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Green Purchasing Adoption: Effect of Regulation, Corporate Factor and Supplier in Malaysian Construction Companies

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ABSTRACT

The construction industry in Malaysia faces increasing pressure to adopt sustainable practices due to its high energy consumption and significant greenhouse gas emissions. Green purchasing (GP), defined as the purchasing of goods and services that minimise environmental impact through low-carbon, low-waste, and energy-efficient principles, is a critical strategy for reducing the sector's ecological footprint. However, the industry's limited adoption of green purchasing and the dominance of unsustainable building practices continue to pose challenges. This study investigates the influence of government regulations, corporate factors, and material suppliers on the adoption of green purchasing among Malaysian construction firms. A cross-sectional survey was conducted with 187 (G7) contractor companies registered with the Construction Industry Development Board (CIDB). Data were analysed using partial least squares structural equation modelling (PLS-SEM). The results confirm that government regulation ($\beta = 0.148$, $p < 0.05$), corporate factors ($\beta = 0.265$, $p < 0.01$), and material suppliers ($\beta = 0.405$, $p < 0.001$) each have a positive and significant effect on green purchasing adoption, with supplier influence showing the strongest impact. These findings highlight the importance of establishing supportive regulatory frameworks, fostering internal corporate commitment, and strengthening long-term supplier partnerships to drive sustainability in the construction sector. The study contributes to the understanding of green purchasing adoption in developing countries and offers practical insights for policymakers and industry leaders seeking to align construction procurement with national sustainability goals.

Keywords: Green purchasing adoption; green purchasing influencing factors; construction companies; sustainability; Malaysia

INTRODUCTION

Construction activities significantly impact the environment, accounting for 39% of energy-related CO_2 emissions and 36% of global energy use (UNEP-EGR, 2019). Fossil fuel consumption in energy production and manufacturing remains the largest contributor to GHG emissions, with global levels reaching 37.9 Gt in 2019 and rebounding to the same level in 2021 Crippa et al. (2022) followed by a further 1.1% rise in 2023 (IEA, 2024). The sector consumes vast amounts of non-renewable resources (Wong et al. 2016).), with buildings alone using up to 40% of global energy (Hassan et al. 2024). Material production, transport, and installation further intensify emissions (Ho et al. 2010; Li et al. 2023). In Malaysia, the construction industry is a key economic driver (Alaloul et al. 2021; CIDB, 2015), yet residential and commercial buildings consume 15% of total national energy and contribute substantially to GHG emissions (Energy Commission, 2014; Shaikh et al. 2017). Although sectoral growth has been supported by lower inflation Alaloul et al. (2021), this raises sustainability concerns. To address these challenges, the government is advancing green construction initiatives, with industry output projected to grow 4.4% during 2025–2028, driven by renewable energy and sustainability projects (Markets and Research 2025). The Malaysian government promotes

green purchasing through the MyHijau Programme and the Green Technology Master Plan (GTMP 2017), which aim to expand the pool of certified products and services listed in the MyHijau Directory. To support these efforts, the Eleventh Malaysia Plan, (2015) set a target of at least 20% green public procurement, while the Twelfth Malaysia Plan, (2021) highlights green purchasing as a driver of demand for sustainable products and industry-wide greening. Yet, Malaysia's construction sector has not fully embraced these practices, largely due to limited practitioner knowledge (Bohari et al. 2017). Recent studies highlight persistent barriers, including internal and external adoption challenges *(Jamil & Zulfakar, 2025)* and cost-related *(Meor Gheda et al. 2025)*. Similarly, Yap et al. (2024) identified high upfront costs, inadequate expertise and guidelines, weak regulatory support, limited top management commitment, and low stakeholder awareness as key obstacles to green purchasing.

There are several studies (ElTayeb et al. 2010; Foo et al. 2019; Hsu et al. 2014; Min & Galle, 2001; Ramakrishnan et al. 2015; Sajeewanie et al. 2019; W. Yang & Zhang, 2012; Yen & Yen, 2012; Zhu & Geng 2006) on green purchasing adoption. Nevertheless, most of these studies did not provide enough empirical evidence on green purchasing adoption in the construction industry, specifically for construction companies. The study by Allal-Chérif (2015) in the construction industry focused on road construction only. Accordingly, this study is undertaken to contribute to the existing body of knowledge by analysing the factors that affect green purchasing adoption among construction companies in Malaysia. Table 1 displays the study examines the effect of the three identified influencing factors: government regulation, corporate factor and material supplier.

TABLE 1. Green purchasing influencing factor

No	Authors	Year	Government Regulation	Corporate Factor	Material Supplier
1	Ramakrishnan et al.	2015	x		
2	Wong et al.	2016		x	x
3	Yang & Wong	2016		x	
4	Chkanikova	2016			x
5	González-Benito et al.	2016			x
6	Balasubramanian	2017		x	x
7	Yook et al.	2018		x	x
8	Morales-Contreras et al.	2019	x	x	x
9	Foo et al.	2019	x		
10	Chin et al.	2020			x
11	Vörösmarty & Dobos	2020		x	x
12	Asif et al.	2020	x		x
13	Moktadir et al.	2020	x		
14	Najmi et al.	2020	x	x	x
15	Fraser et al.	2020	x		x
16	Balon	2020	x	x	x
17	Arora et al.	2020		x	x
18	Hallikas et al.	2020		x	x
19	Mohamad & Koilpillai	2020		x	x
20	Foo et al.	2021	x	x	x
21	Sarwar et al.	2021			x
22	Yang et al.	2022	x	x	x
23	Martens & Schwarz	2022	x	x	x
24	Hazaea et al.	2022	x		
25	Mojumder et al.	2022	x	x	x
26	Bohari et al.	2022		x	x

LITERATURE REVIEW

GREEN PURCHASING ADOPTION

Green purchasing is purchasing environmentally friendly (Hazaea et al. 2022) or sustainable products and services (Al Nuaimi et al. 2020; Horne, 2009; Joshi & Rahman, 2015). This encompasses a product's life cycle, the materials used in production, energy efficiency, and end-of-life disposal (Yang et al. 2022). The purpose of green purchasing is to reduce environmental impact (Foo, Kanapathy, et al. 2021; Renukappa et al. 2016; Wibowo et al. 2018) and enhance sustainability (Famiyeh et al. 2018; Fang & Zhang, 2018; Zaid et al. 2018). From product design to disposal, green purchasing takes environmental considerations into account at every stage of the purchasing process (Yang et al. 2022). When a consumer makes an effort to increase the environmental efficiency of the goods they purchase and the suppliers they use, the purchasing process is considered green (Kanapathy et al. 2016) According to Ho et al. (2010) businesses and organisations that adopt green purchasing strategies and practices will see significant improvements in their marketing effectiveness, employee environmental awareness, public perception and reputation, and energy and resource conservation accomplishments.

In this study, green purchasing is defined as the adoption of purchasing practices that integrate low-carbon, low-waste, and energy-efficient methods throughout the supply chain, from raw material extraction to product use and end-of-life disposal. These principles are central to achieving both environmental and economic performance:

1. Low-carbon – prioritising materials and processes that reduce greenhouse gas emissions, including transport efficiency and renewable energy use.
2. Low-waste – minimising waste generation by favouring recyclable, reusable, and biodegradable materials.
3. Energy-efficient – selecting products and suppliers that optimise energy use during production, operation, and maintenance.

These principles align with international sustainability agendas, particularly the United Nations Sustainable Development Goal (SDG) 12 (UNEP, 2021). For the construction industry, green purchasing is particularly significant as material selection, supplier practices, and procurement strategies (Voon & Lee 2025) strongly influence project-level carbon emissions and waste output (Wibowo et al. 2018; Wong et al. 2016). By embedding these principles, green purchasing not only supports compliance with environmental regulations but also enhances corporate reputation, supplier collaboration, and long-term operational efficiency.

Most research on green purchasing originates from developed countries, with limited studies in emerging economies (ElTayeb et al. 2010). Evidence from manufacturing shows mixed results regarding firms' commitment to proactive adoption. In developing countries, the concept remains relatively new, and limited data exist due to weak implementation by firms (Foo, Shaharudin et al. 2021).

GREEN PURCHASING INFLUENCING FACTOR

There are several external and internal factors that influence a company's adoption of green purchasing. An extensive literature review found that among the factors are government regulation, corporate factors and material suppliers.

GOVERNMENT REGULATION

Previous research has shown that most developed countries, including the USA, Japan, Germany, Sweden, and the Netherlands, view green purchasing as a beneficial legal regulation (Carter et al. 1998; Min & Galle 1997; Sterner 2002; Yook et al. 2018). This regulation is to encourage businesses to take environmental actions or prevent adverse environmental impacts. The regulatory sector, as defined by Carter & Carter (1998), includes government organisations and stakeholders that have an impact on government and regulatory organisations, such as lobbying and consumer organisations. Studies indicate that stronger regulatory pressures lead to better adoption of green purchasing practices (Famiyeh et al. 2018; Malviya & Kant 2017; Yook et al. 2018). As pointed out by Zhu & Sarkis (2007), green purchasing as part of regulatory policies would boost environmental performance. The Chinese government adopted certification ISO 14001 without altering its impact on economic performance. From a regulatory standpoint, stringent and restrictive environmental laws and consensus should be enforced and introduced to enable these companies to increase green purchasing adoption (Mohd Saad et al. 2025; Ramakrishnan et al. 2015; Yen & Yen 2012)

In Malaysia, no policies or regulations require companies to engage in green purchasing practices (Foo et al. 2019). Instead, initiatives such as the MyHijau Programme and the GTMP 2017 encourage voluntary adoption by certifying green products and providing tax incentives. However, regulatory organisations in Malaysia and other nations have established regulations prohibiting

the use of toxic or hazardous materials in products made with recycled materials and facilitating their use (ElTayeb et al. 2010). In addition, the construction industry experts interviewed for the study by Wong et al. (2016) recommended that the government should actively promote green purchasing. Previous studies stated that government regulation positively affects green purchasing (Eltayeb & Zailani, 2010; Min & Galle, 2001; Preuss, 2001; Ramakrishnan et al. 2015). Asif et al. (2020), ElTayeb et al. (2010), Ramakrishnan et al. (2015), and Rao (2002) highlighted governmental or regulatory pressure as the primary external force that encourages businesses to implement green environmental measures. Government regulations can advocate green purchasing practices by legally holding companies accountable for environmental sustainability (Hsu et al. 2014). Effective purchasing must operate alongside governance mechanisms that ensure project continuity and resilience (Samsudin et al. 2023). If supported by government policies and legislation, it is evident that the public and private sectors are more likely to implement green purchasing. According to Brammer & Walker (2011), policymakers need to focus on the different aspects of green purchasing. As a result, this study proposes:

H1: Government regulations positively influence the adoption of green purchasing among contractor companies in Malaysia.

CORPORATE FACTOR

Internal organisational commitment is essential to green purchasing adoption, encompassing genuine concern for environmental issues (Balasubramanian, 2017), successfully, strong ethical standards, supportive incentives, and leadership that prioritises sustainability (Carter & Carter, 1998). The structure of the purchasing department also influences success (Zhu & Geng, 2006) while organisational capability, as shown in manufacturing studies, is equally critical (Salim et al. 2021). Achieving this requires companies to reframe supplier relationships by strengthening collaboration, sharing knowledge, and providing support (Rao, 2004). In addition, both external pressures and a sense of industry responsibility can drive organisational commitment to green initiatives ElTayeb et al. (2010).

The main driver identified by Perry & Singh (2001) in their study is corporate pressure to standardise subsidiaries' environmental performance in various international locations, which motivates their investments in environmental initiatives. It is an excellent encouragement for team members to continuously improve the R&D, purchasing, marketing systems and collaboration for green purchasing (Dubey et al. 2013; Yook et al. 2018). A clearly defined green purchasing policy is vital for companies to identify their green purchasing goals and objectives (Chen, 2005). In corporate environmental strategies, the link between effective green purchasing and strong environmental and economic results is important. This is because there is a clear order in how to implement environmental operational strategies (Yook et al. 2018). For instance, companies use databases internally for green purchasing processes. They also have access to financial and human resources for these activities. Additionally, suppliers and contractors receive environmental or technical advice (Wong et al. 2016). In the Malaysian context, large contractors often implement ISO 14001 Environmental Management Systems, but practical adoption varies depending on internal policies and resource availability (Mohamad & Koilpillai, 2020). A clearly defined corporate green purchasing policy not only improves environmental outcomes but also enhances competitiveness and corporate reputation. As such, corporate factors are expected to significantly influence GP adoption among construction companies. As a result, this study hypothesises that:

H2: Corporate factors positively influence the adoption of green purchasing among contractor companies in Malaysia.

MATERIAL SUPPLIER

Companies' and suppliers' environmental cooperation has a substantial effect on their green purchasing adoption. According to Walton et al. (1998), there are many important areas to improve purchasing for better environmental outcomes. These include the materials used in sustainable product design, designing products, system enhancement for suppliers, supplier assessment, and logistics start-up procedures. In production processes, procurement and disposal of hazardous materials also constitute an "evil requirement." Therefore, purchasing non-hazardous materials (Balasubramanian, 2017) and the cost of eco-friendly products are taken into account (Min & Galle, 2001, 1997). The design of products also contributes to a significant effect on the environment (Walton et al. 1998; Wong et al. 2016). More redesigns are complex and should aim at reducing waste. Hence, the whole life cycle of raw materials for production, distribution, operation, reuse or recycling and disposal requires careful consideration for effective environmental management (Zsidisin & Hendrick 1998).

It is critical to provide green purchasing guidelines for employees in order to promote "green building" in

sustainable development. An internal database should be established to facilitate the effective implementation of green purchasing (Wong et al. 2016). According to Brammer & Walker (2011), companies require a transparent database of supplier products that includes information on materials used, manufacturing processes, recycling facilities, and product life cycles. The availability of green material data is critical (Chkanikova 2016). Some businesses have created databases to manage suppliers based on performance-based criteria (Kanapathy et al. 2016). Therefore, suppliers in green construction projects must provide greener goods and materials and educate contractors about green practices, which, instead of a typical win-lose relationship, suppliers and subcontractors should be viewed as long-term partners by a company (Mokhlesian, 2014). Specifically, the implementation of such actions has a positive effect on the purchasing system's operational efficiency. This effect is stronger if a company maintains a long-term connection with its suppliers (González-Benito et al. 2016). Accordingly, the following hypothesis posited that:

H3: Materials suppliers positively influence the adoption of green purchasing among contractor companies in Malaysia. Figure 1 depicts the study's framework.

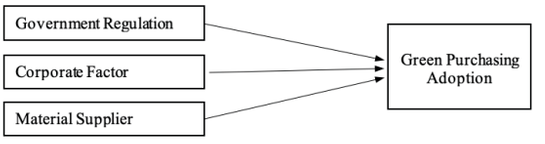

FIGURE 1. Conceptual Framework

METHODOLOGY

INSTRUMENTATION

The following Table 2 presents the alignment of each construct with the conceptual framework and the development of the measurement items. It also details the selected sources for each operational variable.

TABLE 2. INSTRUMENTATION

No	Statement	Source
Government Regulation		
1	The threat of future legislation.	Carter & Carter (1998a); ElTayeb et al. (2010); Carter & Dresner (2001); Hsu et al. (2014); Wong et al. 2016); Brammer & Walker (2011)
2	Influence of international environmental laws, such as those in Europe, Japan, and the USA.	
3	Proactive efforts toward environmental regulation.	
4	Financial support for environmental initiatives from international bodies like the United Nations	
5	The presence of extensive environmental policies enforced by the Malaysian government in the construction sector	
6	Legal responsibility is placed on companies by the Malaysian government for environmental harm, including waste management.	
7	Routine inspections or audits are conducted by authorities to monitor regulatory compliance.	
8	The requirement of government and non-governmental organisations, such as the green label scheme.	
9	The support given by the Malaysian government makes the green purchasing process easier.	
10	Incentives from the Malaysian government, such as grants or tax benefits.	

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Corporate Factor		
1	Organisational commitment to reduce environmental harm across all operations	ElTayeb et al. (2010); Yook et al. (2018); Wong et al. (2016); Yang & Wong (2016); Yook et al. (2018)
2	Internal belief that the company can help mitigate global environmental issues.	
3	The strong teamwork that exists among the Research & Development (R&D), marketing, and purchasing departments.	
4	Sustainability policy/green procurement program is being continuously strengthened through training and education.	
5	Integration of green purchasing targets into staff roles and incentive schemes.	
6	Development of internal benchmarks, including green product criteria and supplier certifications.	
7	The expenditure to purchase environmentally friendly materials.	
8	Use of internal databases to manage and streamline green purchasing.	
9	Availability of financial and human resources for green purchasing activities.	
10	Environmental/technical advice is being offered to suppliers and contractors.	
Material Supplier		
1	Consideration of environmental impact during the material selection process for construction.	Wong et al. (2016); Björklund (2011); Chkanikova (2016); Balasubramanian (2017); Min & Galle (2001); Yook et al. (2018); Carter & Carter (1998a); Miemczyk et al. (2012)
2	Access to alternative or substitute materials with lower environmental impact.	
3	Dependable sources of information regarding eco-friendly materials.	
4	Environmental considerations are factored into purchasing decisions.	
5	Preference for materials with high recycled content and low embodied energy.	
6	Suppliers' environmental mission.	
7	Suppliers capable of consistently offering sustainable products and services.	
8	Availability of numerous suppliers providing eco-friendly construction materials.	
9	Structured job roles for employees involved in supplier relations for green purchasing.	
10	Ensuring suppliers meet environmental standards, laws, and certifications like ISO 14001.	

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Green Purchasing Adoption		
1	Suppliers receive detailed environmental specifications for the items they are to provide.	ElTayeb et al. (2010); Tate et al. (2012); Hsu et al. (2014)
2	Suppliers are expected to adopt and maintain environmental management frameworks.	
3	Suppliers are required to hold certifications such as ISO 14001 for their environmental systems.	
4	Collection of supplier environmental data via structured questionnaires.	
5	Requirement to procure materials that possess eco-friendly qualities, such as recyclability.	
6	Prohibition of materials containing harmful substances like lead or toxins.	
7	Supplier selection involves evaluating environmental performance criteria.	
8	Second-tier suppliers are also assessed for their environmental practices.	
9	Environmental responsibility is viewed as a strategic advantage for the company.	
10	Preference for purchasing energy-efficient or water-saving goods and services.	
11	Prioritisation of materials and services that reduce emissions and waste.	
12	Procurement from vendors engaged in recycling or remanufacturing.	
13	Preference for suppliers who assist in environmentally sound waste management.	
14	Implementation of reuse strategies, including product buy-back or leasing options.	

INSTRUMENT DEVELOPMENT

This study employed a quantitative cross-sectional survey design to investigate the factors influencing green purchasing (GP) adoption among Malaysian construction companies. A survey method was selected because it enables the collection of data from a large sample within a limited timeframe and allows for the testing of hypothesised relationships through statistical modelling. The survey questionnaire was developed based on validated scales from prior studies The instrument consisted of four main constructs: Government Regulation, Corporate Factors, Material Suppliers, and Green Purchasing Adoption, measured using a five-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree). To ensure content validity, the initial draft was reviewed by ten academic experts in sustainability and procurement, as well as two senior managers from G7 contractor firms. Following expert feedback, a pilot test with 33 respondents was conducted to assess construct validity, content validity and reliability. The pilot study confirmed that the items were appropriate and statistically valid for further analysis. Based on the pre-test and pilot test inputs, minor changes to the questionnaire were made.

SAMPLING

The population comprised G7 contractor companies registered with the Construction Industry Development Board (CIDB). G7 contractors were chosen because these companies are classified as having no project value limit and are more likely to implement ISO 14001 environmental management systems, making them relevant for green purchasing adoption studies. Using proportionate stratified random sampling, a total of 300 questionnaires were distributed via email to executives and managers involved in procurement. Out of these, 187 valid responses were received, representing a response rate of 55%. This sample size exceeded the minimum requirement suggested by Hair et al. (2014), for achieving adequate statistical power in PLS-SEM analysis. The unit of analysis in this study is the organisation (construction company), with one response obtained per company.

DATA ANALYSIS TECHNIQUES

Data were analysed using Partial Least Squares Structural Equation Modelling (PLS-SEM) with SmartPLS 3.0

software. PLS-SEM was selected because it is well-suited for predictive research models and handles latent constructs with multiple indicators (Hair et al. 2019).

The analysis followed a two-step approach:

1. Measurement Model Assessment: reliability and validity were tested using Cronbach's alpha, composite reliability (CR), average variance extracted (AVE), Fornell–Larcker criterion, and the Heterotrait–Monotrait ratio (HTMT).
2. Structural Model Assessment: hypotheses were tested using a bootstrapping procedure with 5,000 resamples, generating t-values, p-values, and bias-corrected confidence intervals (Ramayah et al. 2018). Effect sizes (f^2) and variance inflation factors (VIF) were also assessed to evaluate the strength and collinearity of relationships.

This systematic procedure ensured the robustness of the findings and allowed for meaningful interpretation of the causal relationships among government regulation, corporate factors, material suppliers, and green purchasing adoption.

RESULTS

This section presents the empirical findings from the demographic profile of respondents highlighting geographical distribution, principal business operations, and company characteristics. Selangor received the most responses (33.2 per cent), indicating the largest number of G7 registered contractors. Civil engineering (54 percent) and building firms (39.6 percent) account for the majority of the company's principal business operations. The majority of the companies (79.7 per cent) are local contractors, with personnel ranging from 50 to 249 (42.8 percent).

MEASUREMENT MODEL

The integrity of the measurements was tested using validity and reliability criteria. As presented in Table 7, the Cronbach's alpha values ranged from 0.80 to 0.95. As outlined by Henseler et al. (2009), the primary types of validity assessment include convergent and discriminant validity. Convergent validity examines the degree to which a new scale demonstrates strong correlations with other measures assessing the same construct. Convergent validity is deemed acceptable when the AVE reaches 0.50 or above, indicating that the construct accounts for a minimum of 50% of the variance in its items (Hair, Risher, et al. 2019). Consistently, the evaluation of the measurement model in this study confirms that the reflective constructs meet the required criteria for both reliability and validity. Across all sample sizes, all loadings exceed the generally accepted threshold value of 0.70. Correspondingly, the extracted average variance is more than the crucial threshold of 0.50. The majority of the composite reliability values are around 0.90, indicating that the measures possess a high level of internal consistency. Measurement model evaluation supports the reliability and validity of the reflective service value criterion construct. In order to ensure that each construct is unique and distinct, it is imperative to establish discriminant validity. Discriminant validity can be used to evaluate convergent validity, such as the Fornell-Larcker criterion (Fornell & Larcker, 1981) and cross-loadings analysis (Henseler et al. 2009). Table 8 presents the Fornell-Larcker assessment, where the AVE of each construct should surpass the squared correlations with all other constructs (Fornell & Larcker, 1981). Nonetheless, Henseler et al. (2015) recently introduced the new correlation measure between heterotrait and monotrait (HTMT) to examine discriminant validity, which is considered exceptional (Duarte & Amaro, 2018). Table 9 verifies discriminant validity through the HTMT approach, showing that none of the values exceed the rigorous 0.85 threshold (Kline, 2011). Using the and HTMT criteria, the measurement instrument's discriminant validity was validated in this situation.

TABLE 7. Reliability and convergent validity measures

Constructs	Items	Loading	AVE	CR
Government	GR1	0.623	0.521	0.896
Regulation	GR3	0.751		
	GR4	0.600		
	GR5	0.825		
	GR6	0.695		
	GR7	0.738		
	GR8	0.759		
	GR9	0.756		
Corporate	CF1	0.707	0.547	0.923
Factor	CF2	0.734		
	CF3	0.750		
	CF4	0.810		
	CF5	0.819		
	CF6	0.691		
	CF7	0.724		
	CF8	0.744		
	CF9	0.762		
	CF10	0.638		
Material	MS1	0.836	0.555	0.925
Supplier	MS2	0.826		
	MS3	0.859		
	MS4	0.742		
	MS5	0.679		
	MS6	0.817		
	MS7	0.626		
	MS8	0.641		
	MS9	0.648		
	MS10	0.726		
Green Purchasing	GPA1	0.711	0.535	0.941
Adoption	GPA2	0.778		
	GPA3	0.622		
	GPA4	0.632		
	GPA5	0.796		
	GPA6	0.717		
	GPA7	0.783		
	GPA8	0.722		
	GPA9	0.761		
	GPA10	0.750		
	GPA11	0.744		
	GPA12	0.776		
	GPA13	0.716		
	GPA14	0.704		

TABLE 8. HTMT values for discriminant validity

	Corporate Factor	Government Regulation	Green Purchasing Adoption	Material Supplier
Corporate Factor				
Government Regulation	0.515			
Green Purchasing Adoption	0.629	0.419		
Material Supplier	0.686	0.326	0.658	

STRUCTURAL MODEL

In line with the recommendations by Hair et al. (2019) and Ramayah et al. (2018), to test the hypotheses, a bootstrapping procedure with 5,000 resamples was employed, generating bootstrapped confidence intervals, t-values, and p-values. However, as noted by Hahn & Ang (2017), relying solely on p-values may not provide a comprehensive assessment of hypothesis significance. Therefore, a combination of statistical indicators, including p-values, effect sizes, and confidence intervals, should be considered to ensure a more robust evaluation. Table 9 provides an overview of the standards used to assess the validity of the proposed hypotheses. A total of three hypotheses were tested, and as presented in Table 10, all were found to be statistically significant. The results indicate that government regulation, corporate factors, and material suppliers each have a positive influence on the adoption of green purchasing among contractor companies in Malaysia. Specifically, government regulation recorded a beta coefficient of 0.148 ($p = 0.036$; $f^2 = 0.067$), suggesting a modest yet significant effect. Corporate factors demonstrated a stronger influence with a beta of 0.265 ($p = 0.001$; $f^2 = 0.031$), while material suppliers exerted the most substantial impact, with a beta value of 0.405 ($p = 0.000$; $f^2 = 0.187$), which is highly significant and has a medium effect size. Consequently, the model supported and accepted hypotheses H1, H2, and H3 in this study. Figure 2 shows the results for the green purchasing adoption framework. This demonstrates that the relationship between independent constructs accounts for 46.9% of the variance in green purchasing adoption.

TABLE 9. Structural Model

Hypothesis	Relationship	Std. Beta	Std. Dev	t-value	p-value	BCI LL	BCI UL	f^2	Effect Size	VIF
H1	GR -> GPA	0.148	0.082	1.796	0.036	-0.006	0.269	0.067	Small	1.327
H2	CF ->GPA	0.265	0.083	3.198	0.001	0.123	0.399	0.031	Small	1.975
H3	MS -> GPA	0.405	0.090	4.520	0.000	0.24	0.54	0.187	Medium	1.656

TABLE 10. Hypothesis results

Hypothesis	Statement of Hypothesis	Results
H1	Government regulations positively influence the adoption of green purchasing among contractor companies in Malaysia.	Accepted
H2	Corporate factors positively influence the adoption of green purchasing among contractor companies in Malaysia.	Accepted
H3	Material suppliers positively influence the adoption of green purchasing among contractor companies in Malaysia.	Accepted

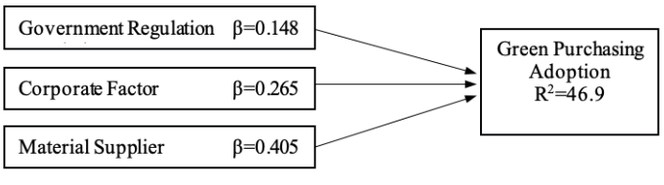

FIGURE 2. Results for Green Purchasing Adoption Framework

DISCUSSION

The analytical finding shows that government regulation, corporate factors and material suppliers significantly affect green purchasing adoption. Importantly, the results show that material suppliers exert the strongest effect, followed by corporate factors and regulatory influences. This is consistent with other studies where government regulation positively affects green purchasing (Balasubramanian 2017; Hsu et al. 2014; Shen, Zhang, & Zhang 2017; Vörösmarty & Dobos 2020; Wong et al. 2016; Yen & Yen 2012; Zhu & Geng 2013). In Malaysia, current initiatives such as the MyHijau Programme and the Green Technology Master Plan (GTMP 2017–2030) encourage sustainable purchasing but remain largely voluntary. The results highlight the need for more coercive policies, including mandatory procurement of certified green products for public projects and tax incentives for private firms. Strengthening enforcement can align the construction sector with the Twelfth Malaysia Plan (2021–2025) targets and contribute directly to SDG 12: Responsible Consumption and Production.

Corporate factors also play a substantial role. This result aligns with research findings from (Ho et al. 2010; Mohamad & Koilpillai 2020) on the corporate factor. Firms with strong environmental commitment, formal green purchasing policies, and internal capacity (e.g., staff training, budget allocations) are more likely to integrate green purchasing practices effectively. This aligns with prior findings that organisational culture and management support are essential for sustainability transitions (Mohamad & Koilpillai, 2020). Practically, construction firms should institutionalise green purchasing through integrating sustainability metrics into procurement policies, Providing continuous training on green procurement standards and allocating dedicated budgets for environmentally friendly materials. Such initiatives can improve not only compliance but also corporate reputation and competitive advantage in securing green-certified projects.

The strongest predictor of GP adoption was supplier influence underscoring the pivotal role suppliers play in providing eco-friendly materials and knowledge. This finding resonates with studies that stress long-term supplier collaboration as a key enabler of sustainable procurement (Foo, Shaharudin et al. 2021; Gimenez & Tachizawa 2012; Yen & Yen 2012). In Malaysia, supplier partnerships are critical because contractors rely on the MyHijau Directory for certified products. Policymakers and industry associations should therefore expand supplier databases with certified green materials, provide incentives for suppliers to innovate in low-carbon and low-waste products and facilitate contractor–supplier collaboration platforms for knowledge sharing. By improving supplier engagement, the construction industry can accelerate the availability and affordability of green products, thus overcoming one of the most cited barriers to adoption.

CONCLUSION

The Malaysian government has proposed the MyHIJAU Directory to guide green purchasing in the Green Technology Master Plan. Despite this, Malaysia has no government legislation or policies requiring businesses to engage in green purchasing. The findings indicate that Malaysian contractors adopt proactive organisational strategies by implementing environmental management practices independently, rather than being driven solely by external pressures. To encourage green purchasing, rigorous and thorough environmental laws and regulations should be established and enforced.

Generally, Malaysian contractor companies show a proclivity to react to a slight external and internal pressure placed by government regulation, corporate factors and material suppliers, concerning green purchasing adoption. The strong effect of government regulation and corporate factors revealed that a well-defined green purchasing policy enables businesses to articulate their green purchasing aims and objectives. This effect can be achieved through adequate incentives, strong teamwork, establishing standards, and the availability of both human and financial resources for green purchasing initiatives. The adoption has a substantial impact on operational efficiency, as suppliers are the ones that supply green materials and services. This effect is noticeable when a company maintains a long-term relationship and collaboration. Based on this study, the finding shows that the relationship with material suppliers, along with external and internal pressure from government regulation and corporate factors, can motivate the green purchasing adoption in construction companies.

This study has certain limitations. The analysis was restricted to main contractors, which may not fully capture the perspectives of subcontractors or suppliers directly. Moreover, the study focused specifically on green purchasing adoption rather than broader sustainable construction practices. Future research should therefore explore contractors' prior experience in green projects, comparative analyses across ASEAN countries, and the moderating role of organisational culture in shaping green purchasing adoption.

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DECLARATION OF COMPETING INTEREST

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REFERENCES

Al Nuaimi, B.K., Khan, M. & Ajmal, M. 2020. Implementing sustainable procurement in the United Arab Emirates public sector. *Journal of Public Procurement* 20(2): 97–117.

Alaloul, W.S., Musarat, M.A., Rabbani, M.B.A., Iqbal, Q., Maqsoom, A. & Farooq, W. 2021. Construction sector contribution to economic stability: Malaysian GDP distribution. *Sustainability (Switzerland)* 13(9): 5012.

Allal-Chérif, O. 2015. Implementing a sustainable purchasing policy: An exploratory study in the Colas Group. *European Scientific Journal* 7881(November): 427–438.

Arora, A.S.A., Sivakumar, K. & Burke, G. 2020. Strategic sustainable purchasing, environmental collaboration, and organizational sustainability performance: The moderating role of supply base size. *Supply Chain Management* 25(6): 709–728.

Asif, M.S., Lau, H., Nakandala, D., Fan, Y. & Hurriyet, H. 2020. Adoption of green supply chain management practices through collaboration in developing countries: From literature review to conceptual framework. *Journal of Cleaner Production* 276: 124191.

Balasubramanian, S. 2017. *Green supply chain management: An investigation on the construction sector*. Middlesex University, London.

Balon, V. 2020. Green supply chain management: Pressures, practices, and performance – An integrative literature review. *Business Strategy and Development* 3(2): 226–244.

Björklund, M. 2011. Influence from the business environment on environmental purchasing: Drivers and hinders of purchasing green transportation services. *Journal of Purchasing and Supply Management* 17(1): 11–22.

Bohari, A.A.M., Bidin, Z.A. & Khalil, N. 2022. Government intervention through collaborative approach in promoting the adoption of green procurement for construction projects. *International Journal of Sustainable Construction Engineering and Technology* 13(2): 68–82.

Bohari, A.A.M., Skitmore, M., Xia, B. & Teo, M. 2017. Green-oriented procurement for building projects: Preliminary findings from Malaysia. *Journal of Cleaner Production* 148: 690–700.

Brammer, S. & Walker, H. 2011. Sustainable procurement in the public sector: An international comparative study. *International Journal of Operations and Production Management* 31(4): 452–476.

Carter, C.R. & Carter, J.R. 1998. Interorganizational determinants of environmental purchasing: Initial evidence from the consumer products industries. *Decision Sciences* 29(3): 659–681.

Carter, C.R. & Dresner, M. 2001. Purchasing's role in environmental management: Cross-functional development of grounded theory. *Journal of Supply Chain Management* 37(2): 12–27.

Carter, C.R., Ellram, L.M. & Ready, K.J. 1998. Environmental purchasing: Benchmarking our German counterparts. *International Journal of Purchasing and Materials Management* 34(3): 28–38.

Carter, C.R. & Jennings, M.M. 2004. The role of purchasing in corporate social responsibility: A structural equation analysis. *Journal of Business Logistics* 25(1): 145–186.

Chen, C.C. 2005. Incorporating green purchasing into the frame of ISO 14000. *Journal of Cleaner Production* 13(9): 927–933.

Chkanikova, O. 2016. Sustainable purchasing in food retailing: Interorganizational relationship management to green product supply. *Business Strategy and the Environment* 25(7): 478–494.

CIDB. 2015. *Construction Industry Transformation Programme (CITP) 2016–2020*. Construction Industry Development Board Malaysia (CIDB).

Crippa, M., Guizzardi, D., Banja, M. et al. 2022. Fossil CO_2 emissions of all world countries – 2020 report. *JRC Publications Repository*.

Duarte, P. & Amaro, S. 2018. Methods for modelling reflective–formative second order constructs in PLS: An application to online travel shopping. *Journal of Hospitality and Tourism Technology* 9(3): 295–313.

Dubey, R., Bag, S., Ali, S.S. & Venkatesh, V.G. 2013. Green purchasing is key to superior performance: An empirical study. *International Journal of Procurement Management* 6(2): 187–210.

Eleventh Malaysia Plan. 2015. *Eleventh Malaysia Plan 2016–2020: Anchoring growth on people*.

Eltayeb, T.K. & Zailani, S. 2010. Investigation on the drivers of green purchasing towards environmental sustainability in the Malaysian manufacturing sector. *International Journal of Procurement Management* 3(3): 316–337.

ElTayeb, T.K., Zailani, S. & Jayaraman, K. 2010. The examination of drivers for green purchasing adoption among EMS 14001 certified companies in Malaysia. *Journal of Manufacturing Technology Management* 21(2): 206–225.

Energy Commission. 2014. *Malaysia Energy Statistic 2014. Statewide Agricultural Land Use Baseline 2014*.

Famiyeh, S., Kwarteng, A., Asante-Darko, D. & Dadzie, S.A. 2018. Green supply chain management initiatives and operational competitive performance. *Benchmarking* 25(2): 607–631.

Fang, C. & Zhang, J. 2018. Performance of green supply chain management: A systematic review and meta-analysis. *Journal of Cleaner Production* 183: 1064–1081.

Foo, M.Y., Kanapathy, K., Zailani, S. & Shaharudin, M.R. 2019. Green purchasing capabilities, practices and institutional pressure. *Management of Environmental Quality: An International Journal* 30(5): 1171–1181.

Foo, M.Y., Kanapathy, K., Zailani, S. & Shaharudin, M.R. 2021. Green purchasing: Capabilities, practices and effects on firms' triple bottom line performance. *Estudios de Economía Aplicada* 39(3): 1–21.

Foo, M.Y., Shaharudin, M.R., Ma, G., Zailani, M.H.S. & Kanapathy, K. 2021. Green purchasing capabilities and practices towards firms' triple bottom line in Malaysia. *Journal of Cleaner Production* 307: 127268.

Fornell, C. & Larcker, D.F. 1981. Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research* 18(1): 39–50.

Fraser, I.J., Müller, M. & Schwarzkopf, J. 2020. Dear supplier, how sustainable are you? *Sustainability Management Forum | NachhaltigkeitsManagementForum* 28(1): 127–149.

Gimenez, C. & Tachizawa, E.M. 2012. Extending sustainability to suppliers: A systematic literature review. *Supply Chain Management* 17(5): 531–543.

González-Benito, J., Lannelongue, G., Ferreira, L.M. & Gonzalez-Zapatero, C. 2016. The effect of green purchasing on purchasing performance: The moderating role of long-term relationships and strategic integration. *Journal of Business and Industrial Marketing* 31(12): 312–324.

GTMP. 2017. *Green Technology Master Plan (GTMP)*.

Hahn, E.D. & Ang, S.H. 2017. From the editors: New directions in the reporting of statistical results in the *Journal of World Business*. *Journal of World Business* 52(2): 125–126.

Hair, J.F., Risher, J.J., Sarstedt, M. & Ringle, C.M. 2019. When to use and how to report the results of PLS-SEM. *European Business Review* 31(1): 2–24.

Hair, J.F., Sarstedt, M. & Ringle, C.M. 2019. Rethinking some of the rethinking of partial least squares. *European Journal of Marketing* 53(4): 566–584.

Hallikas, J., Lintukangas, K. & Kähkönen, A.K. 2020. The effects of sustainability practices on the performance of risk management and purchasing. *Journal of Cleaner Production* 263: 121–131 (approx.; keep as 263(1): 1–11 if unknown).

Hassan, J., Zin, R.M., Majid, M.Z.A., Balubaid, S. & Hainin, M.R. 2024. Building energy consumption in Malaysia: An overview. *Jurnal Teknologi* 707(7): 2180–3722.

Hazaea, S.A., Al-Matari, E.M., Zedan, K., Khatib, S.F.A., Zhu, J. & Al Amosh, H. 2022. Green purchasing: Past, present and future. *Sustainability (Switzerland)* 14(9): 5008.

Henseler, J., Ringle, C.M. & Sarstedt, M. 2015. A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science* 43(1): 115–135.

Henseler, J., Ringle, C.M. & Sinkovics, R.R. 2009. The use of partial least squares path modeling in international marketing. *Advances in International Marketing* 20(1): 277–319.

Ho, L.W.P., Dickinson, N.M. & Chan, G.Y.S. 2010. Green procurement in the Asian public sector and the Hong Kong private sector. *Natural Resources Forum* 34(1): 24–38.

Horne, R.E. 2009. Limits to labels: The role of eco-labels in the assessment of product sustainability and routes to sustainable consumption. *International Journal of Consumer Studies* 33(2): 175–182.

Hsu, P.F., Hu, P.J.H., Wei, C.P. & Huang, J.W. 2014. Green purchasing by MNC subsidiaries: The role of local tailoring in the presence of institutional duality. *Decision Sciences* 45(4): 647–682.

IEA. 2024. *CO_2 emissions in 2023: A new record high, but is there light at the end of the tunnel?*

Jamil, N. & Zulfakar, M.H. 2025. Green supply chain management adoption's internal and external barriers in Malaysia construction industry: A case study. *Information Management and Business Review* 17(2(I)S): 185–201.

Joshi, Y. & Rahman, Z. 2015. Factors affecting green purchase behaviour and future research directions. *International Strategic Management Review* 3(1–2): 128–143.

Kanapathy, K., Yee, G.W., Zailani, S. & Aghapour, A.H. 2016. An intra-regional comparison on RoHS practices for green purchasing among E&E SMEs in Southeast Asia. *International Journal of Procurement Management* 9(3): 249–271.

Kline, R. 2011. *Principles and practice of structural equation modeling* (3rd ed.). New York: The Guilford Press.

Li, S., Wang, S., Wu, Q. et al. 2023. Emission trends of air pollutants and CO_2 in China from 2005 to 2021. *Earth System Science Data* 15(6): 2279–2294.

Malviya, R.K. & Kant, R. 2017. Modeling the enablers of green supply chain management. *Benchmarking: An International Journal* 24(2): 536–568.

Markets and Research. 2025. *Malaysia construction market size, trends, and forecasts by sector – Commercial, industrial, infrastructure, energy and utilities, institutional and residential market analysis to 2029 (Q2 2025)*.

Martens, S.G.L. de P. & Schwarz, G.M. 2022. Examining contemporary Australian local government sustainable procurement practices: A national study. *International Journal of Public Administration* 1–17.

Meor Gheda, M.L., Cheah, C.Y. & Abdull Rahman, S.H. 2025. Identifying and overcoming cost barriers to sustainable construction in Johor Bahru. *International Journal of Research and Innovation in Social Science (IJRISS)* 8(12): 1644–1651.

Miemczyk, J., Johnsen, T.E. & Macquet, M. 2012. Sustainable purchasing and supply management: A structured literature review of definitions and measures at dyad, chain and network levels. *Supply Chain Management: An International Journal* 17(5): 478–496.

Min, H. & Galle, W.P. 2001. Green purchasing practices of US firms. *International Journal of Operations and Production Management* 21(9): 1222–1238.

Min, H. & Galle, W.P. 1997. Green purchasing strategies: Trends and implications. *International Journal of Purchasing and Materials Management* 33(2): 10–17.

Mohamad, M.N. & Koilpillai, C.S.S. 2020. Effect of corporate sustainable development on green purchasing: Insights from ISO 14001 certified manufacturing companies in Malaysia. *International Journal of Integrated Supply Management* 13(2–3): 234–251.

Mohd Saad, S., Md Zani, R. & Ramli, A.R. 2025. Navigating Malaysia's green public procurement policy: A sustainability-driven review. *International Journal of Research and Innovation in Social Science (IJRISS)* 9(5): 330–343.

Mojumder, A., Singh, A., Kumar, A. & Liu, Y. 2022. Mitigating the barriers to green procurement adoption: An exploratory study of the Indian construction industry. *Journal of Cleaner Production* 372: 133505.

Mokhlesian, S. 2014. How do contractors select suppliers for greener construction projects? The case of three Swedish companies. *Sustainability (Switzerland)* 6(7): 4133–4151.

Moktadir, M.A., Dwivedi, A., Ali, S.M., Paul, S.K., Kabir, G. & Madaan, J. 2020. Antecedents for greening the workforce: Implications for green human resource management. *International Journal of Manpower* 41(7): 1135–1153.

Najmi, A., Maqbool, H., Ahmed, W. & Ur Rehman, S.A. 2020. The influence of greening the suppliers on environmental and economic performance. *International Journal of Business Performance and Supply Chain Modelling* 11(1): 69–90.

Perry, M. & Singh, S. 2001. Corporate environmental responsibility in Singapore and Malaysia: The potential and limits of voluntary initiatives. *Programme Paper No. 3, Technology, Business and Society*.

Preuss, L. 2001. In dirty chains? Purchasing and greener manufacturing. *Journal of Business Ethics* 34(3–4): 345–359.

Ramakrishnan, P., Haron, H. & Goh, Y.N. 2015. Factors influencing green purchasing adoption for SMEs in Malaysia. *International Journal of Business and Society* 16(1): 39–56.

Ramayah, T., Cheah, J., Chuah, F., Ting, H. & Memon, M.A. 2018. *Partial least squares structural equation modeling (PLS-SEM) using SmartPLS 3.0: An updated and practical guide* (2nd ed.). Kuala Lumpur: Pearson.

Rao, P. 2002. Greening the supply chain: A new initiative in South East Asia. *International Journal of Operations and Production Management* 22(6): 632–655.

Rao, P. 2004. Greening production: A South-East Asian experience. *International Journal of Operations and Production Management* 24(3): 289–320.

Renukappa, S., Akintoye, A., Egbu, C. & Suresh, S. 2016. Sustainable procurement strategies for competitive advantage: An empirical study. *Proceedings of the Institution of Civil Engineers: Management, Procurement and Law* 169(1): 17–25.

Sajeewanie, L.C., Ab Yajid, M.S., Khatibi, A., Azam, F. & Tham, J. 2019. Integrated model for green purchasing intention and green adoption: Future research direction. *Journal of Sociological Research* 10(2): 23–66.

Salim, N., Ab Rahman, M.N. & Abd. Wahab, D. 2021. Enhancing green product competitiveness through proactive capabilities of manufacturing firms. *Jurnal Kejuruteraan* 33(1): 73–82.

Samsudin, K., Sansuddin, N., Hussin, M.F., Kamarudin, A.H., Hapani, M. & Hashim, A.F. 2023. A review of emergency management governance at construction sites in Malaysia. *Jurnal Kejuruteraan* 35(2): 275–285.

Sarwar, A., Zafar, A., Hamza, M.A. & Qadir, A. 2021. The effect of green supply chain practices on firm sustainability performance: Evidence from Pakistan. *Uncertain Supply Chain Management* 9(1): 31–38.

Shaikh, P.H., Nor, N.B.M., Sahito, A.A., Nallagownden, P., Elamvazuthi, I. & Shaikh, M.S. 2017. Building energy for sustainable development in Malaysia: A review. *Renewable and Sustainable Energy Reviews* 75: 1392–1403.

Shen, L., Zhang, Z. & Zhang, X. 2017. Key factors affecting green procurement in real estate development: A China study. *Journal of Cleaner Production* 153: 372–383.

Sterner, E. 2002. 'Green procurement' of buildings:

A study of Swedish clients' considerations. *Construction Management and Economics* 20(1): 21–30.

Tate, W.L., Ellram, L.M. & Dooley, K.J. 2012. Environmental purchasing and supplier management (EPSM): Theory and practice. *Journal of Purchasing and Supply Management* 18(3): 173–188.

Twelfth Malaysia Plan. 2021. *Twelfth Malaysia Plan 2021–2025: A prosperous, inclusive, sustainable Malaysia*.

UNEP-EGR. 2019. *Emission Gap Report 2019*.

UNEP. 2021. *Sustainable consumption and production: A handbook for policymakers (global edition)*.

Voon, V.K.Y. & Lee, Y.L. 2025. Digital transformation in construction: Assessing e-tendering adoption in Malaysia's industry landscape. *International Journal of Research and Scientific Innovation (IJRSI)* XI(XII): 969–985.

Vörösmarty, G. & Dobos, I. 2020. Green purchasing frameworks considering firm size: A multicollinearity analysis using variance inflation factor. *Supply Chain Forum* 21(4): 290–301.

Walton, S.V., Handfield, R.B. & Melnyk, S.A. 1998. Green supply chain: Integrating suppliers into environmental management processes. *International Journal of Purchasing and Materials Management* 34(1): 2–11.

Wibowo, M.A., Handayani, N.U. & Mustikasari, A. 2018. Factors for implementing green supply chain management in the construction industry. *Journal of Industrial Engineering and Management* 11(4): 651–679.

Wong, J.K.W., Chan, J.K.S. & Wadu, M.J. 2016. Facilitating effective green procurement in construction projects: An empirical study of the enablers. *Journal of Cleaner Production* 135: 859–871.

Yang, C.-C. & Wong, C.W.Y. 2016. Configurations of environmental management strategy: Evidence from the container shipping service industry. *International Journal of Shipping and Transport Logistics* 8(3): 334–356.

Yang, J., Wang, Y., Gu, Q. & Xie, H. 2022. The antecedents and consequences of green purchasing: An empirical investigation. *Benchmarking* 29(1): 1–21.

Yang, W. & Zhang, Y. 2012. Research on factors of green purchasing practices of Chinese firms. *Journal of Business Management and Economics* 3(5): 222–231.

Yap, J.B.H., Teh, Y.H., Loo, S.C., Shavarebi, K. & Zamharira, B.S. 2024. Green procurement in the construction industry: Unfolding new underlying barriers for a developing country context. *Journal of Civil Engineering and Management* 30(7): 632–645.

Yen, Y.X. & Yen, S.Y. 2012. Top management's role in adopting green purchasing standards in high-tech industrial firms. *Journal of Business Research* 65(7): 951–959.

Yook, K.H., Choi, J.H. & Suresh, N.C. 2018. Linking green purchasing capabilities to environmental and economic performance: The moderating role of firm size. *Journal of Purchasing and Supply Management* 24(4): 326–337.

Zaid, A.A., Jaaron, A.A.M. & Talib Bon, A. 2018. The impact of green human resource management and green supply chain management practices on sustainable performance: An empirical study. *Journal of Cleaner Production* 204: 965–979.

Zhu, Q. & Geng, Y. 2013. Drivers and barriers of extended supply chain practices for energy saving and emission reduction among Chinese manufacturers. *Journal of Cleaner Production* 40: 6–12.

Zhu, Q. & Geng, Y. 2006. Green purchasing in Chinese large and medium-sized state-owned enterprises. In: Hutchison (ed.). *Greening the supply chain*: 173–187.

Zhu, Q. & Sarkis, J. 2007. The moderating effects of institutional pressures on emergent green supply chain practices and performance. *International Journal of Production Research* 45(18–19): 4333–4355.

Zsidisin, G.A. & Hendrick, T.E. 1998. Purchasing's involvement in environmental issues: A multi-country perspective. *Industrial Management and Data Systems* 98(7): 313–320.