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Implementation of resource recovery practices among Malaysian construction stakeholders

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Abstract

Most of the construction stakeholders around the world especially in developing countries are not really aware of the Resource Recovery approaches in contemporary construction projects. Previous studies reported that Resource Recovery issues received less attention from the construction industry stakeholders compared to construction costs and time related issues. However, this trend has changed due to the depletion of non-renewable resources, greenhouse gas emissions and global warming with much effort now being directed to 'build greener' construction projects through proper application of the Resource Recovery approach. This study examined current application of Resource Recovery approach among Malaysia's construction stakeholders. Primary data were gathered from 122 questionnaires returned by Malaysian construction stakeholders that included consultants, contractors and clients . The analysis revealed that the adoption of Resource Recovery was only mildly practiced by the Malaysian construction stakeholders.

Keywords: construction waste, Malaysian construction, recycle, resource recovery, reuse, stakeholders

Introduction

Construction and Demolition (C&D) waste is often seen as the major contributor to the solid waste stream that is going to landfill, hence, making it the area of focus for improvement (Tam and Tam 2006). C&D reuse and recycle principles have been promoted in order to reduce waste and protect the environment. Financial, environmental factors and regulative interventions have provided the incentives for companies to redesign their forward supply chain networks to further incorporate and optimize the resource recovery processes (Georgiadis et al., 2006; Kralj and Markic, 2008). Integration of resource recovery of construction materials in new as well as rehabilitation construction projects provides environmental as well as economic benefits. These benefits can be summarized as, reduce the use of virgin materials, divert materials from landfills, reduce energy consumption, reduce emissions and decrease costs in construction projects (Wilburn, 1998). Currently, the existence of regional and national policies, laws and regulations governing Reuse and Recycle principles for C&D waste is minimal in Asia. In Malaysia, for example, construction industry has been urged to use innovative construction techniques and to shift from the traditional practice of brick and mortar systems to an Industrialised Building System (IBS) of construction, or Offsite Manufacturing/ Offsite Construction as part of the initiative by Government for reducing wastage at construction projects however the level of its adoption process is still low (Nawi et al., 2014a; Nawi et al., 2014b). According to Coventry (1999), C&D wastes including demolished concrete, bricks and masonry, wood and other materials such as dry wall, glass, insulation, roofing, wire, pipe, rock and soil constitute a significant component of the total waste. Without proper reuse and recycle policies, these C&D wastes would quickly fill all the remaining landfill space, which has already been growing in scarce around this region.

According to IGES (2006), in almost all developing countries, legal system regarding the reuse and recycle policies have yet to be established. Some of the policies exist and the others are still in the process of formulation. For Malaysian construction industry, the development of reuse and reduce principles programme is spearheaded by Construction Industry Development Board (CIDB) in coordination with the government. It also elaborates the insufficient institutional capacity to support the principles and measures of reduce and reused which is a common issue for all developing countries to be addressed. According to Addis (2001), reduce and reuse principles should be addressed by the key parties in the construction industry which include clients, consultants and contractors. Reuse and recycling opportunities for construction and demolition wastes depend on the markets for the individual materials comprising the wastes and the ability to process the commingled waste or separate the individual materials (Kreith and Tchobanoglous, 2002). The aim of this research is to measure the adoption level of Resource Recovery Practices among Malaysian construction stakeholders.

Resource recovery practices

Many building materials may be reusable during renovation projects where a new building is built following the demolition of another (Matthew, 2009). Reuse of construction and demolition waste is an effective and economically viable way to reduce the volume of wastes deposited in landfills, thereby extending the life of existing landfills and open new landfills (Tech Data Sheet 1998). When reduction and reuse is not feasible, recycling can offer the benefits of reduced demand for new resources, a reduction of transport and production energy costs, and the utilization of waste that would otherwise be lost to landfill sites (Hao et. al, 2008). Recycling is defined as the recovery of what would otherwise be a waste material. Recycling is the removal of material from waste for reprocessing. Recycling is recognized today as a solid waste management strategy that is preferable compared to landfill or incineration and it is also for environmental desirability (Ruiz, 1993). Recycling is the reprocessing of a reclaimed material and converting it into a new material or use.

Recycling techniques are being developed around the world and many have proven to be effective in protecting our environment and conserving natural resources (Pierce and Blackwell, 2003). Recycling of materials such as, rubber, glass, demolished concrete, metal, and plastic represent a clear model for the proper disposal of waste materials for a better environment (Batayneh & Marie, 2006; Marzouk et al., 2007).

Research and development within the industrial world is continuously progressing towards finding new and innovative techniques to recycle waste materials. Worldwide, the use of recycled materials has been practiced for years in highway application and in rubberized concrete (Siddique & Naik, 2004). The benefits from waste recycling are not solely environmental, but economic and aesthetic as well. According to Matthew (2009), recyclable materials have differing market values depending on the presence of local recycling facilities, reprocessing costs, and the availability of virgin materials on the market. In general, it is economically feasible for construction sites to recycle those waste materials. According to Carneiro et al (2000), waste recycling can preserve finite natural resources, for example by reducing the demand for the extraction and processing of new aggregate. The main advantage of recycling demolition materials is that the product can be reuse, and with economic benefits if properly managed. Recycled materials can be made to meet the design specifications for normal construction materials if properly processed (Reusser 1994, Kawano 1995; 2000; 2003, Hassan *et al.* 1995, Tomosawa & Noguchi 2000, Poon *et al.* 2003, Cheung 2003, Tam 2005, Tam *et al.* 2005a, b).The profitability of recycling C&D wastes critically depends on the regulatory policy, contract specifications, economics, selected technology, and project management practice (Tansel et al., 1994). Suggestions for conducting a

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profitable recycling program for construction and demolition wastes were discussed by Brooks et al. (1995).

According to Matthew (2009), the advantages of a construction and demolition recycling program are including avoid trash collection and disposal fees, save resources and money through deconstruction, improve organization's public image, make new products from old materials, improve the market for recycled content products and help community meet local and state waste reduction goals. Edwards (1999), found that recycling, being one of the strategies in minimization of waste, offers three benefits by reducing the demand upon new resources, cut down on transport and production energy costs and use waste which would otherwise be lost to landfill sites. However, in Malaysia, the amount of construction waste reuse and recycle are still low (Begum et.al 2006). See Table 1.

Table 1. Amount of reused and recycled construction waste materials on site

Construction Waste Material	Amount of reused and recycled	
	Tonnage	Percentage
Soil and Sand	5400	27.33
Brick and block	126	0.64
Concrete and aggregate	13365	67.64
Wood	810	4.00
Metal products	54	0.27
Roofing material	5.4	0.03
Total	19760.4	100

Research methodology

The population of this study comprised of construction stakeholders that are operating in Malaysia. The list of the companies was obtained from Real Estate and Housing Developers' Association Malaysia (REHDA), Construction Industry Development Board (CIDB), Association of Consultants Engineer Malaysia (ACEM), Board of Architects Malaysia (PAM) and Board of Quantity Surveyors Malaysia.

The companies that had been selected are only companies located in Peninsular of Malaysia. Sabah and Sarawak would be excluded because of the geographical scope of the study. To be more representative, it was decided that the samples come from northern, central, southern and eastern regions of Peninsular Malaysia. Based on the Development Composite Index (DCI), the central region which includes Melaka, Negeri Sembilan, Selangor and Wilayah Persekutuan Kuala Lumpur are the most developed regions in 2005 (Ninth Malaysian Plan, 2006b, p.356). Sabah, Sarawak and the states in the Eastern region which comprises of Kelantan, Pahang and Terengganu are the least developed region, while the Northern region which includes Kedah, Perak, Perlis and Pulau Pinang, and Southern region which includes Johor is the most and moderately developed states (Economic Planning Unit, 2005). Besides DCI, the development gaps between regions and states were identified in terms of the level of gross domestic product (GDP), and its growth, household income and incidence of poverty as well as attractiveness to new investment in construction industry.

This research applied stratified data sampling. A stratified sampling is a probability sampling technic. For this research, the entire target population had been divided into different strata and then randomly selects the final subjects proportionally from the different strata. These subgroups are including the clients, contractors and consultants.

The data

This study targets Malaysian local construction sector. The respondents are the industrial practitioners which include the contractors, project clients and the consultants. Besides mailing the questionnaires, a personal visit to the related companies had been done and a visit to the 11th International Construction Week also had been initiated in order to increase the response rate. Finally, the number of questionnaires received was 128 but only 122 were usable.

Descriptive summary of respondents

The data of this study was gathered from 122 companies to represent the construction stakeholders in Malaysia as discussed in the previous chapter. The following subsections present the descriptive summary of demographic information of the respondents.

Regarding the role of every construction stakeholders, 31 companies (25.4%) are developers or clients, 57 companies (46.7%) are contractors, and the balance of 34 companies are consultants (27.9%).

The study found that 18 respondents (14.8%) have less than a year experience, 30 respondents (24.6%) have 1 to 5 years experiences, 31 respondents (25.4%) have 6 to 10 years experiences and 43 respondents (35.2%) have more than 10 years experiences. For those respondents who have less than a year experience, they are still reliable due to the reason that all of them have professional qualification.

In term of education background, 7 respondents hold PhD (5.7%), 14 respondents hold Masters Degree (11.5%), 66 respondents hold First Degree (54.1%) , 13 respondents hold Diploma (10.7%), 5 respondent hold Certificate (4.1%), 2 respondents have Malaysian Higher School Certificate (STPM) (1.6%) and 15 respondents have Malaysian School Certificate (SPM) (12.3%).

The companies participated in this study exhibited the following statistics. 79 companies (64.9%) hired less than 50 staff, 12 companies (9.8%) hired between 50 to 100 staff, 10 companies (8.2%) hired between 101 to 300 staff, 3 companies (2.5%) hired between 301 to 500 staff and 18 companies (14.8%) hired more than 500 staff.

In term of the years of experience of the companies in the construction industry which were represented by the years on incorporation of the companies, 36 companies (29.5%) were in the construction industry for more than 20 years, 39 companies (32.0%) were in the industry for more than 10 years, 30 companies (24.6%) were in the industry for more than five years and the balance of 17 companies (13.9%) were in the industry for about 1 to 5 years.

Data analysis

The level of implementation of Resource Recovery is presented in Tables 1. Table 1 organize each level of Resource Recovery practices from scale 1 to 4. The highest practiced for this factors was scored on a scale of 1 to 4 with 1 having the lowest practice and 4 the highest practice. To identify the criticality index for each factor, the factor criticality was defined as in Table 2.

Table 2. Criticality assessment criteria

Mean Factor Score Range	Level of Practiced
< 2.0	Least practiced
>2.0 – 3.0	Mildly practiced
>3.0 - 3.5	Moderately practiced
>3.5 - 4.0	Most practiced

Resource recovery

The mean score of Resource Recovery for the whole data set as perceived by the construction players was 2.9085 which can be considered as mildly practiced. The minimum and maximum scores were 2.6967 and 3.1475, respectively, with the theoretical range of 1-4. To identify the criticality index for Resource Recovery, the factor was criticality defined as in Table 3.

Table 3. Mean analysis resource recovery

Mean Factor Score Range	Items
3.1475	Our organisation always reduced the amount of waste that we produce from time to time.
3.0656	Our organisation always promotes efficient use of resources.
3.0410	I don't have any difficulties in understanding the concept of recycle in the scope of construction industry.
3.0164	We have a good communication about resource recovery with all the players involved.
3.0164	We always communicate the good examples of recycled materials with our staff.
2.9262	Most of the staffs in our organization know about the recycling programmes
2. 8689	We don't have any problem to get any green and recycled construction material provided in the Bill of Quantities (BQ).
2.8279	Most of the recycled construction materials are cheaper than others common product
2.8197	Our organisation uses recycled construction materials.
2.7377	Our organization has an environmental or ethical on recycle materials purchasing policy.
2.7377	Our organization provides training programmes based on the use of renewable and recyclable resources.
2.6967	We don't have any difficulty finding a recycling material supplier in our area.

Conclusion

For the Resource Recovery practices, this study found that the adoption levels of these practices are poor. From the analysis, lack of staff's concern about the recycling programmes, lack of recycle construction materials used, difficulties of finding a recycling material supplier, high price of recycle construction materials as compared to common materials, lack of ethical on recycle materials purchasing policy, problem of getting recycle material provided in the Bill of Quantities (BQ) and lack of training programmes based on the use of renewable and recyclable resources can be considered as the main problems towards implementing resource recovery in local construction industry with the mean score range was 2.6967 to 2.9262. Other items can be categorised as moderately practiced with the mean score range between 3.0164 to 3.1475.

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