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To Study an Awareness on Sustainable Green Building Practices Amongst Construction Industry Players

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Abstract

Green building is refers to both a structure and the using processes that are environmentally responsible and resource efficient throughout the building's life cycle. Green building concept is introduced in 1960s and has gradually spread throughout the world and emphasized more on to energy conserving for office building in 1970s. In Malaysia, the green building concept has been accepted after announcement of 9th Malaysian Plan (2006-2010) in 2006 with focusing more on Renewable Energy (RE) and Energy Efficiency (EE). Furthermore, Malaysia has launched its own Green building Index (GBI) in year 2009. However this GBI is concentrated only on the measurement of green building but not for other aspects of green building such as indoor environmental quality, sustainable site planning and management, and so on. Moreover, the development of green building concept has occurred with limited understanding and guidance, and some cases have added a cost to the development. Therefore, this paper aims to identify factor influencing green building practice in Malaysia as well as to study awareness on green building practices amongst construction industry practitioner. The findings of this research were based on the questionnaires mailed and e-mailed to 75 construction industry companies; Property development company, Contractor company, Architect firm and Property management company within Klang Valley area. The findings have identified independent/government rating system as the main factor influencing construction industry player to undertaking green building practice. The results also revealed that the awareness amongst the construction players towards sustainable green building concept is moderate, and property development companies contributed to the highest mean score. These results show the willingness of the respondents to participate and committed with the green building development. This will allow recommendations to help ensure more sustainable green building development in Malaysia in the future.

Keywords: Green building; Green building practice; Construction Industry; Construction industry players.

1. Introduction

Building and construction land development, land use planning, and provision and services are significantly linked in the sense of urban form. By considering all components sequentially has resulted successful implementation of development projects. Moreover, all these aspects also considered as a key components in considering, formulating and implementing green building design and construction. Incorporating these key elements is important for maintaining sustainability of the green development projects as well as increased environment quality, social life and economic (Beyer, 2002).

Green building is being introduced several decades ago as a new way forward in improving the built environment issues. Generally, the concept of green building has began with the environment movement in the 1960s which started a "back to nature" concept in the design of houses then moved to energy conserving office building in the 1970s (Boyle, 2004).Until now, the concept of green building has been accepted throughout the world and keeps growing for the future..

In Malaysia, the Malaysian government has started documented the aspects of sustainable development in the broad-based policy for the past 10 years, specifically after launching of 9th Malaysian Plan (2006-2010). However, during that time, the policy focusing more on to the development of Renewable Energy (RE) and the enhancement of Efficient Energy (EE). And only now all aspects of green building development have been wholly covered. However, the development of green building concept has occurred with limited understanding and guidance, and some cases have added a cost to the development.

Therefore, this paper aims to understand green building practice in Malaysia as well as to evaluate the behaviour amongst construction industry practitioner towards green building practice. This will allow recommendations to help ensure more sustainable green building development in Malaysia in the future.

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2. Literature Review

2.1. Green Building

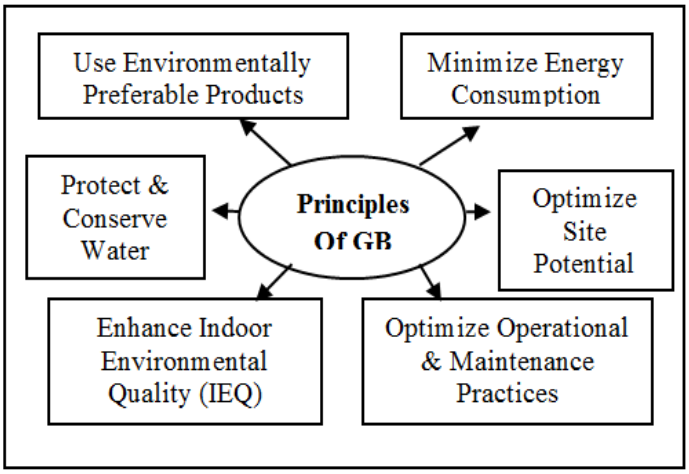
There are various terms used to describe green building such as green building, sustainable building, high-performance building, and whole building design. According to McDonald (2005); green building as a design and construction practices that reduce negative impacts on the environment, but which continue to rely on stored stocks of natural capital and produce external costs.

Moreover, green building also refers to the shift from standard building practices, which are typically guided by short-term economic considerations, to "best practices" emphasizing quality construction, energy efficiency, indoor air quality, conservation of water and other natural resources, and thoughtful planning and design for human productivity and health. Importantly, green building employs a "life-cycle approach," estimating the cumulative environmental and social impacts of a building throughout its lifespan, from construction to use to demolition (Tepe, 2007).

2.2. Principles of Green Building

According to Kruger and Seville (2013) there are six fundamentals principles of green building as acknowledge by everyone involved in green building practice as presented in Figure 1 below.

Fig-1. Principles of Green Building



2.2.1. Principle 1: Optimize Site Potential

Creating green buildings starts with proper site selection, including consideration of the reuse or rehabilitation of existing buildings. The location, orientation, and landscaping of a building, affect the local ecosystems, transportation methods, and energy use.

2.2.2. Principle 2: Minimize Energy Consumption

A building should rely on conservation and passive design measures rather than fossil fuels for its operation. It should meet or exceed applicable energy performance standards.

2.2.3. Principle 3: protect and Conserve Water

In many parts of the country, fresh water is an increasingly scarce resource. A green building should reduce, control or treat site runoff, use water efficiently, and reuse or recycle water for on-site use when feasible.

2.2.4. Use Environmentally Preferable Products

A green building should be constructed of materials that minimize lifecycle environmental impacts such as global warming, resource depletion, and human toxicity. In a materials context, lifecycle includes raw materials acquisition, product manufacturing, packaging, transportation, installation, use, and reuse/recycling/disposal.

2.2.5. Enhance Indoor Environmental Quality (IEQ)

The indoor environmental quality (IEQ) of a building has a significant impact on occupant health, comfort, and productivity. Among other attributes, a green building should maximize day lighting, have appropriate ventilation and moisture control, and avoid the use of materials with high-VOC emissions.

2.2.6. Optimize Operational and Maintenance Practices

A green building should be designed to take into account the energy and environmental impacts of operating and maintaining the building. Designers are encouraged to specify materials and systems that reduce the needfor maintenance and/or require less water, energy, and toxic chemicals and cleaners to maintain.

2.3. Benefits of Green Building

Generally, practicing the green building approach is commonly understood as practicing sustainable development. In fact, by practicing sustainable green building will increased staff productivity, sustain environmentally, enhance building's life time and friendly use of local resources (Kats, 2003). In specific, the benefits of green building can be categories into six categories are as follows;

2.3.1. Upfront Costs vs. Lifecycle Savings

Applying green building will be cost more up front, but saves more with reducing cost of operation over the building life. By incorporating eco-friendly technologies and sustainable design can resulted impressive saving in future.

2.3.2. Productivity and Health Benefits

Incorporating green building practice has positive relationship with staff productivity in term of output. Study conducted by researcher showed that employee productivity has increased about 16% to 60% in green building environment, and these contributes positive sign of staff performance towards organization (Romm and Browning, 1998); (Heerwagen, 2000).

2.3.3. Economic Benefits

The economic markets are expanding with the expansion of green construction such as; improving the bottom line of building's lifecycle costs, decreasing operation costs and increasing asset value.

2.3.4. Community or Municipal Enhancement

Green building has positive relationship towards community. By applying green building approach, all the stakeholders involved in the development project can demonstrate their commitment to the environment for the sake of employees and community welfare.

2.3.5. Natural resources and environment

Green design can creates an opportunity to improve environment quality and increase quality of life by protecting natural resources and enhancing ecosystems. By using environmental friendly construction material also helps in avoiding pollution and safe the environment.

2.3.6. Learning Curve

The financial, economic, and social benefits of green buildings are worth the investment of time and resources in learning about and planning a green building. However, learning curves can pose significant challenges for building teams that are not prepared for them.

2.4. Barriers to Green Building Practices

Vittori (1999), has identified several barriers that constraints in applying green building practice by stakeholder are as follows;

2.4.1. Separate Capital and Operating Budgets

Understanding life cycle cost of building is continuous challenges by developer including government and private sector. Therefore, including year to year building operation cost is significant as an additional to initial building cost. This is important to be considered prior deciding to invest in green building practice.

2.4.2. Higher Perceived-or Actual-First Costs

Higher perceived or actual first costs of many green building strategies and technologies are a significant disincentive. The cost of green building estimating to be increased 17% as compared to conventional construction approach.

2.4.3. Risk and Uncertainty

Although popularity and interest on green building practice is growing significantly, but several risk and uncertainty must be highlighted by the potential green building investor such as; uncertainty over reliability of green building technologies, Uncertainty over costs of developing of green real estate; Uncertainty about the economic benefits of green real estate; and Uncertainty about green building performance over time.

2.4.4. Lack of Research Investment

Advances in green building research can result in significant consumer savings and a strong return on investments.

2.4.5. Split Incentives

Split incentive problem faced by developer and end user of the product. Generally, additional cost for green building practices cannot simply passed to the end user, and the users probably want shortest time for payback period on energy saving investment.

2.4.6. Expense

Theoretically, green building is expensive due to incorporating modern technologies as well as innovation construction material, and these discourage property developer to taking place in this kind of development project. However, most of the green building techniques represent low cost replacement and maintenance, and usually the cost will be paid for them over the life of the building.

2.4.7. Product Information and Sourcing

The lack of information about performance and cost attributes of building elements can force projects to depend on specialized consultants, and these will required additional cost to the developer.

2.4.8. Client Knowledge

Commonly, client desire to incorporate green elements into their building projects without understands time and cost barriers inherent in adding these features. In addition, client knowledge barrier also pertains to codes and regulations. Due to complexity of regulations, sometime developers and clients have difficulty in assessing the costs and requirements of complying with the regulations.

2.4.9. Code Barriers

Changing regulations that are based on assumptions or past practices requires education of public officials and administrators. In some cases, the building code makes it difficult to pursue green building techniques.

2.4.10. Tradition

Applying green building means adopting new technology of development, and need for new approaches to education and training that raise awareness about green buildings.

2.5. Malaysia Green Building Index

Green Building Index (GBI) is developed specifically for the Malaysian-tropical climate, environmental and developmental context, cultural and social needs. The Green Building Index (GBI) is considered as a rating tool for buildings to promote sustainability in the built environment and raise awareness among real estate practitioners – developer, architect, planner, valuer, and public about environmental issues and our responsibility to the future generations.

The assessment of commercial and residential properties under the GBI rating tool is based on six main criteria as follows:

2.5.1. Energy Efficiency (EE)

Improve energy consumption by optimizing building orientation, minimizing solar heat gain through the building envelope, harvesting natural lighting, adopting the best practices in building services including use of renewable energy, and ensuring proper testing, commissioning and regular maintenance.

2.5.2. Indoor Environmental Quality (IEQ)

Achieve good quality performance in indoor air quality, acoustics, visual and thermal comfort. These will involve the use of low volatile organic compound materials, application of quality air filtration, proper control of air temperature, movement and humidity.

2.5.3. Sustainable Site Planning and Management

Selecting appropriate sites with planned access to public transportation, community services, open spaces and landscaping. Avoiding and conserving environmentally sensitive areas through the redevelopment of existing sites and brown fields, as well as reducing the strain on existing infrastructure capacity.

2.5.4. Material And Resources

Promote the use of environment-friendly materials sourced from sustainable sources and recycling. Implement proper construction waste management with storage, collection and re-use of recyclables and construction formwork and waste.

2.5.5. Water Efficiency

Considering rainwater harvesting, water recycling, and water-saving fittings.

2.5.6. Innovations

Innovative design and initiatives are important to meet the objectives of the GBI.

3. Research Methodology

In this study, a quantitative research strategy was adopted as a strategy for the data collection. The survey was carried out within Klang Valley area, and the respondents were construction industry payers' who were actively participated in the construction activities in Malaysia and Klang Valley area respectively.

A stratified random sampling was chosen as part of probabilistic sampling (Sapsford and Jupp, 2006; Sekaran, 2003) in this study. The sample data comprised of construction firms which were located in Klang Valley area. Considering that a green development project requires strong financial records and sufficient and efficient management teams as well as excellent experience in the past, the selection of construction firms in this study was therefore appropriate. Finally 75 construction firms were participated in this study.

4. Results and Discussion

4.1. Response Rate

Of the 75 questionnaires mailed to the respondents, 44 were returned and this resulted in a total of 58.7% useable response rate. The 58.7% response rate obtained was considered a high response rate for this type of postal or e-mail survey given that a typical response rate would be 30%. From the results, it appears that the range of the respondents represented in the sample is similar; that is, they are players in construction industry that have been actively practicing property developments for many years.

4.2. Profile of Respondents

The profile of the respondents participated in this study are presented in Table 1 below.

Table-1. Respondents' profile

Variable	Details	n=44	%
Years of operation	Below 10 years	12	27.3
	11 – 15 years	17	38.6
	16 – 20 years	7	15.9
	Over 20 years	8	18.2
Number of employee	0 – 10 people	9	20.5
	11 – 50 people	25	56.8
	51 – 100 people	6	13.6
	Over 100 people	4	9.1
Type of organization	Property development	2	4.5
	Property Management	11	25.0
	Contractor	26	59.1
	Architecture firm	4	9.1
Type of development project	Residential	16	36.4
	Commercial	20	45.5
	Industrial	8	18.1

As presented in Table 1 above, one third of the organizations were established up to 15 years and been actively involved in construction projects throughout Malaysia. More than half of the organization were employed more than 50 employees consists of skilled and unskilled workers. Moreover, almost two third of the organization participated in this study are contractor and the rest are property development company, architecture firm and property management company. All of the organizations were actively participated in the property development projects including residential, commercial and industrial within Malaysia and international.

4.3. Familiarity with Green Building Terminology

The respondents were then asked several questions in order to determine their level of familiarity towards green building terminology. The questions include; Green design, Green purchasing, MS1525:2007 code of practice on energy efficiency and the use of Renewable energy for non-residential buildings, and Malaysia green building mission. From the results, more than half of the respondents were somewhat familiar with the green building terminology, and surprisingly, contractor has the highest respond as compared to other organization. Table 2 below presents the results from respondents on familiarity with green building technology.

Table 2. Familiarity with Green Building Technology

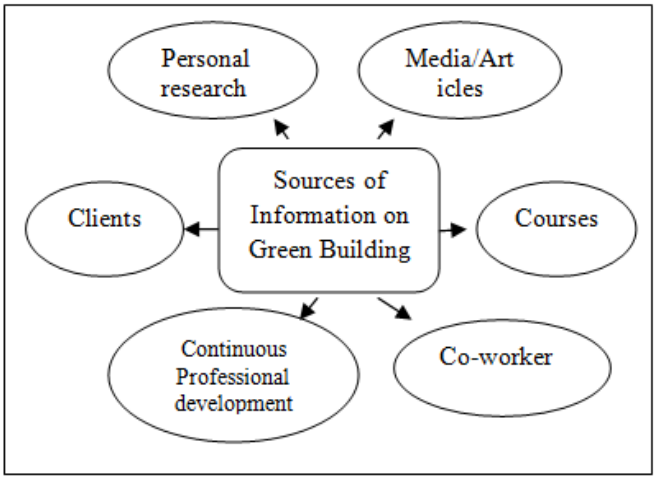
Organization	1	2	3	4	Total
Developer	0	2	0	0	2
Property Management company	2	2	6	1	11
Property Developer	3	9	13	1	26
Architecture firm	0	3	1	1	5
Total	5	16	20	3	44

Note: 1=Never heard of it; 2=Have heard of it; 3=Somewhat familiar; 4=Very familiar

4.4. Sources of Information on Green Building

Based on the results, there were six sources of information on green building as presented in the Figure 2 below.

Fig-2. Surces of Information on Green Building



From the results, respondents usually search for media or articles for getting information on green building (84.09%), while the least common mode is co-worker which accounted for 15.91%). The second highest score is personal research accounted for 36.36%. Other sources of information on green building practices can be obtained through courses and continuous Professional Development. Therefore it's crucial to provide more training in order to increase awareness on Green Buildings' practices.

4.5. Factor Influencing Green Building Practices

From the results, there were six (6) factors influencing respondents participated in the green building practice, as presented in table 3 below.

Table-3. Factor Influencing Green Building Practice

Factors	Mean	Ranking
Independent/Government rating system	4.14	1
Environmental conditions	3.88	2
Competitive advantage / Corporate Social Responsibility	3.74	3
Client demand	3.44	4
Low lifecycle costs	3.35	5
Government regulations / incentives	3.16	6
Rising energy costs	2.53	7

Based on the above table, independent/government rating system, environmental condition and competitive advantage/corporate social responsibility were the most significant factors influencing green building practices with ranking on number 1, 2 and 3 respectively. They were followed by the factors of client demand, low lifecycle costs, government regulations / incentives and rising energy costs in ranking 4, 5, 6 and 7 respectively.

4.6. Knowledge Level on Green Building

Results revealed that the majority of the respondents have moderate knowledge regarding green building (average mean=4.85), with the highest is on the statement of minimizing use of materials that emit harmful pollutants (mean=5.09). This statement revealed that most respondents believe that the green building is about reducing pollution. The lowest mean is refers to the statement that indicated green building use the most economic construction method (mean=4.36). Table 4 presents the results for knowledge level on green building.

Table-4. Knowledge Level on Green Building

Attributes	Mean	Level Score
Use of the most economic construction methods	4.36	Low
Use of energy efficient systems / design features	4.98	Moderate
Design that maximize utilization of natural ventilation and daylight	5.07	Moderate
Maximizing use of recycled and recyclable materials	4.91	High
Maintenance of asset value within the life-expectance of buildings	4.75	Moderate
Good operation and maintenance	4.73	High
Minimizing construction and demolition waste (Ex: Using Prefabricated Product)	4.89	High
Minimizing use of all kinds of natural resources	4.80	Moderate
Minimizing use of materials that emit harmful pollutants	5.09	Moderate
Minimizing use of materials that are energy intensive to produce	4.86	Moderate
Design that fit well with the intended purposes	4.86	Moderate
Overall Mean = 4.85		**Moderate**

In comparison, the results indicated that each organization has moderate level of knowledge towards sustainable green building practice with mean score ranges between 4.79 and 5.00. Property development companies and architecture firm showed the highest mean score, 5.00 with moderate level of knowledge towards sustainable green building practice. Table 5 below presents the level of knowledge from different organization.

Table-5. Level of Knowledge towards Sustainable Green Building Practice Between Organizations

Type of organization	Mean score	Level score
Property Development	5.00	Moderate
Property Management	4.79	Moderate
Contractor company	4.83	Moderate
Architecture Firm	5.00	Moderate
Average mean score = 4.90		**Moderate**

Level score: Low (1.00-4.29); Moderate (4.29-5.16); High (5.17-6.00)

4.7. Behavior Amongst Construction Industry Players Towards Sustainable Green Building Practice

In order to determine the behavioral level of construction industry players towards sustainable green building practice, twenty-two attributes for behavioral were tested. Table 6 below presents the results from respondents.

Table-6. Behavior Level Amongst Construction Industry Players Towards Sustainable Green Building Practice

Attributes	Mean	Level Score
Lower operating costs	4.57	Moderate
Lower lifetime costs	4.75	Moderate
Higher building value	4.77	Moderate
Higher return on investment (ROI)	4.61	Moderate
Helping to transform the market	4.52	Moderate
Enhanced marketability	4.53	Moderate
Increase staff productivity and retention	4.55	Moderate
Reduced liability and risk	4.61	Moderate
Scarcity of natural resources	4.73	Moderate
Protection of the environment	5.23	High
Reducing climate change and carbon emissions	5.09	Moderate
Minimizing ecological impact of building	5.02	Moderate
Moral imperative of green	4.82	Moderate
Improving indoor environment quality of buildings and “sick building” syndrome	4.64	Moderate
Greater health and well being	4.91	Moderate
Support for the local economy	4.68	Moderate
Aesthetics	4.64	Moderate
Overall Mean = 4.75		**Moderate**

Level score: Low (1.00-4.29); Moderate (4.29-5.16); High (5.17-6.00)

From the result, majority respondents show moderate level of behavior regarding sustainable green building practice with an overall mean score 4.75. The results show that the lowest mean score is on the statement that green building is helping to transform the market, with the score of 4.52, while the highest mean score is on the statement

protection of environment. In fact, most of the construction industry players believe that green building approach would not helps much in transforming the future market due to several reasons such as increasing in development cost.

Furthermore, the results indicated that each organization has moderate level of behavior towards sustainable green building practice with mean score ranges between 4.57 and 5.06. Property development companies showed the highest mean score, 5.06 with moderate level of behavior towards sustainable green building practice. Table 7 below presents the level of behavior from different organization.

Table-7. Level of Behavior Towards Sustainable Green Building Practice Between Organizations

Type of organization	Mean score	Level score
Property Development	5.06	Moderate
Property Management	4.57	Moderate
Contractor company	4.75	Moderate
Architecture Firm	4.84	Moderate
Average mean score = 4.80		**Moderate**

Level score: Low (1.00-4.29); Moderate (4.29-5.16); High (5.17-6.00)

5. Conclusion

The findings of this research show that the willingness of the respondents to undertaking green building practice is influenced by six factors; Independent/Government rating system, Improve environmental conditions, Competitive advantage / Corporate Social Responsibility, Client demand, Low lifecycle costs, Government regulations / incentives, and rising energy costs. Moreover, the results also identified several sources used by the respondent in order to obtain information on green building practices namely media or articles, personal searching and clients. Furthermore, the results revealed that the level of knowledge and behaviour amongst the construction industry practitioners in respective case study area is still in moderate level, and property management companies indicated the highest mean score. Therefore, some actions need to be taken by the government, Non-governmental organisation and construction industry players to cooperate and improve the level of awareness and specifically behaviour amongst construction industry players towards green building practice.

6. Acknowledgment

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