

Construction and Demolition Waste Management Gaps in Construction Industry

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Abstract

Construction and Demolition (C&D) waste is one of the fastest growing waste stream in Sri Lanka due to the construction boom after three decade of war. Thus, C&D waste management has become an environmental problem due to the lack of treatment and uncontrolled land filling. Thus, this study is focused on identifying the gaps which need to be addressed in C&D waste management.

Survey approach and interviews were used to gather information. Consequently, ten semi-structured interviews were conducted with experts involved in C&D waste management. The collected data was analysed using content analysis technique.

The findings revealed that the major gaps exist in C&D waste management as lack of capacity to handle an enormous quantity of waste, difficulty in estimating the quantity and composition of waste, lack of dumping sites and coordination among different parties involved, financial incapability and lack of technical people. Therefore, the study proposed seven areas for improvements as institutional and legal framework, fund allocation, site waste management plan, waste management hierarchy, supportive environment and monitoring, evaluation and reporting.

Keywords: C&D waste, Waste management, Gaps, Construction

1.0 Introduction

Construction and demolition waste is generally defined as waste which arises from construction, demolition and renovation activities including land excavation, site clearance, civil and building construction, demolition activities, roadwork, and building renovation (Yuan, Shen, & Wang, 2010). However, lack of awareness of resource-efficient construction practices has resulted in excessive use of natural resources and generation of large amounts of C&D waste that is rarely recycled (Borongon, & Nitivattananon, 2007). C&D waste has become one of the major concern in lot of developed and several developing cities throughout the world. Waste has even been seen as a crisis in these cities because landfill space is exhausted at a rate much faster (Mou, 2008). Central governments, regional and local authorities in many developed countries have policies related to the management of C&D waste (Borongon, & Nitivattananon, 2007). These all include a commitment to minimize generation of C&D waste and to adopt waste minimization strategies that because of the shortage of landfill facility (Addis, 2006). The foremost benefits through applying this approach are considered as the prevention of creating new and undesirable landfill sites, stemming potential environmental health risks related with C&D waste and its disposal and reducing the cost of construction (Lingard, Graham, & Smithers, as cited in Tam, Shen, Fung, & Wang, 2007).

Sri Lanka is a developing country and the construction industry contributes average 7.1% to the GDP (Central Bank of Sri Lanka, 2012). This contribution factor expected to be higher in future years due to government concentration on expedite development activities in all areas after the war. C&D waste form construction projects are inevitable but waste cannot be illegally disposed. Due to rapid development in construction industry, C&D waste has become one of the major concerns in future. Relevant authorities have little focus on C&D waste management at present. However there should be a proper management system to implement in the future to the expedite development programs forecast in the country (Kumara, 2009).

To have a better C&D waste management system it is important to recognize the existing gaps. Consequently feasible solutions to overcome the identified gaps should be identified. Thus, this research is focused on identifying “the gaps in existing C&D waste management and probable solutions?”. Accordingly the paper covers what is C&D waste management, adopted methodology and the research findings.

2.0 Construction and demolition waste management

C&D waste stems from construction, refurbishment, and repair work, and can emerge at any stage of a project from inception to completion. Generation of the waste stream is affected by various causes. According to Gavilan & Bernold (2008) these causes can be classified into six categories namely design, procurement, handling of materials, operation, residual related and other.

Compared with municipal waste, sources of C&D waste can be readily identified and the composition of C&D waste is relatively well-defined. In accordance with the composition of C&D waste it can be classified into two major parts such as inert and non-inert waste material. The inert material can be categorized into two major parts namely soft and hard inert material. The soft inert materials contain soil, earth, silt, slurry as well as hard inert materials contain rocks and broken concrete and non-inert materials include timber, plastics, metals and packaging waste.

In past, C&D waste was simply dumped in open dumps or the sea as the final treatment. Some of them were used in earth filling works however without much effort on waste separation. The aim of C&D waste management is based on minimization of waste and proper disposal, which both two help to reduce adverse environmental impacts and positively affect to the social economic and economic performance (Ye, Yuan, Shen & Wang, 2012). The European Union (EU) suggested a strategy for waste management based on waste hierarchy which gives preference to the prevention of waste minimization, then the recovery of waste and ultimately waste disposal (National construction & demolition waste council in Ireland, 2008). Moreover, C&D waste can be managed through “3Rs” principle (Lu, & Yuan, 2011). The 3Rs are refer to reduce, reuse, and recycle, which classify waste management strategies according to their desirability (Peng, Scorpio, & Kibert, 1997).

3.0 Research methodology

The survey method is adopted to find out the existing gaps and probable solutions for C&D waste management in Sri Lanka. Semi-structured interviews were selected to gather relevant information from experts who involve in solid waste management because semi-structured rather than structured interview enable sufficient flexibility to approach different respondents differently while still covering the same areas of data collection (Noor, 2008). The sample size of the study was limited to ten because of the limited number of experts involving in C&D waste management in Sri Lanka. Interview guidelines were prepared prior to the data collection. The design of the interview guidelines was done in accordance to capture the required data to analyse the research problem. The questions of the interview guidelines were developed based on the objectives of the study. While interviewing, note taking and tape recording were done to maintain the accuracy of data collection and avoid losing data as it is impossible to note down everything during the interview. The collected data were analysed using the content analysis technique. During write-ups, key findings were cross-referred with the related literature findings.

4.0 Findings

This section elaborates the gaps in existing construction and waste management practices and policies and probable suggestions.

4.1 The Gaps in existing C&D Management in Sri Lanka

4.1.1 Low percentage of on-site waste sorting

In the current scenario the C&D waste generated in construction sites are mixed. Local authorities and contractors not much consider on site waste sorting. According to the gathered data, all type of C&D waste collect without separation. This will lead to reduce efficiency of recycling and reusing of C&D waste along with a reason to increase reuse costs for construction companies. Moreover the waste collection parties do not consider on the toxicity of the waste and finally put them all into landfill without any separation. This will lead to increase environmental pollution, soil pollution and create bad impacts for the health and safety of people.

4.1.2 Lack of awareness on construction waste reduction

Waste reduction is the best waste management practices among the 3R waste management policies. Through interviews, it is identified few reasons for poor waste reduction in construction project. C&D waste management is new area in Sri Lankan construction industry therefore most of architects and designer are not aware the importance of waste reduction during planning and design stage. Lack of awareness of waste minimization design and construction alternative methods and design changes occurred in construction stage is the major factor for waste generation due to architectures unawareness of the importance of waste management. During the construction stage bulk amount of waste can be generated due to poor site waste management plan.

4.1.3 Lack C&D waste recycling facilities and systematic planning

There are no enough C&D waste recycling facilities in Sri Lankan construction industry. There is an only one plant established in the country named COWAM. COWAM plant is operating in the 14 days per month due to limited number of employees and limited quantity of C&D waste availability. Due to high cost of waste transportation contractors are not willing to transport the generated waste to the plant. Due to the same reason Galle local authority which owns the plant is not willing to go sites and collect the waste.

4.1.4 Lacking of a market for recycled products

Lack of awareness of recycling market for the C&D waste is a significant factor preventing the expansion of recycling in Sri Lanka. Moreover market values of C&D recycled products are low with less customer satisfaction on the quality of the recycled products and companies are afraid to go for new products. In the current situation most of the recycled materials are used for road works.

4.1.5 Limited landfills for receiving C&D waste

In Sri Lanka, presently amount of C&D waste generation increasing rapidly with the rapid development of construction industry. Local authorities are responsible for the waste collection and disposal. There are only few permanent landfills are belong to the local authorities and this amount is not sufficient to the dispose all the waste generated in construction sites. According to the literature foreign countries have common C&D waste disposal sites to operate proper disposal system for C&D waste. However due to lack of landfills in Sri Lanka, people used to dump C&D waste everywhere creating environmental and social problems. Therefore, the inadequate facility of landfills in Sri Lanka is a main barrier to C&D waste management.

4.1.6 Low charge for collection C&D waste

Currently Sri Lankan local authorities charge maximum of Rs. 2000 per tractor and Rs.1500 per half of tractor in C&D waste collection. However waste collection charges of developed countries are higher than the Sri Lankan charges. When the charge is low, there is no influence on the waste reduction, reuse or recycling. However according to the local authorities, C&D waste is not a big issue for the environment and therefore they are not geared up to increase the fee of C&D waste collection.

4.1.7 Unavailability of a centralized body

In Sri Lanka there are responsible bodies for managing municipal solid waste and hazardous waste however there is no responsible body to manage C&D waste. Furthermore it was revealed that establishing a separate body for managing C&D waste is high costly with allocating a place, allocating funds and allocating human resources for a separate body. Similarly, managing C&D waste has not been felt as a need for the government.

4.1.8 Unavailability of a national policy

Findings revealed that complexity of making a national policy due to time and cost constraints have caused for the unavailability of a national policy. Furthermore negligence of government and relevant ministry on C&D waste issues has exaggerated the problem.

4.1.9 Less rules and regulations on C&D waste management

The existing laws and regulations for waste management in Sri Lanka are imperfect to manage C&D waste. It is not helpful to increase the rate of recycle, reuse of waste and decrease the illegal disposal of waste. Moreover, C&D waste cannot manage through the existing general waste management rules and regulation. Therefore special rules and regulations are needed to better C&D waste management practice.

4.1.10 Limited researchers conducted regarding C&D waste management

Lack of awareness on importance of C&D waste management and lack of funds allocation for C&D waste management have created limited researchers for waste management. Due to these reasons limited researches are conducted regarding C&D waste management. It is generally identified researches are necessary for improvement of C&D waste management field.

4.1.11 Lack of commitment of government and local authorities

C&D waste management should be initiated by the central government and local authorities. Generally, laws and regulations are imposed by the government and by laws are imposed by the local authorities. Additionally waste management is a responsibility of local authorities. Furthermore most of the massive construction projects are done by the central government. Therefore government can deliver greater support to manage C&D waste. However government and local authorities confer lack of commitment for the C&D waste management in the current scenario.

4.1.12 Lack of community awareness on C&D waste management

Ordinary people are not much aware on the new demolition techniques and benefits of reusing C&D waste. Therefore they demolish houses without considering reuse of material. Majority of the interviewees expressed people are not aware of the recycling market of C&D waste. Due to lack of awareness on C&D waste management people used to put waste everywhere. Additionally, people are not aware on the effects of hazardous waste and collect toxic and non toxic waste together and put to the landfills.

4.1.13 Lack of skills of labours

Skill levels of construction labours are directly affects the generation of construction waste. Most of the appointed labours are not permanent and most of the time they are farmers before joining to the project without training or experience on construction methods, materials, handling of construction material. Due to insufficient skills of labours, generate more wasted plastering and form work.

4.2 Probable Attributes and Suggestions

The previous section identified several gaps in existing C&D waste management practice. This section attends to determine probable suggestions to mitigate gaps in C&D waste management.

4.2.1 Providing on-site sorting facilities

Providing on site sorting facilities will increase the efficiency of C&D waste management. Through the corporation of government and local authority can be provided on site sorting facilities and required awareness programmes to recover usable material. Providing on site sorting facilities will increase the proportion of construction waste reuse and recycling and decrease the environmental impact.

4.2.2 Creation of markets for C&D waste recycled products

Involvement of government is the optimal solution to create market for recycle product. In Sri Lankan context government is the biggest client in the construction industry. Recycled products can be used in government construction projects. Through the involvement of government in recycling industry there is a guarantee for quality of recycled material. Moreover this will convince private sector to use the similar recycled products with an assurance. When government trust the quality of recycled products, market for the recycled material are stable as there is a strong client to buy recycle products. Government can provide guidelines to the recycling companies, give opportunities to take new technologies and knowledge from developed countries and provide facilities to improve the industry.

4.2.3 Innovations and creativity in sorting, reducing, reuse and recycling of C&D waste materials

Researches and technical innovations are needed to identify new ways for C&D waste reduction, reuse, recycling and sorting. The low-waste generation designs and low-waste construction technologies minimize the generation of construction waste. Use of new construction methods and new construction materials will optimize the uses of unnecessary construction materials. It needs to identify the current trend of construction industry and market then developed a solution to optimize the reuse of C&D waste.

4.2.4 Awareness programmes on C&D waste management

Awareness on C&D waste management directly affects the efficiency of waste management. Thus it is important to have awareness programmes to the contractors, technical staff and school and university students about importance of waste management. These programmes should address the community on environmental, social and economic benefit of C&D waste management. This will improve C&D waste management practices. Government can play a major role in this with the help of non government organization as they can be incorporated with experienced persons on C&D waste management.

4.2.5 Communication system among stake holders

In Sri Lankan context there is no communication system to share information on C&D among the stake holders. In this situation the government can develop a database on C&D waste management system including new demolition techniques, reuse and recycle practices and details of stakeholders involving in C&D waste management process. The communication systems will link clients, contractors and waste collection organizations. Therefore a communication system is essential among parties involved in C&D waste management.

4.2.6 Evaluating and monitoring of C&D waste management procedure

The experts' opinions gathered through the expert interviews identified a standardized evaluation and monitoring system as essential for C&D waste management. At the moment responsible authorities are not concerned with C&D waste management. Government should monitor the waste management practices of construction sites. Moreover, contractors should evaluate their waste management procedures to bring in a cost saving by reusing and recycling of material.

4.2.7 Develop statistical information system for amount of C&D waste generation

Statistical information on waste generation is essential for proper waste management practice. However, most of the local authorities or municipal authorities have not regulated statistical information on amounts of construction waste generation. Through the proper coordination of local authorities, government and contractors can develop a statistical information system to calculate the amount of construction waste generation per month. With the understanding of amount of waste generation can provide recycling facilities for the areas which generate more C&D waste.

4.2.8 Vocational training for labours

It was revealed that lack of skills of construction workers has a greater impact on C&D waste generation. Most of the experts expressed that giving opportunities for labours for vocational training can reduce the construction waste generation. Vocational training programmes can be conducted by training organizations accredited by the government. The training programmes should be continued and should contain the information of construction materials and new construction techniques.

4.2.9 Setting up administrative bodies for C&D waste management

In the current scenario Central Environmental Authority, Waste Management Authority and National Solid Waste Management Support Center have the authority to administer solid waste management in Sri Lanka. However, these authorities are involving in C&D waste management in an indirect way and it cannot expect an effective C&D waste management system through the current system. In contrast to the Sri Lankan level, developed countries have established separate bodies for C&D waste management and through these organizations they have executed legislations, policies and administered waste management practices of contractors and waste collection companies. Hence, it is clear that allocating responsibilities for C&D waste management to a separate institution can support to create a better C&D waste management system.

4.2.10 Development of new rules and regulation for C&D waste management

Findings revealed that there are some provisions in the National Environment Act and its amendment to assure environmental responsibility and social responsibility of C&D waste. However C&D waste management related rules and regulations are incomplete and new rules and regulation should impose to separate hazardous and non hazardous waste generated in C&D projects.

4.3 Implications of the study

4.3.1. Fundamental areas to be considered in C&D waste management

The theoretical framework of the research study was developed by expressing suggestions and recommendation for a C&D waste management system. The framework summarized seven fundamentals as an institutional and legal framework, fund allocation, site waste management plan, waste management hierarchy, supportive environment, awareness of waste management of client, design team, contractor and sub contractors, and monitoring, evaluation and reporting waste management (Refer Figure 1).

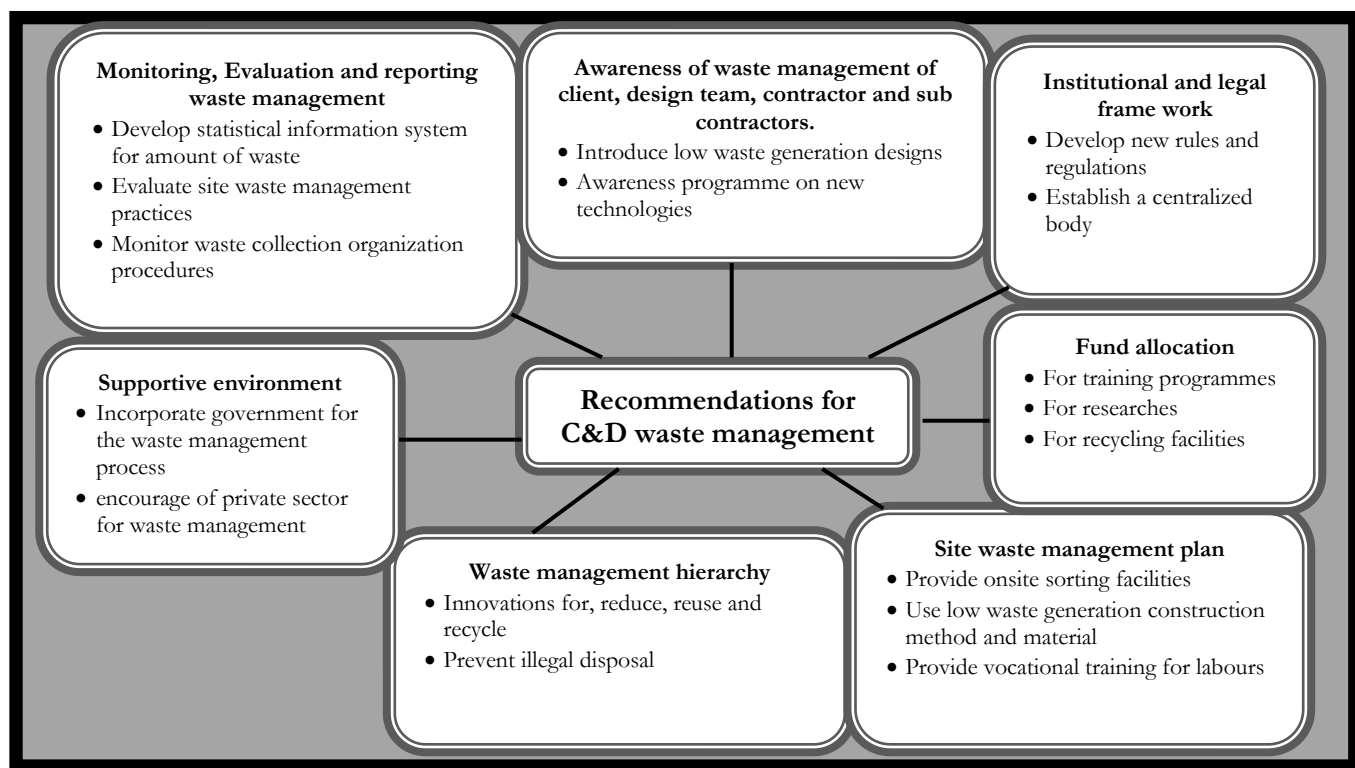


Figure 1: Developed theoretical framework of the study

4.3.2 Role of Government in C&D Waste Management

Findings revealed that the central government has a major role in C&D waste management. In dealing with C&D waste the government should act more reactively than other stakeholders. The government should take steps to promote waste management practices in the construction industry and should encourage the construction industry to implement these practices.

- Government can play different roles in the management of construction waste namely contractor, regulator of C&D waste management, user of the reused and recycled material and as a market creator for waste materials.
- Sri Lankan government lacks strong political views for the implementation of waste management practices and policies. The Government should develop national policy for C&D waste management to improve actions of

waste management. Through this process government could also establish the requirements of specifications and technical guidelines on C&D waste management practice for contractors.

- Laws and regulations for C&D waste management are less visible in Sri Lanka. Thus, implementation of strong rules and regulation for C&D waste management is important. The government shall impose rules to the contractors for reuse and recycling of waste generated in construction project instead of disposing to illegal land filling with the involvement of expertise. After the real application in construction industry the government can identify the limitations and then these can be addressed by the further amendments.
- Government can play a special and meaningful role in the initiation and development of waste management and recycling market in Sri Lanka. Firstly government has to take risks to invest for recycling facilities and technologies as at present recycling market has a big risk. The government's involvement will build up the confidence among the other stakeholders. Additionally, government can establish recycling plants through the local authorities. It will create more recycling plants than the landfill sites. Therefore the contractor's motivation to recycle the C&D waste will high due to economical benefits which can gain through recycling rather than land filling.

Therefore it is crystal clear that the government has a key responsibility in filling the gaps in existing C&D waste management system in Sri Lanka. Moreover it was identified that thorough government intervention is much important to deal with issues of C&D waste.

5.0 Conclusions

6.0

The ever increasing C&D waste generation makes urgent need to realize importance of managing C&D waste and implementation of comprehensive national strategy and a policy specially deals with C&D waste management. C&D waste is a solemn threat which was faced by the whole world thus there is a major attention to manage C&D waste. In this study, several concepts, practices and strategies in C&D waste management were identified which are significant in global and Sri Lankan context.

The existing gaps in C&D waste sorting, collection, disposal, reuse and recycle practices can be alleviated through the identified suggestions (Figure 1). Moreover government can develop new rules and regulation, set up administrative bodies, develop communication linkage among stake holders, develop statistical information system for generation of waste, create market for recycle product, develop recycling facilities and evaluate and monitor waste management procedures to address the gaps in existing C&D waste management practices. Ultimately this will create an environmentally, economically and socially feasible C&D waste management system.

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