

Current practice of waste management system in Malaysia: Towards sustainable waste management

Tey Jia Sin¹, Dr. Goh Kai Chen², Dr. Kek Sie Long³, Ir. Dr. Goh Hui Hwang⁴

Faculty of Technology Management and Business¹
Universiti Tun Hussein Onn Malaysia
Johor, Malaysia
hp120038@siswa.uthm.edu.my

Faculty of Science, Technology and Human Development³
Universiti Tun Hussein Onn Malaysia
Johor, Malaysia
slkek@uthm.edu.my

Faculty of Technology Management and Business²
Universiti Tun Hussein Onn Malaysia
Johor, Malaysia
kaichen@uthm.edu.my

Faculty of Electrical and Electronic Engineering⁴
Universiti Tun Hussein Onn Malaysia
Johor, Malaysia
hhgoh@uthm.edu.my

Abstract—Nowadays, the increasing quantity of municipal solid waste has caused serious environmental problem which requires a better solution in handling the wastes that generate. Construction waste is considered as part of the municipal solid waste. Construction wastes that produce in the construction process contribute a large amount to municipal solid waste. For that reason, a proper way of handling construction wastes is significant in reducing the negative impacts towards the environment, social, and economy. Sustainable waste management is introduced to maintain the balance between the environment, social and economic aspects through several ways such as acts implementation, and techniques in managing waste. Therefore, it is essential to identify current waste management system adopted by industry in order to make adjustment and improvement in moving towards sustainable waste management. This paper highlights the current waste management system implemented in Malaysia and the challenges in applying the concept of sustainability into waste management through reviewing past similar researches. This research has conducted an exploratory interview to six industry practitioners in both private and government sector in Malaysia. The results obtained show the current waste management systems applied in Malaysia and factors that hinder the concept of sustainability into waste management. It allows a major shift in Malaysia waste management by improvise current waste management technology into more sustainable way.

Keywords—waste management system; construction wastes sustainability; technology

I. Introduction

The increasing number of municipal solid waste management has become the biggest environmental problem in Malaysia [1]. Population growth has led to the increase in generation of solid wastes in Malaysia and it has become a crucial issue to be solved [2]. According to Zia & Devadas [3], the waste generated are from sources like domestic, industrial and commercial and it shows an increasing trends throughout

the world. Due to this reason, solid waste management plays an important role in maintaining a sustainable environment.

In addition, construction waste is part of the waste generated and categorized under solid waste. It is supported where Malaysia construction waste forms a significant portion of wastes that is finally disposed in landfills [4]. Agyekum, Ayarkwa, & Adinyira [5], construction waste materials can be defined as the comprising of unwanted materials generated during construction. Furthermore, pollution caused by construction waste has caused negative impacts towards the environment and leads to economic lose [6]. Therefore, to reduce the total amount of wastes generated, an optimal waste management system should be adopted [7] in order to achieve sustainability.

In the process of achieving sustainability in waste management, it requires the cooperation of every waste management practitioners involved with suitable method or technology used. In short, a practice in applying sustainable waste management system has to be integrated into all the industries thus building a promising future. As a result, the purposes of this study is to find out the current waste management implemented in Malaysia, and also the challenges in achieving sustainability in waste management. To achieve these goals, past similar researches is reviewed and also through conducting the exploratory interview to the industry key players.

The results that obtained from this paper are the ways in managing wastes in Malaysia industry and the challenges in adopting the concept of sustainability into waste management from both literature review and the preliminary interviews based on the industry practitioners from government and private sectors. This paper provides industry practitioners an insight of the current ways of how Malaysia industry managing wastes for both municipal solid waste and construction wastes. Besides, through identifying the challenges in integrating the concept of sustainability into

waste management, it will be the knowledge that fills in the gap for the development of technologies to manage the wastes produce in order to achieve sustainability.

II. Current Practices for Malaysia Municipal Solid Waste Management

In this section, it will be focused into two aspects of current practices implemented in waste management system in Malaysia in which it divides into waste management policies and its technologies used.

A. Waste Management Policies and Programmes

In general, municipal solid waste management is handled by several government agencies from the federal to state and to local authorities [8]. There are four private consortia: Urban Solid Waste Management; Government- Funded Public information campaigns; Action Plan for a Beautiful and Clean Malaysia; and Recycling campaigns [9]. The Action Plan for a Beautiful and Clean Malaysia (ABC) has been a guideline and procedures in implementing solid waste management programme in Malaysia [8].

In the year 2007, Solid Waste and Public Cleansing Management Act 2007 is established whilst there are two federal institutions has implemented the policy which are National Solid Waste Management Department & Solid Waste Management and Public Cleansing Corporation [10].

The 3R programme: reduce, recycle and reuse has been promoted by Malaysia government, however, it is said to be still in an infant stage [11]. Most of the construction practitioners still not implement the 3R concept into their construction sites or some of them are unaware of it.

Despite some policies and programmes were carried out by government agencies, yet it is not enough and few are fully apply by the waste management practitioners.

B. Waste Management Technology

There are a few types of technologies applied in the Malaysia waste management system. In Table I, it presents the types of waste management used and the percentage of waste disposed by using each technique in different years.

TABLE I. METHOD OF WASTE DISPOSAL IN MALAYSIA [9]

Treatment	Percentage of Waste Disposed		
	2002	2006	Target 2020
Recycling	5.0	5.5	22.0
Composting	0.0	1.0	8.0
Incineration	0.0	0.0	16.8
Inert landfill	0.0	3.2	9.1
Sanitary landfill	5.0	30.9	44.1
Other disposal sites	90.0	59.4	0.0
Total	100.0	100.0	100.0

Recycling refers to the widespread collection and reuse of waste dispose while incineration refers to the method of dispose waste through combustion [12]. Composting is applicable to municipal solid waste or separate collected leaves, yard, and food waste [2].

Badgie, *et al.*, [2] has stated that landfill is the ultimate waste disposal method that can deal with many types of materials. Due to this reason, it can be seen in Table I, the percentage of waste disposed through landfill is increasing directly propotional till the targeted year, 2020. However, most landfills in Malaysia are small scale operations with varying designs. In addition to it, most of the landfills are poorly maintain [8]. Landfilling also contributes the highest potentials to global warning [7]. According to Table I, landfills can be categorised into inert and sanitary landfills.

Among all the methods used, other disposal sites achieve highest percentage followed by sanitary landfill whilst the least is incineration. Other disposal sites are the open dumpsites that have illegal dumping or has accumulate a large quantities of garbage [11]. However, Malaysia targeted in the year 2020, sanitary landfill will be the highest percentage followed by recycling and incineration. Even though there are slight changes in the method of waste treatment, it is hard to improve the current conditions of economics, social and environment. The best way in achieving sustainable waste management is start from minimise the generation of waste.

Due to construction wastes constitutes a large portion in municipal solid wastes, this paper discusses the current practices of Malaysian construction waste management in terms of its policy and current technologies as to provide a way to improve and achieve sustainability.

III. Current Practices for Malaysia Construction Waste Management

Rapid growth in the construction industry as a result from the expansion of the standards of living, demands of infrastructure projects, changes in consumption habits, as well as the increasing of population has significantly contributes to waste generation [13]. Construction wastes are in the form of building debris, rubble, earth, concrete, steel, timber and mixed site clearance materials, arising from various construction activities [14]. Hassan, Ahzahar, Fauzi, & Eman [15] mentioned that construction wastes can be hazardous, for example, asbestos in which it generated during demolition of existing structures. Hence, a proper and well defined policy and technologies used in managing wastes produces from the construction activities is required to reduce the adverse effect that may be arised on environment, social, and economy aspects.

A. Construction Waste Management Policy

Construction wastes constitutes a large portion of municipal wastes, hence, it is appropriate to have a better policy in dealing with the construction wastes in order to have pollution free environment. In response, Malaysia Government has developed an agency namely, Construction Industry Development Board (CIDB) to transform the industry by improving its environmental performance [10]. CIDB has

produce a Construction Industry Master Plan to further enhance the construction key players in the awareness of sustainability.

In conjunction to it, Malaysia government has established Standard Specifications for Building works (SBW) which is governed by Ministry of Works, while Pembinaan Malaysia Act 1994 (PMA) is governed by CIDB as well [13]. The aim for SBW is to ensure the garbage and construction clearance to be done twice a week and will send in to landfill whilst PMA is to prevent and reduce the pollution caused by construction waste.

All of the policies and acts that established by government bodies shows that the desires in handling the construction waste in a proper way. However, not all the policies implemented is followed by construction practitioners and a more holistic policy is needed to ensure economic, social, and environment aspects can be protected.

B. Waste Management Technologies

Giusti, [16] highlighted that the most environmentally sound criteria for a waste management hierarchy should start from waste minimization, waste re-use, recycling, and lastly composting. As a result, industry key players have slowly started to see the importance of the adoption of waste minimisation technique in construction industry [15]. Waste minimisation include source reduction which is eliminates the generation of waste at source and recycling which stand for recovery of reuse a waste material [17].

Malaysia is moving towards the adoption of Industrial Building system (IBS) which it is said to be able to control the waste generation during the construction activities and it is environmental friendly [17]. IBS is define as a construction system that built using pre-fabricated component [18].

According to Zeng, [19] there is an urgent need for the construction industry to adopt IBS in order to reduce construction waste effectively, conserve landfill capacity and also it helps to achieve the concept of sustainability in waste management. However, due to higher initial cost that incur, it hindrances the construction practitioners to adopt this technique although IBS can be one of the great way in minimising waste on site.

Therefore, the challenges in achieving sustainability in waste management needed to be further investigated to better identify the key issues and progress towards sustainable waste management.

IV. Challenges in Achieving the Concept of Sustainability in Waste Management

It is important to identify the root problem in every issue to be solved. Likewise, challenges that hinder the achieving of sustainable waste management need to identify in order to effectively implement the concept of sustainability in waste management. Among the common challenges are shown in the Table II.

TABLE II. CHALLENGES IN ACHIEVING SUSTAINABLE WASTE MANAGEMENT

Challenges	Description
Insufficient technologies and facilities [1, 9]	The ever increasing rate of waste generation has caused the current technologies such as landfilling unable to cope with.
Lack of a well recycling market [20]	Recycling requires aggressive marketing efforts to locate market and sells with higher price. Lack of it will hinder the effective in implementing waste recycling.
Insufficient fund [1, 20]	As waste minimization requires higher cost, therefore, many industry practitioners are reluctant to apply the waste management technique. An incentives or appropriate fund may be their motivation to apply waste minimization as one of the waste management method.
Insufficient regulations [11, 20]	Regulations are requires for the industry practitioners to follow and apply in their way of waste management. However, it is a challenge to generate a holistic solid waste management system integrated, cost effective, sustainable, and acceptable to the community, with emphasis on environmental conservation and technology selection.
Lacking of awareness [11, 20]	Although there are several policies establish, most of the industry practitioners do not realize the importance in implementing solid waste management based on the waste management hierarchy that gives the priority to waste reduction through 3R, intermediate treatment and final disposal

Through identification of the challenges encountered by Malaysia waste management industry in achieving sustainability, it enables both private and government sectors to pay more attention in resolving the issues to achieve sustainable waste management.

v. Research Methodology

This paper employed extensive literature review and preliminary interview approaches. Through the extensive literature review, the overview of the current waste management can be identified. The overview done by this research is on current policies and technologies used in waste management. Besides, through the extensive literature review in this paper, it provides a solid background of challenges in developing sustainable waste management.

In addition, exploratory interviews were conducted to six industry practitioners. The respondents are from both private and government sectors in Malaysia. The professions of the respondents are classified into four categories namely manager, site engineer, assistant environmental control officer and contractors. The purpose of choosing the respondents from those four categories are to make sure the data collected is complete in which the point of view gathered is ranging from on site and off site.

The aim of conducting exploratory interview for this paper is to determine the readily of data collected via extensive

literature review and to know the current challenges face by industry. The results shows the opinions from industry players regarding the ways of how they manage wastes on construction site, the systems used and also the major factors that may hinders them from adopting sustainable waste management.

VI. Results and Discussion

The result of this study is presented through matrix table. It focuses on a few main elements extracted from the interview session which is displayed in Table III:

TABLE III. SUMMARIZATION FROM THE INTERVIEW RESPONSES

Respondent	Ways of Managing Waste on site	System Applied	Factors Hinders the Adoption of Sustainability in Waste Management
R1, R6	<ul style="list-style-type: none"> - 'Bin' is provided. - No specific waste management system 	<ul style="list-style-type: none"> - Concept 3R is applied as required by JKR 	<ul style="list-style-type: none"> - Profession Awareness - Economics - Tender project
R2	<ul style="list-style-type: none"> - Steel 'bin' used for the storage of waste 	<ul style="list-style-type: none"> - Apply concept 3R. (Recycle: wood, Reused: steel) - Renewable: system (hydraulic, kinetic, and electricity) 	<ul style="list-style-type: none"> - Concept of "Green" apply - Sustainability incur high cost
R3, R5	<ul style="list-style-type: none"> - No Specific Schedule, Checklist. - 'Bin' is provided for construction waste 	<ul style="list-style-type: none"> - Incineration - Landfill-ancillary system - Sanitary system 	<ul style="list-style-type: none"> - Finance - Public Works Department specification on too general - Awareness - Construction profession
R4	<ul style="list-style-type: none"> - No waste management is carried out on site - Recycle bin is provided to sort out the construction waste 	<ul style="list-style-type: none"> - Usually burn the waste though incinerator or send to landfill 	<ul style="list-style-type: none"> - Lack of skilled workers - Lack of awareness - High maintenance cost

From the interview responses, it can be concluded that the current construction waste management in Malaysia is not fully developed. There is no waste management applied in the construction site except sorting the wastes into recycle bins.

Besides, there are only few system used which are concept 3R, incineration and landfilling.

According to Table III, it shows that all of the interviewees have mentioned finance is one of the factors that influence their decision in adopting sustainability in waste management. Apart from it, insufficient awareness and lacking of professionals or skilled workers has hindered them to take the step in applying sustainability into waste management as well.

Lastly, some of the interviewee mentioned in the tender project or Public Work Department specification should highlight waste management as part of the requirement. They also suggested applying the "Green" concept in achieving sustainable waste management.

VII. Conclusion

The general approach for this paper is exploratory. Based on the literature review done in this study, it can be seen that the government policies are still not effectively taken action by industry practitioners. The policies are not enough to encompass whole concept of sustainability. Other than that, the technology mostly used by Malaysia is landfill. However, landfill brings many adverse effects towards the environment, social, and economic aspects.

Furthermore, through the exploratory interview, it provides more clarity on actual practices on waste management practices in construction sites. This paper reveals that most of the construction practitioners do not have a proper waste management system in managing construction waste. Landfill is the main technique in disposing construction waste while only a few of the respondents are applying 3R concept in managing construction waste.

Improper ways of managing construction wastes may bring a significance impacts and it should be dealt with to ensure they manage the construction waste in a more sustainable way. Hence, there is an urge for Malaysia government to look into the issues in improving the waste management techniques, cooperate with private industry sectors in realization the concept of sustainable waste management in construction industry.

As all the parties involved in the managing of wastes taking their part in achieving sustainable waste management, it will not only able to improve current condition for the economic, social or environmental aspects, it can also reduce the issues of settling the gradually increasing solid wastes by having a better technologies in the sustainable waste management.

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References

- [1] M. O. Saeed, *et al.* Assessment of municipal solid waste generation and recyclable materials potential in Kuala Lumpur, Malaysia. *Waste Management*. 2009. vol. 29(7): pp. 2209-2213.
- [2] D. Badgie, *et al.* Assessment of Municipal Solid Waste Composition in Malaysia: Management, Practice, and Challenges. *Polish Journal of Environmental Studies*. 2012. vol. 21(3): pp. 539-547.
- [3] H. Zia and V. Devadas. Municipal Solid Waste Management in Kanpur, India: Obstacles and Prospects. *Management of Environmental Quality: An International Journal*. 2007. vol. 18(1): pp. 89-108.
- [4] R. A. Begum, *et al.* Factors and values of willingness to pay for improved construction waste management—A perspective of Malaysian contractors. *Waste management*. 2007. vol. 27(12): pp. 1902-1909.
- [5] K. Agyekum, *et al.* Consultants' perspectives on materials waste reduction in Ghana. *Engineering Management Research*. 2012. vol. 1(1): pp. 138-150.
- [6] T. Esin and N. Cosgun. A study conducted to reduce construction waste generation in Turkey. *Building and Environment*. 2007. vol. 42(4): pp. 1667-1674.
- [7] S. Piyaphant and K. Prayong. Environmental impact on municipal solid waste management system in Chaiyaphum. in *Proceedings of the 10th WSEAS international conference on System science and simulation in engineering*, 2011, pp. 213-218.
- [8] Z. Sakawi. Municipal solid waste management in Malaysia: Solution for sustainable waste management. *Journal of Applied Sciences in Environmental Sanitation*. 2011. vol. 6(1): pp. 29-38.
- [9] A. Periathamby, *et al.* Evolution of solid waste management in Malaysia: impacts and implications of the solid waste bill, 2007. *Journal of material cycles and waste management*. 2009. vol. 11(2): pp. 96-103.
- [10] E. Papargyropoulou, *et al.* Sustainable Construction Waste Management in Malaysia: A Contractor's Perspective in *Proceedings of the MISBE 2011-International Conference on Management and Innovation for a Sustainable Built Environment*, 2011.
- [11] L. A. Manaf, *et al.* Municipal solid waste management in Malaysia: Practices and challenges. *Waste Management*. 2009. vol. 29(11): pp. 2902-2906.
- [12] Z. Bacinschi, *et al.* Waste management practices used in the attempt to protect the environment. in *Proceedings of the 3rd WSEAS international conference on Engineering mechanics, structures, engineering geology*, 2010, pp. 378-382.
- [13] S. Nagapan, *et al.* Issues on construction waste: The need for sustainable waste management. in *Humanities, Science and Engineering (CHUSER), 2012 IEEE Colloquium on*, 2012, pp. 325-330.
- [14] L. Shen, *et al.* Mapping approach for examining waste management on construction sites. *Journal of construction engineering and management*. 2004. vol. 130(4): pp. 472-481.
- [15] S. H. Hassan, *et al.* Waste Management Issues in the Northern Region of Malaysia. *Procedia-Social and Behavioral Sciences*. 2012. vol. 42(pp. 175-181.
- [16] L. Giusti. A review of waste management practices and their impact on human health. *Waste management*. 2009. vol. 29(8): pp. 2227-2239.
- [17] R. A. Begum, *et al.* Implementation of waste management and minimisation in the construction industry of Malaysia. *Resources, Conservation and Recycling*. 2007. vol. 51(1): pp. 190-202.
- [18] N. H. Hamzah, *et al.* A Study on the Acceptance of IBS in Construction Industry in Kelantan: Application of Logistic Regression Analysis. 2010.
- [19] S. Zeng, *et al.* Towards implementation of ISO 14001 environmental management systems in selected industries in China. *Journal of Cleaner Production*. 2005. vol. 13(7): pp. 645-656.
- [20] H. P. Yuan, *et al.* Major Obstacles to Improving the Performance of Waste Management in China's Construction Industry. *Facilities*. 2011. vol. 29(5/6): pp. 224-242.