

Exploring Dimensions of Sustainable Housing Development: Results from a Pilot Study in Pulau Pangkor, Malaysia

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Pulau Pangkor (Pangkor Island) is a famous tourist destination located in the state of Perak, Malaysia, and it is also home to an increasing number of islanders. With 70% of the island still forested, most of the resident population is concentrated in pockets of housing development in Pangkor Town, Pasir Bogak, Sg. Pinang Besar, Sg. Pinang Kecil, Teluk Gedung, Teluk Nipah and Teluk Dalam. The challenge for the future is seen as bringing about sustainable development within the housing sector. This article aims to investigate the key factors that affect sustainable housing development on Pulau Pangkor through the use of sustainability indicators that have been earlier identified through the literature review. Primary data was collected through a questionnaire survey on selected households from six residential areas/villages. There are four dimensions of sustainability assessed, namely the physical, social, environmental, and economic dimensions of housing. The study found that all four dimensions are significant predictors for sustainable housing development. The physical dimension is the main predictor of sustainable housing development in Pulau Pangkor ($R^2 = 0.466, p < 0.05$), followed by the social, environmental and economic dimension. The research findings may be used by local officials to enhance the living conditions of the island residents through provision of sustainable housing infrastructure.

Keywords: Pulau Pangkor, housing, sustainable development, indicators

Introduction

In addition to the basic necessities of life such as food, water, air and clothing, housing is another basic element that must be provided at a satisfactory level before other advanced human needs can be achieved in line with Maslow's hierarchy of needs theory. This claim is also consolidated by the inclusion of subsistence and safety, among other related needs, by both Max-Neef (2009) and Maslow (2010). According to the

Oxford Dictionary, 'home' refers to a building for human habitation. On the other hand, housing no longer refers solely to homes that are physically and economically viable, but extends ever more beyond that. Housing is seen as a place to build a life and well-being in a fixed locality. Marcussen (1990) notes that housing contains the concepts of safety, love, peace and freedom.

In terms of land use, residential land use is the largest user of urban space; consisting of between 30 to 50 percent of built-up land in urban areas. In addition to dwellings, residential areas contain other facilities that support the day-to-day life of households, such as schools, shops, playgrounds, open space, community centres, and a circulation network for pedestrians and bicycles as well as transportation. Residential areas can be seen as micro-communities within the larger urban community. The challenge for planners is to design different types of living environments, providing choices for households with a variety of propositions of value, with a range of needs to satisfy and abilities of residents to afford such housing.

The function of residential areas is to support and meet the needs of the residents in ways that also further community goals such as environmental quality and efficiency in government service. Residential areas are required to relate spatially to each other, to the regional network of employment and commercial centers, and to the open space system. Residential areas integrate key elements in the system that works as follows (Richman & Chapin 1977; Richman 1979):

- Shelter, the basic unit for human protection and a key source of basic services, such as water, sewer, and electricity
- Security, providing a safe, stable and ordered setting free of danger from violence, criminal actions and other physical and psychological hazards
- Child-rearing, facilitating transmission of values through the family, neighbours, peer groups, community centres, schools and playgrounds and recreational spaces
- Symbolic identification, providing a sense of place, belonging, pride and satisfaction to the resident
- Social interaction, providing a basis for personal associations through social networks, organizations and physical facilities
- Leisure, providing recreation, entertainment, cultural and educational facilities and programs and open space
- Accessibility, providing access to employment, shopping and personal services required to maintain a household
- Public efficiency, minimizing public or societal costs associated with meeting the needs of households, including the costs of water and

drainage, garbage and trash collection, fire and police services, education and transportation

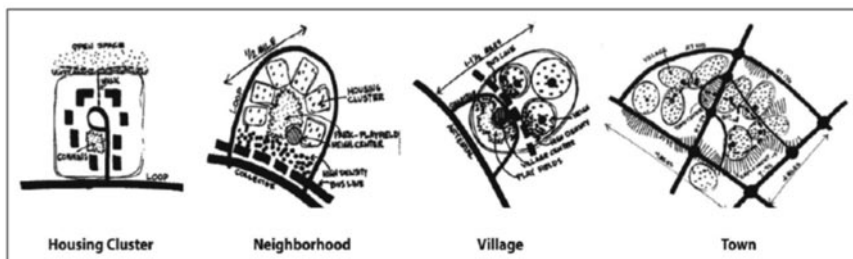
Planning initiatives in the past have emphasized the importance of formulating housing development strategies that can solve housing-related issues and problems. This article will discuss the conceptual approach towards sustainable housing development and focus on identifying indicators that can contribute to sustainable housing. Next, it will discuss the current issues pertaining to existing housing development as found on Pulau Pangkor. Based on a pilot study, the findings will assist decision-makers in identifying significant factors that influence the development of sustainable housing on Pulau Pangkor.

Literature Review

The fundamentals of designing sustainable housing development go back a long way in the planning literature, although different terminologies were then used. Perry (1929) suggested the idea of a neighborhood unit consisting of about one thousand to five thousand people, which has clear boundaries, contains pedestrian paths connecting a public elementary school and recreation facilities, and incorporates a connected open space system.

FIGURE 1

The Elements of a New Town: Aggregating to Form the Next Larger Unit (L to R)



Source: (Hoppenfeld 1967 as cited in Park & Rogers 2015)

A practical manifestation was developed in Columbia, Maryland, which opened in 1967 and has 10 self-contained villages, incorporating 33 neighborhoods containing several housing clusters (Figure 1). The facilities for mothers and children are located in the centre of the neighborhood. These facilities include a school, day care center, small shop, swimming pool or playground. A village contains two or three major neighbourhoods of approximately 640-1500 acres of land, with a population ranging from 10,000 to 15,000. A village is a physical community with a shared function and identity for residents, services and facilities

such as middle or high school, shopping centres and recreational facilities located across the village. A town has a town centre to serve 250,000 people with around 25,000 acres of land (Hoppenfeld 1967). The town would be more like a sub-district of a city, which could sustain itself with a business district, college site, and shopping facilities in the town centre. In summary, the hierarchical concepts (smaller to larger) of housing cluster-neighborhood-village-town form a nested system of spatial communities (Figure 1). The sizes of neighborhoods and villages are determined by the nature and size of commercial areas and community facilities to be located there (Hoppenfeld 1967).

The notion of sustainable development is the development process that takes place in a manner that integrates social, economic and ecological dimensions. Sustainable housing refers to “housing contributing to community building, social justice as well as economic viability at the local stage” (Morgan and Talbot 2000, 321). Sustainable housing development refers to both the development of buildings and the housing area layout. Thus, through the literature review of previous studies on the development of sustainable housing in other regions and countries, the framework of sustainable housing development has been developed. A set of indicators of sustainability has been identified and they are in turn grouped into four main dimensions of sustainable housing (Table 1). Sustainable housing development is influenced by factors comprising physical, social, environmental and economic dimensions.

Sustainability indicators should contain a number of important characteristics: (a) integrating – in that sustainability indicators integrate to describe the relationship between the economic, environmental and social dimensions of sustainability; (b) forward-looking – consisting of two types of forward-looking methods, first the trend indicator describing historical trends and providing indirect information about future sustainability; second, the predictive indicators relying on mathematical models for the future development of variables describing the environment, the economy and society, or the linkages among them; (c) distributional – in that they should be able to consider the distribution of conditions (social, economic, environmental) within a population or across geographic regions; (d) multi-stakeholder input – hence, the most significant, valid and reliable social indicators have been those developed from a wide range of participants (Maclaren 1996).

The Current Housing Situation on Pulau Pangkor

Pulau Pangkor is located about 85 km west of Ipoh and 3.8 nautical miles from Lumut. It is separated from the mainland of Peninsular Malaysia by the Straits of Dinding. Pulau Pangkor is a small island with a total land area of about 27 km² (Majlis Perbandaran Manjung et al. 2015). Due to the rich

TABLE 1
Indicators of Sustainable Housing Development

Dimensions	Indicators	Dimensions	Indicators
Physical	House type	Social	Shops (local shops, shops for fresh produce and other goods)
	House location		Places of worship
	House size		Educational institutions
	House design		Public transportation
	Construction quality		Pedestrian route
	Building material quality		Bikeways
	Paint quality		Public children's playgrounds
	Color match		Leisure facilities
	Indoor air quality		Police station
	Internal finishing quality		Fire station
	Vehicle parking space		Post office
	Child play space		Utilities offices (electricity and water)
	Environment		Safety features
Cleanliness of the housing area		Clinic	
Drainage		Waste management facilities (rubbish bins)	
Rubbish collection		Public library	
Natural disaster risk		Local social activities facilities (public hall)	
Economic	Green public space	Workplaces	
	Water recycling	Basic goods	
	Waste recycling	Religious activities	
	Durability	Cultural activities	
	Affordability (house price or rental fees)	Educational services	
	Building material cost	Public transportation services	
	Maintenance cost	Leisure or recreation	
	Modification cost	Road	
	Clean water supply	Level of safety (crime rate)	
	Electricity supply	Telecommunication network	
	Monthly water cost	Health services	
	Monthly electricity cost		
Basic goods cost			
Transport cost			
Medical cost			

marine resources surrounding the island, the key economic activity on the island is the fisheries sector (Wong 1998). Pulau Pangkor currently has ca. 15,499 residents (Majlis Perbandaran Manjung et al. 2014).

Generally, housing development on Pulau Pangkor can be divided into four geographic zones, namely North, East, South and West. The

residential areas of Pulau Pangkor can be divided into two main categories, i.e. planned residential areas and unplanned housing. Planned housing includes such housing area development comprising modern detached and semi-detached houses, terraced housing, and government employees' housing quarters. Unplanned housing mostly includes village houses, squatter housing, and fishing villages. Table 2 and Figure 2 below detail the available housing in Pangkor as gathered by site visits and data from the review of secondary sources (government reports).

TABLE 2
Housing Areas by Zones on Pulau Pangkor

Zone	Area	Housing Estate / Village
North	Teluk Dalam	Kampung Tersusun Fishermen Longhouse
	Teluk Chempedak	Housing Area
	Sungai Pinang Kecil	Fishing Village
East	Sungai Pinang Kecil	Housing Area
	Sungai Pinang Besar	Housing at Jalan Eu Ling Kong Sungai Pinang Besar Village
	Pangkor Town	Housing at Pangkor Town Desa Pangkor Park Pangkor Mutiara Park Seri Pangkor Park
West	Pasir Bogak	Housing at Pasir Bogak Alam Impian Pangkor
South	Teluk Gedung	Pangkor Indah Park
	Teluk Kecil	Kampung Teluk Kecil Perkampungan Nelayan

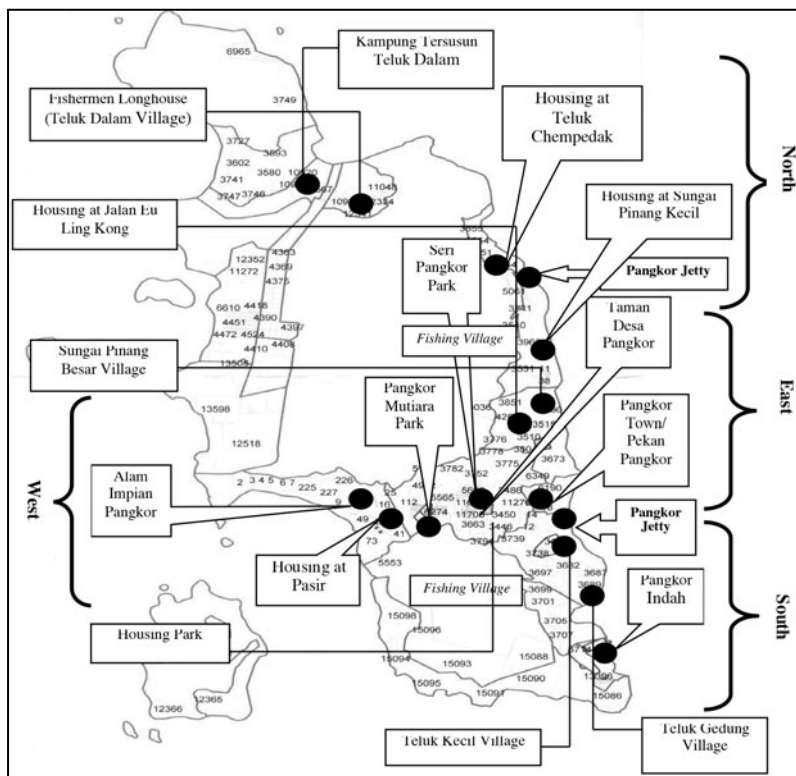
A number of housing issues were highlighted in the Physical Report for Pangkor Island Local Plan 2015. Forest reserve areas dominate Pulau Pangkor, comprising between 70 and 80% of the total land area for the period 1999-2015. The potential area for new housing development becomes very limited considering the conflicting demands on land use from other business sectors such as tourism. The tourism sector has grown rapidly and has resulted in rapid land use changes. Most of the planned development on Pulau Pangkor is concentrated in the western part of the island due to its coastal tourism potential.

Most of the earlier residential areas on the island developed in a piecemeal fashion and thus have contributed to unharmonious land use. The unplanned development is due to organic growth as a result of the increase in the island population. Unplanned housing such as squatter housing areas negatively affect the social and environmental images of the island. Squatter housing often triggers various legal, social and political issues. Additionally, squatter housing has the effect of channeling

FIGURE 2

Distribution of Housing Areas and Fishing Village on Pulau Pangkor

(Adapted from the original sketch map of a housing area by the Manjung Municipal Council)



infrastructure facilities and utilities that are not comprehensive and orderly. Unorganized squatter housing also poses security and fire risks.

The lack of public facilities such as sports, recreation and leisure facilities will indirectly contribute to social problems among the youth. Public services should be increased especially to meet the growing resident population and tourists needs. Village areas such as Kampung Masjid, Kampung Sungai Pinang Kecil, Kampung Sungai Pinang Besar, Kampung Pasir Bogak and Kampung Teluk Gedung often face flood problems due to the inadequate drainage infrastructure.

Most Pulau Pangkor residents work as fishermen and their household incomes are low. They are burdened with a relatively high cost of living on the island due to the influx of tourists. In 2015, a total of 946 residents of Pulau Pangkor were beneficiaries of welfare assistance from the Department of Social Welfare, comprising mostly the elderly, children, the disabled and sick persons. The development of housing should take

into consideration the needs of this group in terms of provision of affordable housing. These housing issues need to be taken into account in the housing development planning process on Pulau Pangkor in order to achieve a level of sustainable housing development.

Study Area

The pilot study area is the southeast coastal area of Pulau Pangkor (Figure 3). The southeast coastal area is the area that has been designated by the local planning authorities as a Special Area in the Southeast Coastal Special Area Plan 2025. The Special Area Plan (SAP) is a development plan that outlines the direction and incentives for economic, physical, and community development in the southeast coastal area. The SAP covers an area of 145 hectares of land and has a population of approximately 7,200.

The Special Area Plan includes the main town centre on the island (Pekan Pangkor), Kampung Masjid, Kampung Teluk Kechil, Kampung Teluk Gedong, Teluk Bahru, and Perkampungan Nelayan (the beach coast from Teluk Kechil to Teluk Gedong) (Figure 3). The area has 759 housing units consisting of planned housing (detached houses, semi-detached, terraced, and quarters) and unplanned housing (village houses, squatter houses, and fishing villages) (Majlis Perbandaran Manjung et al. 2014). The five main villages are Kampung Teluk Raja Bayang, Kampung Sungai Pinang Besar, Kampung Teluk Kecil, Teluk Gedong and Kampung Teluk Indah. Each main village consists of several sub-villages. The pilot study was conducted in several sub-villages located within Kampung Teluk Raja Bayang, Kampung Sungai Pinang Besar and Kampung Teluk Kecil.

Methodology

This section will describe the framework for sustainable housing research design undertaken in the main and pilot study; only the results of the pilot study will be reported in the section on Results below. The study area for the pilot study has been discussed in the section above. The pilot study began with an in-depth literature review to identify indicators of sustainable housing development (Table 1). Subsequently, the indicators that were identified were expressed in the form of several different questions in the questionnaire drawn up. In particular, items that contributed to the development of the sustainable development model in this study were captured in the questions relating to the physical, social, environmental, and economic aspects of housing. After the questionnaire was completed, the pilot study was conducted to test the suitability of the terms, arrangement of items, and arrangement of choices for each item.

FIGURE 3

Main Villages and Housing Areas in Southeast Coastal Area of Pulau Pangkor

Source: Majlis Perbandaran Manjung 2014

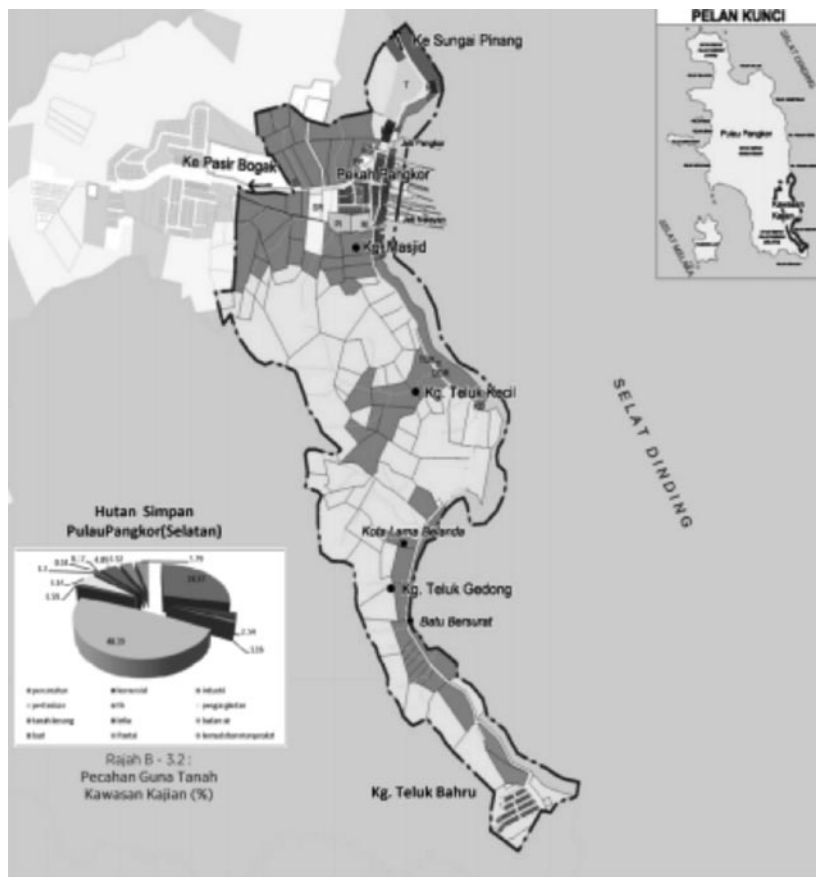


TABLE 3

Housing Units in Selected Residential Areas in the Southeast Coastal Area

NO.	STUDY LOCATION	TOTAL (UNIT)
1.	Pekan Pangkor	148
2.	Kampung Masjid	104
3.	Kampung Teluk Kecil	140
4.	Kampung Teluk Gedung	125
5.	Teluk Bahru	110
6.	Fishing villages (along the coastline from Teluk Kecil to Teluk Gedung)	132
TOTAL		759

Sampling

According to the local council Majlis Perbandaran Manjung, there are 759 units of houses in the study area (Table 3). The authors used two main references for calculating the required sample size. Based on the Krejcie and Morgan (1970), 759 housing units need 255 units to serve as a representative sample. Based on the formula published by the National Education Association, 759 housing units in the population require 255.286 units as a representative sample.

Calculations of the sample size for this study are as follows:

$$s = X^2NP (1-P) \div d^2 (N-1) + X^2P (1-P)$$

$$s = 3.8416 (759) (.50) (1-.50) \div .05^2 (759-1) + 3.8416 (.50) (1-.50)$$

$$s = 728.9436 \div 2.8554$$

$$s = 255.286$$

where s = sample size required

X = the table value of chi-square for 1 degree of freedom at the desired confidence level (3.841).

N = the population size.

P = the population proportion (assumed to be .50, since this would provide the maximum sample size)

d = the degree of accuracy expressed as a proportion (.05)

The determination of sample size for each study location is based on its actual percentage of the total housing units. For example, Kampung Masjid has 104 houses and it represents 13.70 per cent of the 759 houses in the study area. Similarly, the sample size calculation for the pilot and main study is based on the same percentage for each study location. For example, the sample size for Kampung Masjid is 35 units (13.70% of 255), hence the sizes of the sample for the pilot study and main study are 6 units and 28 units respectively (Table 4).

Next, the structured questionnaires were administered to obtain the primary data for the study. The questionnaires provide the required quantitative data. The questions in the questionnaire were of two forms, namely Likert scale-based and open-ended. 162 questions in six different sections formed the entire questionnaire. The questions contained in the questionnaire were formed based on the research objectives and research questions that have been formulated earlier in this study.

The main measurement for sustainable housing item is based on the scores on the Likert scale. This means that the sustainability score of a particular house or study location is based on several measurements set out in the questionnaire. Three main measurements adopted include the

TABLE 4
Sample Size for Pilot Study and Main Study in Six Study Locations

Study Locations	Unit	Percentage (%)	Sample Size	Pilot Study
Kampung Masjid	104	13.70	34.935 (~35)	6.16 (~6)
Teluk Bahru	110	14.49	36.9495(~37)	6.52(~7)
Pekan Pangkor	148	19.50	49.725 (~50)	8.78 (~9)
Kampung Teluk Kechil	140	18.45	47.0475(~47)	8.30 (~8)
Kampung Teluk Gedung	125	16.47	41.9985 (~42)	7.41 (~7)
Fishing villages	132	17.39	44.3445 (~44)	7.83 (~8)
Total	759	100	255	45

level of satisfaction, the level of accessibility, and the level of agreement.

Results

A total of 45 housing units were involved in the pilot survey. Questionnaires were administered through face-to-face interviews. Only 42 data sets were used for the analysis after validation. Out of the total respondents (n=42), 29 respondents (69%) were head of household, 11 respondents (26.2%) were spouse of the head of household and 2 respondents (4.8%) were a child of the head of household. In terms of employment, the data indicate that the majority of respondents (12/ 28.6%) work as fishermen.

Based on Table 5, 91% (38) of housing units are occupied by one household, 2 units are occupied by two households while another 2 units had more than two households. In terms of the number of persons living in the housing unit, 36% (15) of the housing units have 5-6 residents, while another 29% (12) units have between 3-4 residents. In terms of length of stay at the housing units, 62% (26) have lived in the housing units for over 10 years now, while only 4 have recently occupied the existing unit. Out of 42 housing units in the sample, 33.3% (14) reported a monthly household income in the category of RM 501-1,000, while another 31% (13) earn between RM 1001-1500. Another 31% (13) reported a monthly household income above RM 1500.

The survey data also showed the profile of the housing units. Most housing units (30 in total) are detached or single-standing village houses. Other housing unit types are terraced houses or semi-detached ones. Out of 42 housing units, 90.5% (38) are owned by the residents themselves while only 4 units are occupied by tenants. 63.3% (27) of housing units were erected on government land. This includes squatter housing families who had built their housing units on land owned by the government agencies. 24% (10) of the units are built on privately-owned land. The survey data revealed that 61.9% (26) of the housing units were built on government or state-owned land. Only 26.2% (11) housing units were built on

TABLE 5
Profile of Housing Units and Household Characteristics

Variable	Frequency	Variable	Frequency
Employment sector		Household income per month (RM)	
Government	3	<500	2
Tourism	1	501-1000	14
Retailer/ market	3	1001-1500	13
Fisherman	12	1501-2000	6
Retirement	7	2001-2500	4
Housewife	8	2501-3000	1
Others	8	>3000	2
The number of households living in the housing unit		Type of residence	
One	38	Single storey terrace	2
Two	2	Double storey terrace	8
Three and above	2	Detached house (kampung type)	30
The number of persons living in the unit (including interviewee)		Single storey semi-detached	1
1-2	8	Double storey semi-detached	1
3-4	12	Housing unit ownership status	
5-6	15	Owner	38
More than 6	7	Tenant	4
The number of years lived in the unit		Type of land ownership	
<5	4	Permanent	4
5-10	12	Leasehold	1
11-20	26	Government	27
		Private	10
Land owner		Main building material	
Head of family	6	Concrete	19
Family member	5	Mixture of concrete and wood	23
Government	26		
Private	3		
Unsure	1		
Others	1		

land owned by the heads of households or another member of their family. The materials commonly used to build the housing units were mostly of concrete and wooden material.

Further data analysis as reported in Table 6 found that the four dimensions (physical, social, environmental and economic) are significant predictors for sustainable housing development at $p < .05$. The physical dimension is the main predictor of sustainable housing development in Pulau Pangkor ($R^2 = .466$, $p < .05$), explaining 46.6% of the status in sustainable housing development. It is followed by social, environmental

and economic dimensions. The four dimensions contributed 99.99% towards explaining the status of sustainable housing development.

TABLE 6
Coefficients Score for the Sustainable Housing Development Model

Model	Coefficients (a)			t	Sig.
	Unstandardized Coefficients	Std. Error	Standardized Coefficients		
	B		Beta		
1 (Constant)	22.512	2.500		9.005	.000
Physical Total Score	.448	.047	.836	9.620	.000
2 (Constant)	5.049	1.545		3.268	.002
Physical Total Score	.335	.020	.624	16.772	.000
Social Total Score	.306	.021	.548	14.718	.000
3 (Constant)	3.881	.945		4.108	.000
Physical Total Score	.280	.014	.522	20.317	.000
Social Total Score	.264	.014	.474	19.575	.000
Environment Total Score	.282	.034	.227	8.285	.000
4 (Constant)	-.087	.213		-.407	.687
Physical Total Score	.250	.003	.466	91.991	.000
Social Total Score	.252	.003	.452	99.612	.000
Environment Total Score	.250	.006	.201	39.128	.000
Economic Total Score	.248	.008	.153	32.728	.000

a. Dependent Variable: SHD

Conclusion

This research has examined the housing issue on the island of Pangkor by undertaking a pilot study in sustainable housing development. There are various housing issues on the island brought about by competing land uses such as population pressure, influx of tourists, land ownership issues, etc. All stakeholders need to play an important role in ensuring sustainable housing development. The indicators identified in Table 1 need to be considered in housing development on Pulau Pangkor, so that future housing development is carried out in a manner that contributes to sustainable development.

As regards the indicators, the above parameters should be considered before one develops a housing policy. It is necessary to understand how people live in terms of the type and quality of environment; how these have affected their productivity and performance in the economy in terms of minimum standards of space, dwelling types and community facilities they could access. Existing policies should be reviewed to address the issues of design, location and others that may relate to infrastructural provision. In other to evolve a suitable housing policy, other fundamental areas that need to be covered including atti-

tude to ownership; issues of building control; finance and other issues relating to functions at the different levels of government.

Efficient and effective land use planning system is very important because the system exists to ensure that development is in the public interest, weighing up its economic, environmental and social benefits and drawbacks. It plays a key role in making sure the places where we live and work are attractive, vibrant and well-designed. The planning system can ensure that development supports a process of regeneration that caters to local community needs. If properly implemented, it can contribute towards affordable housing development. It can help to ensure that new developments in existing built-up areas take into account its surroundings. The system should function to prevent unacceptable environmental damage, especially in a sensitive environmental setting such as Pulau Pangkor.

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