Recognizing the Important Requirements To Be Incorporated In the Green Building Rating Tools

[1]Muhamad Hafizi bin Mohd Thahrir, [2]Ismail bin Abdul Rahman, [3]Abdul Zaki bin Abd Wahid

[1,2,3]*Faculty of Civil and Environmental Engineering, Universiti Tun Hussein Onn Malaysia, Batu Pahat, 86400, Parit Raja, Johor, Malaysia.*

ARTICLE INFO	ABSTRACT
	This paper presents a study on investigating the important requirements to be incorporated into the Green Building Rating Tool (GBRT) from the viewpoint of the practitioners who are involved or associated with green building works. Even though Malaysia has two green building tools namely the Green Building Index (GBI) and Green Real Estate (Green RE), but elements present in these tools varies as compared to some of the international green building tools. Thus, this study investigated the relevancy of the elements and criteria from the current practice of the green building in Malaysia. Opinions from experts from Malaysia Green Building Confederation (MGBC) were sought in giving the preferences regarding the requirements to be included in a GBRT. Experts' opinion survey using Delphi method was carried out in two rounds. A total of 14 experts were involved in this survey and they were given questionnaire form to rate their preferences in the first round. In second round, level of agreement and group consensus was determined. Through Delphi survey, the results allowed the researcher to construct a suggested requirements for a GBRT based on the group consensus The experts have granted high scores to 8 assessment elements and 16 assessment criteria to be included in a GBRT.

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INTRODUCTION

According to Buys and Hurbissoon [1], Green building is the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building life cycle from the design to construction, operation, maintenance, renovation and deconstruction. Because building sector is one of the major energy usage in the world, it must be inspected to make sure it is sustainable. Green Building Rating Tool (GBRT) is a tool or system that examines the performance or expected performance of a whole building and translates that into an overall assessment that allow for comparison against other buildings [2] There are several GBRT had been formulated as early as 1990 with the released of Building Research Establishment Environmental Assessment Method (BREEAM) in United Kingdom [3]. These assessment tools are able to rate and determine the green performance of a building. Since then, many other countries have taken the effort to come out with their own rating tools. In Malaysia, there are Green Building Index (GBI) and Green Real Estate (Green RE), but elements present in these tools varies as compared to some of the international green building tools. Thus, this study investigated the relevancy of the elements and criteria from the current practice of the green building in Malaysia.

Recognizing the need for Malaysia to undertake development in a more environment-friendly way, Green Building Index was developed through the cooperation of Malaysian Institute of Architects (PAM) and the Association of Consulting Engineers Malaysia (ACEM) [4]. Introduced in 2009, GBI is Malaysia's first green rating tool and specifically established for Malaysia tropical climate, environmental context and cultural and social needs. It takes the framework of BREEAM and LEED in its development process. There are now 389 projects under GBI certification in Malaysia and the number is expected to increase [5]. This is because, building developers believe that it is an advantage for them to take that step as it can increase the value of the buildings.

In 2013, Green RE was established by Real Estate and Housing Developers Association Malaysia (REHDA) as an alternative green rating standards [6]. In the collaboration with private and public relevant stakeholders, it focuses as an affordable tool to promote and encourage more sustainable development in the built environment.

Corresponding Author: Muhamad Hafizi bin Mohd Thahrir, Faculty of Civil and Environmental Engineering, Universiti Tun Hussein Onn Malaysia, Batu Pahat, 86400, Parit Raja, Johor, Malaysia

The release of Green RE claims to create a healthy competition among other building rating tools [7]. Even REHDA headquarters, Wisma REHDA walks the talk with the integration of green sustainable designs to meet the demands for ecological-friendly developments [8]. This paper aims to explore the requirement of GBRT in Malaysia that have been the method to go for determining the sustainability of a building.

Gbrt Assessment:

Building environmental assessment around the word has a similar framework structure, which first to discover the environmental criteria, which are usually derived from the impacts on the environment [9]. Although it has similar framework in its development process, its assessment requirements are different. "The methods that have been developed worldwide are built upon various principles and different evaluation items, data and criteria [10]. There are no available standard guidelines from local authorities regarding the requirements of GBRT. The example of different assessment elements in GBRT presented in Table 1.

Table 1: Different assessment elements in GBRT

Assessment Elements	Green Building Rating Tool (GBRT)				
	BREEAM	LEED	Green Star	GBI	NABERS
1. Energy	•	•	•	•	•
2. Water	•	•	•	•	•
3. Management	•		•	•	
4. Health & Wellbeing	•				•
5. Landscape & Site	•	•	•	•	•
6. Pollution	•		•		
7. Transport	•		•		•
8. Materials	•	•	•	•	
9. Waste	•				•
10. Innovation	•	•	•	•	
11. IEQ		•	•	•	•
12. Refrigerant impact					•
13. Regional Credits		•			
TOTAL	10	7	9	7	8

From Table 1, the total assessment elements for all the selected GBRT have 13 different elements. BREEAM has the highest elements of evaluation with 10, while LEED and GBI have the lowest with 7 elements. Among all the evaluation categories, Landscape and Site, Energy and Water have been included in all of the tools. This shows that these three elements are the major aspects that must be included in a GBRT. Although GBI based on the framework of BREEAM and LEED, it has different assessment elements. Scientific journals have published several studies where the tools have been compared [5,11]

Methodology:

Delphi method was applied to achieve expert's preferences regarding the requirements to be included in a GBRT. Delphi method is a widely used and accepted method for gathering data from respondents within their domain of expertise [12]. This method was developed by Dalker and Helmer at the RAND Corporation to forecast likely inventions, new technology and the social and economic impact of technological change [13]. "This is a method of constructing communication between a group of individuals who can provide valuable aid for solving a complex problem' [14], which suited with the objective of the study.

Selection on the panel of experts:

Delphi method relies on expert feedback to generate a group consensus towards certain issues. Selection criteria should be clearly articulated [15], as example the numbers of years of working experience, highest educational certification or other expert experiences.

For this study, the panels selected from the Malaysia Green Building Confederations (MGBC) members. These experts involved in some way or other in the building industry and concerned about the building environment with the added membership requirements. From the total of 50 email invitations, 14 experts agreed to participate in this study which gave a response rate of 28 percent. A normal response rate in the construction industry for postal questionnaire is 20-30 percent [16]. Various efforts have been taken to improve the response rate of the study.

Design and validation of the questionnaire:

In general , two survey question areas were established to guide the design of the survey questions:
- Preferences regarding the most important assessment elements to be considered in the GBRT; and
- Preferences pertaining the most important assessment criteria to be considered in the GBRT.

After the questionnaire has been developed, a pilot study was conducted. This pilot study generally aimed to highlight problems, improvements and also the viability of the questionnaire amongst a small group of respondent.

Number of rounds and consensus:

Exploratory round : The purpose of this round is to get consensus from the experts regarding preliminary information gathered from the literature work. The survey was carried out using questionnaire form designed based on the literature review. The questionnaire consisted two main sections which are Respondent Background and Assessment Preferences.

First round of Delphi : The purpose of this round is to acquire rating from the expert regarding the most important assessment element and criteria using 5-point Likert scale.

Second round of Delphi : The purpose of this round is to acquire the level of agreement on the result of 1st round of Delphi. The survey was stop when group consensus was achieved.

Analysis and Findings:

From the feedback of 14 experts for first and second round of Delphi, the rating statistic for assessment element and criteria were computed and summarized. The measurement of central tendency (median) and level of dispersion (inter-quartile range) were used for the ranking of assessment elements and criteria. The use of median score, based on Likert-type scale is strongly favored [17, 18, 19]. Although studies using Lickert-scale usually formed feedback by the mean, median and interquartile range [20, 21], mean measurement is not considered very useful for achieving or demonstrating consensus [22]. The rating result of the assessment element and criteria for 1st and 2nd round of Delphi is shown in Table 2 and Table 3.

Table 2: Rating result of the assessment elements form First and Second round of Delphi

	Rating	
Assessment elements	1st round Median (IQR)	2nd round Median (IQR)
1. Energy Efficiency	5.0(0.00)	5.0(0.00)
2. Indoor Environmental Quality (IEQ)	5.0(0.00)	5.0(0.00)
3. Sustainable Site Planning & Management	5.0(0.00)	5.0(0.00)
4. Materials & Resources	5.0(0.00)	5.0(0.00)
5. Water Efficiency	5.0(0.00)	5.0(0.00)
6. Waste Management	5.0(0.00)	5.0(0.00)
7. Pollution & Emission	5.0(1.00)	5.0(0.00)
8. Innovation	4.0(2.00)	5.0(0.75)

Note:
Total number of experts: 14 experts
IQR = Inter Quartile Range
Point range: 1 = Strongly disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly Agree

From Table 2, in the first round of Delphi, the lowest median value for the assessment elements was 4.0 (Innovation) and the highest value of IQR was 2.00 (Innovation). While in second round of Delphi, all the assessment elements received median value of 5.0 and the highest IQR value was 0.75 (Innovation). There were improvements with median and IQR value between first and second round of Delphi. High median value and low IQR gives a perspective of agreement towards group consensus. The rating result of the assessment criteria from first and second round of Delphi as in Table 3.

Based on Table 3, in first round of Delphi, the lowest median value was 3.0 (Require measurable reduction in CO2) and the highest IQR value was 1.75. While in second round of Delphi, all the assessment criteria received 5.0 median value. The highest IQR value was 0.75 in second round of Delphi. There were also improvements in median and IQR value for assessment criteria between first and second round of Delphi.

IQR of 1 or less is found to be a suitable indicator for consensus that used 4 or 5-point unit scales [11, 23, 24]. Using 5-point scale, IQR value of 1 or less is a good pointer that consensus is achieved. Considered group consensus is achieved, the survey is stop after 2nd round of Delphi. Recommended number of rounds based on several studies is between two and three rounds [25]. The experts have granted high scores to 8 assessment elements and 16 assessment criteria to be included in a GBRT. Through Delphi method, the results allowed the researcher to construct a suggested requirements for a GBRT based on the group consensus.

Table 3: Ranking result of the assessment criteria from First and Second round of Delphi

| Assessment criteria	Relevant	
	1st round Median(IQR)	2nd round Median (IQR)
1. Regular update & consensus-based	5.0(0.00)	5.0(0.00)
2. Clear design documentation	4.5(1.00)	5.0(0.00)
3. Independent 3rd party	5.0(1.00)	5.0(0.00)
4. Develop sustainable site	5.0(1.00)	5.0(0.00)
5. Efficient use of water resources	5.0(0.00)	5.0(0.00)
6. Reduction in energy usage	5.0(0.00)	5.0(0.00)
7. Use renewable energy	4.0(1.00)	5.0(0.00)
8. Reduce non-renewable sources	4.5(1.00)	5.0(0.00)
9. Improve IEQ	4.5(1.00)	5.0(0.00)
10. Promote innovative design & process	5.0(1.00)	5.0(0.00)
11. Recognize life cycle value	5.0(0.00)	5.0(0.00)
12. Utilize Life Cycle Assessment	5.0(0.75)	5.0(0.00)
13. Acknowledge bioclimatic differences	5.0(1.00)	5.0(0.00)
14. Reduce on-site & off-site toxic elements	5.0(0.75)	5.0(0.00)
15. Require measurable reduction in CO2	3.0(1.75)	5.0(0.75)
16. Documentation of actual performance	4.0(1.75)	5.0(0.75)

Note:
Total number of experts: 14 experts
IQR = Inter Quartile Range
Table entries in underline represent the key-phrase of the assessment criteria.
Point range: 1 = Strongly disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly Agree

Conclusion:

Delphi method is used to determine the local expert's preferences regarding the most important assessment elements and criteria to be included in the GBRT. It is believe that the results of this study support the use of the Delphi method. Group consensus were determined after 2 rounds of Delphi. Based on the Delphi study, the requirements for a GBRT were identified. From the feedback of the 14 local green building experts, 8 assessment criteria and 16 assessment criteria were suggested to be incorporated into a GBRT that summarized into Figure 1.
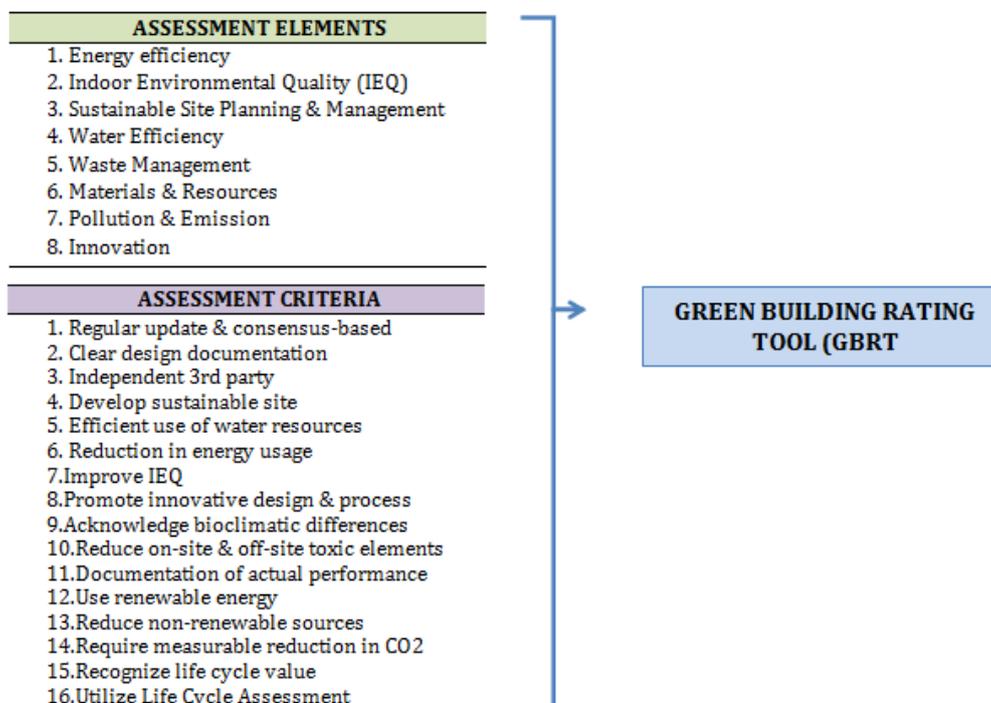
Fig. 1: The suggested requirements for a GBRT

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