SUSTAINABLE HOUSING PRACTICES IN HOUSING DEVELOPMENT IN MALAYSIA TOWARDS ESTABLISHING SUSTAINABILITY INDEX

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ABSTRACT: This paper present the housing development processes aimed at applying sustainability principles specific in Malaysia context by drawing the experiences from exemplar projects in other countries and comparing them with the development needs under local conditions. The complexities of the projects do require compliances of project management best practices to achieve the goal of sustainable housing development. At the same time, this research is to identify the project critical success factor for application in the project management implementation in term of best practice to realize the goal of sustainable housing development. Sustainability Index is established with purpose to generated values into figures for the sustainable housing development that are used to characterize or evaluate specific aspects of the system through the assessment of housing sustainability indicators. The formula of sustainability index in housing development will be established accordingly. The parameters or variables based on the identifiable indicators of the success factors will be established with reference to the designed and practices of the green building rating system that had been adopted in Japan, United Stated, United Kingdom and other countries.

Keywords: **Project Management Best Practices, Sustainable Housing Development, Sustainable Index, Malaysia.**

1.0 Introduction:

The issue of sustainable housing is getting worldwide concern. The concept of sustainability is to meet the needs of today without compromising the needs of future generations has been evolved around for a number of years. (Brundtland Commission)[1] While sustainable housing defined unanimously to meet the criteria of producing good quality housing at a price that is affordable both in the short and long a term with creating elements of energy efficient, and healthy homes, while consider with respect to economic, environment and social benefits. (Frej, Anne B, 2005) 'These objectives will by achieved by taking into account the existing running modes and demonstrating the real feasibility of sustainable housing principles to balance economics, environmental and social benefits, particularly for cooperatives and social housing organizations', cited in the exemplary cases of practicable SHE (Sustainable Housing in Europe) projects. The complication of construction projects do require the compliance of project management best practices to achieve goal of sustainable housing development with meet the projects critical criteria of finish in time, not over budget with built up the quality housing which is affordable, energy efficiency with taking regard to economic, environmental and social benefits. A life cycle of housing projects procedure embraces the different stage of working phases. The defined

crucial steps in working phases for a project life cycle of a construction projects are programming phases, design phase, building construction, building operation and building demolition in the final stage. The working stages are defined based on the outline from author Kimberly, Gregor & Dale (2006). With incorporate each of the individual sustainable guidelines for each of the applicable life cycle areas that already practiced in country of North America, Europe, and Asia like Japan, Korea and Hong Kong, evaluate for each of the applicable life cycle areas of building with emphasis over the category of environmental to shape up a rating system with purpose to assessing environmental performance of the so called sustainable building for housing sectors. For example like LEED (Leadership in Energy and Environmental Design), the rating system was established by evaluate five environmental categories into sustainable sites, water efficiency, energy and atmosphere, indoor environmental quality, material and resources. While for Japan, CASBEE (Comprehensive Assessment System for Building Environment Efficiency), the sustainability measurement in primary unit by adopting the concept of Building Environmental Efficiency (BEE). The CASBEE program had established tool assessment into four separate sections. There are Predesign Tool, The DfE (Design for Environment) Tool, the Eco-Labeling Tools and the Sustainable Operation and renovation Tool (Murakami, S., Iwamura, K., Ikaga, T., and Endo, J., 2002) The practices of sustainable housing in the entire life cycle of projects with applying practicable rating system for measuring environmental performance, achieving the goal of sustainable housing with embrace the knowledge of technologies, standards, and guidelines to address the design needs and practices of our country.

1.1 Statement of Problem:

The developed countries in North America, Europe and Asia do establish the sustainable design programs based on the life cycle of a building. Example In United States of North America, there consist of two major sustainable building design initiatives, (1) LEED) and (2) the American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE) GreenGuide (Grumman, D. L., ed., 2003). While in Canadian, the programs are called C-2000 Integrated Design Process (IDP) in conjunction with the Commercial Building Incentive Program (CBIP) and Green Building Challenge assessment tool (GBTool). Europe comprises the country of United Kingdom, the Netherlands, and Germany. The standard design assessment for United Kingdom was monitoring under The Building Research Establishment Environment Assessment Method (BREEAM). In Asia,

the country include are Japan, Hong Kong and Korea. As CASBEE is a joint venture of governmental, academic, and building assessment project underway in Japan.

However, the issues of sustainable housing still fresh and not that familiar in our country. With reference to the Forum speech 0n 6 July 2004 by Y. Bhg. Dato' Lokman Hakim Mohd Jasan, Secretary General, Ministry of Housing and Local Government Malaysia, stated that the houses being built in the past decade not meeting the essential criteria of sustainability and the problem detailed out in the lists below:

a) The building design not takes into account of energy efficiency and building green with affordable housing. As building green housing will require specialize design of the building such as, materials used either in construction work progress or for building installation purpose, structure of the building and the calculation of energy use of the building. To build the green houses, we need to employ building related professionals with 'extensive residential construction experience, drafting experience, building science backgrounds, indoor air quality investigation training, mechanical ventilation training and much more' (Kibert,C, 2005). The problem is we are lack of the green house expertise builders or consultancies in our country.
b) Regarding with the sustainability of housing development is discusses, most concerned and emphasized was the environmental issues from the global worldwide. The impact of housing development will incur the consequences influence on our economic and society. The building itself will incur variety of environmental problem to our earth such as greenhouse gas emission. The implication of construction activities do relate to environment pollution, mainly because of 'the materials used, nature of design, methods of construction, locations and layout, physical structure and the use to which buildings are put', Ramachandran (1990).
c) The awareness of our society community to the important of sustainable housing is obscurity. This may result the difficulty to achieve the goal of the projects if without the society cooperative and involvement in the whole process as they are the final users of the products.
d) The objective of sustainable housing is to make the projects more valuable. With reducing the criteria of building usage such as energy consumption, water and materials used, life cycle cost plus decrease the accidents occurrence of the sites with improving life quality, productivity and user accessibility.

e) The country of North America, Europe and developed country in Asia do practice the sustainable building with establishment of sustainable rating systems for evaluating each phase of building work in order to assess the environmental performance of the project. Although our country do implement Agenda 21 as an effort with respond to sustainability development, however, there is no assessment tool or method to evaluate our building environmental performance.

1.2 Objectives:

The Objectives of this paper are as follows:

1. to identified the best practices of sustainable housing concept for housing development in Malaysia;
2. to identified factors affecting sustainability performance in Housing Development in Malaysia
3. to establish sustainability index for housing development in Malaysia; and

Furthermore, to make the possible of sustainable project deliverable, the project management should incorporate into each phase of project stage of programming phase, design phase, building construction, building operation and building demolition in the final stage (Kimberly, Gregor & 'Dale, 2006). To promote sustainable housing development, the sustainable building design should enhance in environmental performance of building life cycle since planning stage.

As prescribed, establish a rating system for evaluation sustainable housing development in this country by assessing the defined indicators of sustainability parameters. The prior purpose of the rating system is to evaluate the environment performance of housing projects over the entire life cycle. The rating system is utilized by measuring each phases of project management procedures. This sustainable guideline is to evaluate each of the application of the entire project life cycle areas.

2.0 Theoretical and Conceptual

2.1 The Method of Sustainable Building Practice in Various Countries over the Complete Lifecycle of Project

1) The BREEAM Method

The BREEAM method is an environmental assessment method developed by the BRE Ltd (Building Research Establishment Limited), in England. It evaluates the environmental performance of buildings in both the design phase as well as existing buildings in the UK. It is separated according to the building type to BREEAM for offices, Ecohomes, BREEAM retail, industrial BREEAM, BREEAM schools and health buildings. Credits are awarded to each issue according to their performance and they are added together to produce a single overall score. The building is rated on a scale of pass, good, very good or excellent. The method is not available to the public and it involves the participation of the company and the licensed assessors.

2) The GBTool Method

The GBTool is a software system for assessing the environmental and sustainability performance of buildings. It is an implementation of the green building challenge (GBC) assessment method that has been under development since 1996 by a group of more than a dozen teams. The GBC process was launched by Natural Resources Canada, but responsibility was handed over to the International Initiative for a Sustainable Built Environment (IISBE) in 2002.

The method comprises of two parts, Module A which includes benchmarks and weights, and is intended to be adjusted by third parties to suit local conditions and Module B which results to the sustainability performance of the building in question. The assessment can be carried out at various phases of the life cycle of a project. Parameters included within the system cover sustainable building issues within the three major areas of environment, social and economic sectors. The tool is designed as a generic framework and it requires adjustments by the user, which is expected to import values of weights, benchmarks and emission values. The system carries a wide range of issues related to sustainable design.

Four phases are included in the tool: pre-design, design, construction and operations. A scale ranging from -1 to +5 is used to express the evaluation in any case. The scale is interpreted as 1 negative performance, 0 minimum acceptable performance (usually but not always defined by regulation), three good practice and five best practice.

3) The LEED Method

The LEED system, developed by the US Green Building Council, is a national standard for developing sustainable buildings. LEED applies to new commercial construction and major renovation projects (LEED-NC), existing buildings operations (LEED-EB), commercial interiors projects (LEED-CI), core and shell projects (LEED-CS), homes (LEED-H) and neighbourhood development (LEED-ND). A number of parameters are evaluated and result to a score, which gives a certification of certified, silver, gold and platinum construction.

The LEED method involves several parties along the process of the evaluation and certification. The verification process consists of four phases, namely inspection, performance testing, rating and certification. In all the phases, the participating of the provider is mandatory.

4) The CASBEE Method

CASBEE is a Japanese environmental labelling method for buildings, based on assessment of their environmental performance. CASBEE is developed based on three major concepts. Firstly, it is designed for the assessment of buildings which corresponds to their lifecycle. Secondly, it is based on a concept that early distinguishes environmental load (L) and quality of building performance (Q) as the major assessment targets. Thirdly, it introduces a new indicator, namely BEE (building environmental efficiency) based on the concept of eco-efficiency. BEE is defined as Q/L to indicate the overall result of environmental assessment of buildings.

CASBEE can be applied to both private and public buildings, which are broadly divided into residential and non-residential and further into building types. The tool comprises of a set of four basic assessment tools, namely CASBEE for pre-design (CASBEE-PD), CASBEE for new construction (2004) (CASBEE-NC), CASBEE for existing buildings (CASBEE-EB) and CASBEE for renovation (CASBEE-RN), which correspond to the individual stages of the building's lifecycle.

BEE values are represented 1 by plotting L on the x axis and Q on the y axis.

The higher the Q value and the lower the L value, the steeper the gradient and the more sustainable the building is. This simple graph has provided a graphical representation of the environmental efficiency of a building. The tool has introduced a labeling classification

of five areas, where class C is regarded as poor in terms of sustainability, class B + , class B - , class A, are regarded as average and class S as excellent.

5) The HQE® method

The HQE® (High Quality Environment) project methodology was developed in France and presents a mostly open character. It integrates a great number of parameters, requires a mode of management of the operations inspired by the international standard ISO 14001, and consists of a project methodology instead of a simple ex-post certification like the majority of the other existing methods. Launched in 1996, the HQE® programme enables developers and project owners to adopt construction options appropriate to sustainable development, at all stages of a building's life cycle (manufacture, construction, use, maintenance, conversion and end of life). The HQE Association defined 14 targets specifying the particular environmental requirements that a building, whether new or rehabilitated, must satisfy. The method is applicable in all phases of design.

Environmental management system (EMS) is needed to implement the HQE® method. In fact, most of the builders in France refer to a general declaration without an operative EMS. Few of them are developing a specific approach based on an environmental policy, objectives and targets, requirements and evaluation. In the context of ISO14001, EICs are the criterion of environmental performance to design, build, use and deconstruct (end of life) the building.

Using the ISO 14001 requirement, the builders define and check the environmental impacts of the building. All the EICs could describe the requirement for a HQE® method, which is defined as a voluntary step beyond the regulation. The major reference is the French building regulation, which has been supplemented by the EICs.

6) The VERDE method

VERDE is a Spanish method for evaluating the environmental performance of buildings. It is developed by the Arquitectos, Urbanistas e Ingenieros Asociados, S.L.U. in the GBC Spain Consejo Superior de los Colegios de Arquitectos de Espana.

The method applies to new buildings of various types, namely residential, offices, commercial, hotels, hospitals and educational. VERDE is designed to allow assessments at various phases of the life cycle of a project. The method comprises of three phases:

(1) HV1, the pre-design phase assessment

(2) HV2, the design and construction phase assessment
(3) HV3, assessment during the operation phase

The system covers a wide range of sustainable building issues, environmental loadings, resources exhaustion, emission to air, water and solid wastes, local and regional impacts, factors affecting building environment, indoor environment quality and quality of service, as well as social and economic aspects.

The intention of VERDE-HV2 is to evaluate the environmental impact of newly constructed buildings. It is mainly based on the GBTool using benchmarks and weights appropriated for each criterion. A value scale is introduced ranging from 0 to+5, with 0 representing the reference scale, minimum acceptable performance and five representing best practice, maximum performance achieved using the best available technology with affordable cost.

The analysis of the existing assessment tool and design methodologies has shown that a plethora of environmental issues are examined in all cases. It is worth noting that not all the tools take into consideration aesthetic as well as social parameters. Another parameter, which is not accounted for in all the tools is the economic impact of the construction in question. However, it is evident that a holistic approach, which would consider every possible parameter and would result to a more pragmatic and operational evaluation is difficult.

Tab 2.1 General comparison of the tools presented

	Geographical Range	Life cycle phases of design	Usage of tool	Outcome
BREEAM	National UK	All phases	Import data for third party to asses	Poor, good, very good, excellent environmental performance
GBTool	Global	All phases	Complex spreadsheet	-1 to +5 scale for each environmental issue
LEED	National US	All phases	Import data for third party to asses	Labelling (certified – platinum performance)
CASBEE	Global	All phases	Complex spreadsheet and manual	Score graphs, labelling (poor – excellent sustainable building)
HQE	National-France	All phases	Simple/open, linked to the French regulations	Checklist
VERDE	Global-med	New Construction	Spreadsheet	From 0-5 for each parameters

(Sources: *Management of Environmental Quality: An International Journal 'Present and Future of Building Performance Assessment Tool)*

Table 2.2 Primary issues of concern identified in each tool

	Site	Indoor Environment	Energy
BREEAM	X		X
GBTool	X	X	X
LEED	X	X	X
CASBEE	X	X	X
HQE	X	X	X
VERDE	X	X	X
	Material resources	Water	Transport
BREEAM	X	X	X
GBTool	X	X	
LEED	X	X	
CASBEE	X	X	
HQE	X	X	
VERDE	X	X	X
	Health	Social	Economic
BREEAM	X		
GBTool		X	X
LEED			
CASBEE			
HQE	X		
VERDE	X	X	X
	Comfort	Management	Services
BREEAM			
GBTool			
LEED			
CASBEE	X		X
HQE	X	X	
VERDE			X
	Long term performance	Design aesthetics	Functionality
BREEAM			X
GBTool	X		
LEED		X	
CASBEE			
HQE	X		
VERDE			

(Sources: *Management of Environmental Quality: An International Journal 'Present and Future of Building Performance Assessment Tool)*

The analysis of the primary environmental parameters (Table 2.2) showed that some of them such as site, energy, resources and materials, indoor environment (besides the BREEAM tool) and water were involved in all the tools examined.

2.2 Methods existing in our country

The general subject matter of the study is to seek common references in our countries aiming to the integration of the environment and sustainable development principles in building construction. The study examines whether a method inspired from other countries

building environmental efficiency assessment tool (like, for example, the CASBEE or the VERDE) can be effective practical to our countries and also investigates the definition of the approach of such a method. This method has to meet several needs according to the building life cycle (programming, design, construction, and operation phases).

2.3 Sustainable Housing Practices in Malaysia

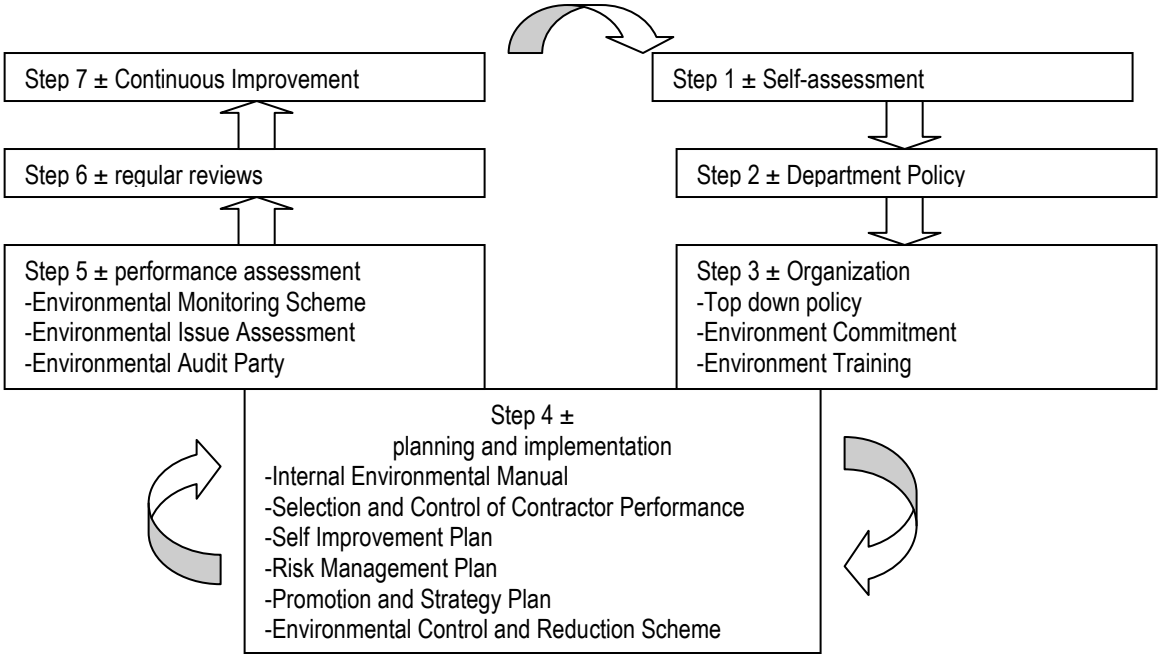
The sustainable guidelines which purpose for sustainable building development was had been practiced in the country of North America, Europe, and Asia like Japan, Korea and Hong Kong. The international building sustainability guidelines and standards for each of individual organization in every country are mainly purpose for evaluate the environment performance of a building over the entire life cycle. Example for LEED in United States, the building is evaluated over five environmental categories: sustainable sites, water efficiency, energy and atmosphere, indoor environment quality, and materials and resources. As well as BREEAM in United Kingdom, the program of this organization used to assess a building's performance which relate to environmental issues. The assessment of following areas include: management, energy use, health and well being, pollution, transport, land use, ecology, materials and water.

To achieve the sustainable housing development, suggest the author, our country can implement Environment Management System (EMS) in building project by adopting the guideline of ISO (International System Organization) 14001. Each of the guideline provided in ISO 14001 can incorporate in building lifecycle working phase for the establishment and monitoring of project's EMS implementation. For incorporating the compliance requirements of ISO 14001, the approach addresses the policy, the implementation and monitoring, and continuous improvement of construction operations. An environmental management system is an integral part of an overall management system that includes organizational structure, planning, activities, responsibilities, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining environmental policy (ISO, 1996a, 1996b). It serves as a systematic approach to address environment protection and utilize organizational resources for corporate environmental goals.

The system helps organizations to develop and carry out a set of work procedures and methodologies for improving environmental performance (Wever, 1996; Kuhre, 1997). According to Pun, Hui and Lee (2001), the housing department from Hong Kong has

developed a seven-step EMS approach for managing its construction projects and site operations revision of EMS manuals, procedures and instructions, as well as the methods of evaluating contractors' performance. Below are the figure show the steps of seven approach and elaboration of each Individual steps.

Fig 2.1 *A seven-step approach for EMS implementation*



(Sources: Pun, Hui and Lee (2001), An EMS approach to environmentally friendly construction operations)

With the comparison of project lifecycle working phases, each step in EMS approaches can be incorporated in the working phases like wise the categorized as shown below:

Tab 2.3 Categorization of EMS approaches into project lifecycle working phases

Building Working Framework	Step of EMS approaches
A. Programming Phase	1. Self- assessment
	2. Departmental policy
B. Design Phase	3. Organization 4. Planning and implementation
C. Building Construction	5. Performance assessment
D. Building Operation	6. Regular reviews
	7. Continuous improvement

2.4 Toward Establish a Rating System

A rating system for building performance is established with according the available assessment methods that have been developed worldwide are built upon various principles and different evaluation items, data and criteria. (Maria & Stella, 2006) A rating system for assessing building performance based on the indicators categories in

sustainability criteria. By assessing the building sustainability performance, these indicators can integrate into each stage of project lifecycle. This project management mode was inspired by ISO 14001 methodology. Credits of measurement are accumulated by the scores given by each of the indicators with higher scores allocated for more sustainable actions.

2.5 The set rule for indicators shape-up:

Table 2.4 The criteria used in the selection of sustainability indicators

Criteria	Reason
Policy relevance	To ensure that indicators relate to the concept of sustainable rural housing and existing Irish legislation and policy
Simplicity	To ensure indicators are easily understood, to avoid ambiguity, and to ensure all stakeholders can be fully interactive with the index
Validity	To ensure that the data collected are accurate and reliable. Proved methodologies and analysis are necessary to obtain relevant information
Affordable data	To ensure that data for indicators can be collected at a reasonable cost and within a reasonable time-scale
Reliability	To ensure that the indicators selected provide long-term information that is unlikely to change over time (which could result in a reduction in sustainability)
Adequate scope	To ensure that indicators are able to deal with all aspects of housing sustainability, in terms of local, national and global issues
Openness	To ensure that the methodologies, analysis and application of the indicators are readily available for all stakeholders in a fully interactive and clear manner

(Source: N. F. Gray and M. Carton-Kenney (2004), 'A rural housing sustainability index')

The indicators should be policy relevant and satisfy as many as the criteria mentioned above in table 3.4. The indicators, which identified by Irish country for building sustainable assessment, was drawn up from existing literature reviews and subsequently being categorized into four main grouping for building sustainability measurement. These main groupings do corresponding with the evaluation of entire project life cycle process. The specific required criteria for evaluating the indictors were identified with according the required rules for shaping up those indicators. This might provide a guidance references to our country when establish a rating system. The indicators for building assessment performance like given by The Organization for Economic Cooperation and Development[1], should be policy relevant with our country regulations analytical soundness, measurability and satisfy as many as the criteria mentioned above.

1) Site (environmental) indicators, 2) Design indicators, 3) Building (construction) indicators, 4) Social indicators.

2.6. Example Sustainability Index in Ireland Country

The rural housing sustainability index (RHSI) comprises 70 indicators [21 site (environmental), 28 design, 15 building (construction), and six social]. There are two approaches to obtaining a score for the index: either to weight the indicators against one another or to weight each category of indicators. Each indicator is weighted according to its relative importance, the RHSI being a number from 0 to 100 derived by summing up the individual scores for each weighted indicator using the arithmetic weighted equation

$$RHSI_1 = \sum_{I=1}^{n} qiwi$$

where n is the number of indicators, q the score of the ith indicator, and wi the weighting attributed to the ith parameter.

The total score is a measure of the combined effects of the selected weighted indicators. This is the square of the arithmetic weighted index divided by 100

$$RHSI_2 = \left(\sum_{I=1}^{n} qiwi\right)^2$$

Apart from using a total aggregate score, consideration is also being given to requiring minimum compliance levels for each of the four indicator categories. The index is based on what is currently available in Europe, and should be seen in terms of compliance-plus with existing building and environmental regulations.

3.0 Methodology:

For the environment of sustainable housing development, we should balance the projects into three important elements of world sustainability criteria; there are economics, socials and environmental benefits with providing affordable, quality and accessible housing. Based on the practicable of example SHE project which had done successfully with scientific achievements, the projects' objectives were accomplished with the good effort of methodologies as excerpt in Executive publishable summary, related to reporting period (12 months) are alike below:

a) 'Create a cooperative atmosphere in the organizations with purpose to ensure technical, scientific, and financial condition, communication within the project organization.'

b) 'To produce a set of recommendations and format for each of the main sustainability topics (social and economic aspects).Transfer recommendations in everyday practice to housing organizations.'
c) 'To develop in design phase, detail choices and prescriptions regarding: architectural, engineering and resources (energy, waste and water aspects), starting from site analysis and diagnoses. To set up a comprehensive design approach, both on neighbourhood and building scale, aiming at to reduce building environmental impacts, to promote as ecological mobility approach, to promote passive strategies for climate control, the correct use of daylight and to increase indoor and outdoor acoustic comfort, promote the use of safe and ecological materials and technologies.'
d) 'Follow up the widespread dissemination action, but also to involve and convince stakeholders, and overall users, local authorities and housing organizations movement.'
e) 'Cost is commonly assumed to be the major obstacle to the uptake of sustainable building. The building stakeholders and clients tend to focus on short term gains rather than long term saving. So the point is 'great political key to open new forms of incentives for sustainable housing'.'

The research development is undergoing the four main phases of works, there are literature reviews, methodology, data collection and analysis. The establishing of rating system is with the hope to assure the practicable in our country with the initiative to study from the practices of other countries with bestowed sustainability rating system. Through the evaluating the similarities and differences between the international sustainable practices, better sustainable guidelines and practices can be developed and used universally in our local regional. Individual sustainable guidelines are evaluated and incorporated for each of the applicable life cycles project phases. To probe the practicable of rating system for assessing our country sustainable housing development, this research employ quantitative methods in empirical study on Malaysia.

This research will involved local housing developer and Local Authorities selected from various regions in Malaysia major cities such as, i.e.,Penang, Alor Star, Ipoh, Kuala Lumpur, Melaka, Johor Bahru, Kota Kinabalu and Kuching where most of the development are focused. This study will carry out by survey method where questionnaires will be used

to get the information. Statistical Package for Social Science (SPSS) will be used for data analysis. The results of the survey will be analyzed using frequency, correlation, cross tabulation and regression. The interview and observation will also be conducted to confirm the result of the survey. The outline of the research methodology can be summarized as below:

4.0 Conclusion

Sustainable building design includes formal and informal initiatives advanced by governments, professional organization, and private industry. Nowadays most countries designed and practices green building rating system towards sustainable development. For example in Asia, CASBEE for Japan, LEED In the United Stated and BREEAM for United Kingdom, and other countries so on.

With purpose to improve the level of sustainability practices in housing development this research will identify a guideline for rating the residential development in respect to sustainable housing by using the sustainability index. The formula of sustainability index in housing development will be produce based from the critical factors to the success of a sustainable building or housing and the rating system that apply in Japan, United Stated and United Kingdom with some modification to suit Malaysia condition.

From studies carried put in other countries, it is observed that there is higher concern on the environmental impacts and the almost total absence of social and economic references. The analysis on different tools from various countries is very useful for a more integrated approach that would incorporate social, economic and other significant parameters.

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