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BARRIERS OF GREEN SUPPLY CHAIN MANAGEMENT IMPLEMENTATION IN MALAYSIAN CONSTRUCTION INDUSTRY

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ABSTRACT

Profit maximization is a key priority of construction industry stakeholders but may challenge the stakeholders to look into other aspects. Environmental aspect is one of the sustainability elements that tends to be neglected in the supply chain management. Its impact on project site and living surrounding environment is either taken lightly or ignored by the construction stakeholders. This paper aims to investigate the barriers of the uptake of Green Supply Chain Management during the pre-construction stage of construction project to assist stakeholders with planning in relation to the environmental protection at the earliest stage of a project. Pre-construction is the stage within a project life cycle for decision making on the selection of materials, labours, plants and equipment. Questionnaire survey was distributed to the construction stakeholders, with 44 valid responses returned. The analysis was drawn from the feedback of the architects, contractors, consultants, and engineers. The results revealed that the critical barriers for the GSCM were lack of company's leadership and support, lack of awareness, and lack of sustainable GSCM practices. This research provides an overview of current GSCM practices in Malaysia and alerts stakeholders to focus on specific organizational strategies in adopting GSCM.

Keywords: Barriers; Environment; Green Supply Chain Management; Malaysian Construction Industry

1. INTRODUCTION

The rise in population contributes to the demand of buildings. A technical report by United Nations Environment Programme (UNEP) (2019) reported that construction sector contributed about 40% of the energy-related and processed carbon dioxide emissions in 2018. This high number of energy emissions alerted the nations on the challenges set by World Green Building Council in achieving net-zero carbon by 2050 (UNEP, 2019). To reduce the amount of carbon dioxide emissions, construction sector needs to look into the sustainable construction, from design to demolition stage of the buildings (Ojo et al., 2014). Internationally, the Intergovernmental Panel on Climate Change had proposed on the usage of renewable materials for the production of industrial products in the United States (United States Environmental Protection Agency, n.d.). An organization in Taiwan practised green related strategies in its operation and experienced positive outcome (Yang et al., 2013), and similar finding was discovered in Brazilian suppliers by encouraging environmental practices through stakeholders' collaboration (Vanalle et al., 2017).

Various initiatives had been introduced in Malaysian construction industry to provide an avenue to sustainable construction measures. Sustainable development was introduced in 1970s in New Economic Policy (NEP) and specified sustainable development elements in the five-year Malaysia Plan (Economic Planning Unit, 2017). The Malaysia Green Building Confederation (MGBC) was formed in 2007 and officially launched in 2009, to promote and monitor sustainable development in the country (Malaysia Green Building Council, 2018). Rahim et al. (2020)

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stressed that a certified green project manager is essential towards the achievement of sustainable development goal in Malaysian construction industry.

However, the construction industry that have the nature of fragmentation, creates difficulties in ensuring that all the stakeholders who involved throughout the life cycle of the buildings adopted sustainable practices (Djokoto et al., 2014; Pozin et al., 2017; Samari et al., 2013). Supply chain management (SCM) could be considered as a network which involved multiple organizations, with different activities that leads to the goods productions and services generations towards end customers (Christopher, 2005). Such network could be linked with the information, financial and material flows (Stadtler, 2008). This process also involving overseeing on the monetary, data and materials aspects, where such aspects are streamlining in the sequential order of: designers, suppliers, manufacturers, sellers, and consumers (Abdullah & Mohd Nasir, 2017). Various stakeholders and materials are involved throughout this process, and this could lead to the inefficiency of construction industry, such as labour management. Even though SCM could improve workers' productivity (Riazi et al., 2018), its inefficiency could produce enormous amount of waste, which leads to the environmental issues (Vrijhoef & Koskela, 2000).

To ensure effectiveness of the SCM in reducing the environment impact, green SCM (GSCM) were being introduced, as a concept that include "green" practices into SCM. GSCM is a more specific terms that particularly focused on the environmental aspects, to combat with the carbon emissions and greenhouse gases emissions issues (de Oliveira et al., 2018). The "green" practices include green design, initiation, materials management, construction, operation and maintenance, and logistics (Wibowo et al., 2018; Wu et al., 2012). These different practices of GSCM could occur at different project life cycle stages. For example, green design, initiation and materials management are regarded as process that occurred during pre-construction stage; green construction occurs during construction stage; green operation and maintenance, and logistics occur after the construction (Wibowo et al., 2018). Green design and initiation are important stages as these create opportunity to identify and incorporate possible environmental aspects into a construction project (Zhang et al., 2011). Green materials management could be considered as replacing the non-environmental friendly materials (e.g. concrete which contribute to higher carbon dioxide emissions) and/or activities (e.g. illegal waste disposal from construction activities) with green materials sourcing and selection (Azevedo et al., 2011; Khung, 2019; Sourceable, 2016). Therefore, it is important to study the GSCM implementation in the pre-construction stage of construction project, to warrant that green aspects being incorporated in the earliest stage of a project.

2. LITERATURE REVIEW

GSCM was originated from Ayres and Kneese (1969) through balancing the industrial materials' metabolism by fulfilling the supply chain's production and consumption. Ayres and Kneese (1969) concerned the residuals generated from the production and consumption processes, and discussed that climate change issues as a result from greenhouse gases emissions through assessing the relationship between organizations. The topics related to balancing materials' metabolism with the involvement of government and organizations continued to evolve in 1970s (Ayres, 1978). GSCM was striving with the technical concepts evolvement such as life cycle assessment throughout 1980s (Erkman, 1997), which gradually leading to the introductory of reverse logistics, operations, materials purchase and marketing within the green focus (Sarkis, 1995).

Various literature emerged since 20th centuries with regards to GSCM (de Oliveira et al., 2018). Around half of the research carried out were centred in the manufacturing sector. For example, Sundram et al. (2017) investigated the relationship of GSCM on the performances of manufacturing companies in Malaysia. de Oliveira et al. (2018) performed literature review and found that around 43% of the literature were in the area of manufacturing and/or automotive sectors, while there is only 3% of the literature been conducted in construction sector.

In western countries, GSCM research had been conducted mostly in United States of America (with 74 publications) and United Kingdom (with 40 publications) (de Oliveira et al., 2018). In Denmark, a fuzzy method of improvising GSCM was proposed (Govindan et al., 2015). In Brazil, de Sousa Jabbour et al. (2015) investigated on the relationship between company's performance and GSCM practices. In Italy, a review on the trends and planned guidelines of SCM in relation to environmental measures were conducted (Centobelli et al., 2018).

In the eastern countries, research had been conducted mostly in India, China and Nigeria (de Oliveira et al., 2018). For example, in Nigeria, Ojo et al. (2014) studied on the barriers that hinders GSCM implementation in construction firms. In India, Reshma and Mittapalli (2016) identified the importance, drivers and barriers of GSCM adoption in construction industry. Luthra et al. (2016) evaluated on the barriers of sustainable supply chain with

regards to its consumption and production practices in India. It seems that most of the literatures in western countries are concentrated in developing a framework or literature review, and the literature in the eastern countries are focused on the drivers and barriers of GSCM implementation.

de Sousa Jabbour et al. (2014) classified the barriers into external and internal barriers. Internal barriers are the barriers which occurred within the organisation and relied on the managements' decision. External barriers are the barriers that outside the organisation and may need the collaboration with other stakeholders to overcome such barriers. Table 1 summarized the barriers of implementing GSCM from literature.

Table 1: Literature related to GSCM barriers

Barriers	1	2	3	4	5	6	7	8	9
Internal Barriers									
High implementation cost	√		√	√	√	√		√	
Lack of legitimacy			√	√		√	√		
Lack of knowledge and awareness	√		√	√	√	√	√	√	√
Lack of technology infrastructure			√	√				√	
Lack of green initiatives				√			√		
Lack of education and training				√	√	√			
Lack of sustainable GSCM practice	√			√		√	√	√	
Lack of company's leadership and support		√		√	√	√		√	√
Lack of company policy								√	√
Additional responsibility for construction maintenance							√	√	
Tendency to maintain current practices						√	√	√	
Requirement for long payback periods								√	
Lack of quantitative evaluation tools for green performance		√		√			√		
Low profit margins gained				√				√	
Risks and uncertainties				√				√	
Technical difficulty during the construction process				√			√	√	
External Barriers									
Shortage of green suppliers	√		√					√	
Extension of project schedules	√					√			
Shortage of green professionals	√	√		√	√	√	√	√	√
Perceived lack of government support		√			√	√		√	√
Lack of public awareness			√	√			√	√	√
Lack of stakeholder engagement/collaboration	√		√					√	√
Conflicts in benefits with competitors			√	√	√				
Imperfect green technological specifications					√	√		√	

Note: 1 = Balasubramanian and Shukla (2017); 2 = Reshma and Mittapalli (2016); 3 = Pinto and Allui (2016); 4 = Panigrahi and Rao (2018); 5 = de Oliveira et al. (2018); 6 = Walker et al. (2008); 7 = Zulkefli et al. (2019); 8 = Govindan et al. (2014); 9 = Ojo et al. (2014)

Up to 2018, there were only 17 publications of GSCM in Malaysia (de Oliveira et al., 2018). Wooi and Zailani (2010) and Ghazilla et al. (2015) focused on the GSCM in small and medium-sized companies. Abdullah et al. (2016) discussed on the barriers of GSCM implementation in Malaysian manufacturing industry. With regards to the green procurement in the design and initiation stage, there seems to have a lack of strategic management of green technology in the construction industry (Hassan et al., 2018). Zulkefli et al. (2019) reported that commitment from leaders of a company was the key challenge of GSCM implementation in Malaysian construction industry. Little-to-none research focused on the GSCM implementation during the pre-construction stage of project in Malaysia.

Pre-construction stage involves designers for projects' planning and design at the initial stage of project's life cycle and hence this stage could be regarded as an important phase that significantly affecting the successful rate of a project (Abd Hamid & Embi, 2016). The effective planning specifically the design of a project (e.g. incorporation of green practices with the use of recyclable materials in projects' specifications), is crucial for waste and pollution minimization within the construction industry (Omardin et al., 2015). Moreover, project procurement which includes the materials purchasing is vital to ensure that the materials planning were carefully being considered to avoid

excessive wastage or shortage, which could severely affecting the project timeline and costs (Gulghane & Khandve, 2015). It is undeniable that green related strategies and initiatives could be incorporated at the early life cycle of a project for the reduction on waste and greenhouse gases emissions (Wong & Zhou, 2015), but the GSCM adoption in Malaysia is still not reaching the mature level as developed countries. Therefore, this paper aims to investigate the barriers of GSCM implementation during the pre-construction stage in Malaysian construction industry.

3. METHODOLOGY

Questionnaire survey was selected as the data collection instrument by following similar approach as Ghazilla et al. (2015), Huang et al. (2015), and Jum'a et al. (2022). The targeted group of respondents identified in this research were construction stakeholders, including consultants, architects, contractors, interior designers and engineers, who involved in the pre-construction stage of a project. The potential respondents were identified through desktop research, such as from the Construction Industry Development Board (CIDB) official portal. Hence, simple random sampling was used. As it was impossible to include all construction stakeholders in Malaysia, assumption that the participants of the questionnaires represent the overall Malaysian construction industry was made. A total of two hundred sets of questionnaire have been distributed to various construction stakeholders, with 30 sets by email and 170 sets by visitation.

The questionnaire consisted of the general background of participants, participants' involvement in GSCM and the barriers of GSCM implementation in Malaysian construction industry. The barriers of GSCM implementation were classified into internal and external barriers, based on the classification carried out in Walker et al. (2008). A five-point Likert scale of agreement (i.e. 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree and 5 = strongly agree) was used to determine the critical barriers of GSCM implementation. Fifty-two responses were received with eight responses of high consistency in the Likert scale questions. This lead to the total final valid responses of 44 and a total response rate of 22%. This responses could be considered low if compared to the previous research, as 202 and 376 valid responses were reported by Huang et al. (2015) and Jum'a et al. (2022) respectively. However, this research could provide a brief overview on the current status of GSCM practices in Malaysia, specifically during the pre-construction stage.

4. FINDINGS AND DISCUSSION

4.1. Background of Respondents

Out of the 44 respondents, 54.5% of the respondents were engineers, 11.4% of respondents were consultants, 11.4% of the respondents were contractors, 6.8% of them were architects, 4.5% of the respondents were interior designers, and 11.4% of the respondents were consisted of planners, project designers and developers.

As majority of the respondents were engineers, the data obtained could potentially create a bias of opinion on the research topic. Hence, the respondents were classified into two groups, i.e. Group 1 (engineers) and Group 2 (non-engineers, which are consultants, contractors, interior designers, planners etc). The overall opinions by all the respondents were also included in the analysis.

Majority of the overall respondents have more than five years working experience (43%), while 25% of the overall respondents have more than ten years working experience in construction industry. It is also worth noting that about 15% of the respondents in Group 2 have more than 25 years of working experience. The experienced respondents could potentially assure the relevancy of responses collected. The years of working experiences were being asked in five-year interval as indicated by adopting the similar approach by Jum'a et al. (2022). Table 2 shown the working experiences of the respondents in terms of the frequency (*n*) and percentage (%).

Table 2: Years of working experiences

Years of experience	Overall		Group 1		Group 2	
	n	%	*n*	%	*n*	%
0-5 years	25	56.8%	13	54.2%	12	60.0%
6-10 years	8	18.2%	6	25.0%	2	10.0%
11-15 years	3	6.8%	2	8.3%	1	5.0%
16-20 years	5	11.4%	3	12.5%	2	10.0%
21-25 years	0	0.0%	0	0.0%	0	0.0%
25 years and above	3	6.8%	0	0.0%	3	15.0%
Total	44	100.0%	24	100.0%	20	100.0%

4.2. GSCM Practice at Organizational Level

To investigate GSCM practices in the construction companies, the respondents were asked if their companies had implemented GSCM, with yes and no options being provided. The results shown that 29.5% of the companies implemented GSCM, whereas 70.5% of the companies did not have any involvement in GSCM practices. This seems to imply that GSCM is not a common practice in Malaysian construction industry, as out of the small number of respondents (44 respondents) recruited in this research, there is only about one-third of their companies had implemented GSCM.

Those 29.5% of the respondents whose companies have involvement in GSCM were further asked to classify the companies' involvement at different stages of pre-construction process, with options green initiation, green design, green material management and/or all of these three options. The results shown that 56% of the companies claimed that they involved in all three stages of pre-construction process, which are green material management, green initiation and green design (see Figure 1). Green initiation is a critical planning step for designers to design and/or developers to decide on the project's location, for waste minimization and environmental protection (Ali et al., 2016) while green design includes the features of design consideration, environmentally friendly materials usage (which is also part of the green materials management), lightning design, water conservation etc (Akadiri et al., 2012; Wibowo et al., 2018). On the other hand, pre-construction stage is the stage for information gathering for the determination of project's objectives and include design and planning, prior to the signing of contract (Ham et al., 2008; Schierholz, 2012). Hence, this pre-construction stage somewhat inclusive of certain steps identified in the green initiation, design and material management, despite certain discrepancies.

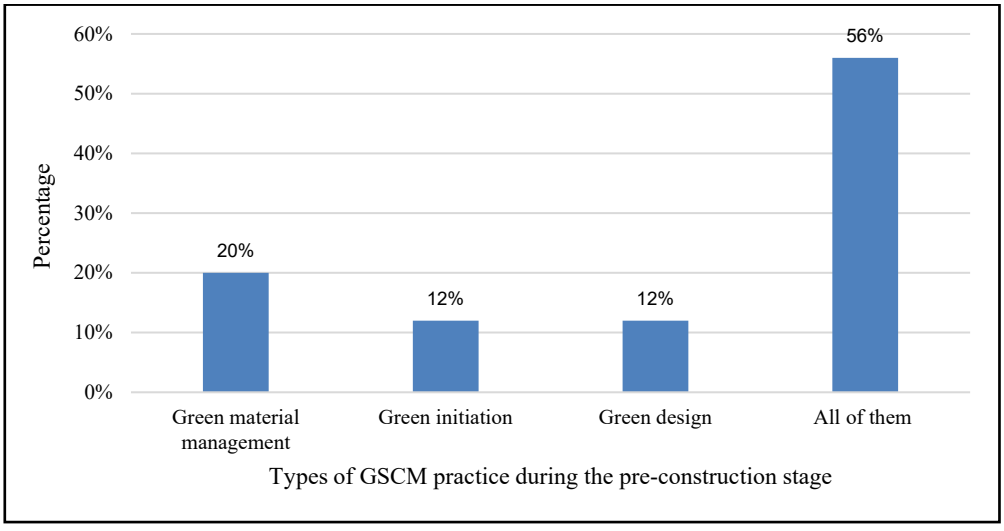

Figure 1: Companies' GSCM involvement in pre-construction stage

4.3. Barrier of Implementing GSCM

The respondents were then asked to rank their level of agreement on a list of barriers, with question "*What are the barriers to implement GSCM in Malaysian construction industry? Please select one of the Likert-scale options, with one being strongly disagree to five being strongly agree*". The results were shown in Section 4.3.1 and 4.3.2.

4.3.1. Internal Barrier

The most important internal barriers ranked by the respondents was the lack of company's leadership and support towards educating labours in GSCM adoption (see Table 3). The respondents may regard the company did not emphasise much on the GSCM practices. This seems to support the current findings that there were only about 29.5% of the respondents' companies have involvement in project with GSCM. This may hinder the chance of involvement and exposure of employees in GSCM as the top management in the companies do not have such commitment.

Table 3: Mean, standard deviation (SD), and ranks of internal barriers

Internal barriers	Overall			Group 1			Group 2		
	Mean	SD	Rank	Mean	SD	Rank	Mean	SD	Rank
High implementation cost to adopt green procurement	4.05	0.78	7	4.17	0.65	7	3.90	0.89	8
Lack of legitimacy in contract and procurement	3.91	0.77	9	4.13	0.76	8	3.67	0.73	11
Lack of knowledge and awareness on green adoption	4.27	0.73	2	4.22	0.85	4	4.33	0.58	1
Lack of technology infrastructure to implement green	3.86	0.93	11	4.22	0.85	6	3.48	0.87	14
Lack of green initiatives by the government in encouraging GSCM	4.11	0.78	5	4.26	0.75	3	3.95	0.81	7
Lack of education and training provided to the construction professionals	4.09	0.68	6	4.04	0.71	9	4.14	0.66	3
Lack of sustainable GSCM practices such as clear procurement chart, the roles and risk of each party	4.23	0.71	3	4.43	0.66	1	4.00	0.71	6
Lack of company's leadership and support towards educating labours in adopting GSCM	4.30	0.73	1	4.39	0.66	2	4.19	0.81	2
Lack of company policy towards achieving GSCM target	3.86	0.93	11	4.04	0.88	11	3.67	0.97	12
Additional responsibility for construction maintenance in sustaining the GSCM from starts until ends	3.84	0.94	13	3.96	0.93	13	3.71	0.96	10
Tendency to maintain current practices to avoid changes required by GSCM	4.14	0.73	4	4.22	0.67	5	4.05	0.81	4
Requirement for long payback periods that potentially lead to payment dispute	3.82	0.92	14	4.04	0.88	11	3.57	0.93	13
Lack of quantitative evaluation tools for green performance	3.93	0.85	8	4.04	0.83	10	3.81	0.87	9
Low profit margins gained compared to apply GSCM	3.91	0.98	10	3.78	0.95	14	4.05	1.02	5
Unclear/greater risks and uncertainties	3.57	1.07	16	3.74	0.96	16	3.38	1.16	16
The ability to anticipate or foreseen technical difficulty during the construction process	3.61	1.02	15	3.78	1.00	15	3.43	1.03	15

Lack of knowledge and awareness on green adoption was ranked as the second most important internal barriers (mean value = 4.27), followed by lack of sustainable GSCM practices such as clear procurement chart in the company (mean value = 4.23). Both of these barriers could related to employees and/or employers do not have the knowledge about GSCM and hence did not practice the sustainable GSCM inside the companies. For instance, green

initiation stage could not be carried out without the awareness and practice in the companies (Ojo et al., 2014). The ranking of lack of knowledge and awareness in this studies is contradicted with the previous studies. In the studies of Panigrahi and Rao (2018), lack of knowledge on GSCM is considered as the unstable barriers and hence it was ranked as the second least important barriers. The discrepancies might occur due to the differences in the practices of construction firms, which located in different geographical locations (i.e. India and Malaysia).

High implementation cost to adopt green procurement was ranked as the seventh most important internal barrier. This seems to contradict with the literature as the literature found that high cost is the top three barrier. High costs could create a huge challenge to the stakeholders as it required additional capital investment (Balasubramanian, 2012; Balasubramanian & Shukla, 2017; Pinto & Allui, 2016). The small firms may face the difficulties in implementing GSCM as additional cost is required for the design, certification and development of the environmental management system (Rondinelli & Vastag, 2000).

Group 1 (engineers) and Group 2 (consultants, contractors, planners etc.) had different ranking on the importance of internal barriers. Group 1 ranked lack of sustainable GSCM practices such as clear procurement (mean value = 4.43) as the most important barrier, while Group 2 ranked lack of knowledge and awareness on green adoption (mean value = 4.33) as the most important barrier. Such differences may due to the profession work nature of the respondents. The respondents in Group 1 are all engineers and they may be focusing on the rational selection techniques of a project (Bakht & El-Diraby, 2015), which in turn, regarded sustainable GSCM practice in a company as important issues in getting certification from the relevant organisations. Whereas, the respondents in Group 2 consisted professionals from different background, which are contractors, consultants, interior designers, architects and planners. These professionals may deal with different types of clients and meeting diverse needs of clients. Hence, they could be more focus on the importance of knowledge and awareness. Additionally, the designers designed a project and other stakeholders may have little power to alter the designs that had been decided by the designers.

The respondents in Group 1 and Group 2 opined differently on the barriers that had higher mean value, but they had similar ranking on the least important barrier which had lower mean value. Unclear risks and uncertainties was being ranked as the least important barriers by Group 1 and Group 2, with mean values of 3.74 and 3.38 respectively. This may due to the fact that the respondents were confident on the GSCM, and could not foresee severe risks and uncertainties in its implementation. Eliwa and Ayob (2020) stressed that the companies that adopt GSCM practices could potentially reduce the dispute and/or lawsuits related to the anti-environmental activities. This seems to imply that GSCM could have a positive future in the construction industry.

The top six barriers identified in the overall group in Table 3 possessed similarities and dissimilarities between Malaysia and other countries. Similarities existed on the barriers related to the lack of knowledge and awareness on green adoption (Mathiyazhagan et al., 2013), lack of green initiatives by the government in encouraging GSCM (Sheu & Chen, 2012), and lack of education and training provided to the construction professionals (Govindan et al., 2014). Dissimilarities existed on the barriers related to the lack of company's leadership and support towards educating labours in adopting GSCM, lack of sustainable GSCM practice such as clear procurement chart, the roles and risk of each party, and tendency to maintain current practices to avoid changes required by GSCM. These may due to the fact that Malaysia is laggard in the GSCM adoption and hence certain barriers such as the procurement chart and tendency to main current practices required times for addressing. Moreover, the full adoption of GSCM requires enormous efforts from various stakeholders specifically from the government and local authorities due to the high cost involvement which normally hesitate the clients.

4.3.2. External Barriers

Overall, the respondents ranked lack of public awareness on GSCM benefits towards environmental impacts as the most important barrier, with mean value of 4.14 (see Table 4). This result was consistent with the findings in Ojo et al. (2014) as the respondents ranked lack of public awareness as the most important barriers. The respondents seems to imply that the initiative of their GSCM involvement is from the external sources, such as government and material manufacturers. If the external parties would ask for the GSCM practice, this may provide more motivations and confirmations to the construction industry stakeholders to invest in GSCM (Jayaram & Avittathur, 2015; Mathiyazhagan et al., 2018).

Lack of stakeholder engagement and/or collaboration in ensuring continuation of green practices was ranked as the fourth most important barrier by the overall group of respondents. This seems to contradict with the previous literature as this barrier was ranked as the top barrier. Balasubramanian and Shukla (2017) opined that lack of stakeholder engagement could signify the weak opportunity for long-term partnership between contractor and

supplier. This is important in the supply chain as the adaptation of GSCM has to depend on the supplier for green materials.

With respect to the results from the perspectives of Group 1 and Group 2, Group 1 ranked lack of public awareness on GSCM benefits towards environmental impacts as the most important barrier (mean value = 4.26), while Group 2 ranked shortage of green suppliers (mean value = 4.10) as the most important barrier. The respondents in Group 2 may deal with the suppliers of green products in the sourcing of the materials and equipment. Hence, they are more likely concern on green suppliers as the products they produce could reflect the current market demand which could affect their decision in materials selection and involvement in GSCM.

Table 4: Mean, standard deviation (SD), and ranks of external barriers

External barriers	Overall			Group 1			Group 2		
	Mean	SD	Rank	Mean	SD	Rank	Mean	SD	Rank
Shortage of green suppliers (materials & machinery using green energy, green power engines)	4.02	0.98	2	3.96	0.93	4	4.10	1.04	1
Extension of project schedules in ensuring green project have enough time to adopt GSCM	3.55	1.09	7	3.87	0.97	6	3.19	1.12	8
Shortage of green professionals	3.98	0.93	3	3.91	0.90	5	4.05	0.97	2
Perceived lack of government support such as levy exemption, tax reduction, subsidy etc.	3.91	0.94	5	4.00	0.85	3	3.81	1.03	4
Lack of public awareness on GSCM benefits towards environmental impacts	4.14	0.82	1	4.26	0.75	1	4.00	0.89	3
Lack of stakeholder engagement/collaboration in ensuring continuation of green practices	3.91	0.83	4	4.13	0.76	2	3.67	0.86	5
Conflicts in benefits among green companies' competitors	3.57	1.00	6	3.78	0.85	7	3.33	1.11	6
Imperfect green technological specifications which causes green adoption hard to receive confidence	3.50	0.95	8	3.74	0.92	8	3.24	0.94	7

4.3.3. Summary of Internal and External Barrier for GSCM

The mean values of the internal barriers were higher compare to the mean values of external barriers. This seems to indicate that the main barriers that hinder GSCM implementation were related to the organisation strategies and/or companies' management decision, which is similar to the findings in Somsuk and Laosirihongthong (2017).

The companies could provide some internal training to equip both employers and employees, for better knowledge about GSCM, specifically in the area of green initiatives, green design and green materials supply. The adoption of GSCM in the pre-constructions stage could help in ensuring that the whole project have higher chance in meeting the needs of positive environmental outcomes, and hence reducing the carbon emissions.

5. CONCLUSIONS AND RECOMMENDATIONS

This paper had investigated the barriers of GSCM in Malaysian construction industry. The literature review indicated that there is little literature related to GSCM in Malaysian construction industry. The results of the questionnaire survey revealed that there were only 29.5% of participants' companies that selected through simple random sampling method, are involving in the adoption of GSCM, which pointed out that Malaysian construction industry may still at the infant stage of GSCM adoption. The key barriers were the lack of cooperation from leadership team in the companies, and the lack of knowledge and awareness. This seems to imply that the construction industry may need to provide more training and increase the adoption of GSCM in their practices, as suggested by scholars which had been implemented in developed countries such as Canada and China, in ensuring that the industry practitioners could have better understanding on the benefits of GSCM and practise its implementation. This could eventually encourage the GSCM practice in Malaysian construction industry, which in turn may reduce energy consumption in the construction sector, and achieve the goal of sustainable construction in Malaysia.

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