Application of sustainability indicators and rating tools: Envisioning 'Life Cycle' assessment for buildings in Malaysia.

Speakers:
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Abstract: *This paper aims to explore the various building assessment systems in Malaysia; how do they work to define sustainability, how far the achievement is and what barriers are involved. The intent is to initiate a critical comparison among the approaches taken by different authorities and to see how far a 'life cycle' based assessment can be adopted for the Malaysian context. To achieve this, the study investigates the organizations involved, the assessment structures, the sustainability indicators and the challenges involved.*
The results illustrate the room for evidence-based improvement in the Malaysian built environment domain. With the multiple approaches taken locally and internationally, this research becomes the critical first step to develop a robust sustainability assessment tool underpinned by the 'life cycle' approach to help achieve a more sustainable built environment in Malaysia.

Keywords: sustainability indicators, building's life cycle, green building rating tools, Malaysia.

Introduction

Building assessment and certification tools are now becoming a norm worldwide and contribute positively to environmental performance in many developing countries. On the one hand, Cole [1] have argued that the development of building environmental assessment methods has largely been an exercise in structuring a broad range of existing knowledge and considerations into a practical framework, rather than requiring or demanding new research. On the other hand, Kohler and Hassler [2] have claimed that research can be organized either along environmental assessment methodologies which privilege impacts in a defined time and space, or life cycle approaches which privilege global impacts over a longer period for products or services. Kohler and Moffatt [3] further suggested that the first step is the definition of a certain number of indicators of sustainability, in which indicator systems are scaled at the macroeconomic level, at regional and town planning levels and at the level of the building and its life cycle.

With the rising demand to achieve more sustainable buildings and cities globally, the 'life cycle' concept has become more significant. The notion of Life Cycle Assessment (LCA) has

been generally accepted within the environmental research community as the only legitimate basis on which to compare alternative materials, components, elements, services and whole buildings [1]. Well-established green building rating tools such as BREEAM-UK and LEED-USA have recently addressed the life cycle approach as the basis for one or more criteria related to materials. In contrast, DGNB-Germany and CASBEE-Japan have already embedded the life cycle approach into their systems [4]. In addition, there are less familiar but increasingly important tools such as 'One Planet Living' and 'Living Building Challenge' which have adopted life cycle thinking.

This paper describes a comprehensive review of selected green building initiatives in Malaysia which investigates the methods used in these assessment systems, how they work to define sustainability, how well they achieve sustainability and what barriers are involved. The intent is to initiate a critical comparison among the approaches taken by different authorities and to see how far a 'life cycle' based assessment can be adopted for the Malaysian context. To achieve this, the study investigates the organizations involved, the assessment structures, sustainability indicators and the challenges involved.

Malaysia as a case study: Green initiatives in the building industry

Since independence, Malaysia has generally registered continuous economic growth and this development has brought numerous benefits including improved social amenities and a trend towards greater urbanization of the population. However, economic development in Malaysia has contributed to environmental degradation and uncontrolled development. Protection of the environment has become a necessity rather than a luxury in order to maintain public health and well-being as well as to sustain the economic growth [5]. In Malaysia, building assessment systems emerged at a time when interest in environmental and sustainability issues was on the rise and developers, architects and government agencies were seeking new methods to integrate those concerns into their work. Todd, Crawley [6] also noted that several innovations that consider local and regional context within green building assessment match the particularities of local practice.

There have been many initiatives towards the development of 'green' buildings and cities in Malaysia in recent years. The most established building rating tool in Malaysia as widely recognised in the literature is the Green Building Index (GBI). Since its launch in 2009 it has enjoyed a rapid take-up, with the goal of reducing carbon emission intensity by up to 40% by 2020 compared to 2005. A number of additional building assessment systems and policies have evolved alongside the GBI, for example the Green Performance Assessment System (GreenPASS), Green Assessment System in Construction (GASSIC), Green Real Estate (GreenRE) and Public Work Department (PWD) Green Rating Scheme. These assessments are among the outcomes from the Low Carbon Cities Framework and Assessment System (LCCF) under the Ministry of Energy, Green Technology and Water of Malaysia.

i. Green Building Index (GBI)

The Malaysian GBI was launched in 2009 and is a joint project of the Malaysian Institute of Architects and the Association of Consulting Engineers Malaysia. It was the first environmental rating system for buildings in Malaysia. The GBI has been modelled on internationally recognized green building rating systems such as USA's LEED (Leadership in Energy and Environmental Design) and UK's BREEAM (Building Research Establishment Environmental Assessment Method) [7]. The GBI also draws fundamental ideas from existing systems including Australia's GREENSTAR and Singapore's GREENMARK, but it has been modified to cater for local environmental, economic and social needs (Greenbuildingindex, 2013).

GBI evaluates the environmental design and performance of Malaysian buildings based on six independent criteria including Energy Efficiency, Indoor Environmental Quality, Sustainable Site Planning and Management, Materials and Resources, Water Efficiency, and Innovation. Each criterion has a different weighting depending on the building category namely, Non-residential New Construction, Residential New Construction, Non-residential Existing, Industrial New Construction and Township. In May 2013, GBI launched the GBI- Retail tool for New and Existing Construction (Greenbuildingindex, 2013) and in February 2014, it launched GBI-Hotel and Resort (Greenbuildingindex, 2014).

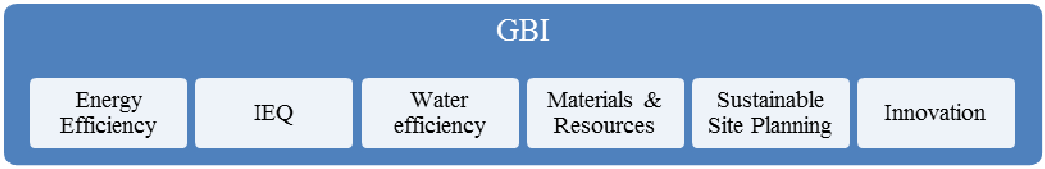

Figure 1: Criteria in GBI

An encouraging sign is that, according to Greenbuildingindex (2013), as of 15th June 2013, 4 years since the launch of GBI, Malaysia has attained almost 58 million square foot gross floor area of GBI certified buildings and reduced carbon emissions by nearly 225 thousand tonnes (tCO_2e/annum, based on electricity energy reduction @1kWh=0.69 kg CO2).

ii. Green Performance Assessment System (GreenPASS)

GreenPASS was developed by the Construction Industry Development Board (CIDB). It is an evaluation system that measures the impact of building construction works and building operations on the environment. It applies to new and existing buildings and is based on the evaluation of embodied carbon and operational carbon, including quantitative measurement covering five elements: site, energy, indoor environmental quality, water and waste. This value is then compared with the carbon footprint based on proposed carbon reduction strategies and the improvement is rewarded by a designated diamond rating. GreenPASS was initially based on two reference models, NABERS (National Australian Built Environment Rating Australia) and Green Globe USA. Unfortunately, to date, this assessment has not been materialised due to some internal issues.

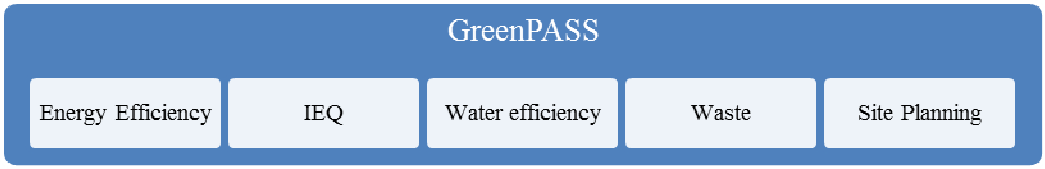

Figure 2: Criteria in GreenPASS

iii. Green Assessment System in Construction (GASSIC)

The Construction Industry Development Board (CIDB) is also developing GASSIC [8]. It is a system or method to measure and evaluate the green attributes of a construction project from design to construction stage based on developed standards. This assessment system will be used together with GBI as a measure to certify green buildings in Malaysia. GASSIC will be made mandatory for all public projects in the future to facilitate broad adoption of green technologies and sustainable development [8]. But to date, there is insufficient information about GASSIC in the literature.

iv. Public Work Department (PWD) Green Rating Scheme

According to Rashid, Sulaiman [9], PWD has produced its Green Rating scheme to achieve the goals on green government building initiatives for new and existing buildings. Currently, the research focus is on developing a 'Comfortable and Energy Efficient Government Office Building Design' and the outcome will be used as a guideline for the designers. For new buildings, the rating criteria are energy efficiency through passive and active design, sustainable site planning and management that complies with JKR 14001:2008 Environmental Management Systems and also water efficiency.

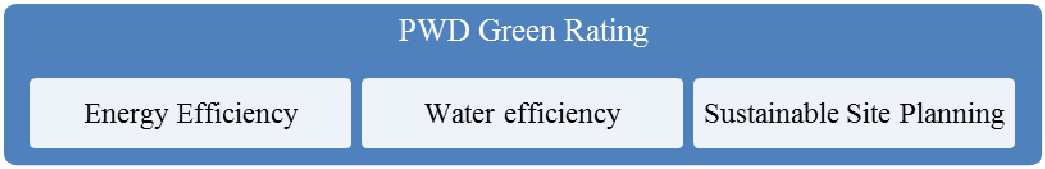

Figure 3: Criteria in PWD Green Rating

v. Green Real Estate (GreenRE)

GreenRE is a project of the Real Estate and Housing Development Association of Malaysia. GreenRE is a not-for-profit initiative and is committed to promoting a sustainable Real Estate Industry by encouraging voluntary adoption of green building practices. It offers a practical and efficient solution to green certification. The tool was developed in close collaboration with relevant stakeholders from both the public and private sectors including industry professionals. This system evaluates building's carbon emissions, water and energy efficiency and also indoor environmental quality. A GreenRE framework is to achieve minimum environmental sustainability standard, including a minimum energy standard that yields about 10%-15% energy saving above the Malaysian Energy Efficiency Standard MS 1525:2007 (GreenRE, 2014). GreenRE offers 2 types of certification, GreenRE Criteria for Non-Residential Buildings and GreenRE Criteria for Residential Buildings.

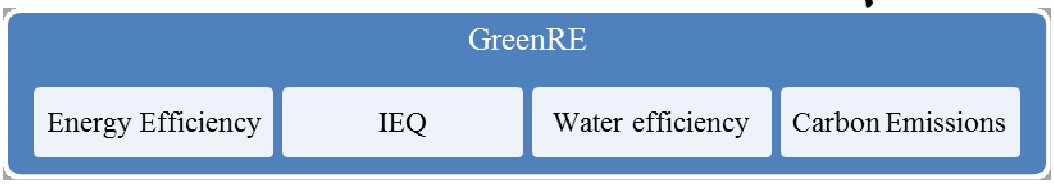

Figure 4: Criteria in GreenRE

Barriers and Opportunities

This paper reviews the various building assessment systems that currently are practised in the Malaysian building industry. These initiatives are driven by both government and private agencies. However, most of the assessments focus mainly on environmental aspects, and the other two dimensions of sustainability (social and economic) are not directly considered in the assessment systems. In terms of environmental criteria, almost all assessments adopt similar criteria for example, energy and water efficiency and site planning.

These assessment tools are still fragmented across the building lifecycle, for example, GBI relates mostly to the design and construction phases, while GreenPASS and GreenRE are focused on the construction and operation phases. Table 1 shows the overview of the sustainability indicators in each assessment system, as well as to what extent these assessments cover the whole of building life.

Assessment tool	Year	Sustainability Indicator			Building Life			
		Env.	Social	Economic	Design	Construction	Operation	Decommission
GBI	2009	x			x	x	x	
GreenPASS	2012	x				x	x	
GASSIC	2011	x			-	-	-	-
PWD Green Rating	2012	x				x	x	
GreenRE	2013	x				x	x	

Table 1: Selected building assessments across sustainability indicators and stage of building life

In terms of economic dimension, several issues arise regarding green buildings in Malaysia. According to Halim [10], the economic issues are the incremental construction cost, rental benefit, operating cost saving and increase in value on sale. In addition, Isa, Rahman [11] identified the factors affecting green building investment, in which the economic aspects have been classified as risks and returns. Each green property investment decision should take into account the risk factors which affect not only the investment decision but also the return on investment. Other studies (e.g. Papargyropoulou, Padfield [7] have identified other barriers and constraints to Malaysian sustainable development that includes limited local expertise, skills and maintenance culture, and also lack of awareness among building end-users.

Papargyropoulou, Padfield [7] also concluded, however, considering the developing nature of Malaysia's sustainability market, that there were many opportunities if various factors were

taken into consideration, for example legislation and policy reform, financial incentives and disincentives, emphasis on environmental and business opportunities, knowledge transfer and capacity building and also, education and engagement of end-users.

Conclusion: Envisioning 'Life Cycle' assessment for buildings in Malaysia

Indicators have an important role to play in assisting countries to make informed policy decisions concerning sustainable development. The development and implementation of sustainability indicators at the national level could be significantly enhanced through the establishment of national programmes, improved communication and cooperation through the establishment of coordinating mechanisms, further methodological development and training and also improved data and statistics to underpin the indicators. Partnerships between relevant national, regional and international institutions and organizations would contribute to achieving more reliable and timely indicators to measure progress made in achieving sustainable development.

With the support of the Low Carbon Cities Framework (LCCF), which comes under the umbrella of the Ministry of Energy, Green Technology and Water, the quality of building assessment in Malaysia is likely to be expanded and enhanced. This approach is in line with Lützkendorf, Hájek [12], who recommend a top-down approach which establishes the system structure and indicators, considers all dimensions of sustainability and capture the technical and functional qualities to ensure integration. From this perspective the present research aims to develop an assessment framework with two-fold dimensions; the triple bottom line of sustainability and whole of building life cycle, based on the barriers and opportunities discussed earlier in this paper. The outcome of this research is intended to be of practical value to build environment stakeholders in Malaysia to support decision-making and to improve the quality of information on the impacts of buildings on the environment, society and economy at different stage of a building's life.

Disclaimer

This paper is part of the lead author's ongoing postgraduate research study. The authors welcome comments and update information from all readers.

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