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Stakeholder Background and Knowledge Regarding Green Home Rating in Malaysia

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***Abstract*—**Green home rating has emerged as an important agenda to practice the principles of sustainability. In Malaysia, the establishment of the 'Green Building Index – Residential New Construction' (GBI-RNC) has brought this agenda closer to the stakeholders of the local green building industry. GBI-RNC focuses on the evaluation of the environmental impacts posed by houses rather than assessing the Triple-Bottom-Line (TBL) of Sustainability which also include socio-economic factors. Therefore, as part of a wider study, a survey was conducted to gather the backgrounds of green building stakeholders in Malaysia and their responses to a number of exploratory questions regarding the setting up of a framework to rate green homes against the TBL. This paper reports the findings from Section A and B from this survey and discusses them accordingly with a conclusion that forms part of the basis for a new generation green home rating framework specifically for use in Malaysia.

***Keywords*—**Green home rating, Malaysia, stakeholder survey analysis

I. Introduction

As part of a PhD research which utilizes a simultaneous mixed-method design, a survey questionnaire was administered to a group of green building industry stakeholder in Malaysia. The other research method employed was structured interviews of a small group of Malaysian green building experts who have direct experiences with green buildings and green homes. This group of experts belonged to the same stakeholder group who were surveyed with a questionnaire instead. The overall objective of the survey was to establish a consensus on the importance of indicators pertaining to the building of green homes which were grouped into seven categories according to the Triple-Bottom-Line (TBL) of Sustainability. The underlying principles and objectives behind the survey were explained in detail to the respondents in the first page of the questionnaire. In keeping with the sustainability principles, this survey was conducted electronically in order to limit the carbon footprint that entails printed and posted questionnaires including any ensuing carbon emission due to vehicular transport during subsequent "follow-ups" needed to achieve a respectable response rate.

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II. Survey Questionnaire

A. Rationale

The survey questionnaire is the most feasible research method to gather information from a large group of people [1, 2]. In this case there were 379 potential respondents who are categorized as Malaysian green building (GB) stakeholder through association with green building movements such as the Malaysian Green Building Confederation (MGBC), the Green Building Index (GBI), Centre of Technology, Development and Energy Malaysia (CETDEM), proponents of the Smart and Cool Home, proponents of the Cooltek house, GB researchers, GB academicians and government official related to GBs. Utilizing a few focus groups involving a sample from the stakeholder to explore and discuss the research topic was first considered but gathering them at specific time and venue was difficult and beyond the means of the researcher as warned by Knodel [3], Krueger and Casey [4] among others [5-9]. The analysis of focus groups also required videotaping the group, which the researcher did not have ethical permission to do so. Hence, a simultaneous mixed-method research design employing both structured interviews and survey questionnaire was devised instead as laid out by Morse and Niehaus [10]. Some findings from both methods were comparable but this is beyond the scope of this paper.

B. Sampling

Out of the 379 stakeholder group only 293 have listed and known email addresses. Initially all 379 were contacted via email to assess if the addresses acquired were valid. A total of 86 addresses were invalid, thus excluded from the research. In effect, the survey sample has reduced to 293. This group of respondents was varied due to their various associations, backgrounds and principled stances. Hence, for a conventional 50/50 split with ±5% reliability, a total of 166 respondents were needed. As it turned out, 46 respondents replied with completed questionnaires before the due date of 29 October 2010.

C. Reduction of Errors

In order to reduce errors, the questionnaire was piloted involving 9 respondents. They tested the feasibility and the validity of all included questions. All of them agreed that the questionnaire was suitable with minor changes and additions. Eventually, additions were made to include the metrics or measurements for all questions while questions 1.11 in

Section D1, 7.19 and 7.20 in Section D7 were added. The wordings and structure of some questions were also changed in accordance with their recommendations.

Besides this, as mentioned earlier, all GB industry stakeholders were emailed initially with a note of the impending questionnaire, the objectives and timeline. This notification not just served to validate their email addresses but also to ensure that the respondents were more receptive to the survey and would not simply delete subsequent emails or put them into the "Junk folder." A total of three emailed reminders were sent throughout the allocated period from 26 September 2010 to 29 October 2010 as advocated by Babbie [11] and Salant and Dillman [8]. The number of responses increased when reminders were sent.

Despite the precautions, the survey could still be deemed to suffer from non-response error due to small number of completed questionnaires (response rate of 27.7%) and a risk of measurement error due the principled categorization of indicators according to the TBL. The TBL has seven categories in total; Environment, Social, Economy, Environment – Social - Economy, Environment - Social, Social - Economy and Economy - Environment. All indicators were gathered from literature, existing GB rating tools and existing building sustainability assessment methods. In total there were 82 indicators unevenly distributed into the seven categories.

The questionnaire was divided into four sections, Section A: Expert Classification, Section B: Home Rating Characteristics, Section C: Category Weight and Section D1: Environment Category to Section D7: Economy – Environment Category. In this paper, the findings from Sections A and B were reported.

III. Findings from Survey Questionnaire

A. Findings from Section A: Expert Classification

In Section A, respondents were asked to identify their profession classification. 29 out of 46 of the respondents identified themselves as "Building Practitioner", 13 as "Building Academician" and the remainder was "Government" officials. These classifications are important because the overall results in Section B through D7 are defined by the views of three different groups of respondents. Hence, the need for detailed comparisons among them can be made.

TABLE I
CLASSIFICATION OF STAKEHOLDERS IN SECTION A

		Frequency	Percent	Valid Percent	Cumulative percent
Valid	Building practitioner	29	63.0	63.0	63.0
	Building academician	13	28.3	28.3	91.3
	Government officials	4	8.7	8.7	100.0
	Total	46	100.0	100.0	

Subsequently, the respondents were asked to give "Yes" or "No" answers to nine further questions in order to establish their backgrounds and familiarity with a few concepts. It was found that although 54.3% of the respondents have been involved with GBs, only 39.1% of them were actually certified GB accreditor / certifier. Even less, only 10 of them or 21.7% were involved in the development of GB rating tools whether directly or indirectly through contribution of knowledge during the development of the Green Building Index Malaysia (GBI). Through further investigation using a chi-square test for goodness of fit (within $\alpha = .05$) as advocated by Allen and Bennet [12], it was found that the difference between the number of respondents who were developers of GB rating tools and those who were not was statistically significant with X^2 (1, N = 46) = 14.696, $p < .05$ and Cohen's w was 0.565, which can be considered large.

TABLE II
DESCRIPTIVE STATISTICS FOR QUESTIONS A2 TO A10

	Expert classification			Total
	Building practitioner	Building academician	Government officials	
A2 - Certified GB accreditor / certifier				
No	12	12	4	28
Yes	17	1	0	18
Total	29	13	4	46
A3 - Involvement in GB				
No	9	9	3	21
Yes	20	4	1	25
Total	29	13	4	46
A4 - Research on GB				
No	15	4	3	22
Yes	14	9	1	24
Total	29	13	4	46
A5 - Publications on GB				
No	24	6	4	34
Yes	5	7	0	12
Total	29	13	4	46
A6 - Developer of GB tools				
No	25	8	3	36
Yes	4	5	1	10
Total	29	13	4	46
A7 - Familiarity with Sustainability				
No	3	1	0	4
Yes	26	12	4	42
Total	29	13	4	46
A8 - Familiarity with SD				
No	3	1	0	4
Yes	26	12	4	42
Total	29	13	4	46
A9 – Familiarity with TBL				
No	10	3	0	13
Yes	19	10	4	33
Total	29	13	4	46
A10 – Familiarity with Systems Thinking				
No	21	7	2	30
Yes	8	6	2	16
Total	29	13	4	46

Although all respondents were GB industry stakeholders whose names were publicly listed on various GB movement and entities in Malaysia, only about half of them (25 out of 46) acknowledged that they were involved in GBs. This is hardly surprising since the numbers of built GBs and "Green

Homes" (GH) in Malaysia is still very small as compared to conventional buildings. Until now, only one building which has been certified by the GBI and a few others which are in design and construction stages and to be certified by the Green Mark from Singapore and the Leadership in Energy and Environmental Design (LEED) from the USA. This confirmed that the GB industry in Malaysia is still in its infancy. However, it is good to know that a large number of those who were involved in GBs in Malaysia were in fact certified GB accreditor / certifier.

In terms of research, about half or 52.2% of the respondents have done any research on GBs but only half of them or 12 respondents ever made any publications on their GB research. Through a chi-square test for goodness of fit (within $\alpha = .05$), it was found that the difference between respondents who have published their research on GBs and those who did not was statistically significant with X^2 (1, N = 46) = 10.522, $p < .05$ and Cohen's w was 0.478, which can be considered medium. In all, the level of interest in GBs is present due to ongoing research both by researchers at local universities for theoretical development of GBs and at private organizations for business purposes.

It is more settling to find that 42 out of 46 respondents acknowledged their familiarity with the "Sustainability" concept and the same respondents were also familiar with the "Sustainable Development" (SD) concept. However, only 33 of them recognized the TBL of "Sustainability." Fewer respondents (16 out of 46) recognized the "Systems Thinking" concept. Again the statistical differences between respondents who recognize the Sustainability, SD and TBL concepts were significant with X^2 (1, N = 46) = 31.391, $p < .05$ and a large Cohen's w of 0.826; X^2 (1, N = 46) = 31.391, $p < .05$ and a large Cohen's w of 0.826; and, X^2 (1, N = 46) = 8.696, $p < .05$ and a medium Cohen's w of 0.435 respectively.

B. Findings from Section B: Home Rating Characteristics

In Section B, the respondents were asked to note their levels of agreement using a five point "Likert" response format from "Strongly agree" to "Strongly disagree." The five statements were:

- B1 - Homes can be rated using TBL
- B2 - Indicators must be localized
- B3 - Rate against checklist of standards
- B4 - Rate as systems; and
- B5 - Rate at any stage of life.

TABLE III
DESCRIPTIVE STATISTICS FOR ANSWERS GIVEN IN SECTION B

		B1	B2	B3	B4	B5
N	Valid	46	46	46	46	46
	Missing	0	0	0	0	0
Mean		4.17	4.80	4.04	3.83	4.15
Median		4.00	5.00	4.00	4.00	4.00
Mode		4	5	4	4	4
Std. Deviation		.769	.453	.788	.877	.965
Variance		.591	.205	.620	.769	.932
Skewness		-.620	-2.306	-.649	-.679	-1.712
Kurtosis		-.047	4.973	.357	1.081	3.617

It was found that most respondents agreed to all five statements with a combined agreement percentage of 82.7% for statement B1, 97.8% for statement B2, 80.5% for statement B3, 67.4% for statement B4 and 86.9% for statement B5. More respondents took a neutral stance for statement B4 because only a small number of them (16 out of 46) recognized the Systems Thinking concept.

TABLE IV
TEST STATISTICS TO DETERMINE THE STATISTICAL DIFFERENCE BETWEEN RESPONDENT GROUPS FOR EACH QUESTION IN SECTION B

	B1	B2	B3	B4	B5
Chi-square	.871	3.717	.609	1.733	4.216
df	2	2	2	2	2
Asymp. Sig.	.647	.156	.738	.420	.122
Cohen's f	.141	.300	.117	.200	.322

a. Kruskal Wallis Test
b. Grouping Variable: Expert classification

On further investigation, each response for questions in Section B of the survey has a negative skew making them unsuitable for inclusion in regular one-way between-groups ANOVA [12-14]. Hence, the Kruskal-Wallis ANOVA test was used instead to highlight any statistical differences between each respondent group as this test was not bound by the assumption of normality [12-14]. The test indicated that there were no statistically significant differences between the levels of agreement among all three respondent groups for all questions in Section B of the survey as outlined in Table V.

C. Hypothesis testing

There are null hypothesis (Ho) and alternative hypothesis (Ha) for each statement in Section B of the questionnaire. They are as the following:

- Ho B1: GH cannot be rated using the TBL
- Ha B1: GH can be rated using the TBL
- Ho B2: Indicators must not be localized
- Ha B2: Indicators must be localized
- Ho B3: GH cannot be rated against checklist of standards
- Ha B3: GH can be rated against checklist of standards
- Ho B4: GH cannot be rated as systems
- Ha B4: GH can be rated as systems
- Ho B5: GH cannot be rated at any stage of life
- Ha B5: GH can be rated at any stage of life

Since the sample is small (N = 46) and the data were negatively skewed, a Binomial test was conducted to test the series of hypotheses above. A cut point of 3.00 (Neither agree nor disagree) was selected with a Test proportion of .50. In a normal distribution where the mean was 3.00, a perfect 50/50 split should be expected. The output in Table V shows that answers for all five statements were broken down into two groups: <= 3 and > 3. It was found that more than 67% of respondents gave an agreement level of more than 3 (either 4: Probably agree or 5: Strongly agree) to all statements with $p < .05$ which is significant. Hence, all null hypotheses Ho B1 to Ho B5 can be safely rejected.

TABLE V
BINOMIAL TEST TO TEST THE SET OF HYPOTHESES FOR ALL STATEMENTS IN SECTION B

		Category	N	Observed Prop.	Test Prop.	Asymp. Sig. (2-tailed)
B1	Group 1	<= 3	8	.17	.50	.000[a]
	Group 2	> 3	38	.83		
	Total		46	1.00		
B2	Group 1	<= 3	1	.02	.50	.000[a]
	Group 2	> 3	45	.98		
	Total		46	1.00		
B3	Group 1	<= 3	9	.20	.50	.000[a]
	Group 2	> 3	37	.80		
	Total		46	1.00		
B4	Group 1	<= 3	15	.33	.50	.026[a]
	Group 2	> 3	31	.67		
	Total		46	1.00		
B5	Group 1	<= 3	6	.13	.50	.000[a]
	Group 2	> 3	40	.87		
	Total		46	1.00		

a. Based on Z approximation

Further investigation using the Chi-square test for goodness of fit (within $\alpha = .05$) was also conducted to test the level of agreement among the respondents with regard to all five statements.

The results from the Chi-square test above showed that the observed frequencies of agreement deviated substantially from the pattern of frequencies if the respondents just chose randomly among the levels of agreement and most respondents agreed to all five statements.

TABLE VI
TEST STATISTICS TO DETERMINE THE PROBABILITY OF CHOOSING A LEVEL OF AGREEMENT FOR EACH QUESTION IN SECTION B

	Chi-square	df	Asymp. Sig.	Cohen's *w*
B1	21.826[a]	3	.000	0.689
B2	51.435[b]	2	.000	1.057
B3	23.391[a]	3	.000	0.713
B4	31.391[c]	4	.000	0.826
B5	43.348[c]	4	.000	0.971

a. 0 cells (.0%) have expected frequencies less than 5. The minimum expected frequency is11.5
b. 0 cells (.0%) have expected frequencies less than 5. The minimum expected frequency is15.3
c. 0 cells (.0%) have expected frequencies less than 5. The minimum expected frequency is 9.2

IV. CONCLUSION

The backgrounds of the respondents who were GB industry stakeholders in Malaysia were identified in Section A: Expert classification of the questionnaire. It was found that their backgrounds varied in terms of frequency between each group of respondents as laid out in Table II. Statistically significant differences between respondents who answered "Yes" and "No" for questions A5 to A9 were observed. The majority of the respondents (N = 46) did not publish any of their research; were not involved in the development of any GB rating tool; were familiar with the concepts of Sustainability, SD and TBL; and were not familiar with the concept of Systems Thinking. Thus, the respondents need more education on the principles and concepts of GBs and GHs and the concept of Systems Thinking to make objective decisions. They also need more exposure to the principles of rating GBs and GHs.

In Section B: Home rating characteristics, it was found that there were no significant statistical differences among all three groups of respondents between their level of agreement to all five statements B1 to B5.

A set of null and alternative hypotheses were also tested in Section B. Both Binomial test and Chi-square test for goodness of fit was conducted and it was found that all five null hypotheses can be safely rejected without causing any Type I error. Hence, GHs can be rated using the TBL approach to Sustainability, all indicators used to rate GHs must be localised, GHs can be rated against a checklist of standards, GHs can be rated as whole systems rather than in components and GHs can be rated at any stages of their lives.

In all results from Sections A and B showed that did have some knowledge in the principles of rating GHs but they need more education and confidence to be actively involved in rating GHs.

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