AN ASSESSMENT OF SUSTAINABLE HOUSING AFFORDABILITY IN KLANG VALLEY RESIDENTIAL AREAS

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ABSTRACT

The steep rise in housing price and rapid development has marginalized part of the population. As a consequence, the provision of affordable housing for the low and middle-income population has always been a hotly debated topic in Malaysia. The current practice of looking at affordability is somehow distorted. Affordable housing shall not be construed merely as short term price-to-benefit that focuses too much on price but rather on an interconnectedness, dynamic set of elements within affordability and sustainability measures. Affordability and sustainability have long been defined separately by various schools of thought. Some, however, argue that the two terms go hand in hand, and one cannot exist without the other for effective application to solve this particular housing problem. It is, therefore, the purpose of this thesis to explore the said alternative and presented a viable mean of assessing both terms. In order to achieve the objective(s) of the thesis, a research design was developed to encompass data collection, analysis and interpretation. Secondary data was obtained through an extensive review of past literature in order to reveal all the criteria that can be admissible as contributing to sustainable housing affordability. A total of 44 elements was found to be relevant and were then incorporated into the questionnaire as a primary data tools. The questionnaire basically includes all of the elements divided into 4 of the factors existed under Affordable Housing Schemes (AHS) and Affordable Housing Principles (AHPs) and were dissipated to a sample population of five (5) key locations in the Klang Valley area. The resulting data were then analyzed using IBM SPSS 16.0 software as well as one of the multi-criteria decision making (MCDM) method, namely COPRAS. In addition, inferential statistics was used to illicit information on the reliability, significant and correlational strength of the result respectively. The final result suggests that locations with the highest utility degree, μ are more likely to satisfy the requirement for sustainable housing affordability.

ABSTRAK

Kenaikan mendadak harga rumah dan pembangunan yang pesat telah meminggirkan sebahagian daripada populasi. Rentetan itu, peruntukan perumahan mampu milik bagi golongan berpendapatan rendah dan sederhana sentiasa menjadi topik hangat di Malaysia. Amalan kontemporari melihat kepada kemampuan pemilikan adalah tidak sempurna. Rumah mampu milik sepatutnya tidak hanya ditaksir melalui hubungan harga kepada kebaikan yang bersifat jangka pendek tetapi sebagai ukuran kemampuan pemilikan dan kemampanan yang saling berkaitan beserta dengan elemen-elemen yang sentiasa berubah. Kemampuan pemilikan dan kemampanan sejak sekian lama ditafsir secara asing oleh pelbagai aliran pemikiran. Sebahagian pula cenderung kepada penafsiran yang keduanya bergerak siiringan dan satu tidak dapat wujud tanpa yang lain untuk applikasi berkesan bagi menyelesaikan masalah perumahan ini. Tujuan tesis ini untuk mendalami alternatif tersebut dan membentangkan satu cara menilai kedua-dua terma yang boleh digunakan. Reka bentuk kajian telah dibangunkan yang merangkumi perolehan data, analisis dan intrepretasi. Data sekunder diperoleh melalui kajian lalu untuk mendapatkan kriteria yang boleh dimaksudkan sebagai menyumbang kepada kemampuan pemilikan rumah yang mampan. Sejumlah 44 elemen didapati relevan dan telah dimasukkan dalam borang soal selidik. Borang soal selidik secara dasarnya mengandungi kesemua elemen yang wujud dalam 4 sub-faktor kepada *Affordable Housing Schemes* (AHS) dan *Afordable Housing Principles* (AHPs) dan telah diedarkan kepada sampel kependudukan di lima (5) lokasi utama di sekitar Lembah Klang. Hasil data telah dianalisis dengan menggunakan perisian IBM SPSS 16.0 dan satu daripada kaedah-kaedah dalam *multi-criteria decision making method* (MCDM) iaitu COPRAS. Hasil akhir mencadangkan yang lokasi dengan darjah utiliti tertinggi, μ adalah lebih menepati syarat untuk kemampuan pemilkan rumah yang mampan.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1: INTRODUCTION

1.1 Introduction

This chapter introduces the background as well as the basic terms used in the research and the general direction of this research is heading to. The chapter starts off with a brief introduction to the current property market situation and how it relates specifically to this research. Identification of problem statement, research questions and objectives. The scope of the study is presented here along with research limitations. The main motivation is to be able to fill the gap in the research field and contribute to the research community as a whole.

This chapter introduces the current situation in the housing market and the affordability of the purchasers, especially for the low and middle-income groups. The first part gives a background of the housing affordability and scrutiny on the concept of sustainability and how it relates to the housing market. The next section describes and formulates the problem statement by looking into a current impediment to the property market in Malaysia. The following section gives a set of research questions that are to be met along with the objectives of this study. The scope, framework along with methodology will be discussed and elaborated afterward. This chapter concludes with a discussion of the significance of this study.

1.2 Research Background

Housing is a basic need that is dreamed by everyone. It fulfills the most basic need and enhances our quality of life. The Malaysian government has launched National Housing Policy (NHP) to ensure and assess the quality and affordable housing according to the increased number of population by corresponding demand with supply. However, factors such as affordability of the buyers, development cost and selling price

persistently disrupt the availability of supply and the consistency of demand in the housing sector.

Housing affordability is a complex issue that must be carefully interpreted and assessed not only based on economic viability but should include the citizen's quality of life especially in the middle and lower income group. In this context, the most important aspects that should be aware of are the ability of these income groups of people to afford a house. The citizen of any country regardless of any social status should be able to occupy a housing unit that meets the norm of well-established social requirement with appropriate types, layout and sizes and leave the household with a certain surplus of their income which put them, to the very least, above poverty standard.

Affordability deals with citizen's ability to pay a mortgage as well as the balance of their income to purchase necessity goods or fulfill other commitments. The household will need to strike the right balance between satisfying housing and non-housing expenditure within the limitation of income available (Stone, 2006). Common conjecture for affordability index is put to be around 30% of monthly income. This amount is then distributed by household to support various housing-related costs such as rents or mortgages, taxes, and insurances. This value is merely a rule of thumb though many agree that expenses beyond the 30% threshold will jeopardize budget and indicates a constraint on the financial commitment to support other necessities of day-to-day living (Majid *et al.*, 2012; Pollack *et al.*; 2010).

Although there are many differing opinions on what sustainability is, the definition put forward by World Commission on Environment and Development seems to be the most prevalent one. As World Commission on Environment and Development (WCED) suggested, sustainable development concerns with 'satisfying the needs of the present without jeopardizing the future generation ability to fill their needs'. It has taken some

years to integrate the concept of sustainability into the thinking of local and global governance, business and civil and education context (Adams, 2006). The adaptation of the concept of sustainability employed in various issues ranging from planning of cities and neighbourhood to agriculture and fishery (Kates *et al.*, 2005)

In recent years, Malaysia is also faced with the issues of affordable housing and sustainable development like many other countries around the globe. The National Housing Policy (NHP) stipulates that everyone should own a house be they from high, medium and low-income groups irrespective of ethnicity. However, Malaysian finds it increasingly difficult to own a house. This is especially true for first-time homebuyers who have been facing with high house price that are beyond their affordable level. People in this country are keeping a watchful eye with growing tension and anticipation on what will be the next step taken by government and corporation to minimize the impact of rising property price towards economic and social welfare in this country.

This issue has created interest among Malaysian researchers. Affordability and sustainability go hand in hand. They are mutually discussed by researchers both in Malaysia and other parts of the world, and most of them recognized that they are important to one another. Although the government has tried to tackle the issue by introducing a new scheme for first time home buyer but this group of housing purchasers still fall below the affordability level (Khan *et al.*, 2012). Hashim (2010), in turn, analysed house price movement in Malaysia concerning affordability, availability and the effect of the budget on home ownership.

In the other spectrum, the government has taken various measures to curb the rising price of houses and action has been initiated to help stabilize the property market. Measures such as My First Home Scheme was launched in 2011, PR1MA was launched under PR1MA Act 2012, and 'Rumah Transit' specifically for a young couple under

Ministry of Housing and Local Government introduced in early 2014. Furthermore, the imposition of the revised real property gains tax (RPGT) 2014 rates is intended to curb speculation and the sudden increase in house price.

The purpose of this research is to assess the affordability of housing in different housing locations by taking into account a various range of economic, financial, environmental and social attributes.

1.3 Problem Statement

It is not uncommon to hear or read in the media or even government's publication that housing is becoming increasingly unaffordable. Not to mention, current effort on housing affordability failed to highlight the mediocre delivery of housing, substandard construction and diminishing quality of life. Looking to tackle affordability in a one-way view is futile as it needs to take into account sustainability in order to be effective in the short run and practical in the long run. There is an urgent needs to establish what are the criteria for assessing sustainable housing affordability, which is currently lacking in the country. These criteria, comprising of wide ranging elements, will need to be tested to determine the most preferred criteria. Naturally, the use of certain methodological procedure will help determine the preference level. Once this was done, it brings into question what are the areas that best fulfill the aforementioned criteria. Therefore, it is a question this research hopes to answer.

1.4 Research Question

Based on the issues mentioned above, four research questions need to be answered. The research questions are as follows:

1) What are the criteria for affordable housing principles (AHPs) and affordable housing schemes (AHS)?

2) What is the acceptance between AHPs and AHS toward affordable and sustainable housing?

3) What are the most preferred homeownership criteria under AHPs and AHS in assessing sustainable and affordable housing in Malaysia?

4) What is the best sustainable and affordable housing area in terms of AHPs and AHS?

1.5 Research Objective

The aim of this research is to access various sustainability traits and the affordability level of Malaysian middle-income house buyers. Therefore, few objectives need to be achieved in doing this research. The objectives are as follows:

1) To determine the criteria for affordable housing principles (AHPs) and affordable housing schemes (AHS).

2) To investigate the acceptance between AHPs and AHS towards affordable and sustainable housing.

3) To examine the most preferred homeownership criteria under AHPs and AHS in assessing sustainable and affordable housing in Malaysia.

4) To analyse the best sustainable and affordable housing areas in terms of AHPs and AHS.

1.6 Scope of the Research

In recent years, Malaysia is also faced with the issues of affordable housing and sustainable development like many other countries around the globe. The national housing policy stipulates that every household has a right to own a house and subsequently increase homeownership rate in Malaysia regardless of social status, ethnic, race and so on. However, current housing affordability problems are more inherent to the middle-income group of the household rather than low-income group of household because there are specific programs directed to this low-income group by artificially alleviating their buying power by means of various government initiatives, policies and measures.

In contrast, there are no specific policies that allocate for middle-income household, make it difficult for them to own a house. They have been facing with high house price that is beyond their affordability level. Therefore, this research focuses on measuring housing affordability among middle-income household and at the same time increase their quality of life by enhancing the sustainability of the preference house attributes specifically in the five areas of Klang Valley region namely Kuala Lumpur, Petaling Jaya, Shah Alam, Klang and Putrajaya.

1.7 Research Methodology

The research methodology adopts a quantitative approach. The research considers the application of a methodology that can be applied to assess the affordability of different housing locations in a sustainable manner, taking into account a range of economic, financial, environmental and social attributes. The multi-criteria decision making (MCDM) using COPRAS method will be used and applied to five different locations around Klang Valley which are Kuala Lumpur, Petaling Jaya, Shah Alam, Klang and Putrajaya. These five areas are chosen as the examples of how sustainable housing affordability can be assessed using an MCDM method. This method deals with the aggregation and consideration of numerous criteria to justify a set of alternatives in finalizing the decision- making by potential home buyers.

In order to use such method, two-stage approaches will be adopted. Firstly, an extensive literature review will be conducted to determine attributes that influence housing affordability and sustainable development and community. In order to validate the identified attributes, semi-structured interviews with relevant professionals will be conducted in the chosen regions to identify major factors influencing housing affordability. This helps to establish the full criteria system as well as a derivative of each criterion. Finally, the criteria system will be validated and weighted using

questionnaire surveys. The questionnaire surveys will be distributed to targeted respondents in each area of interest in order to elicit data on the importance of the sustainable housing affordability criteria.

1.8 Significance of the Research

This research is going to benefit many types of organization and reader. The significances of this research are:

1) The research will be able to contribute to the knowledge and understanding to housing affordability level for a young couple with particular attention to the first time home buyers in five (5) specific locations in Klang Valley.

2) The findings of the research could be used by the government of Malaysia in formulating future strategies of housing affordability and enhance the effectiveness of the policy created.

3) The findings of the research could also be used by the developer in order to plan future residential projects based on the location of five regions in Klang Valley and this action can be taken in a way to avoid oversupply of housing in tandem with unsold units due to its very high price in somewhat unattractive, undesirable, unsustainable places.

Limited research has been done to tackle the problem of affordability in the country and even few have applied the same technique in their methodology. The author believed that at the end of this report readers would find that this research is hitting the nail on the head in addressing the complexity of the issue.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter deals with the critical and comprehensive account of past literary works directly related to the field. This chapter includes assessment of vast literature component pertaining to the definition of various terms relevant to the topic of this research. This chapter also ventured to explore and identify the necessary criteria as part of its function to fulfill research's objective. It includes depth elaboration on the key ingredient of this research as well as to disclose and disseminate knowledge on the method or technique being employed in this research as a whole.

2.2 Definition

2.2.1 Affordability

According to Nelson *et. al.* (2002), affordability comprises the capacity of households to consume housing services and willing to spend income to bear its cost. Similarly, Stone (2006) also defines affordability as not solely focusing on housing, but also the need to consider housing services in relation to consumer capacity and the ability to pay for it. This shows that housing affordability differs between household capacities as it bears different commitments of expenditure and housing cost.

Alternatively, affordability is defined as the relationship between household's income, house price and rents (Aziz *et al.* , 2010). The authors take into considerations the house price and also rent price because affordability problems seem to affect purchasers as well as renters. Yates *et al*. (2007) agreed that affordability problems are greater for renters compare to purchasers. Housing affordability problems are alarmingly more serious and make it difficult to get homeownership specifically for the young couple.

Based on the definition given by the past literature, it advocates that affordability, in housing particularly cannot simply be defined by anyone because of the complexity of its conceptualization. Due to heuristic nature in defining affordability, the cost burden measure has been widely mooted ever since its inception (Newman & Holupka, 2014). Housing affordability is mostly encountered within the ability of an individual or households to own and consequently implying, to pay for it. According to Kutty (2005), affordability is frequently measured in terms of the ratio of housing costs to income. Communities and Local Government (2006) sees affordable housing as housing provided to a specific group of people, which are not met by the market and that it also meets the need for any household.

A household would feel that they can afford to own a house with a level of income and spend a portion to housing expenditure, meanwhile, another household that has the same level of income might have a lower affordability level due to bigger size of household members and contribute to a high commitment for non-housing expenditure thus it might lead them to a shortage of income. Broadly speaking, affordable housing is considered housing that satisfies the needs of a household with certain income constraints to allow them to access appropriate housing in the absence of any form of aid (Emsley, 2008).

Traditionally, affordability issues are solely focusing on the household income and expenditure towards housing cost. This resolution combines the amount of total income taking into consideration of all the living cost expenses and the amount of money spent towards housing mortgage. The ratio approach is the most direct and overused method to measure affordability. This method commonly involved the use of average benchmark of both income and housing costs across different household types or changing circumstances to measure its viability. Alternatively, affordability is defined

as; given the household's type and size, the household has the ability to occupy housing that meets the well-established criterions of adequacy at a net rent which provides them adequate income to live on without falling below some poverty standard (Bramley, 2011). However, the definition of housing affordability is still not fully acknowledged and preserved in agreed standards, due to different views about how it should be measured and at what circumstances it relates to.

As a consequence, while it may appear that the only probable solution is to build more houses as what is commonly the main objective of housing policy in most countries (Aziz *et al.,* 2010), the actual solution may not be as straightforward. Researchers seem to take housing affordability as a serious issue nowadays and have a wider range of consideration when measuring affordability. This consideration is done in order to be able to assess a true housing affordability without comprising general welfare. Affordability is not just about cheap houses but also include the availability and quality of transportation, neighbourhood environment as well as the availability of facilities and services among other things (Mulliner & Maliene, 2011).

Thus, it can be said that measuring affordability is difficult and creates problems in determining and conceptualizing the accurate and actual housing affordability among the purchaser. This is because, some of the purchasers would feel that they can afford to pay the particular amount of money on the housing cost. In real fact, some of them cannot afford due to the high commitment in other living costs.

There are few ways in determining housing affordability. House price to income ratio is a tool used to assess how much is the median house price that households can afford to purchase based on their level of income (Fox & Finlay, 2012). Household income is considered as a major determinant of affordability since the income itself would determine how much a household is willing and able to pay for housing.

Bogdon & Can (1997) argued that the current and existing affordability literature are only focusing on house prices rather than the condition, location and neighbourhood characteristics of the housing. Besides, the house buyer's preferences and behaviour varies and could highly determine the affordability level in purchasing a house. The house buyer behaviour would contribute to housing affordability indirectly since the different behaviour could lead to unreasonable decision- making.

Therefore, how does the affordability level be measured in just taking into consideration only on certain variables especially price and income?

It seems like we have hit the wall by the current affordability measures and we need to move on to new ways of thinking about how to measure affordability level especially for first-time house buyers with the consideration of various factors that would highly contribute to determining the affordability level of a household.

The issue of affordability is very complex, yet its conceptualization and the measuring itself has been reviewed differently by many researchers due to the different approach taken by them. According to Kutty (2005), housing is affordable when it consumes a reasonable or moderate amount of household income. Furthermore, Hulchanski (1995) states that, a household is said to have a housing affordability problem when it pays more than a certain percentage of its income to obtain adequate and appropriate housing. Similarly, looking at housing affordability in a wider context, Yates *et al.* (2007) have stated that this problem exists when housing costs either for rent or home purchases haul a big proportion of total household income.

According to Pendakur, as cited in Luffman (2006), since this reflects all household spending priorities, many researchers are beginning to use detailed spending data to assess affordability. It is said that housing price and household income are the key

determinants of measuring affordability. However, in order to determine the accurate affordability level among house buyer, the consideration of other factors is a must. Therefore, a wider measurement of housing affordability is significant in measuring the affordability level in today's current situation in five different localities taking into consideration a range of economic, environmental, social and financial criteria that influence both the affordability and sustainability of housing.

2.2.2 Housing

With the current booming of demand and inadequate supply of housing unit, many low-income households especially younger households are unable to either gain home ownership or even enter into a rental market (Beer et al., 2007). Households are considered to having housing affordability problems when they are forced into decisions that negatively affect them (Emsley, 2008). This issue gives a big impact to this group of people primarily due to the high property price, compounded by rising cost of living which detrimentally affects their long-term welfare.

Homeownership provides benefit to owner particularly over the fact that owning can provide protection against rental risk and the gains from capital appreciation (Keng & Hwa, 2004). Affordability problem as faced by both low and middle-income households cannot be disregarded and is a pressing issue domestically and globally.

According to Leigh (2008), a household has to bear high monthly expenditure due to increasing costs in most of the household expenses such as transportation, healthcare and childcare cost, increasing land values and also high construction cost. This situation has cumulatively strained household budgets and led to the housing problems among the nation's households. Furthermore, real estate boom of the last few years has caused housing prices to rise steeply (Fiscelli, 2005; Hashim, 2010). Hence, making it difficult for the household to buy a house and get ownership. Consequently, Yates *et al.* (2007)

state that housing problems relate to the shortage of household income towards the ability to pay for their housing and the decreasing housing affordability would also affect homeownership effort by the average household, especially middle and low-income group.

Housing in Klang Valley is prone to increment in price. The trend of rising housing price continues today with no apparent sign of deceleration. Klang Valley as the heart and soul of the country and the prime economic zone in the country remains a choice for migration into the region for job opportunities and career advancement, thereby creating an influx of demand for residential property (Ong, 2013). However, some areas in Klang Valley do not fare very satisfactory in term of housing affordability index as endorsed by the World Bank - where house price is considered affordable if it does not exceed three times the annual household income. According to United Nations Development Programme (2014), Kuala Lumpur, Putrajaya, and the state of Selangor recorded affordability index that can be considered severely unaffordable.

Housing remains as the main distress due to high prices of present properties and the shortage of supply of affordable, desirable and well-located properties in an urban centre. Housing affordability problems, as stated by Yates *et al.* (2007) are structural as well as cyclical which is contributed to the cyclical stability of homeownership and also contributes to its structural unsustainability. These problems would create risk for the economy as a whole since it arises because of the actions of those who do not have affordability problems. Therefore, many researchers have started to study on housing affordability problems due to its condition of getting more serious and are going to get worse if these problems are not overcome from this moment.

2.2.3 Affordable Housing

There is quite a number of past literature that gives various definitions on affordable housing each may come with a slightly tweaked version of the other. As stated in Encyclopaedia of Housing and has been accepted by many scholars, housing affordability is a correlation between income distribution, a household's income and the cost and financial condition in housing submarket (Van Vliet, 1998). Hulchanski (1995) stated that the term housing affordability had been used to summarize the difficulties faced by individual households in accessing decent or adequate housing.

The encyclopedia of housing suggests housing affordability as the ability of the household to apply the rule of thumb which is housing cost including mortgage and utilities of each household which must not more than 30% of monthly income. The residual of 70% must be allocated for other household expenses. This is to ensure that the household can afford to own a house, and at the same time still be able to afford to spend their income on the other daily expenses such as food, healthcare, transportation, childcare and so on, in order to survive on their day-to-day basis. If household spent more than 30% of their income only for housing cost as mentioned earlier, it would be quite a cost burdened and finally reduce the level of affordability among the household.

As stated by most affordable housing researchers (Kutty (2005); J. Luffman (2006); Yates *et al*. (2007)), the traditional rule of thumb in determining whether a household can afford to buy a house is when they spend 30% or less of their income to housing cost. However, criticism towards this traditional rule of thumb arises when it comes to the willingness of household to spend more than 30% of their income to housing cost since they are able and willing to pay for it. This kind of willingness may not greatly affect high-income household though low-income household would most definitely expose to the affordability problems (Yates *et al.*, 2007). The 30% rule can be used as

an indicator but in itself is non-consequential. Therefore, Pelletiere (2008) propounds additional criteria or guidelines to supplement the rule of thumb that will allow a more accurate and reliable nuance of housing affordability. Market inefficiencies as characterized by current housing environment causing stress especially for low and middle-income earner (Burke et al., 2007).

To put this in perspective, an example can be illustrated as follows: two households with monthly income of RM 12,000 and RM 5,353 respectively intended to own an ordinary terrace house in the suburban area of the city with similar facilities and services, which amounted to RM 1,500 monthly mortgage commitment. Basing our example on the traditional rule of thumb, monthly mortgage commitment for the first household will amount to just 12.5%. This is below the 30% threshold. By putting monthly mortgage commitment at constant, lowering the monthly income to say, RM 5,353 (median income in the state of Selangor for the year 2012) (Jabatan Perangkaan Malaysia, 2013) will result in 28% - which is dangerously closing to the 30% threshold. A report by the United Nations Development Programme (2014) stated that property prices in Malaysia are well beyond the reach of the ordinary citizen which in turns increase national household debt two-fold in 2010 at 47% of GDP to 83% in 2012.

The above calculation is based purely on a monthly mortgage, not including another property-related cost such as taxes, insurances, service charges and so on.. Additionally, this household must be able to support their family with adequate supplies of basic necessities such as food and services such as school to ensure well-being. However, concern with this ratio is primarily related to income and wealth distribution (O'Neill, 2008). For example, an expense of 30% or higher for high-income household, still leaves it relatively high, above-average disposable income. The rise in real income since the 1990’s have made the 30% benchmark rendered obsolete (Battellino, 2008).

However, many researchers had found that house price to income ratio is imperfect. House price to household income ratio would create a complex interaction in interpreting the affordability level of a household due to the significant difference between the styles of living in each household. With regards to the housing prices, the difference of house types and locations would be resulting in a different price range, which is the house price in the urban centre is definitely much higher than the price of house in the rural area, while prices of luxurious type of house will, of course, be higher than price of low-cost housing.

Basically, house price to income ratio may indicate that they are affordable, merely because they are low cost. Nevertheless, Mulliner *et al.* (2013) goes on to argue that this is an unsustainable way to view affordability because it fails to indicate anything about the quality of housing or even the environment in which the housing is situated. The author has a point in indicating the need for an alternative method of evaluating affordability.

In addition, according to Housing Industry Association (2010), the house price to household income ratio is imperfect because it does not include the fluctuations of interest rate in measuring the affordability level among the purchaser. Trimbath and Montoya (2002) state the agreement in interest rate is indeed playing a significant role in increasing/decreasing home affordability. The authors go on to argue that the affordability level is increased directly when the interest rate is low, nevertheless the lower interest also indirectly responsible for reducing it.

Theoretically, the purchaser would avoid buying a house at the time of high interest rate due to the high price, henceforth when the interest rate is low, the housing market attracts more buyer and it leads to the high demand of house. High demand in the house will directly increase the price of the house and would reduce the affordability level of

the potential purchaser. We can say that the fluctuations of interest rate will definitely affect the affordability level, but the lower interest rate itself could not lead the affordability level to rise, it also involves a wise decision making by the purchaser on how much they would spend on housing without affecting the other living cost.

The situation described rightly illustrates why housing affordability problems happen for most low and middle-income household. According to Yates *et al.* (2007), housing is not merely a shelter, but also as an investment. For low and middle-income people, buying a house and access to home ownership is the most expensive investment that they would make in order to have a place to live in and as a guarantee of life for the future (Hashim, 2010). However, the high-income household would take this opportunity to increase their portfolio in property investment for wealth creation as more are calling for the inclusion of residential properties into personal investment portfolio (Keng & Hwa, 2004). The manipulation of house price by these investors either for the selling or renting of their residential property would directly distort the market and indirectly increase housing price in the housing market (Malpezzi & Wachter, 2005). In other words, the action of investor or wealth creation could worsen housing affordability problems and decrease the level of affordability for low and middle- income household.

Housing affordability problem usually affects low and middle-income household with unplanned decision making while purchasing or renting a house. Most often than not, the decision will be made based on ongoing negotiation of individual choice and constraint (Burke *et al.*, 2007). A report by the United Nations Development Programme (2014) revealed a shocking revelation that only one-tenth of households in Putrajaya owns some asset or in other word, nine out of ten households have no homeownership along with about half of households in Kuala Lumpur. A middle-

income household usually being a trap by the national policy that is focusing too much on low-income household (Aziz *et al*., 2010).

However, Aziz *et al.* (2010) stressed that the real situation is, the middle-income household is also facing with housing affordability problems with the skyrocketing of house price which rises way beyond their affordability level and inadequate supply of affordable unit thereof. This is further supported by the Minister of Urban Wellbeing, Housing and Local Government, Abdul Rahman Dahlan, when he said there is still a large gap of 40% differences between affordable housing supply and demand (Hisyam, 2013); indicating a mismatch in supply to meet increasing demand.

2.2.4 Sustainable Housing

While the term sustainable housing is often associated with its environmental connotation, other researchers are now looking beyond its obvious literature to include such thing as financial, policy, geographical and its direct relation to built environment not just in terms of construction and material usage. The term refers to housing which is socially recognizable, economically viable, financially accessible and environmentally allowable.

Due to different intrepretation, our adopted definition of sustainable housing in this thesis is that housing which is of sufficient workmanship quality, in a livable environment and is available for access financially to general households.

However, the history of sustainable housing goes a long way since 1983. Realizing the deteriorating state our world is in, United Nation (UN) General Assembly in 1983, through resolution 38/161 authorizes the establishment of Brundtland Commission. Sustainable development was defined by the Brundtland Commission in 1983 on WCED as “development that meets the needs and demands of the present generation

without compromising the ability of future generations to meet their own needs and demands". Only recently, the concept of sustainability has been incorporated into other area of human development such as housing from its early preconception concerning primarily macroeconomics (Choguill, 2007).

Sustainability has evolved and over time gaining influence in both local and global agenda. With many different views and many different definitions established in wider literature context, it is no wonder many are still baffled by it. As Gibson (2001) rightly put it, the concept is subversive, and it goes against traditional status-quo thus a certain amount of hesitation by all interested parties is to be expected. In short, studies on sustainability examine the complexity of interactions between the acts of balancing the need of the three pillars of economic development, social equity and environmental protection (Drexhage & Murphy, 2010). Maliene *et al.* (2008) with the same air of agreement are of the opinion that sustainable communities can be materialized from its conceptual theory by, among many, efficient utilization of development land to create a higher density living and component that will be integral in the sustainable communities such as transport.

The two words: sustainable development and sustainability have their share of a dispute with government and institution favour the use of the term sustainable development. NGOs and academicians prefer the more general term of sustainability to refer to the same context (Robinson, 2004). The works of De Schiller *et. al* (2003) and Da Silva (2003) stress the fact that acceptance of sustainability and its concept be highly dependent on local culture level and general education attainment (as cited by Kowaltowski *et. al.* 2006).

On the other side of the coin, some critics argue on the concept of sustainability. After 31 years since Brundtland, progress towards sustainability has been dreadfully

sluggish. Development accompanied by increasing income inequality involves slower advances in human development, poor social cohesion and slow reduction in poverty (United Nations Development Programme, 2013). Not withholding the various definitions came up by various institutions. Perhaps the most salient features of the word sustainability are that it conjures a lot of different meaning and interpretation by so many different sects (Robinson, 2004). This result in lip service where government, organizations and the rest can talk about being sustainable without having to walk the talk, in other word 'business as usual' (Laszlo, 2010).

Gibson (2001) listed down important limitations in sustainability. One of the points, he argued that the system proposed by sustainability demand more sophistication than we are currently in possession. Also, in real world compromise and trade-off are rarely avoidable, integration and reconciliation are possible but demanding positive result every time can be overly ambitious. The author thus can be said to refer to pollution crises as an undesirable output of development and industrialization which in turn is what the extent of the current situation of the world. To give an analogy, it is like the first world countries tell developing nations to curb pollution in their growth to modernization while they are the ones responsible for the most part of the pollution crises. Gibson also pointed out three ostensible concerns on the subject of sustainability that it was vague; it would attract hypocrites; it was likely to attract delusions (as cited by Robinsons, 2004).

The study of sustainability has also been criticized due to its anthropocentric nature. In another word, it focuses too much on human development and neglecting the other greater community of life such as the flora and fauna that also within the realm of sustainability and equally at par with the need for sustainability as a human being would have (Boff, 2012). The issues in sustainability thus fundamentally boil down to both the

need for growth and the result of removing the degradation of the quality of life and environment that follows (Adams, 2006). Adams further asserted that these issues tightly related to the wellbeing of poor people. This is especially true in a society where rapid urbanization in developing countries is threatening the demise of the valuable ecosystem to satisfy urban needs (Shen *et al.*,2011).

In the same note, Mulliner and Maliene (2011) has reviewed in their research that the availability supply of affordable housing is significant in getting home ownership. The author further added that supply constraint may limit the ability of an area to provide housing for those who need it. This condition arises in accordance with high demand for housing, but the affordability level declines, thus led to a shortage of affordable house in the housing market. Other than that, the availability of rented accommodation should also be taken into account as authors, Mulliner and Maliene (2011) believe that the private, as well as the public affordable rented house, has to ensure the social and sustainable communities. Therefore, the housing market could supply shelters that are not only affordable to the house buyer, but also optimize the social need to produce sustainable communities in the future.

Figure 2.1 describe how the relationship between economic and demographic in the property cycle that affects the supply-product-demand continuum. The economic and demographic component in the property cycle is aptly named as the affordable housing principles (AHPs). The human and product relationship is described as affordable housing schemes (AHS).

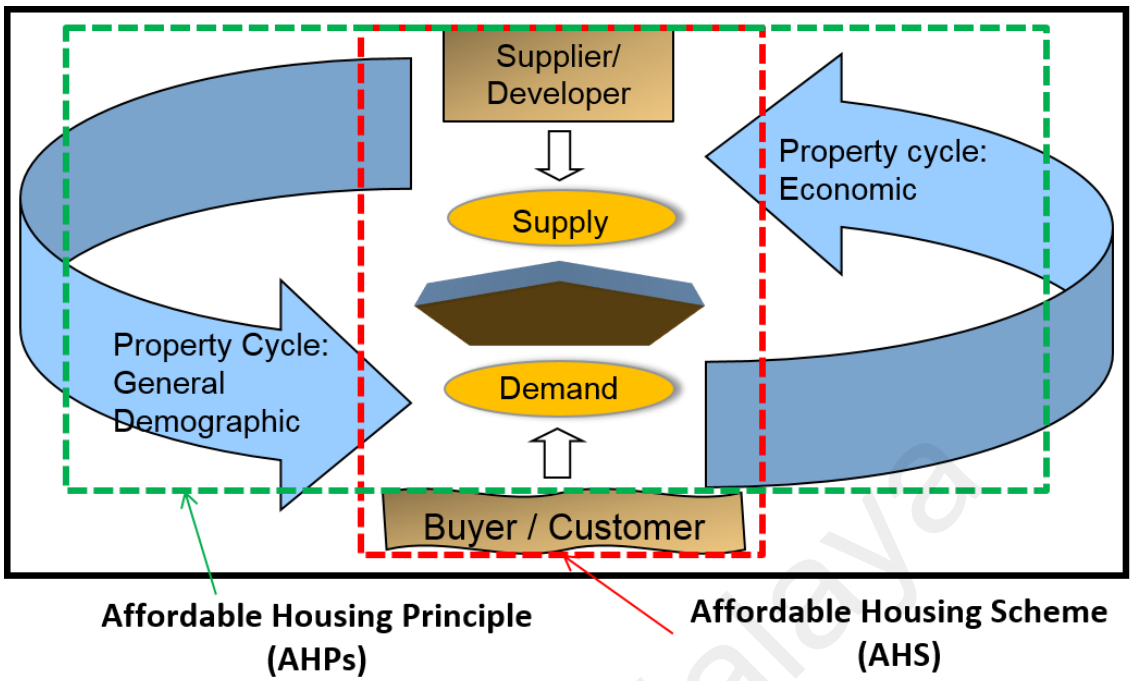

Figure 2.1: The relationship between demand-supply and the property market

2.3 The component of Sustainable and Affordable Housing

The components of sustainable and affordable housing can be divided into two: affordable housing schemes (AHS) at one end and affordable housing principles (AHPs) which is shown in Figure 2.2. The division is clear-cut and obvious whereas AHS is particularly focused on the product factor i.e. relating to the house itself while AHPs goes beyond the product. These two components are fundamental to understanding the further development of the various factors involved in sustainable and affordable housing.

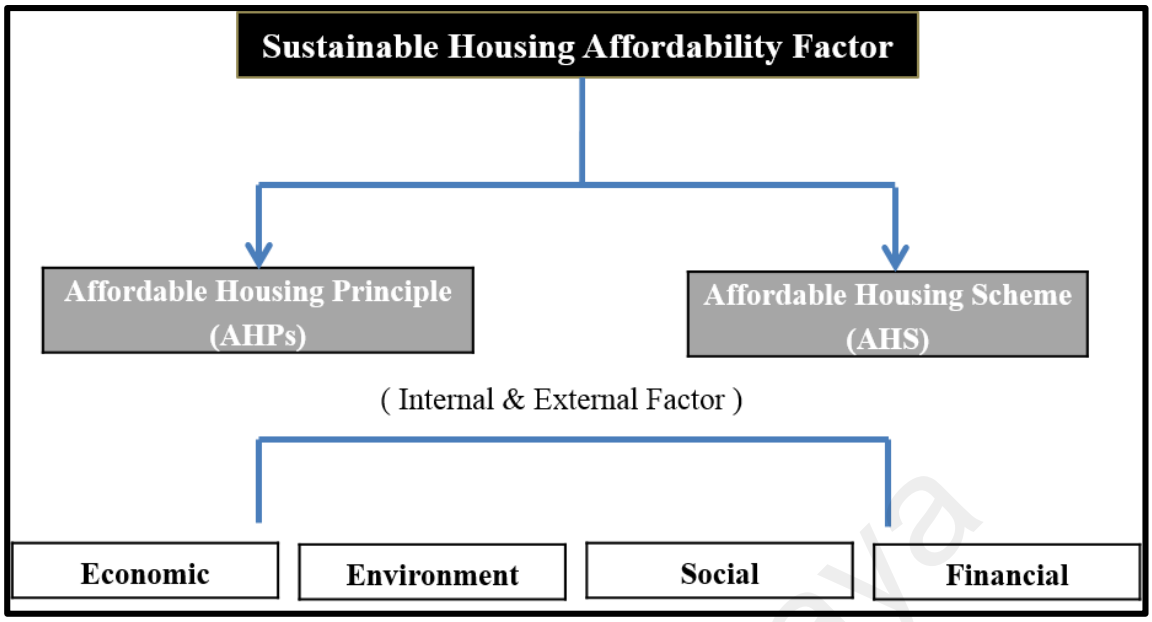

Figure 2.2: The components and factors of sustainable housing affordability

2.3.1 Affordable Housing Schemes (AHS)

As stated earlier, housing is a big investment and even more valuable as a long-term asset. Prior research has consistently propounded and verified how homeownership to some extent can specifically be beneficial to the work-life balance as a whole as well as tangible financial benefits to individual homeowners (National Association of Realtors, 2012; Rossi & Weber, 1996). Not only that, but research also suggested the link between homeownership and self-esteem as well as active community participation. The decision on owning or renting is not simply a financial question or be based on economic rationale but the underlying motivation such as security and creation of long-term family home (Burke *et al.*, 2007).

AHS is particularly useful to be categorised as the product factor i.e. relating to the house itself and its environment. Location, design, price and the likes will be taken into account when an individual is deciding to buy a house. Property developers strived to offer a wide range of houses to suit individual preferences and choices. Given the options and the variety of offered product, this gives the buyer or potential buyers the

illusion of choice. In actuality, very rare that product matches what buyers really want (Hinshaw & Allot, 2007). This is due to the tendency of developers to conform to the standard and intuitive approach to housing design and construction rather than doing a careful examination of consumer needs and preferences.

Unarguably, catering to individual's demand is in itself is not efficient but affordable housing is not about that, it is about catering to the masses of the population. Often, housing as a product has failed to meet the requirement of buyers (Booth, 1982). Various other factors such as site locality and general locality also contributed to consumers decision on finding the right housing product (Reed and Mills, 2007). Danielsen *et al*. (1999) proposed density as the key element in future housing and how it can be used to control excessive development without endangering economic growth or affordable housing. Studies by Khoiry *et al.* (2012) and Llinares and Page (2011), further supported the theory of how physical attributes of a house such as accessibility, layout, size, quality of finishes and view and others can affect property purchase decision, therefore, contributing to wide array of elements essential in sustainable and affordable housing.

The impact of a neighbourhood or surrounding albeit not directly linked to the physical structure of a house may have contributed to developing of housing that fulfills the requirement for sustainable and affordable housing. Literature that seeks to discuss such matter and its relations include those studies by Ahonen (1980); Teck-Hong (2011). One research particularly in favour of combining development to fit the surrounding as to enhance and create a sense of place (Logan, 2010). Since surrounding impacted property value and it is directly tied to the product, this puts surrounding as one of the AHS factors. On the same note, Ahrentzen (2008) believed that affordable

housing has a positive influence on nearby residential property values subjected to a host of context such as the degree of concentration of affordable housing units.

AHS can be divided into an internal and external factor which are equivalent to supply and demand. The internal factors are intrinsically from the supplier and have the most control of it. In contrast, the external factor is demand-induced and tangible whereby potential buyers can assess and decide upon. AHS is important since most of the elements involved in its factors and sub-factors are in direct relation and significant in the lives of buyers or potential buyers. The elements of AHS are further subdivided into five distinct sub-factors which are property condition, marketing aspect, property layout, surrounding and accessibility.

2.3.2 Affordable Housing Principles (AHPs)

As per stated, housing the people is not an end in itself. The requirement to create suitable, affordable, and comfortable homes is an ideology that transcends beyond that of local agenda towards a sustainable future. Choosing to ignore the principles behind it may prove catastrophic and disastrous not just in economic or financial terms but also environmental and social in the near future. Many researchers have suggested numerous maxims on how affordable housing shall be governed and these principles are by no means exhaustive. This research, however, does not embark on the creation of new principles but merely reorganized it to suit the research objective.

AHPs, as opposed to AHS, is not specifically related to housing in itself but in a way crucial to the development of a sustainable and affordable housing. The unseen or intangible can sometimes exert more influence than the obvious. AHPs may include a variety of factors that are inherent as well as local in any society or system. Demographic, for example, has traditionally been the fulcrum in sustainability as well affordability studies. As a matter of fact, previous researchers (Bujang *et al.* (2010);

Engelhardt & Poterba (1991); Green & Hendershott (1993); Li (2014); Majid et al. (2012), identified demographic to be an essential part of housing and have taken deep interest in its impact as a whole. Demographic is only part and parcel of the broader social factor.

The micro and macro-financing application may have such powerful tool in alleviating standard of living as well boosting economic and social condition in developing countries (Hermes & Lensink, 2009; Pollin, 2008). Notwithstanding, it can also be particularly beneficial in the context of the housing market as suggested by a Ferguson (1999) and Galati *et al.* (2011). To discuss the mechanism behind the financial factor can be lengthy and especially out of scope but what is important is how it can contribute in a way towards the development of sustainable affordability housing.

Having established AHPs as one that indirectly contributes to sustainability and affordability of housing, it is also essential to be able to identify which element belong to what factor or sub-factor. Much like AHS, AHPs can also be divided into internal and external factor. Whereby internal is the function of AHPs that are personal or immediate to buyers or house itself but not directly linked to the house as to set it apart from AHS. The external factor of AHPs, on the other hand, is completely non-related to the buyer (or potential buyer) or house themselves but are interconnected and dependent on one another in order to function. The elements in AHPs are categorically divided into social and financial factors. The next topic will hold forth the explanation on these factors and its subsequent sub-factors.

2.4 Factors Influencing Sustainable and Affordable Housing

With the growing interest in incorporating sustainability into the affordability of housing equation, a framework combining the various elements, criteria or factors that span the whole concept must be developed. This framework must envelop not only the

multi-facets of housing environment but also qualities that may not be directly related but significant nevertheless. The availability of such framework will prove invaluable to the methodology undertaken in this research.

The link between affordability and sustainability is a strong one. The viability of a successful affordable housing depends on short and long-term financial concerns in the process of creating a viable sustainable objective (Murray, 2015). As a matter of fact, a tweak in design or construction stage can greatly impact the affordability of housing. Gibson (2014) proposed a modular construction method, as an alternative to conventional construction. The substantial savings in time, cost and risk allow for increased efficiency and opportunities for access to affordable and sustainable housing.

Figure 2.3 below concisely summarize the dynamism of the four factors that made up sustainability housing affordability factors. Having established the relationship between sustainability and affordability, the sustainable housing affordability in this thesis can be divided into four general factors: economic, environment, social as well as financial. These four factors are then subdivided into a set of components which are then further sub-subdivided into even more elements accordingly. Notice that the first three factors are directly related to the three sustainability pillars above: economic, environment and social factor (United Nations, 2005). While an additional factor- financial- is required to relate specifically to housing and built environment.

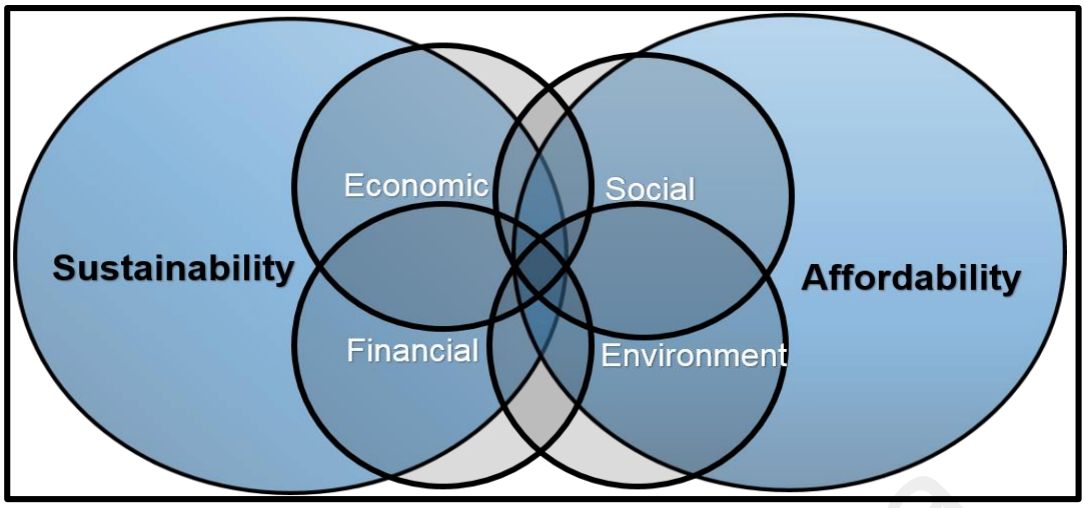

Figure 2.3: The convergences of factors for sustainability and affordability

Mulliner et. al. (2013) in their research proposed an integration of affordability and sustainability which seems probable for a number of reasons. Firstly, because considerable efforts have been channeled to point out that affordability definition must go beyond bricks and mortars, beyond cents and dollars. Obviously, its definition may not be concrete. A better way to get through this ordeal is to propose a solid, measurable, mathematical formula that can be used again and again as a barometer to measure integration of sustainability and affordability. This necessitate the formulation of a method (COPRAS) that is the basis of this thesis.

2.4.1 Economic Factor

Economics is a branch of social science that primarily concerns with the allocation of resources, production and use of goods and services (Reddy & Saraswathi, 2007). Alternatively, it can be said that economics deals with how limited or scarce resources can be used efficiently to benefit the most number of people (Satija, 2009). The distinction between economic and financial factor are very narrow, albeit essential in developing the framework for the factors influencing sustainable and affordable housing. Colander (2006) specifically defined economics as a study of decision-making mechanism as a function of wants and desires in human beings. Finance, on the other

hand, can be defined loosely a subset of economics where it uses not a few economic concepts such as breakeven analysis, opportunity cost and so on.. (Coffman, 1983). Housing outcome may also in some respect affected by economic forces (Grimes *et al.*, 2006).

Economics can be divided in two- microeconomics and macroeconomics- where the differences lie in focusing on the actions of players in the market such as buyers-seller, lender-borrower and a broader view of analysing in bulk the performance of economic activity of a country or global interaction respectively (Colander, 2006). The subfactors that are identified under this factor include the property condition, property layout and the marketing aspect of the housing itself. Basically, these elements are directly related and play a large influence on specific housing. An overview of the identified subfactors under economic factor are elaborated in the following subsections.

2.4.1.1 Property Condition

One of the elements in this component of economic factor includes house quality. House quality in this sense concerns with the use of quality instead of subpar, inferior materials utilized in its construction. To further reduce the price in the construction of low-cost housing, developers have no qualm at finding cheaper alternative often at the expense of buyers. Department of the Environment Heritage and Local Government (2007) defines quality housing as a development that fulfils all requirement standards by the government, includes promoting high design and standards in construction, accessible, practice a high performance of environment and provide amenities and infrastructure that could enable the house buyer to live in a sustainable housing development and produce a sustainable communities.

The finishes use, as well as the general exterior view of the subject property, can also be regarded as important to each individual. The types of finishes use and its general

exterior condition is seen as important to prospective house buyers and they are willing to pay a premium to have a sufficient quality finish (Teck-Hong, 2011). An exterior condition in this research refers to the more general external surrounding of the house itself rather than the architecture or building-specific. Therefore it is more appropriate to list this element under property condition component rather than in the marketing aspect component. Property condition differs with marketing aspect in terms of perceiving and reality. Property condition is what resident or the prospective buyer will experience first-hand. By being physically present, individual can only judge the quality of a house and its finishes instead of being bombarded with marketing gimmick which sometimes may be exaggerated or misleading.

2.4.1.2 Marketing Aspect

The marketing aspect is another important component in economic factor due to its direct influence on buyer's preferences. Three Dragons Strategic Solution (2007) listed marketing as one of the determinants of the demand side contributing to affordable housing. Understanding of the cultural definition of a product allowed buyers to create a meaningful personal attachment thus translates to a more successful marketing gimmick (Peter & Olson, 2008). King (1976) with the same air of agreement on the topic stated that the attractiveness of a house depends on its perceived usefulness. In this research, we particularly concern on various elements of marketing aspect which are the theme or development theme/concept, housing price, type and design, property interest and age of the house.

While many researchers try to steer away from focusing too much on price- giving greater emphasis on either quality or income distribution or accessibility- it is nevertheless a very powerful game-changer especially in the context of sustainable housing affordability. Normally, the more benefit a house has to offer the household,

the higher the price or rental price it would be (Aoki *et al.*, 2004). The benefits here indicate the accessibility or advantages that the house buyer will embrace after the purchase. Henceforth, even a modest house located in some highly-connected location may not be in the price range for middle to low-income prospective buyers. According to Bujang *et al.* (2010), the level of housing price affects affordability across various income groups. House price variations are affected by the mismatch between demand and supply (Drechsel, 2015). It can be clearly seen that pricing under marketing aspect is a powerful tool in affecting the demand of potential homeowner.

Theme or concept of development also affects the decision on buying a house (Majid, 2011). The appropriate choice in naming a development, for example, can exude the feelings of belongings and sense of harmony. Given the many house types and design, the buyers can have a greater choice in choosing the type of dwelling they prefer. Greater choice means a better predictor of residential satisfaction (Day, 2000). Some buyers may prefer a house with wall windows to allow natural lighting and some prefer a large garden for recreational activity or many bedrooms to suit family size. It is impossible to generalize what buyers want thus making a choice as wide as possible which allows them to choose wisely among many types and designs. Hofman *et al.* (2006) prioritise potential buyers' preference for various housing design and element in which he found that the relative importance of the type of kitchen was more important to their respondents than floor finishes.

The property interest is another element in this component. There should be no doubt that financial factor plays a major force in determining the choice between freehold or leasehold since owner-occupation sector requires some financial stability (Abramsson et al., 2004). This is because freehold is more expensive and exclusive compares to leasehold (provided other factors remain constant). Homeownership is viewed by many

housing economists as an investment consideration not just as a consumption decision (Clark *et al.*, 1994). Since land is a state matter in this country as provided in Schedule 9 of the Constitution, National Land Code (NLC) 1965 granted state authority a full power in alienating any state-owned land by, among many others, in perpetuity or for a term not exceeding 99 years.

There are conflicting views on how the age of a property can influence decision making and, therefore, affect demand. As house ages, it requires, even more, financing to maintain and function as it is, thereby reducing the demand for such property. Unlike land underneath the physical structure which appreciates over time, the physical structure depreciates over time and in respect of design or functionality may one day become obsolete and out of trend. This is precisely the reason why many of the research pertaining demand include the age of house as one of its variable (Ioannides & Zabel, 2003). On the other hand, Do & Grudnitski (1993) believe that older house age is more expensive due to various improvements made over its existence. In addition to existing literature, the potential young homeowner may prefer a newly constructed house with their children in mind. This is because younger household wants their children to easily find playmates with roughly the same age and playmates are hard to come by in an older neighbourhood.

2.4.1.3 Property Layout

This specific component of economic factor primarily deals with direct property-related elements. What all elements in this component have is that all of them are physical. According to Reis (2001), physical aspect or the aesthetic value of housing is a strong determinant of overall resident's satisfaction. This is further supported by Tarcisio (2010), where he added that the internal & physical aesthetics of housing could be the criterion for the positive or negative evaluation by current or prospective

residents. The position of the house in layout plan, for example, is directly related to where the structure could be in the layout plan whether it is a corner lot, intermediate lot, building-facing lot and so on. The size of both built-up and the land area can be instrumental for just about any family. The choices of which are often based on family size and financial capabilities. In addition, the topography of housing be it at the bottom of a hillslope or the top of a cliff or situated in an unruly landscape may be included in this sub-factor.

The size of the built-up area and the size of the land area can make a big difference in term of the sale price. Although in many cases, the term built-up area is a misnomer since the structure is only built using half of the lot size (Alig & Healy, 1987). A house with small built-up area relative to its overall land size but located in prime location in a city will usually command a better sale price since land is far more expensive than the structure. Quality housing with a mixed size of land or built-up area allows for greater economic and social mixes (Rowlands *et al.*,2006).

Other than that, the topography of the general area surrounding the development or housing estate needs to be considered. The consideration for first layer or second layer, flat land or rough terrain, laterite or road access, road level or otherwise can be sensitive to some people. Buyers will generally prefer a distant away from dangerous topography such as slope and hill as to avoid the risk associated with it. The work of Saiz (2008) suggests the relationship between topographic constraints in the housing market with recent price growth to be strong.

2.4.2 Environment Factor

The talk on sustainability can be quite meaningless and thoughtless without the effort of mentioning environment characteristics. After all, the very definition of sustainability taken by many including the resolution adopted by United Nations (2005) identified the

'three pillars' for sustainable development goals which are social, economic and environment. The environment remains a prominent issue and aspiration and the effort intensified with the establishment of The World Commission on Environment and Development (WCED) in 1982 and continued to this day (Kates et al., 2005). The sub-factors included in this factor are surrounding and accessibility. Both are regarded to be an important selling point and are appreciated by potential buyers. An overview of the identified subfactors under environment factor are elaborated in the following subsections.

2.4.2.1 Surrounding

Surrounding is one of the components in environment factor. The impact of surrounding on a particular housing cannot be overlooked. Residents in any neighbourhood will generally look for a safe environment with a scenic view and little traffic congestion. There are many types of neighbourhood available in the market and its design may have influenced positive social interaction within the dynamics of the neighbourhood (Wilkerson, 2011). The observation of environmental qualities within and around the neighbourhood can be used to classify its various types (Teck-Hong, 2011).

One element that is closely related to surrounding is the environment. Individual's evaluation of environment is affected by the physical structure and surrounding land use (Ahonen, 1980). In order to ensure the efficacy of statues relating to the environment, federal and state government must work together for the benefit of the people in this country. Malaysia has experienced an obvious rise in pollutant emission along with its economic growth (Ang, 2007). According to Jabatan Perancangan Bandar & Wilayah Persekutuan Semenanjung Malaysia (2006), rapid urban development resulted in eroding of environmental quality. Many rivers as a source of drinking water are no

longer safe for human consumption due to the presence of pollution from domestic waste, industrial effluents and the likes. Subsequently, a growing number of developers and designers are seeking more environmentally-friendly, sustainable architecture and development strategies to address these concerns (Scheur *et al.*, 2003).

Traffic congestion is another element in surrounding component of environment factor. As we advanced toward a more robust economy, purchasing power of the people also increases. This has in a way contributed to the slews of personal vehicle and the resulting traffic congestion in many areas especially in and around the city centre. Urbanization rate in Malaysia is expected to increase to 75% by the year 2020 and the current trend itself is believed to ensue numerous traffic congestion along with many other woes (Jabatan Perancangan Bandar & Wilayah Persekutuan Semenanjung Malaysia, 2006).

Findings from both Hymel (2009) and Fernald (1999) suggest that traffic congestion can elicit huge negative impact on economic growth and by extrapolation the property market itself. This is because noises from the traffic can disturb social activity and in some extreme cases imperil long-term health, therefore, degrading productivity and quality of life (Nelson, 2008). Individual prefers a smooth traffic in their general area so that it is convenient to move around. A recent study indicates that the levels of congestion in an urban environment are directly proportional to employment growth (Hymel, 2009).

The differences in residential density between one area and another are part of town planning policy. Density, according to Brownstone & Golob (2009) can alternatively be regarded as a proxy for employment availability and commercial activities and is frequently used as an indicator of urban sprawl owing to its availability of data and

consistent measure of space and time. As a matter of fact, increasing density is one of the aspects of sustainable residential design (Sivam & Karuppannan, 2009).

The reason "view" is included in environment component is straightforward. View or landscape can often lead houses to fetch a higher price, signifying that some buyers are willing to spend more to get a 'better' view (Luttik, 2000; Teck-Hong, 2011). According to Benson *et al.* (1998), properties can be divided into either 'view' property or 'no view' property and the quality of such views such as full view or partial view of the water/lake affect its attractiveness among prospective buyers. The value of view or landscaping shall not be undervalued. The impact of residential view can have critical implication on the accuracy of valuation and the property market (Malinde & Tokunboh, 2003).

Any individual or family will want to live in an environment that can grant them a safety or to the very least exert the feeling of being safe. Safety of the family must come first before all else. Therefore, safety level is placed as one of the top priority for any family. As a matter of fact, Maslow's hierarchy of needs listed safety as one of its basic needs that are required to be fulfilled before progressing on to higher level needs (Maslow, 1943). This research took the assertion to adopt the definition of safety by Merriam-Webster online dictionary which is defined as "the state or place that is free from any harm or danger" combine with the definition from Albrechtsen (2003) to include "unexpected natural event that is observable or otherwise; causing losses related to human injury or assets". This definition differs from that of security which will be defined under social factor (Facilities - page 42)

2.4.2.2 Accessibility

A true housing affordability measure must look at the wider range of cost, such as transportation cost. According to literature by Mulliner & Maliene (2011), the

availability access to public transport service is needed in order to make an area as a good place to live in. Australian Conservation Foundation (2008) have stated that affordable houses are basically built in the isolated location and poorly designed, without the integration of public transport and only dependent on cars due to the lack of accessibility between housing development and public transport services.

Even if the cost of the house itself is reasonably low, the cost of transportation to travel from house to the workplace is cumulatively high which put the household in a shortage of income. This shows that sustainable housing affordability must take into account the availability of the public transport to reduce the burden that they have to face in order to sustain the affordability of low-income household especially the first time house buyer. The decision of owning a house was also dependent upon commuting time (Levine, 1998). He further asserted that allocation of affordable housing near employment could influence the residential locational decision.

Samuels (2004), in the report for Chartered Association of Building Engineers (CABE), stated that housing development is highly attractive in terms of locality for house buyer if the school is provided. This is due to the significance importance of accessibility of school, not just consider the price of the house. Mulliner & Maliene (2011) also agreed that individual's future and locality of the prospective house are influenced by the availability of good education place, which is a school. It is at the same time could affect the quality of life in a household since school is the place to shape the early education of the children.

Ivor Samuels (2004) stated the importance of accessibility to shops in the housing area. Good access to shops is of particular significance for the household in getting the daily stuff and buy goods for the family. Home buyers tend to consider these criteria before they end up making a payment in the purchase of a particular house as the

availability of shops and schools is convenient in creating a sustainable community within a sustainable housing affordability. Additionally, Bujang *et al*. (2010) have stated in his research that location of the property would highly influence the demand for housing and level of affordability among the household.

Furthermore, in accordance with the criteria of choosing the most suitable housing location, easy access to healthcare service centre is deemed to be significant for the house buyer. According to Zhu *et al.* (2006), the accessibility to the hospital is important as the need for shops and other facilities. This is because, easy access to healthcare service centre would benefit the housing community in getting treatment when in need, thus create a sustainable housing and communities.

Other than that, access to child care could influence the choice of house buyer in determining the suitable place they would live in. According to Mulliner & Maliene (2011), housing area should have easy access to early child care facilities, as the community have to place their child while they are out for work. However, the consequences of poor child care facilities would cause parents to spend more to travel directly from their house to the child care facilities that are located far from the housing area, thus increase their transportation cost and expenditure.

Easy access to leisure facilities can influence a house buyer to choose their housing location. Mulliner & Maliene (2011), discussed on leisure facilities in his study, and stress the importance of leisure facilities to the community. The community that has accessibility to leisure facilities will improve their health. Health care could be achieved by having a healthy and sustainable lifestyle. According to Cowan & Hill (2005), park and open spaces would provide a proper recreational area for the housing community to exercise and to relax their mind. In addition, the community could also use the park and

open spaces to jog and does some other exercise that they would prefer while creating sustainable communities.

Bujang *et al. (*2010) stated that making a house purchase decision is based on personal preference. It is, therefore, showing that the house buyer would prefer a house that is located near to the city centre by which allowing them to access the necessary facilities and infrastructure. Henceforth, by demanding all these criteria, the house buyer would prefer a house that is located at a well-developed location with a well-design. Unfortunately, this is beyond their affordability level. Opting for a house in a good location without considering the cost involved would lead to involuntarily worse of affordability level.

According to Mulliner & Maliene (2011), a sustainable housing is located at the attracted location which includes easy access to the public facilities, amenities, health care services, shops, and also easy access to employment opportunities. It advocates that house buyer would take into consideration all these criteria in determining their house location.

2.4.3 Social Factor

Social factor in recent times is gaining a larger audience. The influence it has on sustainable and affordable housing must also not be side-lined. Social according to Cambridge dictionary refers to, in this context, "the structure of society and the way each individual react and living together in an organized, established way". The government of Malaysia has recognized the impact of rapid increment in urban population and sought to tackle it by introducing policies such as National Urbanisation Policy, National Housing Policy and *Rancangan Fizikal Negara*.

Owing to its fixed character, the housing can be used as a tool in determining the underlying connection to social mobility (Somerville, 1998). Other researchers such as Rossi and Weber (1996), explored the relationship of homeownership to both owners and renters. One of the 'strong' consistencies was that homeowners have more income but also more debt and the 'weaker' consistency rated homeowners as happier and their children less likely to drop out of school (Rossi & Weber, 1996)

Other example of how sustainable and affordable housing can relate to social factor is provided by Grimes *et al.* (2006) where the authors relate how positive externalities of housing can reinforce social stability and foster social involvement and how negative externalities may inevitably lead to a social problem. The subfactors included in social factor are demographic, facilities or amenities and government initiative. An overview of the identified subfactors under social factor are elaborated in the following subsections.

2.4.3.1 Demographic

Not many researches have been undertaken to examine the impact that demographic subfactor of a social factor has on the property market. Notable research such as Majid *et al. (*2012); Mankiw & Weil (1989) among many other had linked demand to age as one of the demographic factors. Housing demand can also be related to the rate of household formation which is influenced by the demographic structure of the population (Skaburskis, 1997). Demographic factors such as age, household income, the number of person per household and education level, can to some extent influence the pattern of demand and supply thus making it appropriate to be included as one of the elements in this sub-factor.

Linneman & Megbolugbe (1992) found that the low levels of job skills and a low level of education might lead to the problem of affordability level, especially for lower

and middle-class households. This circumstance happened to these groups of people not only because of the rapid increase in the housing price, but their income level is increasing too slow. Hence they could not survive with the high price offered on the market. It is indeed, the level of educations will determine the income that a person would earn. Thus, there will be a significant different in determining the level of housing affordability among the house buyer. Research by Hurtubia *et al.* (2010) also found that education to be a deciding factor for buyers when faced with different types of property.

Age seems to be a rather prominent element in this sub-factor. Mankiw and Weil (1989) successfully demonstrated that age could significantly affect housing price. Alternatively, more contemporary findings by Levin *et al.* (2007) for example found that both the declining and ageing of the population may hold downward pressure on housing prices. According to Canada Mortgage and Housing Corporation (2003), housing demand is influenced by the population growth and the characteristics of individuals. Similarly, Swann *et al.* (2013) believed that increased in population growth translated to increase demand for housing services. Alternative demand for services can be a direct result of changes in the age structure and reducing the population densities in lieu of housing usage. Age also affects housing tenure and type. Logan (2010) concluded that since younger people have a higher mobility, they are more inclined to become renters and to live in a multi-family dwelling such as flats.

Most literature has linked household income to affordability. As part of the demographic portion of social factor, income plays a major role in determining whether or not a household can afford to own a house. As explained earlier (Affordable Housing - page 14), income is often coupled with price or cost of the house to create a measure

of the ratio between household income and house price to be termed income affordability (Bujang *et al.*, 2010; Md Sani, 2013; Stone, 2006).

The number of persons per household is important as any other demographic criteria. The measurement of housing affordability and sustainability will not be completed without the discussion on household size. Unsurprisingly, household size is often associated with income and mortgage/rent as these two are set as indicators towards the well-being of the family in general and to be able to pay for housing-related cost without falling below the poverty line (Md Sani, 2013). According to Rosen (1974), the demand for affordable housing, is influenced by, among other, changes in the family structure or number of persons per household.

The habit of saving is a noble one and strongly encouraged in almost every culture across every country. The availability of savings can be a savior in time of unstable or unpredict financial situation and an essential part of family planning (Bosworth *et al.*, 1991). On a global scale, a more sustainable development can be achieved by incorporating alternative towards traditional accounting method to account for national savings by factoring its negative toll on the economy, environment and social as a whole (World Bank, 1997). A shocking revelation by the Malaysian Human Development Report 2013 found that 53% of Malaysian household has no savings. The report further revealed that even after taking into account compulsory savings (from Employees Provident Fund), the savings of the top 1.7% of depositors exceed those of the bottom 57%. Myers (1991) also categorised the availability of saving as part of macro factors impacting the property demand.

2.4.3.2 Facilities

Indeed, sustainable housing affordability has to achieve certain criteria that the house buyer would prefer in choosing their housing location. The availability of waste

management facilities provides adequate space for the containment and proper management of wastes. Therefore, each house would practice a sustainable waste management by using a good disposal way. Furthermore, with proper waste management, not only by city council but also individual house will lead to a clean environment and avoid pollution in the surrounding area. In addition, Mulliner and Maliene (2011) suggest that household has to minimize waste and follow the good disposal method. Therefore, it shows that waste management facilities would influence house buyer to make a right decision in purchasing a house and ensure to live in a sustainable housing area.

Sustainable housing is said to be located in a secure residential environment. According to Samuels (2004), concern on physical security of house can be achieved through the installation of security devices. The differences between security and safety may not be a clear-cut, but distinction has to be made for the benefit of this research. Security, as defined by Merriam-Webster online dictionary is "things done to make people or places safe and being protected from harm" taken together with the definition of security by Peterson (2014) as to have the meaning of a measure of protection from injury or loss as a result of action - intentional or unintentional – by people. For example, adequate lighting in the neighbourhood park or gated and guarded neighborhood. To that extent, it was found that gated or guarded neighbourhood are dependent upon some other factors, could push property values up for as high as 18.1 percent and induce price premium of 23.7 percent (Teck-Hong, 2011).

2.4.3.3 Government Initiatives

The Ministry of Housing and Local Government launched the National Housing Policy (NHP) in guiding housing development in Malaysia. This guidance is needed to provide the direction and basis for the planning and development of the housing sector

undertaken by all relevant ministries, departments and agencies at the federal, state and local levels as well as the private sector (Kementerian Perumahan dan Kerajaan Tempatan, 2013).

The objective of the NHP is to provide an adequate, comfortable, quality, and affordable house to improve the well-being of the people. In addition, the formulation of the National Housing Policy (NHP) is suitable for assisting the private sector to respond to the government's aspiration towards providing adequate and affordable houses for the lower income group. The NHP consist of six thrusts and twenty policy directions that are well defined focussing on achieving a progressive and sustainable housing sector by government agencies at the federal and state levels. Success on the implementation of NHP depends very much on the commitment and collaboration of all parties in the housing industry in the country. Therefore, a close relationship between the public and private sectors is essential to address various issues and challenges faced by the housing industry.

The housing affordability crisis has been developing for some years and has been increasingly documented in recent media reports. One of the biggest problems especially for the first time house buyer in Malaysia is to get homeownership while finding affordable, quality, secure and appropriate housing. The government has launched several affordable housing initiatives, such as *Perumahan Rakyat 1 Malaysia* (PR1MA) and My First Home Scheme. Technically, these initiatives show a well-planned programme for the potential house buyer; somehow it is reported that only small number of the projects has been launched since their introduction in 2011. According to HwangDBS Vickers Research, (The Star, 2013), the government should introduce a more comprehensive affordable housing policy and encourage the

participation of the private sector and the support of banks to accelerate the rollout of the policy as well as increase product and geographical range.

My First Home Scheme (MFHS)

According to the Ministry of Finance, My First Home Scheme was first announced in 2011. Under the government budget the purpose is to assist young adults who have just joined the workforce to own their first home. At first, this Scheme is open to all Malaysian citizens aged 35 years old or less with a household monthly income of not more than RM 3,000. However, during 2013 budget, the government has announced that the household monthly income of the applicant is increased from RM 3,000 to RM 5,000.

The scheme allows young adults to obtain 100% financing from financial institutions, enabling them to own their first home without the need to pay a 10% - 20% down payment (Teck-Hong, 2012). This is in line with the Government's aspirations for increasing home ownership amongst the Malaysian first home buyers. In addition, this scheme covers both completed properties and those under development. The guarantee is effective upon full disbursement of the financing.

PR1MA

PR1MA Corporation Malaysia (PR1MA) was established under PR1MA Act 2012 to plan, develop, construct and maintain affordable lifestyle housing for middle-income households in key urban centres. The Prime Minister is fully aware of the financial burdens faced by the urban, middle-income population due to Malaysia's rapid urbanization. Middle-income refers to a monthly household income of between RM2,500 – RM10,000. His vision is to re-balance assistance to the Malaysian citizen in both rural as well as urban areas. PR1MA is one of the various initiatives implemented

to help the citizens manage costs of living in urban areas. PR1MA will be the first that exclusively targets this middle segment with homes ranging from RM100,000 to RM400,000 in a sustainable community.

According to the HwangDBS Vickers Research (2013), some respondents from the middle-income group think that the PR1MA projects is lacking inclusivity, due to the location which is a little bit isolated to suit the price caps. However, Baharom (2013) as reported in the Focus Malaysia, PR1MA houses are going to cater the needs of the target group, not solely focused on building the house. This is due to the demands of potential house buyer who seeks security and amenities as their priorities in purchasing a house. Despite the good intention, PR1MA housing project remains largely unaffordable to middle-income earners (United Nations Development Programme, 2014). Therefore, PR1MA has the plan to enhance the quality of the affordable house in PR1MA projects and at the same time consider the needs of the target groups such as easy access to public transportation, security and amenities in a way able to tackle both affordability and sustainability issues in the future.

Despite various government measures, home ownership is still an elusive and pressing issue for most household, especially younger household. The Asia Market Sentiment Survey 2013 conducted by iProperty Group revealed that most respondents of the online survey, of which 37% are in the range of 20-30 years old, agreed that unexceptional high house price, is their main concern of the property market. This survey is a regional survey across a few countries in South East Asia and Hong Kong. The findings reveal that most respondents are having trouble in finding a property within their affordability level and named location, size as well as price as the three deciding factors when looking to buy property.

2.4.4 Financial Factor

While his method may be unorthodox, White (2013) tried to 'associate' sustainability with its most recurrent elements over a period of times. His method, using a tag cloud web based software, identified the most associated terms with sustainability by reviewing hundreds of raw data online. He then comes up with a conclusion that the top three elements were social, environment and economics. While these result maybe predictable, it challenges the position of financial as one of the factors of sustainable housing affordability in this thesis.

The author would like to challenge the result, however, since the use of tag cloud only reported the previous use of the same category of wording. As a core of sustainability, it was only obvious to see the top three results are social, environment and economic. It merely reported the use of certain words on the internet without creating anything new. Moving forward, the author would provide a reason as to why financial factor should be part of sustainability along social, environment and economic and why it should be incorporated as part of sustainable housing affordability factors.

The traditionally acceptable notion of sustainability include the three aforementioned pillars i.e., social, environment & economic. Due to its loose definition, some authors have expanded its definition to include a fourth pillar such as culture (Scerri & James, 2009), politics (James, 2015) institution or governance (United Nations, 2014). Scerri & James (2009) argued that in some ways, 'economy' is in essence an offshoot of 'social', where without the modern concept of properties, ownership and capitalism, it may not be as relevant as it is today. The three initial components should not be seen as entirely separable spheres of activity, but rather it is analytically and practically useful to treat it that way over the difficult task of negotiating over the priorities of what need to change and what not.

Finance is a distant offshoot of economics but should not be mistaken as one and the same. While economics is more concern about supply and demand, goods and services and allocation of resources, the study of finance revolves around the theme such as time value of money, cash flow and risk. The financial factor is thus important in considering the sustainability and affordability of housing (United Nations, 2005).

One has to look beyond the tangible attributes towards the intangibles to be able to see a bigger picture of the problem. Financial affects individual homeownership's ability and is instrumental towards the efficacy of any measure to raise the level of affordability for the people as a whole. Many of the elements involved are directly related to banking or financial institution, therefore, the need to have a transparent and reliable policy. Nonetheless, the deliberate act of giving away loan and easy access to money may have been the reason for the trend in rising house price (Said *et al.*, 2014).

The impact of finance is so important, authors such as Opoku and Abdul-Muhmin (2010) ranked financial, among ten factors, as one of the top three that detrimentally affect buyers' consideration to buying or renting a new housing unit. Said *et al*. (2014) on the same note, profound for the first time in this country, Vector Autoregressive measure and Granger Causality to test the relationship between the housing market and housing finance system. The result highlighted that there is a strong, bi-directional relationship between the housing market and the housing finance system. The sub-factor in this factor revolves around financial consideration or requirement on the part of the buyer set by a financial entity such as commercial banks. An overview of the identified subfactors under financial factor are elaborated in the following subsections.

2.4.4.1 Financial Aspect

The financial factor is also important in considering the sustainability and affordability of housing. One has to look beyond the tangible attributes towards the

intangibles to be able to see a bigger picture of the problem. Financial affects individual homeownership ability and is instrumental towards the efficacy of any measure to raise the level of affordability for the people as a whole. Many of the elements involved are directly related to banking or financial institution, therefore, the need to have a transparent and reliable policy. Nonetheless, the deliberate act of giving away loan and easy access to money may have been the reason for the trend of rising house price (Said *et al*., 2014).

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Statistical release shows that in the fourth quarter of 2013, for the state of Selangor residential houses in the price range of RM 100,001- RM 200,000 recorded 22% of total transactions followed closely by houses in the range of RM 500,001 to up to RM 1 million at 18.8% (Napic, 2014). Table 2.1 provides the overview of the full categories. This indicates that housing price in Malaysia is increasingly beyond control and prices of new residential properties will keep on increasing to a point where it is neither sustainable nor affordable. Between the periods of one year - from the first quarter of 2013 to the first quarter of 2014 - the overall residential transaction value across all price ranges increase by 4.4%.

Table 2.1: Percentages of market share of residential property in Selangor

House Price Range (RM)	Q42013	Percentage
<100,000		16.5%
100,001-200,000		22.0%
200,001-300,000		14.5%
300,001-400,000		12.0%
400,001-500,000		7.9%
>500,001 up to 1mil		18.8%

Source: Property Sales Data, NAPIC (2014)

Financing real estate is a big business to the banking industries, and this fact takes precedence over the course of history (Christenson & Meh, 2011). Home financing in Malaysia remains traditionally unchanged since the liberation of the property market in the 80's and booming period in the 90's-halting only during the Asian Financial Crisis 1997-1998 (Ezeanya, 2004). Mortgage availability to the household is also dependent on the loan-to-value (LTV) ratio in which Almeida, Campello, and Liu (2006) opined that the presence of a maximum LTV ratio affects the price of housing. According to Investopedia, LTV ratio is a lending risk assessment value in which financial institutions evaluate before giving out a loan to the borrower. High LTV equates to high risk to the lender in a way that if borrower default, the lender will be having a hard time recovering the initial amount loaned.

Household, due to its magnitude and vulnerability to financial sectors plays a major role in both monetary and financial stability (Santoso & Sukada, 2008). Santoso and Sukada (2008) believe that household saving and spending behaviour affects the market prices. In line with government policy to promote homeownership since the 1970s, especially among low and middle-income groups, banking institutions are encouraged to facilitate and increase access to credit for the housing sector (Endut & Hua, 2009). However, after 40 years, the rate of homeownership is still lower compared to countries

such as Romania (Eurostat @ Statista, 2015), Mexico (Lopez-Silva, 2011) or even neighbouring Singapore (Singapore Department of Statistics, 2011).

Since housing is the biggest financial investment a person will ever make, it comes as no surprise that mortgages are the biggest constituent in household debt. In Malaysia, as of 2013, housing loan comprises the bulk 47.1% of the total loan giving out by financial institutions followed by all sort of household loan including the purchase of non-residential properties, purchase of a motor vehicle, personal, securities, credit cards and others (Bank Negara Malaysia, 2013).

There are various available home financing sources in Malaysia. Generally, the sources can be from banks, finance companies, two building societies i.e. Malaysian Building Society Berhad (MBSB) and Borneo Housing Mortgage Finance Bhd (BHMFB), Treasury Housing Loan Division (THLD) specifically for public sector workers and others. Preliminary data from Bank Negara Malaysia Annual Report 2013 indicated that commercial banks (including Islamic banks) account for 90.2% of the total market share while the rest is less than 0.8% shared between MBSB, BHMFB, THLD, Bank Kerjasama Rakyat Malaysia Berhad and Bank Simpanan Nasional (Bank Negara Malaysia, 2014).

Following this further, the availability of mortgages offers by the financial institution could, in a way determine the affordability level of house buyer. According to Mulliner and Maliene (2011), high-interest rate will increase the mortgage payment by the household, and this situation would decrease the household's ability to save due to the increment in the housing cost expenditure. In addition, Yates *et al.* (2007) also agree that in order to provide affordable housing to low-income household, especially for the first time house buyer, the rate of interest should not be too high because the house buyer would not be able to pay for the high monthly instalment and also due to other

commitments. It shows that a moderate interest rate and the availability of mortgage for the house buyer are important criteria in providing a sustainable housing affordability.

In addition, loan other than mortgage must also be taken into account. Vehicle loan, credit card loan and personal loan, for example, is a norm in today society and its impact can be profound if not handled prudently. Endut and Hua (2009) believe the stable and prosperous economic growth coupled with low inflation and the interest rate has minimized the cost of borrowing over the years. Thus, encourage household to take up more debt. Housing loan makes the bulk of household debt in this country followed by vehicle loan. With the increment of household debt from 75.8% (as a percentage of GDP) in 2011 to 80.5% in 2012, the government is becoming an increasingly concern and actively involved (Alias *et al.*, 2013). The use of debt for both low and middle to the high-income household is different (United Nations Development Programme, 2014). While low-income household acquires debt for consumption, middle and high-income household use debt as an asset creation tool. A low-income household is especially vulnerable with longer tenure which in turn create a larger amount of debt. Through loan default, various fees and high penalties may turn household to debt slave

The use of credit facility has resulted in high rate of compulsive spending leaving very little for future savings (Atkinson & Kempson, 2004). Savings according to Borch-Supant *et al.*, 2001 is the residual after the expenditure is subtracted from income. While many realize the benefits of savings, very few cultivate this habit or at least save a portion of their disposable income regularly. Spending most of the disposable income on expenses cannot be sustainable for the household in the long run. Study on household savings is comparatively scarce due to the data not readily available as compared to income or expenditures (Phipps & Woolley, 2008). Low-income households tend to save less than others when they have to save a larger portion of

income toward essential needs before anything else. Analysis by United Nations Development Programme (2014) of the Household and Income Survey 2009 revealed that up to 90% of both urban and rural household in Malaysia have almost zero savings. There is a relationship that relates the amount of savings to performance. A study by Tung and Baumann (2009) indicate that employees with higher savings are more satisfied with their life. This comes as no surprise as any household will feel better having the knowledge that they will be able to weather any unforeseen circumstances financially or physically. Living in a house that does not interfere with their saving can be rewarding to some household. The list of subfactors in the factors are listed down in Figure 2.4.

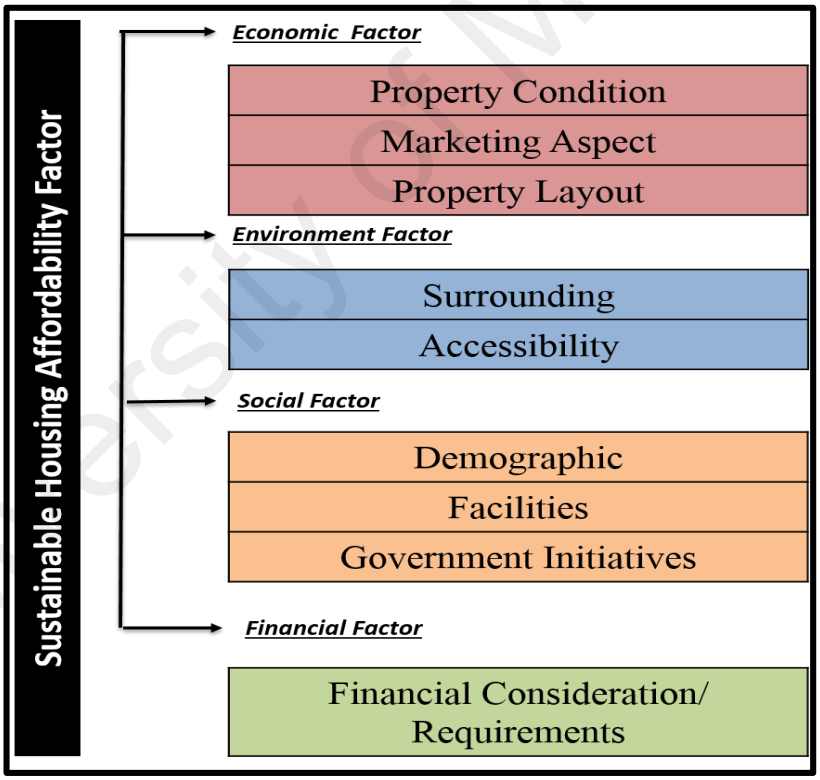


Figure 2.4: The four factors and nine sub-factors of sustainable affordability housing

Moving progressively, Figure 2.5 below summarises all the aforementioned elements in its respective categories. The AHPs is the social and financial part of sustainable housing affordability while AHS is the economic and environment parts. Under each of

the four main factors are the nine sub-factors and under those subfactors are the 44 elements contributed to sustainable housing affordability (in the red box).

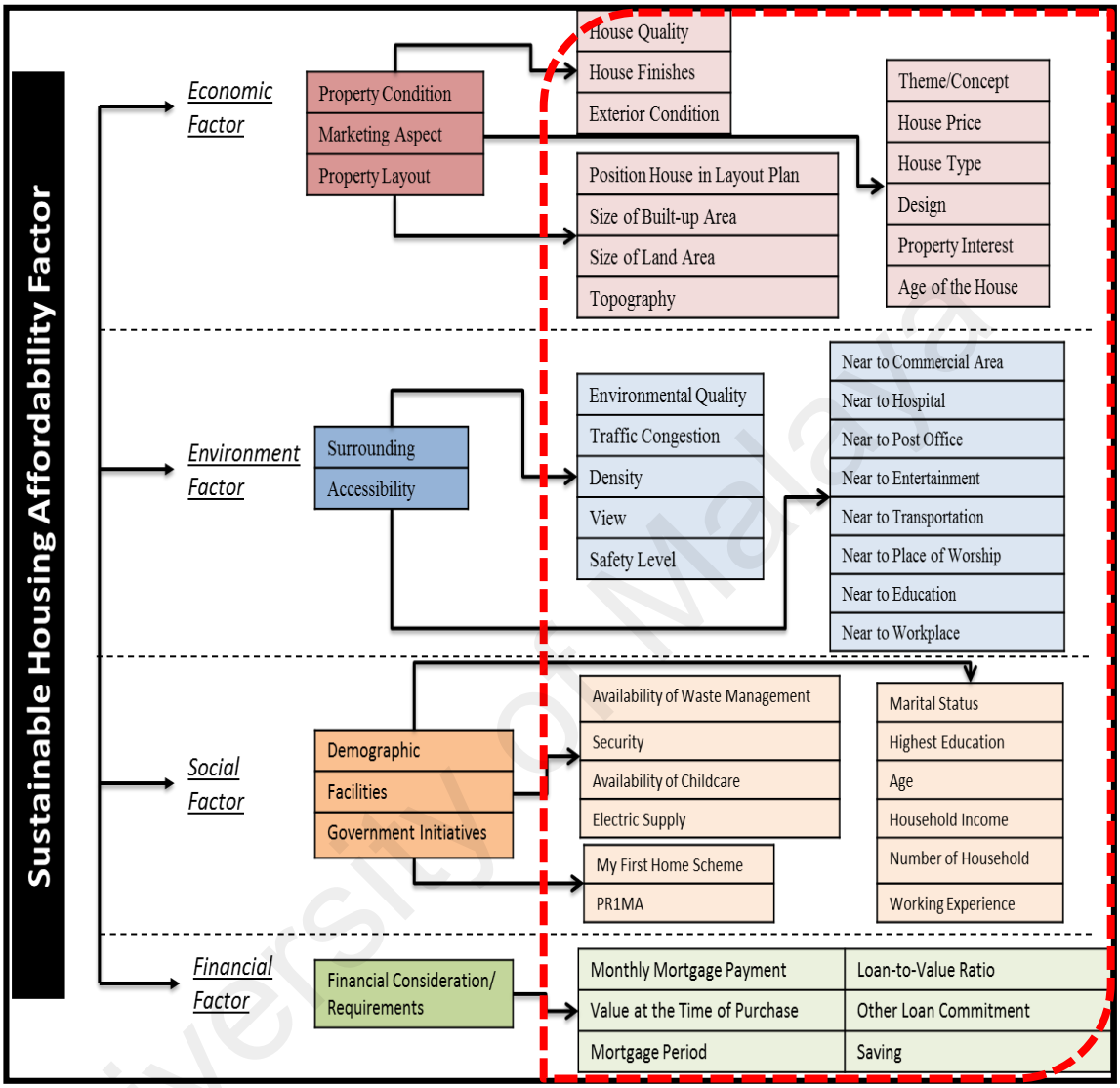


Figure 2.5: The elements in sustainable housing affordability

Source: This study

2.5 Measuring Sustainable Housing Affordability

2.5.1 Multi-Criteria Decision Making

There are few works by many noteworthy researchers in the field, primarily concern with the affordability-sustainability conundrum. In order to have a wider measurement of housing affordability instead of only focusing on the house price to household income ratio, a multi-criteria analysis is a suitable tool to measure accurate affordability

level (Zopounidis, 1999). Constantin Zopounidis and Doumpos (2002) went on to explain that the multi-criteria analysis which is often known as multi-criteria decision making (MCDM) by the School of American and multi-criteria decision aid (MCDA) by the European School. A study by Mulliner *et al.* (2013) finds that MCDM can address the various quantitative and qualitative criteria that affect both housing affordability and sustainability. This kind of analysis allows the researcher to assess the sustainable housing affordability with the consideration of the various factors that can contribute directly to the problems and analyse the aggregation of several evaluation criteria in order to choose, rank or determine the right decision making (C. Zopounidis, 1999). The objective is to enable the decision maker in solving a problem by providing them a proper tool, in this case, making a decision in house purchasing in order to properly look at affordability level of each household and individual.

Haarstrick and Lazarevska (2009) stated that, resources are the main components in any MCDM techniques. The term resources include the accuracy of possible attributes, criteria and alternatives that lead to the main issues in the decision making that are going to be made as it will affect the results of decision-making at the end of the process. According to E. Triantaphyllou, as cited in Mulliner *et al.* (2013), while conducting MCDM techniques in research, there are three steps that need to be followed. The steps can be applied to all types of research field since this is a general method for conducting all MCDM techniques. The first step is to determine relevant attributes, criteria and indicator that contribute to the problems. In particular, a distinctive MCDM problem involves a number of attributes to be assessed and using a number of criteria or indicators to assess that particular attributes (Lertprapai, 2013). Each of the attributes will create value for each criterion and indicator. Thus, these values allow the attributes to be assessed and ranked.

As discussed in the literature before, there are several attributes that need to be taken into account in measuring the level of housing affordability especially the first-time house buyer. In this regard, the affordability level is assessed in six different housing locations in a sustainable manner, taking into account the consideration of economic, social, environment and financial factors. The identification of significant attributes can address the numerous quantitative and qualitative criteria that affect both housing affordability and sustainability, all of which can be integrated into one evaluation process. Figure 2.5 below shows the illustrations of MCDM techniques that are usually being adopted by the researcher while conducting their research. This illustration is used by Haarstrick and Lazarevska (2009) in his study and could be adopted in assessing sustainable housing affordability.

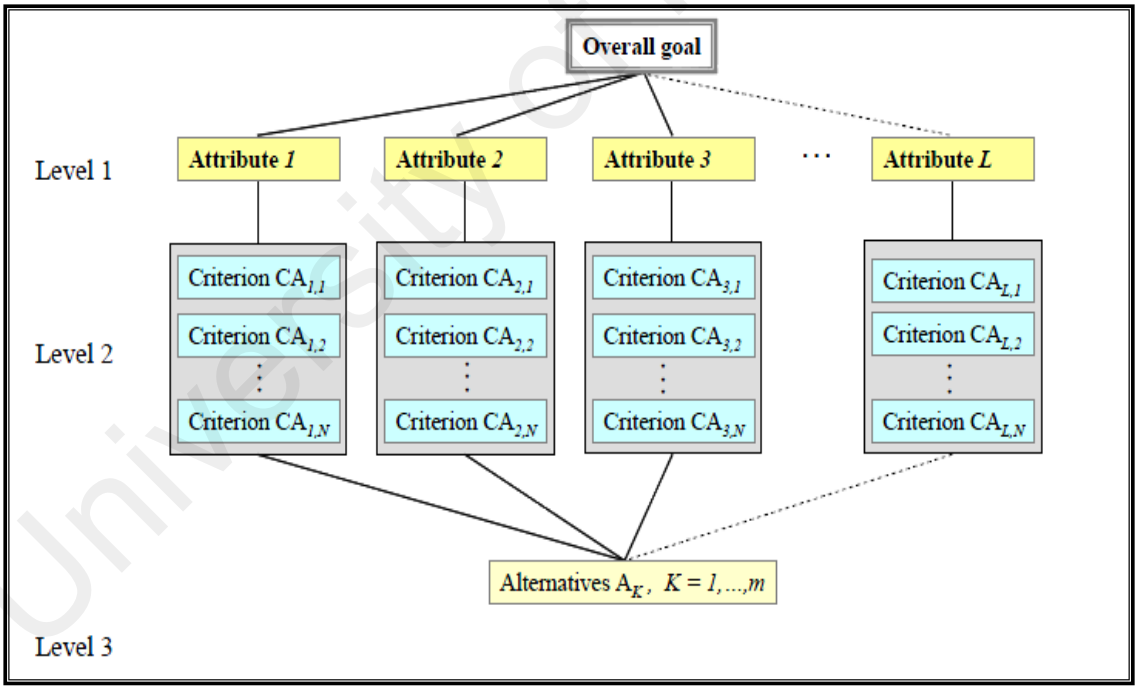


Figure 2.6: Illustration of MCDM techniques

Source: Haarstrick and Lazarevska (2009)

The second step is to attach numerical measures to weight the importance of the criteria and to measure the impacts of the alternative on these criteria. The ratio of any criteria weights or alternatives, ratings should not be extremely high or extremely low

as this will avoid irrational cases or imbalances scale-induced between methods, performance and then deteriorates the overall result.

The last step in conducting MCDM is to process the numerical values in order to determine a ranking of each alternative. The MCDM methods are used to process the numerical values for each alternative with their unpredictable characteristics. Different methods have been developed to solve multi-criteria analysis problems. According to (Mulliner *et al.* (2013), the most frequently used methods include UTA, MACBETH, AHP, TOPSIS, PROMETHEE, TACTIC, VIMDA, RNIM, ELECTRE and COPRAS. Since there are a lot of MCDM methods available in practice, the researcher should choose the most suitable methods to be applied in the study. Table 2.2 below shows the different method of MCDM techniques used by the researchers in conducting their study in property, built environment and planning related search.

Table 2.2: Previous studies using MCDM methods relating to property, built environment and construction.

Author (Year)	Research Related	Method Used
Medineckienė, Turskis, Zavadskas, and Tamošaitienė (2010)	-Multi-criteria selection of one flat dwelling house - taking into account the construction, ecological aspects, their impact on the environment and their economic and social condition	-COPRAS, SAW, MEW, AHP
Zolfani, Rezaeiniya, Aghdaie, and Zavadskas (2008)	-The study on seven criteria of quality control manager namely knowledge of product and raw material properties, experience and educational background, administrative orientation, behavioural flexibility, risk evaluation ability, payment and teamwork	-AHP, COPRAS-G
Bender, Din, Hoesli, Aberdeen, and Brocher (2000)	- the study on the perception of environmental quality of residential real estate in New Zealand - Using eight different environmental quality	-AHP

	criteria	
Kaklauskasa, Zavadskasb, and Trinkunasa (2007)	-support on-line system for construction. - to the analysis of construction alternatives which is usually performed by taking into account economic, quality, technical, technological, comfort and other factors.	-COPRAS
Mulliner et al. (2013)	- A study to assess housing affordability in three different locations by taking into consideration of few attributes that affect housing affordability. - The 20 criteria differ according to their relative importance to sustainable housing affordability.	-COPRAS

Based on Table 2.2 above, it shows that there are varieties of research in a built environment related field that applied COPRAS method in solving the decision-making problems using MCDM techniques. The using of COPRAS method in the listed research above is to rank and to select the optimal alternatives based on the chosen criteria by the survey results. Specifically, this study is aimed to focus on the applicability of COPRAS method in assessing housing affordability in Malaysia. The research presents a tool that can be used to assess sustainable housing affordability accordingly based on a criteria system developed by the author and validated by professionals (Mulliner *et al.*, 2013). In order to carry out an initial assessment of sustainable housing affordability, a method of MCDM is utilized.

2.6 Summary

As a conclusion for this chapter, it has to be stressed that the use of COPRAS in assessing the sustainability and affordability of built environment especially in housing is an appropriate choice. The previous work done by other researchers in the field using COPRAS further strengthens its ability and capability as a good measurement tool. Now that the elements or criteria required in achieving sustainable housing affordability

checklists have been identified, the next chapter will incorporate what the researcher has known so far into research methodology.

Through analysis of past works in the related field, the criteria that may involve in housing affordability and sustainability were found and documented. Segmenting the aforementioned elements into a narrower group of categories will improve the general clarity of the research. All of the criteria were segmented into nine smaller sub-factors which are property condition, marketing aspect, property layout, surrounding, accessibility, demographic, facilities, a government initiative, and financial considerations. These sub-factors are branched out to form a narrow group of categories consists of economic, environment, social and financial which in turn, is either affordable housing schemes (AHS) or affordable housing principles (AHPs). The criteria are listed in Figure 2.5. This answers the first objective of the research thesis.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

This chapter aims to describe the data collection strategy pertaining to how the researcher collects and analyses data. It is a way to solve the research problem systematically. This chapter will further explain all information and data gathered in the research design including the development of methodology and the step by step process for this research. The process involves, but not limited to, design, techniques, sampling, collection and the conceived method of analysis.

3.2 Research Design

The research design is the plan and structure of investigation to be conceived as to obtain answers to research questions. In a research design, the researcher decides on what types of sources or information are needed to meet the research questions. It also acts as the framework for specifying the relationship between the study's variables as well as the blueprint that outlines each procedure from the hypothesis of the data analysis (Kothari, 2004). This chapter specifically seeks to answer what technique to be used, how the sampling is selected and how time and cost constraints to be dealt with.

This research is more inclined towards a quantitative research. The complexity of design relies primarily on the objective and the context of the study thus necessitates the use of whichever method appropriate to deliver the required result. The quantitative methods seek to the use of various mathematical formulation to verify criteria involved alongside data analysis.

A particular type of analysis was used to analyse the data collected by the use of multi-criteria decision making (MCDM) approach using COPRAS technique. Five geographical areas; Petaling Jaya, Kuala Lumpur, Klang, Shah Alam and Putrajaya

were chosen to assess sustainable housing affordability can be assessed using an MCDM method. This method manages the aggregation and the weighting of various criteria so as to support a set of choices in concluding the decision made by potential home purchasers.

To utilize such method, a two-stage approach was embraced. Firstly, the attributes that influence housing affordability and sustainable development and community were determined by extensive literary studies on past literature. Semi-structured interviews were conducted to determine and distinguish attributes with professionals in the related field. This helps to secure the full list of criteria through refinement and confirmation. These criteria were then validated and weighed by utilizing questionnaire survey.

3.3 Data Collection

Data collection is a process where data or information are gathered and measured in a systematic and reliable manner. Research design would mean nothing if the data collection process were hindered and inappropriate. This research makes use of both primary and extensive sources of secondary data as a check and balance to the legitimacy of the outcome. The choice of a method may be dependent on the consideration of both objectives and constraints involved (Marsland *et al.*, 1998).

Data collection is a very stringent process ranging from the decision on what type of data in which the researcher exactly needed, the targeted sample of the population from which the data are to be extracted and the appropriate tools to extract those valuable and sometimes raw and unorganized data.

a) Primary data

According to Sekaran & Bougie (2013), primary data refer to information obtained first-hand by the researcher on the variable of interest for the specific objective of the

study. For example interviews, structured questionnaire, observation or focus groups are all rich sources of primary data. Michelle *et al.* (2007) added that the collection of primary data is integral and often very complex and should only be done when the value of surplus information offset the cost of not doing so.

In this research, the data collected from the questionnaire in the form of an opinion of the respective respondents is considered as primary data. Surveys using structured questionnaire is necessary since it is part of a strategy in collecting a mass number of variables from a massive sample in expansive targeted population (Joop & Hennie, 2005).

b) Secondary data

Secondary data, on the contrary, concern the information collected from sources that already exist. For example journal, newspaper, article, company archive, government publications, statistical bulletin, website or the internet in general and so on (Sekaran & Bougie, 2013). Academic books or articles in various journals are often a most useful source of secondary data. Nevertheless, information from private agencies or newspaper is also useful, and it is always best to use a combination of various sources. This type of resources is basically applied in the literature review since it contains valuable ideas and definition, written from a particular point of view to fulfilling certain aims or express a view on the nature of the topic (Hart, 1999).

In this research, a critical literature review on housing affordability and sustainability is conducted to gain much exposure on the subject. Other than identifying a broad literature on the criteria for sustainable affordable housing, literature review also consists of the various literature available on method and tools in addressing the

affordability of housing as well the government's initiative in solving housing affordability problems.

3.3.1 Population

The number of population is significant to be identified as the population represents a group that the researcher intends to generalize in a study. Therefore, the populations that need to be identified are only those living in the major cities characterised by a rapid increase in housing price. All of the five areas are within the Greater Klang Valley, a relatively new term to refer to Kuala Lumpur and its immediate surrounding. It currently includes ten municipalities.

However, as a case study, we chose five localities based on different municipalities. These localities are very active in terms of a number of transactions. Collectively, in the year 2014, the two districts in Selangor, Petaling and Klang alone represents about half of the total 60,903 number of residential transactions. Table 3.1 below shows the number of population in the area under study according to their respective local administration.

Table 3.1: Population by local authority areas in the year 2010

AREA	LOCAL ADMINISTRATION	TOTAL POPULATION
W.P Kuala Lumpur	Kuala Lumpur City Hall	1,440,158
W.P Putrajaya	Putrajaya Corporation	66,785
Klang	Klang Municipal Council	679,792
Shah Alam	Shah Alam City Council	411,206
Petaling Jaya	Petaling Jaya City Council	559,695

Source: Jabatan Perangkaan Malaysia (2011)

i) Sampling and Sample Size

Most often than not, measuring the entire population is impractical and unfeasible due to few constraints facing the researcher. Sampling is the next best thing in continue doing the intended research without incurring too much cost, time or workforce. Sampling is the process of selecting ample amount of the elements from the entire population, thus making it possible to generalise the population by studying and understanding of properties and characteristics of the sample (Sekaran & Bougie, 2013). A sample can also be considered a subset of the whole population. Sampling needs to be done before data collection can be proceeded.

Bank Negara's 2015 annual report stated that even though half of Malaysian Households earned below than RM4,585 monthly, only 21% of new housing launches in Malaysia were priced below RM250,000. This far surpassed the 30% rule of thumb which puts suggested the price at up to RM165,060. On the contrary, there are an over abundant of high-end housing which only less than 6% of the population can truly afford. Clearly, there is a serious mismatch of supply-demand.

The population of this research is the household in Klang Valley with specific target population who resides in the Greater Klang Valley. Klang Valley is chosen due to it

being the most developed region in the country as well as it registers a rapid increase in both housing price and cost of living. This is supported by recent findings from Khazanah Research Institute (2015) which found that, using a multiple median method, locations with severely unaffordable housing include Kuala Lumpur, Penang and Selangor among others.

The geographical localities to be specific consist of five areas within the administration of five different local authorities. They are Majlis Bandaraya Petaling Jaya (Petaling Jaya), Dewan Bandaraya Kuala Lumpur (Kuala Lumpur), Majlis Perbandaran Klang (Klang), Majlis Bandaraya Shah Alam (Shah Alam) and Perbadanan Putrajaya (Putrajaya).

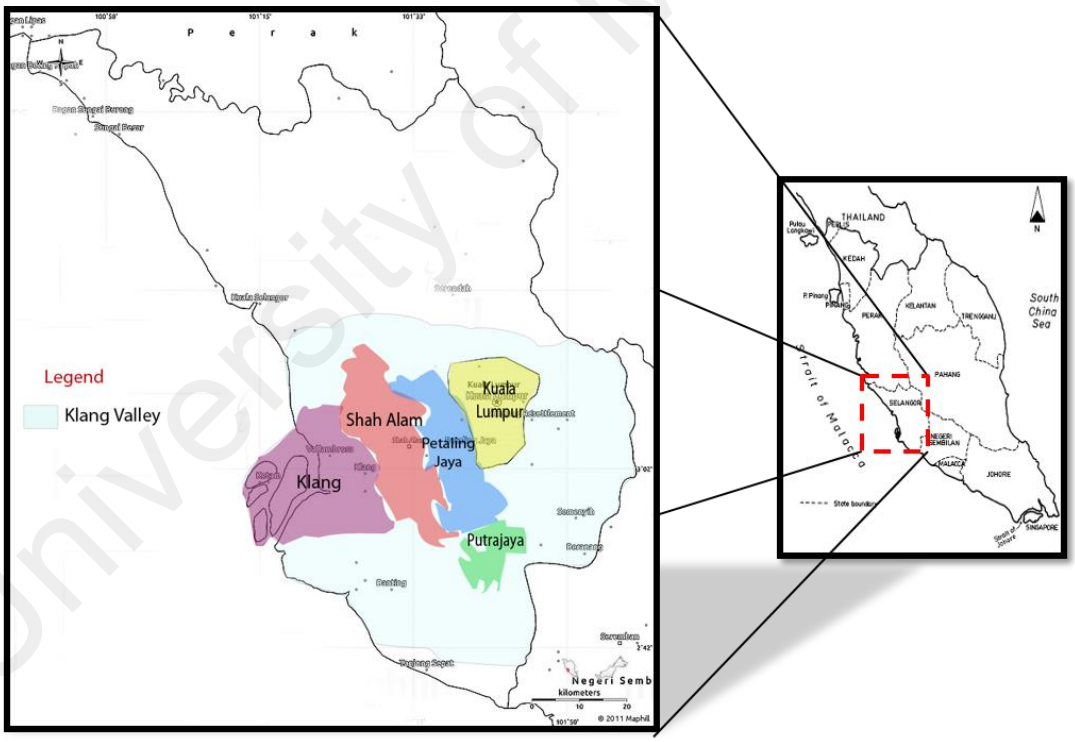


Figure 3.1: The five localities under study

These five areas were chosen because it is the most developed area in Malaysia. These areas represent the most expensive area where affordability issue is a real

concern. Therefore, this research was conducted to see if the price or rent can be sustained.

Krejcie and Morgan (1970) simplified the formula to determine sampling size by providing a concise table for good decision making. Figure 3.1 can be applied to any defined population. However, he noted that the higher the population, the higher is the sample size albeit at a much-diminished rate and eventually remains constant at around 384 counts. Roscoe (1975) further proposed that sample size of fewer than 500 be appropriate for most research. A total of 700 questionnaires have been distributed for this research and 412 (59%), were returned.

Total	*Sample*	*Total*	*Sample*	*Total*	*Sample*
10 ⇒	10	220 ⇒	140	1200 ⇒	291
15 ⇒	14	230 ⇒	144	1300 ⇒	297
20 ⇒	19	240 ⇒	148	1400 ⇒	302
25 ⇒	24	250 ⇒	152	1500 ⇒	306
30 ⇒	28	260 ⇒	155	1600 ⇒	310
35 ⇒	32	270 ⇒	159	1700 ⇒	313
40 ⇒	36	280 ⇒	162	1800 ⇒	317
45 ⇒	40	290 ⇒	165	1900 ⇒	320
50 ⇒	44	300 ⇒	169	2000 ⇒	322
55 ⇒	48	320 ⇒	175	2200 ⇒	327
60 ⇒	52	340 ⇒	181	2400 ⇒	331
65 ⇒	56	360 ⇒	186	2600 ⇒	335
70 ⇒	59	380 ⇒	191	2800 ⇒	338
75 ⇒	63	400 ⇒	196	3000 ⇒	341
80 ⇒	66	420 ⇒	201	3500 ⇒	346
85 ⇒	70	440 ⇒	205	4000 ⇒	351
90 ⇒	73	460 ⇒	210	4500 ⇒	354
95 ⇒	76	480 ⇒	214	5000 ⇒	357
100 ⇒	80	500 ⇒	217	6000 ⇒	361
110 ⇒	86	550 ⇒	226	7000 ⇒	364
120 ⇒	92	600 ⇒	234	8000 ⇒	367
130 ⇒	97	650 ⇒	242	9000 ⇒	368
140 ⇒	103	700 ⇒	248	10000 ⇒	370
150 ⇒	108	750 ⇒	254	15000 ⇒	375
160 ⇒	113	800 ⇒	260	20000 ⇒	377
170 ⇒	118	850 ⇒	265	30000 ⇒	379
180 ⇒	123	900 ⇒	269	40000 ⇒	380
190 ⇒	127	950 ⇒	274	50000 ⇒	381
200 ⇒	132	1000 ⇒	278	75000 ⇒	382
210 ⇒	136	1100 ⇒	285	100000 ⇒	384

Figure 3.2: Suggested sample size for a given population

Source: Krejcie and Morgan (1970)

3.3.2 Questionnaire survey

In conducting a quantitative research, questionnaire survey frequently uses tools to acquire response or view from the respondent involved in the research. Questionnaire survey requires a number of respondents to provide respond to the questions asked regarding the research objectives and the number of respondents involves in the survey shall determine the validity and reliability of the result in the analysis stage.

i) Questionnaire structure

The structure of the questionnaire was developed to obtain information and feedback from the respondent of the respective area which is to study on the housing affordability level among house buyer from middle-income group. Basically, the questionnaire was divided into five parts that include the followings:

Part A: Respondent's Background

Part B1: Respondent's occupied own unit

Part B2: Respondent's occupied rental unit

Part C: Monthly expenses

Part D: Governments initiatives on housing programs

Part E: Product factors

ii) Questionnaire format

The questionnaire was divided into five parts. Part A consists of close-ended questions, constructed to gather background of the respondent. Part B1 and B2 used close-ended questions to determine the status of homeownership belongs to the respondent either homeowner or tenant. Part C contains questions on household expenditure to determine the distribution of monthly household income between

housing expenditure and non-housing expenditure. The next part (Part D) requested the opinion of house buyer on government initiatives in housing programs. Lastly, Part E used Likert-Scale questions to determine the house buyer considerations towards internal and external factor deems important for a more sustainable living. The respondents are requested to provide their rank towards each of the factors to show their variety of preferences in order to measure sustainability-affordability ranking.

iii) Questionnaire respondents' criteria

Our respondents comprise of the population in the aforementioned five areas. More specifically, they are of middle-income group. Respondents can be in possession of a house i.e. owner, or temporary possession of the dwelling unit i.e. renter.

iv) Questionnaire distribution

The author make use of ground survey in order to get the innate responses from respondents with exactly the right type of criteria at exactly the right place we want them.

The mode of distribution after completion of the questionnaire is a two-part process. It first requires that the questionnaire be distributed to clients of identified valuation firms. We have a good relationship with some valuation firms and this is considered an opportunity to the author. The way it was done involved passing out the questionnaire to be filled on the spot or to be returned via email.

The second process involved house-to-house survey at random neighbourhood in selected areas. These areas as a rule, must reasonably within the boundary of the five localities. The house-to-house survey was done with distribution around Kuala Lumpur since it is the closest and slowly expanded outward to Petaling Jaya, Shah Alam, Putrajaya, and Klang (in no specific order).

The researcher went to the pre-determined locality and met the potential respondents face to face. This type of distribution allowed the respondents to have more understanding of the question in context and assisted them to answer any doubt regarding the research objectives.

iv) Questionnaire validation

Before it was distributed to the general public, a pilot test was conducted. A total of 20 respondents were chosen among small member of respondents. There were no specific criteria to qualify for respondents. However, it was distributed to career adult with generally the same basic demography as the respondents in the main study. The goal was to ensure the apprehension of all the questions before releasing. The pilot test was a success and the draft for the questionnaire was taken as a final questionnaire.

3.4 Data Analysis

For analytical purposes, some data from the questionnaire are converted into codes for easy reference. The codes for all 44 elements are summarized in Table 3.3.

Table 3.2: Coding of elements involved in analysis

	Element	**Coding**
1.	Marital Status	MSTAT
2.	Highest Qualification	EDUD
3.	Age	AGED
4.	Household Income Per Month	INCOM
5.	Number of Persons in Household	NOHSD
6.	Years Working Experience	EXPER
7.	Monthly Mortgage Payment	MORTY
8.	Value Time of Purchase	VALUE
9.	Mortgage Period	MORTP
10.	Loan to Value Ratio	LTVR
11.	Other Loan Commitment	OTRL
12.	Saving	SAVIN
13.	My First Home Scheme	MFHS
14.	PR1MA	PRIMA
15.	House Price	PRICE
16.	House Quality	QUAL
17.	House Type	TYPE
18.	House Finishes	FINIS
19.	House Design	DESIG
20.	Position House in Layout Plan	POSIT
21.	Size of Built-up Area	BUILA
22.	Size of Land Area	LANDA
23.	Age of the House	AGEH
24.	Topography	TOPO
25.	Property Interest	PROPI
26.	Near to Commercial Area	NEARC
27.	Near to Hospitals	NEARH
28.	Near to Post Office	NEARP

29.	Near to Entertainment	NEARE
30.	Near to Transportation	NEART
31.	Near to Place of Worship	NEARY
32.	Near to Education	NEARD
33.	Near to Workplace	NEARW
34.	Environmental Quality	ENVIR
35.	Security	SECUR
36.	Traffic Congestion	TRAFF
37.	Density	DENSI
38.	View	VIEW
39.	Exterior Condition	EXTER
40.	Availability Waste Management	WASTE
41.	Safety Level	SAFET
42.	Theme or Concept	THEME
43.	Availability of Child Care	CHILC
44.	Electric Supply	ELECT

3.4.1 Descriptive Statistics

Results from analysis were arranged according to their level of analysis. For example, descriptive statistics was used to 'feel the data' and examine common characteristics and background of respondents. It is used to summarize the data for the purpose of describing it. Further examination by way of cross-tabulation between demographic sub-factors with the rest of the sub-factors was also conducted to provide clear direction for further analysis.

3.4.2 Inferential Statistics

This involves the use of various inferential techniques including reliability test by Cronbach's alpha analysis, α, the power of significant, p, and the use of Pearson's correlation, r, to measure any meaningful relationship beyond merely describing the data. As the name implies, inferential statistics are used to infer on the selected sample to generalize a wider population. Very few researchers have access to a global population and to overcome this, the researcher makes use of inferential statistics and makes an adjustment to adapt it to another area.

3.4.3 COPRAS analysis

The multi-attribute Complex Proportional Assessment (COPRAS) is one of the various methods of multi-criteria decision making (MCDM) techniques. According to Chatterjee and Bose (2012), COPRAS method is done under a fuzzy environment with the help of multiple decision makers. In processing the numerical values for each alternative, COPRAS method is usually assumed to be accurate. According to Zavadskas *et al.* (2008), this method adopts direct and comparative dependence of the weight and utility degree of investigated versions.

Utility degree allows direct comparison between each of the alternative (i.e. areas)-represented in a percentage, to show the extent at which one alternative is better than the other. While ranking is useful as far as any types of ordinal data are concerned, utility degree can show a deeper more meaningful meaning. Ordinal data can be ranked, but it does not tell the distance between values i.e. the distance between 1 and 2, 3 and 4 and the likes. Much like the differences between scalar and vector, scalar only shows the direction, unlike vector which shows both direction and strength.

Utility degree can tell how exactly further each value from each other or in this case, from the best ranked alternative area. The utility degree for each alternative is compared with residential areas that best satisfy sustainable housing affordability elements and have the highest utility degree which is $\check{u}_q = 100\%$.

A structure of attributes effectively described the alternatives and also values and weights of the attributes. Accordingly, Podvezko (2011) has mentioned a few times regarding COPRAS that is used for multi-criteria evaluation of both maximizing and minimizing criteria values.

On the other hand, the application of COPRAS method, (Mulliner et al. , 2013) is to eventually establish the priority order by given alternatives in residential areas by taking into consideration a number of alternatives with respect to the multi-criteria problems, in this case sustainable housing affordability. A full criteria analysis of various factors that influence sustainable housing affordability is provided in the approach. Figure 3.2 below explains the process of using COPRAS in conducting this research.

Figure 3.2 below was taken and altered from Zavadskas *et al.* (2008). According to Zavadskas *et al.* (2008), the process of ranking is to determine their degree of effectiveness and indications are illustrated in percentage form. Hence, this ranking is for the purpose of determining better or worse alternatives.

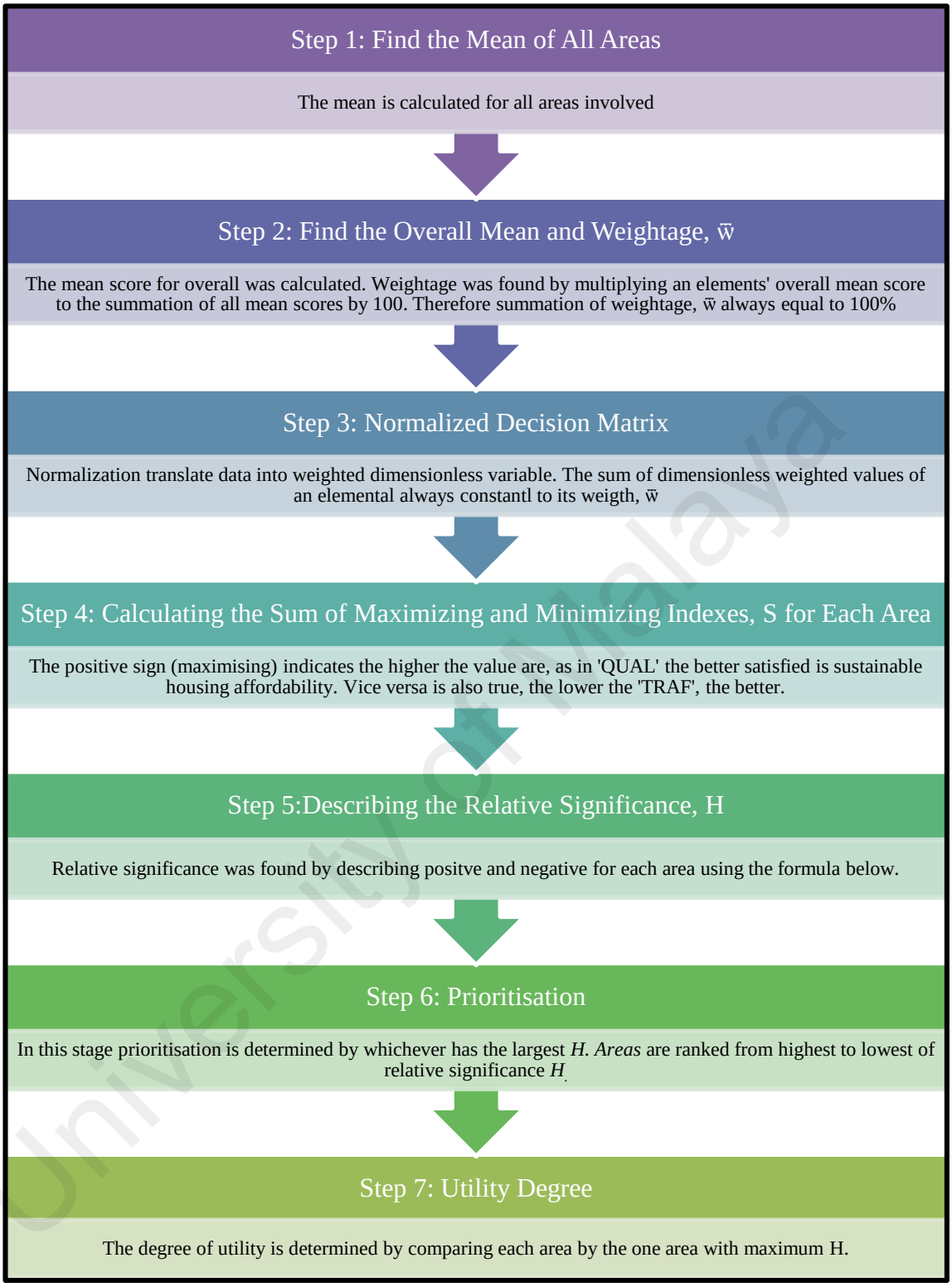


Figure 3.3: The process of using COPRAS method

The specific formulas used for Figure 3.3 are as follows:

To calculate the weightage, $\bar{w}$ for each element, p in step 2:

$$\bar{\omega}_p = \left(\frac{M_p}{\sum_{i=1}^{n} M}\right) \times 100$$

Where M_p is the overall mean score of the *p*-th element and M is the mean scores of elements.

To translate data into weighted dimensionless variable in step 3:

$$m_{pq} = \frac{\bar{\omega}_p}{\sum_{q=1}^{n} x_{pq}} x_{pq}$$

Where x_{pq} is the value of the *p*-th element of the *q*-th area, and $\bar{w}_p$ is the weight of the *p*-th element. From here on, the aggregate of the dimensionless weighted values m_{pq} of each factors x_p is constant to the weight $\bar{w}$ of that particular factor:

$$\bar{\omega}_p = \sum_{q=1}^{n} m_{pq}$$

To calculate the sum of normalized weighted indexes, S in step 4:

$$S_q^+ = \sum_{\lambda_p = +} m_{pq}$$

$$S_q^- = \sum_{\lambda_p = -} m_{pq}$$

The sums of both positive and negative for each area, q are calculated. The sums of S_{+q} of attributes values which larger values are preferable (optimization direction is

maximising). The sums of S_{-q} of attributes values which smaller values are preferable (optimization direction is minimising).

To calculate the relative significance in step 5:

$$H_q = S_q^+ + \frac{S_{min}^- \sum_{q=1}^n s_q^-}{S_q^- \sum_{q=1}^n \frac{S_{min}^-}{S_q^-}} = S_q^+ + \frac{\sum_{q=1}^n S_q^-}{S_q^- \sum_{q=1}^n \frac{1}{S_q^-}}$$

Or

$$H_q = S_q^+ + \frac{S_1^- S_2^- S_3^- \ldots}{S_q^- \left(\frac{1}{S_1^-} + \frac{1}{S_2^-} + \frac{1}{S_3^-} \ldots\right)}$$

To find the utility degree, μ in step 7, the following formula is used:

$$\check{u}_q = \frac{H_q}{H_{max}} 100\%$$

The degree of utility compares each area by the area with $H_{max.}$ Area with the highest degree of utility ($\check{u}_q$ = 100%) represents an area that most satisfies sustainable housing affordability. Other areas will show utility values ranging from 0%-100% which indicate the worst to the best-case scenario.

In this chapter, we discussed on the methodological structure of the thesis. The choices for the areas of study are justified. The areas are Petaling Jaya, Kuala Lumpur, Klang, Shah Alam, and Putrajaya. The techniques of analysis are rationalized to include both descriptive and inferential statistical analysis. Descriptive analysis is primarily done to reorganize data collected into a visual representation that is much easier to translate, understand and comprehend. Inferential statistics such as reliability coefficient, the power of significant and correlation are also used to identify any

meaningful relationship in collected data. Also, a detailed explanation on the working of MCDM COPRAS as a suitable method adopted in this research.

CHAPTER 4: DATA ANALYSIS

4.1 Introduction

This chapter presents the application of methodology as mentioned in the previous chapter. As a way to measure housing sustainability, a survey had been carried out consisting of 487 respondents in five (5) separate localities within Klang Valley. The survey data were organised and analysed using SPSS 16.0. In order to achieve the research objectives, both descriptive and inferential statistics were employed. Descriptive statistics was primarily done to describe and organize data into meaningful visual representation, summarize and ultimately interpret a quantitative observation so that the trends or patterns could emerge. It tends to provide and present the broad characteristics of the data with the help of graphs or charts. The analysis simplifies and visualises what can otherwise be a mess of unstructured data.

Inferential statistics is a technique used to derive generalization about the population from a smaller sample. This is due to the fact that researcher seldom gets access to an extensive and costly population parameter. Inferential Statistics use probability theory to measure whether any difference between samples is due to chance or actual effect in a particular test. This is represented by p-value using an assortment of statistical significance tests. A general confidence interval of less than 0.05 is deemed by many researchers to be the cut-off point. Precision and validity are another concern in inferential statistics.

4.2 Description on Respondents' Profile

This section employs descriptive statistics in table and figures for easy interpretation and referencing.

4.2.1 Frequencies

4.2.1.1 Area of Residence

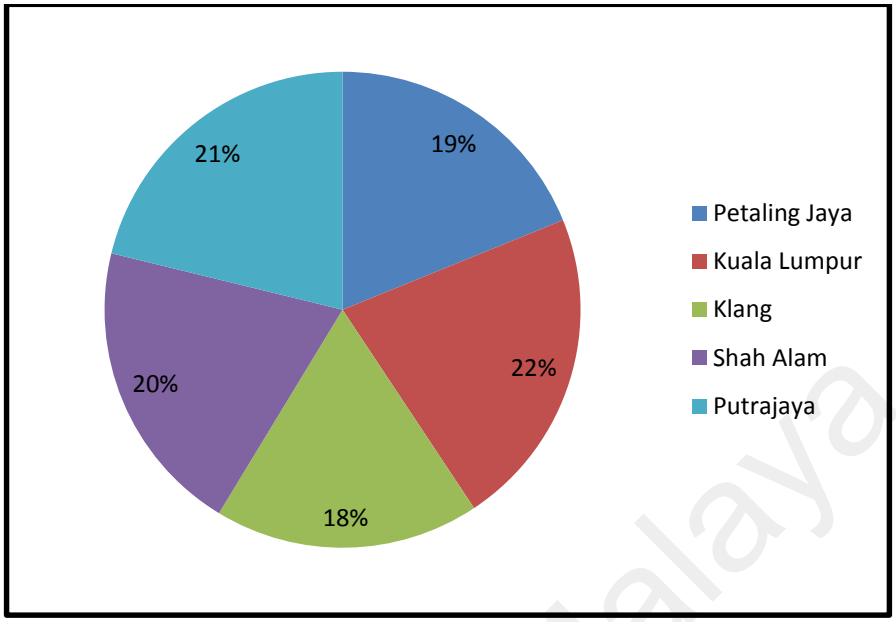


Figure 4.1: Pie chart showing division of residents by area

The number of respondents is almost equally distributed across all the five areas. This evidence considers the difference between the minimum and maximum of only 4%. Klang represents the minimum figure of 18% whereas the maximum representative of Kuala Lumpur at 22%. Petaling Jaya makes up 19% of the total respondents while Shah Alam and Putrajaya at 20% and 21% respectively.

4.2.1.2 Employment Sector

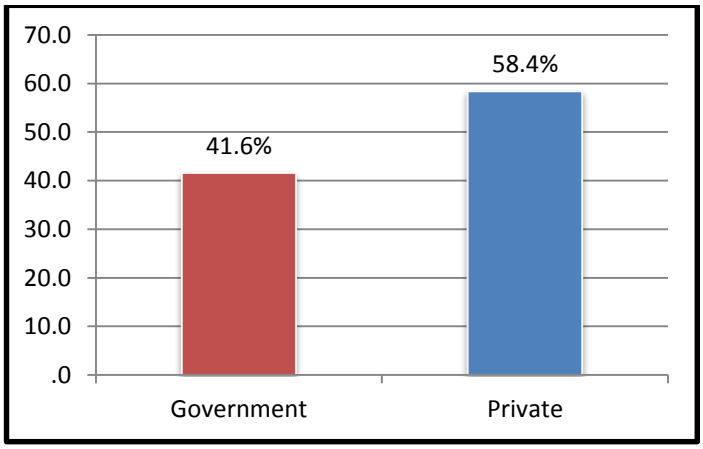


Figure 4.2: Respondents by employment sector

Table 4.1: Employment sector of respondents by area

Area of Residence		Percentage (%)
Petaling Jaya	Government	22.7
	Private	77.3
Kuala Lumpur	Government	29.4
	Private	70.6
Klang	Government	35.7
	Private	64.3
Shah Alam	Government	49.5
	Private	50.5
Putrajaya	Government	68.7
	Private	31.3

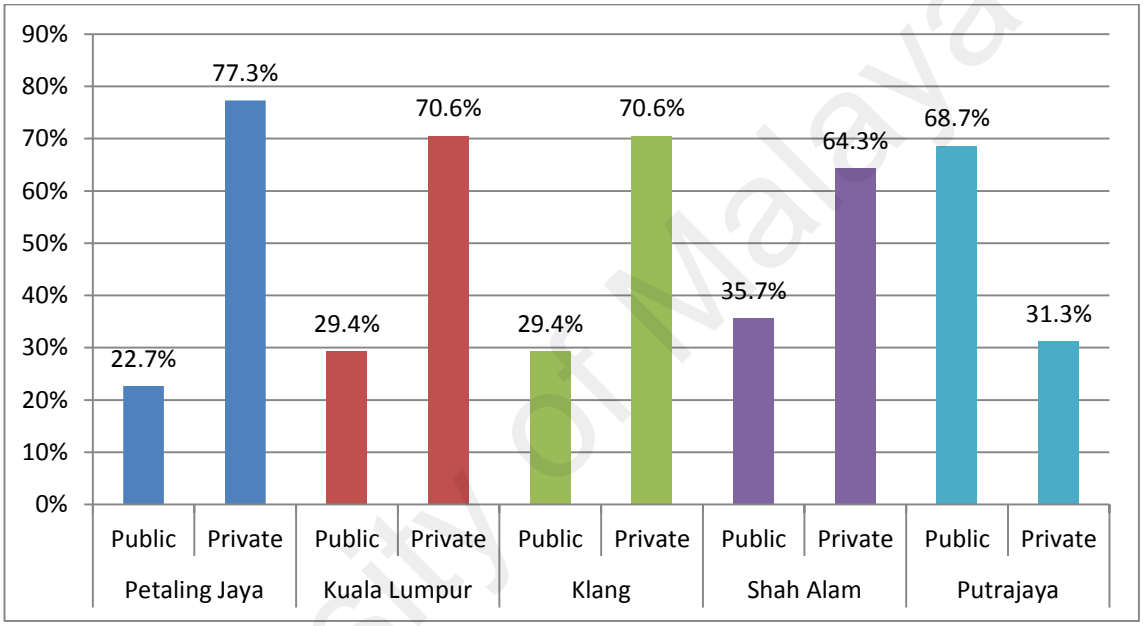


Figure 4.3: Respondents distribution by employment status by area

Figure 4.2 shows the employment sector of respondents. Overall, the number of respondents from the public and private sector are 41.6% and 58.4%, respectively. Table 4.1, on the other hand, shows the employment sector by its respective area. The distribution is almost identical and the trend conforms with Figure 4.2 where in many instances , the private sector exceeds the public sector except in the case for Putrajaya where 68.7% of respondents from the public sector and 31.3% from the private sector. Petaling Jaya has 77.3% of respondents from the private sector and only 22.7% from the public sector. 70.6% of respondents from Kuala Lumpur are in the private sector while only 29.4% from the public sector. The trend continues for Klang where 70.6% of

respondents from the private sector and 29.4% from the public sector. Shah Alam recorded respondents from the private and public sector at 64.3% and 35.7%, respectively.

4.2.1.3 Gender

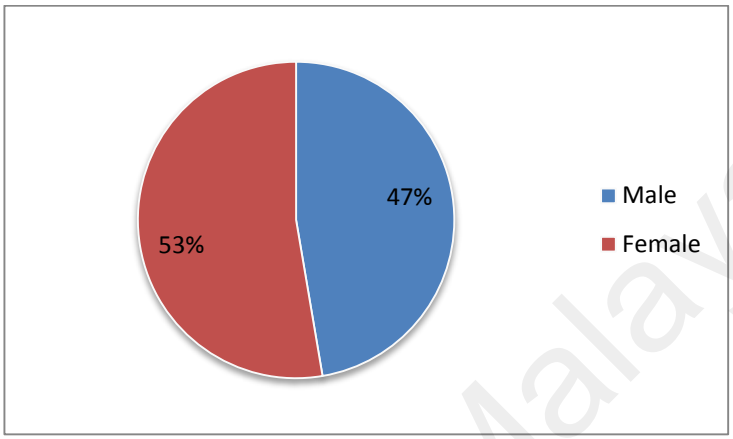


Figure 4.4: Gender of respondents

Figure 4.3 shows the distribution of respondents with regards to gender. There are almost equal numbers of female and male representatives, 53% and 47% respectively.

4.2.1.4 Marital Status

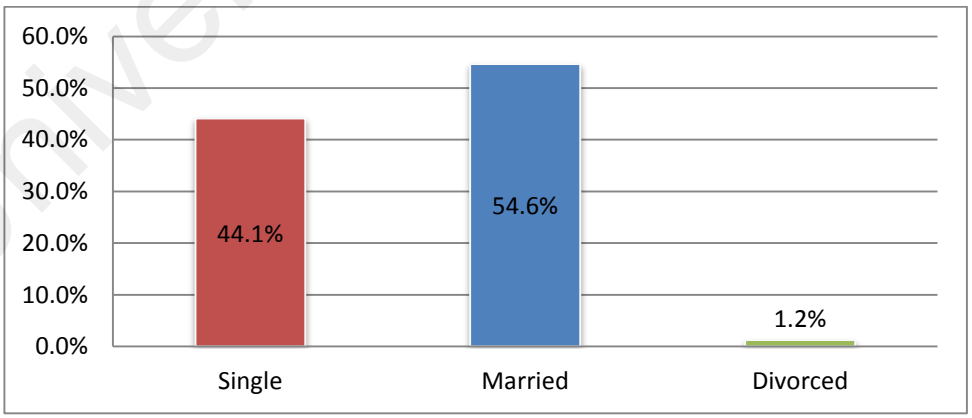


Figure 4.5: Marital status of respondents

Figure 4.4 above shows the marital status of respondents. Out of the total respondents, more than half or 44.1% are single while 54.6% are married. Only 1.2% of respondents are divorced.

4.2.1.5 Academic

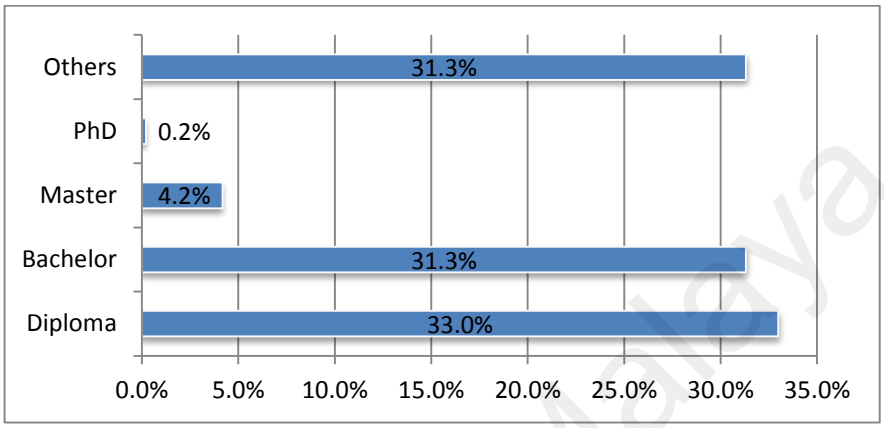


Figure 4.6: Highest academic qualification of respondents

Figure 4.5 above illustrates the academic qualification of respondents. Overall, there is only 0.2% of the Ph.D. holder and 4.2% master degree holder. There are equal numbers of the respondent that hold at least a bachelor degree and other qualification at 31.3%. Diploma holder made up the majority of academic qualification at 33.0%.

4.2.1.6 Age

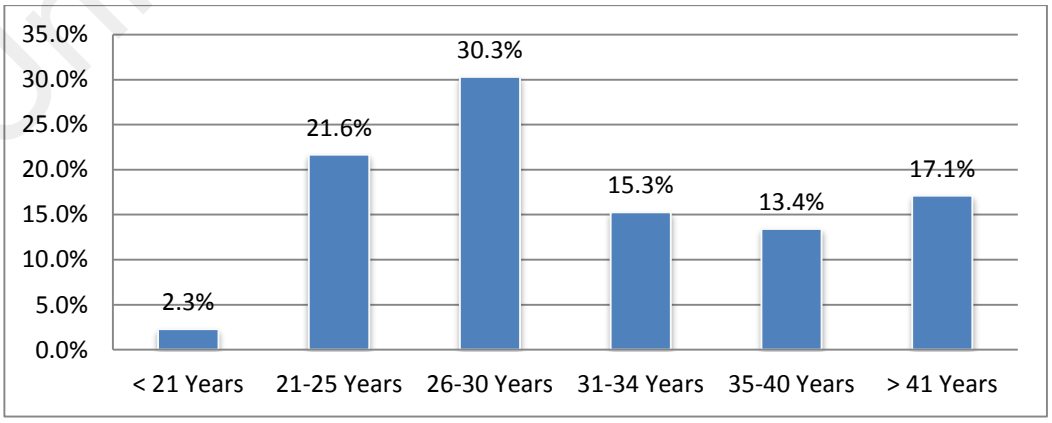


Figure 4.7: Age distribution of respondents

Figure 4.6 shows the distribution of age amongst the overall sample population. The majority of respondents are between the ages of 26-30 years old. This age group comprises 30.3% of the total 487 respondents. The 21-25 years old age group is in the second spot at 21.6%. There are almost equal numbers of the respondent of the age group 31-34 years and age group 35-40 years old at 15.3% and 13.4% respectively. There are only 17.1% and 2.3% of respondents are of the age of more than 41 years old and less than 21 years old respectively.

4.2.1.7 Household Income

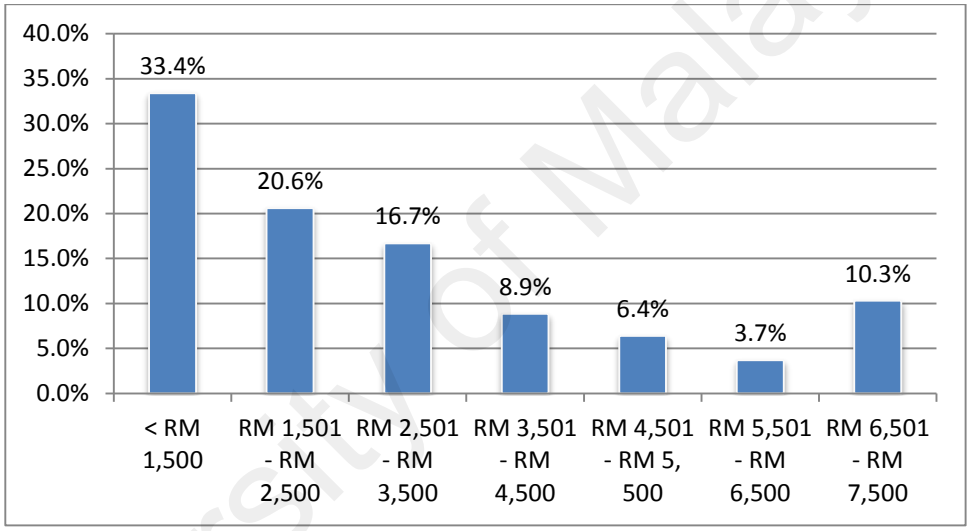
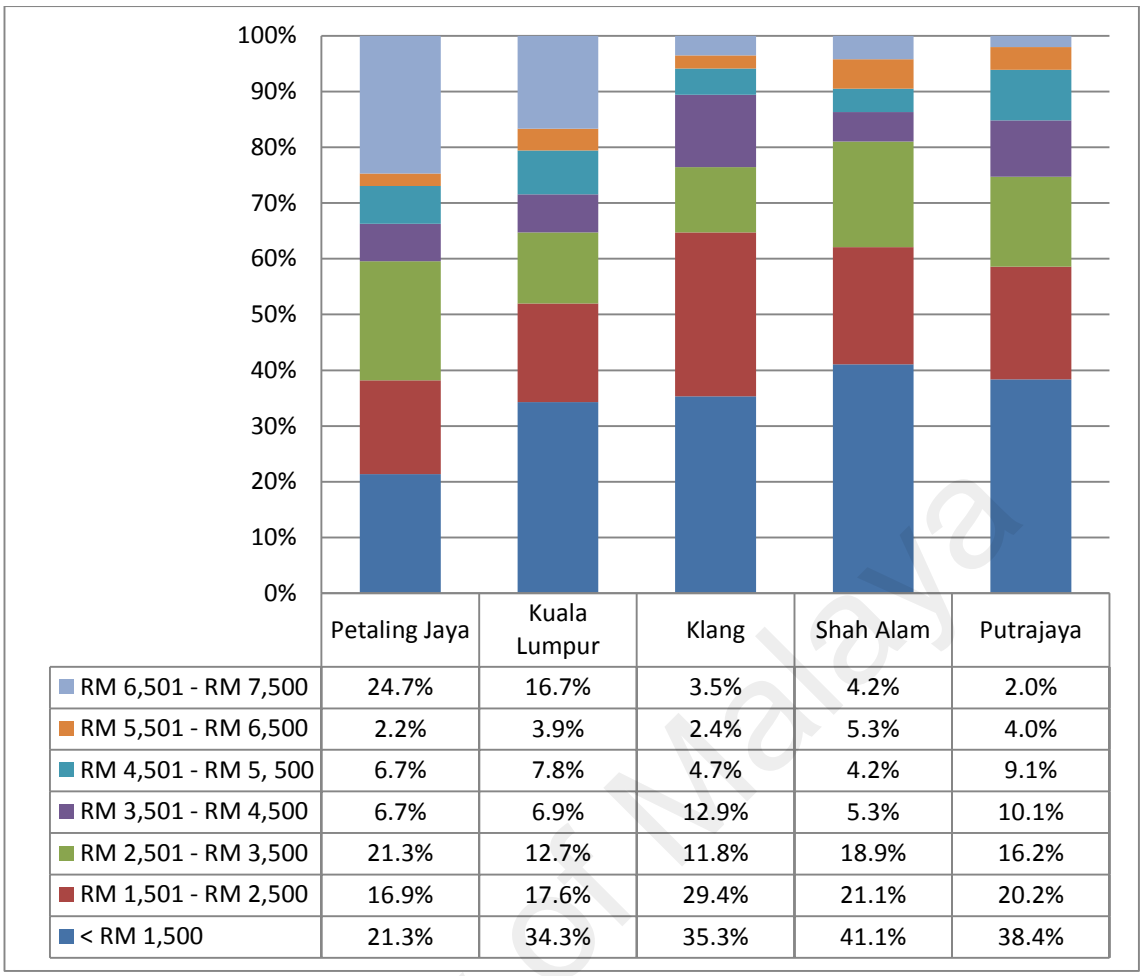


Figure 4.8: Monthly household income of respondents

The overall stratification of monthly household income of all respondents can be seen in Figure 4.7. Figure 4.7 shows that the majority of respondents (33.4%) earned less than RM 1,500 per month. It is followed by (20.6%) earned between RM1,501-RM2,500 per month and 16.7% who earned between RM 2,501- RM 3,500 per month. There are 8.9% and 6.4% who earned between RM 3,501-RM 4,500 and RM 4,501-RM 5,500 per month respectively. However, only 3.7% of the respondents earned between RM 5,501-RM 6,500 per month. The rest of the respondents (10.3%) earned between RM 6,501-RM7,500 per month.



	Petaling Jaya	Kuala Lumpur	Klang	Shah Alam	Putrajaya
RM 6,501 - RM 7,500	24.7%	16.7%	3.5%	4.2%	2.0%
RM 5,501 - RM 6,500	2.2%	3.9%	2.4%	5.3%	4.0%
RM 4,501 - RM 5, 500	6.7%	7.8%	4.7%	4.2%	9.1%
RM 3,501 - RM 4,500	6.7%	6.9%	12.9%	5.3%	10.1%
RM 2,501 - RM 3,500	21.3%	12.7%	11.8%	18.9%	16.2%
RM 1,501 - RM 2,500	16.9%	17.6%	29.4%	21.1%	20.2%
< RM 1,500	21.3%	34.3%	35.3%	41.1%	38.4%

Figure 4.9: Monthly household income of respondents by area

Going into income bracket by area, Shah Alam recorded the most proportion of respondents with a monthly household income of less than RM 1,500 at 41.1%, followed closely by Putrajaya at 38.4%. Respondents in Klang are the majority at 29.4% who earned between RM 1,501 - RM2,500 as compared to other areas. Less than 10% of respondents, regardless of area, reported an income of between RM4,501-RM5,500 as well as RM 5,501-RM6,500. Respondents from Petaling Jaya who earned between RM 6,501-RM7,500 per month made up 24.7% and recorded the highest proportion of income bracket across all areas. Meanwhile, respondents who earned RM 6,501-RM7,500 made up of only 16.7% in Kuala Lumpur, 3.5% in Klang, 4.2% in Shah Alam and only 2% in Putrajaya.

4.2.1.8 No. of Person in Household

Table 4.2: Number of person in the household

No. of person in household	Percentage (%)
1	14.1
2	12.0
3	18.9
4	21.4
5	17.0
>5	16.6

Table 4.2.1.8 shows the overall respondents number of the person in their household. The table reveals that 14.1% of respondents reported the number of the person in their household to be one, indicating that they live alone. There are 12% of the total respondents admitting to having at least two persons in their household. Most of the respondents (21.4%) have at least four people within the household, followed closely by a household with three persons at 18.9%. A household with five and more than five number of people in their household each recorded at (17% and 16.6% respectively).

4.2.1.9 Home Ownership

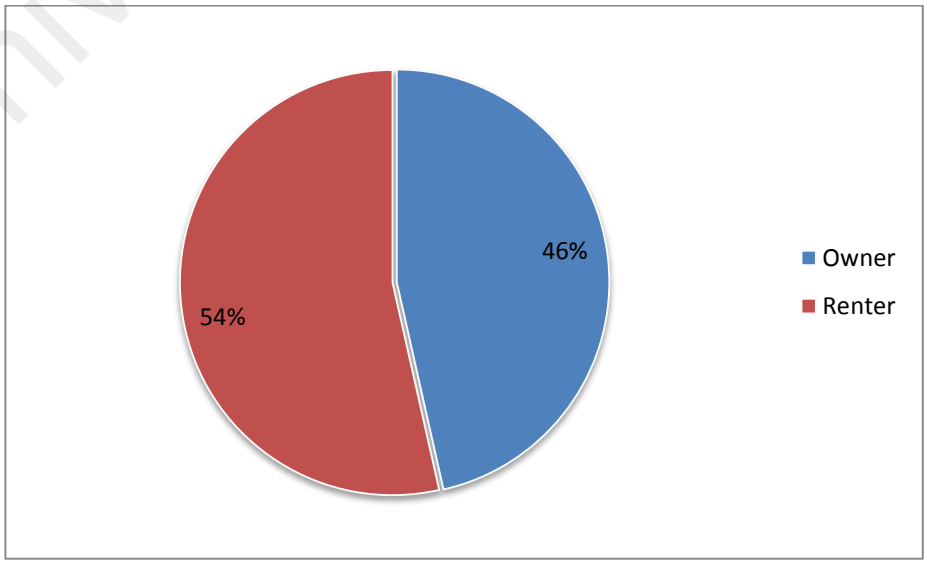


Figure 4.10: House ownership of respondents

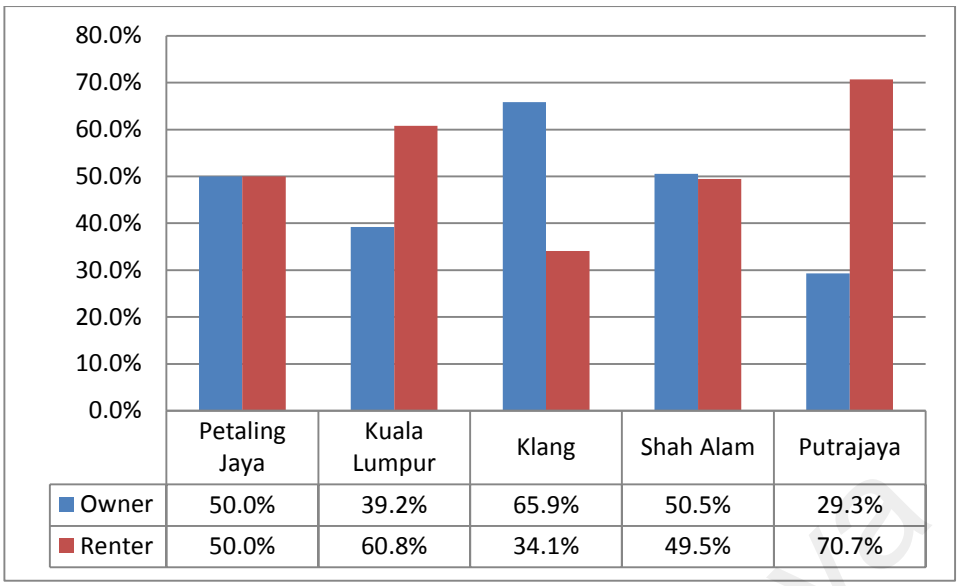


Figure 4.11: House ownership of respondents by area

Both Figure 4.9 and Figure 4.10 depict the house ownership of respondents. The former shows the overall house ownership while the latter shows house ownership trend in each area. Out of 487 respondents, a total of 46.5% claimed to be house owner and 53.5% who declare themselves as a renter. Petaling Jaya recorded the same number of respondents owning and renting (50%). Kuala Lumpur recorded more renter than house owner at 60.8% and 39.2%, respectively. This is the opposite of Klang which has more house owner than renter at 65.9% and 34.1%, respectively. There is an almost equal number of house owner and renter in Shah Alam at 50.5% and 49.5%, respectively. Putrajaya noted the largest discrepancy between owner and renter with a 41.4% differences between the two. There 29.3% who classified themselves as house owners and the rest is renter at 70.7%.

4.2.2 Cross tabulation

Table 4.3: Owner cross-tabulation of selected item in section A

Owner		**Area of Residence**					**Total**
		PJ	**KL**	**KLG**	**SA**	**PT**	
Employment Sector	Public	4.2%	6.0%	7.9%	12.6%	10.2%	40.9%

	Private	16.3%	12.6%	17.7%	9.3%	3.3%	59.1%
Total							**100%**
Marital Status	Single	9.3%	3.7%	9.8%	5.6%	2.3%	30.7%
	Married	11.2%	14.9%	15.8%	16.3%	10.2%	68.4%
	Divorced	0.0%	0.0%	0.5%	0.0%	0.5%	0.9%
Total							**100%**
Highest Qualification	Diploma	3.3%	2.8%	9.0%	9.4%	7.5%	32.1%
	Bachelor	9.0%	8.0%	4.7%	5.2%	0.5%	27.4%
	Master	2.4%	1.9%	0.5%	0.5%	0.0%	5.2%
	PhD	0.5%	0.0%	0.0%	0.0%	0.0%	0.5%
	Others	5.7%	5.2%	11.8%	6.6%	5.7%	34.9%
Total							**100%**
Household Income Per Month	< RM 1,500	0.9%	1.4%	8.4%	6.5%	1.9%	19.1%
	RM 1,501 - RM 2,500	3.3%	1.9%	7.4%	4.2%	2.8%	19.5%
	RM 2,501 - RM 3,500	5.1%	2.3%	2.8%	4.7%	2.3%	17.2%
	RM 3,501 - RM 4,500	0.9%	1.9%	4.2%	0.9%	3.3%	11.2%
	RM 4,501 - RM 5, 500	0.9%	3.3%	0.9%	1.9%	0.9%	7.9%
	RM 5,501 - RM 6,500	0.5%	0.5%	0.9%	1.9%	1.4%	5.1%
	RM 6,501 - RM 7,500	8.8%	7.0%	1.4%	1.9%	0.9%	20.0%
	> RM 7,500	0.9%	1.4%	8.4%	6.5%	1.9%	19.1%
Total							**100%**
Number of Persons in Household	< 2	1.9%	1.4%	2.8%	2.8%	0.9%	9.8%
	2	1.4%	3.7%	3.3%	1.4%	1.4%	11.2%
	3	3.7%	4.2%	4.7%	3.3%	1.9%	17.8%
	4	5.6%	3.7%	3.7%	3.7%	2.8%	19.6%
	5	1.9%	2.8%	6.5%	5.6%	2.8%	19.6%
	> 5	5.6%	2.8%	5.1%	4.7%	3.7%	22.0%
Total							**100%**
Years of Working Experience	< 1 Year	1.4%	0.0%	0.9%	0.5%	0.9%	3.7%
	1-5 Years	6.5%	1.4%	7.0%	5.1%	2.3%	22.3%
	6-10 Years	2.3%	7.9%	7.4%	6.0%	3.7%	27.4%
	11-15 Years	3.3%	4.7%	3.7%	4.2%	0.0%	15.8%

	16-20 Years	3.3%	1.9%	2.8%	2.8%	1.4%	12.1%
	> 20 Years	3.7%	2.8%	3.7%	3.3%	5.1%	18.6%
Total							**100%**

Table 4.3 above is the cross-tabulation of selected items in section A of the questionnaire with the owner. Most of the owners work in the private sector (59.1%), while 40.9% in the public sector. Klang recorded the highest number of respondents from the private sector while Putrajaya the lowest. On the other hand, Shah Alam recorded the highest number of public servants (12.6%) compared to the lowest which is Petaling Jaya (4.2%).

Most of the owners are married (68.4%) while the rest are either single (30.7%) or divorced (0.9%). By area, Klang recorded the highest number of the single owner (9.8%) while Putrajaya the lowest (2.3%). Shah Alam, on the other hand, recorded the highest number of owners who are married (16.3%) while Putrajaya the lowest (10.2%).

A large percentage of owner claimed to have an unspecified academic qualification (34.9%) as compared to Diploma (32.1%), Bachelor degree (27.4%), Master degree (5.2%) and Ph.D. (0.5%). Petaling Jaya recorded the most respondents with an academic qualification in all three categories which are Bachelor, Master and Ph.D. Most of the respondents in Klang reported having 'other' as their highest academic qualification (11.8%) while Shah Alam has the most number of respondents with a Diploma (9.2%).

Among owners, respondents with income group of RM 6,501 – RM 7,500 (20%) is the highest number of respondents among all income groups. To stark contrast, only 5.1% recorded a household income of RM 5,501 – RM 6,500. The income group of less than RM 1,500, RM 1,501 – RM 2,500 and RM 2,501 – RM 3,500 have almost equal number of respondents at 19.1%, 19.5% and 17.2% respectively. Respondents with

income group between RM 3,501 to RM 4,500 and RM 4,501 to RM 5,500 are recorded at 11.2% and 7.9% respectively. By area, Petaling Jaya and Kuala Lumpur recorded almost equal number of respondents with income group RM 6,501 – RM 7,500 at 8.8% and 7.0% respectively. Klang, on the other hand, shows the most number of respondents with an income of less than RM 1,500 at 8.4%.

The majority of the owners have more than five persons in their household (22.0%) as compared to second highest with four and five persons in their household at 19.6% respectively. This is followed by the owner with a household three persons at 17.8%. Respondents with less than two and two persons in their household recorded at 9.8% and 11.2% respectively. Going by area, Petaling Jaya recorded the highest number of respondents with more than five persons in the household (5.6%), followed closely by Klang (5.1%) and Shah Alam (4.7%). Kuala Lumpur reported the highest number of respondents with two persons in their household while Klang and Shah Alam both tied as having the most numbers of respondents with less than two persons in their household.

Most respondents reported having 6-10 years of working experience (27.4%), followed by the second most at 1-5 years of working experience (22.3%) and third most with more than 20 years (18.6%). Next are those with 11-15 and 16-20 years of working experience recorded at 15.8% and 12.1% respectively. A very small group of owners reported having less than one year of working experience (3.7%).

Table 4.4: Renter cross-tabulation of selected item in section A

Renter		Area of Residence					Total
		PJ	KL	KLG	SA	PT	
Employment Sector	Public	4.4%	6.4%	5.2%	7.2%	18.5%	41.8%
	Private	12.9%	18.1%	6.4%	11.2%	9.6%	58.2%
Total							**100%**
Marital Status	Single	12.0%	19.1%	5.6%	8.0%	11.6%	56.2%
	Married	5.6%	5.2%	5.6%	9.6%	16.3%	42.2%
	Divorced	0.0%	0.4%	0.4%	0.8%	0.0%	1.6%
Total							**100%**
Highest Qualification	Diploma	4.8%	7.3%	4.4%	5.6%	12.5%	34.7%
	Bachelor	8.1%	10.5%	1.6%	5.6%	6.9%	32.7%
	Master	1.6%	0.4%	0.4%	0.4%	0.0%	2.8%
	PhD	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Others	3.2%	6.9%	5.2%	6.5%	8.1%	29.8%
Total							**100%**
Household Income Per Month	< RM 1,500	6.8%	12.7%	4.8%	9.6%	13.5%	47.4%
	RM 1,501 - RM 2,500	2.8%	5.6%	3.6%	4.0%	5.6%	21.5%
	RM 2,501 - RM 3,500	3.2%	3.2%	1.6%	3.2%	4.4%	15.5%
	RM 3,501 - RM 4,500	1.6%	0.8%	0.8%	1.2%	1.2%	5.6%
	RM 4,501 - RM 5, 500	1.6%	0.4%	0.8%	0.0%	2.8%	5.6%
	RM 5,501 - RM 6,500	0.4%	1.2%	0.0%	0.4%	0.4%	2.4%
	RM 6,501 - RM 7,500	1.2%	0.8%	0.0%	0.0%	0.0%	2.0%
	> RM 7,500	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total							**100%**
Number of Persons in Household	< 2	7.0%	6.2%	0.4%	0.8%	3.7%	18.1%
	2	3.3%	2.1%	2.9%	2.9%	2.1%	13.2%
	3	1.2%	4.1%	2.5%	4.9%	5.3%	18.1%
	4	2.9%	5.8%	2.1%	4.5%	7.8%	23.0%
	5	2.1%	3.7%	2.1%	2.5%	5.3%	15.6%
	> 5	1.2%	3.3%	1.2%	2.5%	3.7%	11.9%
Total							**100%**
Years of Working Experience	< 1 Year	2.4%	7.2%	0.0%	3.6%	2.8%	16.1%

	1-5 Years	11.2%	10.8%	5.2%	7.2%	11.2%	45.8%
	6-10 Years	2.0%	4.0%	4.0%	4.0%	10.0%	24.1%
	11-15 Years	0.4%	1.2%	0.0%	2.0%	1.2%	4.8%
	16-20 Years	0.4%	0.4%	0.8%	0.4%	1.2%	3.2%
	> 20 Years	1.2%	1.2%	1.6%	0.4%	1.6%	6.0%
Total							**100%**

Table 4.4 above illustrates the cross-tabulation of selected items in section A of the questionnaire with the renter. Most of the renters work in the private sector (58.3%) as compared to 41.8% from the public sector. Kuala Lumpur recorded the highest number of respondents from the private sector (18.1%) while Klang the lowest (6.4%). In contrast, Putrajaya recorded the highest number of government worker (18.5%) compared to the lowest in Petaling Jaya (4.4%).

Most of the renters are still single (56.2%) while the rest are either married (42.2%) or divorced (1.6%). By area, Kuala Lumpur recorded the highest number of the single renter (12.0%) while Klang the lowest (5.6%). Putrajaya, on the other hand, recorded the highest number of a renter who are married (16.3%) while Kuala Lumpur the lowest (5.2%).

The vast majority of renters claimed to have the academic qualification of either a Diploma (34.7%) or a Bachelor (32.7%). There is no renter with academic qualification being Ph.D. However, 29.8% of respondents recorded having qualifications other than specified and only 2.8% having a Master degree. Petaling Jaya recorded the most respondents with academic qualification of a Master degree while Kuala Lumpur reported the most number of respondents with a Bachelor degree. Putrajaya has the most number of respondents with a Diploma and others.

Among renters, respondents with the second highest income bracket of RM 6,501 – RM 7,500 (2.0%) represented the lowest number of respondents among all income groups. On the contrary, almost half of renters (47.4%) recorded a household income of less than RM 1,500. The second and third most number of respondents is those within income group of RM 1,501- RM 2,500 (21.5%) and RM 2,501-RM 3,500 (15.5%). Next in line are those within income group of RM 3,501-RM4,500 (5.6%) and RM4,501-RM5,000 (5.6%). The second lowest number of respondents recorded an income range of RM 5,501-RM 6,500 (2.4%). The table also shows that there is no renter with the income bracket of above RM 7,500. By area, Putrajaya recorded the highest number of respondents with the income range of less than RM1,500 (13.5%) whereas Petaling Jaya recorded the most number of respondents with the income range of RM 6,501- RM 7,500 (1.2%).

By a number of person in the household, about 23.0% of respondents reported to having four persons in their household followed by respondents with three persons (18.1%) and less than two persons (18.1%) per household. Next are renters having five persons in their household (15.6%) and two persons in a household (13.2%). Last are renters with more than five persons in a household at 11.9%. By area, Petaling Jaya recorded the most number of respondents having less than two persons in their household while Putrajaya recorded the most number of respondents with a number of person in the household of more than five. Most renters reported of having 1-5 years of working experience (45.8%) and followed by both 6-10 years (24.1%) and less than a year of working experience (16.1%) There are only 6.0% who have more than 20 years of working experience, 4.8% having 11- 15 years of working experience. The lowest in the group are renters with 16-20 years of working experience recorded at 3.2%.

Table 4.5: Owner and renter type of dwelling by area of residence

			Area of Residence						Total
			PJ	KL	KLG	SA	PT	OT	
Owner	Type of Dwelling	Bungalow	3	0	2	0	3	1	8 (3.7%)
		Semi-Detached	2	3	3	5	1	1	14 (6.5%)
		Terrace	24	15	34	26	16	4	115 (53.7%)
		Cluster	0	1	0	0	1	0	2 (0.9%)
		Condominium	4	10	2	3	0	1	19 (8.9%)
		Apartment/ Town House	9	8	6	7	6	1	36 (16.8%)
		Other	2	3	9	5	1	0	20 (9.3%)
		Total	44	40	56	46	28	8	**214 (100%)**
Renter	Type of Dwelling	Bungalow	0	0	0	0	1	0	2 (0.8%)
		Semi-Detached	1	0	3	3	3	0	10 (4.0%)
		Terrace	7	10	17	12	18	4	64 (25.3%)
		Cluster	0	4	0	0	2	0	6 (2.4%)
		Condominium	13	13	1	2	1	0	30 (11.9%)
		Apartment/ Town House	18	31	5	24	40	3	120 (47.4%)
		Other	4	4	3	5	5	0	21 (8.3%)
		Total	43	62	29	46	70	7	**253 (100%)**

Table 4.5 illustrates the type of dwelling of both owner and renter by area of residence. Evidently, more than half of owners reside in terrace dwelling (53.7%), apartment (16.8%) and the least prefer the type of dwelling is cluster housing (0.9%). By area, Klang recorded the most number of respondents with terrace housing while Kuala Lumpur and Petaling Jaya reported with the most owners of the condominiums and apartment respectively. Klang is reported having the most number of respondents having an area of residence other than specified.

As seen from Table 4.5, renters predominantly dwell in an apartment (47.4%) and followed by terrace renter (25.3%). The third most chosen type of dwelling by renter is apparently condominium (11.9%). Bungalow seems to be the least prefer by renters (0.4%). By area, Putrajaya is the only area with Bungalow renter and at the same time, reported the most number of respondents with the apartment as well as terrace housing. Both Petaling Jaya and Kuala Lumpur reported the highest and an equal number of respondents with condominium as their type of dwelling.

4.3 Sustainable and Affordable Factor

Inferential statistics is a technique used to derive generalization about the population from a smaller sample. This is due to the fact that researcher and scientist seldom get access to extensive and costly population parameters. Inferential statistics make use of probability theory to measure whether any differences between samples are due to chance or actual effect in a particular test. This is represented by p-value using an assortment of statistical significance tests. A general confidence interval of less than 0.05 is deemed by many researchers to be the cut-off point. Precision and validity are another concern in inferential statistics.

This analysis was conducted to achieve objective no.3 which is to examine the most preferable homeownership criteria under both AHPs and AHS in assessing sustainable and affordable housing in Malaysia.

4.3.1 Reliability Test

Table 4.6: Cronbach's alpha of elements in AHS according to sub-factor

AHS	Element	Cronbach's Alpha	Cronbach's Alpha per Sub-Factor
Property Condition	QUAL	.614	.733
	FINIS	.520	
	EXTER	.773	
Marketing Aspect	THEME	.802	.806
	PRICE	.802	

	TYPE	.753	
	DESIG	.756	
	AGEH	.764	
	PROPI	.774	
Property Layout	POSIT	.820	.844
	BUILA	.777	
	LANDA	.779	
	TOPO	.832	
Surrounding	ENVIR	.784	.820
	TRAFF	.769	
	DENSI	.792	
	VIEW	.805	
	SAFET	.771	
Accessibility	NEARC	.746	.780
	NEARH	.735	
	NEARP	.734	
	NEARE	.745	
	NEART	.741	
	NEARY	.870	
	NEARD	.750	
	NEARW	.753	

Tables 4.6 and 4.7 show the Cronbach's alpha value for all the elements in sustainable housing affordability organized according to their respective subfactor. Table 4.6 shows that all of the elements in any of the sub-factors in AHPs have a Cronbach's value of more than 0.7 which indicates that the reliability or internal consistency of the elements in its sub-factor is relatively sound. Property condition recorded an alpha of .733 while marketing aspect recorded an alpha of .806. Property layout remained as one of the highest with an alpha of .844 and followed by surrounding sub-factor at .820. Lastly, accessibility alpha coefficient is at .780.

Table 4.7: Cronbach's alpha of elements in AHPs According to sub-factor

AHPs	Element	Cronbach's Alpha	Cronbach's Alpha per Sub-Factor
Demographic	MSTAT	.601	.630
	EDUD	.646	
	AGED	.430	
	INCOM	.685	
	NOHSD	.641	
	EXPER	.442	
Facilities	WASTE	.688	.780
	SECUR	.738	
	CHILC	.766	
	ELECT	.715	
Government Initiatives	Good Effort by Government	.956	.960
	Helping People Own House	.953	
	Fulfilling Social Obligation	.954	
	Solving Affordability	.957	
	Good Effort by Government	.955	
	Helping People Own House	.952	
	Fulfilling Social Obligation	.952	
	Solving Affordability	.956	
Financial Consideration/ Requirements	MORTY	.427	.613
	VALUE	.464	
	MORTP	.619	
	LTVR	.702	
	OTRL	.576	
	SAVIN	.522	

Table 4.7 Continued

Table 4.7, on the other hand, shows the Cronbach's alpha value for all the elements existed under AHPs sub-factors. Some of the sub-factor recorded an alpha of more than 0.6 and some are relatively very high at more than 0.9. Cronbach's alpha value for demographic is .630 while facilities at .780. Alpha value for government initiatives is high at .960 while financial requirement/ consideration is .613.

4.3.2 Significant

Table 4.8: Significant value for elements in AHS according to sub-factor

		MSTAT	EDUD	AGED	INCOM	NOHSD	EXPER	Significant Status (✓/ X)
Property Condition	QUAL	.900	.316	.180	.997	.622	.588	X
	FINIS	.577	.878	.660	.226	.500	.593	X
	EXTER	.744	.138	.996	.486	**.038**	.790	✓
Marketing Aspect	THEME	.399	.538	.157	.591	.050	.432	X
	PRICE	.595	.689	.154	.240	.237	.350	X
	TYPE	.213	.251	.808	**.011**	.156	.761	✓
	DESIG	.102	.885	.548	.117	.876	.322	X
	AGEH	**.022**	.100	.167	.155	**.039**	.080	✓
	PROPI	**.027**	.069	.230	.486	**.001**	.200	✓
Property Layout	POSIT	**.049**	.051	.203	.537	.186	.178	✓
	BUILA	**.010**	.236	.562	**.008**	.585	.390	✓
	LANDA	**.026**	.929	.847	.415	.327	.581	✓
	TOPO	**.004**	**.029**	**.027**	.807	**.018**	**.008**	✓
Surrounding	ENVIR	.974	.581	.819	.625	**.019**	.374	✓
	TRAFF	.218	.730	**.049**	.128	.061	.433	✓
	DENSI	.559	.660	.612	.528	.075	.874	X
	VIEW	.120	**.014**	.131	.957	.053	.199	✓
	SAFET	.177	.153	.190	.676	.942	.155	X
Accessibility	NEARC	.972	.878	.438	.632	.459	.356	X
	NEARH	.400	.365	.538	.248	.065	.821	X
	NEARP	.606	.303	.801	**.005**	.249	.294	✓
	NEARE	.560	.224	.314	.082	.481	.690	X
	NEART	.476	.778	.520	.903	.674	.555	X
	NEARY	.292	.952	.460	.843	.574	.216	X
	NEARD	**.003**	.739	.673	.374	.005	.904	✓
	NEARW	.305	.603	.420	**.056**	.579	.106	✓

Table 4.8 describe the power or significant value for all elements in AHS under their respective sub-factors with elements of sustainable housing affordability under demographic factor. Across column, marital status recorded the most number of significant particularly with elements in property layout sub-factor along with marketing aspect and accessibility. Number of the household has a number of significant in some elements in 4 sub-factors which are property condition, marketing

aspect, property layout and surrounding. Across row, topography surprisingly reported significant with all of the elements in demographic except for household income.

Table 4.9: Significant value for elements in AHPs according to sub-factor

		MSTAT	EDUD	AGED	INCOM	NOHSD	EXPER	Significant Status (✓/ X)
Facilities	WASTE	.767	.545	.762	.981	.383	.755	X
	SECUR	**.037**	.978	**.012**	.181	.807	.095	✓
	CHILC	**.009**	.529	.648	.156	**.001**	.881	✓
	ELECT	.524	.133	.612	.323	.758	.947	X
Government Initiatives	Good Effort by Government	.803	.885	.863	.099	.510	.575	X
	Helping People Own House	.768	.600	.289	.516	.432	.405	X
	Fulfilling Social Obligation	.858	.915	.469	.157	.302	.138	X
	Solving Affordabilit	.347	.940	.405	**.006**	.146	.273	✓
	Good Effort by Government	.751	.764	.451	**.001**	.342	.224	✓
	Helping People Own House	.756	.515	.365	.085	.229	.382	X
	Fulfilling Social Obligation	.580	.471	.303	.100	.857	.166	X
	Solving Affordabilit	.520	.855	.480	**.033**	.169	.249	✓
Financial Consideration	MORTY	.515	.536	.806	**.000**	.869	.546	✓
	VALUE	.576	.106	.440	**.000**	.273	.979	✓
	MORTP	.215	.452	.866	**.001**	.825	.795	✓
	LTVR	**.026**	.440	.657	.138	.851	.605	✓
	OTRL	**.000**	.952	**.000**	**.000**	.129	**.000**	✓
	SAVIN	.920	**.030**	.402	**.000**	**.031**	.330	✓

Table 4.9 illustrates the power or significant value for all elements in AHPs under their respective sub-factors with elements of sustainable housing affordability under demographic factor. Across column, household income is significant with most of the elements under financial sub-factor and some in government initiatives. Across row, other loan element is significant with almost all of elements in demographic sub-factor

except academic qualification and a number of households. Other than the two, all other demographic elements recorded a very high significant value with other loan element.

4.3.3 Correlation

Table 4.10: Correlation value for elements in AHPs according to sub-factor

		MSTAT	EDUD	AGED	INCOM	NOHSD	EXPER
Property Condition	QUAL	-.006	.046	-.061	.000	.023	-.025
	FINIS	.025	-.007	-.020	.055	.031	.024
	EXTER	-.015	.068	.000	-.032	.095*	.012
Marketing Aspect	THEME	.039	.028	.065	.025	.090	.036
	PRICE	-.024	.018	-.065	.054	-.055	-.043
	TYPE	.057	-.053	-.011	.116*	-.065	.014
	DESIG	.075	-.007	.027	.072	.007	.045
	AGEH	.105*	.076	.063	.065	.095*	.080
	PROPI	.102*	.084	.055	.032	.150**	.059
Property Layout	POSIT	.090*	.090	.058	.028	.061	.062
	BUILA	.117*	-.054	.026	.121**	.025	.039
	LANDA	.102*	.004	.009	.037	.045	.025
	TOPO	.133**	.101*	.101*	.011	.110*	.122**
Surrounding	ENVIR	-.001	.025	-.010	.022	.108*	.041
	TRAFF	-.056	-.016	-.090*	.069	.086	-.036
	DENSI	.027	.020	.023	.029	.082	.007
	VIEW	.071	.113*	.069	.002	.089	.059
	SAFET	-.062	.066	-.060	.019	-.003	-.065
Accessibility	NEARC	.002	.007	-.035	-.022	.034	-.042
	NEARH	.038	.042	-.028	-.053	.085	-.010
	NEARP	.024	.047	-.012	-.127**	.053	-.048
	NEARE	-.027	.056	-.046	-.080	.033	-.018
	NEART	-.033	-.013	-.029	-.006	.019	-.027
	NEARY	.048	-.003	-.034	.009	-.026	-.057
	NEARD	.135**	-.015	.019	-.041	.129**	-.006
	NEARW	-.047	.024	-.037	-.088	.026	-.074

Table 4.11: Correlation value for elements in AHS according to sub-factor

		MSTAT	EDUD	AGED	INCOM	NOHSD	EXPER
Facilities	**WASTE**	.014	.028	-.014	.001	.040	-.014
	SECUR	-.095*	.001	-.115*	.061	-.011	-.076
	CHILC	.119**	.029	.021	-.065	.158**	-.007
	ELECT	.524	.133	.612	.323	.758	.947
Government Initiatives	**Good Effort by Government**	.011	-.007	-.008	-.076	.031	-.026
	Helping People Own House	-.014	-.024	-.049	-.030	.037	-.039
	Fulfilling Social Obligation	-.008	-.005	-.033	-.065	.048	-.069
	Solving Affordability	-.043	.004	-.038	-.126**	.068	-.051
	Good Effort by Government	-.015	.014	-.035	-.149**	.044	-.056
	Helping People Own House	-.014	-.030	-.042	-.080	.056	-.041
	Fulfilling Social Obligation	-.026	-.034	-.048	-.076	.008	-.064
	Solving Affordability	-.030	-.009	-.033	-.099*	.064	-.054
Financial Consideration	**MORTY**	.046	-.043	.017	.364**	.012	.042
	VALUE	-.038	-.111	-.053	.510**	-.075	-.002
	MORTP	.086	-.052	-.012	.235**	-.015	.018
	LTVR	.055	-.032	-.106	-.013	.037	.055
	OTRL	.285**	-.003	.279**	.436**	.073	.277**
	SAVIN	-.005	-.100*	.039	.491**	-.100*	.045

Pearson product-moment correlation was run to determine the relationship between elements in AHS and AHPs sub-factors with elements in demographic sub-factor. Tables 4.10 and 4.11 listed down the result of such correlation. Table 4.10 reported the Pearson correlation coefficient, r for elements in AHS according to their respective sub-factors. It was found that there were very mild positive coefficients between demographic elements with some of the elements. An element such as age was negatively correlated with traffic congestion at -.090 (-9%). Household income also was

negatively correlated with both access to the post office and access to the workplace at -.127 (-12.7%) and -.088 (-8.8%) respectively. The highest correlation coefficient in Table 4.10 can be found in the number of person in the household with property interest which was .15 (15%).

Table 4.11, on the other hand, lists the correlation coefficient, r of AHPs elements with demographic sub-factor. Overall, much of the elements recorded a positive correlation with some such as value and saving are as high as .510 (51%) and .491 (49.1%) respectively when correlated with household income. However, some of the correlations were mildly negative such as security with marital status at -.115 (-11.5%) and savings with a number of persons in the household at -.100 (-10%).

4.4 COPRAS Analysis

4.4.1 Owner Occupier

Table 4.12: Owner means score of sustainable housing affordability elements by area

		PJ	KL	KLG	SA	PT
Property Condition	**QUAL**	4.2500	4.3250	4.1818	4.0652	3.9310
	FINIS	3.8864	3.7500	3.7636	3.6739	3.7586
	EXTER	3.9545	4.0500	3.9091	3.8261	4.0690
Marketing Aspect	**THEME**	3.8864	3.7000	3.5273	3.4565	4.1379
	PRICE	4.3864	4.3500	4.4545	4.1522	3.8621
	TYPE	3.9773	3.7500	3.7818	3.7609	3.9655
	DESIG	3.8182	3.7500	3.7273	3.6522	3.8276
	AGEH	4.0909	3.6750	3.9273	3.8000	3.9310
	PROPI	4.0465	3.9500	4.1818	4.0465	3.9310
Property Layout	**POSIT**	3.8636	3.9250	3.8519	3.7174	3.8966
	BUILA	3.8864	4.1000	3.9818	3.8261	3.8276
	LANDA	3.6818	3.9750	4.0000	3.7609	4.0000
	TOPO	3.8864	3.6923	4.0000	3.7381	3.7931
Surrounding	**ENVIR**	4.3409	4.0500	4.1818	4.1957	4.0345
	TRAFF	4.1818	4.1750	4.1132	3.9130	3.7586
	DENSI	3.9773	4.0000	3.7455	3.7391	3.6552
	VIEW	3.8864	4.0250	3.7273	3.7174	4.2759

	SAFET	4.2273	4.4500	4.1455	4.1333	4.1034
Accessibility	**NEARC**	3.9091	3.9500	3.9818	3.9556	3.9310
	NEARH	3.9773	4.2250	3.9636	3.9783	3.8966
	NEARP	3.6364	3.7750	3.7455	3.5652	3.7931
	NEARE	3.5000	3.5500	3.6545	3.6304	3.6897
	NEART	4.0227	4.1500	3.8727	4.0435	3.8276
	NEARY	3.8636	3.9250	3.6182	4.1087	4.0370
	NEARD	4.1364	4.1000	3.7818	4.1522	4.1724
	NEARW	3.9773	3.9500	3.9273	4.0217	4.0357
Demographic	**MSTAT**	1.5455	1.8000	1.6429	1.7447	1.8571
	EDUD	2.8182	2.8158	3.0364	2.5000	2.6897
	AGED	4.4318	4.8500	4.1250	4.2979	5.1379
	INCOM	4.6818	4.8205	2.6250	3.0213	3.4828
	NOHSD	4.0465	3.6000	3.8929	4.0217	4.2069
	EXPER	3.5682	3.8250	3.4545	3.6170	4.0345
Facilities	**WASTE**	3.9767	4.1250	3.8727	3.8043	3.8929
	SECUR	4.2955	4.2000	4.0182	3.8889	3.8276
	CHILC	3.7500	3.8500	3.6727	3.7778	4.1071
	ELECT	4.4318	4.5500	4.3636	4.1304	4.2414
Government Initiative	Good Effort by Government	3.4286	3.6500	3.6481	3.6222	3.5185
	Helping People Own House	3.4762	3.4474	3.7037	3.5556	3.3333
	Fulfilling Social Obligation	3.3171	3.3684	3.6481	3.5778	3.2963
	Solving Affordability	3.1463	3.1842	3.4630	3.4222	3.1852
	Good Effort by Government	3.2143	3.4474	3.5741	3.5682	3.4074
	Helping People Own House	3.2143	3.2368	3.6296	3.5455	3.4074
	Fulfilling Social Obligation	3.1220	3.2105	3.6667	3.5682	3.3333
	Solving Affordability	3.0976	3.2368	3.5741	3.3864	3.0741
Financial Consideration	**MORTY**	3.3902	3.1351	2.3137	2.7556	2.1481
	VALUE	2.7955	2.8250	2.2075	2.6136	2.3214
	MORTP	3.5000	3.2632	2.6981	3.1163	2.9259
	LTVR	2.8158	2.5250	2.7400	2.3077	2.3462
	OTRL	2.3409	2.9250	1.9231	2.3864	2.1034
	SAVIN	3.5909	4.2750	3.0370	3.4889	2.8889

Table 4.12 continued

Table 4.12 shows the distribution of mean score for the owner for each element involved in AHS and AHPs. The value was derived by findings the average of an element and then compared with the same element from a different area. The proceeding Table 4.13 now includes the mean score of each of the element for all area regardless of its corresponding area. The table also presented the weight of individual elements that is essential to the next step of this method. Table 4.14 was synthesized from the preceding table using the formula stated in Chapter 3.

Table 4.13: Overall Owner Mean Score and weightage of elements by sub-factor

Elements		Mean Score (overall)	Weight, $\bar{w}$
Property Condition	**QUAL**	4.1636	2.2779
	FINIS	3.7664	2.0606
	EXTER	3.9486	2.1603
Marketing Aspect	**THEME**	3.7009	2.0248
	PRICE	4.2757	2.3393
	TYPE	3.8364	2.0989
	DESIG	3.7477	2.0504
	AGEH	3.8873	2.1268
	PROPI	4.0476	2.2145
Property Layout	**POSIT**	3.8451	2.1037
	BUILA	3.9299	2.1501
	LANDA	3.8785	2.1220
	TOPO	3.8373	2.0994
Surrounding	**ENVIR**	4.1729	2.2830
	TRAFF	4.0472	2.2143
	DENSI	3.8271	2.0938
	VIEW	3.8879	2.1271
	SAFET	4.2113	2.3040
Accessibility	**NEARC**	3.9484	2.1602
	NEARH	4.0093	2.1935
	NEARP	3.6963	2.0223
	NEARE	3.6028	1.9711
	NEART	3.9860	2.1808
	NEARY	3.8868	2.1265
	NEARD	4.0467	2.2140
	NEARW	3.9765	2.1756

Demographic	**MSTAT**	1.7023	0.9313
	EDUD	2.7877	1.5252
	AGED	4.4954	2.4595
	INCOM	3.6465	1.9950
	NOHSD	3.9393	2.1552
	EXPER	3.6605	2.0027
Facilities	**WASTE**	3.9292	2.1497
	SECUR	4.0563	2.2192
	CHILC	3.8019	2.0800
	ELECT	4.3458	2.3776
Government Initiative	**Good Effort by Government**	3.5817	1.9597
	Helping People Own House	3.5291	1.9309
	Fulfilling Social Obligation	3.4683	1.8976
	Solving Affordability	3.3024	1.8069
	Good Effort by Government	3.4537	1.8896
	Helping People Own House	3.4244	1.8736
	Fulfilling Social Obligation	3.4069	1.8640
	Solving Affordability	3.3088	1.8104
Financial Consideration	**MORTY**	2.7612	1.5107
	VALUE	2.5502	1.3952
	MORTP	3.0927	1.6920
	LTVR	2.5699	1.4060
	OTRL	2.3254	1.2722
	SAVIN	3.4667	1.8967
Total		182.77	100.00

Table 4.13 continued

Table 4.14: Owner normalized decision matrix

Elements		λ	PJ	KL	KLG	SA	PT
Property Condition	QUAL	+	0.467	0.475	0.459	0.446	0.432
	FINIS	+	0.425	0.410	0.412	0.402	0.411
	EXTER	+	0.431	0.442	0.426	0.417	0.444
Marketing Aspect	THEME	+	0.421	0.400	0.382	0.374	0.448
	PRICE	-	0.484	0.480	0.491	0.458	0.426
	TYPE	+	0.434	0.409	0.413	0.410	0.433
	DESIG	+	0.417	0.410	0.407	0.399	0.418
	AGEH	-	0.448	0.402	0.430	0.416	0.430
	PROPI	+	0.445	0.434	0.459	0.445	0.432
Property Layout	POSIT	+	0.422	0.429	0.421	0.406	0.426
	BUILA	+	0.426	0.449	0.436	0.419	0.419
	LANDA	+	0.402	0.434	0.437	0.411	0.437
	TOPO	-	0.427	0.406	0.439	0.411	0.417
Surrounding	ENVIR	+	0.476	0.444	0.459	0.460	0.443
	TRAFF	-	0.460	0.459	0.452	0.430	0.413
	DENSI	-	0.436	0.438	0.410	0.410	0.400
	VIEW	+	0.421	0.436	0.404	0.403	0.463
	SAFET	+	0.463	0.487	0.454	0.452	0.449
Accessibility	NEARC	+	0.428	0.433	0.436	0.433	0.430
	NEARH	+	0.435	0.462	0.434	0.435	0.427
	NEARP	+	0.397	0.412	0.409	0.389	0.414
	NEARE	+	0.383	0.388	0.400	0.397	0.404
	NEART	+	0.440	0.454	0.424	0.443	0.419
	NEARY	+	0.420	0.427	0.394	0.447	0.439
	NEARD	+	0.450	0.446	0.412	0.452	0.454
	NEARW	+	0.435	0.432	0.429	0.439	0.441
Demographic	MSTAT	+	0.168	0.195	0.178	0.189	0.201
	EDUD	+	0.310	0.310	0.334	0.275	0.296

	AGED	+	0.477	0.522	0.444	0.463	0.553
	INCOM	+	0.501	0.516	0.281	0.324	0.373
	NOHSD	-	0.441	0.393	0.424	0.438	0.459
	EXPER	+	0.386	0.414	0.374	0.392	0.437
Facilities	**WASTE**	+	0.435	0.451	0.423	0.416	0.425
	SECUR	+	0.471	0.461	0.441	0.427	0.420
	CHILC	+	0.407	0.418	0.399	0.410	0.446
	ELECT	+	0.485	0.498	0.478	0.452	0.464
Government Initiative	**Good Effort by Government**	+	0.376	0.400	0.400	0.397	0.386
	Helping People Own House	+	0.383	0.380	0.408	0.392	0.367
	Fulfilling Social Obligation	+	0.366	0.371	0.402	0.395	0.364
	Solving Affordability	+	0.347	0.351	0.382	0.377	0.351
	Good Effort by Government	+	0.353	0.378	0.392	0.392	0.374
	Helping People Own House	+	0.354	0.356	0.399	0.390	0.375
	Fulfilling Social Obligation	+	0.344	0.354	0.404	0.394	0.368
	Solving Affordability	+	0.343	0.358	0.395	0.375	0.340
Financial Consideration	**MORTY**	-	0.373	0.345	0.254	0.303	0.236
	VALUE	-	0.306	0.309	0.241	0.286	0.254
	MORTP	-	0.382	0.356	0.294	0.340	0.319
	LTVR	-	0.311	0.279	0.303	0.255	0.259
	OTRL	-	0.255	0.319	0.210	0.260	0.229
	SAVIN	+	0.394	0.469	0.333	0.383	0.317

Table 4.14 Continued

Table 4.15: Owner COPRAS assessment by area of residences**.**

	PJ	KL	KLG	SA	PT
S^+	15.94	16.32	15.77	15.72	15.94
S^-	4.32	4.18	3.95	4.01	3.84
H	19.748	20.253	19.943	19.831	20.224
Priority	5	1	3	4	2
ŭ(%)	97.51%	100.00%	98.47%	97.92%	99.86%

The result of the calculation shows that KL ranked as first. It is followed by PT on the second spot, KLG in third and PJ in fourth. Last but not least is SA in the fifth spot.

4.4.2 Renter

Table 4.16: Renter means score of sustainable housing affordability elements by area

		PJ	KL	KLG	SA	PT
Property Condition	**QUAL**	4.1860	4.3710	4.4138	4.3111	4.2286
	FINIS	4.0000	3.8548	4.0345	3.7778	3.8571
	EXTER	4.1136	4.0161	3.9655	4.1556	4.0714
Marketing Aspect	**THEME**	3.7273	3.6452	3.7586	3.5778	3.6571
	PRICE	4.4773	4.5323	4.6552	4.5333	4.0429
	TYPE	4.0455	3.9516	3.8621	3.7556	3.8986
	DESIG	3.9091	3.7097	3.8966	3.7333	3.8429
	AGEH	3.8182	3.8871	4.2069	3.8222	3.8429
	PROPI	3.7727	4.1129	4.3448	4.2000	4.0147
Property Layout	**POSIT**	3.9091	3.8548	3.8621	3.7333	3.9130
	BUILA	3.9318	3.9677	4.1379	3.8444	3.9143
	LANDA	3.9091	4.0000	4.1379	3.9778	3.9000
	TOPO	3.7045	3.8197	3.9310	3.9333	3.8857
Surrounding	**ENVIR**	3.9545	4.2419	4.3448	4.3111	4.2000
	TRAFF	4.0000	4.3387	4.1724	4.0667	4.0857
	DENSI	3.8182	4.0323	3.7931	3.8889	4.0714
	VIEW	3.7727	4.0806	3.9310	3.8667	3.9143
	SAFET	4.5000	4.5645	4.3793	4.4444	4.2000
Accessibility	**NEARC**	3.8864	4.3226	4.1724	3.7556	3.8571
	NEARH	3.9318	4.3065	4.1379	3.9111	3.9857

	NEARP	3.8864	3.9677	4.1724	3.6222	3.9143
	NEARE	3.6905	3.8226	3.8966	3.4222	3.8143
	NEART	4.3636	4.5484	4.1379	4.2222	4.1143
	NEARY	5.2093	4.1129	4.1034	4.3111	4.0571
	NEARD	3.9773	3.9194	4.2069	4.2000	4.2143
	NEARW	4.2273	4.1774	4.1034	4.3182	4.0580
Demographic	**MSTAT**	1.3182	1.2419	1.5517	1.6087	1.5857
	EDUD	2.3636	2.5484	3.0000	2.7778	2.4265
	AGED	3.3721	2.8387	3.5172	3.2174	3.5000
	INCOM	2.6818	2.0806	2.0690	1.8696	2.1143
	NOHSD	2.6279	3.3443	3.5556	3.6818	3.7206
	EXPER	2.3636	2.2097	3.1034	2.4091	2.7000
Facilities	**WASTE**	4.0455	4.1935	4.2069	4.3636	3.9571
	SECUR	4.2727	4.3548	4.3448	4.1818	4.0143
	CHILC	3.9070	3.7581	3.7586	4.0222	4.1857
	ELECT	4.3256	4.4839	4.5862	4.5556	4.2429
Government Initiative	Good Effort by Government	3.2558	3.9194	3.6897	4.0000	3.4783
	Helping People Own House	3.2558	3.9672	3.6552	4.0000	3.5652
	Fulfilling Social Obligation	3.3023	3.8548	3.5517	3.8222	3.3623
	Solving Affordability	3.0930	3.7097	3.5172	3.5333	3.3333
	Good Effort by Government	3.3256	3.9344	3.6207	3.9333	3.5217
	Helping People Own House	3.2093	3.9344	3.6897	3.9111	3.4348
	Fulfilling Social Obligation	3.2326	3.7377	3.5517	3.6889	3.4348
	Solving Affordability	3.0698	3.7213	3.2759	3.4667	3.3768
Financial Consideration	**MORTY**	n.a.	n.a.	n.a.	n.a.	n.a.
	VALUE	n.a.	n.a.	n.a.	n.a.	n.a.
	MORTP	n.a.	n.a.	n.a.	n.a.	n.a.
	LTVR	n.a.	n.a.	n.a.	n.a.	n.a.
	OTRL	2.0526	1.6538	1.5862	1.6571	2.0333
	SAVIN	3.5682	3.2787	3.2069	2.7381	2.3857

Table 4.16 continued

Table 4.16 above shows the distribution of mean score for a renter of each element involved in AHS and AHPs. The value was derived by findings the average of an

element and then was compared with the same element from a different area. Table 4.17 on the other hand, shows the overall mean score of each of the element for all area regardless of its corresponding area. The table also presents the weightage of individual elements that is essential to the next step of this method. Table 4.18 was synthesized from the preceding table using the formula stated in Chapter 3.

Table 4.17: Overall Renter Mean Score and weightage of elements by sub-factor

Elements		Mean Score (overall)	Weight, $\bar{w}$
Property Condition	**QUAL**	4.2932	2.5205
	FINIS	3.8880	2.2826
	EXTER	4.0680	2.3882
Marketing Aspect	**THEME**	3.6640	2.1511
	PRICE	4.4000	2.5832
	TYPE	3.9076	2.2941
	DESIG	3.8080	2.2356
	AGEH	3.8880	2.2826
	PROPI	4.0685	2.3885
Property Layout	**POSIT**	3.8594	2.2658
	BUILA	3.9440	2.3154
	LANDA	3.9680	2.3295
	TOPO	3.8514	2.2611
Surrounding	**ENVIR**	4.2040	2.4681
	TRAFF	4.1400	2.4305
	DENSI	3.9520	2.3201
	VIEW	3.9240	2.3037
	SAFET	4.4080	2.5879
Accessibility	**NEARC**	3.9960	2.3460
	NEARH	4.0600	2.3835
	NEARP	3.9000	2.2896
	NEARE	3.7339	2.1921
	NEART	4.2880	2.5174
	NEARY	4.3213	2.5370
	NEARD	4.0960	2.4047
	NEARW	4.1694	2.4478

Demographic	**MSTAT**	1.4542	0.8537
	EDUD	2.5766	1.5127
	AGED	3.2640	1.9162
	INCOM	2.1554	1.2654
	NOHSD	3.4074	2.0004
	EXPER	2.5141	1.4760
Facilities	**WASTE**	4.1325	2.4261
	SECUR	4.2129	2.4733
	CHILC	3.9518	2.3200
	ELECT	4.4137	2.5912
Government Initiative	**Good Effort by Government**	3.6694	2.1542
	Helping People Own House	3.7004	2.1724
	Fulfilling Social Obligation	3.5806	2.1021
	Solving Affordability	3.4435	2.0216
	Good Effort by Government	3.6761	2.1582
	Helping People Own House	3.6356	2.1344
	Fulfilling Social Obligation	3.5344	2.0750
	Solving Affordability	3.4130	2.0037
Financial Consideration	**MORTY**	n.a.	n.a
	VALUE	n.a	n.a
	MORTP	n.a	n.a
	LTVR	n.a	n.a
	OTRL	1.8224	1.0699
	SAVIN	2.9756	1.7469
Total		170.3343	100

Table 4.17 continued

Table 4.18: Renter normalized decision matrix

Elements		λ	PJ	KL	KLG	SA	PT
Property Condition	**QUAL**	+	0.490	0.512	0.517	0.505	0.495
	FINIS	+	0.468	0.451	0.472	0.442	0.451
	EXTER	+	0.483	0.472	0.466	0.488	0.478
Marketing Aspect	**THEME**	+	0.437	0.427	0.440	0.419	0.428
	PRICE	-	0.520	0.526	0.541	0.527	0.470
	TYPE	+	0.476	0.465	0.454	0.442	0.458
	DESIG	+	0.458	0.434	0.456	0.437	0.450
	AGEH	-	0.445	0.453	0.490	0.446	0.448
	PROPI	+	0.441	0.480	0.508	0.491	0.469
Property Layout	**POSIT**	+	0.460	0.453	0.454	0.439	0.460
	BUILA	+	0.460	0.464	0.484	0.450	0.458
	LANDA	+	0.457	0.468	0.484	0.465	0.456
	TOPO	-	0.435	0.448	0.461	0.461	0.456
Surrounding	**ENVIR**	+	0.464	0.497	0.509	0.505	0.492
	TRAFF	-	0.470	0.510	0.491	0.478	0.481
	DENSI	-	0.452	0.477	0.449	0.460	0.482
	VIEW	+	0.444	0.480	0.463	0.455	0.461
	SAFET	+	0.527	0.535	0.513	0.521	0.492
Accessibility	**NEARC**	+	0.456	0.507	0.490	0.441	0.453
	NEARH	+	0.462	0.506	0.487	0.460	0.469
	NEARP	+	0.455	0.464	0.488	0.424	0.458
	NEARE	+	0.434	0.449	0.458	0.402	0.448
	NEART	+	0.514	0.535	0.487	0.497	0.484
	NEARY	+	0.606	0.479	0.478	0.502	0.472
	NEARD	+	0.466	0.459	0.493	0.492	0.494
	NEARW	+	0.495	0.490	0.481	0.506	0.476
Demographic	**MSTAT**	+	0.154	0.145	0.181	0.188	0.185
	EDUD	+	0.273	0.294	0.346	0.320	0.280

	AGED	+	0.393	0.331	0.410	0.375	0.408
	INCOM	+	0.314	0.243	0.242	0.219	0.247
	NOHSD	-	0.311	0.395	0.420	0.435	0.440
	EXPER	+	0.273	0.255	0.358	0.278	0.312
Facilities	**WASTE**	+	0.473	0.490	0.491	0.510	0.462
	SECUR	+	0.499	0.509	0.508	0.489	0.469
	CHILC	+	0.462	0.444	0.444	0.475	0.495
	ELECT	+	0.505	0.524	0.535	0.532	0.495
Government Initiative	**Good Effort by Government**	+	0.382	0.460	0.433	0.470	0.408
	Helping People Own House	+	0.383	0.467	0.431	0.471	0.420
	Fulfilling Social Obligation	+	0.388	0.453	0.417	0.449	0.395
	Solving Affordability	+	0.364	0.436	0.414	0.416	0.392
	Good Effort by Government	+	0.391	0.463	0.426	0.463	0.415
	Helping People Own House	+	0.377	0.462	0.433	0.459	0.403
	Fulfilling Social Obligation	+	0.380	0.440	0.418	0.434	0.404
	Solving Affordability	+	0.364	0.441	0.388	0.411	0.400
Financial Consideration	**MORTY**		n.a.	n.a.	n.a.	n.a.	n.a.
	VALUE		n.a.	n.a.	n.a.	n.a.	n.a.
	MORTP		n.a.	n.a.	n.a.	n.a.	n.a.
	LTVR		n.a.	n.a.	n.a.	n.a.	n.a.
	OTRL	-	0.244	0.197	0.189	0.197	0.242
	SAVIN	+	0.411	0.377	0.369	0.315	0.275

Table 4.18 Continued

Table 4.19: Renter COPRAS assessment by area of residences.

	PJ	KL	KLG	SA	PT
S^+	16.74	17.26	17.33	17.06	16.67
S^-	2.88	3.01	3.04	3.00	3.02
H	19.843	20.234	20.265	20.029	19.629
Priority	4	2	1	3	5
ŭ(%)	97.92%	99.85%	100.00%	98.84%	96.87%

Table 4.19 above presents the outcome of the analysis for the renter. The table shows that KLG is ranked first followed closely by KL in the second spot. The third spot is occupied by SA while PJ occupied the fourth spot. PT is ranked last in the fifth spot.

4.5 Summary

This chapter presents the various findings during the course of the research. The results of the analysis were arranged in the order of descriptive and inferential statistics so as to paint a larger view of the overall result as well as to provide a convenient and structured way to answer the relevant objectives stated in chapter 1. The next chapter will thoroughly explain the result presented here. Some explicit discussion on the result and its conclusion will also be included.

The chapter starts off with basic demographical profiling of respondents. This is essential to create an understanding of the overall background of respondents. For the second objective of the thesis which is to investigate the acceptance between AHPs and AHS toward sustainable and affordable housing: A reliability analysis was conducted. Table 4.6 and Table 4.7 clearly shows that all the elements in AHPs & AHS show a strong coherent within their respective groups or sub-sectors. It means that some

question in the questionnaire belongs to a certain sub-sectors making it convenient for categorization i.e. property condition, surrounding, property layout and the likes.

For the third objective, a significant and correlational analysis to the demographic profiles was done to examine the criteria most detrimental out of all elements in both AHPs and AHS. The findings indicate that some elements are more preferred. For example, the demographic factor which represent the no.of household (NOHSD) is more strongly correlated with age of the house (AGE) and property tenure (PROPI) These two are part of the marketing aspect sub-sector through the previous objective. Therefore, a direct conclusion would be that, respondents with a high or low number of the household will give more attention to the marketing aspect of a house.

Through analysis by means of COPRAS method, the fourth objective which is to find the areas that meet sustainable housing affordability in terms of AHPs and AHS is achieved. The result is separated from owners and renters since some of the elements used are different for both.

CHAPTER 5: DISCUSSION AND CONCLUSION

5.1 Introduction

The previous chapter exhibits the findings of this research in a concise and structured manner. However, it necessitates a more thorough and in-depth exploration on some of the key findings of this research and how it can be used to answer the stated objective.

5.2 Objectives Achievement

5.2.1 Objective 1

This section sought to answer objective one (1) which was to determine the criteria or elements for affordable housing principles (AHPs) and affordable housing schemes (AHS). This objective has been accounted for and answered through various literary components as presented in chapter 2. It was found that through the work of dozens of researchers, authors, academicians as well as professionals that the need to assess affordability must also be in conjunction with sustainability, hence the prerequisite for a guiding principle on AHPs and AHS.

The common conjecture is to separate the notion of both: affordability and sustainability and derive one another by separate means. However, this is simply not the case. Even if the housing cost is kept to the minimum, what constitutes 'affordable' can only be dictated when conditions, on whether the building itself and immediate facilities as well as the environment for the purpose of making living comfortable, are met. In other word, the actual need for the people instead of what developers and governmental institutions think the people need.

The infused of the terms sustainability and affordability gave rise to many researchers to explore and explicate through their studies. The term affordability vis-à-vis sustainability, requires the needed components to set as a basis or foundation for

developing the concept, even further to tackle the dynamic changes of the urbaner and progressing modern world - the era of smart cities, smart growth, smart energy, smart neighbourhood and green building and so on. Perhaps the forerunner of the business in sustainability can be attributed to the World Commission on Environment and Development (WCED) established under the United Nations (UN) in 1982. There are extensive and elaborate resources on the topic and one can be easily overwhelmed by the list.

Through examination and extrapolation of past and recent studies, the author was able to identify and determine the most relevant elements suitable to be adapted to both the principles (AHPs and AHS) as a function of both sustainability and affordability. The elements were then segregated to their respective sub-factors for easy analysis one by one. The list of available elements is shown Figure 5.1.

Each of the elements is believed to have an impact to a certain extend and some elements outweigh the other. The choices of elements are arbitrary in the literature review and not in a specific order. On its significance to the whole research, we now have a checklist on where to begin. It is important to note that these elements are extensive but not exhaustive, important but not overburden for a simple research.

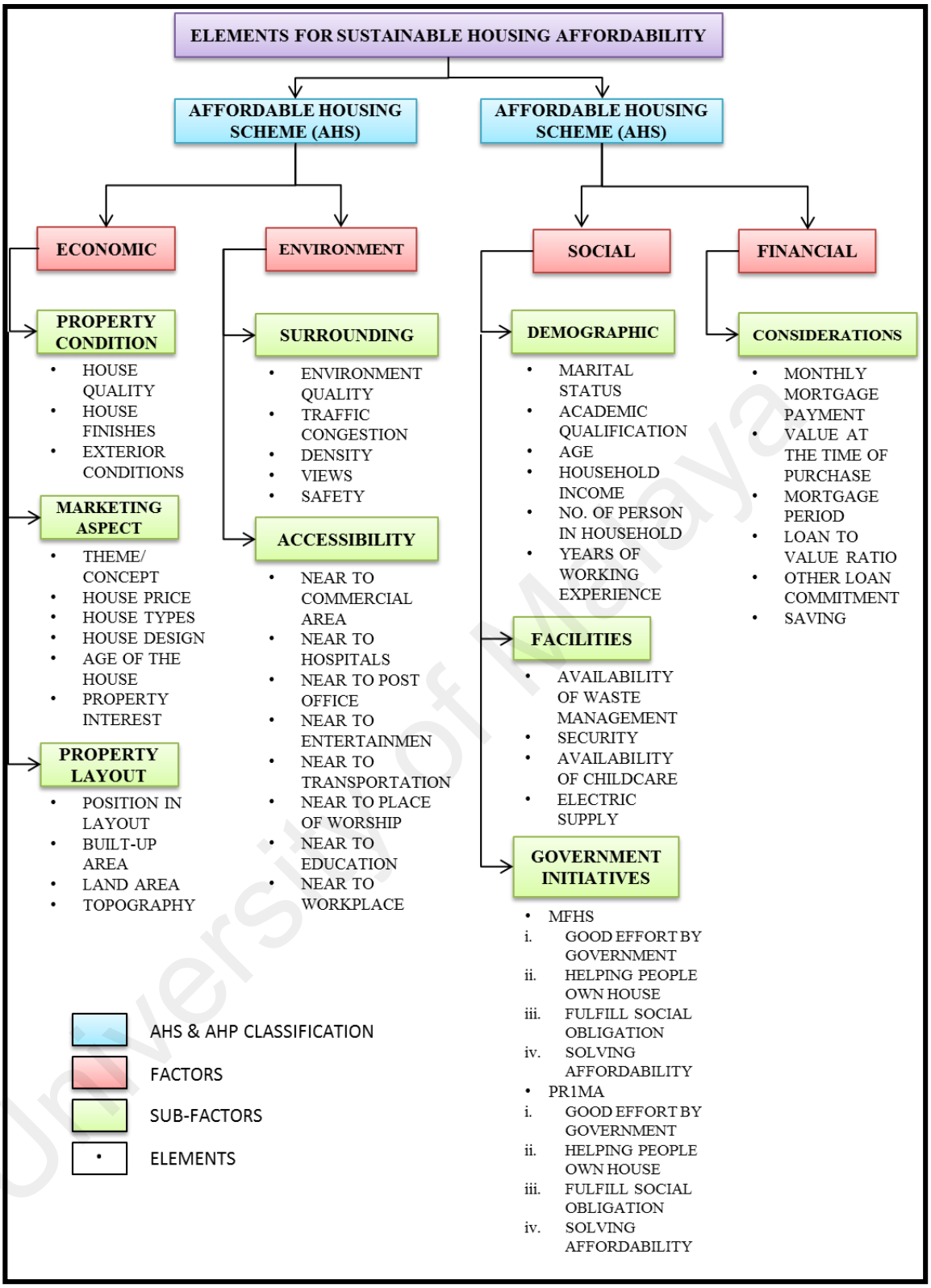


Figure 5.1: List of elements of sustainable housing affordability by AHPs & AHS classification, factors and sub-factors

5.2.2 Objective 2

This section attempts to answer objective two (2) by measuring the internal consistency of items in the questionnaire. Internal consistency is specially administered to assess the outcome of a questionnaire in a particular context that addresses the same underlying construct. In simpler terms, when questions asked multiple items on the same concept e.g. demography, it must at best demonstrate some sort of association. The same test can be administered to a different sample in the same population that can reasonably expect the same result depending on its consistency. In devising a questionnaire for this research from scratch, we found that there are a lot of elements, with no characterization nor categorization. Therefore, a measure for such aspect is required.

Reliability is only part and parcel of a broader term named psychometric properties, in a view to ascertaining how well it measures the domain of interest. It is basically the quantifiable attributes that relate to both strength and weakness of an examination. By estimating the reliability of a test, it can be used to assess the instrumental as well as response reliability. In real world application, the same test administered to the same group on alternate days may not produce the perfectly identical outcome. However, we expect more or less the same degree of similarity between all responses when responding to the same context. The more corresponding the score are, the more reliable it becomes. Thus, it is always advantageous to have more data in this case.

Much like in a classroom test where certain genre of the item is relatively easy for a student to answer. This genre must conform to a common, more accurate sphere of interest in which most students happen to be knowledgeable and, therefore, able to answer correctly on the particular item regardless of time, status, knowledge, location in

the test or number of items. Cronbach's alpha coefficient was used to determine its internal consistency.

Much like in the classroom example, we make the assumption that respondents will respond the same way to a certain question. Housing design or position of the house in layout elements by some loose definition should be grouped together. However, it is found that these two elements belong to a different group (i.e. marketing aspect & property layout). Now marketing aspect and property layout are simply our terms for easy categorization. However, from the data that were analysed, the position of house in layout plan is more comfortable to be a group with other elements in property layout such a built-up area and land area.

On its significance, it is known that instead of referring traffic congestion, density, view, safety or environment quality as single and separate elements, they are all related and inherently bonded together in a collective term known as the surrounding. Figure 5.2 demonstrates the extent of the outcome.

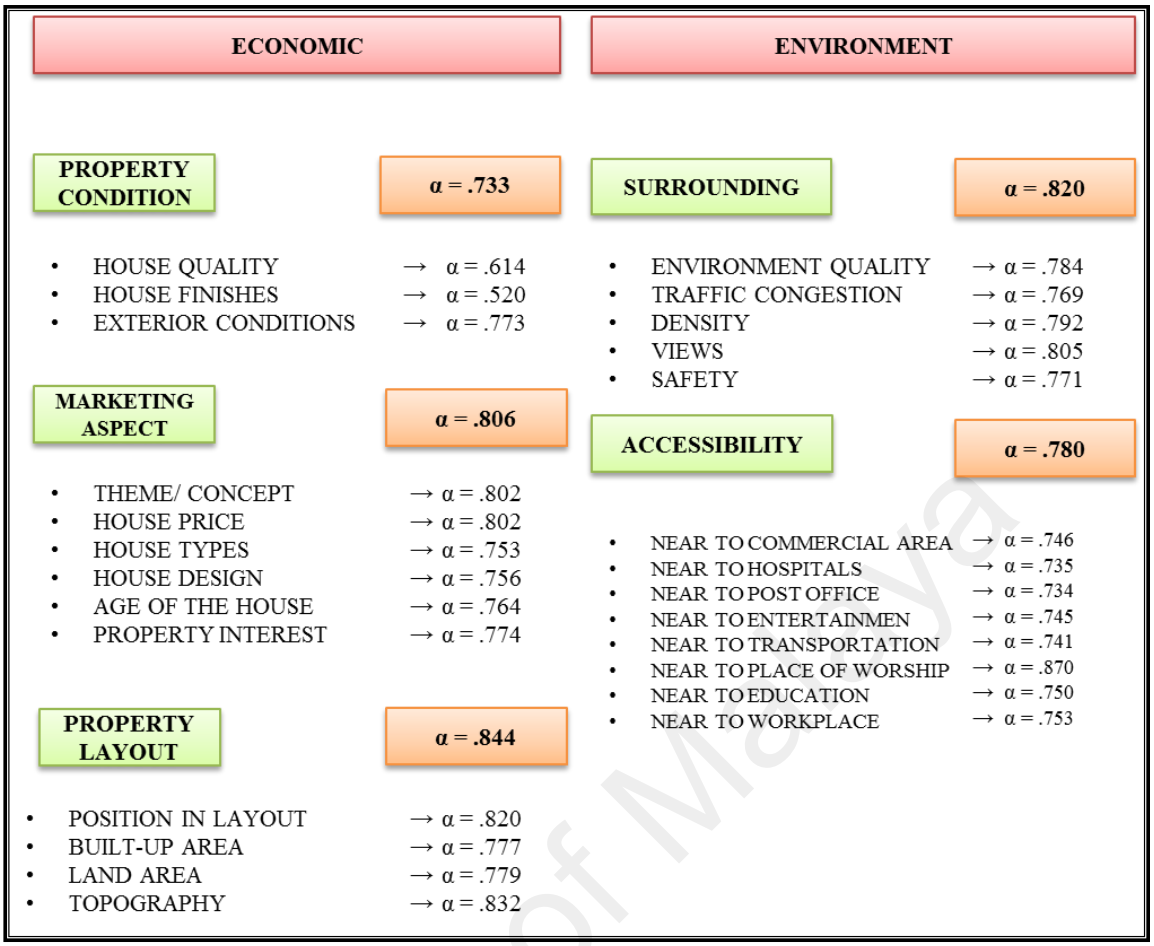


Figure 5.2: Cronbach's alpha coefficient, α value for items under economic and environment factor

Figure 5.2 presents the result as reported in the previous chapter. Focusing on economic factor above, property condition sub-factor has the least alpha coefficient compared with the other two but still relatively acceptable. An alpha coefficient (α= .733) indicates that all elements in this particular sub-factor 'hang' together around the same context. The alpha coefficient for house quality is the least, indicating that removing this element from the analysis will bring down the stability or robustness of the property condition sub-factor from (α= .733) to (α= .614). Since the closer the alpha coefficient to 1 the more preferable, it is best to keep that element within the sub-factor. Removing exterior condition, however, will result in a higher alpha coefficient that is from (α=.733) to (α= .773). However, as per common in the field of research, a gathering of the perfect result is almost non-existent. Removing exterior condition as

one of the elements in property condition will result in a minuscule alpha coefficient increment, but it comes with the tremendous cost of lessening the elements within property condition which are necessary for further analysis. Therefore, the exterior condition was not eliminated from the list of items within property condition.

As for marketing aspect, the alpha coefficient for the sub-factor is (α=.806) which indicates how strong, correlated the different items in it. In layman term, all items in the sub-factor measure the same thing – which is marketing aspect. As apparent as it looks like, the reliability measure for this subfactor is already at its highest and removing any of the element will not increase it further nor improve the research in any way other than it currently is. Those who inclined to be positive about the theme or concept (α= .802) of a residential development also remain the same towards the offer price (α= .802). In which case, they strongly consider both when purchasing the property. Another element in this sub-factor record quite high Cronbach's coefficient individually. Housing types (α= .753) and housing design (α= .756) both seems to be important to the buyer or potential buyer.

Property layout recorded the highest alpha coefficient (α=.844) among AHS sub-factors. This can be translated that all elements in it are almost identical and revolve around the same theme. The position of the house in the layout is at alpha coefficient (α=.820) which is rather high. Thus, it can be concluded that buyers or potential buyers consider the exact position of the house in layout plan at the same level they consider other elements in this sub-factor such as built-up area (α=.777), land area (α=.779), and topography (α=.832). Removing any of the elements will only result in a lower alpha coefficient for this particular sub-factor. Therefore, none of the elements are removed.

For the environment factor, the two sub-factors in it are surrounding and accessibility. Surrounding recorded high alpha coefficient at (α=.820) and each of the

elements in it also recorded relatively high alpha coefficient. The lowest among those is traffic congestion with an alpha coefficient (α=.769) followed by safety at (α=.771) and environment quality at (α=.784). The density of residential development seems to be relevant as it records an alpha coefficient of (α=.792). Last but not least, the view or the ability to have the better view of its surrounding is the selling point when it comes to this sub-factor. People are primarily attracted to a more scenery or beautiful view therefore not surprising as more people think views to be critical in the decision to buy a house.

Accessibility is one of the sub-factors in the environment factor. All the elements here relate to its relative position to a certain point or central location of a landmark that is common in everyday lives. Accessibility recorded an alpha coefficient of (α=.780) which is high for reliability analysis. Near to place of worship with an alpha coefficient of (α=.870) which is higher than the current alpha for accessibility should be removed traditionally. However, the author decides not to, again because it is required for further analysis and the alpha coefficient for accessibility itself is not as low or at a critical level as to requiring an extreme remedy such as removing one of the elements. Overall, other than that, eliminating any other element will not increase the alpha of the sub-factor substantially.

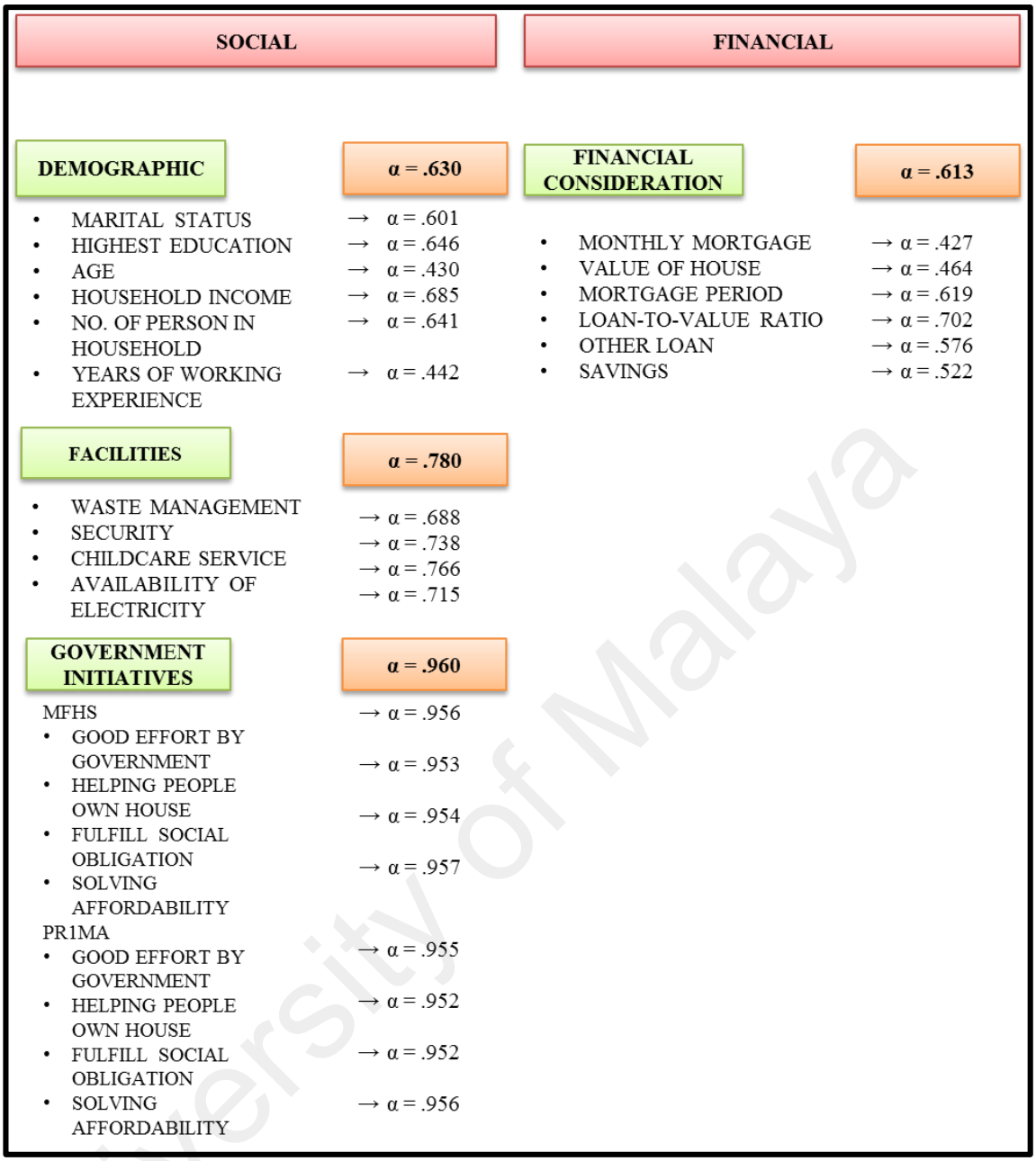


Figure 5.3: Cronbach's alpha coefficient, α value for items under social and financial factor

Figure 5.3 is the visual representation of the result presented in the earlier chapter. There are two factors in the AHPs with four sub-factors within it. Under financial factor, financial considerations sub-factor recorded an alpha coefficient of (α=.613), which is lower than the previous value. However, this value is still within the acceptable range of value from $0.6 \leq \alpha \leq 0.7$ as suggested by George and Mallery (2003) and L. Juul (2012). The alpha coefficient for a monthly mortgage is at (α=.427), which means

removing this particular element will only lower the alpha coefficient for the whole sub-factor. The same can be said about the value of the house at the time of purchase with an alpha coefficient of (α=.464). Only with mortgage period, the alpha coefficient went up although very slightly at (α=.619). The alpha coefficient for loan-to-value ratio shows a peculiar finding which when removed will result in a preferable alpha value. However, as explained before, the current alpha value is still within an acceptable value, therefore, prompting no change. Other loan and savings both show almost identical alpha value at (α=.576) and (α=.522) respectively.

For the three sub-factors in social factor, demographic recorded the lowest alpha coefficient with just about (α=.630). This is not a reason to be alarmed though since it is within the acceptable range. Going through the elements, household income per month recorded an alpha coefficient of (α=.685) if removed but for the same reason as above, the change is not substantial and the current alpha for demographic sub-factor is still reliable. Removing the element age from this sub-factor will only bring down the alpha coefficient to just (α=.430), almost the same with years of working experience (α=.442)

For facilities subfactor, it records a satisfactorily high alpha coefficient of (α=.780) indicating strong internal consistency. All of the elements in it also recorded high alpha but none, if removed will change the original alpha significantly. As for the government initiative, the alpha coefficient for the sub-factor is very high at (α=.960). Furthermore, each of the elements in both MFHS and PR1MA record consistent high alpha coefficient all around.

5.2.3 Objective 3

This section will attempt to elaborate the answer to objective three (3) by analysing the power of significant, p and its Pearson's correlation, r. Table 5.1 is the agglomeration of the result presented earlier in chapter 4 organized according to their respective group (AHPs & AHS) as well as sub-factors. Using this technique, we were able to identify which elements are significant and also its corresponding correlational strength as well as the direction of the strength (either positive or negative).

Table 5.1: Simplified significant and correlational table for AHS elements

		MSTAT	EDUD	AGED	INCOM	NOHSD	EXPER
Prop Cond	EXTER	-	-	-	-	**.038 (9.5%)**	-
Marketing Aspect	TYPE	-	-	-	**.011 (11.6%)**	-	-
	AGEH	**.022* (10.5%)**	-	-	-	**.039 (9.5%)**	-
	PROPI	**.027 (10.2%)**	-	-	-	**.001** (15.0%)**	-
Property Layout	POSIT	**.049 (9.0%)**	-	-	-	-	-
	BUILA	**.010 (11.7%)**	-	-	**.008** (12.1%)**	-	-
	LANDA	**.026 (10.2%)**	-	-	-	-	-
	TOPO	**.004** (13.3%)**	**.029 (10.1%)**	**.027 (10.1%)**	-	**.018 (11.0%)**	**.008** (12.2%)**
Surrounding	ENVIR	-	-	-	-	**.019 (10.8%)**	-
	TRAFF	-	-	**.049 (9.0%)**	-	-	-
	VIEW	-	**.014 (11.3%)**	-	-	-	-
Accessibility	NEARP	-	-	-	**.005** (-12.7%)**	-	-
	NEARD	**.003** (13.5%)**	-	-	-	-	-
	NEARW	-	-	-	**.056 (-8.8%)**	-	-

**elements are significant at 0.01 level (two-tailed)

In Table 5.1 all unmarked elements are significant at 0.5 level unless stated otherwise. The table was made uncluttered by removing unnecessary value leaving only flagged significant as well as its correlation in parenthesis. Significant and correlational analyses are usually done after the reliability of the instrument has been assessed. As the previous result for alpha coefficient has been encouraging, we can proceed to the next level of analysis.

In the table above, most of the elements in economic and environment factors show a positive correlation with demographic elements. Another finding is the mild correlation between accessibility or near to education with marital status with (p=.003) and Pearson's correlation value of (r=13.5%). This is not surprising since married respondent presumably with dependents will prefer to be closer to the school of their dependents regardless of their distance to the workplace, which in this case seems to be statistically insignificant. The exception has to be made to household income, though. From the table, monthly household income is statistically significant (p=.056) although negatively correlated (r=-8.8%) with distance to the workplace. In other word, higher income respondents are less concern about distant to the workplace. Thus, to cater to lower income people, accessibility needs to be high and distant low as possible. Another finding in accessibility sub-factor is that distant to post office is statistically significant (p=.005) and negatively correlated (r=-12.7%) with household income.

In the surrounding sub-factor, education and view from the property commanded a significant (p=.014) with correlation (r= 11.3%). This means that education plays a role in deciding to have a better view. With higher education, people seem to be more appreciative of the surrounding view and, therefore, speculate to more willing to invest for a better view overall. Number of person in a household affect their consideration in environmental quality as seen from the table above with significant (p=.019) and

correlation (r=10.8%). This translates to the larger household whom would take into account the general environmental quality in homeownership decision making. Traffic, on the other hand, shows a positive correlation with age significantly, (p=.049) and highly correlated. This means, as respondents get older the more they take into account the traffic or the time caught in traffic congestion. The right marketing technique that utilised this information can be used to target certain buyer or potential buyer within specific age.

In property layout, marital status is significant and positively correlated with most elements in it. Highest among them are topography with significance value of (p=.004) and correlation value of (r=13.3%) and the built-up area with significant value of (p=.01) and correlation value of r=11.7%. These go to show that both topography and built-up area affect the decision making of a person with differing marital status. Although it is entirely up to individuals, we speculate that single or divorced people could not care less about living in a larger space.

Likewise, for topography, although it is arbitrary, physical features, the shape, height and size of an area do have an effect on marital status. Those who are unmarried for example have greater flexibility and does not mind living in a property with the more versatile landscape. Age and years of working experience are statistically significant (p=.029, p=.008 respectively) and correlated (r= 10.1%, r=12.2% respectively) with topography. This goes to show that as people aged and as they accumulate work experience people tend to include topography in their decision making on property purchasing.

As for marketing aspects, marital status and a number of person in household again play a pivotal role. Marital status is significant with the age of the property as well as a property interest. Each has a significant value of p=.022, p=.027 respectively and

correlation of r=10.5% and 10.2% respectively. This can be translated as; the marital status of a person can determine their preference or bias in the choice of property both in terms of age of the house itself and its interest. The result means that married people would prefer a freehold house while single unmarried people are less concern on this topic. Perhaps, most notable are those between property interest and the number of person in a household which have significant value (p=.001) and Pearson's correlation value of (r=15.0%). In other word, the property interest is 15% positively correlated with a number of person in the household. The more people in the house, the more respondents are likely to include property interest in their homeownership decision. Price is not even included in the significant status element in marketing aspect sub-factor. This could mean that while price remains a factor in homeownership decision making, there is a more prevalent factor that could influence people to buy a house.

Table 5.2: Simplified significant and correlational table for AHPs elements

		MSTAT	**EDUD**	**AGED**	**INCOM**	**NOHSD**	**EXPER**
Facilities	SECUR	**.037 (-9.5%)**	-	**.012 (-11.5%)**	-	-	-
	CHILC	**.009** (11.9%)**	-	-	-	**.001** (15.8%)**	
Government Initiatives	Solving Affordabilit	-	-	-	**.006** (-12.6%)**	-	-
	Good Effort by Government	-	-	-	**.001** (-14.9%)**	-	-
	Solving Affordabilit	-	-	-	**.033 (-9.9%)**	-	-
Financial Consideration	MORTY	-	-	-	**.000** (36.4%)**	-	-
	VALUE	-	-	-	**.000** (51.0%)**	-	-
	MORTP	-	-	-	**.001** (23.5%)**	-	-
	LTVR	**.026 (5.5%)**	-	-	-	-	-
	OTRL	**.000** (28.5%)**	-	**.000** (27.9%)**	**.000** (43.6%)**	-	**.000** (27.7%)**
	SAVIN	-	**.030 (-10.0%)**	-	**.000** (49.1%)**	**.031 (-10.0%)**	-

**elements are significant at 0.01 level (two-tailed)

Table 5.2 shows the hybrid of significant and correlation table of elements under AHPs and its respective sub-factors. There are some significant findings for facilities subfactor which include marital status with both security and childcare availability. Marital status is statistically significant with security at p=.037, r= -9.5% and with childcare availability at p=.009, r=11.9% respectively. The result means that, as people go through different status in life i.e. from single to married, they are more concern towards finding childcare service within the prospective house. A number of person in the household is also significant with the availability of childcare at p=.001, r=15.8%. This could mean that as the family grows bigger, they want more for childcare services and will more likely to factor this into their choice in buying a house.

As for government initiatives, all of the elements are statistically significant with household income, although they have mostly negative correlation. Under MFHS, household income is statistically significant with solving affordability at p=.006, r=-12.6%. This means that the household income of respondents is negatively correlated with their opinion that MFHS can solve affordability. Another point of interest, under PR1MA household income, is also statistically significant with both good efforts by government and solving affordability at p=.001, p= .033 respectively and correlational value r=-14.9%, r=-9.9% respectively. From this, it can be interpreted that as the income of respondents increases, they opine that PR1MA is a good effort by the government but it cannot solve affordability. This is conversely true with lower income group, as household income lowers they are of the opinion that MFHS can solve affordability problem, and PR1MA is a good effort by government and also helps in solving affordability issue in this country.

In financial consideration/ requirements subfactor, almost all elements in it, except the loan-to-value ratio, are statistically significant and strongly positively correlated

with household income. Monthly mortgage is very significant with household income with p=.033, r=36.4% meaning that 36.4% of monthly mortgage is correlated with income. The value of the house at the time of purchase is also statistically significant at p=.000, r=51.0%. This means that household income plays 51% occurrences in the value of the property at the time of purchase. The same can be said to the loan other than housing loan and savings which have p=.000 and correlation r= 43.6%, r=49.1% respectively where both are correlated with household income. The relationship is linear and straightforward, the higher the household income, the higher the monthly mortgage payment, the value of the house at the time of purchase they can afford and so on. Another point is that the higher the household income, the more likely that people will tend to involve with loan other than existing housing mortgage. As long as the payment for each loan are kept to the minimum or provided no major shock in the economy in the near future, it is likely that this trend can be allowed to continue.

Marital status is another demographic element that is statistically significant with other loan at p=.000, r=28.5%. This means that as marital status changes, people are more likely to get involved with more loan. Apart from other loan, marital status is also statistically significant at p=.026, r= 5.5% with loan-to-value ratio although it is a smaller correlation. On whatever basis the financial institutions are deciding upon giving out a loan, marital status of respondents is relevant even though the correlation is low. Another shocking finding is education which is statistically significant and positively correlated with savings at p =.030, r=-10%. This findings can only mean that as people gain a higher level of education, their tendency to save will be lower; and vice versa. It can be the case since higher income people will contribute more to statutory retirement plan like Employee Provident Funds (EPF) or otherwise invest in an alternative investment like Amanah Saham, health or educational insurance for children,

etc. (this can relate to their tendency to have a higher other loan in the previous paragraph) thus, having less need to have cash on hand.

Another two demographic traits that may have an association with other loan is age (p=.000, r= 27.9%) and years of working experience (p=.000, r=27.7%). The older one gets, the more they have access to wide variety of loan (implying higher income and more commitments). The same argument can be said to years of working experience. In contrast, the number of person in a household is statistically significant (p=.031) and negatively correlated (r=-10%) with savings. We speculate that as the number of person in household grows, households commit less to savings.

Pearson product moment is a dimensionless sample correlation coefficient for raw data. Correlation is a very useful tool as a way to elicit evidence due to its wide variety of application and a single number to conveniently measure the strength of association. Given the result of the above discussion, we can say that some elements are significant and are either positive or negatively correlated. However, the association does not mean causation. A change in one thing may not directly link or by certain caveat and may not have an association at all but rather due to coincidence. Keeping that in mind, research should take into every possible causative relationship to produce solid evidence of a cause-effect relationship. It is, however, a common mistake to make a premature assumption based on the preliminary correlation. Though, looking at the basis for this research, adequate work has been done to ensure the validity and consistency for both research instrument (questionnaire) and analysis.

5.2.4 Objective 4

This section is dedicated to discussing the result of analysis that will answer the last and final objective. All the other objectives have been built up to answer this objective. A literature review was conducted to determine and identify the various criteria that may or may not contribute AHS and AHPs. This meticulous process listed down several criteria that were then incorporated into the framework of this research. The reliability test was then used to test its validity and accuracy. Once its reliability has been established, further analysis can be conducted onwards. This particular objective is to analyse the best sustainable and affordable housing area in term of AHS and AHPs of both owner and renter categories using the method of COPRAS.

The term 'best' simply referring to how well the areas performed compared to others. It can also be said that the areas satisfied much of the criteria as in figure 2.5, the elements in sustainable housing affordability criteria.

Below is the result for owner occupier. Figure 5.4 below shows the final result of the analysis which comprises of the utility degree in each of the area as well as its corresponding ranking.

1	KUALA LUMPUR	Utility Degree: 100.00%
2	PUTRAJAYA	Utility Degree: 99.86%
3	KLANG	Utility Degree: 98.47%
4	SHAH ALAM	Utility Degree: 97.92%
5	PETALING JAYA	Utility Degree: 97.51%

Figure 5.4: Ranking and utility degree by area for owner occupier

Figure 5.4 clearly illustrate that KL is the top choice for an owner that assess all of the elements of sustainable and affordability. KL being the capital city of Malaysia is a magnet for commerce and commercial activities. Modern infrastructure coupled with high accessibility anywhere in the city makes it the first in the rank of five. Interesting to note, that KL is not the cheapest city among those five, in contrary it is among the most expensive. However as clearly seen from the above result, owners in general, with the prefabricated list of AHPs and AHS elements consider KL as the city that most adhere or conform to sustainable and affordability component.

This is naturally a surprise since even though the price is a major obstacle especially in housing purchase decision-making, putting it side by side with other elements or criteria in sustainable and affordable housing still make it triumph due to the offsetting effect brought along with other elements. With the recent effort to make better the city's overall image and infrastructure, by implementing green building concept, river

cleaning, more parks and recreational areas, removal of slum areas, effective waste management, road upgrade, rail transit extension, and the city's expansion program, Greater KL will undoubtedly improve its long-term standing with the four factors; economic, environment, social and financial.

PT is ranked the second best and its utility degree suggests a very competitive position with the first ranked K L with a difference of only 0.14% - a minuscule value. Putrajaya is the country's first planned city and the implementation of sustainability is well acknowledged even during its conception in the city's blueprint. It is a surprise rather that PT does not come out the top. However, this can be explained due to error or the variability of the research itself such as personal opinion, preferences, bias and so on. which are outside the focus of the study and of which the researcher has no influence over.

PT is highly known for its fusion of modern and traditional architecture with plenty of amenities in and around the city itself. It was built from scratch as a model city thus allowing proper planning to be implemented in its infancy with laser-focus accuracy. Today, PT as the government administrative area houses various government agencies and private sectors, as well as witnesses, an upward trend in migration to the city. With the increase in migration, more residential housing is expected to be built to cater to the increasing demand. Housing in Putrajaya fulfills the elements of sustainability and affordability of current owner. Owner occupier makes a decision based on either strictly their experience or opinion from own observation. Based on the aforementioned list of elements, owner occupier ranked PT as a second place that fulfills both sustainability and affordability.

The third place now is KLG. KLG is in the western part and one of the most populated areas in Greater KL. Prior to Kuala Lumpur and Shah Alam, this city is the

state capital of Selangor and carries a long line of history. Proximity to Malaysia' premier port, Port Klang and large population increase its economic and social dimensions thus promoting an integrated development and an influx of investment into the city. Being a large city in itself, it holds the advantages of any large city but also disadvantages. Larger population requires better facilities and amenities, infrastructure and substantial improvement in terms of traffic accessibility in order to be competitive.

KLG has now become the alternative choice for residential housing to the more expensive Petaling Jaya or Subang Jaya area. As of now, residents in KLG enjoy a comfortable standard of living, with inter-connected highways for ease of transportation. By all account, owners consider KLG to be more fulfilling of the AHPs and AHS elements compare to another area such as SA or PJ.

Both KL and PT are most desirable for ownership because it satisfies the both AHP and AHS in the research. This is, however, contrary to international and local reports which posited that KL and PT have a very high affordability index issues. From the very beginning, this research aims at looking at sustainable and affordable housing from a different angle by which it employs the criteria previously mentioned. An index like the one being said on the other hand is based solely on monetary terms-median house price divided by gross annual median household income- which is not the focus of this research.

Figure 5.5 presents the result for the renter. This is the result of the final analysis using the stipulated method arranged by ranking and its corresponding utility degree.

1	KLANG	Utility Degree: 100.00%
2	KUALA LUMPUR	Utility Degree: 99.85%
3	SHAH ALAM	Utility Degree: 98.84%
4	PETALING JAYA	Utility Degree: 97.92%
5	PUTRAJAYA	Utility Degree: 96.87%

Figure 5.5: Ranking and utility degree by area for renter

Figure 5.5 shows the ranking of desirable areas with KLG in number one spot with a utility degree of 100.00% followed closely with KL in second place with utility degree of 99.85%. SA gains the third spot with a utility degree of 98.84%. PJ and PT both in fourth and fifth place respectively at 97.92% and 96.87%.

How can we synthesize this? Both KLG and KL appears in the two figures. A stark contrast to the previous figure, this time, PT is at the bottom or the least desirable for renter compared to for owner. The first is KLG, while being in the lower tier for owner section, the city proved resilient and managed to secure first place for renter section. We can infer that the current situation or the property market is benefitting to renter in KLG. Even though homeownership is traditionally more preferable in this country, there is nothing wrong with renting as long as there are intentions to buy and as long as the benefits of renting can offset its cost. Lower rent, lower living cost, adequate amenities can prove to be an attraction to the renter.

KL is ranked second of six in the figure. Being the economic centre of the country certainly helps in creating more business as well as attracting more job opportunity. With job supply remain high, people flocked to the city creating a consistently and persistently high demand for both ownership and renting as an alternative. Either way, it is not easy for any other city to compete with KL in terms of facilities and location but certainly not impossible to outdo it in every other aspect. As for now, KL will remain to be among the top choice for both homeownership-seeker and renter-seeker.

SA holds the third place in the ranking. While SA may not be the best performing area in the analysis, it boasted several advantages. As the city continues to expand massive development and infrastructure building of a grand scale are underway. This has benefitted the city with the booming of new towns allowing construction of more residential housing in the area. The new town will create job and the already developed city will become the convergent of migration driving the demand up. With the increasing development, the city has been known to protect and preserve its environment with the introduction of various laws and by-laws, facilities construction, effective management and proper city planning made SA one the most desirable city for the renter.

The access to affordable housing is a need to become central in the hearts of policy-making. In order to control the excessive housing price, social policy must not focus too much on the low-income group but also the middle-income group since they made up the majority in the country. Failure to do so can spark off a chain of event that will eventually affect all the players.

Prior to 1970s, government policies emphasized on the low-income group because this group is the most vulnerable in the housing market. Low purchasing power coupled with very low profit margin discouraged property developer to take up housing

development project that may further complicate the issue. Today, in the latest publication of the national housing policy, the government encouraged the housing development for both low and middle-income groups- housing that is of adequate, comfortable, quality and affordable. This aims to enhance the sustainability of the quality of life.

On the significance of this finding, we should know that although the decision on where to live lies on individual preference - it is neither entirely unpredictable nor mysterious. Digesting a certain cue or trend, the final decision is based on a small basket of factors. With that in mind, and to relate to the title of this research, certain factors would be more important than the other in achieving sustainable & affordability objective.

For example, by referring to Table 4.15 in Chapter 4, the sum of S^{+}_{q} of PJ is actually the same as PT which is at 15.94. However, the ranking of these areas is very different i.e. PJ at no. 5 and PT at no. 2. This is because of the sum of S^{-}_{q} of PJ is higher than that of PT. Being an older, mature neighbourhood, it also draws a lot of problems such as unplanned infrastructure and development, over density, traffic woes, limited recreation area all of which added up to the sum of S^{-}_{q} which is at 4.32 in PJ and only 3.84 in PT. PT being a relatively newly developed area, and also as a model planned city by the government as the federal administrative centre, have less negativity as a whole.

Further Discussion

The result of this research and its discussion would like to shift the perspective on how affordable as well as sustainable housing is viewed. The combination of both terms leads to a broader view of housing solution. This wholesome concept incorporates many factors that affect household anywhere in the country. It is now known that income, expenditure and cost can potray one side of the story, but it does not represent the bigger picture of housing problems. Many of the government initiatives to tackle the issue have for some time have been too optimistic with too many assumptions. Revising RPGT, for example, is only a short-term cooling measure, and it will hinder the growth of the built environment even further. The constriction in supply will increase demand in the long run and the whole agenda will backfire. The research proposes that instead of direct intervention, the government should focus on improving income growth and increasing supply for low to medium-cost residential properties to cope with the growing number of younger generations looking to buy a house and start a family.

5.3 Limitation and Recommendation

There are limitations that prevent the research from reaching its true potential. Below are some limitations identified during the course of completion of this research and the recommendation for future research.

5.3.1 Data

More data are needed especially concerning the input value of some of the elements. Part of this research employs the filling of a Likert-scale questionnaire that makes use of the ordinal level data. Converting it into an interval scale will make it more accurate. For example, asking respondent on their resident, current distance to a key location in the city. Factual data instead of personal opinion will undoubtedly give a great deal more thorough and more impact. Another point is to conduct a set of interviews with

professionals relating to the field to identify and illicit more information on the individual element that should be inserted and factor in the analysis.

5.3.2 Time Constraint

Gathering a large number of respondents is a daunting task. A large section of the researcher's time is dedicated toward the fulfillment of the objective. This limits the number of respondents that the researcher is able to gather. As for the analysis, time is also of the essence. To analyse such big data and input individually into the system for analysis, the time constraint must also need to be factored in. This can be overcome by employing more than one researcher especially in research of this scale.

5.3.3 Financial Constraint

Another limitation that needs to be addressed is a problem personally faced by the researcher. In the initial effort as to preparation and ultimately distribution of questionnaire, the cost of conducting such research must be taken into account.

5.4 Conclusion

This research is intended to demonstrate and implement how both sustainability and affordability can be assessed together. In the time of fast changing, rapid development, economic fluctuation, a higher standard of living, and volatile landscape of built environment have made home ownership a difficult endeavor in recent times. Sustainability and affordability should not be differentiated as one cannot exist without the other. It should go hand in hand so that the definition of affordability must also incorporate sustainability

Using a set of methodology, this research fuse both into the framework and use the various criteria existed in sustainability and affordability to make a comprehensive list of elements that encompasses and satisfy both AHPs and AHS. This is by far the most

complete list and the first to be implemented in this country using the MCDM method COPRAS. This method along with the others are used in concert to produce the final result that can answer the objective seeks in the beginning.

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LIST OF PUBLICATIONS AND PAPERS PRESENTED

1. Nozin, A.S., Ab Majid, R. Said, R. (2014) The Assessment of Expenditure Pattern among Young Couple towards Affordability of Housing. *Conference paper at the 8th Asean Post-Graduate Seminar (APGS*), December 11-12. University of Malaya

2. Said, R. Ab Majid, R. Nozin, A.S. (n.a.) The Measurement of Sustainable Housing Affordability using a Multiple Criteria Decision-Making Framework: Case Study of Malaysia. *Conference paper at the LARES International Conferences*, September 23-25. Sao Paolo, Brazil. (presented)

3. Nozin, A.S., Said, R., Ab Majid, R. (2015) Homeownership; Assessment of Young Couples' Behaviour on Housing Expenditure and Affordability. *Jurnal Teknologi (Sciences & Engineering)* (SCOPUS-Cited Publication) (accepted for Publication)

APPENDIX A

UNIVERSITI MALAYA KUALA LUMPUR

FACULTY OF BUILT ENVIRONMENT
UNIVERSITY OF MALAYA

SURVEY SHEETS

The purpose of this questionnaire is to investigate the level of housing affordability and the factors that contribute to that affordability. The questions fall into the following sections: Respondent's Profile (Sec A & B), Types of Expenditure (C), Housing Support Programs (D) and Product Factors (E).

SECTION A: RESPONDENTS PROFILE

1. Area of Residence

2. Employment Sector

	Government
	Private

3. Sex

	Male
	Female

4. Marital status

	Single
	Married
	Divorced

5. Highest Qualification

	Others : Please state
	Diploma
	Bachelor
	Master
	PhD

6. Your Age

	< 21 years
	21 -25 years
	26 -30 years
	31 -34 years
	35 -40 years
	41 -45 years
	46 -50 years
	> 51 years

7. Age of Spouse

	< 21 years
	21 -25 years
	26 -30 years
	31 -34 years
	35 -40 years
	41 -45 years
	46 -50 years
	> 51 years

8. Household Income per month

	<RM 2,500
	RM 2,501 – RM 3,500
	RM 3,501 – RM 4,500
	RM 4,501 – RM 5,500
	RM 5,501 – RM 6,500
	RM 6,501 – RM 7,500
	>RM 7,501

9. Number of persons in household

	< 2
	2
	3
	4
	5
	> 5

10. Please indicate your years of working experience

	< 1 year
	1 – 5 years
	6 – 10 years
	11 – 15 years
	16 – 20 years
	> 20 years

11. I am … (please tick one)

	An owner occupier
	A renter

If you answer 'owner occupier', proceed to Section B1. If your answer is 'Renter', proceed to Section B2

SECTION B1: IF YOU ARE AN OWNER OCCUPIER

1.Type of Dwelling

	Bungalow
	Semi-Detached
	Terrace
	Cluster
	Condominium
	Apartment/Town House
	Other (Please state)

2. Monthly Mortgage Payment

	< RM 500
	RM 501 – RM 1,000
	RM 1,001 – RM 1,500
	RM 1,501 – RM 2,000
	RM 2,001 – RM 2,500
	RM 2,501 – RM 3,000
	RM 3,001 – RM 3,500
	> RM 3,501

3. Value at the time of purchase

	< RM 100,000
	RM 100,001 – RM 200,000
	RM 200,001 – RM 300,000
	RM 300,001 – RM 400,000
	RM 400,001 – RM 500,000
	> RM 500,001

4. How did you buy the house: via

	Owner
	Estate Agent
	Auction
	Other

5. Mortgage Period

	<15 Years
	15-20 Years
	21-25 Years
	26-30 Years
	31- 35 Years
	>35 Years

6. How long have you owned this house for

	< 1 Year
	1 Year
	2 Years
	3 Years
	4 Years
	> 5 Years

7. Loan To value Ratio (LTV)

	0:100
	10 :90
	20: 80
	30: 70
	Other (pl. state)

8. Name of Housing Credit Institution

	Commercial Banks		Bank Rakyat
	Treasury Housing Loan Division		Borneo Housing Mortgage Finance Bhd
	Sabah Credit Corporation		Malaysian Building Society Bhd
	Bank Simpanan Nasional		Other (pl. state)

9. Status of House at the time of purchase

	New Unit
	Sub-sale unit

10. Status of Ownership

	Individual
	Joint ownership with spouse
	Joint ownership with parents

11. Year of Purchase _____

SECTION B2: IF YOU ARE A RENTER

1. Type of Dwelling

	Bungalow
	Semidetached
	Terrace
	Cluster
	Condominium
	Apartment/Town House
	Other (pl. state)

2. Rental Cost per month

	< RM 500
	RM 501 – RM 1000
	RM 1001 – RM 1500
	RM 1501 – RM 2000
	RM 2001 – RM 2500
	RM 2501 – RM 3000
	> RM 3001

SECTION C: MONTHLY EXPENSES

1. Other loan commitment (s)
(eg: Car loan, personal loan)

	< RM 500
	RM 501 – RM 1,000
	RM 1,001 – RM 1,500
	> RM 1,501

2. Food & Beverages

	< RM 500
	RM 501 – RM 750
	RM 751 – RM 1,000
	More than RM 1,001

3. Monthly Utilities

	< RM 100
	RM 101 – RM 250
	RM 251 – RM 300
	> RM 301

4. Transportation cost

	< RM 200
	RM 201 – RM 400
	RM 401 – RM 600
	More than RM 601

5. Household Equipment
(Monthly furnishing, equipment & routine household maintenance)

	< RM 500
	RM 501 – RM 1,000
	RM 1,001 – RM 1,500
	> RM 1,501

6. Saving

	< RM 100
	RM 101 – RM 200
	RM 201 – RM 300
	RM 301 – RM 400
	RM 401 – RM 500
	> RM 501

7. Communication
(prepaid phone or broadband top-up, streamyx, UNIFi, cable network such as ASTRO, or online portal)

	< RM 100
	RM 101 – RM 200
	RM 201 – RM 300
	RM 301 – RM 400
	RM 401 – RM 500
	RM 501 – RM 600
	RM 601 – RM 700
	> RM 701

8. Miscellaneous (unplanned groceries, exp: repairs, Clothing &personal accessories

	< RM 100
	RM 101 – RM 200
	RM 201 – RM 300
	RM 301 – RM 400
	RM 401 – RM 500
	RM 501 – RM 600
	RM 601 – RM 700
	RM 701 – RM 800
	> RM 801

9. Healthcare & Education
(include insurances premium)

	< RM 100
	RM 101 – RM 200
	RM 201 – RM 300
	RM 301 – RM 400
	RM 401 – RM 500
	> RM 501

SECTION D: GOVERNMENT SUPPORTS ON HOUSING PROGRAMMES

Please indicate your opinion based on the given scale

1	2	3	4	5
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree

D1-My First Home Scheme

	1	2	3	4	5
1. A good effort by the government					
2. Helping people to own a house					
3. Fulfilling social obligation					
4. Solving affordability					

D2- PR1MA

	1	2	3	4	5
1. A good effort by the government					
2. Helping people to own a house					
3. Fulfilling social obligation					
4. Solving affordability					

UNIVERSITI MALAYA KUALA LUMPUR		FACULTY OF BUILT ENVIRONMENT UNIVERSITY OF MALAYA

SECTION E: PRODUCT FACTORS

Based on the given scale, please indicate how far you consider the following aspects prior to purchasing a house

1	2	3	4	5
Very weakly	Weakly	Indifferently	Strongly	Very Strongly

E1- Internal Factors	1	2	3	4	5
1. House price					
2. House quality					
3. House type					
4. House finishes					
5. House design					
6. Interior features					
7. Position of the house in layout plan					
8. Size of built-up area					
9. Size of land area					
10. Age of the house					
11. Topography					
12. Property's Interest (i.e. LH or FH)					

E1- External Factors	1	2	3	4	5
1. Near to commercial area					
2. Near to public services - hospitals					
3. Near to public services - post office					
4. Near to public services - entertainment					
5 .Near to public services - transportation					
6. Near to public services – place of worship					
7. Near to education - schools, preschool					
8. Near to workplace					
9. Environmental quality - far from any pollution such as noise and air pollution					
10. Security at the housing area - gated and guarded arrangements					
11. Traffic congestion at the housing area					
12. Density of the housing area					
13. View of the housing area - greenery view, landscape or water elements					
14. Exterior condition of the house/Parking/Fencing/ Front yard/ Backyard					
15. Availability of waste management					
16. Safety Level					
17. Theme/Concept of the housing area					
18. Availability of child care					
19. Electrical supply					