

The Initiative of Green Supply Chain Management (GSCM) in the Malaysian Construction Industry

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Abstract— *Nowadays, green supply chain management (GSCM) has gained greater attention to the construction industry players because of the concern of the people on environmental and sustainability issues. Thus, this study is being conducted with the aims to identify the green supply chain initiatives in the Malaysian construction industry. Aside from literature review, semi-structured interview were conducted to two project's team in order to gain insight review on the initiatives implemented by each of the party during the construction supply chain phase. The study suggests that the level of adoption of GSCM in the Malaysian construction industry was still at the development phase. The initiatives of GSCM implemented was not as a whole and restricted to several supply chain phase only mainly green design, green purchasing and green construction. It is hoped that, the study information will be useful in promoting GSCM amongst the Malaysian construction industry players.*

Keywords—*green supply chain management (GSCM), sustainable supply chain, green purchasing*

I. INTRODUCTION

According to the report produce by [14], construction sector accounts 30% to 40% of the world's total carbon emission which may lead to the severe environmental pollution. As end-users nowadays are becoming more concern on the environment plus the government itself is making stricter regulations, the industries had come out with various kind of initiatives to reduce the environmental impacts of their activities [10]. Converging sustainability with the core business functions such as supply, operations, and purchasing strategies has led to a new interdisciplinary field called the green supply chain management (GSCM). GSCM can be explained as an approach that incorporates the environmental thinking and initiatives into the supply chain management. The concept is basically similar with the existing supply chain management. However, some 'green' elements were added to every phases in consideration to the natural environment. Despite the importance of green supply chain in alleviating environmental issues and providing economic benefits to the organisation, little is known about green supply chain in Malaysia [15]. Although most of the organisations worldwide are increasingly expected to extend their sustainability practice, the situation contradicted in Malaysia. Only few fast forward thinking organisations had already taking steps to develop sustainability in their supply chains [16]. Therefore, since the implementation is still crucial, this study aims to

identify the green supply chain initiatives in the Malaysian construction industry.

II. LITERATURE REVIEW

A. Green Supply Chain Initiatives

[7] and [9] have come out with a systematic guideline and framework for an effective implementation of GSCM. It can be summarized that the implementation of GSCM consists of the following initiatives:

Green Supply Chain Management (GSCM) = Green Product Design + Green Material Management (Green Purchasing) + Green Manufacturing Management + Green Distribution and Marketing + Reverse Logistics

Green product design is an initiative which seeks to improve a product's ecological quality, by reducing its negative impact on the environment throughout its life cycles [1]. Environmental aspects are being integrated into product design process, and will also takes into consideration entire flow of the product in the supply chain [8]. An environmental consideration during the design stage is very important. This is due to at this stage, function of product, process or service is defined, and raw materials, supplies and process chemicals are selected [8]. Thus, energy that will be consumed and waste to be generated from the overall process can be determined. Whilst, green purchasing can be explained as an environmentally-conscious purchasing initiatives that tries to ensure that the purchased products or material meets environmental objectives set by the purchasing firm, such as reducing sources of waste, promoting recycling, reuse, resource, reduction and substitution of materials [5, 8, 11, 17]. Green purchasing basically deals mainly with controlling environmental performance of suppliers.

Apart from addressing environmental product design and material management, issues regarding manufacturing also need to be considered. According to [9], one of the objectives of green manufacturing process is to reduce the use of virgin material and other resources or energies. Other reason of greening the manufacturing process is to minimize the energy and resource consumption by recycling the material involved.

On the other hand, emission reduction is another significant reason for green manufacturing [9]. Two primary emission reductions can be achieved by means of (1) control where emissions are trapped, stored, treated and disposed using pollution control equipment; or (2) prevention such as reducing, changing or preventing the emissions altogether through better housekeeping, material substitution, recycling or process innovation [9].

Reverse logistics incorporates the return of materials, components and products back into the 'forward logistics' chain [13]. [5] further define reverse logistics as an environmentally conscious approach incorporating reverse distribution and resource reduction. Reverse logistics focuses primarily on the return of the products or materials from the point of consumption to the forward supply chain for the purpose of recycling, reuse, remanufacture, repair, refurbishment or safe disposal [5, 8]. Table 1 summarizes criterias measured for each of initiatives discussed earlier.

TABLE 1. GREEN SUPPLY CHAIN INITIATIVES

INITIATIVES	CRITERIAS	SOURCES
Green Product Design (Eco-design)	<ul style="list-style-type: none"> Design for reduction of hazard materials Design for reuse, recycling and repair Design for resource efficiency 	Sarkis, 1998; Beamon, 1999; Zsidisin and Siferd, 2001; Lin et al., 2001; APO, 2004; Rha, 2010; Eltayeb et al., 2011; Thipparat, 2011
Green Purchasing	<ul style="list-style-type: none"> Product content requirements, restrictions and labeling Supplier questionnaire Supplier EMS Supplier certification Supplier auditing 	Hammer, 2006; Eltayeb et al., 2011
Green Manufacturing	<ul style="list-style-type: none"> Waste reduction Resource consumption reduction Emission reduction 	Bearingpoint, 2008; Dheeraj and Vishal, 2012; Ghobakhloo et al., 2013
Reverse Logistics	<ul style="list-style-type: none"> Investment recovery (sales) of excess inventories/materials Sales of scrap and used materials Sales of excess capital equipment 	Rha, 2010; Thipparat, 2011; Chandraker and Kumar, 2012

In conclusion, there are four basic categories of green supply chain initiatives being discussed in the literature; green design, green purchasing, green manufacturing and reverse logistics. However, in the real situation, not all of the above-mentioned initiatives being implemented in the construction industry. Some initiatives may be adopted widely while others may not. Therefore, for this study, only three initiatives will be studied. They are green design, green purchasing and green

manufacturing since they are the most relevant with the construction industry activities and characteristics.

III. METHODOLOGY

In collecting the data for this study, qualitative method was used which utilized two approaches; observations and semi-structured interview. Two project's team that consists of Architect, Green Building Consultant and Main Contractor who familiar and have experience in managing green projects were selected to participate in the interview.

IV. FINDINGS AND DISCUSSION

Table 2 shows the respondents that have been successfully interviewed by the researcher. The respondents were categorized into two based on the project; project A and B. Both projects were a private commercial and office project and come from two different organisations. Out of six interviews targeted, five interviews were successfully conducted. The unsuccessful interview was due to the respondent was not available during the period of interview.

TABLE 2. SUMMARY OF RESPONDENTS

Project's Background	Respondents' Code	Background	Designation	Years of Experience
Project A Commercial and office building located in Shah Alam, Selangor. The project is still under construction and aiming for platinum rating.	A1	GBI Consultant	Snr. Engineer Sustainability & Energy	15 years
	A2	Main Contractor	Project Manager/GBI Coordinator	8 years
	A3	Architect	-Fail to participate-	
Project B Commercial and office building located in Klang Valley. The project has been completed and achieved silver rating.	B1	GBI Consultant	Mechanical/Environmental & Sustainable Design Engineer	3 years
	B2	Main Contractor	Snr. Project Manager	15 years
	B3	Architect	Architect	6 years

Generally, all of the green projects in the Malaysian construction industry will follow the assessment guideline provided by the Green Building Index (GBI). Particularly, because the highest maximum scores point to achieve green rating is energy efficiency, thus all projects aimed at reducing the energy consumption of the building. When preparing for eco-design, the design team will significantly design for resource efficiency which includes energy and material efficiency. Besides, the design will also consider the reduction or elimination of hazardous materials used.

None of the respondents seems to agree with the approach of designing for reuse, recycle or remanufacturing. Respondents A1 explained that *'It is not easy to modify or expand or renovate the building in the future since it will affect the entire integration concept of natural airflow'*. Apart from that, Respondents B3 emphasised that *'The approach is more on the recycling or reused of the product. It may not be suitable for construction'*. This was due to the unique characteristics of construction that is temporary and producing one-off construction projects.

The next phase after green design is the purchasing of materials. The term used for the initiatives is called 'green purchasing'. Contractors are quite familiar in adopting this initiative. The procurement of the materials were mainly from the supplier with eco-labeling, implement EMS system and have a certified ISO. However, it still depends on the types of materials. According to Respondent A2, *'It depends on the types of materials. As example materials where in the long run will produce chemical reaction and able to mold with the building atmosphere. Besides, it focuses specially on the materials within the building envelope'*.

Some additional initiatives aside from literature review include purchasing of material harvested and manufactured within 500 kilometers from site. This approach aimed to reduce environmental impacts from the transportation activities.

Besides, contractors also include the supplier involvement in ensuring supply chain activities is green and sustainable. This includes by providing specific material contents requirements and restrictions to the suppliers together with evaluation of the suppliers' environmental performances. During the construction phase, contractors did implement the Environmental Management Plan (EMP), Waste Management Plan (WMP) and Mold Reduction Prevention Plan (MRPP) in reducing the environmental impacts from the construction industry. However, the initiatives of reverse logistics were not implemented. Table 3 shows the comparisons between the variables extracted from the literature review with the initiatives adopted in Malaysian construction industry.

TABLE 3. COMPARATIVE REVIEW BETWEEN THE LITERATURE REVIEW AND SEMI-STRUCTURED INTERVIEW

Literature Review	Semi-Structured Interviews				
	A1	A2	B1	B2	B3
Initiatives of GSCM					
<u>Green Design/Eco-design</u>					
Design for reduction use of hazardous materials	√	N/A	√	N/A	√
Design for resource efficiency (Materials and Energy)	√	N/A	√	N/A	√
Design for reuse, recycle, remanufacturing	X	N/A	X	N/A	X
<u>Green Purchasing</u>					
Procurement of materials with eco-labeling	N/A	√	N/A	√	N/A
Procurement of materials from supplier with EMS	N/A	√	N/A	√	N/A
Procurement of materials from supplier with ISO certification	N/A	√	N/A	√	N/A
<u>Supplier Involvement and Evaluation</u>					
Provide specific material content requirement	N/A	√	N/A	√	N/A
Provide specific material content restrictions	N/A	√	N/A	√	N/A
Evaluation of supplier's performance	N/A	√	N/A	√	N/A
Specific KPI/Checklist	N/A	X	N/A	√	N/A
Provide assistance or education to supplier	N/A	X	N/A	X	N/A
<u>Green Manufacturing/Construction</u>					
Waste & Emission Reduction	N/A	√	N/A	√	N/A
Resource Consumption Reduction	N/A	√	N/A	√	N/A
Reverse Logistics	N/A	X	N/A	X	N/A

N/A: Not Applicable

V. CONCLUSION

As a conclusion, it can be explained that the initiatives of green supply chain management (GSCM) implemented in the Malaysian construction industry currently almost similar with the literature review. However, the implementations were still at infant stage and mainly implemented according to the GBI assessment criteria guidelines. Besides, most of the industry players who implement the practice are those who only associate with green projects. Out of three initiatives studied, it can explain that the 'green purchasing' initiative was the mostly adopted especially by the contractors. Most of the respondents familiar with the initiatives but had no idea that the initiatives were part of green supply chain management (GSCM). Even so, this data may not be representing the actual scenarios that happen in the Malaysian construction industry. Data seems reliable for the purpose of study. This was due to the numbers of samples selected was not sufficient to

represent the industry as a whole. To get a clearer picture, more rigor research needs to be conducted in the future.

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