000
   - More than RM 600,000

Section B: Criteria for Sustainable Affordable Housings and their Level of Importance

This section aims to evaluate your opinion on the criteria that are required to be included in sustainable affordable housings and their level of importance.

Using a scale of 1= Least Important to 5 = Very Important, please rate the level of importance on the following criteria by ticking at the relevant checkboxes.

Criteria to be Included in Sustainable Affordable Housings (SAH).	**Least Important** **1**	**Less Important** **2**	**Neutral** **3**	**Important** **4**	**Very Important** **5**
Environmental Sustainability					
Energy Efficiency (i.e. the implementation of passive solar home design and LED light installation)	☐	☐	☐	☐	☐
Water Efficiency (i.e. the installation of rainwater tank for vegetation and reusage of grey water from showers)	☐	☐	☐	☐	☐
Indoor Environmental Quality (i.e. the positioning of building for adequate ventilation and sunlight exposure, availability of windows for ventilation, and insulation from	☐	☐	☐	☐	☐

acoustic disturbance)					
Criteria to be Included in Sustainable Affordable Housings (SAH).	**Least Important** **1**	**Less Important** **2**	**Neutral** **3**	**Important** **4**	**Very Important** **5**
Waste Management Facilities (i.e. the installation of waste level tracking system to collect waste whenever the quota is reached)	☐	☐	☐	☐	☐
Housing Density (i.e. the number of units in a building is low)	☐	☐	☐	☐	☐
Land Use Efficiency (i.e. the planning of the building within a “live, work, shop, play” living environment)	☐	☐	☐	☐	☐
Selection and Efficiency of Construction Materials (i.e. the use of durable and versatile construction materials for the building)	☐	☐	☐	☐	☐

Criteria to be Included in Sustainable Affordable Housings (SAH).	**Least Important** **1**	**Less Important** **2**	**Neutral** **3**	**Important** **4**	**Very Important** **5**
<u>Economic Sustainability</u>					
Housing Affordability (i.e. the low purchasing price of affordable housing)	☐	☐	☐	☐	☐
House Price/Rental Cost in Relation to Income (i.e. the amount of income left is sufficient to sustain usual living needs (e.g. food and transportation) after paying for monthly mortgage or rental of affordable housing.)	☐	☐	☐	☐	☐
Mortgage and Interest Rate Charged by Banks (i.e. the provision of low interest rate by the bank)	☐	☐	☐	☐	☐

Criteria to be Included in Sustainable Affordable Housings (SAH).	**Least Important** **1**	**Less Important** **2**	**Neutral** **3**	**Important** **4**	**Very Important** **5**
Housing Subsidy and Funding (i.e. the provision of incentives and subsidies by the government in aiding the people to purchase houses)	☐	☐	☐	☐	☐
Lifecycle Cost and Maintenance Cost (i.e. the low lifecycle and maintenance cost of affordable housing)	☐	☐	☐	☐	☐
Effective Building Management and Maintenance (i.e. the regular repair and maintenance of the infrastructure, facilities and appearance of the building by the management)	☐	☐	☐	☐	☐

Criteria to be Included in Sustainable Affordable Housings (SAH).	**Least Important** **1**	**Less Important** **2**	**Neutral** **3**	**Important** **4**	**Very Important** **5**
Social Sustainability					
Accessibility -Transportation Services (i.e. the location of housing to be near transportation services such as bus stations, MRT stations and LRT stations)	☐	☐	☐	☐	☐
-Education Institutes (i.e. the location of housing to be near schools and educational institutions)	☐	☐	☐	☐	☐
-Health Care Services (i.e. the location of housing to be near pharmacies, clinics and hospitals)	☐	☐	☐	☐	☐
-Leisure and Recreational Spots (i.e. the location of housing to be near recreational parks, gardens, shopping malls, cinemas, gyms, sports arenas, etc.)	☐	☐	☐	☐	☐

Criteria to be Included in Sustainable Affordable Housings (SAH).	**Least Important** **1**	**Less Important** **2**	**Neutral** **3**	**Important** **4**	**Very Important** **5**
-Employment Opportunities (i.e. the provision of job opportunities around purchased house or the availability of public transports to workplaces)	☐	☐	☐	☐	☐
Social Inclusion (i.e. the provision of tangible and advocacy services to enable people to participate fully in the society, such as providing childcare facilities within the building)	☐	☐	☐	☐	☐
Social Equity (i.e. the fair allocation and usage of housing community facilities (e.g. gym, kid's playground, basketball court and etc) and to be used equally among building occupants)	☐	☐	☐	☐	☐

Criteria to be Included in Sustainable Affordable Housings (SAH).	**Least Important** **1**	**Less Important** **2**	**Neutral** **3**	**Important** **4**	**Very Important** **5**
Housing Quality and Occupants' Quality of Life (i.e. the quality and appearance of housing are crucial in purchasing affordable houses)	☐	☐	☐	☐	☐
Safety and Security (i.e. the housing area to be guarded 24 hours and installed with multi-tier security)	☐	☐	☐	☐	☐
Social Amenities (i.e. the provision of gathering spots and public spaces such as community halls, library, recreational grounds and sports complex for all ages, gender and the less fortunate)	☐	☐	☐	☐	☐

Criteria to be Included in Sustainable Affordable Housings (SAH).	**Least Important** **1**	**Less Important** **2**	**Neutral** **3**	**Important** **4**	**Very Important** **5**
<u>Cultural Sustainability</u>					
Cultural Infusion in Housing Design (i.e. the infusion of gabled roof design for Malay architecture, heavy overhang roof for Chinese Architecture, and etc.)	☐	☐	☐	☐	☐
Religious Buildings (i.e. the availability of worship places such as mosques, temples and churches around housing area)	☐	☐	☐	☐	☐
<u>Technological Sustainability</u>					
Building Technology during Construction (i.e. the application of Industrialised Building System (e.g. pre-fabrication construction method/precast building elements)	☐	☐	☐	☐	☐

Criteria to be Included in Sustainable Affordable Housings (SAH).	**Least Important** **1**	**Less Important** **2**	**Neutral** **3**	**Important** **4**	**Very Important** **5**
Smart Home Technology (i.e. the installation of smart home devices such as automated flush toilet, automated lighting system to control lighting from mobile devices, smart thermostat with voice control, smart alarm system, smart lock and etc.)	☐	☐	☐	☐	☐