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RATING SYSTEMS IN HOUSING DESIGN AND DEVELOPMENT

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ABSTRACT: Green or sustainable design approach in all industries and sectors has become a demand of the global world. The negative impacts of the industries such climate change; global warming, ozone depletion and inefficient resource consumption have received a great concern and awareness among the public, politicians and academicians. Thus, a lot of efforts have been implemented either in terms of theories or practices in order to reduce the negative impacts of the industries. In the building sector, the sustainable building rating systems (SBRS) and certification systems has been designed and adopted in the building sector which intended to foster more sustainable building design, construction and operations by promoting and making possible a better integration of environmental concerns with cost and other traditional decision criteria. However, most of the internationally devised rating systems and certification system have been tailored to suit the building sector of the country where they were developed. Despite the different rating system adopted for the building sector in different country, these rating systems shared the common elements. Therefore, the aim of this paper is to explore the elements used in SBRS and the classification of certification system. This paper will start with the historic of sustainable development and green design, subsequently followed with the discussion on the SBRS adopted which focused only for Asian region and lastly, discussion on the unique elements of SBRS.
KEYWORDS: Sustainable Development, Green Building, Building Sector, SBRS

INTRODUCTION

Currently, sustainable approach has become a global demand in order to meet the current needs and future generations. However, to achieve this objective, it requires changes from all sectors and industries. For instance, in the automotive industry, developments of hybrid cars and other types of vehicle that reduces emissions have taken top priority in research and development [1,2]. While in the retailers sector, they are urged to reduce the numbers of plastic bags they hand out to the consumer and replace the plastic bag to degradable product such paper bag. Thus, the need for such similar approaches in the building industry need not be further elaborated. The construction industry is acknowledged as one of the industries that contribute to the major problems on the environmental, human health and energy consumption [3,4,5 & 6]. According to the (UNEP SBCI, 2009) in the “Building and Climate Change” report, the building sector in the developed and developing countries contributed as much as one third (30%) of total global greenhouse gas emissions and consumes up to 40% of all energy. Given the massive growth in new construction in the economic transition, and the inefficiencies of existing building stock worldwide, if nothing is done, this scenario would become worst. In order to promote and facilitate the sustainable practice among the construction players, the building rating systems has been introduced. The building rating system is a building evaluation tools that focus on different areas of sustainable development and are designed for different types of projects (Fowler & Rauch, 2006). However, there are various building evaluation tools has been designed and used in different regions and countries. These evaluation tools have similarities and differences in rating system between regions and countries which it depend on the local conditions [7]. Therefore, this paper is embarks on the following objectives:

1. To review SBRS in Asian countries,
2. Study the elements of these SBSR, and
3. To discuss the unique characteristics of each of all these SBRS for the improvement of the discussed SBRS, if there is any.

BACKGROUND OF SUSTAINABLE DESIGN

Sustainable or green in the construction industry is a concept to satisfy the objectives of sustainable development. Historically, the sustainable development was established in 1987 by the World Commission on Environment and Development [8,9]. The sustainable development was defined as “…the development that meets the needs of the present without compromising the ability of future generations to meet their own needs…” [10,8,3]. The main objective of sustainable development is to treat triple aspect, namely economic, social and environmental equally [11]. This triple bottom line has become a benchmark definition that has been adopted by various publications to base ideas, claims and support sustainability related findings [12]. The *second meeting of United Nations Earth Summit in 1992 was intended to bring sustainability to the fore in policy [13]. During this meeting, the Agenda 21 was formulated which it specifically refers to role of human settlements in sustainable development as highlighted in the Chapter 7 [14]. It is widely accepted that the human settlements is the best place to influence the sustainable development because it 'end product', the built environment is the context for the majority of human activity [14 & 15). To support the call for sustainable development, the First International Conference on Sustainable Construction was held in Tampa, Florida in 1994 [16,12,17]. The conference convener, Kibert defined sustainable construction as '…the creation and responsible maintenance of a healthy built environment based on resource efficient and ecological principles…' [18,19]. As suggested in this conference, there are seven principles in practicing sustainable design [20]:*

- *Minimize resource consumption (conserve);*
- *Maximize resource reuse (reuse);*
- *Use renewable or recyclable resources (renew/recycle);*
- *Protect the natural environment (protect nature);*
- *Create a healthy, non-toxic environment (non-toxics);*
- *Life cycle cost analysis and true cost (economics); and*
- *Pursue quality in creating the built environment (quality)*

To achieve the sustainable design principles, a rating system tool and certificate of classification has been devised by various countries. The development of rating system has been tailored to suit the building sector of the country where they were developed. However, it shared the common objective; to evaluate the level of effectiveness and efficiency of the buildings. The effectiveness and efficiency of the buildings are determined by certain elements which each of the elements in the rating system tool has different score. Finally, the certificate of classification of green building will be given based on the accumulate score from overall elements in the SBRS. Currently, the literatures on SBRS in more focus on the Europe and American settings. It can be said that, there are a little attention has been given to the study related to the SBRS that has been devised in the Asian Region. It is well acknowledged that these three regions have different climate and weather condition which the development of SBRS is highly depending on this aspect. Thus, this paper is aim to review the elements that has been used in Asian SBRS which focus on the new residential development only. By reviewing the differences and similarities between the countries in Asian, better sustainable design practices can be developed and will serve a clear picture to the construction developers who are interested to develop sustainable housing in the Asian Region in the future. However, there are only a few countries of Asian that have already developed the rating system for the new residential development and the rest of the countries are still putting an effort to have their own rating system. Hence, The SBRS is considered in this paper are Malaysia, Singapore, Indonesia, Japan and Hong Kong.

SUSTAINABLE BUILDING RATING SYSTEMS (SBRS)

SBRS are defined as tools that examine the performance of the building and translate that examination into an overall assessment that allows for comparison against the other buildings [21]. To assess the performance of the buildings, there are several elements that have been highlighted in each rating systems. The following are the discussion on the rating system for the new residential development that has been applied for the housing industry in Malaysia, Singapore, Japan and Hong Kong. After review these systems, this paper will discuss on the unique characteristic of these SBRS, if there is any.

Green Building Index (GBI) - Malaysia

Green Building Index (GBI) was developed by Pertubuhan Akitek Malaysia (PAM) and Association of Consulting Engineers Malaysia (ACEM) [22]. The first version of GBI for residential new construction (GBI RNC 1.0) was established in May 2009 and followed by GBI RNC 2.0 in 2011. GBI is a second rating tools that are devised based on tropical setting [23]. There are six main elements to evaluate the performance and environmental design of Malaysian buildings; Energy Efficiency (EE), Indoor Environmental Quality (IEQ), Sustainable Site Planning & Management (SM), Materials & Resources (MR), Water Efficiency (Mills & Glass), and Innovation (IN). Each of these elements have a different total score, and different level of building award or certification will be obtained based on the accumulate score from each elements. Table (1) shows the total score for each element in the GBI NRC 2.0, meanwhile Table (2) shows the GBI NRC 2.0 certification classification.

Table 1: GBI NRC Assessment Criteria Score Summary

ELEMENTS	SCORE
Energy Efficiency (EE)	23
Indoor Environmental Quality (IEQ)	12
Sustainable Site Planning & Management (SM)	37
Materials & Resources (MR)	10
Water Efficiency (WE)	12
Innovation (IN)	6
TOTAL SCORE	100

Source: GSB (2011)

Table 2: GBI NRC Green Mark Classification

GBI RATING & CLASSIFICATION	SCORE
Platinum	86+ points
Gold	76 - 85 points
Silver	66 - 75 points
Certified	50 - 65 point

Source: GSB (2011)

BCA Green Mark - Singapore

The Building and Construction Authority (BCA) Green Mark was launched in 2005 (BCA, 2006) (http://www.bca.gov.sg) and became the first rating tools that develop based on tropical climate. The BCA is an agency under the Ministry of National Development of Singapore. In April 2008, the new *buildings and works on existing building which exceeding 2000 square meters are mandatory to achieve minimum BCA Green Mark. The new building of residential in Singapore will be assessed based on BCA Green Mark for New Residential Building Version RB/4.0. Table (3) shows the score and building award classifications for this version.*

Table 3: BCA Green Mark Classification

Green Mark Rating and Classification	Score
Green Mark Platinum	90 and above
Green Mark Gold Plus	85 - 89
Green Mark Gold	75 - 84
Green Mark Certified	50 - 74

Source: BCA (2010)

The building is evaluated over five elements, energy efficiency, water efficiency, environmental protection, indoor environmental quality, and other green features. Table (4) shows the summary score for each element.

Table 4: BCA Green Mark Summary for Residential Building

Elements	Score
Energy Efficiency	87
Water Efficiency	14
Environmental Protection	41
Indoor Environment Quality	6
Other Green Features	7
TOTAL SCORE	155

Source: BCA (2010)

GREENSHIP - Indonesia

Rating system GREENSHIP was developed by the Green Building Council of Indonesia. The GBC Indonesia was established in 2009 and is an independent institutions and non-profit organization which responsible to promote sustainability approach in the built environment of Indonesia [21].

The first version of GREENSHIP for New Building was released in June 2010 (GBCI, 2010). Thus, it can be said that, GREENSHIP is the third rating system after Singapore and Malaysia that was devised based on tropical settings. So far, the GREENSHIP rating tools still did not separate the rating tools between new development of residential and non-residential buildings. The GREENSHIP assessment of the building is based on six elements. Table (5) shows the assessment elements and summary of the score for each element used in the GREENSHIP rating tool for the new building.

Table 5: Summary of GREENSHIP for New Building and Assessment Score

Elements	Score
Appropriate Site Development (ASD)	17
Energy Efficiency & Refrigerant (EER)	26
Water Conservation	21
Materials Resource & Cycle (MRC)	14
Indoor Health and Comfort	10
Building Environmental Management (BEM)	13
TOTAL SCORE	101

Source: GBCI (2010)

Comprehensive Assessment System for Building Environmental Efficiency (CASBEE) - Japan

CASBEE is a joint governmental, academic, and industrial building assessment project underway in Japan (Bunz, et al., 2006). The development of CASBEE was begin in 2001(Fowler & Rauch, 2006) under a committee established within the Institute for Building Environment and Energy Conservation, under the guidance of the Ministry of Land, Infrastructure and Transport (IBEC, 2008). CASBEE presents a new assessment concept which distinguished between environmental load (L) and quality of building performance (Bunz, et al., 2006; Fowler & Rauch, 2006; Sinou & Kyvelou, 2006). Another two concepts applied in the development of CASBEE were first it was designed for the assessment of buildings which corresponds to their lifecycle and secondly, it introduced the new indicator, namely BEE (building environmental efficiency) (Sinou & Kyvelou, 2006).

The assessment of CASBEE is given in the BEE form as a single value where BEE is defined as Q / L (quality of building performance) / (building environmental loads) (Bunz, et al., 2006; Sinou & Kyvelou, 2006). To assess the BEE value for the new construction (CASBEE - NC), the quality of building performance is divided into three elements, namely, indoor environment, quality of services, and outdoor environment on site. Meanwhile the building environmental load (L) is also comprised three elements, namely, energy, resources and materials, and off-site environment [20, 24, 25].

The BEE value can be divided into five classes from S down to C. the classification of CASBEE system shown in the Table (6).

Table 6: Classification of CASBEE Score and Rating System

Bee Value	Assessment	CASBEE Ranks
3.0 and higher	Excellent	S
1.5 ~ 3.0	Very Good	A
1.0 ~ 1.5	Good	B^+
0.5 ~ 1.0	Fairy Poor	B^-
Less than 0.5	Poor	C

Source: IBEC (2008)

Building Environmental Assessment Method (BEAM) - Hong Kong

BEAM scheme was established in 1996 and was adapted largely based on the UK Building Research Establishment's BREEAM (Bunz et al., 2006). BEAM is owned and operated by the BEAM Society, an independent not-for-profit organization whose membership is drawn from the many professional and interest groups that are part of Hong Kong's building construction and real estate sectors [26]. The original HK-BEAM scheme comprised two versions, one for new (HK-BEAM 1/96) and the other for existing office buildings (HK-BEAM 2/96) [27]. Meanwhile, the pilot assessment tool for the new building was developed in 2003 (version 4/03) and after an extensive review by the BEAM Society Technical Review Panels [26], the HK-BEAM 4/04 'New Building' was released in 2004 [28]. However, this version is replaced with the new version of assessment in 2009 which known as

"BEAM Plus for New Building" as a response to the climate change and global warming issue [29]. In April 2010, the "BEAM Plus for New Buildings Version 1.1" was established as a replacement to the existing version of new building assessment. In this new version, as show in the Table (7), there are 7 elements to evaluate the performance of new building and the bonus credit for each element. Each of these elements has a different weighting factor. While, the bonus credits would not count towards the total number of credits available, but would count towards the total of credits qualifying for an award classification [26].

Table 7: The Score of BEAM Plus for New Building Assessment Elements, Weighting Factor of Elements and Bonus Credit

Elements	Score	Bonus Credit	Weighting Factor (%)
Site Aspects (SA)	22	3B	25
Materials Aspect (MA)	22	1B	8
Energy Use (EU)	42	2B	35
Water Use	9	1B	12
Indoor Environmental Quality (IEQ)	32	3B	20
Innovations and Additions (IA)	-	5B	-

Source: BEAM Society (2010)

For the overall assessment, the building classification is determined by the percentage of the applicable score gained under each element and it's weighting factor. As an additional requirement, the minimum percentage of credit must be obtained for the three elements, SA, EU, and IEQ in order to qualify for the overall grade. The building also needs to achieve the minimum number of credit under the IA element [26]. Table (8) shows the classification award and minimum percentage of credits that need to be obtained by the building to get the overall grade.

Table 8: BEAM Classification Award and Minimum Percentage and Credit for Overall Grade

Beam Classification	Assessment	Overall Percentage (%)	Minimum Percentage (%)			IA (credit)
			SA	EU	IEQ	
Platinum	Excellent	75	70	70	70	3
Gold	Very Good	65	60	60	60	2
Silver	Good	55	50	50	50	1
Bronze	Above Average	40	40	40	40	-

(BEAM Society, 2010)

DISCUSSION OF UNIQUE CHARACTERISTICS

From the review on the selected of SBRS in Asian, there are several similarities and differences between theses SBRS. First, in terms of elements used to assess the new residential building, secondly, the assessment system and lastly, the building award classification. Obviously, the similarity of this assessment tool is that the elements used in these SBRS are almost shared similar characteristics such as energy, water, indoor air quality, site management, material, and innovation. However, the Green Mark of Singapore did not include the site management into consideration to assess the performance of building. This is due to the fact that the facilities and transportation system in Singapore has already developed. Thus, this site management in Singapore is no longer become an element that need to be consider by the housing developer. Meanwhile, CASBEE of Japan is the only rating system that has unique elements where it takes 'quality of services' into the assessment consideration.

For the new residential building assessment system, GBI (Malaysia), Green Mark (Singapore) and GREENSHIP (Indonesia) have similar approach. The total mark is calculated based on the cumulative mark of each element in the rating system which the total mark will determine the award classification. Meanwhile for CASBBE (Japan) and BEAM Plus (Hong Kong), the both of this rating system have different a way to calculate the total mark gained by the building.

For CASBEE, the performance of the building is calculated based on quality of building performance and environmental load (L). The value of Q/L will determine the performance of building which this value known as BEE value. The new residential building in Hong Kong is assessed based on the accumulate score in each element in the rating system of BEAM Plus. Additionally, the elements in the BEAM Plus rating system have different bonus credit. The total bonus obtained during the assessment will determine the award classification. However, to get the overall grade, as shown in the Table (8), the building needs to achieve the minimum percentage for three elements; site aspect, material aspect and indoor environmental quality.

For the building award, Indonesia is the only country that still develops their building award classification. For the GBI, Green Mark and BEAM Plus have similar award classification.

Despite these three rating system have different range of point or mark to get the building award, it have four award classification. The highest award is PLATINUM and the lowest award classification is CERTIFIED for GBI and Green Mark, and Bronze for the BEAM Plus.

For CASBEE system, this rating system is totally different with GBI, Green Mark, and BEAM Plus. CASBEE award has five classifications with the highest CASBEE rank will be labeled with S and the lowest award is C.

CONCLUSIONS

The aim of this paper is to review the rating system used to assess the new residential building in the selected country of Asian. By reviewing the existing SBRS some modification can be made in order to improve this rating system.

As mentioned earlier, GREENSHIP is still developing its own building award classification. Seems Indonesia *is neighborhood to Malaysia and Singapore, it may take GBI and Green Mark as example to develop the award classification. However, it should have own approach to classify the performance of the building just what has CASBEE did to has a unique award classification.*

In CASBEE system, it also includes the quality of service which this element cannot be found in other rating system. Under this element, earthquake resistance is taken into consideration. This shows that the local condition is an important factor in developing rating system. As we acknowledged, Indonesia also have similar situation.

Thus, in the GREENSHIP rating system, the earthquake resistance should be taken into consideration in order to extend the lifetime of building and ensure the security and safety of occupant. Meanwhile, in Malaysia, one of the common problems that always occurred in every year is flood. Maybe in the GBI rating system, this item should be added: flood resistance.

By taking local condition into consideration while assessing the building performance, it will improve the existing tools and optimize the building performance. Indirectly, the protection on the environmental will be improved as desired in the sustainability approach.

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