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A Correlative Study between Internal Factors and the Implementation of the Green Building Development among the Housing Developers in Klang Valley, Malaysia

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Abstract: Building sector plays an important role in changing the environment to be more energy-efficient and climate-friendly as it is the major indexes of greenhouse gas emission from the pre-design phase to demolition phase. Rapid growth in human population makes residential sectors as the major shares of total energy consumption. Therefore, green housing is one of the solutions in order to address the issue of the inevitable environmental change that caused by the development. However, in Malaysia, the green building implementation is still lacking. GBI stated that only 25 housing building is certified with Certified Verification Assessment (CVA) since 2009. This study aims to identify the relationship between internal factors and the green building implementation among the housing developers in Klang Valley. A questionnaire survey was conducted and 234 respondents have been covered the study. A statistical analysis such as descriptive, Principal Component Analysis (PCA) and correlation analysis was used to analyze the data. Result showed that there was a significant positive correlation between value and attitude, whilst between knowledge and emotion was no relationship with the green building implementation among housing developers. The internal factors of developers values and attitudes towards the green building principles will influence the housing developers to implement green development in Malaysia.

Key words: Green building, housing developers, internal factors of green building implementation, implementation, development, rapid growth

INTRODUCTION

The building sector was estimated as the highest carbon emission in 2030. IPCC has stressed that global consumption of fossil fuels and carbon dioxide are the major greenhouse gas emission since 1970 were causing the global warming that contributes towards climate change (IPCC, 2014). The urbanization causes the temperature at the developed area to increase dramatically and contributes to global warming. As a developing country, Malaysia has a critical issue with rapid growth in the urbanization. Khazanah Research Institute (KRI) projection on the figure of Malaysi's population will achieve a total number of 32,441.20 in the year 2020 (KRI, 2014). Thus, the rapid growth in human population will increase the demand for housing development and energy consumption that lead to the increase of CO_2 in urban areas.

Green building has proven in contributing toward sustainability as it can reduce 30-80% of CO_2 emission due to energy efficient consumption. Green building can improve and restore its surrounding and indoor environmental quality for better occupational health and well-being.

Problem statement: Many efforts have been done to encourage the green housing development in Malaysia. However, the implementation of the green building development among housing developers is still lacking. There is no clear measure on factors affecting the implementation of the green housing development among housing developers. Therefore, this research will identify factors affecting the green building implementation among the housing developers to ensure that the green building development is well implemented among housing developers.

In pro-environmental behavior theory by Kollmuss and Agyeman (2002), demographic, external (e.g., institutional, economic, social and cultural) and internal factors (e.g., knowledge, values, attitudes, emotion) have been found to have some influence on pro-environmental behavior. In this study, Pro-Environmental Behavior (PEB) is referred as green building implementation because they have the same meaning which to minimize the negative impact of one's action on nature. This study focuses on the internal factors of PEBs to identify the relation between the internal factor and the green building implementation among the housing developers in Klang Valley.

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In environmental psychology, common measures of PEB are based on a list of PEB behaviors usually developed by the researcher (Gatersleben *et al*., 2002). Respondents are provided with such a list and they are asked to indicate how often (never to always) they perform each of these behaviors. Consequently, an important disadvantage of common social science measures of PEB behavior is that they focus on behaviors that do not significantly contribute to environmental problems that is they do not reflect the actual (lower) environmental impact of persons or households. Therefore, studies based on these measures provide little insight into the variables that could be helpful in significantly reducing the environmental impact of development.

The internal factors of the PEB: Internal factors or psychological factors on PEB reveal that it has a strong internal stimulus on environmental behavior. Kollmuss and Agyeman (2002) stated that human motivations are shaped by intensity and direction from all possible options. Kollmuss and Ageyman (2002) stated that behavior can be changed through personal commitment before becoming as a habit. Although, the internal factors do not directly influence the PEB, it can trigger the environmental consciousness of an individual by environmental knowledge, values, attitude and emotional involvement.

Environmental knowledge of the green building: Knowledge in the green building was included the green buildings principles and benefits towards human and the environment. Environmental knowledge should be given to all individuals in order to be able to change their environmental attitudes and behavior (Ramsey and Rickson, 1976). In this study, the knowledge on pro-environmental behavior was measured on the environmental knowledge of green buildings and green building principles. The knowledge of the green building effect towards environmental protection and human well-being will high the environmental awareness and willing to commit to environmental legislation for environmental protection and improvement. Environmental awareness has both knowledge-based component and emotional involvement (Abdul-Wahab, 2008).

Developer emotion of the green building principles: Emotion is often intertwined with mood, temperature, personality, disposition and motivations. It is also knowns intense mental activity and the degree of pleasure or displeasure (Cabanac, 2002). Emotion is also linked to behavioral tendency and driving the force behind motivation, positive or negatives. Emotion will react when confronted with environmental degradation. Based on Kollmuss and Agyeman (2002), emotional involvement is very important in shaping human beliefs, values and attitudes towards the environment. Emotion is measured by using a degree of pleasure or displeasure according to Paul Ekman six basic emotions such as anger, disgust, fear, happiness, sadness and surprise (Handel, 2011).

Developer values of the green building principles: Values are responsible for shaping human intrinsic motivation. The term values are defined as interest, pleasures, likes, preferences, duties, moral obligations, desires, wants, goals, needs, aversions and attractions and other orientations (Williams and Robin, 1979). The environmental values are based on one's life experience that has shaped the beliefs and value of active environmentalists. According to Karp (1996), Schwart's theory found that values have a positive influence on environmental behavior in openness to change and universalism. Values influence action when they are relevant in the context and important to the actor (Schwartz, 2012).

Developer attitudes of the green building principles: Attitudes are defined as the enduring positive or negative feeling about some person, object or issue. In this study, the attitudes are measured based on developer's agreement on green building knowledge and criteria. Attitudes can directly influence pro-environmental behavior together with the beliefs and values of green building practices as an environmental protection. Many barriers are responsible for the gap between environmental attitudes and pro-environmental behavior like cost and political changes. This is because, there are other factors that influence environmental behavior such as political, economic, social and cultural. However, attitude can indirectly influence the PEB as they believe that in green building have enormous benefits to the human and environments. Thus, value and attitude are important in determining PEB.

Literature review: Based on the literature review discussed, the internal factors were identified. Figure 1 shows the theoretical framework of the factors affecting the implementation of green building. A questionnaire was designed according to identifying the internal factors relationships on the implementation of the green building development among the housing developers in Klang Valley. This study was carried out to explore the relation and comprehensiveness of the internal factors in the green building implementation. This study will provide further understanding of the internal factors of PEB as a crucial element towards formulating a comprehensive tool

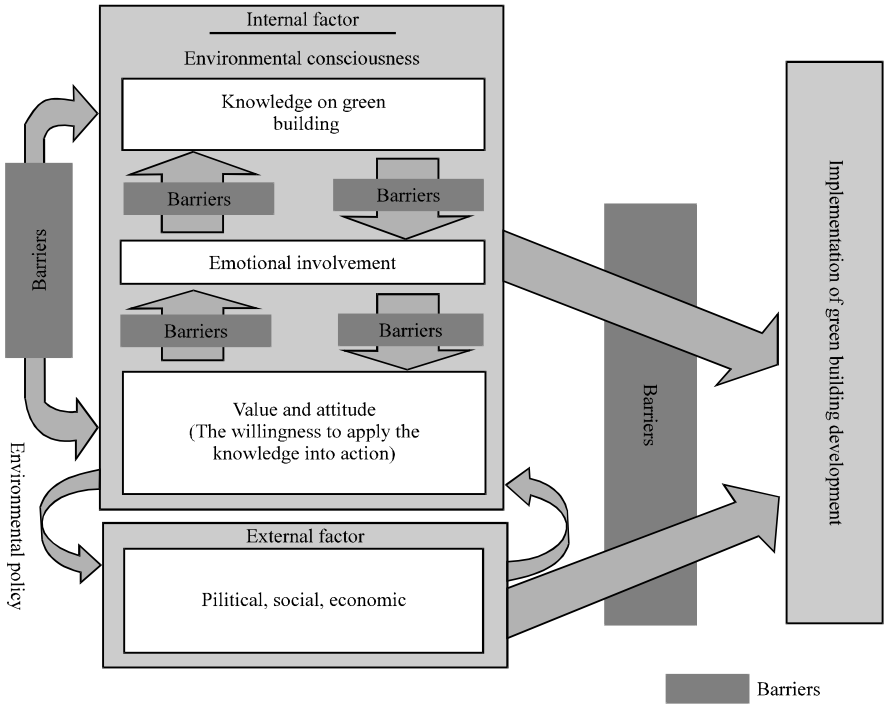

Fig. 1: Theoretical framework of the implementation of green building development

for developers to successfully deliver green building projects in Malaysia and creating a sustainable future.

Hypothesis: There is a significant relationship between the internal factors of green building implementation. There is a significant relationship between the internal factors and green building implementation.

MATERIALS AND METHODS

After doing a comprehensive study in the literature review, a theoretical framework developed using the modified version of pro-environmental behaviour models. To assess the internal factors of green building implementation among housing developers in Klang Valley, a survey questionnaire was conducted from April 2016 until the end of June, 2016. The target respondent in this study was the housing developers in Klang valley area. Table 1 show a total of 24 items on the knowledge of green building which 18 of the items are the green building principles that assess the internal factors that influence the green building implementation. Based on the Likert scale, the respondents were required to choose within the scale of agreement (i.e., 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree and 5 = strongly agree) for question 1 (Section B) and question 4 (Section C). Meanwhile, question 2 (Section B) was based on the scale of emotion (i.e., 1 = angry, 2 = fear, 3 = tender, 4 = happy and 5 = excited). Question 3 (Section C) was based on a scale of importance (i.e., 1 = not important at all, 2 = not important, 3 = neutral, 4 = important, 5 = very important). The questions 5 were about the implementation of the green building principles (i.e., 1 = yes and 2 = no).

The research sample was based on the list of developers located in Klang Valley obtain from the ministry of housing and local government commonly known as Kementerian Perumahan dan Kerajaan Tempatan (KPKT). The random sampling procedure was chosen for this study. This study, have successfully received 234 respondents consist of professional position field such as architect, engineer, planner, quantity surveyor and building surveyor and the top management team. Those people have more understanding and familiar with the subject matter and company project.

The data was then being analyzed by using Statistical Package for Social Science (SPSS) Software. The frequency and descriptive analysis were applied to present the respondent background. The PCA as an extraction method was used to reduce the number of variables and to detect structure in the relationship between variables that is to classify the variables (Statsoft, 2003). The reliability of the variable was tested using Cronbach's alpha coefficients. In addition, correlation analysis was performed to identify the relationship between the internal factors and the implementation of green building. The results are elaborated in the next section.

Table 1: The research items/developers internal factors on the implementation of the green building principles

Codes	Items	References
GBP 1	Should be designed according to the local environment	Aliagha *et al.* (2013), Li *et al.* (2014) Olubunmi *et al.* (2016), Abidin (2010) Hong (2009), Deng and Wu (2014), Sentman (2009) and Zhou (2015)
GBP 2	Should optimize local materials/product consumption	Aliagha *et al.* (2013), Li *et al.* (2014), Olubunmi *et al.* (2016), Abidin (2010) Hong (2009), Deng and Wu (2014), Sentman (2009) and Zhou (2015) [PH]
GBP 3	Apply integrated design and integrated process	Aliagha *et al.* (2013), Li *et al.* (2014), Olubunmi *et al.* (2016), Abidin (2010) Hong (2009), Deng and Wu (2014), Sentman (2009), Zhou (2015) and GBI (2016) [GP][GR][PH]
GBP 4	Encourage green design and innovation	Olubunmi *et al.* (2016), Aliagha *et al.* (2013), Elias and Lin (2015), Li *et al.* (2014), Sood *et al.* (2011), Hamid *et al.* (2014), Deng and Wu (2014), Sentman (2009) [GR]
GBP 5	Energy efficiency	Aliagha *et al.* (2013), Elias and Lin (2015), Isa and Kalsum (2015), Li *et al.* (2014), Samari *et al.* (2015), Sood *et al.* (2011), Shari (2011), Hamid *et al.* (2014), Abidin (2010), Deng and Wu (2014), Sentman (2009), Samari *et al.* (2013) and Zhou (2015)
GBP 6	Water efficiency	Aliagha *et al.* (2013), Elias and Lin (2015), Isa and Kalsum (2015), Li *et al.* (2014), Samari *et al.* (2015), Sood *et al.* (2011), Shari (2011), Abidin (2010) Deng and Wu (2014), Sentman (2009), Samari *et al.* (2013) and Zhou (2015)
GBP 7	Resource efficiency	Aliagha *et al.* (2013), Elias and Lin (2015), Isa and Kalsum (2015), Li *et al.* (2014), Samari *et al.* (2015), Sood *et al.* (2011), Abidin (2010), Deng and Wu (2014), Sentman (2009), Samari *et al.* (2013), Zhou (2015) and GBI (2016) [GP][GR][PH][MC]
GBP 8	Green waste and emission management	Aliagha *et al.* (2013), Elias and Lin (2015), Isa and kalsum (2015), Li *et al.* (2014), Samari *et al.* (2015), Sood *et al.* (2011), Shari (2011), Hamid *et al.* (2014), Abidin (2010), Deng and Wu (2014), Sentman (2009), Samari *et al.* (2013), Zhou (2015) and GBI (2016) [GP][GR][MC]
GBP 9	Renewable energy design approaches	Aliagha *et al.* (2013), Elias and Lin (2015), Isa and Kalsum (2015), Li *et al.* (2014), Samari *et al.* (2015), Sood *et al.* (2011), Shari (2011), Hamid *et al.* (2014), Abidin (2010), Deng and Wu (2014), Sentman (2009), Samari *et al.* (2013) and Zhou (2015)
GBP 10	Better indoor environmental quality/protecting occupant health and improving employee productivity	Aliagha *et al.* (2013), Ceschin (2013), Elias and Lin (2015), Isa and Kalsum (2015), Li *et al.* (2014), Hamid *et al.* (2014), Abidin (2010), Sentman (2009) Samari *et al.* (2013), Zhou (2015) and GBI (2016) [GP][GR][PH]
GBP 11	Consume reused material resources/ reduced waste	Isa and Kalsum (2015), Hamid *et al.* (2014), Abidin (2010), Sentman (2009), Samari *et al.* (2013), Zhou (2015) and GBI (2016) [GP][GR][PH][MC]
GBP 12	Consume green materials and resources	Aliagha *et al.* (2013), Elias and Lin (2015), Hong (2009), Li *et al.* (2014) Sood *et al.* (2011), Shari (2011), Sentman (2009), Samari *et al.* (2013), Zhou (2015) and GBI (2016) [GP][GR][PH][MC]
GBP 13	Sustainable sites planning and management/land use	Shari (2011), Hamid *et al.* (2014) Abidin (2010), Sentman (2009), Samari *et al.* (2013) and Zhou (2015)
GBP 14	Involvement of local expertise in green technology and development, e.g., green building consultant	Elias and Lin (2015), Sood *et al.* (2011) Aliagha *et al.* (2013), Abidin (2010), Sentman (2009) and Zhou (2015)
GBP 15	Occupy an integrated project team/good project team characteristics	Aliagha *et al.* (2013), Li *et al.* (2014), Deng and Wu (2014), Isa and Kalsum (2015), Sentman (2009) and Zhou (2015) [MC]
GBP 16	Involvement of design and construction team since the early stage of planning and design process	Aliagha *et al.* (2013), Isa and Kalsum (2015), Li *et al.* (2014), Abidin (2010), Deng and Wu (2014), Sentman (2009) and Zhou (2015) [MC]
GBP 17	Apply good project management: understanding green objectives of the project is very important	Aliagha *et al.* (2013), Isa and Kalsum (2015), Li *et al.* (2014), Abidin (2010), Deng and Wu (2014), Sentman (2009) and Zhou (2015)
GBP 18	Green building certificate should be applied for green projects	GBI (2016)
GBP 19	The project can be completed within the budget	Aliagha *et al.* (2013), Isa and Kalsum (2015), Li *et al.* (2014), Abidin (2010), Deng and Wu (2014), Sentman (2009) and Zhou (2015)
GBP 20	The project can be completed within the schedule	Aliagha *et al.* (2013), Isa and Kalsum (2015), Li *et al.* (2014), Abidin (2010), Deng and Wu (2014), Sentman (2009) and Zhou (2015)
GBP 21	Green building will give good impacts to the environment	Aliagha *et al.* (2013), Isa and Kalsum (2015), Li *et al.* (2014), Abidin (2010), Deng and Wu (2014), Sentman (2009) and Zhou (2015)
GBP 22	Require owner commitment	Li *et al.* (2014) and Zhou (2015)
GBP 23	Green building reduces bad impact of the built environment on human health and the natural environment	Olubunmi *et al.* (2016), Aliagha *et al.* (2013) Elias and Lin (2015), Isa and Kalsum (2015), Li *et al.* (2014), Shari (2011), Hamid *et al.* (2014), Abidin (2010), Hong (2009), Sentman (2009), Samari *et al.* (2013), Zhou (2015) and Wang *et al.* (2016)
GBP 24	This project able to enhance company reputation/company image	Elias and Lin (2015), Isa and Kalsum (2015), Olubunmi *et al.* (2016), Abdidin (2010), Deng and Wu (2014), Zhou (2015)

1-18 = green building principles, 1-24 = green building knowledge; [GBI = GBI][GP = GreenPass][GR = GreenRE][PH = PH JKR][MC = My Crest]

RESULTS

Table 2 shows the demographic data of the respondent background. The result presents that 60.3% of the respondent were male and the rest 39.7% were female. This shows that the male is dominant in the construction industry. In terms of working position, 73% of the respondent acquired a professional position field, 10% consists of higher management such as chairman, CEO, director and deputy director. The developer company always depend on and trust them in decision making. It has concluded that the sample respondent can provide adequate data for the majority of them are able to involve in the company decision and had many experiences in the development sectors. The majority (58%) of the respondent has a higher qualification at degree level followed by 24% qualified with a master, 10% qualified with HNC/HND/DIP and 4% qualified with PhD. The rest of the respondents (4%) choose others. The working position is more dominated by the engineer which 31% of the respondent, followed by town planner (22%), architecture (18%), Building surveying (12%), Quantity surveying (12) and 4% were others. About 52 (22%) of the respondents have been directly involved in building sector for <5 years. 142 (61%) respondents have involved in building sectors between 6-10 years. About 26 (11%) have involved in building sectors between 11-15 years. The rest of the respondents were involved in the building sector >16 years. The 66% of the respondents have <5 year's experience in green building projects, 28% have 6-10 year's experience and 6% were between 11-15 years experiences. However, there are 1 (1%) respondents have green building experience >16 years because of the broad experience in the green development from the advanced countries.

Table 3 shows the result of descriptive statistic on the internal factors of green building implementation. The result indicates that all the internal factors were scored high as the mean value for items 1-4 are >3.50 and items 5 is >1.00. This shows, the majority of the developer's company understands and aware of green building knowledge. Besides that, they have positive feelings, value and attitude of the green buildings principles. The implementation also high as the majority of the respondents were from developers company with green project.

Table 4 shows the results of reliability test based on Cronbach's alpha coefficients for the internal factors. The results show that the Cronbach alpha is >0.7 which surpassed the value suggested by Sekaran that makes the questionnaire is high internal consistency and statistically reliable.

Table 2: Respondent background

Demographic data	Frequency	Percent
Gender		
Male	141	60
Female	93	40
Working position		
Chairman	5	2
CEO	2	1
Director	4	2
Deputy director	8	4
Professional	176	75
Others	39	16
Highest qualification		
A levels/SPM	1	1
HNC/HND/DIP	23	10
Degree	134	57
Master	57	24
PhD	9	4
Others	10	4
Working position		
Architecture	41	18
Building surveying	29	12
Engineering	73	31
Quantity surveying	29	12
Town planning	52	22
Others	10	4
Years of experience in building development		
<5	52	22
6-10	142	61
11-15	26	11
16-20	5	2
21-25	9	4
Years of experience in green building project		
<5	154	65
6-10	65	28
11-15	14	6
16-20	1	1

Table 3: Descriptive statistic of the variables

Items	Means	Skewness	Kurtosis	Kolmogrov-Smirnov
Developers knowledge of the green building principles	3.96	-0.772	2.941	0.009
Developers emotion of the implementation of the green building principles	3.84	-0.365	1.057	0.004
Developers value of the implementation of the green building principles	3.96	-0.481	3.542	0.000
Developers attitude on the implementation of the green building principles	4.00	-0.474	1.500	0.007
Green building principles implement by the developers	1.92	-1.380	0.180	0.000

*Scoring guide (1-4): 0.00-2.49 = low, 2.50-3.49 = moderate, 3.50-5.00 = high; *Scoring guide (5): 0.00-0.99 = low, 1.00-2.00 = high

Table 4: Reliability test for the internal factors of green building implementation

Items	No. of items	Cronbach's alpha
Developers knowledge of the green building principles	24	0.917
Developers emotion of the implementation of the green building principles	18	0.928
Developers value of the implementation of the green building principles	18	0.878
Developers attitude of the implementation of the green building principles	18	0.906

Table 5: Spearman correlation results

Spearman's rho	Knowledge	Emotion	Values	Attitude	Implementation
Knowledge					
Correlation coefficient	1.000				
Sig. (2-tailed)	-				
N	234				
Emotion					
Correlation coefficient	0.656**	1.000			
Sig. (2-tailed)	0.000	-			
N	234	234			
Value					
Correlation coefficient	0.552**	0.449**	1.000		
Sig. (2-tailed)	0.000	0.000	-		
N	234	234	234		
Attitude					
Correlation coefficient	0.512**	0.397**	0.640	1.000	
Sig. (2-tailed)	0.000	0.000	0.000	-	
N	234	234	234	234	
Implementation					
Correlation coefficient	0.042	-0.021	0.167*	0.166*	1.000
Sig. (2-tailed)	0.520	0.746	0.011	0.011	-
N	234	234	234	234	234

**Correlation is significant at the 0.01 level (2-tailed); *Correlation is significant at the 0.05 level (2-tailed)

The PCA was carried out to reduce a large number of variables to a smaller set of underlying factors that summarize the essential information contained in the variables. Based on the results, there are two items of developers value on green building implementation have been omitted which are 'encourage green design and innovation' and 'design for indoor environmental quality or protecting occupant health and improving employee productivity' because of the communalities is <0.4. The result of the Kolmogorov-Smirnov test in Table 3 states that the variables are not normally distributed because the $p<0.05$. Thus, Spearman correlations were used to test the relationship between variables.

The Spearman correlation result was illustrated in Table 5. The first hypothesis which assumes a significant relationship between the internal factors is ruled out as there is a significant positive correlation ($p>0.05$). There are strong relationships between knowledge and emotion ($r = 0.656$) and between value and attitude ($r = 0.640$). As mentioned before, the knowledge of the GB environmental benefits will trigger emotional involvement in the GB implementation. Thus, if the developer company has more knowledge about the green building they will feel more positive and responsible for applying the environmental approach.

Meanwhile, the second relationship which assumes a significant relationship between internal factors and the implementation f green building is confirmed only for value ($r = 0.167$, $p>0.05$) and attitude ($r = 0.166$, $p>0.05$). The beliefs and values of green building practices as an environmental protection would influence the attitude of the green building principles. When the developer values on the green building high the developer's attitudes towards green buildings principles also high.

DISCUSSION

Based on the data analysis and result, it can be concluded that there is a strong positive relationship between the internal factors of knowledge and emotion and between value and attitude. Besides, there is a relationship between developers value and attitude with the green building implementation. Thus, the first hypothesis which assumes a significant relationship between the internal factors is confirmed. However, the second hypothesis only applies to the items value and attitude with green building implementation.

Considering the relation between knowledge and emotion as the degree of knowledge in green building is higher the developer's emotion will be more positive towards the green building principle. This is because the emotion will react when confronted with environmental degradation if not implement the green development. Developer with higher values on the green building principles will more willingly to implement the green building principles. According to Schwartz (2012), values influence action when they are relevant in the context and important to the actor. Therefore, the advantages of green building towards human, environment and business profit will gain the developer interest to implement green.

CONCLUSION

Correspondingly, the relation between value and attitude with the green building implementation shows that both factors were the drive to the implementation.

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