Key Success Factors of Implementing Green Procurement in Public Construction Projects in Malaysia

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Abstract. In construction industry, sustainability is no longer an option but an imperative. It turns to be an essential element for project stakeholders. Although green procurement is an environmental policy instrument that considers the impact of procurement and purchasing process for the sustainability of project development. However, the concept in Malaysia is still in its early stages and encounters barriers to make a paradigm shift towards a greener approach. This paper tends to shed light on the key success factors and to develop a roadmap for implementing green procurement in building and infrastructure projects. This could pave the road for establishing a transformation plan that could gradually overcome the current challenges. In this study, 380 Malaysian corporations were surveyed to determine their perspective on 50 factors affecting procurement delivery. A number of 142 questionnaires were assessed as valid responses. Results revealed that there is an excellent consistency in the investigated factors which have been statistically analyzed. The significant factors can be categorized into themes namely, perception, organizational management, regulative, logistical, contractual, technical, strategic and financial factors.

1. Introduction
Recently, sustainability becomes an essential pillar for any development. Indeed, it is debated as an indicator of the advancement of nations. The construction sector is considered one of the major pollutants. Globally, construction of building and infrastructure play a major role in producing 40% of CO2 emissions, 30% solid wastes and 20% water pollution [1].

Today, there are urgent calls towards sustainable development in order to respond to the rapid climate changes and minimize the impact on the environment [2].

Green Procurement is defined as “The act of obtaining or disposal and recognition of goods, services, engineering and construction work. It also encompasses the integration and implementation of environmentally friendly practices throughout the processes involved in producing a construction output such as a building or infrastructure” [3]. The Malaysian government is making efforts for minimizing greenhouse gas emissions up to 40% by the year 2020 as compared to 2005 levels. This is to implement the Cancun agreement and the Bali declaration of joint efforts of emission reduction by
both developed and developing countries [4]. In this context, some strategies were recognized by the Malaysian government to accomplish that target. One of the strategies is green procurement which was introduced under the National Green Technology Policy 2009 [5]. The concept of green procurement is somehow new in Malaysia and needs to be studied from different dimensions [6]. Although green procurement provides a wide range of benefits for society, the implementation is facing several challenges in developing countries including Malaysia. Effective and precise preliminary planning is an essential requirement for developing green projects due to the challenges and uncertainty measures that are encountered by the stakeholders [7].

In practice, sustainability outcomes can be achieved through the procurement process. Undoubtedly, green public procurement may act as an engine or instrument for innovative solutions. In another word, it could fuel the market for sustainable solutions and creates opportunities for new green products and services. Although green procurement may provide an opportunity to move towards greener construction, the actual delivery and practicability need more studies to be conducted [8]. Based on Bidin, et al, [9] there are 60 green procurement practices identified and may guide stakeholders to implement green procurement in the Malaysian construction projects. However, there some obstacles hindering the adoption of green procurement practices. The concept faces several obstacles such as related to awareness and knowledge levels among construction practitioners. Additionally, the fragmented strategies and isolated practices to promote green buildings and infrastructure are also barriers preventing the change. This makes the integration of these isolated practices into green procurement as a challenge [3, 9-10].

Currently, the guidelines for green procurement are fragmented [3]. Research discussions on “Green Public Procurement (GPP) have mostly focused on the specific impacts of GPP implementation, while the discussion on GPP as compared to other environmental policy tools, in terms of efficiency and innovation, is still lagging behind” [11]. Furthermore, from a practical point of view, stakeholders have no practical guidelines to procure sustainable solutions. This results in isolation between policy formulation and actual project delivery [12]. Different barriers making the implementation of green projects low priority such as the increased cost of green products and services as well as the lack of legislation to introduce mandatory influence [13]. This study attempts to investigate the effective measures that can be considered as key success factors to overcome the current barriers. Accomplishing this will act as a platform to evaluate the effectiveness of green procurement criteria in the next phase of this study.

2. Literature review

In Malaysia, the construction activities are rapidly increasing and there are continuous initiatives towards a more sustainable approach. MyHijau is a green procurement initiative introduced by the Malaysian government as one of the fruitful efforts to promote the implementation. If well employed, green procurement can be powerful tool to fuel the wheel and drive the transformation process. Recently, it is reported by Construction Industry Transformation Program (CITP) 2016-2020, that the current market demand for environmentally-friendly solutions is still limited and there is a need to bring this issue to the surface. This causes higher carbon emissions and energy usage of buildings which make a challenge to meet the 2020 sustainability outcomes of 4 Million ton (Mt) CO2 reduction per annum. Moreover, meeting the sustainability requirement by 100% for all big scale building and infrastructure projects would not be possible unless the issue is addressed [14].

Green infrastructure and green building projects are associated with complexity and many interdependencies which requires a continuous interaction process among stakeholders. More specifically during the planning and design stage which defiantly has a significant impact on the final product due to the differences in perception and expectations and due to lack of effective measures and relevant indicators [13]. In fact, the identified factors may positively or negatively influence the environmental orientation among construction industry players. The factors that enable public stakeholders to address sustainable construction in procurement strategies have been identified. The factors are categorized into eight themes namely, perception, organizational management, regulative, logistical, contractual, technical, strategic and financial factors [15]. Therefore, there is a significant need to identify the key success factors that could enable the implementation of green procurement in
Malaysian public construction projects. Nevertheless, investigating the key success factors could pave the road for enhancing the green procurement practices and encourage moving towards greener performance levels. The outcome of this study provides insights for construction players towards green orientation. Achieving the goal of this study will be in line with the Malaysian long-term goals of sustainable development. More specifically, what has been recently emphasized by ministry of public works on the transformed public procurement known as JKR Transformasi National 2050. In this regard, there are limited studies have been undertaken to explore the success factors to implement green procurement in building and infrastructure projects. In addition, there is a lack of understanding of the current scenario and procurement practices that could prioritize the adoption. Therefore, investigating the affecting factors is the main focus of this study in order to promote adoption.

3. Research methodology
In this study, a questionnaire survey was designed based on findings identified from the literature review. A pilot study was conducted in order to test the feasibility of a small scale approach that can be employed in a larger scale study. Therefore, the study begins with the identification of the challenges that hinder the implementation of green procurement and the related key success factors in construction projects. A number of eight interviews were held with construction industry practitioners in the initial phase of this study. In this process, questionnaire surveys were distributed to 48 practitioners to obtain initial results. In the next phase, the questionnaire survey was redesigned whereby factors were rearranged, merged and some factors were omitted due to their irrelevancy. The main questionnaire survey was designed to explore the participant’s demographics, the level of their involvement in green projects and the project characteristics.

The goal of collecting the data was to establish a platform for different construction professionals to express their perspective and point of view about the potential success factors. The questionnaire was distributed to a number of construction professionals participating in the International Construction Transformation Conference 2019 (ICTC 2019) and Eco-Build Exhibition 2019 which was held in conjunction with International Construction Week 2019 during 18-21 March 2019 at MITEC-Kuala Lumpur. In addition, the data were distributed and collected in conjunction with a series of relevant seminars on Sustainable INFRASTAR, MYBIM, MyCREST and QLASSIC2019 which were organized by CIDB Malaysia in Terengganu 26th of Jun 2019 and in Johor on the 17th of July 2019. Data were also distributed and collected through a seminar on green supply chain management which was organized by SIRIM in Shah Alam 15th -16th of July 2019. In this research, a wide range of respondents participated in this study from various organizations and different backgrounds. This involves public clients, developers, architects, contractors, consultants, quantity surveyors, facility managers and participants from government organizations such as the ministry of works (JKR) and Construction Industry Development Board (CIDB). The conference put greater emphasis on reinventing construction: “how we build the future which emphasis on greening the construction industry beyond 2020”.

Undoubtedly, this has a positive impact on developing an empirical understanding of the current situation. Besides, it shed the light on the existing level of procurement practices and factors enabling stakeholders to implement green procurement. Overall, a total number of 380 questionnaires were distributed to construction industry practitioners. 142 responses were collected and validated for further analysis.

4. Data analysis and discussion
The data analysis related to respondents’ backgrounds, projects characteristics and key success factors are tabulated in Table 1 and briefly elaborated.

4.1. Respondents’ Demographic Profile
Respondents’ characteristics are assessed in terms of their educational qualification, practical experience, designation, position in the project. Besides, the evaluation of respondents on the level of their involvement in green projects. The summary of the respondents profile is shown in Table 1.
Table 1. Respondents’ profile.

| Demographic Features         | Frequency | Percent (%) |
|------------------------------|-----------|-------------|
| Designation                  | Executives| 34          | 24%         |
|                              | Directors | 10          | 7%          |
|                              | Senior Management | 45 | 32%         |
|                              | Junior Management | 14 | 10%         |
|                              | Engineers  | 31          | 22%         |
|                              | Academician| 8           | 5%          |
| Position in the project      | Consultant| 39          | 27%         |
|                              | Public Client / Government Body | 28 | 20%         |
|                              | Procurement officer | 4 | 3%          |
|                              | Developer   | 16          | 11%         |
|                              | Architect   | 8           | 6%          |
|                              | Contractor  | 18          | 13%         |
|                              | Quantity Surveyor | 16 | 11%         |
|                              | Facility Manager | 2 | 1%          |
|                              | Supplier    | 11          | 8%          |
| Educational Qualifications   | Diploma    | 31          | 22%         |
|                              | Bachelor’s degree | 79 | 55%         |
|                              | Master’s degree | 27 | 19%         |
|                              | PhD         | 5           | 4%          |
| Experience in construction industry | Less than 5 years | 38 | 27%         |
|                              | 5 to 10 years | 39 | 27%         |
|                              | More than 10 years | 65 | 46%         |
| Involvement in green project | First Project | 20 | 14%         |
|                              | More than Project | 45 | 32%         |
|                              | None        | 77          | 54%         |
| Organization Establishment   | Public      | 55          | 39%         |
|                              | Private     | 85          | 60%         |
|                              | NGOs        | 2           | 1%          |

Respondent’ Demographic Profile (n =142)

4.2. Projects’ characteristics

Table 2 summarizes the project features that is referred to as the respondents in answering this questionnaire about the latest project they were involved in.
Table 2. Project’s characteristics.

| Projects features                  | Frequency | Percent (%) |
|-----------------------------------|-----------|-------------|
| Project location                  | Peninsular Malaysia | 135 | 95% |
|                                  | Sabah     | 7 | 5% |
|                                  | Sarawak   | 0 | 0% |
| Project type                      | Residential Buildings | 36 | 23% |
|                                  | Commercial Buildings | 33 | 21% |
|                                  | Industrial buildings | 16 | 10% |
|                                  | Institutional Building | 16 | 10% |
|                                  | Healthcare Buildings | 3 | 2% |
|                                  | Mixed-Development | 2 | 1% |
|                                  | Infrastructure | 45 | 29% |
|                                  | Other      | 6 | 4% |
| Green recognition                | Platinum certification | 4 | 3% |
|                                  | Gold certification | 6 | 4% |
|                                  | Silver certification | 10 | 7% |
|                                  | Certified certification | 37 | 26% |
|                                  | Application Stage | 12 | 9% |
|                                  | None Certified | 73 | 51% |
| Contract Strategy                | Traditional Procurement | 59 | 41% |
|                                  | Design and Build | 50 | 35% |
|                                  | Project Management Agency | 25 | 18% |
|                                  | Private Finance Initiative (PFI) | 4 | 3% |
|                                  | N.A        | 4 | 3% |
| Project Client                   | Federal Government | 41 | 25% |
|                                  | State Government | 70 | 42% |
|                                  | Local Authorities | 15 | 9% |
|                                  | Private Sector/Developer | 39 | 23% |
|                                  | Other      | 2 | 1% |
| Project Size                     | ≤ RM200,000 | 13 | 9% |
|                                  | ≤RM500,000 | 16 | 11% |
|                                  | ≤ RM1 million | 15 | 11% |
|                                  | ≤ RM3 million | 23 | 16% |
|                                  | ≤ RM5 million | 17 | 12% |
|                                  | ≤ RM10 million | 21 | 15% |
|                                  | ≥ RM10 million | 27 | 19% |
|                                  | N.A        | 10 | 7% |

Projects characteristics (n = 142)
4.3. Success factors and framework for implementing green procurement

Several success factors are defined by different researchers in order to prioritize the organization's needs to achieve green procurement goals. Figure 2 shows the conceptual framework to implement green procurement in Malaysia. The basic idea of this framework is to integrate green principles into the main aspects of procurement. These three aspects are namely “policies and guidelines, products and processes, environmental evaluation”. This integration can be an effective instrument for creating green-orientation within construction organizations. Although the three pillars are influenced by drivers and opportunities, in contrast, the pillars encounter barriers and challenges. As the scope of this study, the emphasis is on the key affecting factors to overcome the challenges and expand the circle of enablers of green procurement delivery. Therefore, 50 factors were identified and categorized into 8 themes as illustrated in Figure 1 and tabulated in Table 3. Implementing key success factors may pave the road for achieving green project performance. The green performance project will eventually lead to harvesting the desired outcomes of sustainability environmentally, financially and socially.

![Figure 1. Preliminary framework of green procurement in construction projects](image)

Therefore, 50 success factors were explored from literature in order to be examined and ranked for effective implementation. The responses were tested for consistency and the results show an excellent consistency of 0.976 Cronbach’s alpha. The analysis revealed a high mean greater than 3.77 and relatively high slandered deviation greater than 0.532. This indicates that the identified factors considerably influence respondents’ decisions to implement green procurement. However, the factors are spread out over a wider range of values mainly due to the variation of stakeholders and their different perspectives. The success factors were analyzed through a descriptive analysis where the mean, standard deviation and ranking are listed in Table 3. It can be seen that there is a high level of agreement on the relevancy of the identified measures. Therefore, the results indicate the significance of the investigated factors and their potential to drive the green procurement transformation process.
Table 3. Success factors for implementing green procurement.

| Code | Success Factor                                                                 | Mean  | Std. Dev | Rank |
|------|--------------------------------------------------------------------------------|-------|----------|------|
| SF19 | Consideration of whole life costing and value of money.                         | 4.25  | 0.665    | 1    |
| SF20 | Public procurers to facilitate publicity of actions towards greener approach.  | 4.17  | 0.583    | 2    |
| SF24 | Cooperation and synergy between government, consultants and suppliers to        | 4.15  | 0.622    | 3    |
|       | develop a reliable and accessible database of green specifications.             |       |          |      |
| SF28 | Conducting research on cost-saving proof by green procurement                   | 4.15  | 0.630    | 4    |
| SF18 | Transparency in procurement decision-making process.                            | 4.15  | 0.694    | 5    |
| SF10 | Evaluating alternative procurement methods to achieve objectives.              | 4.11  | 0.620    | 6    |
| SF12 | Selecting materials based on low risks to the environment.                     | 4.10  | 0.718    | 7    |
| SF02 | Raising awareness on sustainability issues and promote green policy             | 4.08  | 0.785    | 8    |
| SF44 | Government initiative to implement green procurement for large projects        | 4.06  | 0.751    | 9    |
| SF49 | Financial support and funding for green projects to drive the adoption.        | 4.05  | 0.737    | 10   |
| SF32 | Project clients to consider costs and benefits by life-cycle costing.          | 4.04  | 0.640    | 11   |
| SF09 | Competency of people responsible for implementing and assessment.              | 4.04  | 0.629    | 12   |
| SF07 | Implementing green procurement goals to job descriptions and procedures.      | 4.04  | 0.544    | 13   |
| SF05 | Clear policies, green guidelines and commitment by project clients              | 4.03  | 0.684    | 14   |
| SF30 | Expand categories and ranges of green alternatives for clients to choose        | 4.03  | 0.532    | 15   |
| SF50 | Green projects to be subsidized to show government’s commitment.               | 4.03  | 0.684    | 16   |
| SF39 | Provision of incentives and rewards based on sustainable performance.          | 4.01  | 0.762    | 17   |
| SF21 | Introducing mandatory influence for environmental regulations.                 | 4.01  | 0.744    | 18   |
| SF16 | Stakeholder’s mutual understanding and environmental collaboration.             | 4.01  | 0.565    | 19   |
| SF11 | Improving organizational business reputation and competitiveness.              | 4.01  | 0.565    | 20   |
| SF23 | Expand the diversity, the liability of registered green-labeled materials.     | 4.01  | 0.601    | 21   |
| SF29 | Apply quality certification for green materials(pre-determined standard)       | 4.01  | 0.589    | 22   |
| SF03 | Use of campaigns to introduce and promote green labeling scheme                | 3.99  | 0.821    | 23   |
| SF22 | Procuring green-labelled materials listed in (MyHijau).                         | 3.99  | 0.652    | 24   |
| SF14 | Involvement of project stakeholders and adopting a top-bottom strategy         | 3.99  | 0.704    | 25   |
| SF41 | Sustainability issues to be incorporated into value and risk management.       | 3.98  | 0.647    | 26   |
| SF42 | Utilization of existing assessment and measurement tools such as (GBI).         | 3.96  | 0.600    | 27   |
| SF06 | Availability of proven green specification model clauses.                      | 3.96  | 0.657    | 28   |
| SF37 | Encouraging tenderer and local market to suggest innovative solutions.         | 3.96  | 0.662    | 29   |
| SF45 | Improve the competency of construction bodies as international trends.         | 3.95  | 0.550    | 30   |
| SF27 | Sharing” green- premium ”with customers upon green certification award         | 3.94  | 0.671    | 31   |
| SF40 | To clearly evaluate and measure sustainability requirements                     | 3.92  | 0.642    | 32   |
| SF31 | Benchmarking green project for effectively reduced energy consumption.         | 3.92  | 0.608    | 33   |
| SF26 | Using green-labelled materials as a selling point of quality standard.         | 3.92  | 0.565    | 34   |
| SF01 | Developing a common understanding of sustainable procurement.                  | 3.91  | 0.798    | 35   |
| SF43 | Strategic partnering approach through contractual arrangements.                | 3.91  | 0.714    | 36   |
5. Conclusion
This research investigates the key affecting factors that could drive and enable the implementation of green procurement in public construction projects. Results revealed that green procurement implementation in Malaysia is still not prioritized yet and the adoption has not reached the desired level. Meanwhile, there is an increasing willingness by construction stakeholders towards a greener approach, but organizations encounter difficulties to implement green procurement practices. This research recommended corporations to utilize the suggested measures to gradually overcome the current obstacles and encourage the transformation towards green orientation. Financial support from the government through subsidizing green projects is an important factor. Government initiative to implement green procurement for all public large projects and benchmarking green projects will accelerate the adoption. More mandatory influence is another important measure. Raising awareness and capacity building through training, institutional organizations will help to bridge the existing gap. In addition, corporations should adopt best practices from experts and develop an individual transformation plan to cope up with the international trend towards achieving sustainable construction.

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Table 3. Success factors for implementing green procurement (Cont.).

| Code | Success Factor                                                                 | Mean | Std. Dev | Rank |
|------|-------------------------------------------------------------------------------|------|----------|------|
| SF04 | Corporate environmental vision, green procurement orientation                | 3.90 | 0.793    | 37   |
| SF17 | Considering multi alternatives to meet the needs.                            | 3.90 | 0.793    | 38   |
| SF48 | Aiming a specific target (%) for sustainable detailed specifications.        | 3.89 | 0.638    | 39   |
| SF25 | Encourage the demand of green products/systems in tender requirements.       | 3.89 | 0.681    | 40   |
| SF38 | Employing skilled and well-trained manpower within the supply side.          | 3.89 | 0.568    | 41   |
| SF46 | Requirements of green aspects for performance-based specifications.          | 3.88 | 0.658    | 42   |
| SF35 | Implementing site precaution measures to mitigate environmental pollution and allow enough time to address sustainability issues. | 3.87 | 0.629    | 43   |
| SF15 | Understanding stakeholders’ expectations on the project performance.          | 3.87 | 0.733    | 44   |
| SF33 | Use of technology to simulate the process for green design to reduce waste.  | 3.85 | 0.641    | 45   |
| SF13 | Trust building in suppliers, audit monitoring and compliance.                | 3.85 | 0.630    | 46   |
| SF08 | Dedicated resources, green expertise to facilitate green procurement.        | 3.85 | 0.694    | 47   |
| SF34 | Quality-bidding strategy for green components into tender pre-qualification. | 3.79 | 0.672    | 48   |
| SF36 | Integrating sustainability requirements in tender evaluation, selection procedures and consider green criteria as a priority. | 3.78 | 0.764    | 49   |
| SF47 | Continuous monitoring, tracking, review process for effective delivery.      | 3.77 | 0.845    | 50   |
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