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Construction Contractors' Perception on Effective 3R Implementation for Solid Waste Reduction

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Abstract—**Construction industry produces large volumes of construction waste which occupy landfills. Construction waste can lead to serious environment issues. Contractors play important role in reducing construction waste through 3R. Weak implementation of 3R solid waste reduction among construction contractors will cause non-sustainable waste management. Disposal of construction waste increases waste generated at landfills, and it is especially crucial for islands where the land is limited for disposal activities. Contractor should manage construction waste through 3R as it is sustainable. This paper aims to study contractors' perception on the elements of effective 3R implementation in solid waste reduction of construction industry. Questionnaire surveys has been conducted among 61 selected contractors registered under CIDB located in Penang, Malaysia. Based on result, all the respondents agreed on most of the elements suggested for effective 3R implementation to reduce construction waste.**

Keywords – 3R, construction waste, Penang, solid waste.

I. INTRODUCTION

Construction waste is defined as waste generated from the construction industry during construction activities, building renovation, civil construction and building, construction site cleaning, road construction, demolition activities, and soil excavation [1]. Construction wastes include dirt, brick, concrete, asphalt, glass, wood, plastic and metal [2]. Construction waste should be recognized as a valuable resource because most types of construction waste can be reused or recycled [3]. Construction waste management is a tool to control the cost of waste disposal and to facilitate alternative methods to reduce waste disposed at landfills [4].

Solid waste reduction through 3R is one of the thrusts of National Solid Waste Management Policy. 3R represents the concept of reduce, reuse and recycle [5]. The 3R concept is often used in construction waste management research and practices [6]. Based on the concept of 3R, waste resources will be fully utilized before disposal. The 3R approach is a popular option among the other alternatives of the waste hierarchy concept and increasingly included in the policy [7]. An improvement to construction waste reduction has been emphasized in order to achieve the goal of sustainable industry [8].

According to [9], National Solid Waste Management Policy aims to (i) establish a solid waste management system which is holistic, integrated, cost effective, sustainable and acceptable to the community that emphasizes the conservation of the environment, selection of affordable technology and ensuring public health; and (ii) implement solid waste management based on the waste hierarchy which emphasizes waste minimization through 3R, intermediate treatment and final disposal. According to [10], the report of UHLG selected statistics until September 2014 shows that there are only 2 operating solid waste disposal sites in Penang, Malaysia. Both landfills will be unable to accommodate the amount of waste disposed in the long term. In addition, Penang is an island and land is scarce to provide for new landfills or disposal site.

The SWMPC Act 2007 (Act 672) has been approved by the Parliament of Malaysia on July 17, 2007 [11], gazetted on August 30, 2007 and enforced beginning September 1, 2011. It was enacted to ensure consistency between laws related to the solid waste and public cleansing management in Malaysia [12]. Act 672 could not be enforced comprehensively throughout Malaysia. States of Labuan, Selangor, Perak, Penang, Kelantan and Terengganu have their own state-level legal enforcement regarding solid waste management and public cleansing [11;13]. Municipal council is involved in providing landfill and disposal services but does not interfere in the process of construction waste management [14]. The implementation of 3R practices are listed in Act 672 (Part X: Reduction and Recovery Controlled Solid Waste). Those who generated solid waste are required to reduce the waste through 3R practice

[15]. However, implementation of policy will not be successful if the law and act are not enforced [16].

Recyclable materials are found at most 70% to 80% of the total waste composition on landfills in Malaysia [11]. According to the National Recycling Target, 22% of the total solid waste can be recycled by year 2020 [17]. Recycling is still at an infant stage in Malaysia [18]. Current recycling rate is only at 5% [11], and about 95% of the waste is directly disposed on landfills. This leads to unsustainable management [17]. Construction and demolition wastes are estimated to be 10% to 30% of the waste delivered to landfills [19;20]. Landfills receive the brunt of un-recycled construction and demolition wastes. The challenges in construction waste management are associated with its high volume and density, larger size, lack of malleability and the hazardous nature [19]. Malaysian government is facing challenges in solid waste management as the implementation of policy differs from the actual planning [21]. Due to lack of proper data collection, actual figures for worldwide waste generation are not available. Data are more accessible in developed countries due to their well established policies and proper waste management systems [22].

Elements of effective 3R solid construction waste implementation include elements of the role of government, legislation and enforcement, 3R implementation among contractors, awareness, and technologies and techniques used.

- *The role of government:* Authority should provide incentives to contractors who manage construction waste through 3R. Besides that, guidance for reducing construction waste should be provided to contractors [23]. Government should set up effective recycling company for various types of waste [24]. Construction Waste Disposal Charging Scheme (CWDCS) has been implemented by the Hong Kong government in order to promote 3R in construction industry. CWDCS provides financial incentives [25] while charges are imposed on construction and demolition waste sent to landfill [26].
- *Legislation and enforcement:* Policy and legislation play crucial role in the implementation of 3R approach [3]. Relevant laws and acts should be enacted and implemented to increase awareness among construction contractors [27]. In Japan, the regulation is mandatory in order to promote the use of recycled construction waste [28]. Meanwhile, Singapore government adopts top-down approach in enforcing the policies [29]. The planning of construction waste disposal should be added into construction tender document which requires separate and recycling construction waste at construction site [30].
- *3R implementation among contractors:* Construction industry should be committed in reducing construction waste by efficiently adopting waste minimization strategies in order to reach the goal of sustainability [3]. Waste management hierarchy approach is believed to be a better method [31]. The concept of integrated waste management has been applied to reduce waste at the source and through reuse and recycling [32]. Contractors should recycle and reuse construction waste at site as much as possible [33]. Construction waste should be managed through reduce, reuse and recycling before disposal at landfill [31].
- *Awareness:* Educational programs, training and awareness campaigns are able to encourage and motivate contractors in managing construction waste through 3R. Thus, the government should provide guidelines regarding waste reduction with governmental ordinances for contractors [23]. Informational campaigns will improve awareness among contractors [7]. In addition, monitoring programs help to ensure compliance of waste management practices with legislation [34].
- *Technology and technique to practice 3R:* Prefabrication of components such as Industrialized Building System (IBS) is sustainable practice and popular environmentally friendly construction approach in reducing the amount of construction wastes at site [27; 35]. Prefabricated component is more conducive in reducing construction waste compared with the traditional cast in-situ construction method [34; 35; 36]. Inert waste which consists of sand, bricks and concrete can be used for land reclamation [37]. Major steel structure components can also be recycled [38]. Timber wastes are known to be easily reused and recycled. Wooden framework can be reused several times [39]. Ceramic, terrazzo and marble can also be patched, cleaned, and polished for new application. Grinded glass can replace sand and pozzolan in the production of concrete products and cement [38].

II. RESEARCH METHODOLOGY

In the study, questionnaire survey has been conducted among contractors. Based on the sample size in the table presented by Krecjie and Morgan [40], a sample size of 92 persons (≈ 75%) is required when the population is 123 persons. In this research, 61 respondents were selected randomly among contractors registered as G7, G6 and G5 grades under CIDB located in 3 selected cities in Penang. The data of the questionnaire were analyzed using Statistical Packages for Social Sciences (SPSS).

III. RESULT AND DISCUSSION

TABLE I shows the level of agreement with elements to effective implementation of solid waste reduction through 3R in construction industry. The mean score analysis for the 5 points Likert scale is show in Fig. 1. Likert scale is used to help respondents indicate their level of agreement pertain the elements to effective implement solid waste reduction through 3R. The mean score of 3.52 shows that the respondents agreed with the role of government in effective 3R implementation of waste reduction by providing subsidiary and incentives, having Construction Waste Disposal Charging Scheme (CWDCS), and establishment of guidelines and variety of waste recycling company. Since construction waste management is at low

priority when the time and cost are concerned, contractors managing construction waste using 3R approaches will benefit from the government encouragements.

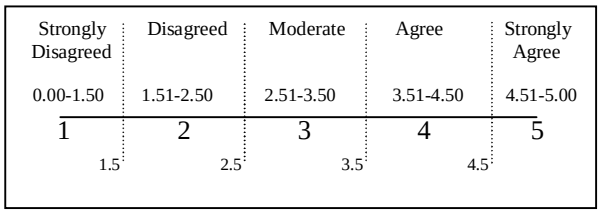

Figure 1. Mean score analysis for Likert Scale [41]

TABLE 1. LEVEL OF AGREEMENT ON ELEMENTS OF EFFECTIVE 3R IMPLEMENTATION IN SOLID WASTE REDUCTION

Element	Mean score	Level of agreement
Role of government	3.52	Agree
Legislation and enforcement	3.71	Agree
3R implementation among contractors	3.72	Agree
Awareness	3.74	Agree
Technology and technique to practice 3R	3.36	Moderate

The element of legislation and enforcement play crucial role in the implementation of the waste reduction through 3R, which scored a mean of 3.71 among respondents. This include addition of construction waste disposal plan into tender document, adopting top-down approach in legislation and establishing policies and regulations in construction industry. Since 3R is still new in the construction industry, there is lack of explicit and specific legislation and enforcement of construction waste management through 3R. Contractors need specific regulations to define their responsibilities and accountabilities in waste reduction.

The mean score of 3.72 in the element of 3R implementation among contractors, showed most of the respondents agreed in the application of waste management hierarchy approach and the integration of waste management concept, construction waste should reduce, reuse and recycling as much as possible before disposal. Some construction waste segregation is practiced among contractors for recycling purposes as some material wastes have high scrap value, e.g. steel. At the same time, contractor reduces the cost of construction waste disposal.

Survey also shows that contractors agreed (mean score of 3.74) with the element of educational programs, training and awareness campaigns in creating 3R awareness. The knowledge and awareness of 3R concept is still low among contractors. Contractors require information, training and awareness campaign to motivate them to be involved in 3R practices.

From the survey, the respondents revealed that the element of technology and technique in practicing 3R in construction industry is moderate, with mean score of 3.36. IBS technology can only be used for big or costly development projects; since it requires experts to handle it. Besides that, the cost of recycling process is greater than the cost of disposal. Purchase of new construction materials is cheaper than utilizing recycled materials. This may be the reason why respondents moderately agreed with this element.

The one-way analysis of variance (ANOVA) had been carried out on the elements of effective implementation of solid waste reduction through 3R among G7, G6 and G5 grades construction contractors. ANOVA is a statistical method for comparing and analyzing the mean of more than one group of respondents. If the significance level $p < 0.05$, the null hypothesis is rejected [42].

Hypothesis tested:
There is a significantly different perception on the statement in elements among G7, G6 and G5 grades contractors.

Null hypothesis:
There is no different perception on the statement in elements among G7, G6 and G5 grades contractors.

ANOVA result shows that the null hypotheses of statement in three elements are rejected (TABLE II). There are significantly differed perceptions on the statement of providing subsidies to the contractors who are able to reduce construction waste through 3R among G7, G6 and G6 grades contractors, where F = 3.379, significant level = 0.042, $p < 0.05$. There is also significant different perceptions on high charges on contractors who send in construction wastes which are reusable and recyclable to landfill, with F = 4.956, significant level = 0.010, $p < 0.05$. ANOVA test also shows that F = 3.667, significant level = 0.032, $p < 0.05$ in the statement of establishing specific 3R policies for waste management in construction industry among G7, G6 and G6 grades contractors.

Apart from these three statements, other null hypotheses are accepted. This shows that there is no difference in perceptions among the G7, G6 and G5 grades contractors as shown in TABLE II. Generally, most of the G7, G6 and G5 grades contractors/respondents have similar perceptions on the elements of effective solid waste reduction through 3R. Only three statements on 3R implementation elements which have differed perceptions among respondents. This may be due to the various experience, project costs or financial limit and personal views between the G7, G6 and G5 grades contractors of CIDB Malaysia.

Besides, larger development projects will generate higher amount of construction wastes as compared to medium size projects. Moreover, different types of construction work or activities generate different types of construction material waste. Thus, practices of construction waste management will also be different among G7, G6 and G5 grades contractors. They will have slightly different perceptions and opinions with the statements of effective 3R implementation of solid waste reduction elements.

TABLE II. ANOVA TEST RESULT ON THE ELEMENTS OF 3R IMPLEMENTATION

Elements of effective 3R implementation in construction solid waste reduction		Sum of Squares	df	Mean Square	F	Sig.
Roles of government/authority						
Provide subsidies to contractors who reduce construction waste through 3R to improve construction waste management.	Between groups	9.574	2	4.787	3.379	**.041**
	Within groups	82.164	58	1.417		
	Total	91.738	60			
Provide financial incentives to promote 3R practices among contractors.	Between groups	3.090	2	1.545	1.360	.265
	Within groups	65.893	58	1.136		
	Total	68.984	60			
Local authorities can provide credit loans for contractors who need buy equipment or machinery used in recycling process.	Between groups	2.611	2	1.306	1.709	.190
	Within groups	44.307	58	.764		
	Total	46.918	60			
Construction Waste Disposal Charging Scheme charge cost of disposal based on the quantity of construction waste sent to landfills.	Between groups	.273	2	.137	.166	.847
	Within groups	47.727	58	.823		
	Total	48.000	60			
High charges on contractors who send in construction wastes which are reusable and recyclable to landfill.	Between groups	8.925	2	4.463	4.956	**.010**
	Within groups	52.222	58	.900		
	Total	61.148	60			
Prepare guidelines with government act for contractors to implement construction waste reduction through 3R.	Between groups	1.799	2	.899	1.812	.172
	Within groups	28.791	58	.496		
	Total	30.590	60			
Local authorities should establish recycling company that are effective in recycling various types of material wastes.	Between groups	.722	2	.361	.948	.393
	Within groups	22.065	58	.380		
	Total	22.787	60			
Legislation and enforcement						
Legislation is important in implementing 3R policies in managing construction waste in order to encourage, promote, and ensure preservation of environment.	Between groups	2.727	2	1.364	2.329	.106
	Within groups	33.961	58	.586		
	Total	36.689	60			
Top-down approach should be mandatory among contractors by enforcing 3R policy legislation and regulations in construction waste management.	Between groups	.081	2	.040	.083	.921
	Within groups	28.247	58	.487		
	Total	28.328	60			
Establish and promote related legislations to ensure contractors manage construction wastes through 3R practices.	Between groups	1.926	2	.963	2.640	.080
	Within groups	21.156	58	.365		
	Total	23.082	60			
Establish specific 3R policies for waste management in construction industry.	Between groups	2.723	2	1.362	3.667	**.032**
	Within groups	21.539	58	.371		
	Total	24.262	60			
Establish law and regulations to prescribe contractors obligations to reduce, classify, segregate, reuse and recycle construction wastes.	Between groups	1.287	2	.644	1.174	.316
	Within groups	31.795	58	.548		
	Total	33.082	60			
Establish law and regulations to prescribe reuse of certain recycling construction wastes such as aggregate, concrete, and wood.	Between groups	1.219	2	.609	1.565	.218
	Within groups	22.584	58	.389		
	Total	23.803	60			
Improve existing standards and quality control for reuse and recycling construction waste management among contractors.	Between groups	1.828	2	.914	2.887	.064
	Within groups	18.368	58	.317		
	Total	20.197	60			
Legislation of 3R practices should be specified in construction contract.	Between groups	.897	2	.449	.791	.458
	Within groups	32.873	58	.567		
	Total	33.770	60			
3R implementation among contractors						
Apply waste management hierarchy in construction waste management.	Between groups	.030	2	.015	.035	.965
	Within groups	24.724	58	.426		
	Total	24.754	60			
Apply integrated waste management concept to reduce construction waste where wastes should be separated into waste streams.	Between groups	.520	2	.260	.528	.592
	Within groups	28.530	58	.492		
	Total	29.049	60			
Contractors should practice reduction, reuse and recycling of construction waste before waste is dispose to landfill.	Between groups	.191	2	.095	.145	.865
	Within groups	38.039	58	.656		
	Total	38.230	60			
Construction waste generated must be recovered through reuse and recycling.	Between groups	1.146	2	.573	1.611	.209
	Within groups	20.625	58	.356		
	Total	21.770	60			
On-site separation of construction wastes is an effective way to increase the recycling rate of construction wastes.	Between groups	.302	2	.151	.350	.706
	Within groups	25.010	58	.431		
	Total	25.311	60			
Reduction of construction waste can be practiced during stages of design, material quantity calculations for procurement, handling, and storage.	Between groups	.580	2	.290	.977	.383
	Within groups	17.223	58	.297		
	Total	17.803	60			
Only un-recyclable and non-reusable construction wastes can be sent to landfill.	Between groups	3.117	2	1.559	2.611	.082
	Within groups	34.620	58	.597		
	Total	37.738	60			
Awareness						
Conduct educational programs and training on environmental management to provide knowledge and awareness on 3R implementation.	Between groups	.382	2	.191	.343	.711
	Within groups	32.307	58	.557		
	Total	32.689	60			
Contractors should provide 3R education and training programs for workers to reduce construction waste generated at construction sites.	Between groups	.069	2	.034	.059	.943
	Within groups	33.702	58	.581		
	Total	33.770	60			
Conduct awareness campaigns to encourage and motivate contractors to practice 3R in construction industry.	Between groups	.864	2	.432	1.770	.179
	Within groups	14.153	58	.244		
	Total	15.016	60			

Awareness campaign is one of the channels to show the importance of 3R implementation among contractors.	Between groups	1.305	2	.652	2.317	.108
	Within groups	16.334	58	.282		
	Total	17.639	60			
Cooperation of public, private sectors, and non-governmental organisations in 3R activities are encouraged to reduce the amount of wastes in landfill.	Between groups	.935	2	.467	1.405	.254
	Within groups	19.295	58	.333		
	Total	20.230	60			
Legislation of 3R should be formulated and introduced in construction waste management to increase awareness of the importance of 3R among contractors.	Between groups	.047	2	.023	.047	.954
	Within groups	29.035	58	.501		
	Total	29.082	60			
Technology and techniques to practice 3R						
Application of Industrialised Building Systems (IBS) to reduce construction waste.	Between groups	3.880	2	1.940	2.356	.104
	Within groups	47.760	58	.823		
	Total	51.639	60			
Inert waste such as sand, bricks and concrete can be used for land reclamation. Grinded rock and concrete can be used as the base for new concrete or filling hole.	Between groups	.547	2	.274	.451	.640
	Within groups	35.223	58	.607		
	Total	35.770	60			
Major steel structural components can be reused and recycled in renovation project.	Between groups	2.092	2	1.046	.983	.380
	Within groups	61.711	58	1.064		
	Total	63.803	60			
Recycled asphalt can be used in base layers for road construction.	Between groups	1.127	2	.564	.651	.525
	Within groups	50.184	58	.865		
	Total	51.311	60			
Wooden wastes are easy to be reused and recycled. Wooden formworks can be reused for several times.	Between groups	.113	2	.057	.065	.938
	Within groups	50.838	58	.877		
	Total	50.951	60			
Ceramic, terrazzo and marble can be patched, cleaned, and polished to be reused in other projects.	Between groups	.190	2	.095	.084	.920
	Within groups	65.580	58	1.131		
	Total	65.770	60			
Grinded glass can be used as substitute for sand and pozzolan in the production of various concrete products and cement.	Between groups	1.695	2	.847	.754	.475
	Within groups	65.223	58	1.125		
	Total	66.918	60			

If significance level $p < 0.05$, null hypothesis is rejected

IV. CONCLUSION

Large amount of construction waste are continually produced by the construction sector with the rapid construction development in Malaysia. The two landfills designated in Penang will soon be not able to accommodate for more waste in the long term. Contractor should reduce, reuse and recycle constrcution waste as much as possible in order to reduce waste disposal on landfill.

Many studies have shown that several types of construction wastes have the potential for reuse and recycle. In order to achieve the goal of sustainable construction waste management, solid waste reduction through 3R should be implemented among construction contractors. Based on the survey conducted, most of the respondents/contractors agreed on the elements of effective 3R implementation in reducing solid waste. Thus, the Government, local authorities and all parties involved should take the responsibility and accountability in emphasizing solid waste reduction through 3R.

REFERENCES

[1] L.Y. Shen, W.V.Y. Tam, C.V. Tam, & D. Drew. Mapping Approach for Examining Waste Management on Construction Sites. Journal of Construction Engineering and Management., 130(4), 472-481, 2004.

[2] J. F. Huang, Q. B. Liang, H. Wang, S.Y. Xu, L.S. Zhang, & Y. Xing. Comprehensive Recycling of Construction Waste. Applied Mechanics and Materials, 117-119, 385-389, 2011.

[3] V. Nitivattananon, & G. Borongan. (2008). Report On Reduce, Reuse And Recycle (3R) Practices In Construction And Demolition Waste Management In Asia. Retrieved on April 22, 2012, Available: http://www.3rkh.net/3rkh/files/3RKH_C&D_waste_FinalReport.pdf

[4] W. R. Minks. The construction contractor's waste management plan: optimizing control and cost. Proc. of 1st International Conf. of CIBTG16 Sustainable Construction, Tampa, Florida, USA, November. 1994.

[5] National Solid Waste Management Department. (2012). National Solid Waste Management Policy. Retrieved on Mac 9, 2013, from http://www.kpkt.gov.my/jpspn/main.php?Content=articles&ArticleID=64&IID=

[6] H. Yuan, L. Shen, & J. Wang. Major obstacles to improving the performance of waste management in China's construction industry. Facilities, 29(5/6), 224-242, 2011.

[7] A. A. Hezri. Toward 3R-based waste management: Policy change in Japan, Malaysia and the Philippines, in Kojima, M. (ed.), 3R Policies for Southeast and East Asia. ERIA Research Project Report 2009-2010, Jakarta: ERIA, 274-290, 2010.

[8] U. Kulatunga, D. Amaratunga, R. Haigh, & R. Rameezdeen. Attitudes and perceptions of construction workforce on construction waste in Sri Lanka. Management of Environmental Quality: An International Journal, 17(1), 57-72, 2006.

[9] National Solid Waste Management Department. (2015). National Solid Waste Management Policy. Retrieved on March 30, 2015, from http://www.kpkt.gov.my/jpspn_en_2013/main.php?Content=vertsections&VertSectionID=170&IID

[10] Ministry of Housing and Local Government. (2007). Solid Waste Management and Public Cleansing Act. (Akta 672). Retrieved on 10 November, 2007, from http://www.kpkt.gov.my/jpspn/main.php?Content=vertsections&SubVertSertionID=6&VertSectionID=5&CurLocation=5&IID=&Page=1

[11] Y. C. Moh & L. A. Manaf. Overview of household solid waste recycling policy status and challenges in Malaysia. Resources, Conservation and Recycling, 82, 50-61, 2014.

[12] Solid Waste Management and Public Cleansing Corportion. (2015, March). The Act. Retrieved on May 21, 2015, from http://www.ppsppa.gov.my/index.php/en/kenali-kami-2/the-act

[13] National Solid Waste Management Department. (2015, July). Frequently asked questions. Retrieved on July 20, 2015, from http://jpspn.kpkt.gov.my/index.php/pages/view/44

[14] L. S. Ng, T. W. Seow & K. C. Goh, The Practice of Construction Waste Management in Penang Island. Toward sustainable management: Proc. of 1st FPTP Postgraduate Seminar "Toward sustainable management". Batu Pahat, Johor: UTHM. 2013.

[15] P. Agamuthu, S.H. Fauziah & K. Khidzir. Evolution of solid waste management in Malaysia: impacts and implications of the solid waste bill, 2007. Material Cycles and Waste Management, 11(2),96-103, 2009.

[16] Z. Wei & S. Rotter. The current situation of construction & demolition waste management in China. Proc. of the 2nd Int. Conference on Bioinformatics and Biomedical Engineering 2008, 4747-4750, 2008.

[17] P. Agamuthu, S. Chenayah, F. S. Hamid & D. Victor. 3R related polices for sustainable waste management in Malaysia. Proc. of Conference on Innovation and Sustainability Transitions in Asia. Kuala Lumpur, Malaysia, Paper 135, 2011.

[18] L. A. Manaf, M. A. A. Samah. & N. I. M. Zukki. Municipal solid waste management in Malaysia: Practices and challenges. Waste management, 29(11), 2902-2906, 2009.

[19] P. Agamuthu. Challenges in sustainable management of construction and demolition waste. Waste Management & Research, 26(6), 491-492, 2008.

[20] B. K. Fishbein. (2008). Building for The Future: Strategies to Reduce Construction and Demolition Waste in Municipal Projects, http://www.informinc.org/cdreport.html

[21] A. M. Latifah, A. S. Mohd Armi & M. Z. Nur Ilyana. Municipal Solid Waste Management in Malaysia: Practices and Challenges. Waste Management, 29: 2902-2906, 2009.

[22] S. H. Fauziah, C. Simon, P. Agamuthu. Municipal solid waste management in Malaysia – possibility of improvement? Malaysian Journal Science, 23(2), 61–70, 2004.

[23] R. A. Begum, C. Siwar, J. J. Pereira & A. H. Jaafar. Implementation of Waste Management and Minimisation in the Construction Industry of Malaysia. Resources, Concervation and Recycling, 51(1),190-202, 2007.

[24] S. M. Shareh Musa, H. Shafii & S. N. Syed Muhammad Zubir. Potential of Recycling in Construction Industry: Case Study in Batu Pahat, Johor. Proc. of the 3rd Malaysian Technical Universities Conference on Engineering and Technology (MUCEET2009), Kuantan, Pahang, 553-559, 2009.

[25] C. S. Poon, A. T. W. Yu, A.Wong & R. Yip. Quantifying the Impact of Construction Waste Charging Scheme on Construction Waste Management in Hong Kong. Construction Engineering and Management, 139(5), 466–479, 2013.

[26] A.T.W. Yu, C.S. Poon, A. Wong, R. Yip & L. Jaillon. Impact of Construction Waste Disposal Charging Scheme on work practices at construction sites in Hong Kong. Waste Management, 33(1), 138-146, 2013.

[27] E. Papargyropoulou, C. Preece, R. Padfield & A. A. Abdullah. Sustainable Construction Waste Management in Malaysia: A Contractor's Perspective. Proc. of International Conference on Management and Innovation for a Sustainable Built Environment, 2011.

[28] D. Xun, G. W. Liu, & J. L. Hao. A study of construction and demolition waste management in Hong Kong. Proc. of the 4th Int. Conference on Wireless Communications, Networking and Mobile Computing, 2008, 1-4, 2008.

[29] Y. Y. Ho. Recycling as a Sustainable Waste Management Strategy for Singapore: An Investigation to Find Ways to Promote Singaporean's Household Waste Recycling Behaviour. Lund University. 2002.

[30] Y. Li, Y. Zheng & J. Zhou. Source Management Policy of Construction Waste in Beijing. Procedia Environmental Sciences, 11, 880-885, 2011.

[31] S. Nagapan, I. Abdul Rahman & A. Asmi. Construction Waste Management: Malaysian Perspective. Proc. of the International Conference on Civil and Environmental Engineering Sustainability 2012 (IConCEES 2012), Johor Bahru, Malaysia, 2012.

[32] U. N. Ngoc & H. Schnitzer. Sustainable solutions For Solid Waste Management in Southeast Asian Countries. Waste Management, 29(6), 1982-1995, 2009.

[33] Y. P. Hu. Minimization Management of Construction Waste. The International Symposium on Water Resource and Environmental Protection (ISWREP 2011), 2769-2772, 2011.

[34] N. Udawatta, J. Zuo, K. Chiveralls & G. Zillante. Improving waste management in construction projects: An Australian study. Resources, Conservation and Recycling, 101, 73-83, 2015.

[35] O. S. T. Ho. Construction waste management–a contractor's perspective. The Hong Kong Institute of Builders, 8-11, 2001.

[36] W. Lu, & H. Yuan. Investigating waste reduction potential in the upstream processes of offshore prefabrication construction. Renewable and Sustainable Energy Reviews, 28, 804-811, 2013.

[37] J. Wang, Z. Li, & V. W. Tam. Identifying best design strategies for construction waste minimization. Journal of Cleaner Production, 92, 237-247, 2015.

[38] G. Winkler, Recycling Construction & Demolition Waste: A LEED-Based Toolkit. USA: McGraw-Hill, pp.19, 2010

[39] V. W. Y. Tam, Rate of Reusable and Recyclable Waste in Construction. Second International Conference on Sustainable Construction Materials and Technologies, Italy: Technical Journal, 329-340, 2010.

[40] R.V. Krejcie & D.W. Morgan. Determining Sample Size For Researching Activities. Educational and Psychological Measurement, 30(608), 1970.

[41] B. B. Bahril & W. Razzaly. Assessment Framework for Recognition of Prior Learning- PLTV in Malaysia, 2012.

[42] S.J. Coakes, L. Steed, & P. Dzidic. SPSS Version 13.0 for Windows: Analysis Without Anguish. Australia: John Wiley & Sons Australia, Ltd. (2006).