Potential Supply and Demand of Construction Waste in Secondary Market

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Abstract: ***The Issue Of Construction Waste Disposal Management Has Recently Gained Widespread Attention. It Is Critical To Perform The Sustainable Construction Waste Management And Waste Minimization Is The Best Strategies In Managing It. Optimization Of Waste Minimization Strategy Can Produced A Large Amount Of Secondary Material Supply. This Supply Can Be Used To Stimulate Local Industry Activity Such As Reuse And Recycling Business. Therefore, This Paper Aim To Investigate The Potential Supply And Demand For Construction Waste In Secondary Market. Secondary Industries, Non-Governmental Support And Incentives Dominates The Ranking Of The Potential Supply And Demand Element. Without These Supply And Demand Influential Factors, Valuable Construction Waste Will Never Be Marketable And The Material Life-Cycle Will End At The Landfill. It Is Expected That The Potential Supply And Demand Will Be Practical In The Secondary Market Development.***

Keywords: Construction waste, secondary market, supply and demand

I. INTRODUCTION

Construction waste minimization has been realized as an ecologically sustainable strategy in the construction industry. It act as a way to solve the need for virgin materials, minimize the space and disposal cost of waste materials, and subsequently utilize the material used [1]. Waste management planners who are interested in increasing the possibility of waste recovery must address the challenges associated with the mixed wastes, which represent most of the construction wastes that are disposed of without any recovery. When an economic incentive is associated, waste is view as a valuable resource.

Statement of Problem

Reuse, recycle and recover of construction materials help in solving the resource issue. The reuse and recycle of materials can be either in parts or as a whole components. When the reuse of a component is impossible, it may still be possible to be recycled or recovered it in whole or in parts [2].

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It is in concern that the quality of recycled materials as it may be hampered by cross-contamination with other elements in the salvaging, collecting and storing process [3].

It is a very significant problem of asbestos contamination, and the most common form of quality control is trough visual inspection [4].

Waste material diversion can generate a considerable amount of secondary material supply. This material supply can be used to encourage local industrial activity through the development of post-consumer waste salvage, reuse and recycling businesses [5]. These businesses can help create more employment opportunities and generate income from recovered waste materials [6].

The recyclable materials are the main source in several countries businesses particularly steel, paper and glass industries [3; 7]. The reliance on recycled materials cuts the need for importing raw materials. The profit of recycling construction wastes critically depends on the regulatory policy, contract specifications, economics, availability of technology, and project management practice [8]. Due to the improper construction wastes disposal in landfills that can cause a remarkable increase in environmental costs, the shortage of raw materials suitable for construction may generate renewed interest in converting construction wastes into useful secondary materials [9].

Secondary materials will exceed local demand if a significant investment has been put into collection programs while secondary markets are underdeveloped. To establish a secondary market, an investigation of the potential supply and demand of construction waste in the secondary market is needed. The construction waste supply and demand for the secondary market may be difficult to achieve, but it provides a goal for the construction industry to improve the current practices of construction-related activities.

II. METHODOLOGY

In this research, questionnaire survey were conducted. Questionnaire were distributed to the respondents which includes of one hundreds (150) number of contractors whom addressed in Kuala Lumpur and Selangor. The questionnaire were distributed to the respondent using various method which includes by hand and email. The questionnaire consist of three sections namely section A (demographic profile), section B (construction waste management practices) and section C (factors influence supply and demand). This paper focuses on the results from section A and section C. Likert scale of five ordinal measures of implementation (section B) and influence (section C) were used.

The data gathered were analyse using Statistical Package for Social Science (SPSS) version 23.0. The analysis was conducted consecutively to interpret the alpha value derived from the test. This was then followed by descriptive analysis and correlation between the satisfaction rate of potential supply and demand and factor influence the supply and demand.

III. RESULTS AND DISCUSSION

Sixty (60) numbers of questionnaire were successfully collected and representing respond rate of 40%. It is norm to obtain a responded questionnaire survey of 20% to 30% for construction industry [10]. Berawi et al. [11] also experienced a low response rate of 9.40%. Therefore, it is acceptable for this research with the response rate of 40%.

The result of the Cronbach's Alpha shows an acceptable coefficient alpha value of 0.961. Since the alpha values is higher than 0.60, the scale of question for all dimensions is consistent and thus, reliable to be used for this survey. Hence, there is no need to carry out factor analysis as the factor is uni-dimensional.

Respondents' Demographic

Table. 1 Respondents Category

Contractor	Percentage (%)
G1	8.3
G2	8.3
G3	18.3
G4	8.3
G5	11.7
G6	16.7
G7	28.3

The experts were identified through the involvement in building construction works and construction waste management. The questions were only distributed to the identified industry practitioner, as the respondent of this survey comprising all class of contractors. The result shows that the majority of the respondents are from G7 contractors with the percentage of 28.3%. This followed by G3 (18.3%), G6 (16.7%) and G5 (11.7%). Meanwhile, G1, G2 and G4 shares the same percentage of 8.3%.

Table. 2 Experience in Building Construction

Experience in building construction	Percentage (%)
<1year	3.3
1 to 5 years	61.7
6 to 10 years	15.0
11 to 15 years	6.7
>15 years	13.3

In Table 2, 61.7% of the respondent has the experience of 1 to 5 years in building construction which form the majority. The result shows that even though their experience is less than 5 years, they have handled more than one construction and development project during their service. This followed by 15.0% of the respondents have been working within the range of 6 to 10 years. Most of them have worked at other organizations before joining their current organization, which adds more significance to their experience. Albeit a relatively small percentage, inexperienced professionals (working experience of less than 1 year) are also represented in the sample.

Rating frequency of potential supply and demand

Table. 3 Satisfactory rate of the potential supply and demand

Rate	Percentage (%)
Poor	6.7
Acceptable	33.3
Good	51.7
Very good	8.3

As depicted in Table 3, 51.7% of the respondents has rate the potential supply and demand of construction waste in secondary market, as good. This followed by 33.3% (acceptable), 8.3% (very good) and 6.7% (poor). The satisfactory rate was meant for the thirteen influential factors mentioned in the questionnaire. This shows that all of the influential factors are related to the supply and demand of construction waste in secondary market.

Table. 4 Rank of the significant potential supply and demand of construction waste in secondary market

Potential supply and demand factors	Average mean	Rank
Material supply	3.72	6
Secondary industries	4.55	1
End market	3.46	9
Partnership	3.38	12
Technical support	3.13	13
Infrastructure support	3.41	10
Non-governmental support	4.01	2
Incentives	3.91	3
Policy and legislation	3.55	8
Education, awareness and public perceptions	3.57	7
Standard and specifications	3.79	5
Technical performance	3.40	11
Application	3.82	4

Secondary markets was not large enough to absorb all the secondary feedstock supply. Demand is needed to balance the secondary market. Table 4 shows the ranking of potential supply and demand of construction waste in secondary market. Secondary industries was placed at the first rank, and followed by the non-governmental support and incentives. This shows that the demand from secondary industries is the critical element in secondary market development. Besides that, without non-governmental support, secondary market will unable to sustain. Incentives on the other hand, will contribute to the increase in demand of construction waste recycling. It is supported by Hiete et al. [12] that disposal taxes are cost-effective lever to increase total recycling, but not necessarily a high-quality recycling.

Above all of the supply and demand influential factors, technical performance, partnership and technical support are place at the bottom three rank. The secondary material performance is another concern as it may be hampered by cross-contamination with other materials during waste handling process [3]. To provide a greater awareness on the importance of waste materials and its ability as alternative to virgin materials, there is a vital need for training and education.

Partnership between construction companies or recycler can contribute to the increase in total recycling activities. However, the result shows that partnership is the second least important in contribution to supply and demand in secondary market. At the moment, construction companies within Belgium has started a partnership testing. The aim of this project is to match between supply and demand among construction companies and site from the same area to avoid unnecessary transport [13].

Following the list, technical support place at the last rank with the average mean of 3.13. Technical support can be in terms of support towards construction waste research by conducting test at laboratories and reviewing research reports for market development. For example in the US, the government has funded and provide a technical support on recycled timber grading project which being conducted to test the recycled lumber [7].

It shows that all of the supply and demand influential factors may works different way in different countries and jurisdiction. As this is still an ongoing research, the results may varied after full survey completed.

Correlation between potential supply and demand and its influential factors

Table. 5 Correlation analysis between rate of potential supply and demand and its influential factors

	MS	SI	EM	P	TS	IS	NGS	PL	I	EAPP	SS	TP	A
Rate of PSD	.046	.600	-.147	-.106	-.099	.030	-.105	-.033	.125	-.047	-.052	-.092	-.037
p-value	.726	.646	.261	.420	.453	.820	.426	.802	.342	.724	.694	.484	.779

Waste generated during construction is considered as any substances generated from construction process [6]. However, the traditional approach of waste handling represents a loss of opportunity as most of the construction waste are valuable resources if it is salvaged and separated properly. The construction waste may not carry the same function, but it can be used for other industries. Therefore, recovering construction waste offers significant economic benefits in the construction industry. It is either selling them for recycling and recovery or by incorporation into future projects. Market demand is needed for the construction industry to supply their construction waste for recycle and recover.

The result shows that market supply, secondary industries, infrastructure support and incentives has the positive correlation with the potential supply and demand rate. Meanwhile, end market, partnership, technical support, non-governmental support, policy and legislation, education, awareness and public perception, standard and specification, technical support and application has the negative correlation coefficient.

Secondary industries has the strong correlation coefficient with the potential supply and demand satisfactory level with the coefficient of 0.60. Whereas infrastructure support, market supply and incentives has a very weak correlation coefficient which range between 0.03 to 0.12. In addition, policy and legislation, application, standard and specification, technical performance, technical support, non-governmental support, partnership and end market also has a very weak negative correlation coefficient which range between -0.033 to -0.147. Furthermore, this research has come to test the hypothesis of relationship in between potential supply and demand satisfaction and the element of supply and demand of construction waste in secondary market.

H_o: There is no monotonic association between potential supply and demand satisfaction rate and the influential factors of supply and demand of construction waste in secondary market.

The p-value is the evidence against a null hypothesis. The results shows that there is no statistically significant correlation between both variables. Therefore, the null hypothesis is rejected due to the bigger p-value than the chosen alpha value (0.05). Besides that, there is more than 5% chance that the strength of the relationship happened by chance if the null hypothesis were wrong.

IV. CONCLUSION

Parallel with the waste management hierarchy by National Strategic Plan for Solid Waste Management, waste minimization should start with reducing the waste generation and followed by reuse, recycle, recovery and landfill disposal. Valuable waste should undergo all the strategy as it may contribute to the secondary material feedstock. The success of construction waste in secondary market depend largely by the supply and demand. The race to meet global target to reduce unnecessary landfill of valuable materials that can be recovered remain a huge challenge. This paper investigate the potential supply and demand of construction waste in secondary market. The content of this paper seems to be beneficial for different construction groups namely, contractors, construction waste collector, secondary industries and researchers.

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