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Green oriented procurement for building projects: Preliminary findings from Malaysia

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Abstract

As Malaysia is planning an increasing number of construction projects in the near future, a major imperative is to embark on a 'greener path' to ensure a more sustainable future. One of the efforts currently being undertaken is the introduction of green procurement, which is part of the government's *MyHijau* initiative and highlighted in the Malaysian economic planning program. Previous studies have found that the concept of green procurement is still very new to the Malaysian construction industry and accordingly have sought to address the low levels of knowledge in this area. This paper presents preliminary findings of green procurement practices in Malaysia based on a review of the existing literature as well as a pilot study utilising semi-structured interviews of experienced practitioners. Our findings indicate that, although the term 'green procurement' is not being used broadly across construction stakeholders, some green practices related to procurement are developing in the industry. These include the availability of green procurement guidelines and the inclusion of green criteria in the tender process, with due consideration given to green purchasing. The findings are encouraging and point to an increasing awareness, practices and implementation of green procurement by practitioners in Malaysia. It is envisaged that the paper will provide the basis for future research into green procurement practices for construction projects in Malaysia and beyond.

Keywords: green construction, green procurement, green practices, Malaysian Construction Industry

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1.0 Introduction

The gradual deterioration of the global environment has been highlighted in many major environmental forums. There have been urgent pleas for necessary remedial action from a variety of sources to conserve and minimise further environmental impact and damage (Dodds et al., 2012). In many developing countries, massive physical development is still taking place to provide much-needed facilities (e.g., building and infrastructure) for local communities. This is consequently contributing to a host of environmental problems, such as indoor and outdoor environmental pollution (Ding, 2008; Geng and Doberstein, 2008), the production of carbon dioxide emissions that cause an imbalance in the ecosystem and impact on climate and ozone depletion (Hes, 2008), significant energy consumption and usage of almost half the global natural resources, in addition to the generation of a large amount of waste (del Río Merino et al., 2010). A delicate balance is needed between the economic and social aspects, and environmental conservation. Thus, there is a call for individuals, as well as public and private organizations, worldwide. There is a clear need for current development to bring about a more comfortable and prosperous existence for the large number of people in the world living in less affluent circumstances.

Early recognition of the problem came about in the seminal 1987 Brundtland Report. This report advocated that the competing issues of physical development and environmental sustainability must be considered together for the improvement of resource management and to reduce resource degradation and minimize pollution for the benefit of future generations (WSSD, 2002). The Kyoto protocol restricts greenhouse gas (GHG) emission limits for developed countries, while concessions are made for GHG emissions in developing countries. This considers each country's developmental needs while still being committed to the reduction of GHG emissions by international treaty. Developing countries are urged to plan their infrastructure needs carefully and ensure that sustainable methods and materials are incorporated. This approach can be highly beneficial for the country, and current and future communities.

In development practice, key decisions occurring in the early stages have the most direct impact on a project's environmental footprint. Of these, procurement is seen as being one of the most important and powerful agents of change, having important multi-dimensional tools capable of integrating green practices throughout the project development process (Bratt et al., 2013; Preuss, 2009; Ruparathna and Hewage, 2015; Zsidisin and Hendrick, 1998). Indeed, green procurement is being increasingly introduced to complement current initiatives to ensure the increased adoption of green construction practices. The term 'green procurement' has been used interchangeably in the literature with terms such as 'sustainable procurement' (Grob and McGregor, 2005; Meehan and Bryde, 2011; Hughes and Laryea, 2013; McMurray et al., 2014) and 'environmental purchasing' (Coggburn and Rahm, 2005), because the term is being define differently depending on the local context and application. As discussed by Vanegas (2003), a sustainable project outcome needs to be supported by an uninterrupted chain of

management mechanisms and multi-disciplinary collaboration involving strategic planning in order to attain sustainable design, construction and operation.

Despite the importance of green procurement in the literature and its burgeoning practices in developed countries, it is nevertheless an emerging concept in many Southeast Asian countries, including Malaysia. The government of Malaysia has started an initiative by establishing both a long and a short action plan that encourages collaboration between industry and academia. The concept of green procurement has been established under *MyHijau* programs. The *MyHijau* Program was launched in 2012 as a platform to encourage green technology and green purchasing under the Ministry of Energy, Green Technology and Water (KeTTHA) and the Malaysia Green Tech Corporation (MGTC). However, the strategic framework for green procurement is still being developed. This will provide a set of specific guidelines for the purchase of green materials and services and create a foundation of awareness that will trigger the need for action by every industry player.

As suggested by Appolloni et al. (2014), more research needs to be conducted to understand best green procurement practices. Although there are emerging publications relating to green procurement for construction, these are mainly focused on developed countries (Brammer and Walker, 2011) such as Japan, Singapore, Australia, the United Kingdom and United States, with little based on the experience of developing countries. Publications concerning green procurement specifically in the Malaysian construction industry, including those by Bakar et al. (2011), Adham and Siwar (2012), Musa et al. (2013), McMurray et al. (2014) and Adham (2014), mainly focus on introducing the concept of green procurement for government projects.

In response, this paper presents findings based on an exploratory study of industry practitioners' perspective in terms of their knowledge base of green procurement practices in Malaysia, as this plays a direct role in the delivery of green projects. The study is presented in the form of a comprehensive review of existing literature and a pilot study involving semi-structured interviews with practitioners experienced in green projects to answer research questions posed in this paper of "What is the current state of green procurement implementation in Malaysia and what are the factors and practices that are important for green oriented procurement of a construction project in Malaysia?"

2.0 Literature review

2.1 Green procurement generally

In the cross-disciplinary area of green procurement research, green procurement has been defined by various studies and organizations based on local cultural and organizational needs. Fig. 1 summarizes the definition and identification of the key objectives of green procurement practices.

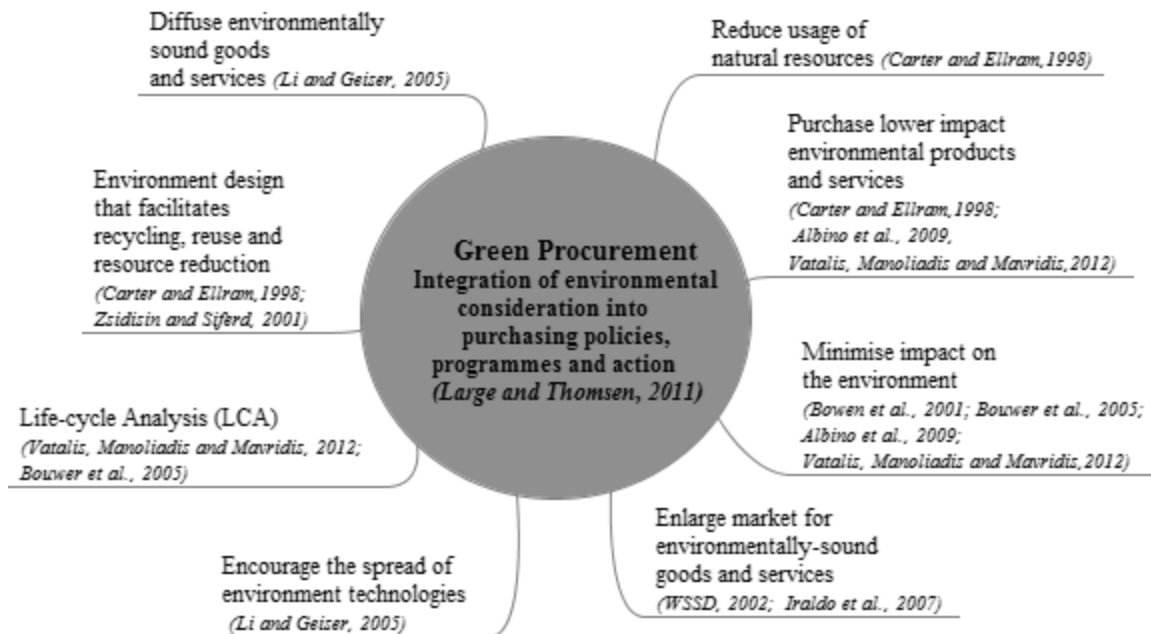


Fig.1. Keywords used in green procurement definitions by various studies and organizations (*authors' compilation from various sources*)

Based on Fig. 1, it is concluded that procurement that is concerned with minimizing environmental impact is referred to as 'green procurement'. The definitions can be further divided into a few themes to capture the key terms used to describe green procurement. The term 'green' refers to the acknowledgment, incorporation and implementation of environmental practices, and the initiatives or systems designed to minimize environmental impact during their life cycle (Albino et al., 2009; Winkler, 2010). However, consideration is also given to economics, specifically the feasible and social benefits that affect the well-being of the organization and stakeholders (Rogers et al., 2006).

The green procurement approach has been suggested by previous researchers as a potential instrument to obtain environmental benefits. The adoption of green procurement helps to create a demand for green materials, products and services. This demand will be able to diffuse green materials and services into the market. A green product or service can claim to have a minimal environmental footprint compared with a standard product or the similar type of service, where the environmental footprint refers to the overall impact on the environment, including energy and water consumption, as well as the effects on health and other aspects of the human environment. Green materials have several advantages, namely a significant recycled content and the ability to be made from renewable biological resources or be created by processes that use a lower amount of energy and produce a low amount of pollutants. Eco-labelling helps the purchaser to make a decision by identifying the green impact of products (Bratt, 2011). Examples of such labelling include Energy Star (USA), Environmental Choice (New Zealand) and

Green Mark (Singapore). The labelling also acts as a guide in assessing the products used to create benchmark criteria for evaluation and scoring.

Richards (1994) argues in favor of green procurement that considers the principle of life cycle analysis (LCA) throughout the product or service life cycle. This study suggests that one of the most far-reaching implications of cleaner production is to take an environmental life cycle approach to production. LCA measures the environmental impact of materials and products, such as fabrication, usage and end-of-life options throughout the product, and services life cycle (Hendrickson et al., 1998). The incorporation of green practices as part of the tender and contract requirements can ensure a compliance that will benefit the environment.

Legislative requirements are common external requirements that drive organizations towards sustainability (Adham et al., 2012; Grob and McGregor, 2005). Grob and McGregor (2005) suggest that procurement needs to be responsive to environmental obligations, whether they arise from laws, regulations, contract, industry standards, internal policies or societal expectations. Qi et al. (2010) found that government environmental regulations and policies are a significant driver in the adoption of green practices. Policies and regulations must be in place and, more importantly, they need to be effectively and efficiently enforced (Sood et al., 2011; Ruparathna and Hewage, 2015). Grob and McGregor (2005) also mention that organisations' need to develop their own mechanisms and strategies to review green progress and identify opportunities regularly throughout project delivery to achieve a better green performance. The available external rating and assessment tools also aim to ensure the organization meets minimal compliance requirements. According to Varnas et al. (2009), monitoring also determines the effectiveness of green initiatives and helps to build the credibility of an organization. The most common practices mentioned in literature are third party rating tools and assessment tools, their difference being that assessment tools are based on quantitative performance indicators and rating tools determine the performance level of the building.

2.2 Green procurement of construction projects

The adverse impacts of construction on the natural environment have long been criticized and it is crucial that they are minimized as much as possible. Wu, Yan and Huang (2012) classify the natural environment as the customer for the construction industry and, as such, the end product should also consider the environmental dimension of building. The green concept is referred to as considering sustainable practices in order to achieve another dimension of project performance known as green performance. The concept of green building should be regarded as a process rather than just the end product when the complete project life cycle is considered (Wu and Low, 2010).

The concept of sustainability is a basic starting point for the sustainability principle that has subsequently been adopted by parties, comprising key construction industry

stakeholders such as policy makers, academia and industry practitioners. The sustainability Triple Bottom Line (TBL) comprises environmental, economic and social concepts (Shelbourn et al., 2006). Rogers et al. (2006) observe that these three sets of dimensions derived from the TBL concept are often used to gauge the success of a project's green performance and, in the context of the built environment, are essential for evaluating a building's response to achieving sustainability.

Many agree that construction procurement is a vital tool for managing the environmental issues involved in construction projects (Zhu et al., 2013). The term 'building procurement' refers to an "amalgam of activities undertaken by a client/owner when seeking to arrange the construction or refurbishment of a building" (Franks, 1998). It also includes the "structure of responsibilities and authorities of the stakeholders within the overall framework of constructing a building" (Love et al., 1998). Combining the definition of green procurement illustrated in Fig.1 and the term "building procurement" as used in Section 2.1, the term 'green procurement for building projects' in the context of this paper can be understood to be:

"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. In addition, it incorporates the framework and structure of responsibilities and authorities for stakeholders within a building project."

Green procurement is defined here as recognizing, integrating and implementing green practices throughout the procurement processes. The procurement of a building is a complex process starting from the strategic planning stage and continuing until contract execution. In development practice, early decisions are the most vital and influential and, of these, procurement is seen as one of the most important and powerful agents of change. The procurement process includes several important multi-dimensional tools capable of integrating green practices throughout the development process (Bratt et al, 2013; Preuss, 2009; Ruparathna and Hewage, 2015; Zsidisin and Hendrick, 1998). As mentioned, decisions pertaining to green strategy and expected green performance must be made at the strategic planning stage. Decisions made during the planning stage are crucial due to their cascading effects at the later part of the development life cycle (Abu Hassim et al., 2011) and because they require continuous auditing or evaluation throughout the process.

Rating tools such as Building Research Establishment Environmental Assessment Method (BREEAM) in the United Kingdom, Leadership in Energy (LEED) in United States, Green Mark in Singapore and Green Star in Australia are widely used in the industry.

2.3 Green construction procurement in the Malaysian context

There are clear indications that Malaysia is very eager to embark on the path of sustainability. As stipulated by the Malaysian Prime Minister, for instance, in the recent 11th Malaysian Plan (SCP Malaysia, 2015), green growth is a necessary strategy for achieving Malaysia's aspirations to advance its economic and societal growth. The development of strategies designed to engage with green growth also indicates that Malaysia is moving towards sustainability. It is a concept that promotes win-win outcomes which stimulates economic growth without compromising the environment or risking the needs of future generations. The World Bank understands the green growth concept as:

“Growth that is efficient in its use of natural resources, clean, in that it minimizes pollution and environmental impacts, and resilient, in that it accounts for natural hazards and the role of environmental management and natural capital in preventing physical disaster.” (Bowen, 2012: p. 8)

This is also mentioned in the ten-year Malaysian Construction Industry Master Plan (CIMP) for 2006-2015, which addresses sustainability issues by emphasizing the highest standards of quality, occupational health and safety, as well as health and environment practices, and recommends procedures “to foster quality and an environmentally-friendly culture” (Kahlenborn et al., 2013).

Green procurement was first introduced in the Tenth Malaysian Plan (Musa et al., 2013). The Ministry of Energy, Green Technology and Water (MEGTW or KeTTHA) and the Ministry of Finance of Malaysia (MoF) (both of which are responsible for green procurement adoption in Malaysia), define green procurement as:

“Procurement activities of products, services and works considering environmental criteria and standards that conserve the natural environment and resources, which minimizes and reduces the negative impact of human activities.” (SCP Malaysia, 2013, p.6)

This definition of SCP Malaysia has been the basis for every industry in Malaysia to guide their procurement system towards a greener path. In Malaysia, green procurement focuses mainly on environmental impact and this has prompted the construction industry to procure more sustainable products and services (Adham and Siwar, 2012; Kahlenborn et al., 2013). A few initiatives exist to encourage the public and private sectors to adopt green procurement in their procurement systems, such as the eco-labelling and green supplier data directory produced by KeTTHA. Malaysia has launched a few pilot projects under the umbrella of a short-term action plan as a preliminary step towards green procurement. The government has also issued instructions and circulars concerning the need to obtain best value for money in any government procurement situation. This means that costs other than primary investment, such as energy costs, should be taken into consideration (Kahlenborn et al., 2013).

Although the green procurement objectives, strategies and mechanisms are available in government strategic planning, studies of the actual delivery and practices involved in green procurement have not yet been conducted in Malaysia. For the construction industry, specifically, there are currently no specific guidelines for green procurement. Although “green building” is a major priority, knowledge of green procurement is unclear and fragmented. For instance, while green procurement should be one of the criteria for producing a green building, the available rating tools do not include any financial aspects in the evaluation framework. This contradicts the ultimate principle of development, because a project may be environmentally-sound but very expensive to build - while obtaining an adequate financial return is fundamental for all projects (Ding, 2008).

2.4 Exploration of important factors of green-oriented procurement

Appolloni et al. (2014) argues current research relating to green purchasing is fragmented and lacks a theoretical basis. In response, this paper adopts the idea proposed by Handfield et al. (2002) of green procurement as a concept of environmental management. This views green procurement as part of an environmentally conscious enterprise that aims to fulfil the environmental objectives of an organization. In the context of building projects, the role of the stakeholder is crucial in both determining the direction of green-oriented procurement and setting the critical success factors. This involves identifying the factors or practices that help determine the green orientation of their procurement and provide an opportunity to integrate green practices into procurement.

Fig. 2 provides a preliminary model based on the preceding discussion and synthesis of the existing literature and practices in Malaysia’s built environment and beyond, and a list of factors and practices that are associated with green procurement and affect a project’s environmental performance identified from the literature are summarized in Table 1.

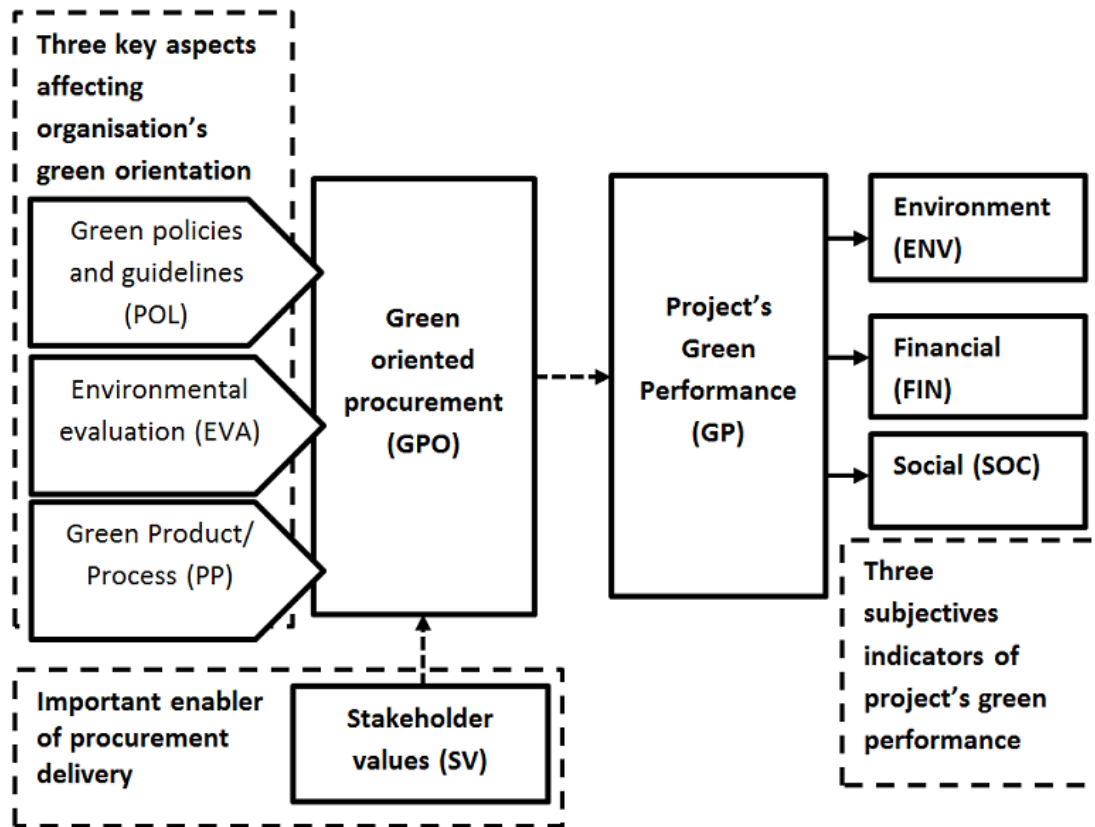


Fig. 2. Preliminary model of green procurement for building projects

Adopting green procurement means an organization needs to commit to minimizing the environmental impacts and consequences of its construction activities by the deliberate selection and assessment of products and services at all developmental stages. For the construction industry, project performance is typically measured in terms of quality, cost and time. However, the demand for performance measurement also currently includes green performance. The three most important green performance aspects are concerned with environmental, social and economic aspects, also known as the triple bottom line assessment (Shelbourn et al., 2006, Rogers, Jalal and Boyd, 2006). Environmental performance mainly aims to reduce greenhouse gas emissions, reduce pollution levels, manage natural resources and the management and disposal of waste; economic performance relates to the concept of value for money; while social performance relates to the level of satisfaction of project clients in terms of obtaining a good reputation, cost performance and design performance (Rogers, Jalal, and Boyd, 2006 and Hussin, Abdul Rahman and Memon, 2013).

Project stakeholders need to review green progress and identify opportunities regularly throughout project delivery to achieve better green performance. A clear measurement of performance will determine how well the green progress procedure has advanced and what improvements need to be made along the way. Some organizations have formal mechanisms with which to ensure compliance and to track non-compliance issues. For example, tender evaluation is one of the tools used for examining environmental criteria

based on a project's environmental requirements listed in the technical specifications (Varnäs et al., 2009). This environmental criterion is integrated into tenders and contracts to ensure it becomes part of the development goals (Sterner, 2002). Compliance with government legislation is also another way of assessing green performance (Grob and McGregor, 2005).

As Meehan and Byrde (2012) note, government legislation is a strong driver in orienting industry's adoption of green practices. Pressures from government and industry through local by-laws and industry guidelines can improve project environmental performance (Liu et al., 2012; Bakir, 2014; Wong et al., 2016). According to Bakir (2014), the successful implementation of green initiatives requires up-to-date information and guidelines from both government and industry. Some studies reveal that industry guidelines such as the International Organisation for Standardization (ISO) 14001 and the Environmental Management System (EMS) can play an active role in ensuring green practices. Eco-labelling programs also provide guidelines and create awareness to help stakeholders in choosing green products and services (Bratt, 2011).

In temporary project organizations, as is typified in construction work, the role of team members is important in ensuring that projects meet the stakeholders' predetermined objectives and expectations. Stakeholder values, such as commitment and capability, can have a significant and direct impact on a project's green performance (Wong et al., 2016). Commitment refers to individuals in an organization who share a strong belief in the organization's goals and values, while capability is measured in terms of knowledge and experience (Zollo and Winter, 2002). ISO14001 and the EMS are the most common and globally-used indicators to signal a firm's improved environmental performance to the stakeholders (Bouwer et al., 2006; Qi et al., 2011; Varnäs et al., 2009). Moreover, the stakeholders' ability and willingness to improve their knowledge through training and collaboration is crucial in order to improve their performance (Robichaud and Anantatmula, 2011).

Please insert Table <1> here

Table 1. Variables for a preliminary model of green procurement for building

3.0 Methodology

3.1 Research design

A comprehensive literature review was conducted and a provisional list of practices that influence the environmental performance of a building construction project was created. Following this, interviews with expert practitioners were conducted to explore the research area further and obtain a better understanding of current practices and phenomena in the Malaysian construction industry. Early consultation with construction practitioners is widely used in construction studies to confirm the appropriateness of the factors involved (Meng, 2011). Fig. 3 summarizes the data gathering processes involved.

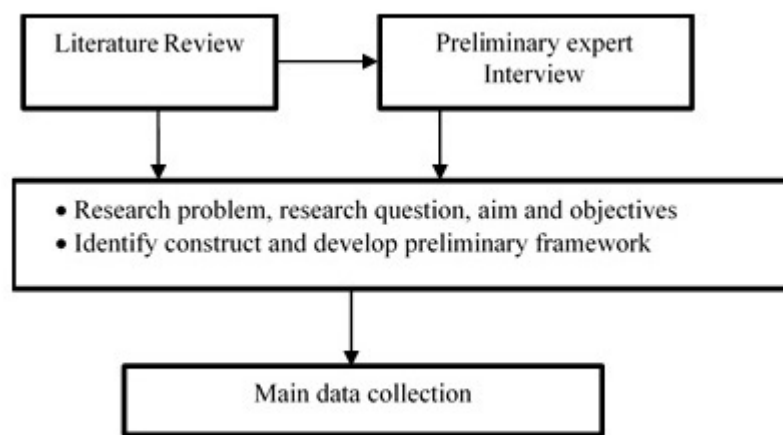


Fig. 3. Research design

3.2 Interview data collection procedure

Purposive sampling was used to select experts who best exhibit the characteristics and expertise appropriate for this study. Due to the limited number of green projects in Malaysia, eight prominent green building projects were identified and relevant practitioners invited to participate in the study. Of the eight projects, four experts working on those projects agreed to participate. This rate falls within the recommended range set by Romney et al. (1986), who recommend four to five interviews being conducted with participants having a high level of knowledge and expertise in the specific area of research. One project is platinum-certified by the Malaysian Green Building Index, two are gold-certified projects and one is a silver-certified project.

The key profiles of the interviewees are shown in Table 2. All the interviewees have been involved in at least one green building project and are involved in green-certified projects under the voluntary Green Building Index (GBI) rating tools. Since green building is still an emerging concept in Malaysia, their experience is very valuable for future guidance and improvement. The interviewees are the entire key stakeholders involved from the planning stage to project hand-over.

Please insert Table <2> here
Table 2. Key profiles of interviewees

Data was collected using semi-structured interviews at a place and time predetermined by the interviewees. Potential interviewees were contacted to seek their interest and agreement to participate and the objectives of the interview were explained by the researcher. Upon receiving verbal consent, a pre-interview information sheet was sent by email highlighting what to expect at the interview and seeking agreement to proceed further. The interviews were conducted face to face, took 40-60 minutes to complete and were audio-recorded. The questions were designed to allow interviewees to provide their expert knowledge on green procurement as follows:

- the understanding of the “green” concept
- the drivers or motivating factors for adopting green practices
- the practices of green projects (focusing on procurement practices)
- an open question for any other issues the interviewee wished to add or discuss.

All the interviewees were assigned codes to protect their anonymity and the interviews were recorded and transcribed verbatim. The transcripts were proofread by the researcher to ensure their accuracy compared to the audio-recorded version. Most interviews were conducted in English, with only one in the Malay language. Back translation process used to ensure the accuracy of the translation. With the back-translation method, the interview conducted in the Malay language is first translated into English and then translated blindly back into the original language by an independent translator. The back-translation version is then compared with the original version in the source language. The compatibility between the back-translation version and the original version is considered to indicate translation accuracy (Douglas and Craig, 2007). A summary of the transcription was then emailed to the interviewees to ensure its accuracy. This was done in such a way as to ensure the meaning was not compromised by being taken out of context. The data were manually analyzed to identify key themes and concepts that could be subsequently followed up. The themes were also matched with the key themes identified in the literature review.

4.0 Findings and discussion

This section analyses and discusses the major findings that emerged from the literature review and semi-structured interviews, and highlights suggestions for the future way forward for green construction practices.

4.1 Policy and guidelines

Various studies have suggested the importance of defining the term “green” within the projects themselves to ensure that all project stakeholders are working towards the same objectives (Hes, 2005; Marcelino-Sádaba et al., 2015). Providing a clear direction helps each party to perform their tasks efficiently to achieve the main project goals. The interviewees mostly associate the term “green” with the need to integrate environmental protection with construction. They agree that this is derived from the awareness that everyone should be involved in the global commitment to mitigate the effects of climate change. They also understand that the green concept applies throughout the entire building lifecycle. One interviewee mentioned that ‘green’ includes considering the economic and social impacts involved – the ‘triple bottom line’ concept of sustainability (R3). One aspect also highlighted by the interviewees is that they are not guided by any specific definition but more from the need for compliance, as evidenced by such comments as:

We don't have any specific definition. The objective is mainly to help the client to achieve platinum certification. (R4)

MS1525 introduced to building sector to promote green effort and to make sure compliance by private sector. (R1)

Although the interviewees are very enthusiastic about the concept of a green project, they agree that this is still very new and at the preliminary stage for the majority of practitioners in Malaysia. The interviewees’ opinions are skewed towards positive remarks of the need to educate every stakeholder about following this greener path and that failure to understand this will lead to confusion about the priority for green construction. One of the respondents (R3) highlighted the importance of the “building green” concept to be the responsibility of each individual in order to create a culture within the industry itself.

The top-down approach is recognized as being an effective driver in the adoption of green construction and requires policies and regulations to be formulated and enforced efficiently (Ruparathna and Hewage, 2015). All the interviewees made positive remarks on the role of government in ensuring that green concepts are adopted, through the provision of environmental standards, regulatory frameworks and incentives. Two of the interviewees mentioned that the tax exemption incentives offered by the government have helped to motivate private developers (R3, R4).

Previous studies revealed that industry standards, such as the EMS and ISO 14001 certification and green labelling, act as industry guidelines. These create a dynamic role in embedding green practices throughout the process (Bratt, 2011; Testa et al., 2015). EMS and ISO certification both help in informing that the organization is operating within the environmental requirement guidelines. Eco-labelling is an effective way of

informing consumers of the green impact of products based on prescribed environmental standards to enable them to make informed purchasing decisions (Li and Geiser, 2005; Bratt, 2011). Although green labelling is still in the development stage in Malaysia, the interviewees agreed that eco-labelling is vitally important to help them in drafting their green specifications (R1, R2, R3, R4). One of the interviews highlighted a willingness to have material tested to ensure it is labelled as green material

because [the manufacture of green products] is still a young industry. Many products are still unavailable and in the process, being labelled. So, they have to go for tests, test reports and labels. Some products are imported.
(R4)

Green Building Index (GBI) rating tools have been widely used by clients and design teams to plan environmentally-friendly project delivery. GBI is in voluntary use for appraising the environmental design and performance of Malaysian buildings. The tools provide category-based checklists to enable applicants to comply with prescribed guidelines and are widely used by clients and consultants in Malaysia to deliver green projects. The tools are also recognized by industry players in Malaysia as providing a guideline for project teams to launch a green project. These industry standards also act as a guide in assessing the products to create benchmark criteria for evaluation and scoring. As stated by interviewees R2 and R3,

Although the team does not have a specific definition and we follow the guidelines given by the Green Building Index, we are all aware that being green is about a global commitment towards [mitigating the effects of] climate change. (R2)

This project also aims to protect the environment and, consequently, we are given Green Building Index guidelines and asked to work towards the certification. As for us, the duty of the consultant producing green buildings is to protect the environment for the benefit of future generations. (R3)

4.2 Green procurement-related practices

All the interviewees agree that the obvious difference with green projects is the need to consider purchasing green products and services. R1 mentioned that

... it is procurement with the existing procedure integrating green practices and specifications. (R1)

A report produced by the Malaysian Department of Business and Innovation (BIS) supports this in revealing that it is the manufacture of construction products and materials that account for the largest amount of damaging environmental emissions in the construction industry - a green product or service having a significantly smaller environmental footprint than the average or standard product or the same type of service.

Zsidisin and Sifer (2001) consider green products as products that consist of features such as environmentally friendly processes during production, ease of distribution and return, use of non-hazardous materials, sustainable waste management and product durability and reliability.

The interviewees indicate that, in any procurement setting, whether conventional, design and build or partnering, the environmental criteria of the desired products and services described in the technical specification are used as guidelines for the design team and other stakeholders.

... using a conventional building contract, we have to integrate some green specifications required by the client into the contract. (R2)

These describe a performance-based definition, including material selection, chemical content and the functional characteristics of products (Bouwer, 2005). These environmental criteria need to be integrated into the contractual requirements to ensure they become part of the development. Similarly to that mentioned by Wickenberg (2004), the interviewees agree that the environmental criteria also form a basis for the evaluation of tenders by stating minimum compliance criteria.

In this case, the selection of stakeholders includes the design team and the construction team. ISO14001 and the EMS are the most common and globally used indicators. This instrument is used for both environmental management and to signal a firm's improved environmental performance to the stakeholders (Bouwer et al., 2006; Qi et al., 2011; Varnäs et al., 2009). However, Roos (2012) argues that the selection process must be kept simple enough to encourage participation from small and medium-sized enterprises in fostering fair competition. Further, Varnäs et al. (2009) suggest that the role of EMS in project-based construction organizations should be further investigated. EMS does not guarantee high-level performance because it can be difficult to differentiate between contractors who can perform and those who simply produce attractive-looking documents (Faith-Ell et al., 2006).

Please insert Table <3> here
Table 3. Procurement green practices

4.3 Environmental evaluation

Cole (2005) argues that the assessment or rating tools could provide an effective means of measuring environmental commitment if there is a balancing mechanism to support implementation. This has created a call for tools to guide clients in procuring a green project. Some organizations have formal mechanisms to ensure compliance and to track issues of non-compliance.

Lifecycle analysis is normally used as a basis for checking the environmental impact of products and services but is mentioned by all interviewees as not being a crucial practice. Meanwhile, green specification and eco-labelling are used as benchmarks in selecting products and services. Tender evaluation is one of the assessment tools used to examine environmental criteria based on a project's environmental requirements listed in the technical specifications (Varnäs et al., 2009). The most common indicators used in the industry are environmental rating tools such as the Green Building Index (also known as the GBI in Malaysia), the Leadership in Energy and Environmental Design (LEEDS) certification in the United States and the Building Research Establishment Environmental Assessment Methodology (BREEAM) in the United Kingdom.

However, the immediate economic aspects involved are also of critical practical importance, with the tender evaluation process being typically used to examine the environmental criteria based on a project's environmental requirements (Varnäs et al., 2009). In many countries now, construction contract award criteria are based on the most economically advantageous tender (Parikka-Alhola et al., 2006), which takes into account all the project considerations; for example, the price, technical merit, environmental characteristics and after-sales service (Parikka-Alhola et al., 2006). There are normally two methods used to assess tender price - price preference and set-aside. Price preference refers to a situation where the client/owner is willing to pay extra for green products (Marron, 1997; Oosterhuis, 2003), while set-asides refer to specific minimum targets being set for green purchasing. As mentioned by one interviewee, the preference is to meet basic requirements as stipulated in the technical specification of the project. However, at the same time, the client/owner's budget is still a major concern, resulting in a situation where what is sought is

The lowest acceptable offer that a supplier can give who can meet minimal green specifications and still offer a very low price. (R2)

As one of the interviewees revealed, their project's client spent about 8% more compared with using conventional methods.

In the case where bidders offer similar prices, consideration is given to their past credentials in terms of experience and qualifications. A pre-qualification procedure to assess the capabilities of contractors to carry out a contract satisfactorily (Hatush and Skitmore, 1997) is regularly used for this purpose and to make sure that green requirements are fully implemented. Past credentials including experience, knowledge and qualifications for carrying out green projects are a major advantage. The EMS and ISO14001 are used to benchmark the organization to help with their assessment. It is important, however, that the selection process is kept simple to encourage participation from small and medium-sized enterprises in order to foster fair competition (Roos, 2012).

As previously described, Life-cycle Analysis (LCA) is often said to be one of the important elements in green procurement and involves three components of inventory

analysis, impact analysis and improvement analysis (Pun, 2006; Klöpffer, 1997). The interviewees are less sure, however, with one commenting that

Most contractors and suppliers are still in a grey area about green projects, especially regarding details such as the technical parts (especially materials), implementation on-site and the most difficult one, which is LCA. (R2)

The interviews suggest that most interviewees have carried out an inventory analysis and impact analysis, as evidenced by the comment that

When we ask for the green certificate, we will carefully check the details submitted, for example, the regional materials and the recycle content, etc. (R3)

In the inventory analysis, extensive information is collected regarding the early production stage, energy consumption and material requirements, emissions, solid wastes and other residues from the product, process or activity. Impact analysis then both quantitatively and qualitatively addresses the effects on the environment, such as resource depletion, pollution and health impacts (Pun, 2006).

Please insert Table <4> here

Table 4. Environmental evaluation practices

4.4 Stakeholder values

Green-oriented procurement is enabled by a stakeholder value such as the stakeholder's commitment, capabilities and motivations, which helps translate the planning into real action. The interviewees agree that client commitment is the top priority as clients hold decisive power in the decision to venture into green buildings. As mentioned by R3,

Our client is very committed to producing a green building, so we are all very keen and excited as well. (R3)

Nevertheless, the commitment of the whole procurement supply chain is regarded as important in achieving a better result for a project's green performance. The current challenge is to shift the *status quo* of current practices. Commitment from the projects team will provide benefits to the project.

During the pre-award, we manage to convince the supplier of the long-time benefits to reduce the cost in the long run. We are indirectly saving the environment. (R2)

One of the interviewees mentioned that, in order to build the project team capabilities, they engaged an external green consultant to assist and guide them, saying that

“Since this industry is new, our project engaged a green consultant overseas to help us with this green strategy.” (R1)

The capabilities of the project team positively affect green procurement orientation and delivery. As experienced by one of the interviewees,

We are lucky that our contractor is a pioneer of green building, green consultancy and green energy facilitation in Malaysia. He is experienced, and you don't need to educate him much about what needs to be done. (R3)

Continuous training and knowledge sharing among the stakeholders is important to align stakeholder values with project outcomes. As remarked upon by the interviewees, project teams are required to attend the courses and training provided by external organizations. Interviewees R1 and R3 are even required to visit local and overseas green projects to benchmark their green performance.

Together with the client, we visited the green projects in Singapore and Australia to help us in initiating the green concept for our project, including green design, green purchasing and green labelling. (R1)

In addition, knowledge sharing within the project team also helps the project to achieve its green objectives. A willingness to share information and expertise concerning a green building project to be proactive in its delivery. As R4 commented,

This is the first time the consultant has been involved in green building. Fortunately, the contractor is knowledgeable and very proactive in the green aspects. (R4)

As similarly mentioned by Robichaud and Anantatmula (2011), knowledge sharing and transfer can be carried out during project briefing, the initial meeting, monthly meetings, periodical training and educational sessions. It provides another means of helping create the awareness and capabilities of stakeholders.

Most are 'newbies', like engineers who have attended intense GBI courses and site visits. (R3)

Please insert Table <5> here

Table 5. Stakeholder values

4.5 Towards te better implementation of green procurement of construction projects in Malaysia

The literature highlights the importance of green procurement as a major complementary aspect in constructing green buildings or infrastructure projects. Governments from developed countries such as Australia, the European Union, and Singapore have long been promoting green procurement to undertake green production and purchasing. In the Malaysian context, the introduction of green procurement is still in its infancy. Much more needs to be done to provide a better implementation of green procurement procedures. The results of the interviews underline several points that signal the way ahead, including expanding the system to create more awareness, making green procurement mandatory and enhancing the institutional system by providing incentives and recognition.

Expanding the system by creating more awareness and strengthening knowledge of green procurement issues appears to offer the greatest opportunity for the adoption of green procurement. Currently, there is an increased awareness of green purchasing, but not across the whole construction sector. Instead, project stakeholders are merely required to be aware of the issue and suggests that they should become more specialized. It is important to trigger individual awareness first, as this should then create collaborative awareness among project teams. The cooperation of the government, through its policies, instruction and programs, is a crucial precursor to commencing implementation.

Training is equally important in terms of raising awareness of the shift towards green purchasing. Once this is achieved, a series of training programs for key approaches and practical guidelines needs be developed and delivered to guide stakeholders. However, this requires a change in stakeholder mindsets, which is difficult to do in Malaysia since it requires changing long-existing industry practices (Wooi and Zailani, 2010, Preuss and Walker, 2011). Many studies (e.g., Abidin, 2010; Wooi and Zailani, 2010; Abidin et al., 2013) suggest that, in nurturing an awareness of this greener path, it is vitally important to start with early education and inclusion in school curricula, although this has not been accorded priority as yet. In some cases, younger practitioners who have been exposed to sustainability issues in their tertiary studies find it difficult to translate these ideas into practical actions due to industry resistance. As one of the interviewees pointed out,

Schools, especially at tertiary level, have removed building environment science and focused more on computer drawings. The problem starts with the tendency to focus more on aesthetic values at the expense of environmental science. (R1)

It is important, therefore, to enhance the institutional system through policies and guidelines at both the macro and project levels. The creation of policies at the macro level helps generate ideas that guide the formulation of guidelines at the project level. There have been studies made and guidelines developed that have led to the implementation of

such components of green procurement as lifecycle analysis, green products and services, and the incorporation of green specifications (refer to Tables 3 and 4). However, the current adoption of green procurement is fragmented and suggests that what is needed is a concerted strategy of raising awareness of the benefits of green procurement to key stakeholders. Testa et al. (2016) recommend the use of external 'know-how' measures for green procurement, such as the development of guidelines and toolkits. On a more positive note, the interviewees see that green procurement is moving towards eventual adoption due to the characteristics of green procurement that support sustainability.

5.0 Concluding remarks and future studies

Green procurement is receiving increased attention in Malaysia as part of the government's *MyHijau* initiative and highlighted in the Malaysian economic planning program. The concept is still considered very new, however, and previous studies have sought to address the low level of knowledge in this area. This exploratory phase seeks to ascertain the extent to which this has changed in practice by a series of semi-structured interviews with a small group of experienced practitioners. The results indicate that, even though the term 'green procurement' is still very new to most Malaysian construction industry practitioners, some green practices have been successfully adopted in the industry, such as the inclusion of green criteria in tenders and contracts. The indication is that, while policies and general guidelines for green construction procurement will undoubtedly drive demand, it is important to provide guidelines at the project level. Stakeholders are the project enablers, and thus their values, in terms of knowledge of green construction and commitment towards green compliance, are crucial.

The current study can be extended in various directions. It is clearly limited in terms of sample size, due to the practice of green building and green procurement being so new in Malaysia. Further, with the small population of experienced practitioners available, it is unlikely that a larger sample would produce any significantly different findings. Based on the above exploratory findings from the literature review and preliminary interviews, recommendations for future research are suggested. The conceptual model proposed in this paper needs further investigation to determine the important factors that help clarify the nature of green-oriented procurement. The model needs to be validated empirically and it is suggested that validation by experienced practitioners from the construction industry is needed to suit industry needs. It is also suggested that further study is needed to investigate best green procurement practices in different construction projects.

As it stands, the paper provides a basis for further research by helping shed some light on current major issues and action needed to be taken by industry stakeholders to improve the delivery of green projects in Malaysia. A practical contribution is offered in terms of raising the awareness of industry practitioners of the potential for green procurement to deliver green projects. This concept is currently lacking in the construction industry in Malaysia and other similar developing countries around the world.

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List of Tables

Table 1. Variables for a preliminary model of green procurement for building

Key concept	Description		Author(s), year
Green oriented procurement	Policies and guidelines	Green polices and guidelines aim to encourage environmental obligations, whether they arise from laws, regulations, contract, industry standards or internal policies.	<i>Ofori (2000), Pun (2006), Qi et al. (2010), Meehan and Byrde (2011), Bratt (2011), Liu et al. (2012), Testa et al. (2015), Bakir (2013), Ruparatna and Hewage (2015)</i>
	Green practices product and process	Integrating and recognising the green concept into the procurement practices and process throughout procurement phases	<i>Sterner (2002), Faith-Ell et al. (2006), Lam et al. (2009), Nissinen et al. (2009), Varnäs et al. (2009), Vatalis et al, (2012), Ruparathna and Hewage (2015)</i>
	Environmental evaluation	Monitoring and controlling the green progress that has been made and what more improvements need to be made along the way.	<i>Li and Geiser (2005), Pun (2006), Bratt (2011), Lehtiranta et al. (2012), IISD (2013)</i>
	Project stakeholder values	Stakeholder values refers to the organisational and individual level of commitment and capability towards the project's objectives	<i>Ofori (2000), Pun (2006), Zhu et al. (2008), Robichaud and Anantatmula, (2011), Meehan and Byrde (2011), Liu et al. (2012)</i>
Project's green performance	Environmental improvement, economic impacts and social aspects	Green performance is an additional dimension for a project organisation. Green performance of a building project includes environmental, economic and social aspects.	<i>Morrow and Rondinelli (2002), Ofori (2000), Pun et al. (2006)</i>

Table 2: Key profiles of interviewees

Item	R1	R2	R 3	R4
Interviewees' position	<i>Architect</i>	<i>Project Manager</i>	<i>Architect / Green Consultant</i>	<i>Quantity Surveyor</i>
Organisation	<i>Consultant</i>	<i>Developer</i>	<i>Consultant</i>	<i>Consultant</i>
Experience in the construction industry	<i>More than 10 years</i>	<i>More than 15 years</i>	<i>More than 25 years</i>	<i>More than 5 years</i>
Experience of green projects	<i>Second project</i>	<i>Second project</i>	<i>First project</i>	<i>First project</i>
Green project status	<i>Gold</i>	<i>Platinum</i>	<i>Silver</i>	<i>Gold</i>

Table 3: Procurement of green practices

Key practices	Literature	Key point mentioned by the interviewees
Purchasing green products and services	Adham and Siwar (2012); Ahmad et al., (2015); Bakir (2013); Salam (2008); Tseng et al., (2013)	<i>"We check the details submitted carefully and ask the supplier to provide a green certificate." (R3)</i> <i>"We have to ensure the materials we choose manage to meet the GBI." (R2)</i>
Incorporation of green specifications into the contract	Sterner (2002); Nissinen et al., (2009); Parikka-Alhola and Nissinen (2012)	<i>"... using a conventional building contract, we have to integrate some green specifications required by the client into the contract." (R2)</i> <i>"... it is procurement with the existing policy and practices but with the intention of incorporating green requirements and specifications." (R3)</i>
Purchase value of money	Vatalis et al., (2012); Parikka-Alhola et al., (2006)	<i>"Based on the green specifications provided, we are looking for green contractors and suppliers. Pre-qualification was conducted and then we proceeded with a competitive price." (R4)"</i> <i>"It is very difficult. The market is still very small, with a lack of suppliers. The total cost is slightly high, with an increment of 8%, but fair enough." (R4)</i>

Qualification of stakeholders based on knowledge and experience	Bouwer et al. (2006); Qi et al. (2011); Varnäs et al. (2009)	<p><i>“Our main contractor is very experienced in green building practices. That helps a lot since many are still very new to this process.” (R4)</i></p> <p><i>“Although the main contractors have never had experience of building green projects, they engaged an experienced project manager and green expert to be part of their team.” (R1)</i></p>
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Table 4: Environmental evaluation practices

Key practices	Literature	Key point mentioned by the interviewees
Green criteria in assessing tenders	Sterner (2002); Varnäs et al., (2009)	<i>“The lowest acceptable offer that a supplier can give who can meet minimal technical specifications and still offer a very low price.” (R2)</i>
Life-cycle Analysis	Pun (2006); Kibert (2008)	<p><i>“Our capability of LCC is very weak, so at this time we are discussing LCA briefly.” (R3)</i></p> <p><i>“We know what LCA is all about, but it’s very difficult to educate, especially when green practices are still a new thing for contractors and suppliers. We managed to pick-up one supplier CSR block.” (R2)</i></p>
Green labelling	Ofori (2000); Li and Geiser (2005); Bratt (2011)	<p><i>“Because [the manufacture of green products] is still a young industry, many products are still unavailable and in the process of being labelled. So, they have to go for tests, test reports and labels. Some products are imported.” (R4)</i></p> <p><i>“Green suppliers are limited. Support systems, designers, and factories are not collaborative.” (R1)</i></p>
External rating tools e.g., the Green Building Index	Gowri (2004); Ding (2008); Wu and Low (2010)	<p><i>The team does not have a specific definition, but we follow the guidelines in the Green Building Index.” (R2)</i></p> <p><i>We are given Green Building Index guidelines and asked to work towards certification.” (R3)</i></p>

Table 5: Stakeholder values

Key practices	Literature	Key point mentioned by the interviewees
Commitment	Pun (2006); Hassan (2014); Zhang et al., (2015)	<i>During the pre-award, we managed to convince the supplier of the long-time benefits to reduce the cost in the long run. We are indirectly saving the environment.” (R2)</i>
Capabilities (technical)	Ofori (2000); Pun (2006); Morrow and Rondinelli (2012)	<i>“We are lucky that our contractor is a pioneer of green building, green consultancy and green energy facilitation in Malaysia. He is experienced, and you don’t need to educate him much about what needs to be done.” (R3)</i>
Education and training	Carter et al., (1998); Liu et al., (2012); Robichaud and Anantatmula (2011)	<i>“It is a very young industry and they are learning lessons from Singapore’s Green Mark and Australia’s Green Star conferences. They do much collaboration overseas.” (R3)</i>

Literature Review

**Preliminary expert
Interview**

- **Research problem, research question, aim and objectives**
- **Identify construct and develop preliminary model**

Main data collection