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Green related practices for construction procurement

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Abstract. Environment degradation issue has been a worldwide problem and various efforts have been done to minimise the problem. Construction sectors are pointed as one of the major contributors to its construction activities. Green-oriented procurement [GP] is considered as an environmental strategy to integrate the environmental practices into the construction delivery. Thus, this paper reviews the concept of GP and the practices related to it. The outcome of this research findings provides a basis for understanding the concept of GP and the further development of GP. The listed GP practices identified from this paper can serve as guidelines for industry practitioners to design, implement, and benchmarking the green practices in their procurement delivery.

1. Introduction

The introduction of the Agenda 21 and the Kyoto Protocol 1997 is essential in leading towards sustainability. In the U.S.A, the importance in achieving energy efficient and environmentally sustainable in building practices is highlighted [1]. In Malaysia, the issues of quality and environmental sustainability management have been expected in the construction industry. Pollution is mostly an environmental problem in general opinion of the construction industry [2]. Governments and corporations throughout the world insist to limit the resources and preserve a sustainable environment in introducing environmentally friendly practices and products [3]. In many environmental forums, it has been highlighted that global environment is progressively worsening. Important calls have been made for essential prescribed actions from different sources to protect and minimise a greater environmental impact and damage [4].

Nowadays, green procurement is slowly introduced in the building development to ensure the improvement of construction industry practices in a sustainable, safe, and cost-effective manner [1]. Companies or organisations usually have people with a different way of working and practices, and it is usually in a way which organisations formally portray certain work in manuals, job descriptions, and procedures [5]. Changes in work practices are important, therefore the green procurement can be introduced by the company; for example, the existing of procurement practices are changed or the green procurement is combined with the existing practices. Thus, in implementing green procurement, it is important to consider the actual practices as well [6]. It is expected the most responsible individual in ensuring the minimal of environmental impacts is the construction company or organisation. It is depending on the selection, lifecycle of the products, and practices used whether it brings environmental consequences or impacts. Green products are introduced to be used sustainably in construction. The manufacturing of the green products involves less energy and contains the lower harmful or toxic materials. Moreover, green products have a longer lifecycle, easily being recycled, and produce less wastage. In the context of Malaysian construction industry, pollution is a major problem in terms of an



environmental problem. Thus, green procurement is created as a standard to prevent pollution which aims to extinguish risks to the environment and also human health.

2. Brief introduction to green procurement

Construction has a major impact on the environment and it is important to protect, enhance, and minimise it throughout the construction stages. Wu [7] indicate that the consumer for the construction industry is the natural environment itself and the output also contemplates the environmental aspect of the building. The green concept is a benchmark for the sustainable practice to achieve an integral part in aiming the green project performance. Green procurement initiates an environmental performance factor in the ordinary procurement system [8]. Green procurement is introduced as efficient ways to control the environmental problems. Implementing green procurement means the organisation should entrust to reduce environmental problems of the construction activities during the construction phases. Recognition, integration, and implementation of the green practices along the procurement process are what green procurement is defined as. Building procurement is a complicated process because it involves from the initial planning phase and throughout the contract execution. It is important to develop a strategic planning or early decisions because procurement is somehow meant to be the important factors of change.

The procurement process involves an extensive multifaceted mechanism which is able to integrate the green practices during the development process [9,10]]. According to Albino *et al.* [11] indicate that generally “green” refers to the combination of few aspects, such as integration, recognition, and the adoption of environmental practices or strategy in terms of planning designed to reduce impacts on environmental during the lifecycle stage. The performance of green can be categorised into few aspects not only in the focal point of environmental but also social and economic aspects. To achieve lower environmental problems from the construction activities along the project stages, it is important for an organisation to execute the green procurement practices into their project's activities from the initial phase until the completion phase.

Different perspectives and opinions about green procurement are defined by the authors in previous studies. Green *et al.* [12] indicate the purpose of procurement which also describes as purchasing or supplying the chain management generally considered as a benchmark service in companies and it is expected that the procurement function has a specific aspect to achieve the company's strategic goals. In addition, the need for green procurement in organisations is growing which allows procurements to be essential in the environmental aim [13]. The purchase of “products or services which minimise or provide the positive environmental impacts” through the factoring of “environmental concerns into major purchasing strategies, policies, and directives.” [14]. Thus, different aspects of green procurement need to be considered especially in terms of purchasing where the purchasing practices and decisions need to be evaluated throughout the implementation process which is the implementation of green procurement in the construction industry.

Green procurement implementation in the construction sector takes into consideration of the direction of all the lifecycle phases from choosing the raw material, transportation, packaging of the product, storage, and handling of the product's use and its disposition or recycling [15]. Moreover, the implementation of green procurement can increase the employee awareness of green practices and the related green policies, and the intensity of the implementation can improve the corporate market competition to gain a good image to the public while promoting the corporate social responsibility [CSR], which opens up business prospect with intercontinental investors [14]. Growing practices and the importance of green procurement in the developed countries are widely known, it is, hence appear to be a new concept in various Southeast Asian countries including Malaysia. Long and short-term plan strategies have been developed by the government of Malaysia to motivate the relationship between the construction industry and academic. *MyHijau* program has been recognised as a concept of green procurement. The objective of the *MyHijau* program which has been launched in 2012 is to motivate the implementation of green technology and purchasing lower impact environmental products and services under a group of Ministry of Energy, Green Technology and Water [KeTTHA] as well as Malaysian Green Technology Corporation [MGTC]. Yet, development of green procurement strategic framework

is still being evolved [15,16]. Thus, the framework of the green procurement strategy initiates awareness and actions among the industry players [18].

3. Methodology

In line with the objective of this paper, a comprehensive literature was carried out to identify the current green practices implementation in the construction industry. The purpose of the review is to discover and accumulate the current green practices in addition to generate a wide-ranging list of green procurement practices in the construction industry. Moreover, the discovery of the wide-ranging list of green practices can enhance the current green practices implementation in the construction industry. The previous studies have listed down many green practices implementation which may vary in terms of industry, organisations, parties, and country. An extensive literature review was carried out to identify the list of green practices. According to the discussion from literature review, 60 current green practices and six main inputs were discovered. The six inputs are: (1) the policies, procedures, and guidelines, (2) strategies and framework, (3) green practices, (4) purchasing decision, (5) environmental, social and economic sustainment, and (6) stakeholder values.

4. Findings and discussion

According to Mosgaard [18], the green procurement implementation is quite complex. To perform green procurement, the project stakeholders are expected to have the green-oriented technical capabilities. Prior to the complexity of the environmental issue, thus green procurement requires a collaborative approach among the stakeholders in addressing the issue; for example, the price of a product. The needs of guidelines from both government and industry are crucial to an effective adoption of green initiatives [20]. According to previous studies that expose both International organisation for Standardisation [ISO] 14001 and the Environmental Management System [EMS] are the main characters to establish the green practices. Moreover, stakeholders are provided with guidelines by eco-labelling programs in selecting green products and services as well as generate awareness to the stakeholders [21].

Introducing green procurement requires a change of the practice for green procurement or the evolving detailed work orders for procurement by the companies who are considering in implementing green procurement. Moreover, green procurement adoption involves the needs of changing current procurement practices as well as the current practices connected with green procurement. Thus, green procurement adoption must be anticipated with the actual practices. Organisation needs to obtain the environmental capabilities to achieve the products environmental assessments as well as involving new environmental players in the procurement procedure [6]. It is important for the current green procurement practices being supported by the management in terms of the constant assessment of green procurement. The practices of green procurement emphasised in the manner of green procurement turns up in certain conditions; for example, the traditional ways of using local suppliers, the practice will remain being used even though there is an alternate practice stipulated in the procurement procedures [22]. Collaboration on procurement across departments is one of the cultures in the procurement practices in terms of consideration of choices when purchasing, and arrangement made in the procurement processes. Therefore, the ability formed in the social interaction among the stakeholders makes the procurement as an organisational capability [22]. The list of green-oriented procurement practices from the literature review as listed in Table 1.

Table 1. List of green practices for construction procurement by various authors.

Authors	Green Practices
Min & Galle, 2001	[1] Green purchasing – supplier selection [2] Waste management [3] Packaging [4] Regulatory compliance
Bin & Qinghua, 2005	[5] Supplier evaluation – environmental indicators
Leire, 2009	[6] Products of strategic importance
Lee, 2009	[7] Gender on the green purchase influences
Björklund, 2011	[8] Image [9] Resources of the firm [10] Customer demands [11] Carriers [12] Governmental means of control
Lam et al., 2010	[13] Green technology and techniques [14] Reliability and quality of specification [15] Stakeholder involvement [16] Guide and benchmarking system
Ho, Dickinson, & Chan, 2010	[17] Government involvement and support – green procurement [18] Promotion and delivery of green purchasing database
Wahid, Rahbar & Shyan, 2011	[19] Social influence [20] Environmental concern [21] Green product knowledge [22] Environmental knowledge [23] Environmental label [24] Income level – impact to green purchase behaviour
Yang & Zhang, 2012	[25] Green product [26] Reverse logistics [27] Social responsibility [28] Design for environment
Adham & Siwar, 2012	[29] Purchasing green products and services
Parikka-Alhola & Nissinen, 2012	[30] Incorporation of green specifications into the contracts
Vatalis et al., 2012	[31] Purchase value of money
Shi et al., 2013	[32] Specifications should consider environmental requirements [33] Specification and guide can be easily found interiorly [34] Information or database about green construction [35] Green consideration satisfying mandatory requirements [36] Top management concerning and supporting green construction [37] Forced by the government
Mosgaard, 2015	[38] Environmental objectives of green procurement – both management and purchasers [39] The purchasers involve in developing the green procurement procedures and where a product-oriented approach is decided

Table 2. List of green practices for construction procurement by various authors.

Authors	Green Practices
Routroy & Pradhan, 2012	[40] Organisational attitude – information visibility, cooperative behaviour, and decision-making style [41] Green strategy – purchasing greener products [42] Primary factors – cost, product quality and reliability, delivery lead time, standard deviation of delivery lead time, flexibility, and compatibility [43] Secondary factors – cost reduction plan, value addition plan, pricing terms, customer need response, and resolution time [44] Packaging and handling ability, claims management system [45] Infrastructure factors – financial stability, capability in terms of capacity, information infrastructure, research and development facility, and proximity [46] Organisational attitude factors – quality system, employee relationship management, eagerness to adopt changes [47] New technology, company image and goodwill, transparency in relevant information sharing [48] Focus towards innovation [49] Green strategy; design for environment, focus towards lean, green innovation, green logistics, reverse logistics handling ability, waste management [50] Green reputation; green competency and certification [51] Green customer image [52] Environmental management system
Ruparathna & Hewage, 2015	[53] Guidelines to incorporate environmental and social factors [54] Environmental, social, and economic sustainability – organisation's mission or vision [55] Company values statements recognising the environmental, social, and economic sustainability [56] Procurement manuals contain guidelines to incorporate environmental and social factors
Bohari et al., 2017	[57] Policies and guidelines [58] Green practices [59] Environmental assessment [60] Stakeholder values

From the list of green practices for construction procurement, six main characteristics have been derived from the findings to identify the essential practices for green construction procurement [refer Table 3]. Based on the literature, the first main inputs and processes are the policies, procedures, and guidelines. The policies, procedures, and guidelines are crucial in the implementation of green procurement in organisations. Changing policies is the most important thing as well as establish and prioritise it in the organisation. Moreover, guidelines and specifications must be adequately available and visible [10,17]. The second input is the terms of strategies and framework which the short and long-term strategy must be carefully planned to ensure the purchasing organisation make products greener and environmental performance evaluation should also be taken into consideration [23]. Furthermore, green practices are essential to lead the direction of green-oriented procurement. Thus, better green performance can be achieved.

Management, selection, and assessment of natural products and services must be chosen wisely to ensure the pollution rates and greenhouse emissions can be reduced [18, 24-27]. The fourth input is the purchasing decision. The literature suggests that purchasing lower impact environmental product and services are important as well as the evaluation of purchasing practices should be made to minimise the impact on the environment. The fifth input is environmental, social, and economic sustainment. The

outcome from implementing green procurement, the industry is able to expand the market of green goods and services. In terms of economics, the practitioners have an option to purchase the goods and services that can achieve value for money and able to minimise damage to the environment. The sixth input is related to stakeholder values. Stakeholder values as mentioned in Bohari *et al.* [18], refers to the stakeholder's capabilities, awareness, and interest in adopting green practices. For a construction project, stakeholder plays an important role in achieving project objectives.

Table 3. Essential practices for green construction procurement.

<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 5px; text-align: center;">Input & Processes</div> <div style="border: 1px solid black; padding: 5px; text-align: center;">Outcomes</div> </div>	
Policies, Procedures, & Guidelines	Changing policies and procedures, job descriptions, manuals Policies are established and prioritised Guidelines and specifications adequately available and visible
Strategies & Framework	Short and long-term strategy Environmental performance evaluation
Green Practices	Direction of green-oriented procurement Better green performance selection and assessment of products and services Reduce greenhouse emissions, level of pollution, natural resources management
Purchasing Decision	Purchase lower impact environmental products and services, evaluation of purchasing practices
Environmental, Social, & Economic sustainment	Enlarge market for the environment in terms of goods and services Social aspects in terms of client's level of satisfaction Economic aspects in terms of value of money
Stakeholder values	Early participation, commitment, capabilities and motivation, green technical competences, green procurement, testing green materials, green specification form [contractual framework]

5. Conclusion

This paper describes the results of a literature review that focuses on identifying a list of green practices that related to construction procurement. The outcome of this paper could help the industry practitioner to plan their green procurement implementation in Malaysia. This paper has identified sixty [60] green practices that related to construction procurement from various authors. Further, from that, the 60 lists have been classified under six [6] main groups [refer Table 3]. This paper also identifies the possible outcome derived from practising the green practices. Despite the important outcomes of this paper, there are some limitations. The mutual relationship between [six] 6 main groups of green practices, the outcomes, and how far is the implementation of green procurement among the construction practitioners should be explored in further study. More evidences are also needed to validate the points made by conducting further research in the future. The lists provided in this paper can serve as a basis to further research in the future.

References

- [1] Wong J K W, San Chan J K and Wadu M J, 2016 Facilitating effective green procurement in construction projects: An empirical study of the enablers *J. Clean. Prod.* **135** 859-871.
- [2] Sim Y L and Putuhena F J 2015 Green building technology initiatives to achieve construction quality and environmental sustainability in the construction industry in Malaysia. *Manage. of Environ Qual.: An Int. J.* **26** 2 233-249
- [3] Salam M A 2008 An empirical investigation of the determinants of adoption of green procurement for successful green supply chain management *Management of Innovation and Technology, 2008. ICMIT 2008. 4th IEEE International Conference (Bangkok)* (United States: IEEEExplore) pp 1038-1043
- [4] Dodds F, Strauss M and Strong M F 2012 *Only one Earth: The long road via Rio to sustainable development* (New York: Routledge)
- [5] Orr J E 1996 *Talking about machines: An ethnography of a modern job* (London: Cornell University Press)
- [6] Leire, C. 2009. Increasing the environmental and social sustainability in corporate purchasing: Practices and tools. IIIEE Doctoral dissertations.
- [7] Wu Y N, Yan H Y and Huang Z J 2012 Elementary introduction to the green management of the construction in whole process *Phys. Procedia* **24** 1081-1085
- [8] Giudice F, La Rosa G and Risitano A 2006 *Product design for the environment: a life cycle approach* (New York: CRC press)
- [9] Bratt C, Hallstedt S, Robèrt K H, Broman G and Oldmark J 2013 Assessment of criteria development for public procurement from a strategic sustainability perspective *J. Clean. Prod.* **52** 309-316
- [10] Ruparathna R and Hewage K 2015 Sustainable procurement in the Canadian construction industry: current practices, drivers and opportunities *J. Clean. Prod.* **109** 305-314
- [11] Albino V, Balice A and Dangelico R 2009 Environmental strategies and green product development: an overview on sustainability- driven companies *Bu. Strateg. Environ.* **18**(2) 83-96
- [12] Green K, Morton B and New S 1998 Green purchasing and supply policies: do they improve companies' environmental performance? *Supply. Chain. Manag.* **3**(2) 89-95
- [13] Seuring S and Müller M 2008 Core issues in sustainable supply chain management—a Delphi study *Bus. Strategy. Environ.* **17**(8) 455-466
- [14] Green Council 2010 *Report of the research study on the current status and direction for green purchasing in Hong Kong* Green Council Hong Kong
- [15] Ofori G 1999 Satisfying the customer by changing production patterns to realise sustainable construction *Proc. Joint Triennial Symposium of CIB Commissions W65* 55 (Cape Town) pp 41-56
- [16] Adham K N, Siwar C 2012 Empirical Investigation of Government Green Procurement (GGP) Practices in Malaysia *OIDA. Int. J. Sustainable. Dev.* **4**(04) 77–88
- [17] Musa N D, Buniamin S, Johari N H, Ahmad N, Rauf F H A and Rashid A A 2013 Key indicators towards the implementation of green government procurement in Malaysia *World Applied Sciences Journal* **28** 127-135
- [18] Bohari A A M, Skitmore M, Xia B and Teo M 2017 Green oriented procurement for building projects: Preliminary findings from Malaysia *J. Clean. Prod.* **148** 690-700
- [19] Mosgaard M A 2015 Improving the practices of green procurement of minor items *J. Clean. Prod.* **90** 264-274
- [20] Bakir S 2013 *Environmental Orientation of Government Procurement in Singapore* PhD Thesis (RMIT University, Melbourne, Australia)
- [21] Bratt C, Hallstedt S, Robèrt K H, Broman G and Oldmark J 2011 Assessment of eco-labelling criteria development from a strategic sustainability perspective *J. Clean. Prod.* **30** 1631-8

- [22] Mosgaard M, Riisgaard H and Huulgaard R D 2013 Greening non-product-related procurement—when policy meets reality *J. Clean. Prod.* **39** 137-145
- [23] Møller M M, Johansen J and Boer H 2013 Managing buyer-supplier relationships and inter-organisational competence development *Integr. Manuf. Syst.* **14**(4) 369-379
- [24] Routroy S and Pradhan S K 2012 Framework for green procurement: a case study. *Int. J. of Proc. Manage.* **5** 3 316-336.
- [25] Lam P T, Chan E H, Poon C S, Chau C K, Chun K P, 2010 Factors affecting the implementation of green specifications in construction. *J. Environ. Manage.* **91** 3 654-661.
- [26] Wahid N A, Rahbar E, Shyan, T S, 2011 Factors influencing the green purchase behavior of Penang environmental volunteers. *Int. Bus. Manag.* **5** 1 38-49.
- [27] Yang W, Zhang Y, Research on factors of green purchasing practices of Chinese. *J. of bus. manag.econ.* 2012; **3**(5), pp.222-231.