COMFORT FACTORS IN LOW COST HOUSES: CASE STUDY AT BATU PAHAT, JOHOR MALAYSIA.

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ABSTRACT

Comfort is a physical condition, a feeling of contentment or a sense of well-being. Lack in comfort remains a major problem for most, especially in low cost houses. Insufficient space, indoor environmental qualities, environmental facilities, affordability of the houses and accessibility to social facilities are part of the major contributing factors to lack in comfort which can have adverse effect on the quality of life. The objectives of this research includes, evaluating the current housing policies in Malaysia in relation to the physical and social aspects of sustainability, identifying how the physical and social aspect of the building affects the residents comfort and identifying the relationship between the physical and social aspects of the building as it relates to sustainability. The methodology adopted for this research includes library study, interview and questionnaire design. Random sampling method was used in selecting the respondents, which consists of a government official, 6 practicing architects and 215 low cost housing inhabitants. Findings from this research show that although the government policies are being implemented, low cost houses are still lacking both in quality and quantity. Low cost housing inhabitants were fairly satisfied with the houses they live in as it relates to the social and physical aspects of their building. It also shows that to achieve sustainability in low cost housing, prospective house owners should be involved in the planning stage of the buildings. It is important to improve stakeholders' collaboration as it leads to better housing performance. This study may improve key participants attention to low cost housing inhabitants needs and ensure they are integrated in the housing policies.

ABSTRAK

Kekurangan keselesaan masih menjadi masalah utama terutamanya di kawasan perumahan kos rendah. Kekurangan ini adalah disebabkan oleh ruang yang tidak mencukupi, kualiti persekitaran dalaman, kemudahan alam sekitar rumah-rumah tersebut dan akses kepada kemudahan sosial yang boleh memberi kesan yang negatif kepada kualiti hidup. Objektif kajian ini termasuklah mengenalpasti dasar-dasar perumahan di Malaysia, mengenalpasti bagaimana aspek fizikal dan sosial bangunan berkaitan untuk keselesaan penduduk dan mengenalpasti hubungan di antara aspek-aspek fizikal dan sosial bangunan itu. Kaedah kajian yang digunakan termasuklah kajian perpustakaan, temu bual dan reka bentuk kualitatif. Responden kajian terdiri daripada pegawai kerajaan, enam arkitek dan seramai 215 orang penduduk rumah kos rendah. Hasil daripada temu bual dengan pihak kerajaan mendapati bahawa walaupun dasar-dasar kerajaan telah pun dilaksanakan, rumah-rumah kos rendah masih mengalami masalah kekurangan dari segi kualiti dan kuantiti. Hasil kajian mendapati bahawa semua responden tidak begitu berpuas hati dengan keadaan rumah yang dihuni kerana ia berkaitan dengan aspek-aspek sosial dan fizikal bangunan mereka. Hasil kajian juga menunjukkan bahawa perumahan yang disediakan melalui skim perumahan kos rendah mempunyai hubungan dengan aspek-aspek reka bentuk dan penyertaan bakal pemilik rumah. Ia juga menunjukkan bahawa untuk mencapai kemampanan dalam perumahan kos rendah, bakal pemilik rumah juga perlulah melibatkan diri dalam peringkat perancangan bangunan. Perbezaan yang signifikan juga dikenalpasti dalam ciri-ciri sosio-ekonomi penduduk dan tahap kepuasan responden serta bilangan rumah yang mencukupi. Cadangan kajian ini adalah dasar perumahan perlu menitikberatkan faktor keselesaan dalam reka bentuk rumah-rumah kos rendah dan mewujudkan reka bentuk yang mudah disesuaikan supaya dapat memaksimumkan keselesaan penduduk rumah-rumah ini

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LIST OF ABREVIATIONS

MDG	-	Millenium Development Goals
LCH	-	Low Cost Housing
WCED	-	World Commission on Environment and Development
REHDA	-	Real Estate And Housing Developers' Association
NEP	-	New Economic Policy
IAQ	-	Indoor Air Qualities
WHO	-	World Health Organisation
OECD	-	Organization for Economic Cooperation and Development
SPSS	-	Statistical Package for Social Sciences

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Increase in urbanization has being perceived extensively as a significant symbol of economic prosperity which has being sought by many countries. Due to this increase however there has being extreme anxiety in the housing of this rather huge population. As a result of the rapid growth experienced in most countries and due to the importance the quality and availability housing plays in the lives of its inhabitants various governments have searched for ways of providing shelter especially for the low income earners of their country. This is in line with the United Nations Universal Declaration of Human Rights 1948 which states that "everyone has the right to a standard of living adequate for the health and well being of himself and of his family including food, clothing, housing, medical care and necessary social services" (Choguill, 2007). This housing provision is known in different countries as different schemes. To some it is low cost houses and some others it is affordable housing.

According to Disney (2007), well practiced measurement of affordable housing is that housing cost should be less than 30% of household income of the occupants in the bottom 40% of household incomes. Affordable Housing Management Methods (2007) suggests that affordable housing should be defined as a kind of security housing supported by government's preferential policies, which is restricted from the perspective of areas and sale price to be provided to the urban low-income people with housing difficulty and is built in compliance with normal construction standard. Queensland's Department of Housing (2007) describes affordable housing as fitting the household needs and as well located in relation to

services including employment, transport and the cost for housing. In Malaysia low cost housing refers to the houses with selling prices fixed by the government as ranging from RM25, 000 to RM42, 000 per unit depending on the location of the development (Abdullahi & Aziz, 2011a).

1.2 Background of study

Housing besides being a very valuable asset, has much wider economic, social, cultural and personal significance (Kajimo & Evans, 2006). Despite this importance however most countries are yet content with the provision of shelter to the various economic groups that make up its general population. Housing issues still remains a major discussion in several global summit such as the 1992 Rio-de Janeiro summit on environment and development, the 1996 Habitat Summit at Istanbul, the 2000 New York, United Nations Millennium development Goals (MDGs) summit, 2002 World Summit in Johannesburg and the 2005 La Havana, Un sustainable cities Documentation of Experience Program (Oladujoye, 2005; Un-Habitat, 2010, UNDPI, 2008).

Over the last few decades, there has been an increasing focus on how to build a sustainable society (WCED, 1987). Increasingly significant also is the desire for a clean environment, preservation of nature and concern for the welfare of future generations. To be classified as sustainable, a house must stay within the absorptive capacity of the local and global waste absorption limits; use renewable and replenishable resources sustainably, meet basic human needs and comfort levels, are economically viable and socially acceptable, improve socio-economic equity, and be technologically feasible (Choguill, 2007). Several policies have being created to ensure that the society is directed towards sustainability. It seems only natural that such policies are targeted towards areas where they can make the most difference. Certainly, housing is one such area, partly because its current substantial impact on the environment may be lowered using existing and relatively cheap measures and partly due to housing being highly durable goods that will impact the environment for many years to come.

Housing undoubtedly plays an important role in environmental sustainability, physical and economic development, employment generation as well as wealth

creation. In line with the importance housing plays in the life of people, coupled with the need for sustainable solution to the growing housing challenges; most governments in developing countries are engaging in new housing policies, programs and strategy that seeks to meet demands of market-driven economies in addressing housing needs of their people (Sengupta & Sharma, 2008). In Malaysia efforts are made by the government to ensure sufficient provision of housing especially for the low income group in the urban areas through the establishment of different housing development policies in the various five year Malaysian plans and the second outlined perspective plan (OPP2) (1991–2000). Low cost housing is a mandatory section of housing development in Malaysia abided by housing developers to provide 30% of their total housing development for low cost (Aziz, Hanif & Yahya, 2007). This is to ensure that more low cost houses are available for the inhabitants. The policy is imposed through administrative procedures that forces developers to provide a portion of development for low cost housing in order to gain approval by local authority (Aziz 2007; REHDA, 2008).

Although the number of low cost housing in Malaysia has increased in quantity especially after the involvement of private developers, concerns over the livability of these flats grow as studies on residential preference and satisfaction repeatedly point to the importance of such low cost housing design to be more sensitive to the social implications of physical planning (Paim & Yahaya, 2004; Salleh & Yusof, 2006; Salleh, 2008). This raises the question of how comfortable the people are with the provisions made in these buildings. The facilities provided seem to fall short of their needs and aspirations.

The provision of housing with better services leads to community growth and stability, improved health conditions, increased safety and education among the citizens which ultimately leads to the development of a nation. Most of individuals' working time is spent in buildings and most of our leisure time is spent at home or close by in the neighbourhood. Such significant importance deserves an examination of how houses can become more sustainable.

1.3 Problem statement

Being uncomfortable can be described as a state of lacking what your body needs. The way inhabitants feel about where they live has being known to be a contributing factor to their health and state of well being. Public housing as a social intervention program is designed according to peoples 'perceptions of what seems to work based on practitioners' assumptions and logical reasoning (Birckmayer & Weiss, 2000).

The inability of construction projects to achieve user's satisfaction is one of the major housing delivery problems. Although finding out which specific factors are important to user satisfaction for product improvement has become an acceptable norm and there exists increasing recognition that customers are important in assets management, housing producers have been unable to effectively capture users' habits, traditions or reflect these in the product processes resulting to mismatch in product performance with user objective (Othman, 2008).

Various researches on housing in Malaysia mainly focused on housing satisfaction, which is still limited and fragmented. The studies either focused only on the dwellings and neighbourhood facilities and environment (Salleh, 2008) or linking types of housing project (low cost, medium cost and high cost), price of house and length of residency with satisfaction. Very few studies have been carried out relating to the combined effect of the various environmental parameters and also other predominant factors that affects comfort such as the social and economic aspects. Therefore this study hopes to fill this gap by looking at a combination of the various factors which influences comforts in houses from the user's perspective

According to Kwong, Adam & Tang (2009), conversely indoor environmental comfort comprises of four research fields which includes thermal, visual, acoustic and ergonomic comfort. A reflection of residents' reaction towards their living environment is in their satisfaction towards the housing environment, in this context; environment does not merely refer to the physical and environmental components of housing but also covers social factors and economic conditions (Kellekci & Berkoz, 2006).

Many opportunities abound to reduce the problems of comfort over a facilities life time. These however can be achieved if sustainable values are

introduced from the design stage. To achieve such improvements in the buildings however the perception of the inhabitants should be considered.

1.4 Research question

As a result of the shortcomings identified in the literature and in practice, this research will examine the following research questions:

- What are the physical or social elements relating to sustainability measures which are included in the the housing policy?
- What are the physical and social aspects of the building relating to sustainability that affects the comfort of the inhabitants?
- What are the similarities between the physical and social aspect of the building as it relates to sustainability?

1.5 Aim of the study

This research aims at understanding the problems of low cost housing inhabitants relating to comfort to enhance the building performance by identifying the hindrances and enabling factors to the achievement of the users precise expectations which are valuable as a foundation on which improved houses can be based.

1.6 Objectives of study

In order to achieve the research aim, three key objectives were set. The objectives are to:

i) Evaluate the current housing policies in Malaysia as it relates to the physical and social aspects of sustainability.

ii) Identify how the physical and social aspect of the building affects the residents comfort.

iii) Identify the relationship between the physical and social aspects of the building as it relates to sustainability.

1.7 Significance of the study

The study is expected to be of benefit to the housing industry and the inhabitants of low cost housing because; it identifies the essential client's expectations in low cost housing as well as the factors hindering these expectations.

1.8 Scope of the study

The scope of this study will be limited to only low cost housing projects in Batu Pahat, Malaysia. The focus will be identifying the comfort level of respondents as it relates to the physical and social aspects of the low cost housing. It shall also identify the current level of sustainability in low cost housing development in Batu Pahat as it relates to the physical and social economic aspect of it.

1.9 Organization of the thesis

The thesis format follows the logical steps of establishing the research questions, developing the methodology, gathering and analyzing data and drawing conclusions. The thesis is organized into six chapters as follows:

Chapter 1 discusses the background of the research by highligteing the research problems, research purpose, research objectives and justification and thesis organization. It includes the background of studies, the problem statement, aim of studies, objectives of study scope of study, organisation of study and the conclusion.

Chapter 2 gives a background introdution on housing in general, it examines literature and studies carried out on sustainable housing the characteristics of a sustainable house, overview of sustainable housing in developing countries, sustainable housing in Malaysia, the housing industry in Malaysia, low cost houses in Malaysia the problem associated with the low cost houses, a theoretical framework of the topic, comfort as it relates to quality of life and finally the conclusion of the topic. Overall, this chapter identifies the research gap, which justifies the need for this study.

Chapter 3 describes the methodology used in carrying out the research describes the research methodology in detail including: the research methodology;

data collection methods (namely questionnaire and interview), research information; selection of participants case projects; research instrumentation; data analysis and validation of results; and finally, guideline formulation.

Chapter 4 talks about the first objective for the purpose of this reserach which is identify the current housing policies in Malaysia.

Chapter 5 this will also look into the second objective and third obejective which will identify how the physical and social environment of low cost housing in Batu Pahat relates to sustainability and identify any relationship between the physical and social aspects of the building as it relates to the residents comfort.

Chapter 6 re-examine the research objectives and propose conclusions regarding the research result based on the respective research questions, the contributions to the body of knowledge and its implications for both the research community and low cost housing. Finally, recommendations for future research are proposed.

1.10 Summary

In this chapter the foundation for the thesis was established. The research background was first introduced and explains affordable housing in the Malaysian context and as adopted in this research. The aim and objectives of the research were established as well as the scope and method of study. Outline of the thesis chapters were also discussed. On this basis, the study continues with a detailed explanation of the research and development processes.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter presents, a review of recent literature related to the research objectives set out in section 1.6. The literature review is interpreted from findings of preliminary literature study, work and thoughts of experts and practitioners within the subject field. The purpose is to achieve the overall objectives based on the specific points of interest. Literature review is particularly important as it helps in identifying existing gap in literature, which this study attempts to fill.

2.2 Housing

The United Nations Centre for Human Settlements (UN-Habitat) wrote in its *Global Report on Human Settlements* in 1995 that "homelessness is a problem in developed as well as in developing countries". The Report noted that poor urban housing conditions are a global problem, but conditions are worst in developing countries; and that today, 600 million people live in life and health threatening homes in Asia, Africa and Latin America. The fight for housing as a basic need has increased progressively and as the human race advances in numbers and cultural diversity it has moved beyond simply providing shelter and protection to the consideration of sustainability. Housing can provide a vehicle to aid in developing elements of community; creating sustainable communities in a resource efficient manner (Guy & Moore, 2005) and reflecting relationships between the individual, family and community (Mallett, 2004).

2.2.1 Housing and inhabitants needs

Certainly shelter, social needs, a response to special needs, social interaction, comfort and security are some of the important drive for housing. According to Sweta Misra (1996) the importance of housing was universally recognized from the dawn of history.

With the advancement of knowledge and civilization however, housing perception experienced an incredible paradigm shift and has more importance in the present world than it had in the past. The effect it has on the overall policy of the entire nation was also identified. This was illustrated in Figure 2.1.

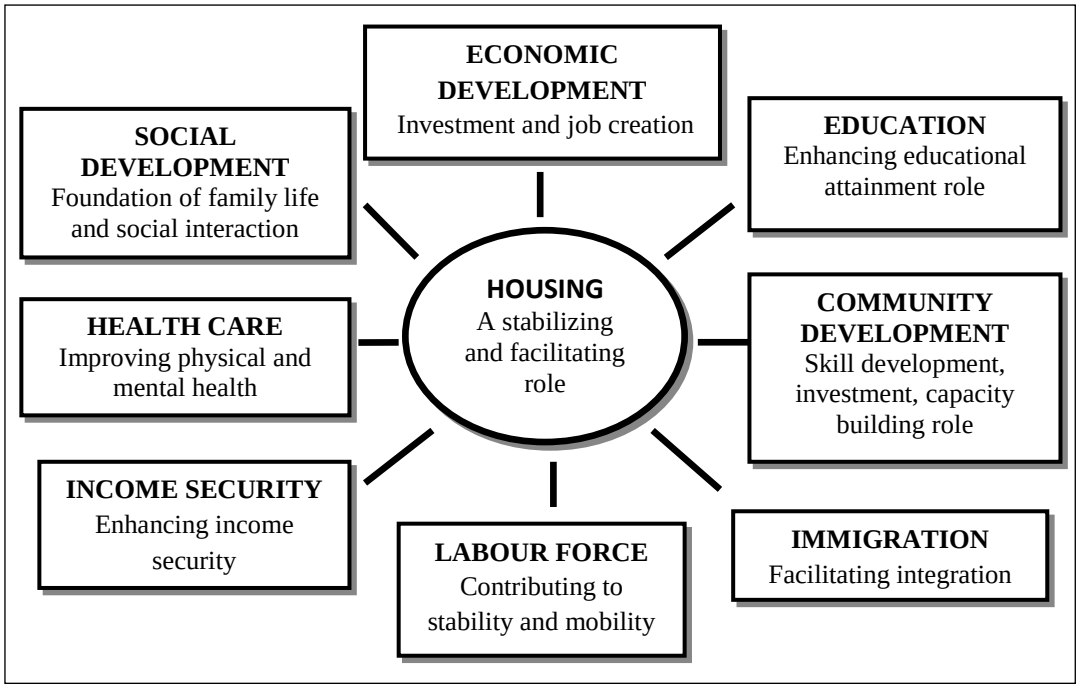

Figure 2.1: The importance of housing to the success of other policy and program areas. (Myers, 2008)

In view of the various contributions housing has in individual's life, the homeowner of tomorrow should be able to expect a modified solution that permits changes and upgrades over time. Home design and facilities should easily be improved to help manage energy and resource conservation, health, communication, and learning within the home. This should be possible at high quality and reasonable cost.

2.2.2 Housing condition: quality and adequacy

The state of a house determines the quality of life the inhabitants of such building will have. The vital role access to good quality housing plays in improving public health, quality of life, combating exclusion and discrimination as well as strengthening social cohesion (Kahlmeier *et al.,* 2001; Aliu & Adebayo, 2010) underscores the need to upgrade the condition of public housing in many developing countries. In the following sub-sections, quality and adequacy will be discussed to understand the importance it plays as it relates to human comfort.

2.2.2.1 Quality

Quality has been defined as conformance to requirements, not as goodness "in line with the definition of adequate housing (Un-Habitat, 2010) features such as durability of construction materials, structural soundness, spatial adequacy, and availability of basic services such as water, sewage disposal and electricity, location in an area with good connections with other parts of the city and infrastructure and secured tenure are considered to be indicators of good quality housing. Put differently, housing quality refers to those highly valued attributes that housing possesses that makes it suitable in meeting occupants' needs. Quality housing feature includes physical and non-physical characteristics. The physical characteristic comprises of location, housing design, types of housing and the residents comfort level. On the other hand, non physical characteristic comprise of the aspect of socio economic, people mixture and level of crime of that area (Aulia, 2006). Braubach (2007) indentified personal characteristics (age, gender and socioeconomic status) as having marginal influence on housing quality judgments .

However to date, the actual process of setting new home quality requirements has rested with the builder. Love, Tse & Edwards (2005) concluded that one of the most perplexing issues that the construction industry faces is its ability to become quality focused. This makes achieving quality difficult especially for the inhabitants of the building.

2.2.2.2 Adequacy

Adequate housing was defined as "adequate privacy and space, physical accessibility, adequate security, secured tenure, structural stability and durability, adequate services and infrastructure, suitable environmental quality and health related factors*"* **(**The HABITAT, Conference in Istanbul 1996). A house is considered adequate only if it is safe, secure and affordable with access to suitable facilities for daily living (such as washing, cooking and heating), and has sufficient living space.

Various factors have been known to have influence on housing. Habib *et al.* (2009) indicated that a number of studies have identified housing conditions, overcrowding, access to basic infrastructure and services as key factors affecting adequacy of housing. Viewed from another perspective, Domanski *et al*. (2006) pointed out that socio-ecological characteristics of neighborhoods such as spatial composition, access to recreational areas, local infrastructure and facilities, the degree of pollution and level of social problems are vital determinants of qualitative adequacy of housing. Obeng-Odoom (2009) identified both socio-economic variables and consumer preferences as having direct association with housing adequacy.

With increase in standard of living, individual's choice of identity, culture and sense of belonging is highly reflected in their housing choice. Since preferences differ amongst individual the concept of adequacy will also be different. It is therefore important that the housing stock reflects the wishes of the population so as to enable as many as possible to find housing suited to their needs. This is essential owing to increasing variation in family and lifestyle patterns.

2.2.3 Housing values and preferences

A person's opinion of a place depends on how the place is perceived as well as the socio-economic characteristics of the individual. Coolen *et.al*. (2002) defined housing preference as value-oriented and goal-directed activities which are influenced by motivations for the choice taken for a certain characteristic of housing conditions. The need of current residents are diverse and includes safety, physical and mental health, privacy, entertainment, education, socializing, comfort,

adaptability, access to workplace, transport (including bicycle), utilities (clothes drying spaces), availability of garden space, access to foodstuffs and other commodities and of course affordability (Tuohy, 2004). Several researches however identified some of the factors influencing these needs.

Canadian Housing Observer (2003) points out that housing needs and preferences are influenced by the characteristics of individuals in a population, particularly by age, ethnicity and family status. Arifin & Dale (2005) discovered that the main factor that influenced housing choice were not related to housing price. According to Foster *et al*. (2011) housing location and neighborhood quality are also important. Consequently perception of a house or environment by an individual may be of having high quality or having lower or no quality.

Winston (2009) also supported this claims in his findings when he stressed that the important aspect for housing development that needs to be emphasized includes elements such as the location, construction and design, dwelling use and regeneration and cultural factors which influence the primary requirements of housing. Incorporating these needs in low cost housing is therefore important to ensure there sustainability.

2.3 Definition of terms

Definitions of terms aims to gain a clear understanding of the concept of comfort and sustainability and its relevance in the housing industry, there is a need to find a summarizing and suitable definition of the terms as they relate to this study. A brief definition as it relates to the research is given below.

2.3.1 Comfort

In the housing context, a definition of comfort is suggested as a physical condition, a feeling of contentment or a sense of well-being (Chappells & Shove, 2005). Comfort is the result of the interaction between all senses (Dubois, Demers & Potvin, 2007). It is also influenced by architectural and human factors (Parpairi, 2004).

2.3.2 Low cost housing

These are houses that are built solely for the purpose of meeting the housing needs of the low income earners. Lefebvre, Sturrock & Kipfe (2009), defined low cost housing as affordable housing for poor or low-income individuals and families. This does not necessarily refer to individual houses and it also includes rental housing. In Lefebvre's definition reference was not only made in relation to the ownership of a house constructed for low income earners or seemingly poor, it also included rental of a house in relation to income, the bottom line being as long as it is affordable. Kellekci & Berkoz (2006) however defined low cost housing in plain terms as provision of housing which caters to the minimum requirements of masses within their income capabilities, without sacrificing the quality of construction.

2.3.3 Sustainable building

Sustainable building is often referred to as "green" or "environmentally sound" building. Some also see it as "timeless". Sustainable building is about doing it right the first time, by keeping an eye on short and long-term consequences. Boyko *et al* (2006) described it as a development that reaches or maintains a sustainable state. This in order words a building that can last for a long time through thick and thin. It is the guiding principle for international environmental policy and decision-making in the twenty-first century (Braimoh & Osaki, 2010).

2.4 Sustainability and housing

Rapid urbanisation is expected to continue raising demand for housing. Housing perceptions has undergone a remarkable change over the years. The desire for a clean environment, preservation of nature and concern for the welfare of future generations on the other hand is also important. To achieve this desire there is an urgent need to balance urban planning, design and construction. This realization brought to limelight the concept of sustainability.

Numerous researches have been carried out to investigate a variety of topics related to sustainability and housing. Tosics (2004) stated that housing is linked to

the sustainable concept in a number of important ways, for example; various aspects of the location, construction, design, management/maintenance and use of housing.

Sustainability has being defined in different ways by different researchers. Although the various definitions of sustainability are made to suit various researches and societies, one thing they still have in common is that they are all in line with the Brundtland definition which is defined as "a development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED 1987). All definitions agree that it is important to consider the future of the planet and there are many ways for humans to protect and enhance the earth while satisfying the needs of various stakeholders (Boyko *et al*., 2006).

Although there are many definitions of sustainability it is generally agreed the economy, environment and social equity are three prime values of sustainability (Chan & Lee, 2009). According to Gibson *et al.* (2005), traditional concepts of sustainability are depicted as circles of sustainability with a certain ordering; economy prevailing over society, prevailing over ecology or the other way round. Adams (2006) describes sustainable development in terms of economic growth, environmental protection and social progress known as the core of mainstream sustainability thinking, drawn in a variety of ways as pillars, concentric or interlocking circles of sustainable development. These aspects need to be considered, incorporated, and improved to achieve a desired level of sustainable development. These aspects are illustrated as the three pillars of sustainable development in Figure 2.2.

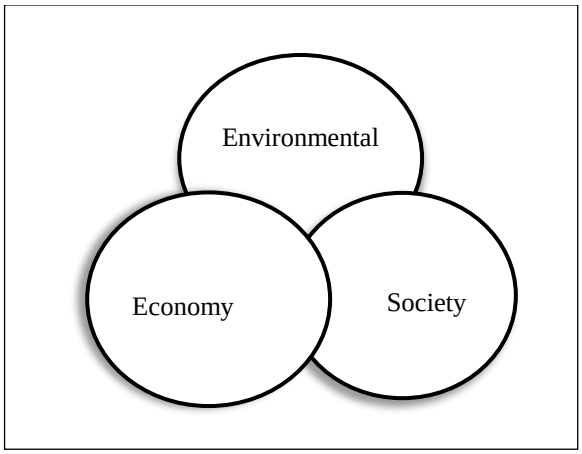

Figure 2.2: The mutual-reinforcement model of triple-bottom-line sustainability (Priemus, 2005)

Due to its lifespan and the effects it has on human's life, housing development can be considered as a pioneering step for sustainable development. While housing is one of the best ways to achieve the goals of sustainability, Winston & Eastaway (2008) however, concluded that housing is one of the more neglected aspects of sustainability despite its potential to make a positive contribution. It is, therefore important to adopt methods to ensure that new housing projects are sustainable.

2.4.1 Sustainable affordable housing

A sustainable house is cost efficient over time, comfortable, cheap to maintain and complements our unique environments (Queensland Government, 2004). For housing that make up a great proportion of building however, sustainable housing could be defined as housing practices, which strives for integral quality (including economic, social, and environmental performance) in a broad way (John, 2005) Sustainable housing offers a better environment which encourages residents to stay at home longer among friends and families and neighbor in the social context. Abidin & Jaapar (2008) mentioned that the principles applied in sustainable housing, includes concern for people by ensuring that they live in good health, productive and in harmony with nature.

The availability of decent and affordable housing is said to be an important factor in contributing to the sustainability of communities (HM Government 2005; Maliene, Howe & Malys, 2008). Given the long life-spans of buildings, it has the potential to impact the natural environment and ecology well into the future, locally and globally (CIDB, 1998; du Plessis, 2002; IPCC, 2009). Savaya, Spiro & Elran-Barak (2008) noted that planning for program sustainability is a key factor in social programs. Evidence in literature however shows that this aspect of social programming is lacking in many developing countries (Abdellatif & Othman, 2006). This is attributed to a number of factors such as weak political institutions, social and economic structures and lack of effective accountability and governance mechanisms (Sarker & Azam, 2011). It therefore will be necessary to change the way this activities are undertaken. With this idea, it increases the institutions understanding of the sustainability concepts throughout the lifetime of a housing project.

The field of sustainable development can be conceptually broken into three constituent parts: environmental sustainability, economic sustainability and sociopolitical sustainability. Table 2.1 gives a brief explanation of these factors for a better understanding of them.

Table 2.1: Sustainability factors (McConville , 2006)

Economic Sustainability		Implies that sufficient local resources and capacity exist to continue the project in the absence of outside resources.
Environmental Sustainability		Implies that non-renewable and other natural resources are not depleted nor destroyed for short-term improvements.
Social Sustainability	Socio-Cultural Respect	A socially acceptable project is built on an understanding of local traditions and core values.
	Community Participation	A process which fosters empowerment and ownership in community members through direct participation in development decision-making affecting the community.
	Political Cohesion	Involves increasing the alignment of development projects with host country priorities and coordinating aid efforts at all levels (local, national, and international) to increase ownership and efficient delivery of services.

2.4.2 Objectives of sustainability

Sustainable habitat can he achieved through promoting housing development by balancing social progress, enhancing economic growth, propagating innovative technology along with conserving and protecting the environment and natural resources for future life and development. Sustainable-affordable housing development can thus be conceptualized as a combination of four significant aspects of sustainability, namely socio-cultural, economic, technological and environmental sustainability (Fig. 2.3).

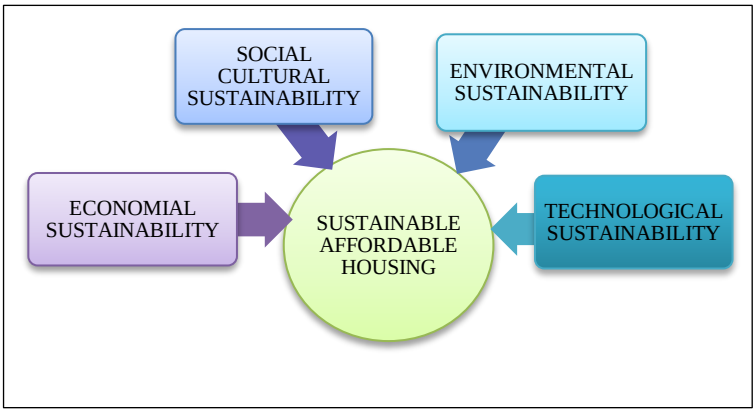

Figure 2.3: Objectives of sustainable affordable housing

2.4.2.1 Economical sustainability

Economic sustainability entails cost savings at construction, in running costs, in living costs, in long-term maintenance, in future modifications, good resale value and cost efficiency to the community. A major concern that is receiving more attention, as building owners investigate the economics of property management, is the cost of building operations over the life of a building (Dunk, 2004). Design that takes care of orientation, ventilation, micro and macroclimate, and materials, generally has lower maintenance and ongoing cost (Chan & Lee, 2008). Instead of merely looking at the materials component in terms of cost to design and build, owners can broaden their perspective to include operations costs, maintenance costs, repair costs, replacement costs, and disposal costs (Dunk, 2004). It is, therefore, important to adopt robust and transparent methods to evaluate and rank projects to ensure that new projects are prioritised objectively.

When taking into account economic affordability, one should not only look at the price of the house, but other expenses associated with living in that house, for example services, rates and taxes. The elements which make up economic sustainability is illustrated in figure 2.4 below.

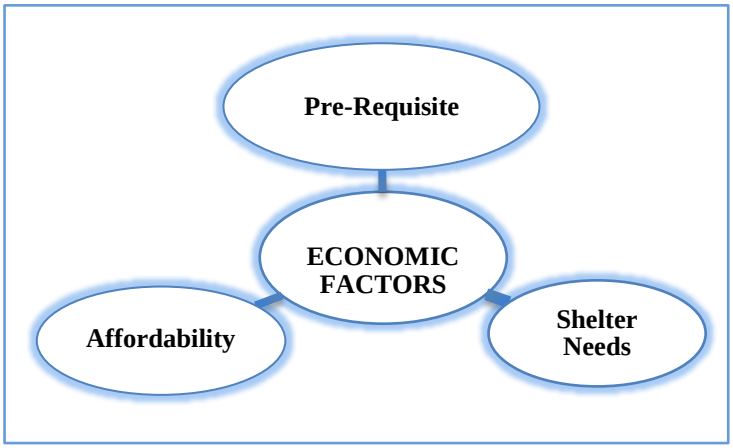

Figure 2.4: Economic sustainability

2.4.2.2 Environmental sustainability

Environmental design is of utmost importance in ensuring that the housing development is adjusted to the surroundings, is accessible for service delivery and conducive for human habitation. The Victorian Government identifies environmental sustainability as: "the ability to maintain the qualities that are valued in the physical environment" (Commissioner for Sustainability, 2006). These can be summed up under feasibility and functionality, strength, environment friendliness, durability and reliability. This is illustrated in fig 2.5 below.

As highlighted by Rosenberger (2009), the most significant matter in environmental sustainability is maximizing the use of recycled material and renewable resources whilst minimizing pollution from energy consumption. Damage to sensitive landscapes, including scenic, cultural, historical and architectural, should be minimized. In view of these a guiding matrix was introduced to assess the environmental sustainability at various stages of the building lifecycle. This is shown in Table 2.2

Table 2.2: Guiding matrix for assessment of environmental sustainability (UN-Habitat, 2011)

Stage Of House Lifecycle	Examples Of Environmental Sustainability Considerations
Planning stage	Impact of the planned site on the local environment; relationships with the city; quality of the local built environment; mixed-use and density; poly- centricity; infrastructure; public transport; green areas; environmental hazards.
Building design	Considering embodied energy and resource utilisation; enabling energy and water efficiency by design; integrating district heating and micro-generation; sustainable waste management; green roofs; robustness and resilience; future-proofing; possibility of upgrading; shaping of lifestyles.
Construction	Safe, environmentally-friendly, local affordable material; minimization of environmental impact from building activity.
Operation	Energy performance; air-conditioning, air quality; pollution by residents and impact of the local pollution on residents, water use and water management, water recovery; comfort and hygiene of homes; quality and energy efficiency of the local infrastructure and transportation; property maintenance and management; waste management and recycling; greening the area; natural hazards.
Refurbishment	Choice of refurbishment material; energy efficient design; disturbance of the environment; management of construction waste.
End of life	Demolishing or reusing; recycling of building components; management of construction waste.

From the table it suggests that for environmental sustainability to thrive it's important to introduce its values at every stage of the buildings life cycle. Opportunities for people to have a home that meets their aspirations however, should correspond with protecting and enhancing the environment, both for the enjoyment of residents presently and to ensure a strong legacy for the future.

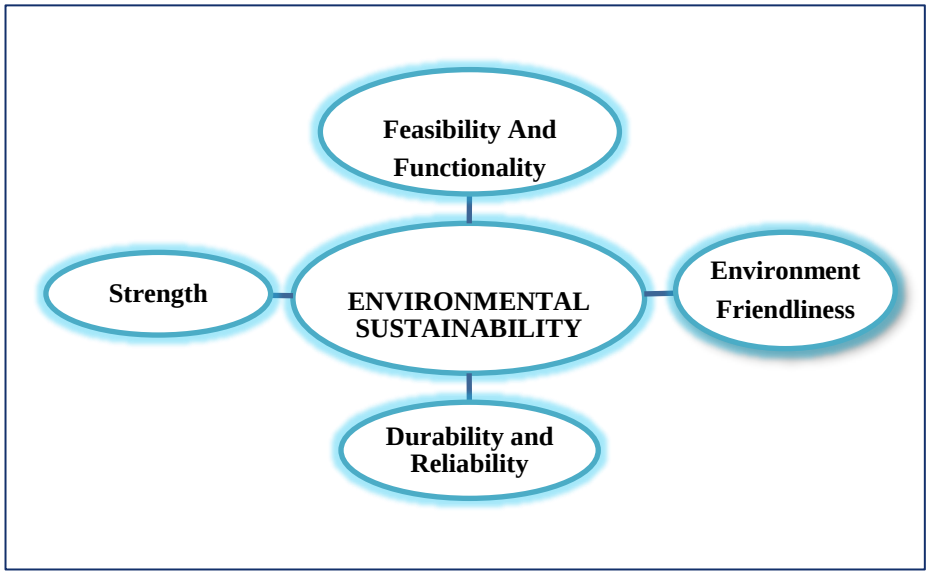

Figure 2.5 Environmental sustainability

2.4.2.3 Socio-cultural sustainability

The elements of social sustainability are design for flexibility, comfort, safety and security. Social sustainability is improvement and maintenance of current and future well-being and it reduces social inequality and improves quality of life (Chan & Lee, 2007). Social and cultural factors are strongly interdependent. They often interlock and are sometimes indistinguishable (Chiu, 2004). Sustainable housing should respond to the socio-cultural needs and practices of the beneficiary households and communities. The criteria for assessment of social sustainability in housing are based on three general principles: affordability, wellbeing and inclusion.

Chan & Lee (2008) argued that form of development affects the micro climate of areas in terms of temperature, relative humidity, air quality, lighting level and ventilation flow, which affects human comfort. Hence, social sustainability is the process that addresses the relationship between society and built environment (design and density) and quality of life in neighborhood setting. These are illustrated as the elements of social sustainability in Figure 2.3.

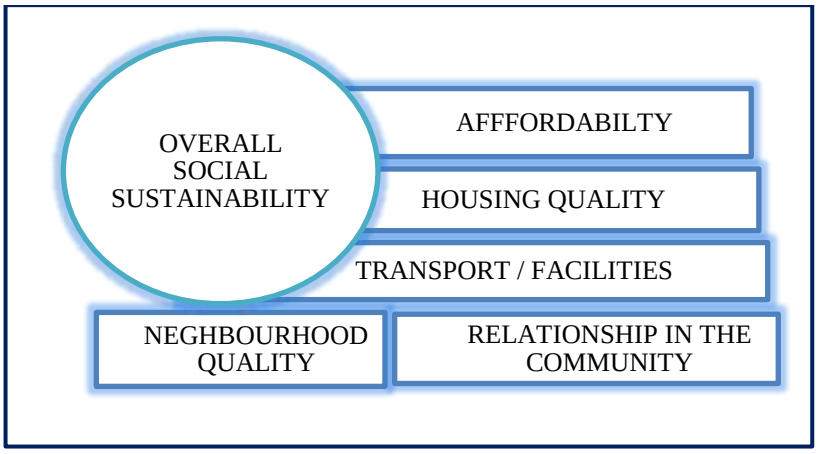

Figure 2.6: Socio-cultural sustainability (Ancell & Thompson-Fawcett, 2008)

Achieving the social sustainability of housing requires sensitive and sensible design. Project design that balances individual and shared spaces and also provides the right balance between privacy and connectedness is vital in the design of low cost housing.

2.4.3 Benefits of sustainable building

Various housing policies have being formed to effect sustainability in buildings. These policies are based on the three aspects of sustainability: environmental, social, cultural and economy. These emphases in current research are illustrated in Table 2.3.

Table 2.3: A multi-scale framework for sustainable housing policies (UN-Habitat 2011)

	Macro (National)	Meso (Region, City)	Micro (Neighbourhood, Household)
Environmental dimension	• Housing to support climate mitigation and adaptation efforts. • Mainstreaming green housing practices and innovations. • Ensuring energy and resource efficiency in the building industry. • Integrating national housing and energy systems	• Achieving good location and density for residential areas and access to infrastructure. • Serviced land in environmentally safe locations and green areas. • Protection of ecosystems and biodiversity. • Promoting sustainable and low carbon urban infrastructure, public transport and non-motorised mobility, energy systems. • Waste management and recycling.	• Ensuring energy efficiency, micro/generation, water and resource efficiency. • Green design, using sustainable local construction and materials. • Sanitation, preventing hazardous and polluting materials. • Affordable use of resources. • Improving resilience and adaptation of homes.
Social dimension	• Ensuring affordable, decent and suitable homes for all, including disadvantaged groups. • Developing social housing provision. • Promoting choice and security of tenure.	• Providing community facilities, preventing segregation and displacement. • Regenerating and reintegrating 'neglected' areas into regional, urban fabric. • Ensuring infrastructural integration of housing into wider areas. • Upgrading inadequate housing and slum areas.	• Providing community facilities, preventing segregation and displacement. Regenerating and reintegrating 'neglected' areas into regional, urban fabric. • Ensuring infrastructural integration of housing into wider areas. • Upgrading inadequate housing and slum areas.
Cultural dimension	• Promoting links between housing and knowledge-based and cultural economies. • Promoting traditional, indigenous and local knowledge (including of relevance to sustainable resource use, energy efficiency and resilient building techniques). • Protecting cultural heritage	• Promoting urban creativity, culture, aesthetics, and diversity. • Shaping values, tradition, norms and behaviours (e.g. in relation to energy use, recycling, communal living and place maintenance). • Protecting housing heritage and familiarity of city (e.g. preventing unnecessary social replacement/ gentrification or complete redevelopment	• Culturally responsive settlements and house planning and design. • Improving aesthetics, diversity and cultural sophistication of the built environment and residence. • Helping community creativity (i.e. via amenities; affordable sporting, cultural and entertainment facilities. • Assisting people's transition from rural and slums areas to decent housing or multifamily housing

	Macro (National)	Meso (Region, City)	Micro (Neighbourhood, Household)
Economic dimension	• Institutional capacities for sustainable housing markets and housing development. • Articulating housing productivity within national economic systems. • Improving housing supply and effective demand, stabilising housing markets. • Improving housing finance options. • Promoting innovations in housing. • Stimulating necessary technological developments for sustainable housing.	• Managing economic activities and growth by strengthening housing provision and housing markets. • Provision of necessary infrastructure and basic services to housing. • Providing serviced land for housing. • Strengthening entrepreneurship of communities, local building industry and enterprise. • Promoting local and traditional building materials and techniques. • Promoting regional and urban regeneration.	• Ensuring housing affordability for different social groups. • Providing adequate residences to raise labour productivity; ensuring housing is integrated with employment. • Supporting domestic economic activities and enterprise. • Promoting petty landlordism and self-help housing. • Housing management and maintenance. • Strengthening resilience and future proofing of homes.

The benefits of sustainable design are related to improvements in the quality of life, health, and well-being. These benefits can be realized as shown at different levels – buildings, the community, and society in general. These policies show that sustainability plays an important role in the development of a housing project and brings about numerous benefits.

2.4.4 Sustainable housing in Malaysia

The Construction Industry Development Board Malaysia (CIDB), which is a corporate establishment with the main function of developing, improving and expanding the Malaysian construction industry, has identified the environment and other sustainability-related issues as one of the top issues of the construction industry. In Malaysia although the government has improved efforts to achieve a sustainable society studies still shows there is still so much to be done in achieving this especially in low cost houses. Suzaini (2011) stated that to date there has been minimal research and development in the field of sustainable low-cost housing in Malaysia. Therefore, the need to bring forth low-cost housing into the context of mainstream sustainable development would be highly beneficial to the country's environmental, economical and social performance.

A study conducted in 2009 to investigate awareness level of the sustainable construction concept amongst developers in Malaysia concluded that little efforts are made to implement it, despite the rising awareness. The study also deduced that developers, as a majority, perceived sustainability was only about environmental protection without social and economy considerations within the construction industry (Abidin & Jaapar, 2008).

Commercial and residential buildings in Malaysia accounts for about 13% of energy consumption and 48% of electricity consumption (Salleh, 2008; Energy Comission Malaysia, 2008). The trend of installing AC systems is further expected to grow as it is proportional to the purchasing power of occupants (Zain-Ahmed, 2008). Shafii & Othman (2007) reveal that one of the major barriers holding back the development of sustainable building in Southeast Asia is the lack of awareness of sustainability issues in relation to profession. The survey conducted by Shari *et al.,* (2012) also reveals that the Malaysian building industry players have 'little' knowledge on sustainable building assessment, rating and labeling system. It is therefore important that government policies take this into account when initiating building policies to achieve the aim of building a sustainable society.

2.5 Housing policy in Malaysia

The growth of the population and specifically, the urban population has been tremendous in Malaysia. In 1957 the country's population was 7.3 million. However, the population has doubled to the figures of 13.3 million and 27.0 million by 1980 and 2008 respectively (Department of Statistics Malaysia, 2009; World Bank, 2010). Similarly, the size of the urban population has increased at the rate of 4.5% per annum and from the total population, the urban residents population has increased from 51% in 1991 to 55.1% in 1995 and by 2000, this proportion has risen to 61.8%; 67% in 2005 (Zin & Smith, 2005) and projected to reach 75% by 2015 (World Bank, 2010). These demographic changes are fundamentally the restructuring point of the New Economic Policy (NEP) that produces industrial expansion and rapid economic growth and that promoted the mass rural-urban migration, most especially among the Bumiputera, which accounts for two-third of the migrations (Agus, 2002). The government of Malaysia recognizes housing as a basic human need and an important

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