

## Integration of Environmental Sustainability Strategies Within Pre-Construction Processes

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**Abstract:** An awareness of the environmental sustainability in the construction project as it can improve the quality of the work progress. To achieve an environmental sustainability it is important to ensure a project sustainable within green agenda. This study provides an overview of how environmental sustainability concept in practices. A survey has been conducted among construction practitioners in Malaysia focusing on the environmental sustainability concept. The findings suggest that many more efforts could be as to push green construction to the forefront. The contribution of this research, it encourage the environmental awareness to ensure sustainability future. Construction at the managerial level must devise robust and innovative environmental sustainability strategies in order to comply with the sustainability requirements and take advantages of the opportunities arising from the implementation of such practices.

**Key words:** Pre-construction, environmental sustainability, strategies, construction industry, implementation

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### INTRODUCTION

The sustainability is placed high selection agenda as an effort to maintain the environment for the future generation. Malaysia is aim at produce their buildings at sustainable. The demand for high performance 'sustainable' buildings is becoming more demand in the construction industry and need to attempt less environmental impact to the construction project. The construction industry should not exempt environmental issues or at very least try to apply the basic principles of environmental sustainability. The objectives of this study are to present the overview of how environmental sustainability in its implementation. A survey has been conducted to explore the perception of the construction practitioner regarding the environmental sustainability and the practices.

### MATERIALS AND METHODS

**Overview of construction industry:** The Malaysian Construction Industry plays an important role in generating wealth to the community and the development of social and economic infrastructure and buildings. Construction can be define as the progressive activity involved in repairing or constructing. It involves many

stages such as planning, managing organizing, conceptual, designing, material application and finally the finished product. Irurah (2001) defined that construction as site activity as the comprehensive project cycle as everything related to the business construction and as the broader process of human settlement creation. Abidin (2010) stress that planning process at the early stage is the main process sustainability application in managing the construction phase. Building project is considered to be the highest demand in Malaysia as it forms about 68% of overall construction work (Abidin, 2009). The construction industry in developing countries states that the construction industry is an essential contributor to the process of development, influencing nearly every sector of the economy. On the other hand, the issues of sustainability and green construction have been highlighted in the Construction Industry Master Plan (2005-2015) as being of significant importance for the Malaysian construction industry.

**Approaching sustainable construction:** Sustainable issues has become a scenario increased and widespread global attention especially during the last two decades. The objectives of sustainable design and construction begin within the entire life cycle of buildings from environmental and functional use, to operation and future

values. Sustainable construction aims to produce structures that enhance the quality of life and protect the environment efficiently and profitably. According to Kibert (2005) mention that it also aims to achieve social progress and maintain economic growth and development. Delivering construction that sustainable need proactive action from all participation in construction and construction services.

Wells and Evans (2003) claims that sustainability has three pillars as economic sustainability, environmental sustainability and social sustainability. Therefore, the consideration of environmental is the vital in construction activities.

**Environmental sustainability strategies in construction industry:** Rapid activities in construction industry has increased the environmental problems of construction around the world. The require of environmental sustainability as the problem solving. The focus of environmental sustainability is the preservation of the environment. Thus finding better ways of doing things, both for the environment protection in the future and the present. Adams mentions that the environmental sustainability is a process of whereby the current processes of interaction with the environment are pursued with the idea of keeping the environment clean and safe for society. According to Kori and Gondo mention that the concept of environmental sustainability was view from the sustainability movement. Also, Morelli (2013) defines environmental sustainability as meeting present and future generation's needs for resources and services without degrading the ecosystems that provide them.

In this case the environmental sustainability made up about maintaining the environmental from damage or being disturb. Several of environmental elements in sustainability include climates change, air pollution, ozone depletion, oceans, wildlife, soil, land use, waste, noise pollution and light pollution. Thus, environmental elements demand that responsible managerial activities to meet human needs and preserving the life support systems of the Earth. Meanwhile, Matson *et al.* (2008) highlight the Association for the Advancement of Sustainability in Higher Education (AASHE) has defines sustainability as an inclusive way, encompassing human and ecological health, social responsibility, secure livelihoods and a better world for future generation.

The negative impacts of construction sector activities on the environment include destruction of natural habitats, land destruction, air emissions and pollutants, health and safety harm, among others. The strategic to environment preservation is based to move towards environmental sustainability. Thus, how to

embed sustainability into project thus understanding the environmental sustainability objectives when project manager making decisions about its planning progress, the project obviously can reduce environmental impact.

**Environmental issues of possible concern:** Over the past decade in particular, an impact to the environmental has become an important aspect of the construction industries. Environmental issues have become a vital and important agenda of discussion in society now a days. According to Zulkefli *et al.* (2014) states that as in the report produce by UNEP (2007) claims that construction industry made up of 30-40% of the world's total carbon emission which may lead to the impact to environmental pollution. In the local context, awareness on environmental issues amongst Malaysian were relatively low. There are many ways in which environmental sustainability issues can be incorporated into design, construction, operation and deconstruction of buildings.

According to Gandu (2005), Kolawole and Anigbogu (2005) and Owoyale (2005) mentions that the negative issues of construction activities include: land misuse (erosion, desertification), change in direction of flow of underground water, loss of wild life and their habitat, destruction of natural resources and vegetation, air and noise pollution, waste/effluent discharges, on-site wastage, health and safety impairment, generation of solid and gaseous wastes and resource depletion.

Issues of environmental have been highly focus about in construction society. In the present years, understanding and awareness on environmental issues among Malaysia need to be considered due to lack of exposure to environmental issues. Research by Zurina dan Norjan indicate that the community do not have a caring attitude towards environment. This statement emphasized when talking about environmental issues, we cannot avoid talking about pollution. Therefore the need to aware of the environment and its mitigation. In order to reduce impact to betterment environmental as mentioned by Pujari (2006) where the require of resource efficiency, waste and emission elimination.

Environmental issues made Malaysia actively taking part in discussions on environmental issues not only regionally but also internationally. The 1989 Langkawi Declaration on the Environment. Singh (2000) reported that the declaration was to discuss major environmental matters such as greenhouse effect, damage to the ozone layer, acid rain, sea pollution and land degradation. Due to this action Malaysian is to be a sustainable aware besides overcoming environmental problems especially in construction industry.

The initiatives took by Malaysia in response to the needs identified in Agenda 21 as well as environmental sustainability. According to Hezri, Omar, Tooley, Hooks, and Basnan, stress out that the pollution issues for one of the element in environmental sustainability.

The construction industry, an industry with a high negative impact on the environment is one of the industries which has to become more sustainable. The environmental issues of possible concern during construction impacts that are common to many development projects, (e.g., land use and environmental impacts) as well as specific impacts associated with the elements of the environmental sustainability. According to Tse and Raymond highlighted that environmental protection is an important issue throughout the world. As early as the 1980's, Malaysia had been making efforts to be actively involved in environmental issues.

Most of the potential environmental impacts during pre-construction are of a local nature. The potential environmental impacts during operation are mostly continuous while those associated with construction activities are temporary and mostly effect the construction process. Hence, it is important that to adapt to the concept of environmental sustainability in construction works. Environmental impact research studies by Majumdar (2006) was define as the implications of human activities force towards the environment.

Previous studies by UNEP (2007), Haggar (2007) and Haselbach (2010) have mentions an increasing significance to the idea of sustainable construction. Referring to the sustainable principles, environmental sustainability can be considered more "friendly" environmental materials waste minimization, energy efficiency, reduced operational costs, increased lifetime span and end-of life issues are important criteria for designers and those aspects need to be considered starting with the early design stage, in order to make the building project "sustainable".

Bruntland Commission (1987) creates the origin concept of sustainable development without threatening the ability of future generations to meet their needs. According to Lapinski *et al.* (2006) mention that a sustainable buildings should be designed and constructed with emphasis to environmental consideration. While, Halliday (2008) mentions a projects should create minimizing on polluting materials, treatments, fuels, management practices, energy and transport.

During the planning process the strategic position to integrate environmental sustainability considerations to have the most sustainable solution on the overall of the project. Thus will enhance the sustainable in the project

phase. According to Abeyundara *et al.* (2009), the application of materials is vital and the selected should be based on the material's environmental impacts at the project planning and design phases.

**Establishment of clear goals and implementation strategy at early phase of project:** The environmental sustainability vision could be apply into clear goals using planning tools for sustainable materials and techniques. The managers use methods like planning and deliverables to ensure that aims are integrated in the areas and objects that are developed in the environmental sustainability project.

**Establishment of multi-disciplinary project teams:** The architects, consultants and contractors whereby in related multi-discipline. They must have a knowledge and skills in handling environmental sustainability in the pre-construction phase. Effective team working across disciplines is good application to solve the technological and managerial problems related with pre-construction phase. Koch (2002) mentions that the involvement of people with different knowledge, experience and skills who come together will help to solve a common task; projects can thus be seen as seek for knowledge creation, integration and sharing where new and proven ideas and thoughts are combined.

**Establishment of strategic planning of decision making:** The environmental sustainability must integrate with strategic planning. This is a decision-making process involving diverse objectives which requires a systematic approach. Therefore a good strategic planning of decision making will also enhance project approach towards environmental sustainability.

## RESULTS AND DISCUSSION

### Data analysis and discussion of findings

**Research question 1:** The involvement of personnel in the construction project. Table 1 shows the roles of the respondents for the interview. The respondents were asked to identify, from the list given, the number of construction project that the respondents have been involved in before. Table 1 show the respondents position in the organization and number of construction projects that the respondents have been involved in previously. The ratings are as follows in.

Table 1 shows most of the respondents have been involved in 5-10 construction project in which the respondents were project managers project engineer architect client representative. These contributes to 1 out of 41 total respondents (41.5%). A total of 31.7% of

Table 1: Respondents position and number of construction project involved

Positions	Construction project involved				Total	Percentage
	Never	1-5 projects	5- 10 projects	10 and more		
Project manager	0	0	4.0	4.0	8	19.5
Project engineer	0	3	5.0	2.0	10	24.4
Architect	0	2	1.0	2.0	5	12.2
Client representative	0	2	1.0	2.0	5	4.9
Quantity surveyor	0	1	0.0	1.0	2	26.8
Others	0	3	6.0	2.0	11	100.0
Total (N = 41)	0	11	17.0	13.0	41	100.0
Percentage	0	27	41.5	31.7	100	

Table 2: Environmental sustainability strategy conceptual model at pre-construction; environmental sustainability strategy conceptual model at pre-construction phase

Factors	Objectives
Major concerns: Environmental (erosion, pollution, species extinction maintenance of biodiversity, environmental conservation Environmental pollution control development of management awareness and more efficient Principles: Environmental sustainability impact assessment on pre-construction stage Ensure of effective environmental sustainability at procurement level	Goal objectives: Ensuring an environmental sustainability level at pre-construction phase Ensure the environmental sustainability at decision making phase  Environmental sustainability strategies: Pollution and waste reduction Coordinate and proactive approaches of environmental sustainability Participatory planning Reforming construction site policies to discourage environmental destruction Environmental awareness to the managerial and workers

respondents have been involved in between 1-5 construction projects. The rest (2.8%) of the respondents have been involved in between 1-5 construction projects. This shows that most of the respondents had multiples experiences in the construction industry.

**Strategy environmental sustainability through pre-construction phase:** The comprehensive phases of a construction project such as feasibility, design, building or construction , operation and demolition. Through the feasibility and design stage it is important to considered the environmental sustainability. The project brief and as the project proceeds the briefing material is to be clearly explained to the client and approval obtained. This could be integrated with environmental sustainability application up to the project completion.

This phase associated with environmental effects where a construction phase also results with land degradation, creation of waste leftover from construction materials, local air pollution, leakages of polluted waters as a result of certain processes as well as with requirements toward safety at work and health of workers Table 2.

The purpose of the study was to determine the main attributes of sustainability in the field of construction and make a conceptual environmental sustainability in this field. As conclusion, the model of sustainable building as in Table 1 and 2 summarize in four categories that main and essential aims in each one are presented. Generally, features of sustainable building are concerned with three major items in social, economic and environmental groups.

Environmental has been highlighted and able to reducing the impact on environment in construction phase. This model generally indicates and proposes features which building should have in order to achieve environmental sustainability.

Environmental sustainability where stated as the attribute of a system that has the capability to maintain and adapt and survive no matter how unsustainable the external environment make it. It also as a catalyze the achievement of the sustainability of its external environment. The successful of achieving the environmental sustainability of its internal organizations to manage the project.

According to Matson *et al.* (2008) stated that the strategic in operational environmental policies in the sustainable development, STARS identifies the aim the need to improve information for decision-making where measuring progress through indicators operation.

Zhang *et al.* (2012) stated that focus strategic must integrate technical knowledge with operability. The construction activities are a very complex industry including a high number of stakeholders. Therefore required a knowledge skill in environmental sustainability to ensure project running at a sustainable target. The indicators should sufficiently contain the environmental strategic objectives of environmental sustainability while also considering the difficulty and reliability of the data input.

**Strategy 1:** Environmental sustainability question: What is the level of professional knowledge of the

Table 3: Respondents awareness on environmental issues

Issues	Summarize of awareness
The awareness on environmental issues among construction players in Malaysia is good	Low
Environmental sustainability aims to reduce pollution, ensure energy efficiency in projects minimize waste and water consumption.	Low
Many developers are keen on applying green concept in their projects	Low
The environmental issues should be at the forefront of any construction projects	High
The environmental problems from construction sectors is major concern	Medium
Many developers are keen on applying green concept in their project	No
Water pollution could affect the environment	Medium
Toxic can cause ozone layer depletion	Medium
All these environmental pollution affect the pre-planning stages	High

environment? Research question one which sought to know what the professional involving in the construction project know about the environment sustainability in which they conducted in research questions comprises of 6 options A, B, C, D, E. Construction industry key players are the target respondent in this research because of their strategic generate to implement environmental sustainability in pre-construction phase of project.

Table 3 shows that most of the respondent agreed that potential environmental impacts during construction. The questions seek to determine from the respondents of the awareness of environmental issue in construction project. Many developers are keen on applying green concept in their project stated which no awareness of such standard while more a stated high awareness which environmental issues should be at the forefront of any construction projects. Most of the environmental pollution affect the pre-planning stages also at the high awareness. This result confirms that much of respondents were aware to the environmental sustainability.

Table 4 shows the potential of environmental impact in the construction work. The sources may affect the community due the activities. The need to have a well planning during the pre-construction stages. The potential environmental impacts during operation are mostly continuous and the need to have awareness on environmental issues. The environment is highly polluted as a result of construction waste, pollution and the dumping of construction waste and toxic to the soil polluted and thus, become a scarce commodity.

**Strategy 2:** Environmental Sustainability at managerial level : Are there environmental related courses assigned to individual in their departments? Research question 2 was to solicit information on environmental sustainability application to the construction project that they had conducted. The research question comprises of 5 items in yes or no options item:

**Questionnaires distributed:**

- Environmental sustainability is important to the pre-project phase

Table 4: Environmental issues and impact in the construction work

Potential environmental impact to the project	Source of impact
Alteration of the natural terrain	Earthworks, construction work
Impacts of construction wastes and excess soil	Earthworks, construction work
Soil and ground water pollution	Earthworks, construction work
Soil and ground water pollutions	Earthworks, construction work
Air pollutions	Earthworks, construction work
Noise emissions	Earthworks, construction work
Impacts on sources-water quality and ecology	Earthworks, construction work
Toxic pollution	Repainting

Table 5: Respondents results based on the questions 1-5 in relation to environmental sustainability awareness on pre-construction stage

Items	Yes	Percentage	No	Percentage
1	126	84	24	16
2	42	28	108	72
3	102	68	48	32
4	55	37	95	63
5	42	28	108	72

- Environmental sustainability is not affected the managerial section
- Supervision require to apply the environmental sustainability at construction planning
- They have not apply for any environmental awareness in a project
- Environmental sustainability is not in their project intention

From Table 5, 84% of the respondents who are project managers agree that environmental sustainability is important to the pre-project stage showing a very high level based on the awareness. This means that almost all respondents focused on environmental issues and environmental concerns. About 72% agree that environmental sustainability is not affected the management, 32% agree to the fact that managers at any level should participate the environmental sustainability at construction site, 63% responded that they have not apply for any environmental awareness, 72% indicated that environmental sustainability is not in their project intention. This could be summary that the individual management on site are sensitised to the environmental

issues and problems. In addition also they are aware and participate on environmental issues on the pre-construction stage.

**Strategic recommendations:** One of the challenges of managerial desiring to design environmental sustainably in a project. It is important for a construction managerial to have an operational approach to environmental sustainability. The concept is often not defined by the managerial claiming to aim for environmental sustainability but the managerial action and behavior towards environmental sustainability is described as part of the business strategy.

In order to achieve an environmental sustainability future in the building industry, a several suggest based on the application and disciplinary environmental approach. The application of green sustainable building is said to be an environmentally approach where include designing, Green approach should be able to reduced energy consumption, use of water, dan be able to recycle its waste. According to Wang (2013) mentions that the good designed green buildings will save money and create healthier environments. constructing and operating. This could lead to minimize the total environmental impacts,

The use of a life cycle framework recognizes the need to consider all the principles of environmental sustainability in pre-construction at early stage of a project's planning. If the managerial's was involved as part of the project team early on in the project, then the chances for breakdown at this phase are less. The managerial's can work with the design team to work out the detailing which will reduce the environmental matters where potential affect work progress during construction. The individual in construction guide the actions in the building of the environment as all the internal stakeholders of a construction project will be affected by the negative or positive impacts of the projects in the end (Plessis and Cole, 2011).

The promotion of multi-disciplinary within private sectors, contractors and consultants should take place in a participatory, interactive and consensual manner. This may focus toward environmental sustainability in the project. The problems start to arise when the contractor is just introduced to the project at this phase and is unfamiliar with the intent of the design team and can worsen if he is unfamiliar with environmental sustainability methods.

Project participants should be noted that critical decision-making responsibilities pertaining to environmental sustainability issues. They must have an experiences, knowledge and expertise in environmental sustainability and environmental issues.

The use of a system's approach acknowledges within interconnections between the planning and environment. This interactive process can be apply to improve implementation in order to support a continuous leading planning and construction development. Evaluating the environmental sustainability impact is an important proactive of the construction society's transition towards the sustainable idea. In this context, this study identified the environmental sustainability concept. The target was not defining the most adequate application but identifying the elements with the purpose of defining the most relevant application for a specific goal.

## CONCLUSION

The construction activities has great impact on the environment, the consideration of environmental sustainability through pre-construction is needed. Environmental Sustainability is approaching that developing awareness and to protect environment. The research can be concluded that most of the environment pollutants are directly or indirectly cause by human activities. Therefore, what we need to realize is that at this point the issue of pollution and degradation of natural environment have influenced communities to consider environmental matters as vital issues. Thus, construction industry is to make its environmental sustainability to the efforts to preserve the quality of the environmental for posterity, then consideration should be at early stages of the development process. Due to this the potential environmental impacts during operation need to be aware and action taken towards environmental sustainability.

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