The Social Sciences 11 (11): 2783-2786, 2016
ISSN: 1818-5800

Source Reduction: Towards Improving Waste Management Strategy and Sustainability in Malaysia Construction Industry

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Abstract: Construction industry involvement is very important in order to achieve environmental sustainability through the improvement of its waste management practices. In most of the countries especially developed countries, construction industry is the major user of energy and natural resources. Thus, issues such as excessive, depletion and degradation of natural resources and waste management has become more apparent among the public and private sector. Construction industry could be considered as one of the mega contributor to the environmental issues. This study will focus on the management of construction waste in Malaysia as an important issue to be discussed in the country. This is due to the construction waste management in Malaysia is at an unsatisfactory level. In this study, concept of sustainability, construction waste, waste management and source reduction has been thoroughly discussedand highlighted.

Key words: Waste, waste management, construction industry, sustainable, Malaysia

INTRODUCTION

The beginning of year 2000 has seen an increasing demand for changes from conventional construction to greener construction practices which has given more consideration on the environmental protection in every single construction project. Construction industry has responded to a challenge of sustainable development since early 1990s after the Rio Earth Summit and the advent of Agenda 21 to be more efficient. With improvement of current practice in construction industry can increase the quality of building, increase collaboration among project stakeholders, reducing the used of energy and natural resources and lastly minimizing project impact toward environment (Nawi *et al*., 2014).

MATERIALS AND METHODS

This study is an initial part of on going research, therefore most of the information presented was gathered from literature in related domain such as sustainable construction, waste management and construction waste. Research has suggest the significant of literature review which is represent "critical analysis of a segment of a published body of knowledge through summary, classification and comparison of prior research studies, reviews of literature and theoretical study. Thus in order to highlight the significant of waste management in construction industry, a critical literature review has been done. In addition, this syudy also highlights a number of strategies and approach in reducing construction resources and sustainable in Malaysia also has been presented.

RESULTS AND DISCUSSION

Sustainability in construction industry: Sustainability and sustainable development are debatable issues all around the world. There is a huge growing awareness based on sustainability issues from the top leaders, researchers and up to the public. According to Chan and Chan (2004), initially, environmental management is the global objective of sustainability. This statement was further supported by Ding (2005). The debate on sustainability issues has come a long way since the 1970's energy crisis which has make the world to focus their attention on the profligate manner with which humankind was consuming the Earth's natural resources. Ugwu mentioned that sustainability should be considered as global issues and it need a global solution. According to Gloet (2006) and Azapagic (2003), sustainability and environmental management related issues are very important whether at the national or international level.

Construction industry involvement is very important in order to environmental sustainability through the improvement of its management practices. Thus,

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Table 1: Definition of construction waste

Definition of construction waste	Literature
"The difference between the value of those materials delivered and accepted at site and those properly used as specified and accurately measured in the work after deducting the cost saving of substituted materials and any materials transferred elsewhere"	Englemere and Berkshire (1980)
"Any activity that absorbs sources and does not have any value adding"	Womack and Jones (2004)
"Any kind of sources-materials, time (labour and equipment) and capital- produced by activities that generate direct or indirect costs but do not add any value to the final product from the point of view of the client"	Formoso *et al.* (2002)
"Mineral and non-mineral matter in variable composition from construction, demolition and renovation projects including excavated natural or fill soil and rock material generated during construction"	Pereira and Begum (2005)
"Materials from construction sites that are unusable for the purpose of construction and have to be discarded for whatever reason"	Formoso *et al.* (2002)
"The different between material delivered to site and those fixed or placed in the building"	Silva and Vithana (2008)

construction industry can be considered as one of the mega contributor to the environmental issues. According to Wenblad (2001), the beginning of year 2000 has seen an increasing demand for changes from conventional construction to greener construction approach which has given more consideration on the Environmental Management Practices (EMP) in every single construction project.

The construction industry has provided infrastructures for example houses and buildings and this sector has profound effects on sustainable development (Asad and Khalfan, 2007). Construction industry has responded to a challenge of sustainable development since early 1990s after the Rio Earth Summit and the advent of Agenda 21, to deliver better environmental friendly products and to be more efficient. The construction stakeholders can contribute for better sustainable practices in the construction industry by being more profitable and more competitive. In most of the countries especially developed countries, construction industry is the major user of energy and natural resources (Shen *et al*., 2004). According to Ding (2008), construction industry is the biggest consumer of natural resources and this industry is also considered as one of the largest polluters in many countries. At the same time, construction sector impacts on other environmental issues including resources depletion and waste at each stage of the construction process through pre-construction stage, construction stage, post construction which includes operation and demolition (Osman *et al*., 2008). Report has identify 40% of greenhouse gas emission from the used of building energy and construction activities. This percentage illustrates the domination of construction industry as contribution towards greenhouse gas emission. In many countries, construction industry accounts for up to 50% of all natural resources extraction by weight. Moreover, this industry also has been addressed as one of the main contributor in solid waste which is approximate 40%. According to UNEP (2003), this increases to as much as 50% in some countries if material production and transport are also taken into account.

Table 2: The composition of total waste generation

Materials	Waste (%)
Concrete and aggregate	65.80
Soil and sand	27.00
Wood based materials such as timber and lumber	5.00
Brick and block	1.60
Metal products	1.00
Roofing materials	0.20
Plastic and packaging products such as papers, cardboards	0.05

Currently, the construction industry faces increasingly restrictive environmental conservation and protection laws and regulations in order to improve the EMP. Thus, the existence of international standard such as ISO 14,000 is significant in order deal with this issue. Moreover, pressure from environmental groups also essential to force a construction practitioner towards sustainability approach. In order to achieve sustainability in the construction industry, one of the efforts that should be considered are through improvements of waste management. Through improved management of construction waste, it is believed able to contribute towards better sustainable construction industry in Malaysia.

Construction waste: Due to the rapid development of construction industry, particularly in building and infrastructure project been addressed as a foundation in the increasing of construction waste. This situation can led to increasing the effect of construction industry towards environmental problem. There are many definitions of construction waste according to the previous researches see in Table 1.

Based on the composition of total waste management, in construction industry, concrete and aggregate is the largest component with 65.8% of total waste generation (Begum *et al*., 2006). Material such as soil and sand, brick and blocks, wood production, method product and roofing material are example of construction waste at project site (Begum *et al*., 2006). Table 2 illustrates the composition of total waste generation.

With the demands in implementing major infrastructure projects in Malaysia, together with many commercial buildings and housing development programmes, a large amount of C and D wastes are being

Table 3: Factors leading to waste in construction industry

Project stage	Cause of waste
Designing stage	Plan errors
	Detail errors
	Design changes
Construction stage	Shipping error
	Ordering error
Materials handling stage	Improper storage
	Deterioration
	Improper handling (on-site or off-site)
Construction and renovation	Human error
	Trades person
	Other labour
	Equipment error
	Others (e.g., catastrophe, accident and weather
Demolition stage	Tipping

produced by the construction sector. Construction waste issue is one of the main environmental problems in Malaysia.

In Malaysia, an increasing of construction waste has negatively effect the environment. According to Graham and Smithers (1996), throughout every phase of a construction project which includes design stage, procurement stage, materials handling stage, construction and renovation stage and demolition stage, there are a lot of factors which cause a waste. As a result, this situation has significantly raised public concern (Bagum *et al*., 2006). There is a need for solution in minimization of construction waste see in Table 3.

Waste management: Previous studies have identified a number of benefits in implementing waste management for construction industry (Tam *et al*., 2007). For example, pollution free, increase the effectiveness of resources allocation and regulatory compliance, enable early evaluation of risk and potential problems. According to Begum *et al*. (2009a), majority of the Malaysian construction stakeholders put low priority on the issues of waste management. Data shows that approximately, 40% of the generated waste portion globally originates from construction and demolition of buildings (Kulatunga *et al*., 2006). Incineration is not suitable for disposing construction waste. This is due to the characteristics of construction waste which is bulky and heavy. Construction waste can be caused by design changes, leftover material, recyclable material and poor weather (Faniran and Caban, 1998). Based on research carried by Osmani *et al*. (2008) among the architects and contractors has reported that design, site operation, procurement routes and material handing is a main cause of construction waste. He also has categories the cause of construction waste into few groups such as comprising contractual, design, procurement, transportation, on-site management and planning, material storage, material handling and site operation.

Source reduction: National, regional and local governments in many countries now have policies concerning sustainable construction. This also includes the commitment to minimize waste generated and to adopt the waste management strategies especially through source reduction principles. Waste reduction is very important in construction industry (Chun *et al*., 1997). In addition, waste reduction has been widely recognised as an effective approach to deal with waste disposal problem (Poon, 2007). Reduction is also considered as the most effective and efficient method for C and D waste management as it offers the dual benefits of preventing the generation of C and D waste and of reducing the cost of high charges for waste transportation, disposal and recycling (Poon, 2007; Esin and Cosgun, 2007). Bossink and Brouwers (1996), has defined source reduction as any activity that reduces or eliminates the generation of waste at the source, usually within a process. Previous research has been highlight several caused of construction waste such as ineffective process during planning and design stage, improper waste management and low awareness. Research has proposed a number of approaches towards minimizing construction waste. For example, Coffey (1999) has highlighted there is a need to implement waste management as part of project management function. He also mentioned the selection of optimum waste solution method should be determined by cost of implementation. According to Ho (2001), reducing of construction management should focus on planning and design stage which is achievable by an adoption of large panel system and prefabrication components.

However, in construction industry there is limited practice that focuses on material reduction due to the availability of building material with low cost. Furthermore, the absent of rule such as policy that compulsory required construction companies to practice sustainable resources and waste management. Thus, this situation always led to environmental problem such as illegal dumping (Begum *et al*., 2009b).

CONCLUSION

In the construction project, planning prior to each project plays an important role. Proper planning will reduce the waste of resources in any project. Detail planning, especially at the design stage is paramount where proper design is one of the stages involved in waste management. At this stage, the reduction of unnecessary resources could be practiced. Only proper amount of material will be identified at this stage. Consequently, waste management through source reduction is seen as essential for implementation in the early stages of construction projects.

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