



Waste Minimization Strategy and Technique: Towards Sustainable Waste Management

Nurhafiza Mohd Noh, Md Azree Othuman Mydin

Generally, sustainable waste management aids construction key players to diminish and making better use of material on their construction project. The waste minimization strategy is not only implemented during the construction stage, but it record and estimates the use materials through whole project delivery process, in order to decrease the amount of waste requiring disposal at landfill and as a consequence, fully mitigate the interrelated cost, strengthen competitive advantage and environmental benefits. The implementation of waste minimizing plan method is an opportunity to increase profit of construction company through identification of valuable waste and invaluable waste to gain profit. Businesses can create value through the return of construction wastes back to recycling and manufacturing processes into new products. Hence this paper will present the waste minimization strategy and technique towards achieving sustainable waste management

Keywords: *building industry, construction, waste minimization, sustainable development, disposal*

1. Introduction

Waste minimization is necessary implemented by all developed countries. During construction and remodelling, the recoverable waste materials generated could be converted to recycled contents [1]. The waste issue and problem had to be managing through various solutions. For example, the local companies can choose using technology such as incinerators, composting, sanitary landfill and using management method (Waste Minimization Plan) depending on their own requirements. The proposed waste minimization plan is determined through which it can function properly on the projects and the identification of the sources of construction waste is important to solve the current problem. Researchers found that eight waste sources were deemed to be sufficiently significant. These were waiting due to staff interference; insufficient equipment, and setup of equipment; waiting for instruc-

tion and inspection; rework due to design efficient; waiting due to stock problem and material supply delay [2]. The related information will help to carry out waste minimization and management practice successfully.

Sustainable waste management helps construction key players to reduce and making better use of material on their construction project. The waste minimization strategy is not only implemented during the construction stage, but it record and estimates the use materials through whole project delivery process [3], in order to decrease the amount of waste requiring disposal at landfill and as a consequence, fully mitigate the interrelated cost, strengthen competitive advantage and environmental benefits. The implementation of waste minimizing plan method is an opportunity to increase profit of construction company through identification of valuable waste and invaluable waste to gain profit [4]. Businesses can create value through the return of construction wastes back to recycling and manufacturing processes into new products.

In addition, the waste minimization plan is essential to diminish current and upcoming dangers to human health and the environment which presents strategies that can be used by professional personnel and organizations to decrease the amount and perniciousness of wastes generated. They defined that every members of the community to be conscious of the environment and financial impacts related to the disposal of construction wastes and materials and also to help minimize the waste produced amount.

3. Definition of Construction Industry Waste

In general, the construction waste can be defined as wastes produced by the construction, refitting, and repairing of separate residences, viable buildings, infrastructural, facility and other structures. Building material can be divided into four categories during construction process which are material used, surplus, use again and material wasted. However, surplus material can also be considered as construction waste because contractors always think that the selling and storage of these materials are not required due to less profit. In the construction industry, the waste is not only concentrated on the building material but also focus on several activities such as storage, time and etc. For example, the waste also can be defined as any losses produced by activities that generate direct or indirect costs but do not add any value to the product from the point of view of the client [5]. As research indicates, various activities during construction process that can produce direct or indirect cost in these activities are required human resources, need more time, more facility or equipment but do not generate interest to the product. Though, the construction waste can also be the asset opportunity for the construction industry through proper management. The local contractors should reassess the value of construction waste as a new source of profit which the waste should be control and manage with appropriate ways such as recycled, reused or disposed. This is because the construction waste may turn into resource through

process of add-value to the waste which it creates use-value for another project. Management is defined as cooperate with team members or other people to complete the mission and vision of a project within organization.

4. Waste Management in Construction Industry in Malaysia

The construction industry in Malaysia continues to grow to achieve approximately 10.3% in 2015 compared to 11.8% in 2014. It grew 18.1% in 2012 and 10.6% in 2013; the number of project has achieved double-digit growth for three consecutive years [6]. The Department of Statistics Malaysia reported the contribution of the construction industry to the GDP has increased dramatically as shown in Figure 1. From Figure 1, GDP from construction industry in Malaysia increased to 13398 MYR Million in the first quarter of 2017 from 12582 MYR Million in the fourth quarter of 2016. GDP From Construction in Malaysia averaged 9808.72 MYR Million from 2010 until 2017, reaching an all-time high of 13398 MYR Million in the first quarter of 2017 and a record low of 6464 MYR Million in the first quarter of 2010.



Figure 1. The Contribution of the Construction Industry to the GDP

However, rapid development in local construction industry lead to higher generation to construction waste which end up in the landfill that it may occurs land shortage in Malaysia. The problems occurred increasingly was illegal disposal waste and illegal dumping site. So, the government has proposed several related policy to address waste issues in order to improve the condition of environment, economic and social [7].

There are few regulations and policy for managing waste generation in Malaysia, which most of them focuses on solid waste. For example, there are four consortiums responsible for processing waste management which are Urban Solid Waste Management, Funded Public information campaigns, Action Plan for a Beautiful and Clean Malaysia and Recycling campaigns. According to the Solid Waste and Public Cleansing Management Act 2007 (Act 672), which is the federal agency; Solid Waste Management and Public Cleansing Corporation will cooperate with others department. They have the power to control and manage the solid waste and public cleansing from the Local Authorities throughout Peninsular Malaysia and the Federal Territories of Kuala Lumpur, Putrajaya and Labuan. However, Construction Industry Development Board (CIDB) is concerned on the impact of construction waste management on the environment pollution, it is responsible to execute the Pembinaan Malaysia Act 1994 [8]. The Construction Industry Master Plan also introduced by CIDB to local construction industries in order to increase the awareness of contractors of environmental protection through effective waste management.

The Ministry of work is liable to govern and administer the Standard Specification for Building Works (SBW) that is applied into all construction projects. The SBW produced a standard to local contractors consist of guidelines on the materials, equipments, transport, lighting and others necessary items from the construction to the completion.

Today, the government is actively promoting the utilization of effective waste management such as the introduction of the 3R concept- reduce, reuse and recycle to sort and collect the solid waste [9]. They also recommended the use of new technology, Industrialized Building Construction (IBS) to replace the traditional construction method in order to minimize the waste of construction project.

5. Waste Minimization Strategy

3R Program as the suitable and economical option that understands the concept of "cause and effect relationship". It is three essential waste minimization strategies which are reduce, recycle and reuse. However, the waste reduction is the most desired plan by many countries due to its efficient and effective solution that decrease most problems related to waste generated. It is possible to manage 90% of the construction and demolition waste with using recycles. Nowadays, 3R Programs always considered as the best waste minimization strategies due to its effectiveness in developing countries in the aspect of environment. For example, an advantage of 2.5% of total construction cost is produced by reuse and recycled activity.

Just-in-time strategy is one of the reduction options that transport and manage storage levels to apart from over ordering. It required controlling the design to avoid wrong specification in order to enhance off site prefabrication quality through offer supplier agility in bring about reduction quantity of materials [10]. This strat-

egy is included how to manage the supply chain and material controlling practices, it is one of the most attractive planning methods. Also, workers training and developing waste awareness among professional can be calculated.

Global Positioning System and Geographical Information System technology can orbit the flow of building material to the construction site, and these is considered as bar code system applications. Based on the quantity of materials onsite needed, the application can measure the performance of the workers. As they indicated, the Global Positioning System and Geographical Information System technology can operate combine with bar code system to quantify the materials used and get the latest information about its delivery time. There are six waste minimization strategies which are recycle, reuse, avoid, compost, burn and dispose at landfills. They are more focuses on the three types for reduction of construction and demolition waste which are avoiding waste; re-using materials; and recycling waste. This is because avoiding waste refers to any fulfilling that avoids or decrease amount waste at source.

The re-using and recycling of waste materials, and thus, minimizing the volume of waste needed to be disposed to the landfills considered as re-using and recycling waste due to composting construction and demolition waste requires widespread use of land. Many type of construction and demolition waste are not combustible, composting waste also cause to the emission of toxic gases. In Malaysia, the land supply is too hard to found, thus it is not feasible in Malaysia, so composting waste would cause the emission of toxic gases and many type of construction and demolition waste are not combustible.

6. Waste Minimisation Technique

Waste minimisation techniques are plays an important role in decreasing the quantity of hazardous waste generated at the construction industry. The waste generators are encouraged to actively look into waste minimisation techniques and include these techniques as an essential component of the education and investigation procedures, as shown in Figure 2.

7. Waste Management Plan

7.1 Issues Addressed by Waste Management System

There are various issues should be addressed during the development of the initial stages of the waste management plan. This is because they have many options for waste minimization or reduction such as salvaging, land filling and waste technology, so it is very important to resolve the options of alternatives for waste minimization. External issues to addressed different factors such as worker cost to gather and process the building waste material, delivery cost, tool and equipment

cost and waste disposal cost, all of these must be analyzed during planning the management [11].

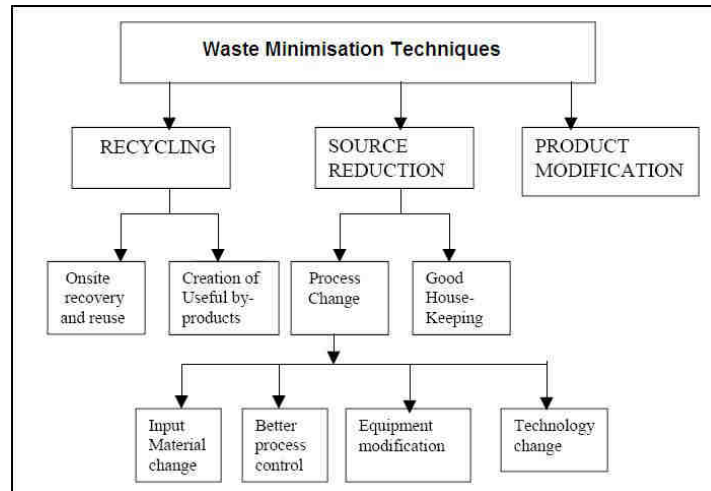


Figure 2. Waste minimisation techniques

7.2 Educating Labour about Waste Management System

When investigating the waste management resources, educated human resources involved in the construction process is very important. This is because the worker must be able to analysis which type of materials can be reuse or recycled, which technique of gathering are used on a project for onsite or off site. The field labours need be actively taking part for nearly any kind of waste management plan to be achieve the outcome, so the education and knowledge about construction and demolition wastes and others alternatives to manage and disposal waste is necessary. For example, the strategy plan allows the workers on site necessary to view the types and amount of building waste being thrown away [12].

7.3 Waste Management Plan Overview

Waste management plan is obtained to protecting the social, environment and economics. Construction waste always arise various conflict due to the environmental problems which are troublesome to quantify, while problems of the economic can be measured with mathematic and several decimal places. Construction industry develop waste management plan for these aspects and reasons, but the plan in all probability, it will be operate by economics. A closed loop system always consider within the waste management process which there are various flexible

inputs. These input need analysis with accurate information due to these input that need be to periodically updated [13].

8. Conclusion

The construction industry has its trends and developments that required to be systematized for the purpose of environment and bonanza. Therefore, materials waste management is an essential part of construction project, which contribute a primary portion of time and cost related activities. The functions of material waste management plan need to be determined in more detail and particular. The management plan will comprehend how the system operates in construction projects due to it is increase the value to company. It will also be advantageous to relate materials management system to supply chain management and waste management systems. It is probable to state the following provision in general as major functions of materials management.

References

- [1] Mallak S.K., Ishak M.B., Mohamad A.F., Abdullah S., *Barriers to Practice of Non-hazardous Solid Waste Minimization by Industries in Malaysia*, Journal of Management and Sustainability, 4(1), pp154-162, 2014.
- [2] Taha M.P., *What a Waste: Solid Waste Management and The Malaysian Perspective on Construction Waste Generation and Management*, Kuala Lumpur: Solid Waste and Public Cleansing Management Corporation, pp 14-18, 2015.
- [3] Tey J.S, Goh K.C, Kek S.L., Goh H.H., *Current practice of waste management system in Malaysia: Towards sustainable waste management*, 1st FPTP Postgraduate Seminar, Universiti Tun Hussein Onn Malaysia, pp 2., 2013.
- [4] Yusoff M.N.B., *Waste Minimization By Recycling of Construction Waste*, FYP Thesis. University Malaysia Pahang, 2010.
- [5] Augustine S., *Managing Waste And Cost In The Construction Industry: A Case Study Of The Road Construction Industry*, Master Thesis. University of Science and Technology, Ghana, pp 6, (2011).
- [6] Construction Industry Development Board (CIDB) Malaysia. (2015). Construction Industry Transformation Programme (CITP) 2016-2020. Construction Industry Development Board (CIDB) Malaysia, p. 184
- [7] Ismam J.N., Ismail Z., *Sustainable Construction Waste Management Strategic Implementation Model*, Journal of WSEAS Transactions on Environment and Development, 10, pp 48-59, 2014.
- [8] Johari A., Alkali H., Hashim H., Ahmed S.I., Mat R., *Municipal Solid Waste Management and Potential Revenue from Recycling in Malaysia*, International Journal of Modern Applied Science, 8 (4), pp 37-49, 2014.

- [9] Mahayuddin S.A., Wan Zaharuddin W.A.Z., *Quantification of Waste in Conventional Construction*, International Journal of Environmental Science and Development, 4(3), pp 297, 2013.
- [10] Memon A.H., *Structural Modelling Of Cost Overrun Factors In Construction Industry*, PhD Thesis, University Tun Hussein Onn Malaysia, pp11, 2013.
- [11] Nagapan S., Abdul Rahman I., Asmi A., Memon M.H., Zin R.M., *Identifying Causes of Construction Waste - Case of Central Region of Peninsula Malaysia*, International Journal of Integrated Engineering, 4(2), pp23, 2012.
- [12] Poon C.S., Yu T.W., Ng L.H., *A Guide for Managing and Minimizing Building and Demolition Waste. Research Paper*, The Hong Kong Polytechnic University, 2001.
- [13] Saadi N., Ismail Z., *Government Initiatives Pertaining to Construction Waste Minimization in Malaysia*, International Journal of Energy and Environment, 9, pp 165-170, 2015.

Addresses:

- Nurhafiza Mohd Noh, Final Year Student of Building Surveying program, School of Housing, Building and Planning, Universiti Sains Malaysia, 11800, Penang, Malaysia, nurhafizabintinoh@gmail.com
- Sr Dr Md Azree Othuman Mydin, Senior Lecturer, School of Housing, Building and Planning, Universiti Sains Malaysia, 11800, Penang, Malaysia, azree@usm.my