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Research paper

Review of sustainable construction practices in Malaysian construction industry

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Abstract

Three key principles of sustainable development which needs to be covered during construction works are social, economic and environmental. This paper outlines the holistic approach which must be taken to define the best practice throughout the lifecycle of a constructed building for responsible use of resources and energy. It also highlights on the driving forces behind the implementation of sustainable methods in construction and outlines the key elements involved in measuring how sustainable a building is designed to be. The research methodology is based on data collection via questionnaires and also adds the views from previous researchers on this topic. This paper's aim is to evaluate and enhance the current practice of sustainability in construction and what steps can be taken to enforce the construction teams to switch from the conventional methods to a sustainable method. . The seven strategies suggested includes education and awareness, effective management of natural resources and the environment, integrated development planning and implementations, prevention and control of pollution and environmental degradation, strengthening administrative and institutional mechanisms, proactive approach to regional and global environmental issues, and formulation and implementation of actions plans. The idea of stage by stage implementation shows that it is possible to implement sustainable methods during construction and a further review should be taken by the stakeholders to work on the idea and turn it into a reality.

Keywords: *Sustainable Construction; Sustainable Development; Strategies & Difficulties in Implementing Sustainability.*

1. Introduction

It is now commonly accepted that construction industry is a major contributor to climate change, as it is responsible for almost half of the global greenhouse gases and consumes 40% of the materials entering the global economy [1]. In general, according to [2], sustainability is defined as the development which meets the needs of the present without compromising the ability of future generations to meet their own needs; in ecology the amount or degree to which the earth's resources may be exploited without deleterious effects. According to [3] there are three key principles involved in sustainability:

1) Environmental responsibility.
2) Social awareness, and.
3) Economic profitability.

The main difficulty in establishing end-goals which span across social, economic and environmental issues lies in defining the common currency for the study. This is why the definition of sustainable development matters a lot. Is it improvement in mankind, development of the built environment or improvement of the global environment, to name but a few of the widely available interpretations? If it is one of these, how is progress or success measured? Three different directions are given. Economists point to measuring the wealth such as GDP to determine the success. Social scientists point to measure the quality of life and the environmentalists go for eco-foot prints and energy consumption. The failure of the parties involved to come to common grounds is the main reason why the implementation of sustainable developments has been very weak by the stakeholders. Sustainability is defined as the development which meets the needs of the present without compromising the ability of future generations to meet their own needs; in ecology the amount or degree to which the earth's resources may be exploited without deleterious effects.

Girardet, H [4] define a sustainable city as organized as to enable its citizens to meet their own needs and to enhance their well-being without damaging the natural world or endangering the living conditions of other people, now or in the future. Schoonbrodt, R. [5] states the following should be included when defining sustainability:

- All rounded development, economic, social, cultural and political
- Equal rights for all with the best quality of life to each and every person
- Reject social, economic and political exclusion
- Control pollution and minimize waste
- Pleasure of city life, dismissing the 'back to nature' dream

2. Sustainability in construction

As worldwide population grows, thus more buildings will be developed. Therefore, the construction industry will tend to increase the hazardous gas emissions unless it changes its practice. Recently, the Malaysian Government has announced on the creation of the Energy, Green Technology and Water Ministry to spearhead the country's sustainability agenda to tackle all green-related issues and it was also highlighted during the lunch of Green Building Index (GBI) by Minister of Works to enforce on the implementation of sustainable practice in construction [6].

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According to [6], buildings will be awarded the GBI Malaysia rating based on the six key criteria mentioned below:

1) Energy efficiency
2) Indoor environmental quality
3) Sustainable site planning and management
4) Material and resources
5) Water efficiency
6) Innovation

In order to stay competitive and to meet upcoming stricter environmental regulations and customer requirements, designers have a key role in designing civil infrastructure that is environmentally sustainable. According to [7], sustainable construction aims to produce structures that enhances the quality of life and protects the environment efficiently and profitably. However, many of the environmental issues that occur in our country are due to lack of environmental consideration in the exploitation, development and management of resources as well as lack of control of the resulting pollution [6]. The lack of appropriate tools and skills for sustainable design is often quoted as a barrier to sustainable design. [8]

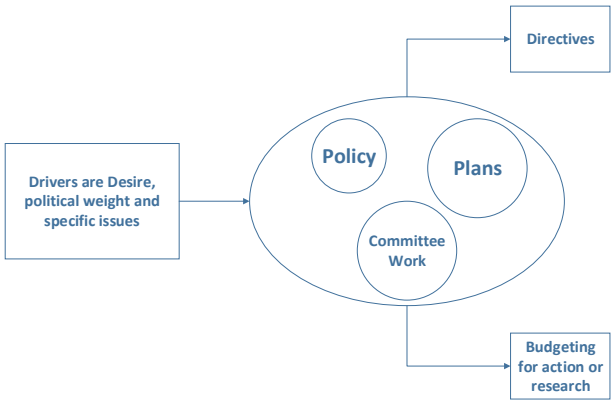


Fig. 1: The Means of Promoting EU Activity in Sustainable Development (European Communities, 2001).

The lack of a unifying, universally accepted theory of sustainable development has therefore caused a vacuum which forces practitioners to redefine the starting point, the end point, and the process for every new project. This is an undoubted area of weakness in the development of a theory of sustainable development to date. Main challenges faced today by groups who want to enforce sustainability is the development and implementation of the proposed programs. Another one is the enhancement of community participation. While it may not be possible to develop a 'universal' process, breaking it down into smaller subjects and studying it element by element in a scientific manner and then creating a feasible process map would help to initiate the practice for sustainable development. Furthermore, a practice on how to measure it to record the achievements made would help to understand the practice more and how to improve on it. Guidance on this is seldom uniform, reflecting on the difficulties of striking a balance on neutrality, practicality, and finding the appropriate scale for judgment. According to research done by [7], it is stated that the construction industry is now changing from developing with environmental concern as a small part of process to the wider context of environmental approach. Benefits of implementing sustainability in green building is that it costs lower than conventional method and saves energy as introduced by [9] and supported by [10,11,12], who added that sustainable buildings will contribute positively to better quality of life, work efficiency and healthy work environment. Kibert, C. [13] has introduced seven (7) principles of sustainable construction as tabulated in Table 1.

Table 1: The Seven (7) Principles of Sustainable Construction [13]

Principle	Descriptions
Principle 1	Minimize resources (conserve)
Principle 2	Minimize resource reuse (reuse)
Principle 3	Use renewable or recycles resources (renew/recycle)
Principle 4	Protect the natural environment (protect nature)
Principle 5	Create a healthy, non-toxic environment (non-toxics)
Principle 6	Apply life cycle cost analysis and true cost (economics)
Principle 7	Pursue quality in creating the built environment (quality)

3. Strategies towards sustainable construction

Focusing on the Malaysian construction industry, all stakeholders involved need to take a holistic approach throughout the construction activities. Thus, the National Policy on Environment seeks to integrate environmental considerations into development activities and all related decision-making processes, to foster long-term economic growth and human development and to protect and enhance the environment [6].

The integrated considerations will drive Malaysia's Green Strategies [14] include:

i) Education and awareness

Same approach as recommended by Agenda 21 [14], a deeper and better understanding of the concepts of environmentally sound and sustainable development and caring attitude towards nature, environmental education and awareness shall be promoted in comprehensive formal and informal education, training and information dissemination programs.

ii) Effective Management of Natural Resources and the Environment

This is to be able to conserve the environment and natural resources to meet the needs of country's population, focusing on land, forests, biodiversity and water.

iii) Integrated Development Planning and Implementation

Environmental aspects will be covered into all stages of development, program planning and implementation and all aspects of policy making.

iv) Prevention and Control of Pollution and Environmental Degradation

Pollution and environmental degradation from the development activities should be minimized. The aspects to control and prevent pollution and environmental degradation therefore include monitoring surveillance programs, expand environmental auditing systems, strengthened the support enforcement program, planning and zoning the regular assessment of the state of environment. In Malaysia, CIDB has boarded on programs related to ISO 14001 certification focusing on construction companies involved in large projects which now require Environmental Impact Assessment (EIA) [15] to continue their construction works.

v) Strengthening Administrative and Institutional Mechanisms

In regards to strengthening administrative and institutional mechanisms, the steps taken are by enhancing the integrated and effective cooperation and coordination among Government and other sectors in order to achieve efficient environmental management and protection. Furthermore, environment-related legislation and standards should be frequently reviewed and revised in order to ensure the effectiveness and coordination of laws.

vi) Proactive Approach to Regional and Global Environmental Issues

Promote cooperation with other countries such as the ASEAN nations to help in adopting a proactive approach by addressing global environmental issues such as the depletion of ozone layer, climate change, trans-boundary pollution, hazardous chemicals and toxic waste management, marine quality and resource conservation and trade in endangered species.

vii) Formulation and Implementation of Action Plan

All the action plan will be implemented and formulated with adequate resource support. All action plans have to be constantly reviewed in order to improve the sustainable methods because as we all know, improvements come by learning from the mistakes made. Therefore, a team should be in place whose role is to focus on reviewing the sustainable methods and suggesting in improvements.

Table 2: Review Paper on Previous Studies on Sustainable Construction Practices

S/N	Researcher	Year	Country
1	C Du Plessis	2002	South Africa

2	CJ Kibert	2007	USA
3	M Pitt	2009	United Kingdom
4	NZ Abidin	2009	Malaysia
5	LB Robichaud	2010	USA
6	NZ Abidin	2010	Malaysia
7	Y Tan	2011	USA
8	KAM Kamar	2012	Malaysia
9	MA Marhani	2012	Malaysia
10	N Zainul	2013	Malaysia
11	AJ McMurray	2014	Malaysia

4. Results and discussion

To observe the current practice of sustainable developments, a survey was carried out by [7] and it was conducted among the construction developers in Malaysia. The survey focused on developers of building construction such as property and commercial building located in the area of Kuala Lumpur and Selangor. A total of 271 respondents and 35 questionnaires were returned for analysis. The companies chosen were obtained from the Real Estate and Housing Developers' Association (REHDA). The discussions were based on two major aspects which are:

Table 3: Idea of Stage by Stage Implementation of Sustainability

No	Stage	Action Taken	Sustainable Implementation Problems Tackled
1	Feasibility Stage	Establishing environmental objectives	a) Urgency factor b) Cost factor
2	Scheme Design Stage	Preliminary Eco-Rating	a) Government intervention
3	Preliminary Design Stage	Weighting of environmental sustainability categories	a) Cost factor
4	Detailed Design Stage	Detailed Eco-Rating Analysis	a) Education vs. experience
5	Construction Stage	Materials and Construction Activities Eco-Analysis	a) Lack of enforcement
6	Defect Liability Period Stage	Measure Results & performance of sustainable construction using social, economic & environmental aspects	a) Education vs. experience
7	Life Cycle of Building	Continue measuring results and compare whether the performance of building has improved environmentally, socially and economically in comparison if sustainable methods weren't implemented.	a) Education vs. experience b) Cost factor c) Government intervention d) Urgency Factor e) Lack of Enforcement f) Passive Culture

a) The level of knowledge and awareness of construction developers on the concept of sustainability and sustainable construction
b) The application of sustainability principles in past and current projects

From the survey, it was concluded that the level of understanding of the concept and principles of sustainability among respondents was moderate or good as shown in Figure 4.1. According to [7], the majority of the developers rely on written materials (journals, proceedings, newspapers, web site) to improve their knowledge about sustainable construction. Other sources of knowledge are through education and higher learning seminars and conferences and also on-site experience with sustainable projects (which is very less practiced making it difficult for the construction stakeholders to get the exposure they need to understand and implement sustainable developments). Regarding the application of sustainable concept and principles in the construction projects, most of the respondent said that the implementation is at low level currently as shown below in Figure 3. Furthermore, according to the research carried out by [1], he introduced the process on how to work towards sustainable buildings. He states that with a complete understanding of the issues of all the stakeholders involved in the sustainable approach to construction, all the challenges faced shall become easier and there will be successful outcomes. The approaches determined were sustainable client-ship, design, services design, cost management, construction, operation and demolishing.

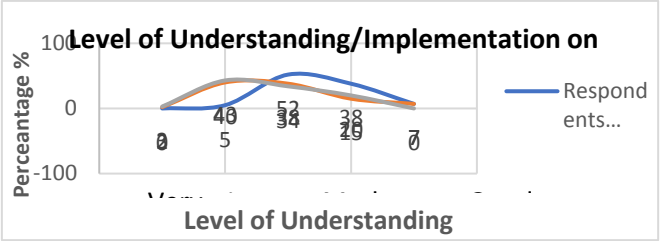


Fig. 3: Level of Understanding/Implementation of Sustainable Development

Abidin, N. Z. [7] highlighted the major reasons involved in the current level of implementation of sustainable developments as the following:

a) Lack of enforcement
b) Government intervention
c) Urgency factor
d) Education vs. experience
e) Cost factor
f) Passive culture

Diligent attention to greener infrastructure solutions from the very earliest phases of construction project will help guarantee that quality design environmental solutions are 'built-in' from the very beginning. It is very important to implement the environmental management from the early stages of the process since the 'freedom' to make decisions, of importance for the environment, decreases with the progress of the project.

The client or developers are known as the determining factor in the sustainability achieved by any project. According to [1], the client or developer must show leadership to their design and procurement team and force innovation through to their design to provide more efficient, less pollution and cost-effective building.

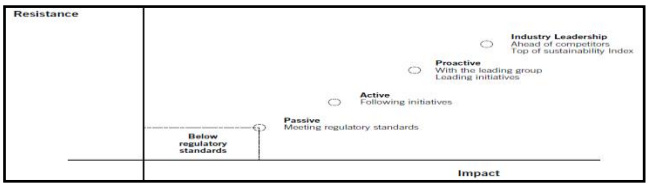


Fig. 4: Profundity of Effort [12].

This requires managing the project in a way as to promote good use of human resources and knowledge and the respect of the client for the values of the organization since it involves in building procurement alongside clear definition of its own values.

By choosing the position in the scale shown in Figure 4.2, client can define their requirements which serves as the selecting point for design and procurement team and they can formulate their benchmarks for the performance of the buildings. Meanwhile, risk management should be determined at the first stage of developing any project. Figure 4.3 shows the procedure to the sustainability risk management.

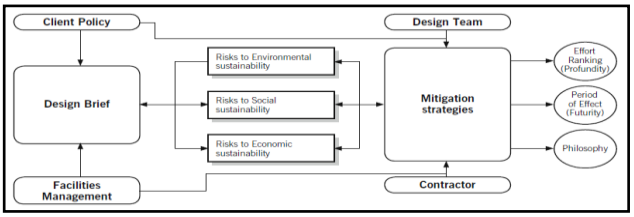


Fig. 5: Sustainability Risk Management Procedure [12].

5. Conclusion

To move an ordinary building to a sustainable building needs a practical approach. If the initiative is taken from the beginning then the design of the project and formation of the project team will definitely reflect on the end product of the project. The project participants should be more exposed to the development, principles, and the methods of implementation of sustainable construction. It is required that there is a clear understanding of the importance of sustainability in construction and how to practically implement it in a sustainable building. The seven (7) strategies suggested includes education and awareness, effective management of natural resources and the environment, integrated development planning and implementations, prevention and control of pollution and environmental degradation, strengthening administrative and institutional mechanisms, proactive approach to regional and global environmental issues, and formulation and implementation of actions plans. The idea of stage by stage implementation shows that it is possible to implement sustainable methods during construction and a further review should be taken by the stakeholders to work on the idea and turn it into a reality. Furthermore, the initiatives taken by the Malaysian Government needs to be strictly enforced by the developers and the construction practitioners as mentioned in the Construction Industry Master Plan 2006-2015 (CIMP) Initiatives that stated in the Thrust 3: Towards highest standard of quality, occupational safety and health and environmental practices. CIDB. (2007b). [15] listed five (5) recommendations to the environmental practices which includes strengthening the development process, enhancing law and enforcement, promoting self-regulation and reflecting the best regulatory practices which are necessary to achieve sustainable construction in future, increasing capacity and public awareness and lastly, addressing knowledge gaps. [16]

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