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Do environmental, economic and reputational advantages strengthen green practices' impact on environmental performance?

Nor'Aini Yusof[1] ⓘ | Amin Akhavan Tabassi[2] | Ernawati Mustafa Kamal[1]

[1]School of Housing, Building and Planning, Universiti Sains Malaysia, Penang, Malaysia

[2]Busines School, Manchester Metropolitan University, Manchester, United Kingdom

Correspondence
Nor'Aini Yusof, School of Housing, Building and Planning, Universiti Sains Malaysia, Penang 11800, Malaysia.
Email: ynoraini@usm.my

Abstract

In an attempt to curb the hazardous effect of construction activities, there is a heightened debate about whether the perceptions of green practice (GP) advantages will encourage the adoption of GPs and improve environmental performance (EnvP). This article investigates the role of environmental, economic and reputational advantages of GPs and their relationship with EnvP. The data were collected from 148 project managers from the Malaysian construction industry and analysed using partial least square structural equation modelling. The results demonstrated that the relationship between green supply management and EnvP is more pronounced when environmental and reputational advantages are perceived as low, with the strongest effects derived from low perception of environmental advantage. The results advance existing knowledge by verifying the moderating effects of the advantages of various GPs. At the end of the article, several recommendations are made to help policy makers and project managers improve the EnvP of construction projects.

KEYWORDS
construction project, economic advantage, environmental advantage, environmental performance, green practice, reputational advantage

1 | INTRODUCTION

Adopting green practices (GPs) in project organisations is one way to address the hazardous impact of construction activities and improve environmental performance (EnvP). EnvP refers to the outcomes of practices that aim to protect the environment (Ardito & Dangelico, 2018; Lee, Ooi, Chong, & Lin, 2015). To ensure superior EnvP, studies have identified three crucial GPs during project planning and implementation. These practices are green supply management (GSM) (Woo, Kim, Chung, & Rho, 2016; Yusof, Tabassi, & Esa, 2020), responsible consumption (RC) (Martens & Carvalho, 2017; Zhu, Zhao, & Sarkis, 2011) and waste management (WM) (Ajayi et al., 2017). With environmental regulations and certification yet to be effective in curbing pollution (Li, Zuo, Cai, & Zillante, 2018; Raman, 2019), and the increasing number of accidents and deaths at construction sites (Dermawan, 2018), doubts have arisen in the construction industries of developing countries about whether GPs achieve environmental goals (Palansamy, Chin, & Tan, 2019; Shurrab, Hussain, & Khan, 2019).

One popular strategy to improve EnvP in the developing world involves changing managers' mindsets to ensure GP adoption is perceived as advantageous (Al-Abdin, Roy, & Nicholson, 2018; Li et al., 2018). This strategy of observing "green adoption as beneficial" is based on an argument that perceptions of the advantages of a practice are more important when encouraging their adoption than the measured advantages of the practice (Al-Abdin et al., 2018; Gledson & Greenwood, 2017). Generally, perceived advantage refers to a perception that a new or modified practice is more beneficial than other practices (Gledson & Greenwood, 2017). In this sense, GPs are considered new practices because they require the adoption of new processes or the adjustment of existing techniques, technologies and systems to protect the environment (Lin & Ho, 2011; Zhu, Zou, &

Zhang, 2019). From this perspective, when an organisation is convinced that GPs result in a cleaner environment, better profits and an enhanced reputation, adopting GPs can enhance EnvP. However, if an organisation is uncertain of the advantages of GPs, adopting GPs may not be accompanied by higher EnvP, signalling a gap between value and action. In Malaysia, because the construction sector is among the highest producers of carbon emissions and consumers of natural resources (CIDB, 2016), such a strategy can be observed through a series of workshops and seminars conducted by the Construction Industry Development Board (CIDB) to create awareness among industry players of the advantages of GPs. Examples of the aforementioned strategy include workshops, seminars or campaigns conducted by the CIDB and the Ministry of Energy, Science, Technology, Environment and Climate Change (MESTECC) to explain the nation's sustainable development initiatives, the Malaysian Carbon Reduction and Environmental Sustainability Tool (MyCrest) and the Sustainable Infrastructure Rating Tool, which encourages construction players to adopt GPs (Sustainable Infrastar) (Aziz, Ong, Foong, Senik, & Attan, 2018; NST, 2019). In other developing countries, studies have identified and proposed green campaigns through roadshows, seminars and workshops to educate and improve practitioners' perceptions of the advantages of GPs (Abisuga & Okuntade, 2020; Rawashdeh, 2018).

Studies have acknowledged the three advantages of GPs in the context of construction projects: (a) environmental advantage (EnvA) due to less pollution and waste (Krueger, Stoker, & Gaustad, 2019); (b) economic advantage (EA) due to higher profits and cost savings (Begum, Siwar, Pereira, & Jaafar, 2006; Kulatunga, 2006); and (c) Reputational advantage (RA) due to a better public image (Abidin, Yusof, & Afandi, 2015; Shurrab et al., 2019). Despite the array of advantages of GPs, scholars tend to consider the general advantages of GPs or concentrate on one specific advantage. When studying the manufacturing sector while acknowledging the adoption of GPs can lead to higher profits and cost savings, Choi and Han (2019) collapsed the two advantages into one variable. Similarly, in a study by Ferrón-Vílchez (2016), only the effect of the relationship between ISO140001 and EnvP on RA was considered. Both studies found no evidence of the moderating effect of green practice advantages (GPAs). In contrast, RA was found to strengthen the relationship between GPs and the sustainable performance of construction companies (Shurrab et al., 2019). In manufacturing firms, GPAs were found to moderate the effects of stakeholder pressure on environmental management and accounting implementation (Wang, Wang, & Wang, 2019). Additionally, the degree of an individual's conviction about the advantages of GPs differs according to their knowledge and awareness, culture and social influences (Al-Abdin et al., 2018) and how GPs are enforced and monitored (Ardito & Dangelico, 2018; Ferrón-Vílchez, 2016). For example, in Japan where environmental management practices are rigorously monitored, car manufacturers enjoy a higher RA worldwide than those from the United States (Narasimhan & Schoenherr, 2012). In contrast with Ferrón-Vílchez (2016), Choi and Han (2019) and Shurrab et al. (2019), which focused on one specific advantage of GPs or considered the advantages of GPs as a single or general construct, the aforementioned

discussion indicates that there are various advantages of GPs with a heterogenous influence on EnvP. Furthering the above discussion, the present study argues that the moderating effects of various GPAs and the degree of GPAs are diverse. Therefore, considering the range of GPAs as one variable is inadequate. To address this deficiency and avoid what Aguinis (1995) identified as the likely loss of information when moderating effects remain undetected, the present study considers the EnvA, EA and RA of GPs as three different GPAs moderators of the complex relationship between GPs and EnvP. Thus, the main aim of the study is to investigate whether the EnvA, EA and RA of GPs can strengthen the effect of GPs on EnvP.

The present study contributes to the literature on the link between GPs and EnvP in the construction sector in two ways. First, the study investigates Al-Abdin et al. (2018) and Gledson and Greenwood (2017) premise that perceptions of the advantages of a practice are important to encourage its adoption. Applying this premise, the present study argues that perceptions of GPAs are important to encourage their adoption and subsequent strengthening of EnvP. Second, this study differs from previous studies by proposing that there are various advantages of GPs therefore, their effects are not necessarily homogenous. To provide a better understanding of the relationship between GPs and EnvP and ensure the moderating effects of GPAs can be ascertained, the EnvA, EA and RA are regarded as three different moderators. This builds on the work of Shurrab et al. (2019) that focuses on RA only. Policy makers and project managers are striving to improve project organisations' EnvP; therefore, these findings will help policy makers and project organisations determine which GPs and GPAs strategies to focus on to improve EnvP.

This article is divided into several sections. In the next part, this article discusses previous studies of green construction, GP, EnvP and the advantages of GPs as moderators, followed by the development of a hypothesis. The following sections present the research methodology, results and a discussion of the findings. The article ends with a conclusion and recommendations for future research.

2 | GREEN CONSTRUCTION, GP AND ENVP

Green construction refers to "the practice of creating structures and using processes that are environmentally responsible and resource-efficient..." (Kubba (2010), p. 4), that is, green construction is about implementing construction in an environmentally friendly manner (Qi, Shen, Zeng, & Jorge, 2010). Green construction has been argued as the best remedy to the ongoing pollution and harmful effects of construction activities (Hussain, He, Ahmad, Iqbal, & Taskheer Mumtaz, 2019). During project implementation, green construction involves practices such as RC of water, energy and materials (Martens & Carvalho, 2017; Zhu et al., 2011) and WM (Ajayi et al., 2017) to ensure air, water, noise pollution, construction waste and use of hazardous materials are prevented or at least reduced (Hussain et al., 2019; Onubi, Yusof, & Hassan, 2020). Apart from RC and WM, scholars have considered that suppliers of materials and

other construction resources play equally important roles in fulfilling environmental goals (Lee et al., 2015; Zhu, Sarkis, Lai, & Geng, 2008; Zhu et al., 2011). Not surprisingly, several studies have considered GSM practices (designing, manufacturing and transporting construction materials or resources) as part of GPs during project implementation (Woo et al., 2016; Yusof et al., 2020; Zhu et al., 2011).

However, engaging in GPs is challenging because of the new knowledge and skills, and additional workload GPs require to fulfil the higher standards (Zhao, Hwang, & Lim, 2020). In an effort to boost EnvP, governments of the developing world have implemented environmental regulations, green policies and tax incentives (see Abisuga & Okuntade, 2020; CIDB 2018; Onubia, Yusof, & Hassan, 2019; Rawashdeh, 2018). The Malaysian government has been implementing its sustainable development initiatives and subsequently, the Construction Industry Transformation Programme, has identified WM, RC and supply chain management as key practices in Environmental Sustainability Strategic Thrust to achieve the nation's environmental goals (Aziz et al., 2018; CIDB, 2015). The aforementioned discussion provides the reason to focus on GSM, RC and WM in this study. The detailed discussion of each GP is provided in the hypotheses development section.

EnvP is an outcome of GPs that indicates how GPs affect the environment (Ardito & Dangelico, 2018; Geng, Mansouri, & Aktas, 2017). Until now, there has been a lack of consensus on how to measure EnvP (Dragomir, 2018). Several studies have used objective measurement indicators such as Rankins' ratings and carbon emission data derived from the secondary data to measure EnvP (Hartmann & Vachon, 2018; Shahab, Ntim, Chengang, Ullah, & Fosu, 2018). However, Elmagrhi, Ntim, Elamer, and Zhang (2019) argue that such measures are "unable to accurately capture the nuanced nature of both the length (scale) and breadth (depth) of environmental activities" (p. 207). Hartmann and Vachon (2018) propose the use of latent items and variables to better explain EnvP rather than the use of "archival and secondary data" (p. 13) such as carbon emission reduction indicators. Examples of these latent variables can be seen in Arimura, Darnall, Ganguli, and Katayama (2016), where the authors use a five-point scale ranging from significant decrease to significant increase in natural resource usage and air pollution emissions to signify EnvP. Moreover, many studies have conceptualised EnvP by using latent variables such as compliance with environmental regulations; reduction in energy; water and resource consumption and elimination of pollution, waste and non-environmentally friendly materials (Aziz et al., 2018; Lee et al., 2015; Yusof & Kamal, 2018; Zhu et al., 2019). In the construction sector, da Silva and Gouveia (2020) acknowledge the use of reduction in energy consumption, pollution emission and waste and minimising the use of hazardous material as the common indicators to measure EnvP. Based on this discussion, the present study considers EnvP to be the improvement in compliance with environmental standards, waste, pollution reduction, consumption of toxic materials and resources consumption.

Regarding the relationships between GPs and EnvP, studies have revealed varying outcomes. For example, Aziz et al. (2018), Woo et al. (2016), Yusof, Awang, and Iranmanesh (2017) and Zhu

et al. (2019) have revealed positive relationships. Additionally, Ardito and Dangelico (2018) and Arimura et al. (2016) have identified vague or negative relationships. This inconsistency suggests that GPs–EnvP relationships are affected by certain conditions or moderating factors. Ignoring these moderators has resulted in the devaluation of GPs (Arimura et al., 2016). The next section presents the discussion of advantages of GPs as moderators that this study argues may help explain the inconsistency in GPs–EnvP relationships.

3 | ADVANTAGES OF GPS AS MODERATORS

A moderating effect exists if a variable changes or strengthens the link between two other variables (Ramayah, Cheah, Chuah, Ting, & Memon, 2018). According to Rogers's (2003) diffusion theory, the adoption rate of a new practice is higher if the new practice is perceived to offer more benefits than other competing practices (Gledson & Greenwood, 2017), which indicates the moderating effect of perceived advantage. As aforementioned, this study considers three main advantages of GPs as moderators—environmental, economic and reputational (Begum et al., 2006; Krueger et al., 2019; Shurrab et al., 2019). Therefore, this study argues that the varying perceptions of GPs' advantages can inculcate heterogenous influence on GPs' adoption and EnvP outcome. EnvA refers to a belief that GPs have minimal or zero impact on the environment (Ferrón-Vílchez, 2016; Krueger et al., 2019). Examples of such EnvA include beliefs that GPs ensure energy efficiency, zero or minimum waste to landfills and fewer carbon emissions (Cha, Kim, & Han, 2009). EA refers to beliefs that GPs generate increased sales and revenue (Begum et al., 2006), reduce costs (Krueger et al., 2019; Wang et al., 2019) and increase profits (Shurrab et al., 2019). GPs are perceived to entail less financial risk because of compliance with environmental regulations, avoiding penalties (Charlo, Moya, & Muñoz, 2017). RA refers to a belief that GPs improve a company's reputation or corporate image (Shurrab et al., 2019), meaning GP adoption enjoys acceptance from stakeholders (Ferrón-Vílchez, 2016). Examples of RA are a better reputation with customers (Lintukangas, Hallikas, & Kähkönen, 2015; Narasimhan & Schoenherr, 2012), business partners and environmental pressure groups (Ferrón-Vílchez, 2016; Shurrab et al., 2019).

The literature provides elusive evidence of the moderating effect of the various advantages of GPs on the GPs–EnvP relationship. RA was found to strengthen the influence of GPs on the sustainable performance of construction firms (Shurrab et al., 2019). In the manufacturing sector, the general advantage of GPs was found to increase the effect of regulator, supplier and consumer pressure on environmental management accounting (Wang et al., 2019). However, as previously mentioned, Choi and Han (2019) found no evidence of any moderating effect of GPAs on EnvP. Similarly, Ferrón-Vílchez (2016) was unable to support the effect of RA on the GP–EnvP relationship. Instead, only close monitoring of the negative environmental effects resulted in a stronger effect of GP on EnvP. This study addresses this gap by investigating the role of EnvA, EA and RA

as three different moderators. Next, we describe the study hypotheses.

4 | HYPOTHESES DEVELOPMENT

Project organisation has long been subjected to intense public scrutiny due to activities that have a negative impact to the environment. An increasing number of project management teams have adopted GPs, but these initiatives have not provided the desired level of EnvP (Dermawan, 2018). As aforementioned, this study investigates three major GPs adopted during project planning and implementation: GSM (Woo et al., 2016; Yusof et al., 2020), RC (Martens & Carvalho, 2017; Zhu et al., 2011) and WM (Ajayi et al., 2017).

Supply management begins with managing the supply of construction inputs, including their manufacturing methods, transportation and product utilisation (Rao & Holt, 2005). GSM considers the environmental impact of the production, transportation, design and procurement of construction materials (Woo et al., 2016). Zhu and Sarkis (2004) provide a detailed discussion of GSM that ranges from top management's commitment towards GSM and environmental audits for suppliers' internal management to requiring suppliers with environmental certification. Liu, Feng, Zhu, and Sarkis (2018) identify four major aspects of GSM—green purchasing, environmental management, eco-design and client support. Well-known companies such as Apple, Coca-Cola and Nike have received public criticism because they engage with suppliers that pollute the environment (Chen, Tang, & Jia, 2019).

Adopting GSM enhances EnvP (Lee et al., 2015); (Woo et al., 2016; Zhu, Sarkis, & Lai, 2013). Specifically, when selecting green suppliers, the characteristics necessary to improve EnvP are eco-design, supplier integration, customer support and employing personnel with skills (Geng et al., 2017; Lintukangas et al., 2015). RAs was observed to strengthen the influence of GPs on sustainable performance of construction firms (Shurrab et al., 2019). Extending Shurrab et al. (2019)'s finding, this study postulates that positive relationships between GSM and EnvP are moderated by perceptions of advantages of GPs. In other words, perceptions that GSM provides environmental, economic and RAs may amplify the EnvP of GSM. Conversely, perceptions that GSM will not result in environmental, economic and RAs may reduce the EnvP of GSM. Based on these arguments, the present study proposes that the higher the perception of the environmental, economic and reputational advantages, the stronger the relationship between GSM and EnvP. Therefore, the hypotheses are as follows:

H1: The positive relationship between GSM and EnvP will be stronger with higher perception of EnvA.

H2: The positive relationship between GSM and EnvP will be stronger with higher perception of EA.

H3: The positive relationship between GSM and EnvP will be stronger with higher perception of RA.

The RC of resources refers to practices that optimise the use of water, energy and construction materials during project implementation (Gupta & Agrawal, 2018; Martens & Carvalho, 2017). RC is a practice that prevents the overexploitation of natural resources and addresses contemporary environmental degradation issues (Gupta & Agrawal, 2018; Nguyen, Nguyen, & Hoang, 2019). In Japan, where consumption of natural resources is highly regulated, RC practices have led to improved EnvP (Arimura et al., 2016). Conversely, the energy consumption of condominium buildings in Sri Lanka was found to be high because of the design of building elements that ignore environmental consequences (Geekiyanage & Ramachandra, 2018). Specifically, the authors found that buildings with a high window-to-wall-ratio and East- and West-oriented windows consume more energy that resulted in low EnvP. Nonetheless, no conclusive evidence has been provided on whether the EnvA, EA and RA of RC practices will result in better EnvP. Without identifying the specific GPs, Shurrab et al. (2019) reveal that RA strengthened the influence of GP on the sustainable performance of construction firms. Following this finding, this study proposes that the higher the perception of EnvA, EA and RA, the stronger the effect of RC on EnvP. Therefore, the hypotheses are as follows:

H4: The positive relationship between RC and EnvP will be stronger with higher perception of EnvA.

H5: The positive relationship between RC and EnvP will be stronger with higher perception of EA.

H6: The positive relationship between RC and EnvP will be stronger with higher perception of RA.

WM refers to the practice of reducing, reusing and recycling that necessitates changes to the conventional construction practice of sending waste to landfill sites (Ajayi et al., 2017; Kulatunga, 2006). WM includes the control of waste generation, waste sorting and separation and disposal during different project phases (Ajayi et al., 2017). The European Union has targeted the minimisation of construction waste to 30% by 2020 (Gangolells et al., 2014). In Malaysia, irresponsible construction waste dumping is a key issue being addressed to ensure environmental sustainability goals can be achieved (CIDB, 2015). WM practices among contractors due to stakeholder pressure have resulted in waste reduction (Li et al., 2018). Closely monitoring construction waste to encourage recycling can be enhanced by using a management tool, such as a total index score to improve project EnvP (Cha et al., 2009). Similarly, Lam, Yu, Wu, and Poon (2019) demonstrate how bills of quantities can be used to accurately estimate the amount of construction waste for effective WM. Their study finds that projects using a prefabricated system and a mixture of aluminium and timber formwork have less construction waste. Barbudo, Ayuso, Lozano, Cabrera, and López-Uceda (2019) propose a three-phase treatment process to produce quality recycled aggregates that can be used in construction projects, limiting wastes that go to the landfills. In contrast with this positive relationship between WM practices and EnvP, little is known on whether perceptions of the EnvA, EA and RA of WM can increase EnvP. Similar to the aforementioned arguments, this study extends Shurrab et al. (2019) by proposing that the higher the perceptions of EnvA, EA and RA, the stronger the relationship between WM and EnvP. Therefore, the hypotheses are as follows:

H7: The positive relationship between WM and EnvP will be stronger with a higher perception of EnvA.

H8: The positive relationship between WM and EnvP will be stronger with a higher perception of EA.

H9: The positive relationship between WM and EnvP will be stronger with a higher perception of RA.

The conceptual model of the study, as shown in Figure 1, presents the study's hypotheses and the relationships between all variables.

5 | RESEARCH METHODOLOGY

The study employs a quantitative methodology for several reasons. First, the predictive nature of the study's objective—identifying the significant relationships between the exogenous, endogenous and moderator variables—justifies the use of a quantitative approach, as per Hair, Risher, Sarstedt, and Ringle (2019) and Ramayah et al., (2018). Second, the study relies on well-defined hypotheses and employs statistical analysis to obtain quantifiable results (Schutt, 2019). Third, the study uses a structured questionnaire survey as its data collection instrument. The questionnaire survey was developed from variables and items that have been identified or used in the plethora of studies that have investigated the influence of GPs on EnvP. Table 1 presents the list of sources of the variables.

5.1 | Measurement of variables

A questionnaire survey was administered comprising 19 items measured on a 5-point Likert scale, from 1 = *strongly disagree* to 5 = *strongly agree*, to rate three exogenous variables (GSM, RC and WM), one endogenous variable of EnvP and three moderators—the EnvA, EA

and RA. The GSM comprised three items adapted from Rao and Holt (2005) and Woo et al. (2016); the RC of four items was adapted from Gupta and Agrawal (2018) and Martens and Carvalho (2017); the WM comprised four items adapted from (Ajayi et al., 2017). There are three moderators; EnvA, EA and RA. Each moderator is measured using one reflective item adapted from Shurrab et al. (2019). All these variables were reflective. Additionally, EnvP, a formative endogenous variable with five items—improvement in compliance with environmental standards, pollution reduction, consumption of toxic materials, waste and energy consumption—was adapted from Geng et al. (2017) and Lee et al. (2015). The questions were content validated by three construction experts to ensure their clarity and suitability in the study's context. Table 1 presents the variables used in the study and their sources.

5.2 | Data collection

Convenience sampling was used to select project managers of contractor firms registered with the Malaysian CIDB who had agreed to participate in the study. First, contact numbers of the contractor firms were obtained from the CIDB; next, telephone calls were made to the contractor firms to solicit participation from their project managers. Subsequently, 280 questionnaires and self-addressed envelopes affixed with stamps were distributed by mail to project managers who had agreed. In total, 148 useable responses were received and analysed. Notably, Hair et al. (2019) suggests the use of "sample size" as an indicator for a representative sample. The required sample size can be calculated using the new gamma-exponential method
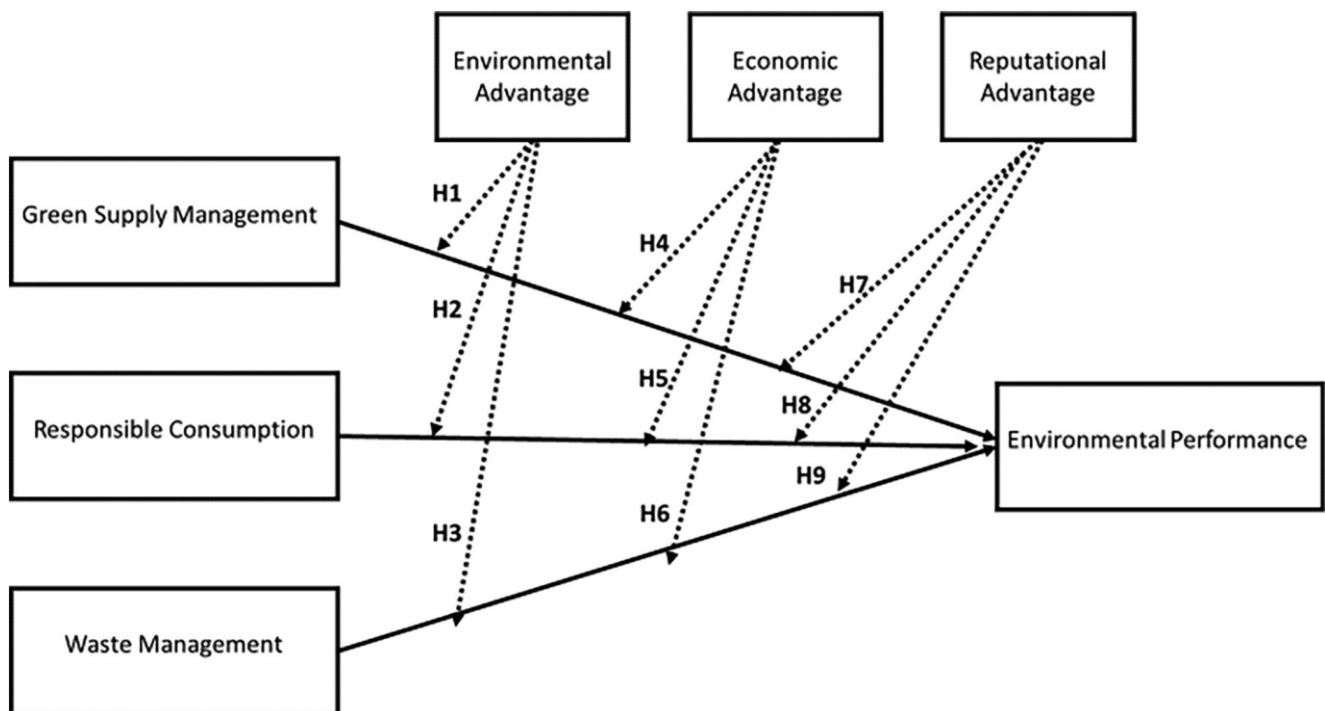

FIGURE 1 The conceptual model of the study

TABLE 1 Variables used and sources

Variables and items	No. of items	Type	Sources
Green practices (exogenous)			
Green supply management GSM1—Environmental consideration in supplier's selection criteria GSM2—Environmental audit for suppliers' internal management GSM3—Require environmental certified suppliers	3	Reflective	Rao and Holt (2005) and Woo et al. (2016)
Responsible consumption RC1—Use water responsibly RC2—Use energy responsibly RC3—Practise air pollution measures RC4—Practise noise pollution measures	4	Reflective	Gupta and Agrawal (2018) and Martens and Carvalho (2017)
Waste management WM1—Implement waste handling WM2—Recycle demolition materials WM3—Crushing and sorting of debris WM4—Transfer of non-recyclable material to landfill	4	Reflective	Ajayi et al. (2017)
Environmental performance (endogenous) EvnP1—Significant improvement in compliance with environmental standards EvnP2—Significant reduction in consumption of hazardous materials EvnP3—Significant reduction in resources consumption EvnP4—Significant reduction in waste EvnP5—Significant reduction in pollution	5	Formative	Geng et al. (2017) and Lee et al. (2015)
Moderators EnvA—Green practices provide more environmental benefits EA—Green practices provide higher economic benefits RA—Green practices enhance project's reputation	1 1 1	Reflective Reflective Reflective	Shurrab et al. (2019)

(Hair et al., 2019; Kock & Hadaya, 2018). The calculation using the gamma-exponential method showed that the minimum sample size of this study should be 146 responses (at the absolute significant path coefficient = 0.197, significant at 0.05 and the power of 0.8). This result indicates that the study's 148 useable responses surpass the threshold; hence, the representativeness of the sample is substantiated.

5.3 | Respondents

All respondents were project managers. In all, 55% of the respondents had worked for 3–5 years in the construction sector, 25% 6–10 years and 20% for >10 years. These measurements indicated the respondents had adequate experience to provide the necessary information to achieve the study's objectives. Project contract sizes were obtained as follows: 50% projects had a contract size of <M$5 million, 22% between M$5 million and M$10 million, 24% > M$10 million–M$50 million and 4% projects >M$50 million.

Since the study was cross-sectional, used the same instrument to collect data from the same sources and measured the endogenous and exogenous variables simultaneously, Harman's single-factor test

and full collinearity test were performed to ensure that study was free from common method bias (Jakobsen & Jensen, 2015). Harman's single-factor test showed that the first factor signified 30.97% of the variance, which was far below the threshold level of 50% of the total variance explained by the 19 items (Harman, 1960). Seven variables explained 77.64% of the variance and were well above 50%. In addition, a full collinearity test was conducted to check for common method bias, resulting in an average full collinearity of the variance inflation factor (AFVIF) = 2.389, in fulfilment of Kock (2017) 3.3 limit. Both tests confirmed the absence of common method bias in this study.

6 | DATA ANALYSIS AND TECHNIQUE

Partial least square structural equation modelling (PLS-SEM) was used to analyse the data for several reasons: (a) the study was predictive in nature and tried to identify how perceived advantages effected the relationship between GPs and EnvP (Rigdon, 2016), (b) the study involved both reflective and formative variables (Ramayah et al., 2018) and (c) The data were not normally distributed (Hair et al., 2019). A Shapiro–Wilk test was conducted, and the result

demonstrated that the study's Shapiro–Wilk was significant at 0.000, confirming the data were not normally distributed (Razali & Wah, 2011). All these reasons justify the use of PLS-SEM to conduct an analysis.

The study follows Hair et al. (2019)'s two stages evaluation of PLS-SEM modelling. Next, these two stages of evaluation were presented: stage 1, an evaluation of the measurement model and stage 2, an evaluation of the structural model.

6.1 | Stage 1-evaluation of measurement model

The validity and reliability of all variables were evaluated. The internal consistency, reliability, indicator reliability, convergent validity and discriminant validity were checked to evaluate the measurement model of reflective variables, whereas collinearity between the indicators and the significance and relevance of the outer weights were used to evaluate the formative variable (Hair et al., 2019). Composite reliability (CR) was used to check the internal consistency and reliability of the reflective items. Loading values were used to check for indicator reliability, and the average variance extracted (AVE) was used to check each indicator for convergent validity. Fornell and Larcker's criteria were used to check for discriminant validity (Hair et al., 2019).

Table 2 shows that the CR and loading values of all reflective variables were above 0.7, and the AVE of all variables was greater than 0.5, therefore complying with Hair et al. (2019) rules. The discriminant validity test using Fornell and Larcker's criterion indicated that the square root of the AVE of a variable was larger than the value of the correlations between model variables (Ramayah et al., 2018). These results indicated that the reflective variables met reliability and convergent validity requirements.

Subsequently, the sole formative variable was evaluated using the statistical significance and relevance of indicator weights, redundancy analysis and indicator collinearity (Hair et al., 2019). Table 3 presents the evaluation of the measurement model for the formative variable. The weights were more than zero with p values less than .05, and the variance inflation factors (VIFs) for the associated formative variable were less than 3.3, meeting Kock (2017) threshold. The full collinearity VIF of the formative construct was 1.776, satisfying Kock's 3.3 cutoff point. The results satisfied the formative variable requirement of validity and reliability.

6.2 | Stage 2-evaluation of structural model

Subsequently, lateral collinearity, the significance and relevance of the structural model relationships, the coefficient of determination (R^2) and predictive relevance (Q^2) were used to evaluate the structural model (Chin, 2010; Hair et al., 2019). Average block VIF (AVIF) and AFVIF values were used to assess lateral collinearity. The values indicated 2.415 for AVIF and 2.389 for AFVIF, which met the threshold of 3.3 indicating that the study was free from collinearity issues (Kock, 2017). The path coefficient was significant ($p \le .001$) with an

TABLE 2 Evaluation of the measurement model of reflective variables

Variables/Items	GSM	GSM1	GSM2	GSM3	RC	RC1	RC2	RC3	WM	WM1	WM2	WM3	WM4	EnvA	RA	EA
CR	0.903				0.899				0.879							
Item loadings		0.858	0.892	0.859		0.793	0.833	0.855		0.772	0.825	0.808	0.806			
AVE	0.756				0.691				0.645							
Discriminant validity (Fornell and Larcker's criterion)																
GSM	0.870[a]															
RC	0.352				0.831[a]											
WM	0.352				0.466				0.803[a]							
EnvA	0.246				0.299				0.471					1.000[a]		
RA	0.400				0.401				0.363					0.445	1.000[a]	
EA	0.176				0.229				0.278					0.525	0.462	1.000[a]

Abbreviations: AVE, average variance extracted; CR, composite reliability.
[a]Square root of the AVEs on the diagonal.

R^2 of 0.480, demonstrating a medium level of predictive accuracy (Chin, 2010). Additionally, Stone–Geisser Q^2 is included as other predictive relevance evaluation measures. The structural model recorded 0.484 for Stone–Geisser Q^2 (cross-validated redundancy), which was greater than zero, indicating a strong predictive power. The model's Simpson's paradox ratio was 0.750, surpassing Kock and

Gaskins (2016) minimum requirement. These results indicated a satisfactory fit and the strong predictive relevance of the structural model.

It should be noted that without the moderator variables the explained variance (R^2) was 0.423, and the Stone–Geisser Q^2 was 0.426. This means that there was an increase in explained variance (R^2) for EnvP by 13.4% (from 0.423 to 0.480) and an increase in the predictive relevance (Q^2) of the model by 12.8% (from 0.414 to 0.467) when the three moderators were included, indicating the presence of moderating effects. Next, the results of the hypotheses tests are discussed.

TABLE 3 Evaluation of the measurement model for the formative variable

Variables	Weight	p value	VIF	Full collinearity VIF
EnvP				1.776
EnvP1	0.243	.001	2.140	
EnvP2	0.248	<.001	2.327	
EnvP3	0.252	<.001	2.529	
EnvP4	0.248	<.001	2.356	
EnvP5	0.223	.002	1.663	

Abbreviation: VIF, indicator variance inflation factor.

7 | RESULTS

A hypothesis test of a one-tailed p value in relation to the path coefficient was conducted where the hypothesis was accepted if $p \leq .05$. A T ratio test was also conducted where the T ratio was calculated and compared against the cutoff point of 1.64 (Kock & Hadaya, 2018).

TABLE 4 Results of the hypotheses tests

| Hypothesis	Relationship	Path coefficient (β)	SE	p value	T ratios	Effect size	Supported?
$H1$	EnvA*GSM ❗ EnvP	−.148	0.080	.033	−1.858	0.043	Reject
$H2$	RA*GSM ❗ EnvP	.152	0.079	.029	1.909	0.031	Reject
$H3$	EA*GSM ❗ EnvP	−.075	0.081	.177	−0.929	0.016	No
$H4$	EnvA*RC ❗ EnvP	−.080	0.081	.160	−0.996	0.006	No
$H5$	RA* RC ❗ EnvP	.091	0.081	.129	1.136	0.001	No
$H6$	EA*RC ❗ EnvP	.027	0.082	.369	0.336	0.002	No
$H7$	EnvA *WM ❗ EnvP	.078	0.081	.168	0.967	0.006	No
$H8$	RA*WM ❗ EnvP	.016	0.082	.421	0.200	0.001	No
$H9$	EA*WM ❗ EnvP	.085	0.081	.148	1.048	0.008	No
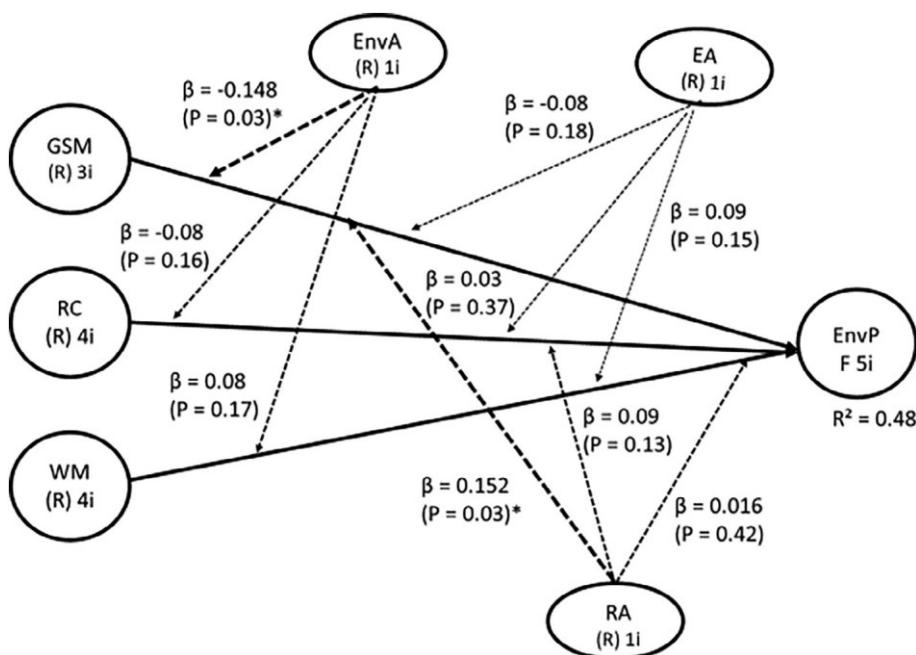
FIGURE 2 Results of the hypotheses tests (in diagram)

Table 4 and Figure 2 show the results of the hypotheses tests. Only two paths were significant: EnvA *GSM ꟷ EnvP path was negative (β = −.148) and significant ($p \leq$ .05 and T ratio $\geq \pm 1.64$), and RA *GSM ꟷ EnvP was positive (β = .152) and significant ($p \leq$ .05 and T ratio $\geq \pm 1.64$), whereas the other paths were not significant. Kenny (2018) guideline was used to assess the strength of the moderating effects where the f^2 value of .005 was small, .01 was medium and .025 was large. The highest moderating effects originated from EnvA *GSM ꟷ EnvP where f^2 = 0.043, which was large. Nevertheless, the effect size of RA *GSM ꟷ EnvP was also large at f^2 = .031.

In EnvA*GSM ꟷ EnvP, the EnvA moderator changed the sign of the path from positive (β = .338) to negative (β = −.148). This means that EnvA change the causal relationship between GSM and EnvP. Figure 3(a,b) plots the differing significant effects of the EnvA moderator on the GSM–EnvP relationship. First, the lower the EnvA, the steeper the slope of the GSM–EnvP relationship. This means that lower EnvA had a greater effect on the GSM–EnvP relationship than higher EnvA. Second, the line of lower EnvA moved upward from left to right, signifying that the relationship between GSM and EnvP is positively strengthened when the EnvA is low. In other words, if the environmental advantage is perceived as low, the more GSM is practised, the greater will be the EnvP. Therefore, this result rejects H1. In contrast to H1, the result reveals that the significant positive relationship between GSM and EnvP is stronger when the EnvA is lower.

Referring to RA*GSM ꟷ EnvP, Figure 4(a,b) plots the differing significant effects of the RA moderator on GSM–EnvP interaction. First, the low RA line is steeper than the high RA. This means that a lower RA had a greater effect on the GSM–EnvP relationship compared with a higher RA. Second, the lower RA line is moving upward from left to right. This means that the relationship between GSM and EnvP is positively strengthened when the RA is low. In other words, when RA is low, the more GSM is practised the greater EnvP will be. Therefore, H3 is rejected. Instead, the result reveals that the significant positive relationship between GSM and EnvP is stronger with lower RA.

8 | DISCUSSION

In contrast to previous studies, this article provides a better understanding of the moderating effects of perceived advantages of GPs by considering separately how EnvA, EA and RA affect the GPs–EnvP relationship. The results provide vital evidence about the heterogeneity of effects: lower EnvA and RA were found to significantly influence the relationship between GSM and EnvP. Generally, the results do not support either Gledson and Greenwood (2017) argument or the argument of Al-Abdin et al. (2018) about the effects of perceived advantages. Instead, the results revealed that the influence of GSM on EnvP is stronger when there are lower EnvA and RA, with the highest
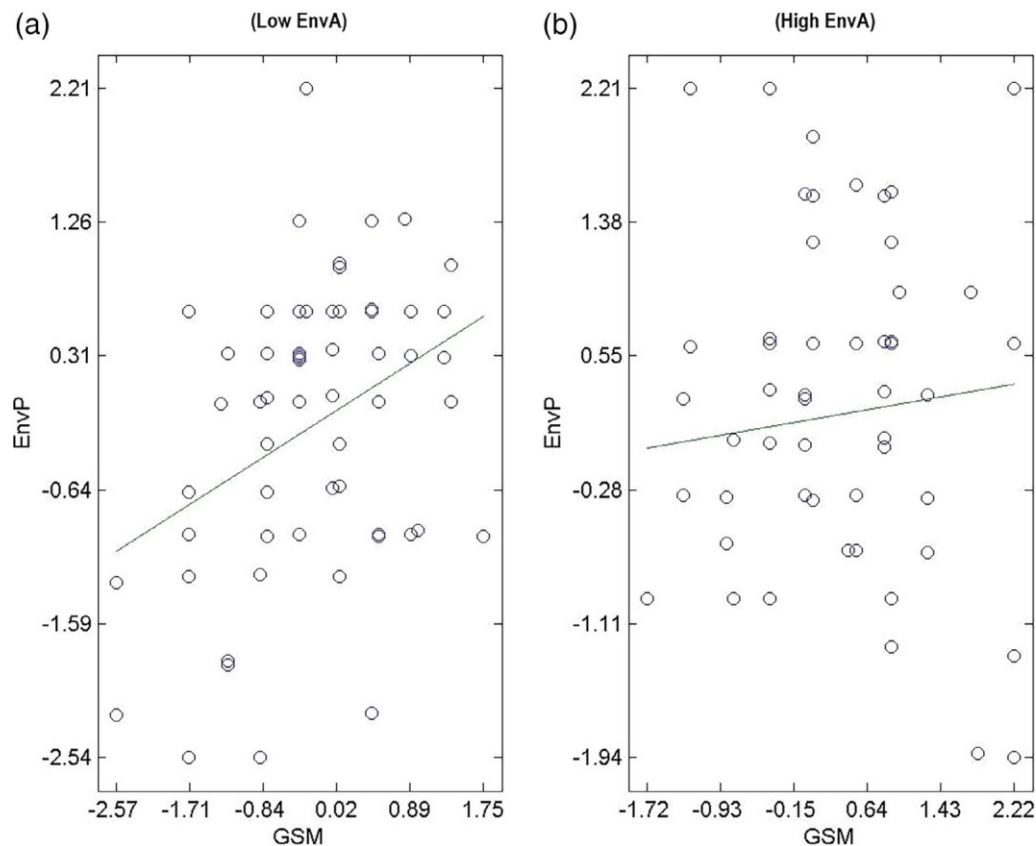

FIGURE 3   (a,b) The effects of environmental advantage on the GSM–EnvP relationship [Colour figure can be viewed at wileyonlinelibrary.com]
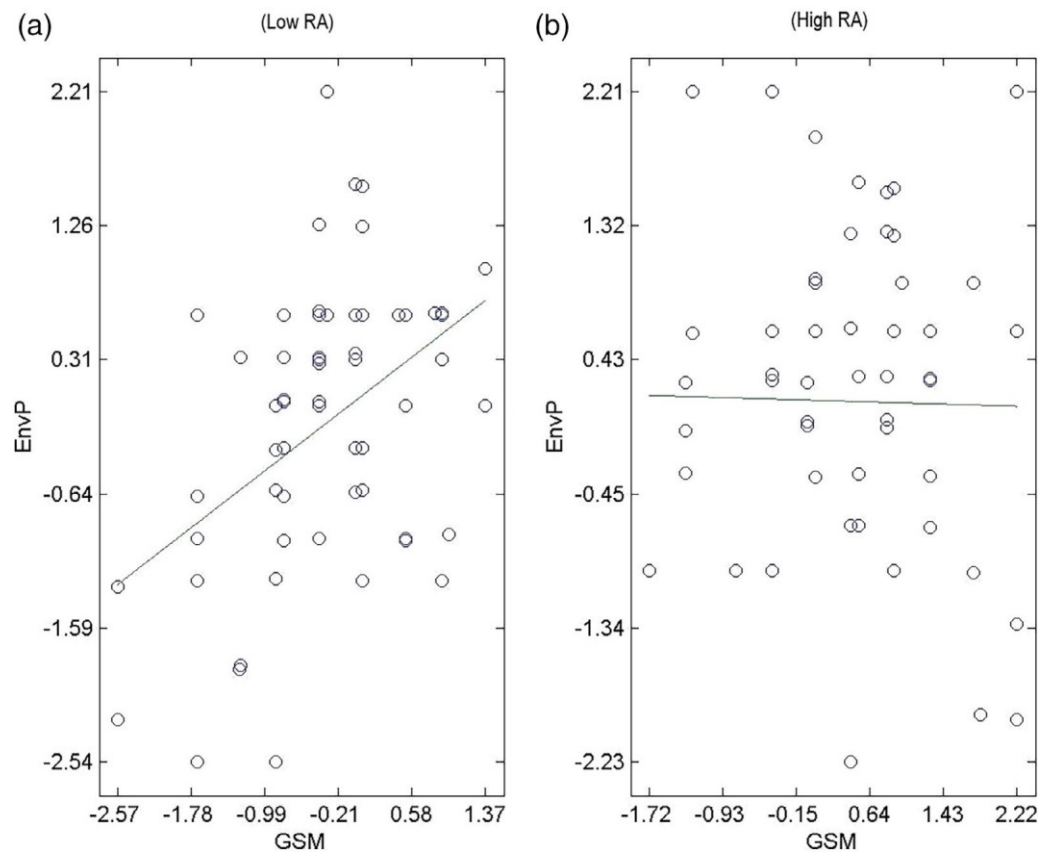
FIGURE 4 (a,b) The effects of reputational advantage on GSM–EnvP relationship [Colour figure can be viewed at wileyonlinelibrary.com]

moderating effect deriving from the lower EnvA and there was insufficient evidence to support the effect of EA.

This study reveals that the positive effect of GSM on EnvP is stronger when the environmental advantage of GPs is perceived as low. One possible reason is that in developing countries like Malaysia, environmental dilapidation still occurs among projects with environmental approval or adopting GPs. The Bukit Kukus landslide (Dermawan, 2018), Pasir Gudang toxic waste and air pollution (Palansamy et al., 2019) and Penang coastal development (Raman, 2019) are examples of such incidents. Additionally, it is widely known that knowledge of GPs among construction workers is lacking (Kulatunga, 2006; Li et al., 2018). In this situation, the EnvA of GPs is unclear. When project managers are uncertain about environmental advantages (or low EnvA of GPs), it puts pressure on project managers to be more vigilant to reduce negative environmental impacts in order to avoid penalties or on-site accidents. In these circumstances, GSM practices such as incorporating environmental considerations in supplier selection or selecting suppliers with ISO14000 certification help to provide better EnvP. Therefore, the study confirms that the positive relationship between GSM and EnvP is stronger with lower EnvA. The result does not support Shurrab et al. (2019) assertion that the advantages of GPs strengthened the influence of GP on the sustainable performance of construction firms.

Similarly, this study shows that GSM practices positively contribute to higher EnvP if reputational advantage is perceived as low. The result differs from Shurrab et al. (2019). One possible explanation is that in most developing countries, price competition strategies are still dominant in the construction sector, meaning projects or practices with lower costs get selected or adopted more often than green projects or GPs (Liu, Teng, Jiang, & Gong, 2019). Likewise, in developing countries, environmental goals are considered less important than the national development agenda of providing the people infrastructure, housing and services needs, which explains insufficient support for GPs (Ma, Hou, & Xin, 2017; Yusof & Kamal, 2018). In this situation, when project managers are not convinced that a better reputation will be gained through GPs, GSM is adopted to increase stakeholders' trust and confidence. Such measures subsequently improve EnvP. Thus, the present study affirms that the positive relationship between GSM and EnvP is stronger when RA is lower.

9 | CONCLUSIONS

The study investigated the effects of EnvA, EA and RA of GPs on GPs–EnvP relationships. Contrary to the general understanding that higher perceived advantages of GPs will exert a stronger influence on GPs–EnvP relationships, this study reveals otherwise. Specifically, the study found that GSM has a stronger impact on EnvP when EnvA and RA are low. The results imply that in Malaysia, where the EnvA and RA of GPs are low or vague, which is also the case in other developing

countries (see Al-Abdin et al. (2018), Nguyen et al. (2019), and Zhu et al. (2019)), green action in the form of GSM is more important for improving EnvP. The more GSM is practised, the better the EnvP. The findings are similar to those from many studies that have emphasised green actions or GPs for enhancing EnvP; for examples, see Lintukangas et al. (2015) and Zhu et al. (2019).

An important policy implication of the findings is that in developing countries "action" is vital to reinforce greater EnvP rather than "perceptions" of the advantages of GPs. These findings act as a wake-up call to developing countries to rethink their campaign strategies that aim to increase practitioners' awareness of the advantages of GPs. Rather, what is more important for policy makers and project managers is ensuring that GSM is implemented and then monitoring how GSM is implemented in construction projects. Therefore, it is essential that campaigns on advantages of GPs are followed by strategies to ensure GSM adoption. Methods for enhancing GSM in project organisations should be identified by considering the limitations and challenges that these developing countries face. Prior studies have recommended several strategies to ensure GSM is being adopted, including the selection of green suppliers and the early and effective involvement of suppliers (Geng et al., 2017; Lintukangas et al., 2015). Construction governing bodies, such as CIDB in Malaysia, can encourage construction suppliers to involve GSM early in the project life cycle so that environmental considerations and regulations are observed. Clients can also request suppliers to be actively and effectively involved in the project's environmental tasks. Project organisations should only select suppliers that are committed to GPs or that adopt environmental management systems. Recruiting skilled purchasing personnel during project organisation to ensure green suppliers are selected can also help to improve EnvP. Following suggestions from prior studies, stricter environmental regulations (Kulatunga, 2006) and closer monitoring (Ferrón-Vílchez, 2016) of GSM can also result in better EnvP.

This study makes two theoretical contributions to the literature. First, this study provides empirical evidence of the importance of "practice" rather than "perceived advantage" to strengthen EnvP, contrary to Gledson and Greenwood (2017). Moreover, this study demonstrates that the extent of GSM practised is crucial too; the more GSM is practised, the greater the EnvP, supporting Lee et al. (2015) and Woo et al. (2016). Second, unlike the literature (Choi & Han, 2019; Ferrón-Vílchez, 2016 and Shurrab et al., 2019), this study considers three moderators of perceived advantages and demonstrates the heterogeneity of their effects: only low EnvA and low RA affect GSM–EnvP. As such, these findings support the assertions of Aguinis (1995) and Arimura et al. (2016) on the importance of recognising moderating factors and their divergent effects.

The study has some limitations that proffer the need for further studies. First, just like prior studies, the present study was unable to support the moderating effects of the three EnvA, EA and RA of RC–EnvP and WM–EnvP relationships. This means that their relationship remains vague and deserves additional study, perhaps through a case study approach. Second, as evidenced by Harman's single-factor test and full collinearity test proposed by Jakobsen and Jensen (2015), the present study is free from common method bias. In addition to these "diagnostic"

tests, as a good research practice, future studies could adopt procedural remedies such as providing clear instructions that all respondents' opinions are valuable, and there is no right or wrong answer, using different scales or obtaining information from different sources for the exogenous and endogenous variables as suggested by Podsakoff, MacKenzie, and Podsakoff (2012). Finally, the study was conducted in Malaysia. Although the results can be generalised to developing countries such as China (Zhu et al., 2019), Lebanon and Turkey (Al-Abdin et al., 2018) that have faced similar development and environmental challenges, testing the model in different countries or conducting a comparative study may provide greater understanding of the GPs–EnvP relationship.

ORCID

Nor'Aini Yusof https://orcid.org/0000-0002-8943-6868

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