CHEMICAL ENGINEERING TRANSACTIONS
VOL. 63, 2018
A publication of AIDIC
The Italian Association of Chemical Engineering
Online at www.aidic.it/cet
Guest Editors: Jeng Shiun Lim, Wai Shin Ho, Jiří J. Klemeš
Copyright © 2018, AIDIC Servizi S.r.l.
ISBN 978-88-95608-61-7; **ISSN** 2283-9216
DOI: 10.3303/CET1863055

Awareness of Green Purchasing Amongst Construction Organisations

Atikah Abdul Rahim[a], Nurul Afida Isnaini Janipha[a,*], Faridah Ismail[b]

[a]Centre Of Studies For Quantity Surveying, Faculty Of Architecture Planning and Surveying, Universiti Teknologi MARA Shah Alam, Malaysia
[b]Centre Of Studies For Postgraduates, Faculty Of Architecture Planning and Surveying, Universiti Teknologi MARA Shah Alam, Malaysia
nurulafida@salam.uitm.edu.my

Contractor's concern with green issues is a worldwide subject that continuously changes their way of life ending up more environmentally responsible. Green awareness influences contractor's action in certain technique such as diminish consumption, changing inefficient or destructive consumption patterns and raising option for ecologically friendly material. The construction organisation should be aware of major sustainability initiatives in which green purchasing practices can apply. Green purchasing refers to the material purchase that is less damaging to the environment and human health and it has become the main part of purchasing decisions when the green building has been introduced. Green purchasing is one of the activities which can help to control environmental impacts during construction projects. This research aims to investigate the level of awareness of green purchasing amongst contractors' organisation. An extensive literature review and a questionnaire survey were done to obtain information on the level of awareness and the ways of promoting the green purchasing in the construction industry. A questionnaire survey was distributed among representative from construction organisations registered under the Construction Industry Development Board (CIDB). The results indicate that most of the construction organisations know and implement green purchasing in their purchasing activities. The understanding and implication of green purchasing are important for the construction organisations to improve their business performance and help in managing the construction project successfully.

1. Introduction

The construction industry plays an important role in shaping the society's physical environment. Most of the resources used up in construction sites is non-sustainable and a few may even make unfriendly ecological implication during their producing. People have expressed their environmental concerns and agreed that immediate actions should be taken for the environment. As the green method of construction becomes more significant, achieving high energy efficiency is one of the objectives to reduce environmental impact (Esfandiari et al., 2017). Only some of them would dependably settle their purchasing decision based on their environmental concerns. The contractors should be concerned and have to rethink their purchasing strategies, which are traditionally neglected by the environmental impacts. Rapid environmental deterioration has dramatically increased contractor's awareness of environmental problems. As contractors become increasingly critical of the industry's reactive environmental policies, there are a growing number of companies which is developing company-wide environmental programs and green material.
For Malaysian construction industry, the contractors have to handle green purchasing at the earlier stages of construction to keep healthy environment surrounding..There is an environmental staff that might be familiar with green purchasing necessities and advantages; in the same time, they may think that it's hard to start the facility or organisation-wide purchase of green material without the participation and cooperation of upper management and those in charge of the green purchase between contractor's firms with the supplier.

Please cite this article as: Atikah Abdul Rahim, Nurul Afida Isnaini Janipha, Faridah Ismail, 2018, Awareness on green purchasing amongst construction organisations, Chemical Engineering Transactions, 63, 325-330 DOI:10.3303/CET1863055

2. Green Purchasing in Construction Industry

Recently, green purchasing in construction considered the team of buyers in deciding the material purchased and they are also being emphasised on the execution principle in the construction sites. They also found many organisations are creating and implementing green strategies to save nature.

According to California Sustainability Alliance (2017), there are eight elements for contractor firm to perform green purchasing: [1] to form green purchasing team, [2] to conduct baseline inventory, [3] to establish desired environmental criteria for purchases, [4] develop green bid specifications [5] take advantage of partnership opportunities, [6] establish a green procurement policy, [7] to educate organisation staff, and [8] to review policy regularly.

Case (2004) stated that some governments had supported these endeavours by constructing green purchasing groups, which are aimed to reduce the environmental effects of the organisation purchasing practices. The team can build an implementation plan and make connections with other significant departments. Same to the contractor firms can form a green purchasing team to develop a good purchasing practice. Completing a baseline review, a questionnaire, a survey or a simple checklist are useful in collecting relevant information with minimal time and resource burden on city staff (Stopwaste, 2014).

It is important to build up environmental criteria for purchases that reflect the contractor firm right. These criteria will help figure out which material to focus on substitution and will shape the improvement of material specifications (Janipha et al., 2015). In order to effectively embrace green purchasing policy, education is essential for all contractor firm staff and the end-users of all purchased material.

Purchasing policy and the program had been assessed at a regular interval, which is in every three years. Babson College (2017) are the forefront of the environmental movement and policies and programs of adoption. They protect the environment and save money through green purchasing policy for their green power purchasing program. There are many issues and challenges happened when the green material is presented around the world. Contractor's concern with green issues is a worldwide subject that continuously changes their way of managing purchasing process, which they started to consider environmentally responsible for the construction.

Some major green initiatives by contractors incorporate with environmental policy and publishing an environmental statement. Incorporation of policy and environmental statement into the yearly report as a review to the contractor's firm that contributes to green factors includes the commitment in the handling and preparing of materials and waste, undertaking environmental audits of their purchasing and environmental impact assessment of some activities during purchasing material for construction. Contractors are also paying more consideration to corporate environmental strategy. An expert and trade bodies have been preparing ‘green' policy papers to control their activities to embrace environmentally responsible practices. With the pressure from statutory control, different competition, social duty and corporate image, business venture, especially those with environmental have changed their corporate policies and operating practices and technique.

The satisfaction of contractor's requirement for environmentally sound practices, the reduction of expenses, and avoidance of infringing environmental legislation can be met by the trade-off. An environmental management system (EMS) is required once the contractor's firm chooses to enhance its environmental performance. EMS is a set of instrument tools, standards, and procedures which the contractor's firm can use to help protect the environment from the potential impact of its activities. It is important for contractor's firm to develop and implement green purchasing strategies successfully and strategically as there is an increased demand for green building in the construction industry (Yang and Zhang, 2012).

3. Research Methodology

The objectives of this data collection were to identify green purchasing in the construction industry, to determine the level of awareness of green purchasing amongst contractors and to suggest the ways in promoting green purchasing in the construction industry. The questionnaire survey has been conducted in 3 Section as follows. Section A: Background information on respondent; Section B: Awareness in Green purchasing; and Section C: Promoting green purchasing in the construction industry. All the data collected from primary data and secondary data were compiled. The respondent of the questionnaire survey was focused on Contractor G7 (Building Works) in Selangor, registered with Construction Industry Development Board (CIBD). The selection of respondents was based on simple random method. 100 copies of questionnaire survey have been sent to the contractor firm via normal postage and email. All collected data in Section A, B and C were analysed using IBM SPSS 20 software. Descriptive analysis was performed to obtain the frequency outcome, mean and standard deviation. Background of the study was analysed using frequency to obtain the percentage of data while mean and standard deviation were used to analyse the level of

awareness and the ways of promoting green purchasing. The mean was used to get the average value of the data and the standard deviation indicates the dispersion around the mean.

4. Analysis of Findings

Table 1, indicated the working experience of the respondents. The result shows the respondent that have working experience 5 - 10 years has the highest percentage which is 56.80 % of the total respondent followed by less than 5 years working experience which was 21.60 %. The respondents that have working experience more than 20 years and 10 - 15 years had the lowest percentage, which was only 2.70 % and 8.10 % of the total respondents. The analysis shows that many of the contractor's firms know about green purchasing which the percentage was 70.30 % of the total respondents. More than half of the respondents know about green purchasing. Only 29.70 % of the respondents don't know what is green purchasing.

Table 1: Working experience and knowledge of green purchasing

Item	Description	Percentage (%)
Working experience	Less than 5 years	21.6
	5 - 10 years	56.8
	10 - 15 years	8.1
	15 - 20 years	10.8
	More than 20 years	2.7
Does your company know about green purchasing?	Yes	70.3
	No	29.7

4.1 Awareness of Green Purchasing

Table 2 shows the awareness of green purchasing. Refer to the high percentage of the knowledge of green purchasing amongst the contractor's firm (Table 1) which the majority of the contractor's firm know what is green purchasing, it is approved and supported with the green purchasing activity or concept in Table 2. Basically, many of the contractor's firms know about green purchasing and implement green purchasing activity in their organisation (Table 2).

Most of the respondents still apply the activity of green purchasing because the mean is quite high. It shows that seeking new suppliers and encouraging existing suppliers to review the manner in which their material is packaged, has the highest mean compared to others activity which is 3.9189 (1.11501). The activity of collect and update current Material Safety Data Sheet (MSDS) on products, is the second crucial activity which the mean score of 3.7838 (1.25023) and followed by seeking to utilise to the fullest extent possible "environmentally friendly" or "green material" such as Cause minimal or no environmental damage during normal use or maintenance which has mean of 3.7568 (0.95468).

The result shows that the activity of seeking to utilise to the fullest extent possible "environmentally friendly" or "green material" such as durable as opposed to the single use of the material is fourth highest mean which is 3.7568 (0.92512). Majority of the contractor's firm also implement the activity of use MSDS to compare products because it shows that the mean is quite high which is 3.7297 (1.21675).

In Malaysia construction industry, the least activity of green purchasing by contractor's firms was seeking to utilise to the fullest extent possible "environmentally friendly" or "green material" which is made of recycled materials, maximising post client objectives. It shows that this activity has the lowest mean compared to others activity which is 2.6486 (0.97799). The activity of creating, adapting and implement a paperless purchasing procedure and process which is the mean is only 2.7838 (0.85424) is the second lowest mean. It shows that majority of the contractor's firm less implement this activity during their purchasing activity, followed by the activity of review purchasing for materials selection to ensure it contains the material usage of reusable/ recyclable content. The mean shows that this activity of green purchasing is quite low because the mean is only 3.0270 (0.79884).

Based on the value of the mean, it is approved that the contractor's firm implements the green purchasing concept in their organisation but there is some activity they really implement it critically and some are not. Even though Malaysia has started to emphasis on the "green material" and "environmental friendly" criteria, the process is only implemented at the manufacturing level. This is due to most of the construction firms have to follow the clients' requirement for the construction of a project.

However, for the awareness of green purchasing process in the construction industry, it is shows that the contractor's firms in Malaysia are extremely aware of the green purchasing activity especially in seeking new suppliers and encouraging existing suppliers to review the manner in which their materials are packaged. Contractors started to have specific criteria on the selection of new suppliers and the material purchased as a result of the Government initiative towards "green", "environmentally friendly" and "sustainability" factors.

Table 2: Awareness in green purchasing

Activity	Mean	Standard deviation
Review purchasing for materials selection to ensure it contains the material usage of reusable/ recyclable content.	3.0270	0.79884
Work with supplier to identify new environmentally friendly materials as well as improvements in purchasing standards that may impact the environment.	3.6757	1.02886
Purchasing from suppliers that provide environmentally friendly services in their daily operations.	3.6216	1.03686
Seeking new suppliers and encouraging existing suppliers to review the manner in which their material are packaged	3.9189	1.11501
Working with suppliers in the areas of reduction and reuse of materials.	3.1081	0.96563
Using cost/benefit analysis to arrive at the correct sourcing decision; one that remains economically practical, reflects effective purchasing practices and satisfies the requirements of the Client.	3.5676	0.86732
Seek to utilise to the fullest extent possible "environmentally friendly" or "green material" such as follow:		
a. Durable as opposed to single use of material.	3.7568	0.92512
b. Made of recycled materials, maximising post Client objectives.	2.6486	0.97799
c. Non-toxic or minimally toxic, preferably biodegradable.	3.3784	0.75834
d. High energy efficient in material used.	3.6486	0.75337
e. Made from raw materials obtained in an environmentally sound, sustainable manner	3.4865	0.69208
f. Manufactured in an environmentally sound, sustainable manner by companies with good environmental track records.	3.6757	1.00150
g. Cause minimal or no environmental damage during normal use or maintenance.	3.7568	0.95468
h. Transport with minimal packaging (consistent with care of the product), preferably made of recycled and/or recyclable materials.	3.3514	0.78938
i. Produced locally or regionally (to minimise the environmental costs associated with shipping)	3.1892	0.77595
Create, adapt, and implement a paperless purchasing procedure & process	2.7838	0.85424
Reduce/ eliminate the purchase hazardous material	3.0811	1.11501
Issue corporate social and environmental reporting supplier letters to suppliers in database.	3.4595	1.01638
Conduct on-going research for all commodities and services	3.4324	0.95860
Use MSDS (Material Safety Data Sheet) to compare products.	3.7297	1.21675
Collect and update current MSDS on products listed above	3.7838	1.25023
Test the more eco-friendly products with major users on campus for acceptability.	3.5405	1.01638
Adopt material checklist for use in purchasing process.	3.5676	0.89878

4.2 Promoting Green Purchasing In Construction Industry

Table 3 shows the promoting green purchasing in the construction industry. There were eleven factors listed for the issue on how to promote the green purchasing in the Malaysia construction industry. Most of the factors highlighted in Table 3 emphasised on the supplier-networking, the purchasing process itself, the materials involved in a project and the environmental factor.

Table 3: Promoting green purchasing in the construction industry

Activity	Mean	Standard deviation
To develop and maintain a consistent supplier-networking and purchasing process which consider economic, ethical, social and environmental impacts for all contract and purchases.	4.1081	0.69856
To integrate green purchasing concepts and products into architectural designs, final construction documents and into the final construction	4.1351	0.67339
To make use of recycled content paper; used paper is turned into scratch pads for distribution to departments within organisation.	3.0541	0.84807
To procure recycled content office supplies (folders, writing pads, etc.)	3.3514	0.48398
Specify the use of reclaimed/ recycled materials where practical.	4.0811	0.68225
Avoid the use and specification of material known to be hazardous to health.	3.9459	0.66441
Purchased recycled paper for all applications in organisation usage where economic use of paper is not compromised or the health and safety for employees prejudiced.	3.3784	0.72078
Whenever possible purchase organic and locally grown produce.	3.4595	0.76720
Purchase material that made from recycled and recyclable materials.	3.7027	0.61756
Must have continuous improvement such as request feedback from supplier, review purchasing process, incorporate feedback into action plan for next project and keep records and track progress.	4.1081	0.80911
Develop an awards program for contractors who contribute successful ideas on green purchasing projects.	4.3243	0.78365

Many of the contractor's firm consider the factors listed in Table 3, can help to promote the green purchasing in the construction industry. It shows that developing an awards program for contractors who contribute successful ideas on green purchasing projects are the highest factor.

Refer to the value of the mean which is 4.3243 (0.78365), the contractor's firm strongly agrees with this awards program for the contractor in Malaysia. For Malaysian context, the second highest ways are to integrate green purchasing concepts and products into architectural designs, final construction documents and into the final construction. The value of mean is 4.1351 (0.67339). It shows that these ways are highly recommended for suggesting the ways in promoting green purchasing in the construction industry.

Based on the result, there are 3 suggested ways in promoting green purchasing in the construction industry that shared the same value of the mean. First is to develop and maintain a consistent supplier-networking and purchasing process which consider economic, ethical, social and environmental impacts of all contract and purchases, second is specify the use of reclaimed/ recycled materials where practical and third factor is the activity must have continuous improvement such as request feedback from supplier, review purchasing process, incorporate feedback into action plan for next project and keep records and track progress. The value of mean were 4.1081 and it shows the majority of the contractor's firm quite agree with these 3 suggested ways listed in promoting green purchasing in the construction industry.

For the factors in make use of recycled content paper; used paper is turned into scratch pads for distribution to departments within organisation and to procure recycled content office supplies (folders, writing pads, etc.), the results show that the value of mean are the lowest which is 3.0541 (0.84807) and 3.3514 (0.66441).

The analysis shows that many of the contractor's firm are less agree with the 2 suggested ways listed. However, the other suggested ways such as ensure that energy efficiency is a prerequisite when purchasing all appliances and materials and avoid the use and specification of material known to be hazardous to health, the contractor's firm still considers these ways in promoting green purchasing in construction industry but it is not crucial as others suggested ways which are the value of mean only 4.0541 (0.66441) and 3.9459 (0.66441).

5. Conclusion

In the Malaysian context, the contractor's firms implement all the activity of green purchasing. Based on the findings, the most crucial activity on the awareness of green purchasing in the contractor's firm is the activity of seeking new suppliers and encouraging existing suppliers to review the manner in which their material is packaged. It is proved that most of the contractor's firm implement this activity during purchasing and this activity has the highest mean compared to others activity. This is because the majority of the contractor's firms

are doing this activity during their purchasing process and they are extremely aware of this activity. Factors such as seeking to utilise to the fullest extent possible "environmentally friendly" or "green material" which is made of recycled materials, maximising post client objectives is the least important activities because the results show lowest mean value. Green purchasing is the activity that involved less hazardous material to the construction and the environment

The most relevant ways on how to promoting green purchasing in the construction industry are developing an awards program for contractors who contribute successful ideas on green purchasing projects. It shows that the contractor's firm considers these ways as the motivation towards a successful construction industry. The contractor's firm strongly agrees with the awards program as to give understanding and better management on green purchasing projects for future construction. The second highest mean indicated that the contractor's firm agrees with the suggestion to integrate green purchasing concepts and products into architectural designs, final construction documents and into the final construction. Besides, the findings show that the contractor's firm still considers the suggested ways which are to make use of recycled content paper; used paper is turned into scratch pads for distribution to departments within the organisation. The value of mean is the lowest score but the contractor's firm still consider these ways of promoting green purchasing in the construction industry.

Acknowledgements

The authors wish to thank the Universiti Teknologi MARA via LESTARI grant, 600-RMI/DANA 5/3/LESTARI (82/2015) for funding this research paper. A high appreciation all people that involved directly and indirectly in the success of this research. Special thanks also go to the reviewers for their valuable comments on this paper.

References

Babson College, 2017, Policies and procedures <www.babson.edu/offices-services/business-financial-services/procurement/policies-procedures/Pages/home.aspx> accessed 04.05.2017.

California Sustainability Alliance, 2017, Eight elements of green procurement <sustainca.org/tools/green_procurement_toolkit> accessed 13.07.2017.

Case S., 2004, Policy Updates inspire environmental purchasing, government procurement <govpro.com/issue_20040201/gov_imp_27724> accessed 20.04.2017.

Esfandiari M., Zaid S.M., Ismail M.A., Aflaki A., 2017, Influence of indoor environmental quality on work productivity in green office buildings: A review, Chemical Engineering Transactions, 56, 385-390.

Janipha N.A.I., Ahmad N., Ismail F., 2015, Clients' involvement in purchasing process for quality construction environment, Procedia - Social and Behavioral Sciences, 168, 30-40.

Stopwaste, 2014, Green purchasing <www.stopwaste.org/preventing-waste/business/green-purchasing> accessed 05.10.2016.

Yang W.F., Zhang Y.L., 2012, Research on factors of green purchasing practices of Chinese, E3 Journal of Business Management and Economics, 3 (5), 222-231.