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KEY STAKEHOLDER VALUES IN ENCOURAGING GREEN ORIENTATION OF CONSTRUCTION PROCUREMENT

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Abstract

Poor environmental management of construction projects contributes greatly to environmental degradation. While many changes have been introduced in the global industry, such as the development of green materials and green building certification, limited effort has been done by stakeholders to bring about any improvement in Malaysia. Green procurement was introduced to accelerate practitioners to procure green buildings. This paper examines the interaction between two main constructs – stakeholder values and green procurement – through a questionnaire survey of experienced Malaysian construction stakeholders, extracted from an extensive literature review

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and validated through expert interviews. The ensuing data is then used to build a structural equation model to measure the constructs through their constituent variables, to verify if stakeholder values have a significant impact on the adoption of green procurement by an organisation or for a project. The study reveals that stakeholder values have a positive influence on shaping the green orientation of a construction procurement. The identified key stakeholder values are stakeholder commitment, technical competencies, awareness and knowledge sharing. The results show the key values needed for their procurement delivery to be on a sustainable path. The study also provides the basis for further research into green procurement for construction projects in Malaysia and beyond.

Keywords: Construction; Green procurement; Stakeholder values; Structural equation model

1 INTRODUCTION

Due to global awareness of the need for environmental protection, many governments are devising policies and legislation aimed at minimising the adverse effects of human activities on the natural environment (Bakir, 2013). One new approach proposed for the construction industry is green procurement, which is recognised as a vital tool for managing environmental issues (Zhu et al., 2013). Procurement that is concerned with green practices and consideration is referred to as 'green procurement' (Bohari et al., 2017). Despite its importance, green procurement for building projects is an emerging research area (Zhang et al., 2015) and is relatively new to the Malaysian construction industry (Kahlenborn et al., 2013).

Two empirical studies pertaining to the barriers to adopting green procurement have revealed that the level of knowledge and awareness of green procurement in Malaysia is still very limited (Adham and Siwar, 2012; McMurray et al., 2014). Green procurement practices have not yet managed to capture any significant interest and attention from construction practitioners (Adetunji et al., 2008). This is likely due to most practitioners (who manage procurement) not knowing the

potential of green procurement (Shen, Zhang and Long, 2017). Although the Malaysian government has paved the way for the adoption of green procurement but it focuses on goods and services (Adham and Siwar, 2017) not construction projects as a whole. Moreover, there are still very few takers of the government initiative (Bohari et al., 2017).

According to Kibert (2012), stakeholders of the procurement must shift their mindset into a greener culture in order to address the problem of environmental degradation. Such a shift requires the support of various stakeholders in the construction industry – all of whom are regarded as important enablers for the inclusion of green practices in the construction project. El-Gohary et al. (2006) stress that the stakeholders can be a decisive factor to "make or break" a project goal. However, the role of stakeholders in green practices within the construction industry is poorly understood (Sarpin, 2016). Their lack of familiarity, knowledge and interest in green procurement are considered major causes of the low levels of support for the sustainability agenda within the construction industry (Shen, Zhang and Long, 2017).

Therefore, it is crucial to first understand why industry practitioners lack interest in implementing green procurement, as well as to identify the factors influencing procurers to adopt green practices in their procurement delivery. This paper aims to determine the influence of project stakeholders in encouraging the inclusion of green practices in construction procurement through a survey of 100 Malaysian construction stakeholders. The ensuing data is then used to build a structural equation model to measure the constructs involved through their constituent variables to verify if stakeholder values have a significant influence on the adoption of green procurement by an organisation or for a project.

The next section contains a review of the literature, covering such aspects as the green reform of construction projects, importance of procurement as a tool for green reform, role of project stakeholders and green oriented procurement. This is followed by the research methodology,

including the questionnaire design and data analysis. Section 4 provides the results of the survey and the resulting structural equation model, with some concluding remarks contained in the final section.

2 LITERATURE REVIEW

2.1 PROCUREMENT AS AN IMPORTANT TOOL FOR GREEN REFORM

Construction is one of the industries most responsible for climate change as it emits carbon dioxide both directly and indirectly. In a global status report published by the United Nations (UN) in 2017, buildings and construction contributed 36% of global energy use and 39% carbon dioxide emissions, and hence the construction industry must be sustainably developed to reduce the demand for energy use, thus reducing the carbon emissions (Abergel, Dean and Dulac, 2017). The adverse impact of construction activities on the natural environment necessitates urgent changes in the way construction projects are designed, built, operated and managed. From an environmental management theory perspective, environmental conservation should be one of the main priorities of organisations in any field, regardless of whether they are permanent or temporary (Sourani, 2008). As highlighted by Wu et al. (2012), environmental considerations should be part of a project's performance evaluation, indicating that managing the adverse impact of building projects on the environment should be a major project priority.

To do this, environmental considerations need to be addressed throughout the conception, preparation, construction and delivery phases of the building development process (Vanegas, 2003; Lehtiranta et al., 2012). Environmental considerations, especially, need to be highlighted and incorporated during the earlier inception and planning stages, as it is well known in development practice that key decisions concerning project direction are made early on and are

most vital and influential in determining project success (Sanchez, 2014). They must also be incorporated as part of such project documents as the project drawings and the form of contract, so the building will be able to provide a comfortable and healthy indoor and outdoor environment (Sanchez, 2014).

New innovative construction materials, technologies and processes are constantly being developed that offer the prospect of significant energy/environmental performance improvements in a cost-effective manner. However, a change in the procurement process and delivery itself is needed as well (Grob and Mcgregor, 2005). Procurement is an important matter for all construction projects as it affects their overall performance. On this basis, the successfully adopting the right procurement strategy depends on the willingness and abilities of the construction industry players.

According to Valdes-Vasquez et al. (2013), project procurement is the key activity contributing to overall project success. Meanwhile, it is very complex and unique as it involves both purchasing and a complicated management process in all stages of development. As Hughes and Laryea (2013) underline, construction procurement includes planning the building material purchases needed as early as the pre-planning stage; it involves a huge investment in high risk purchasing and a large number of suppliers throughout the course of project development.

2.2 CHALLENGES TO TRANSFORM GREEN ORIENTED PROCUREMENT

Procurement practice has evolved over time to meet such market trends as globalisation, changes in consumer patterns and technology advancement (Tassabehji and Moorhouse, 2008). To achieve a competitive advantage, current procurement practices focus on being proactive and value-added rather than on a passive cost strategy. Procurement delivery is a strategy to achieve the best value for the organisation. Organisation buying behaviour theory provides insights into how environmental considerations can be incorporated into the procurement strategy, specifically at the pre-contract stage. The pre-contract stage, also known as the planning stage, is important in

ensuring successful procurement delivery (Abu Hassim et al., 2011). Thus, procurement delivery is seen as one of the most influential mediators in the transformation to adopt green practices throughout the procurement process (Bratt et al., 2013; Ruparathna and Hewage, 2015).

Environmental considerations are factored into current procurement practices in terms of the purchase of green construction materials, green technology, energy efficient appliances and green specification and design. However, current procurement practice is criticised as lacking persuasion to improve green performance in terms of policy setting, project needs statements, binding contract clauses and monitoring towards environmental goals (Bohari et al., 2017). Policy urging green procurement adoption and binding contract clauses is crucial to signal to the stakeholder the urgency to change the way projects are procured. As Sourani (2008) highlights, the implementation of green practices is mostly treated as a separate contract for a project and poses an additional cost. In other words, green practices are treated as an additional task that will increase the project's overall cost (Sourani, 2008).

The literature highlights the need for a paradigm shift for project stakeholders to follow a greener path, as the industry needs to change its thinking, behaviour and production in order to progress towards sustainability (Shen, Zhang and Long, 2016). Various innovative approaches have been recommended, involving changes to current construction methods and resources used. Thus, this shift needs to be driven by the awareness of stakeholders and such specific procurement strategies and skills as a strategic tool for incorporating environmental policies and building project guidelines (Faith-ell, 2005).

2.3 PUSH FACTORS FOR GREEN ORIENTED CONSTRUCTION PROCUREMENT

A number of existing environmental management frameworks are explored next, including Pun's (2006) environmental-responsible-organisation (ERO) framework (Fig. 1), that was developed based on an organisation's environmental management practices. Devised for

manufacturing organisations, the core idea of the ERO framework is to pave the way to developing an organisation's green oriented culture through consideration of the three key factors of policy, the product/process and evaluation, as shown in Fig. 1. Pun's framework led towards the forming of organisation environmental management practices and became the basis for designing a model for the construction industry.

The theory highlights the importance of policy in helping the organisation set environmental goals, demand for stakeholder commitment and encouraging knowledge to be sought and shared. The second factor is related to the product and process of the organisation, with the green principle being internalised within the process of acquiring products and services, and showing concern for waste management and pollution control. Evaluation factors are needed to measure the compliance of a sustainability indicator by performance measurement tools, financial justification and stakeholder feedback.

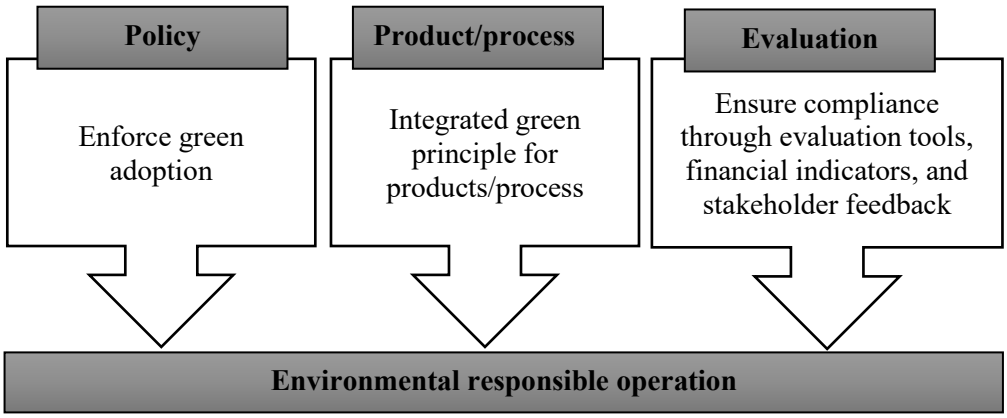

Fig. 1. Determining factors for an organisation's environmental responsible organisation (ERO) Source: Authors' illustration based on Pun (2006)

Another framework Grob and McGregor (2005) on sustainable procurement in the context of the organisational sector (government, business and non-profit organisations) is based on the concept of sustainability and the organisation. This framework suggests the stages of progression for standard procurement practice moving towards more sustainable practices, and the need for the

sustainability principle to be integrated into an approach to procurement that is concerned with the sustainability concept. This framework focuses on a permanent organisation setting and suggests that the shift from conventional procurement to a sustainable approach can be done through these stages.

Specifically for construction projects, Shen, Zhang and Zhang (2017), Bohari et al. (2017) and Wong et al. (2016) highlight the need for policies that encourage environmental obligation – including the formation of laws, regulations, contracts, industry standards and internal policies – also pointing to the need for green procurement to be supported by independent evaluation mechanisms or available external tools to ensure they meet minimal compliance requirements. The green practices must be incorporated into the procurement delivery process, including such activities as energy saving during the production and operation phases, recycling, waste management efficiency and use of green materials and process (Shen, Zhang and Zhang, 2017).

Therefore, three main key aspects are suggested that will affect the procurement's green orientation, namely: policies and guidelines, environmental evaluation and product and process (refer Fig. 2).

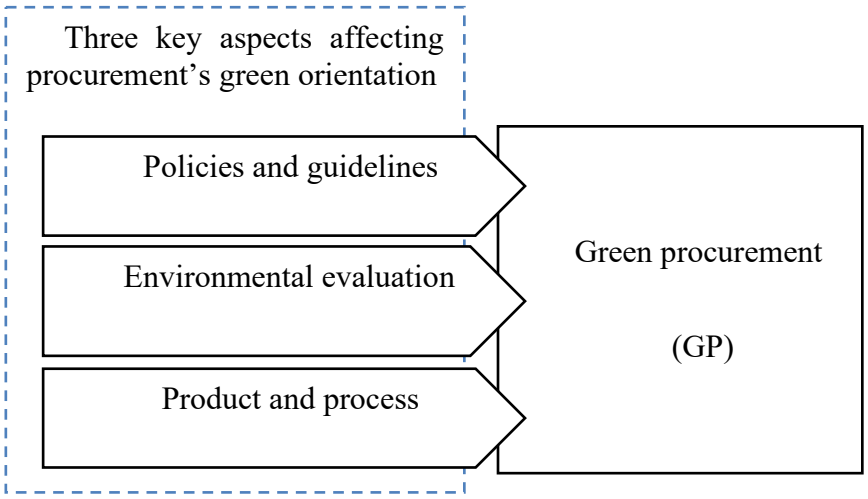

Fig. 2. Three key aspects affecting green procurement orientation

2.4 STAKEHOLDER ROLES TO ENCOURAGE THE GREEN ORIENTED PROCUREMENT OF CONSTRUCTION PROJECTS

The role of construction project stakeholders is undeniably important. As El-Gohary et al. (2006) stress, the stakeholders can be a decisive factor to "make or break" a project. Construction project stakeholders in the context of the present study are referred to as the responsible stakeholder: defined by El-Gohary et al. (2006) as "an organisation or individual who has the responsibility or liability concerning the development project, such as the owner, design teams and contractor". Construction projects are carried out by various temporary organisations such as the owner, contractors and consultant teams within a certain period of time. These various temporary organisations form a temporary construction team, which is guided and motivated by a number of predetermined tasks and goals. Project stakeholders are of primary importance in the concept of a temporary organisation. These are from various permanent organisations and backgrounds, and bring different expertise and experience to the team (Lundin and Söderholm, 1995). They are also expected to interact within the team, which is brought together by a common interest.

One previous school of thought on successful project execution demanding the involvement and commitment of project stakeholders in its complex planning and implementation (Lundin and Söderholm, 1995). Stakeholder values are also credited as providing a guiding principle towards accomplishing an action. Here, value is defined based on Deal and Kennedy's (1983) "… level of commitment and capability of the stakeholders towards fulfilling the project's objective". Stakeholder commitment to a construction project is important, as it is from different permanent organisations and different educational and specialism backgrounds – being part of a project's temporary organisation within a certain limit of time and with a specific mission. Thus, a common interest in the project is needed to build a strong commitment.

From the view of this article, the main challenge identified by previous studies is the lack of project stakeholder awareness and understanding of sustainability issues in general, which hinders the adoption of sustainability practices (Samari et al., 2013; Zhang et al., 2011). Sarpin (2013) urges that stakeholders be expected to have sufficient capability, skills and accumulated knowledge to embed the green objective in the project delivery process, as it changes the way a project is being delivered. However, as Cole (2005) points out, a new skill or routine can be obtained through continuous learning, although this requires commitment from the stakeholders.

Robichaud and Anantatmula (2011) and Aragão and Jabbour (2017) propose the need for continual training throughout the project phases to make sure green performance is achieved. Liu et al. (2020) suggest that training on environmental issues should be an important practice. Training can be carried out by various methods such as formal training, seminars or obtaining green certification. Learning within an organisation can also be achieved through knowledge sharing between project team members (Melander, 2018), where knowledge sharing refers to social interaction which aims to exchange knowledge, experiences and skills through a whole department or organisation (Lin, 2007). Melander (2018) also points out that suitable partnering and joint ventures with other organisations with established green project experiences can encourage knowledge transfer within the organisations involved. Another way to establish knowledge within the organisation is by engaging a green facilitator to advise and direct the organisation's movement towards green objectives.

Capability is seen in terms of green technical knowledge (AlNuaimi and Khan, 2019; Liu et al., 2020) that is able to pave the way for the organisation to achieve the organisation's green goals and targets. Green technical knowledge within an organisation makes the direction clearer in adopting green practices and avoids confusion. AlNuaimi and Khan (2019) emphasise that top management and government officials must re-evaluate their own personal values and commitment to certain issues as they formulate green-procurement policies, regulations and

training programs designed for procurement officials in the United Arab Emirates government organisations. They also propose that an organisation's innovation capability will help drive the adoption of green procurement in the country's public sector.

2.5 PROPOSED CONCEPTUAL MODEL

In establishing the concept of green orientation of a construction procurement , the present study reviewed the current literature and existing guidelines applied in the built-environment in various countries. This identified 64 green procurement related practices (Refer table 2) being applied in the built environment in Malaysia and other countries. The review did not seek to develop or argue the validity of current practices, but to identify and compile them to create a general list of green procurement practices. Thus, interviews were carried out with four green experts in Malaysia to validate the importance of each practice (details of the interviews are contained in Bohari et al., 2017). All had participated in green-certified projects involving the country's voluntary Green Building Index (GBI) rating tools, and were the entire key stakeholders from the planning stage to project hand-over. The interviews were conducted under the limited scope of green procurement practices in Malaysia within a small and homogenous population (green construction). As a result of the interviews, only 45 practices were retained but 10 suggested new practices were added.

Based on the literature and expert interviews, a preliminary model was designed, as shown in Fig. 4, that illustrates the relationship of green procurement (GP) with the observed variables of green policies and guidelines (POL), environmental evaluation (EVA) and the green product/process (PP). Stakeholder values (SV) is used as the factor influencing construction procurement's green orientation.

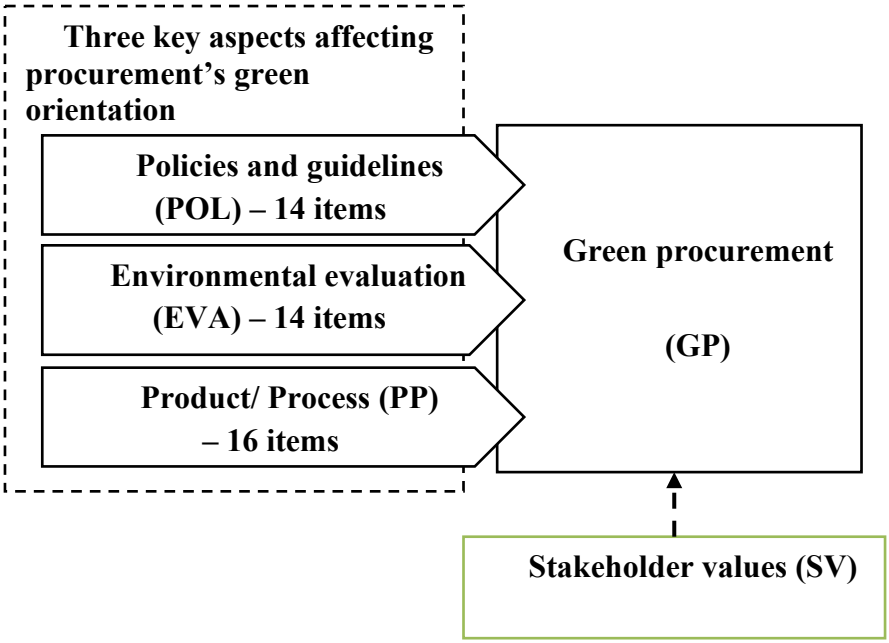

Fig. 3. Initial model based on literature review and expert interviews

Table 1 further provides the description pertaining to the items in the preliminary model and lists their main sources in the literature.

Table 1
Key concepts and their descriptions

Key concept		**Description**	**Author(s), year**
Green procurement	Policies and guidelines	Green polices and guidelines aim to encourage the environmental obligations, whether they arise from laws, regulations, contract, industry standards or internal policies.	*Pun (2006), Bratt (2013), Testa et al., (2015), Bakir (2013), Ruparatna and Hewage (2015)*
	Green practices product and process	Integrating and recognizing the green concept into the procurement practices and process throughout procurement phases	*Faith-Ell et al., (2006), Varnäs et al., (2009), Ruparathna and Hewage (2015)*
	Environmental evaluation	Monitoring and controlling the green progress and	*Pun (2006), Bratt(2013),*

		improvements need to make along the way.	*Lehtiranta et al., (2012)*
Stakeholder Values	Commitment	Stakeholder values refer as a guiding principle towards the organizational action. The principles mentioned such as the commitment and knowledge of the stakeholders.	*Pun (2006), Zhu et al., (2013), Robichaud and Anantatmula, (2011)*

Table 2
Final list of green related practices

Policies and guidelines (POL)	**Green Products and Process (PP)**	**Environmental Evaluation (EVA)**	**Stakeholder values (SV)**
1. Government legislative requirements 2. Government green incentives e.g. tax exemption. 3. Enforcement of Environmental Impact Assessment (EIA) 4. Enforcement of Uniform Building By-Laws Code of Practice MS1525:2014 (2nd revision) ** 5. Obtaining a Green Building Index rating 6. Policy that encourages participation certified ISO 14001:2004 organisation 7. Policy that encourages participation certified Environmental Management Systems (EMS) organisation 8. National Strategic Plan for Solid Waste	1. Compliance with MS1525 guideline** 2. Designing building based on project's green specification 3. Designing building based on GBI guidelines** 4. Selecting materials based on eco-labelling guideline** 5. Selecting materials based on project's basic environmental requirement (technical) 6. Conducting preliminary study on environmental impact 7. Conducting a value management 8. Adopting the Industrialised	1. Government approval at early stage to incorporate green practices 2. Conducting Life Cycle Analysis (LCA) 3. Providing Life Cycle Report 4. Product benchmarking using eco-labelling 5. Using external environmental rating tools e.g., GBI** 6. Environmental requirements in technical specifications 7. Mandatory environmental requirement criteria for tender assessment 8. Project's green compliance mechanisms 9. Tender evaluation based on price preference e.g.	1. Client commitment 2. Project team commitment 3. Support throughout the supply chain 4. Project team competencies (technical) 5. The ability to comprehend greater picture of green construction 6. Selection of project team based on past credentials in terms of knowledge green construction 7. Selection of project team based on past experience in green construction 8. Conducting in-house training/briefing 9. Acquiring external collaboration or training 10. Appointing green specialised consultant/trainer** 11. Sharing experience among stakeholders in project

Management policy** 9. Having an agreed definition of "green" by project team 10. Availability of a green project needs statement 11. Availability of policy at project level urging environmental awareness 12. Availability of appropriate reward/incentives at project level on green achievement 13. Availability of eco-labelling program 14. Adopting other completed green project mechanisms	Building system (IBS)** 9. Information Technology, e.g., managing project 10. Using Building Integrated Management (BIM) 11. Using E-tendering 12. Providing waste management plan 13. Recycling waste 14. Using alternative for material packaging 15. Using On-site systematic waste management e.g. separate hazardous waste with general waste 16. Giving priority to suppliers with long term policy which promotes efficient waste management**	willing to pay extra for green products 10. Tender evaluation based on set-asides e.g. specific minimum targets for green purchasing 11. Benchmarking with previous projects 12. Public reporting on green performance 13. Considering public feedback 14. Mandatory legislative report submission e.g. Environmental Monitoring Report (EMP)**	

** Derived from expert views

3 RESEARCH METHODS

3.3 QUESTIONNAIRE DESIGN, DATA COLLECTION AND THE DATA ANALYSIS PROCESS

The focus of the research is aims to determine the influence of project stakeholders in encouraging the inclusion of green practices in construction procurement mainly on the roles of stakeholder values in determining the green orientation of construction projects. The quantitative methodology is used to test the items influencing green procurement. A questionnaire was designed based on the model in Fig. 4 and distributed to experienced green project practitioners in Malaysia's construction industry: individuals working on at least one certified green building project. The practitioners concerned were gathered from the green building list available on the public Green Building Index (GBI) website.

The questionnaire was developed in three stages: pre-drafting, piloting and finalising, with close-ended questions based on the findings of the literature review and preliminary interviews with industry and academic green construction experts. The survey questions elicited respondent scores of the variables on a Likert scale from 1 (not at all influential) to 5 (extremely influential) with a side choice of 0 (don't know) provided to indicate the respondent's lack of knowledge or opinion of a question. The survey was developed for online use and administered using the Key Survey online software. Potential respondents were sent an email outlining the research project and provided with a web-based link to the questionnaire. A QR barcode was also provided to those who wished to access the survey via smartphone. The questionnaire was sent to 250 stakeholders with experience in green construction, while 108 responses were received, providing a relatively high response rate of 43%.

3.4 DATA CLEANING

Following Hair (2014), the data were cleaned to remove responses with critically missing data by removing questionnaires less than 70 percent completed. This resulted in 6 being omitted and the remaining 102 were retained in the database for further examination for normality and outliers. Two extreme outliers affecting the normality of the distribution were detected and removed from the dataset, reducing the number of eligible responses to exactly 100. Before removal, the data were crosschecked with the questionnaire to ensure the outliers were genuine and not caused by and data entry errors.

3.5 DATA ANALYSIS

Structural Equation Modelling (SEM) is one of the most important multivariate techniques in use today, being a combination of multiple regression and factor analysis (Hair et al., 2014). The main reason for its use is to test and analyse the interrelationships between latent constructs and their measured variables. SEM has been used in a number of construction management studies (Xiong et al., 2015), where researchers frequently wish to identify the variables, the correlations between the variables and the causal paths involved. Covariance-based (CB-SEM) is used because of one of the main reasons suggested by Xiong et al. (2015) – it involves a maximum likelihood procedure.

4 FINDINGS AND DISCUSSION

4.3 PROFILE OF RESPONDENTS

Table 3 provides the respondents' demographics. The professional backgrounds of the respondents comprise of quantity surveyors (34 percent), followed by engineers (29 percent), architects (15

percent), project procurement officers (1 percent) and others such as green consultants and developers (21 percent). The benefit of involving respondents with a variety of backgrounds is that the findings relate to a cross-section of construction project stakeholders. Most respondents (65 percent) had over 5 years' experience in the construction industry, which is considered reasonable for an opinion-based survey analysis like this. The diversity of the respondents' professional backgrounds, their roles in project planning and execution and experiences in working on green projects within the Malaysian construction industry, suggest that the survey opinions have a good degree of representativeness in the Malaysian construction industry context. 42 percent of respondents also reported being involved in more than one green project, indicating that they are generally aware and possess sufficient knowledge of the research area.

Table 3
Demographic background

Demographic features		**Frequency**	**Percentage (%)**
Position in the project	*Project Procurement*	1	1.0
	Architect	15	15.0
	Engineer	29	29.0
	Quantity surveyor	34	34.0
	Other	21	21.0
Experience in the construction industry	*Less than 5 years*	35	35.0
	5 to 10 years	25	25.0
	More than 10 years	40	40.0
Involvement in green projects	*First project*	58	58.0
	More than one project	42	42.0

Respondents' demographic profile (n =100)

4.4 CONFIRMATORY FACTOR ANALYSIS

Confirmatory Factor Analysis (CFA) measures the relationship between the variables of each construct. The validation process involves three basic validities: convergent validity, construct validity and discriminant validity (Hair et al., 2010). Firstly, a unidimensional assessment is conducted, and all meaningless indicators removed. All measured items have acceptable factor loadings for their respective latent construct (Hair et al., 2014). For construct validity, the measurement model needs to have the required goodness of fit. To do this, Hair et al. (2014) suggests using the absolute fit index, incremental fit index and the parsimonious fit index. In this study, these indices correspond with the Root Mean Square Error of Approximation (RMSEA) and Goodness of Fit Index (GFI) (absolute fit), Comparative fit index (CFI) (incremental fit) and Parsimonious fit (CMIN/DF).

Table 4 provides the results, indicating that the AVE of the constructs is greater than the 0.5 needed to accept the observed variables are consistent; the Cronbach Alpha of each construct is above the threshold value of 0.70 (Hair et al., 2014), indicating the data sets are reliable and the CR results are greater than 0.70.

Table 4
Summary of CFA and reliability analysis

Construct	Sub-construct	Item code	Item code description	Measurement and reliability analysis			
				FL (>0.50 – 1.00)	CR (>0.70)	α (>0.70)	AVE (>0.50)
GP	Product/ process	PP5	Selecting materials based on project's basic environmental requirement (technical)	0.67	0.931	0.859	0.817
		PP13	Recycling waste	0.65			
		PP16	Giving priority to suppliers with long term policy which promotes efficient waste management	0.51			
	Policies and guidelines	Pol9	Having an agreed definition of "green" by project team	0.71			
		Pol11	Availability of policy at project level urging environmental awareness	0.84			
		Pol13	Availability of eco-labelling program	0.56			
	Environmental evaluation	EE1	Government approval at early stage to incorporate green practices	0.67			
		EE13	Considering public feedback	0.53			
		EE14	Mandatory legislative report	0.77			

			submission on environment protection				
SV	Commitment	SV2	Project team commitment towards achieving project green goals (building green concept)	0.71	0.854	0.857	0.548
	Technical competencies	SV4	Project team competencies (technical) pertaining green practices	0.78			
	Awareness on green practices	SV5	The ability to comprehend greater picture of green construction	0.86			
	Knowledge-sharing	SV11	Experience and knowledge sharing among stakeholders in project pertaining green practices	0.73			

Factor loading (FL), Composite reliability (CR), Cronbach alpha (α), Average variance extracted (AVE)

4.5 FINAL STRUCTURAL MODEL FOR GREEN PROCUREMENT FOR CONSTRUCTION PROJECTS IN MALAYSIA

After the goodness of fit is satisfied in the CFA phase, the final structural model is generated (Fig. 5) and the correlations between the construct are replaced by the hypothesised causal relationships.

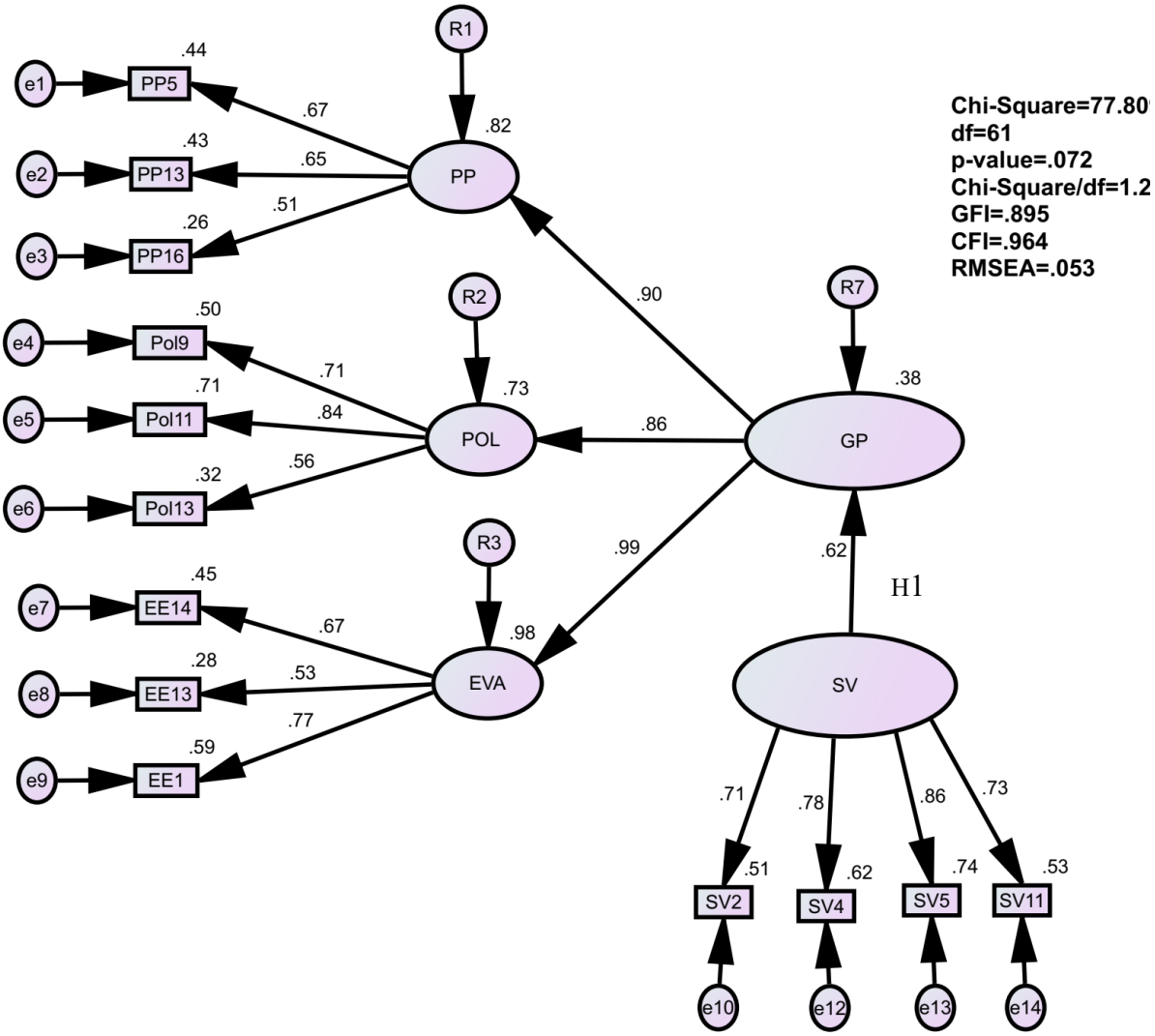

Fig. 4. Final structural model

As suggested by Xiong et al. (2014), a two-stage method is used to develop a structural model. As mentioned earlier, the CFA has a satisfactory goodness of fit and is therefore followed by the

next stage, in which the correlation between the latent variables is replaced by the hypothesised causal relationships.

A path coefficient indicates that all the sub-constructs have the direct effect of a main construct when all the factor loadings are in the range of 0.50-1.00 (Hair et al., 2014). Although there are three variables with factor loadings that are considered low – 0.51 (PP6), 0.56 (Pol13) and 0.53 (EE13) – the focus in CFA is first on the Fitness Index since it reflects the Construct Validity, so it is therefore concluded that the structure model is a satisfactory goodness of fit. The coefficient of determination shows how good is the fit of a regression line: the closer R is to the value of 1, the better is its fit. In this case, the regression between SV and GP has an R^2 of 0.38.

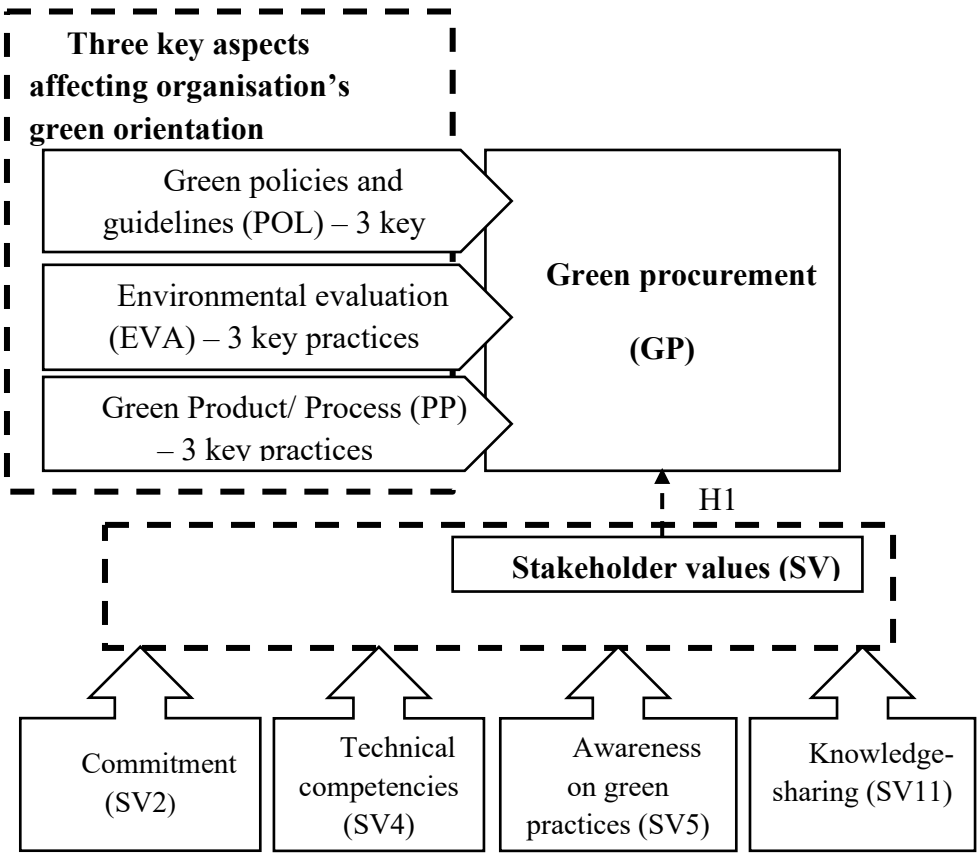

Fig. 5. Interpretation of final structural model

The result is a normed Chi-Square (CMIN/df) value of 1.276, which is within the threshold range of 1.0 and 3.0 suggested by Hair et al. (2014); the GFI and CFI of 0.895 and 0.964 respectively are above the threshold value of 0.80 for GFI and 0.920 for CFI (Anderson and Gerbing, 1984) and a RMSEA of 0.053 is considered to be very close to a perfect fit. The CFI, with a range of 0.964, is above the acceptable fit of 0.90, so it is therefore concluded that the structural model achieves a sufficient goodness of fit (Tables 4 and 5).

Table 5
Summary of CFA test Fit Indices for all measurement model

Index category	Name of index	Achieved fit indices	Comments
Absolute fit	RMSEA	0.053	The required level is achieved
	GFI	0.895	The required level is achieved
Incremental fit	CFI	0.964	The required level is achieved
Parsimonious fit	CMIN/DF	1.276	The required level is achieved

4.6 DISCUSSION OF THE STAKEHOLDER VALUES

In this study, the interaction between two main constructs involves the stakeholder values and the green procurement. Based on the literature and expert interviews, stakeholder values are regarded as an important enabler and a key to shaping the green procurement of any project and, therefore, hypothesis H1 (refer Fig. 5) is

"H1: Stakeholder Values are positively associated with Green Procurement Practices"

The standardised regression weights are used since they allow the researcher to compare the relative effect of each independent variable on the dependent variable directly (Hair et al., 2014). Table 6 presents the standardised regression estimates and allows the examination of the direct association between the stakeholder value construct and green procurement construct: Fig. 5 is the

final structural model. Accordingly, Stakeholder values regress significantly on Green procurement, with standardised estimates of 0.890 and a CR value of 4.718 ($p < 0.001$ indicates a significant relationship).

Table 6
Standardised regression estimates and their significance

Green Procurement		Stakeholder Values	Standardized Estimate	S. E	C.R.	*P*	Result
GPO	<---	SV	0.890	0.189	4.718	0.001	Significant

Initially, there were 11 items under stakeholder values. However, the final model suggests only four stakeholder value constructs are crucial, namely: project stakeholder commitment (SV2), project stakeholder technical competencies (SV4), stakeholder ability to understand the bigger picture of green construction (SV5) and knowledge sharing between the project stakeholders (SV11) (Table 7).

Table 7
Four key stakeholder values

Latent variables	**Observed variables**	**Author(s), year**
Project stakeholder values (SV)	Commitment	Ofori (2000), Pun (2006), Zhu et al., (2008), Robichaud and Anantatmula, (2011), Meehan and Byrde (2011), Liu et al., (2012)
	Technical competencies	Ofori (2000), Pun (2006), Zhu et al., (2008), Robichaud and Anantatmula, Bakir (2013)
	Awareness on green practices	Ofori (2000), Pun (2006), Zhu et al., (2008), Robichaud and Anantatmula, (2011), Meehan and Byrde (2011), Liu et al., (2012)
	Knowledge-sharing	Pati et al., (2006), Robichaud and Anantatmula, (2011), Lin (2017),

Stakeholder commitment carries a strong belief in organisational goal and values. As discussed in the project organisation literature, such commitment is crucial. The stakeholders, being from various permanent organisations, are required to work together to meet project goals, and thus are expected to have a mutual understanding and commitment. Although each stakeholder has different interests, they can be shaped into heading towards the same goal by formulating a common interest (El-Gohary et al., 2006). The commitment starts with creating awareness and nurturing an understanding between the stakeholders. Once the green orientation strategy has been finalised, it can then be made available to all stakeholders, who then need to develop a sufficiently deep understanding of the strategy to articulate it to the other stakeholders involved, both internal and external to the organisation (Adham and Siwar, 2012). The stakeholders' commitment drives the whole team to cooperate in determining the extent of the adoption of green project features (Bakir, 2013). Other than that, effective communication is an essential component for the success of construction projects. As supported by Pati et al. (2006), communication constitutes a vital component of the building procurement process, especially since communication takes place between a varied set of stakeholders.

Technical competencies refer to the specific technical ability to perform activities within an occupation's scope and to the standard expected by the owner (Dada and Musa, 2016). Within the project organisation literature, project stakeholders are from various backgrounds of technical skills and are expected to have sufficient competencies to meet project objectives (Bohari et al., 2017). Thus, for a green project, they are also expected to have a sufficient level of knowledge of green practices. Specifically, technical competencies are the skills required to drive green project delivery, such as green products, environmental and evaluation criteria, verifying that bidders adhere to environmental criteria and monitoring the implementation of green procurement (Adham and Siwar, 2012; Palmujoki et al., 2010).

Awareness of green practices concerns the importance of creating an awareness and educating the project stakeholders before projects commence, as well as throughout the project's life cycle. As Sarpin and Yang (2013) assert, the ability to anticipate short and long-term consequences, including the risks involved in any decision, is crucial for a better future. The provision of adequate guidance and education in adopting and implementing green project practices is therefore an important determinant of an organisation's green operations (Robichaud and Anantatmula, 2011). Stakeholder awareness and capabilities can be helped to grow further by collaboration with other projects and such external organisations as the government and professional green facilitators.

Knowledge sharing, understood as "the social interaction that mainly aims to exchange employee knowledge, experiences, and skills through the whole department or organisation" (Lin, 2007), is ranked as the fourth most important practice. This can be in the form of formal and informal training, project meetings and benchmarking, with continual training a common routine on construction projects, such as project briefings, monthly progress meetings and educational sessions – all helping to create the awareness and capabilities of the stakeholders (Robichaud and Anantatmula, 2011). Sourani (2008) supports this finding and reveals that knowledge-sharing practices in procurement delivery are very important for establishing a link between the project teams in a particular project. In addition, knowledge sharing can enable learning to take place within an organisation (Lin, 2007), and help the project team develop the technical knowledge needed to deliver a green project (Sourani, 2008). Individual factors, namely, enjoyment in helping others and knowledge self-efficacy, are also important for encouraging knowledge sharing among project stakeholders (Lin, 2007), with senior management support being especially important to encourage knowledge-sharing practices, while an experienced stakeholder can help guide project teams through formal and informal knowledge sharing (Bohari et al., 2017).

5 CONCLUSION, LIMITATIONS AND FUTURE RESEARCH

This paper highlights the crucial role of project stakeholders as champions in the greening of construction projects in the Malaysian construction industry. The importance of planning a strategy to realise green performance goals at an early stage, and the decision to adopt green purchasing need to be supported by the owner to have the stakeholders' decisive commitment. Legislative requirements and guidelines can motivate the industry to shift in a new direction. Based on the literature concerning environmental management, two key existing models are identified to be the basis of the framework provided in this paper. Two variables, namely, green procurement and stakeholder values, are identified. Green procurement consists of the three observed variables of policies and guidelines, green practices/products/services and environmental evaluation, while stakeholder values consist of commitment, technical competencies, awareness of green practices and knowledge sharing.

Therefore, this study addresses the inclusion of stakeholder factors in the green procurement model. It contributes new findings to society and the community in providing a sustainable approach involving various construction stakeholders. Four main key stakeholder values are identified – commitment, awareness, knowledge sharing and technical competencies – which are important in being the main focus to shift towards a greener approach. The stakeholders' commitment to green construction, and the associated competencies involved, need to be cultivated as early as the beginning of the project. An awareness of responsible stakeholders, project owners, design teams and contractors of the procurement objective of green practices need to be encouraged through continuous reminders/training and good communication to ensure consistency and persistency. As key stakeholders, owners need to increase their knowledge and skills to form increasingly green-competent project teams, as demands from greener project deliveries from owners signal the whole procurement system.

The study is limited in that, as well as being limited in resources, a greater number of interviews are needed for future study. More evidence is needed to validate the points and suggestions made for improvement, possibly through another round of qualitative validation through focus group discussion or series of expert interviews. Also, the study is restricted to the construction industry alone, and hence generalisations to other types of organisations and projects with fundamentally different characteristics is limited at present. Similarly, the data collected is based on a developing country whose physical infrastructure is increasing very rapidly and with development priority different from developed countries.

Nevertheless, the outcomes of this paper will innovate the existing construction procurement process with the inclusion of green elements and practices as a cleaner approach in producing the construction industry output, as highlighted in the 11th Malaysian Plan, under the Six Strategic Thrusts, Point number 4 and the construction industry transformation plan 2016-2020, under Thrust 2 – Environmental sustainability. It also provides a novel contribution to the aspects involved in delivering and promoting sustainable cities to fulfil the national agenda of achieving low carbon cities by 2030, as well as the sustainable development agenda. Moreover, the outcomes have important implications for the development of green construction in both Malaysia and other similarly placed countries and will encourage further studies in other empirical contexts.

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