

CHALLENGES OF IMPLEMENTING EFFECTIVE SOLID WASTE MANAGEMENT IN CONSTRUCTION PROJECTS

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Abstract: *The construction industry produces a large amount of waste and other seemingly useless materials that can be easily disposed of as solid waste. Contractors are primarily responsible for maintaining a sanitary work environment and properly disposing of waste generated in their work area. The unwillingness to implement waste management practises on construction sites is one of the issues confronting the construction industry in terms of reducing environmental impacts and dumping areas. Improper waste management, collection, transition, and transportation processes have been shown to have a significant impact on solid waste characteristics. The major issue in this study is a lack of waste management knowledge and skill, which can lead to improper solid waste management. The rise in the number of unauthorised dumping practises associated with Malaysia's construction industry suggests that Malaysia's construction waste management should be prioritised. The objectives of this research are to identify the challenges in implementing effective solid waste management in construction projects and to recommend improvements in implementing effective solid waste management in construction projects. Survey respondents agreed that solid waste management needs to be improved in order to reduce illegal landfill on sites. To minimise waste, especially solid waste in construction areas, the standard waste management hierarchy includes five critical steps: reuse, reduce, recycle, treatment, and disposal. Construction waste must be pre-treated before being disposed of in a landfill, and it must be treated in accordance with the waste management hierarchy.*

Keywords: *Challenges, Solid waste management, Implementation, Construction projects*

Introduction

Construction waste management, like the construction industry as a whole, is made up of a variety of issues and concerns that may affect a construction project, all of which are influenced by economic, social, and environmental factors. Construction waste management appears to be a simple concept on the surface: collect waste from construction sites and legally dispose of it somewhere (Clancy et al., 2021).

Waste management has developed into a vital and necessary industry in both developed and developing countries in order to lessen adverse effects on the environment and human health. Any building material that cannot be used again, whether it has been left over, used improperly, or has been damaged during use, is considered a waste from the construction industry.

The overarching goal of a construction waste management plan is to divert construction waste, demolition debris, and land clearing debris from landfill disposal. Effective construction waste management, including non-recyclable waste processing, can also help to prevent contamination and extend the life of existing landfills (Kubba, 2017). As a result, it is critical to develop an overall environmental strategy that allows for the achievement of sustainability goals while also meeting financial objectives. Furthermore, in order to improve the solid waste management service in developing countries, the solid waste management system must be urgently improved through the application of the 3Rs (Reduce, Reuse and Recycle) (Behzad, et al., 2011).

The objectives of this research are to identify the challenges in implementing effective solid waste management in construction projects and to recommend improvements in implementing effective solid waste management in construction projects. Construction waste must be pre-treated before being disposed of in a landfill, and it must be treated in accordance with the waste management hierarchy. Thus, solid waste management can be implemented successfully in the Malaysian construction industry.

Literature Review

The Challenges in Implementing Construction Waste

According to Esa et al. (2017), the construction industry is critical to economic growth in developing countries such as Malaysia. Improper solid waste management methods in construction projects have resulted in insufficient environmental impact reduction and illegal disposal (Saadi et al., 2016). The cost of construction materials is constantly rising as a result of rising demand, a scarcity of raw materials, and a high-energy process. Construction companies used significant amounts of raw materials in their process to produce outputs such as their product and waste materials from that construction development.

As a result, the construction industry is frequently regarded as one of the most serious environmental polluters (Yahya and Boussabaine, 2006; Nasir et al., 2016). Construction solid waste is also distinct because it is affected by construction methods, styles, countries, and other factors. According to Abdel-Shafy and Mansour (2018), the problem of solid waste management is the most difficult challenge for authorities in developed countries, both in small and large cities. This differs from the problem described by Ikau et al., (2016), where it is a difficult challenge for construction site operators to increase the quantity of waste caused by the construction project.

According to Agamuthu et al. (2009) and Wee and Abas (2016), the policy was developed in the context of solid waste management in order to reduce the impact of unsustainable waste management on both humans and the environment. Solid waste management policy has become more important in recent years as the amount of solid waste generated has increased (Sreenivasan et al., 2012; Wee and Abas, 2016). The implementation of environmental policies is critical and has a significant impact on the effectiveness of solid waste management. To

address the issue, governments have set goals for proper solid waste management. These goals are articulated in public policy (Trinh, et al., 2021).

Enhancement of Solid Waste Management Implementation

According to Tam and Tam (2006), on-site sorting reduces construction waste and recovers valuable materials for reuse and recycling, saving money on disposal. Contractors are hesitant to perform on-site sorting despite the high tipping costs due to crowded site conditions, a short construction duration, high labour demand, high operating expenses, and a lack of recycling outlets (Poon et al., 2001). Off-site sorting can be a cost-effective way to promote reuse and recycling because the operational costs are lower than direct landfill disposal (Lu and Yuan, 2012). More on-site recycling technology, as well as increased off-site recycling, are required (Bao et al., 2020).

Waste land filling is still a popular waste management strategy, implying that current waste management strategies are ineffective. Anija-Obi (2001) defines environmental education as a field of study that seeks to promote among citizens not only environmental awareness and understanding, but also the relationship of man with the environment and mandatory actions of responsibility to allow survival while improving life quality standards. Furthermore, environmental awareness and attitudes were influenced by education. People's attitudes toward the environment, as well as their level of concern for it, are linked to how interconnected they perceive themselves to be with nature (Di Fabio and Kenny, 2021). This will have ramifications for the country's long-term viability.

Omeje et al. (2020) believe that it is necessary to assess the knowledge of site employee. Construction waste management on the job site could be critical in lowering waste generation. Finally, a lack of knowledge, poor design documentation, and a lack of waste management awareness all contribute to an increase in construction waste generation. Waste minimisation techniques that can help reduce waste generation on construction sites should be familiar to site managers.

Research Methodology

This paper focused on the challenges associated with implementing effective solid waste management and recommendations for improving effective solid waste management in construction projects. To collect quantitative data, a questionnaire survey with 17 questions is conducted. Furthermore, the study employs a 5-point Likert scale, with 1 being strongly disagree and 5 being strongly agree.

The organisation is the unit of analysis in this study. The information used was gathered from Malaysian contractors. The questionnaire was distributed at random to 454 contractors. The target population for contractors was based on 6,000 companies that registered with the CIDB underclass G7 (projects greater than Ringgit Malaysia 10 million) categories and were identified from the CIDB directory, using a stratified random sampling design.

51 questionnaires were returned within seven months of being sent, for a total response rate of 11.23%. This response rate was finally achieved after several attempts at personal contacts, follow-up emails, and phone calls. The low response rate is thought to be due to respondents' attitudes, busy schedules, and refusal to participate in the survey.

Findings and Discussions

Demographic analysis is the study of a population based on factors such as age, race, and gender. Demographic data in this study include the respondent's age, the number of projects managed in the implementation of construction waste, the current job title, and solid waste management experience in the construction industry. The Contractor made up 48.1% of the respondents who answered this paper questionnaire, according to demographic information shown in Figure 1 after data analysis. This was due to the fact that the contractor was essential to the construction industry from the start of the project until it was completed. Furthermore, 46.2% of respondents who answered the question about their working experiences worked for 11 to 15 years.

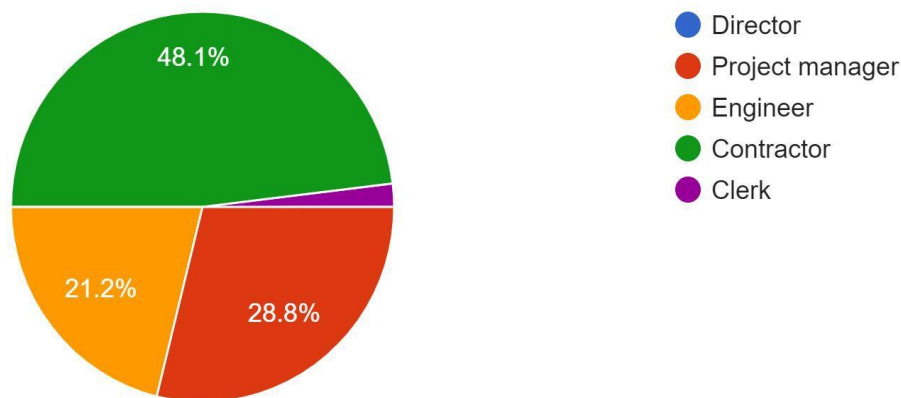


Figure 1: Designation of Respondents

The challenges are divided into three categories: cost consumption, knowledge, and institutions and policies. Inadequate knowledge of construction waste causes illegal dumping, which is the intentional and non-legal disposal of waste material in prohibited places, as shown in the Table 1, with a mean score of 4.59 (standard deviation = 0.536) and first place for overall challenges as a result of the analysis. Aside from that, most contractors avoid implementing this effective waste management technique, claiming that waste materials have little value and prefer to dispose of waste in landfills, which is also a challenge for knowledge with a mean score of 4.55 (standard deviation = 0.541) and a second ranking for overall challenges in implementing solid waste. With a mean score of 4.53 (standard deviation = 0.578), construction waste ranks third in overall challenges.

Large amounts of waste are produced as a result of increased demand for infrastructure, commercial, building, and housing development projects. Because of the increasing amount of solid waste produced, solid waste management policy has become more important in recent years. When it comes to waste management, developing countries face issues such as unsorted waste, littering, insufficient collection, dumping in open landfills, and obsolete technologies. As a result, many issues remain that cannot be resolved completely.

Table 1: The Challenges in Implementing Construction Waste

Descriptions	Mean	Std. deviation	Rank
Illegal dumping results from a lack of knowledge about construction waste.	4.59	.536	1
The majority of contractors avoid implementing this efficient waste management system.	4.55	.541	2
As a result of increased demand, construction waste is being produced in large quantities.	4.53	.578	3
A solid waste management policy serves as a guide for all parties.	4.49	.543	4
Because the budget includes detailed cost data on waste management strategies, it is insufficient.	4.49	.579	5
Construction activities produce a significant amount of waste in construction projects.	4.47	.674	6
Waste management plan coordination should include all stakeholders.	4.39	.568	7

According to table 2, there are enhancements to solid waste management implementation for which the majority of respondents strongly agree or strongly disagree with the overall enhancement. The three components of improving solid waste implementation in construction projects are cost consumption, knowledge and institutions, and policy. According to the table above, the first and second rankings for overall improvement include off-site sorting, which can be a cost-effective way to promote reuse and recycling because operational expenses are lower than direct landfill disposal, and disposal of development waste will be done in stages to save costs, both with the same mean score of 4.53 and standard deviations of 0.542 and 0.578.

Aside from that, the improvement in implementing solid waste management for mean score 4.49 (standard deviation = 0.612), which ranks third, results from a campaign to employees who are unaware of proper and legal construction waste disposal. The fourth and fifth rankings have mean scores of 4.47 (standard deviation = 0.542) and 4.45 (standard deviation = 0.577), respectively, for an ideal location for an off-site construction waste segregation facility that can reduce transportation costs, and companies should identify dedicated vendors to deliver recycled materials to make the use of materials and waste management methods more sustainable.

Construction waste management has yet to be properly put into practise in order to address the issue of illegal dumping. The first step in minimising the amount of waste that ends up in landfills is to lessen the amount of waste that is produced in the first place. Careful planning will be required. Because the operational costs are lower than direct landfill disposal, off-site sorting can be an affordable way to encourage reuse and recycling. How to choose an appropriate location for off-site facilities for sorting construction waste is crucial to take into account because it could lower transportation costs while also lowering noise and dust levels.

Table 2: Enhancement of Solid Waste Management Implementation

Descriptions	Mean	Std. deviation	Rank
Off-site sorting can be a low-cost method of encouraging reuse and recycling.	4.53	.542	1
To reduce costs, development waste will be disposed of in stages.	4.53	.578	2
Make an employee who are unaware of the proper and legal disposal of construction waste.	4.49	.612	3
A prime location for an off-site construction waste segregation facility, which can cut transportation costs.	4.47	.542	4
Companies should seek out dedicated vendors to deliver recycled materials in a more sustainable manner.	4.45	.577	5
Adequate knowledge in If development waste is disposed of properly, illegal landfill will not occur on the construction site.	4.41	.638	6

Conclusions and Recommendations

Implementing solid waste management presents three challenges: cost consumption, knowledge and institution, and policy. Cost consumption, knowledge, and institution and policy are factors that improve solid waste management implementation. Education also had an impact on environmental awareness and attitudes.

When it comes to solid waste management, law enforcement needs to be strict and publicise the issue more to ensure that the general public is aware. Reduce waste at its source, salvage, recycle, and reuse already-existing resources, as well as buy used and recycled products to avoid disposing of them. The government ought to encourage environmentally and economically responsible building. To ensure that all construction waste management strategies are implemented and operating effectively, they should conduct routine site inspections. Before being disposed of in landfills, construction waste must undergo pre-treatment. It needs to be handled in accordance with the correct hierarchy for waste management.

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