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WELCOME SPEECH FROM THE CHAIRMAN

RISM 17th International Surveying Conference for Undergraduates (ISCU 2025)

بسم الله الرحمن الرحيم السلام

عليكم ورحمة الله وبركاته

Greetings to all,

It is with great pleasure that I welcome you to the 17th RISM International Surveying Conference for Undergraduates (ISCU 2025), themed *"Embracing Construction Revolution 4.0: Transforming Malaysia's Built Environment."* On behalf of the Royal Institution of Surveyors Malaysia (RISM), I also wish to express our sincere appreciation to Universiti Teknologi MARA (UiTM), Perak Campus, for graciously hosting this significant event.

As we navigate the era of the Fourth Industrial Revolution (IR4.0)—or in our context, Construction Revolution 4.0 (CR4.0)—we are witnessing transformative advancements across the global construction sector. Technologies such as Building Information Modelling (BIM), the Internet of Things (IoT), artificial intelligence (AI), robotics, big data analytics, and cloud computing are redefining the way we build, manage, and interact with our built environment. For Malaysia, embracing CR4.0 is a strategic imperative to achieve our socio-economic and environmental goals.

This conference serves as a vital platform to unite surveying undergraduates from various disciplines, fostering critical dialogue on industry challenges, enhancing professional networking, and preparing a new generation of talent for the rapidly evolving construction landscape. It is also an opportunity for employers to engage with and inspire our future professionals.

I would like to extend my heartfelt thanks to all industry speakers, paper presenters, judges, and participants for their time, contributions, and support in making ISCU 2025 a success. I also commend the organising committee for curating a meaningful and dynamic conference experience.

May the knowledge gained, connections formed, and ideas exchanged during this event inspire all participants to lead and innovate in their future endeavours.

Wishing everyone a productive and memorable conference.

Prof. Ts Sr Dr. Adi Irfan Bin Che Ani'
Chairman, Universities' Partnering Committee
RISM Session 2024/2025
May 2025

WELCOME SPEECH FROM CO-CHAIRMAN

RISM 17th International Surveying Conference for Undergraduates (ISCU 2025)

Bismillahirrahmanirrahim.

السلام عليكم ورحمة الله وبركاته and greetings to all.

It is my great pleasure to welcome everyone to the 17th International Surveyor Conference for Undergraduates (ISCU 2025), proudly hosted by Universiti Teknologi MARA (UiTM) Perak Branch in collaboration with the Royal Institution of Surveyors Malaysia (RISM). This event is a meaningful platform for students in the built environment to share ideas, showcase innovations, and build professional networks. We are honoured by your presence and enthusiastic participation, with 135 accepted papers and 78 poster presentations this year.

UiTM Perak, home to the College of Built Environment, has long been a hub for academic excellence in architecture, planning, and surveying. Our commitment remains strong in nurturing competent graduates who meet industry demands and contribute to nation-building.

While you're here, we invite you to experience the heritage and culture of Perak Tengah from the architectural richness of Rumah Kutai to the historical towns of Pasir Salak, Bota, and Kampung Gajah.

To all presenters and winners, congratulations on your achievements. Let your work today be a catalyst for future success and academic growth. We hope this conference will inspire you to explore new ideas, foster collaboration, and make lasting memories.

My deepest thanks to the Royal Institution of Surveyors Malaysia (RISM) and the organising committee for making this event a success.

We hope your experience here will be rewarding and unforgettable.

Thank you. Selamat datang dan selamat berjaya.

Associates Professor Dr. Nur Hisham Ibrahim, *PMP*
Co-Chairman, Universities' Partnering Committee
RISM Session 2024/2025
May 2025

WELCOME SPEECH FROM THE PROJECT DIRECTOR

RISM 17th International Surveying Conference for Undergraduates 2025

Alhamdulillah, all praise to Allah S.W.T. for His guidance and blessings in making the RISM 17th International Surveying Conference for Undergraduates (ISCU) 2025 a reality.

It is with great honour and gratitude that I welcome all participants, guests, academicians, and industry professionals to this prestigious event, proudly organized under the Royal Institution of Surveyors Malaysia (RISM). This 17th edition of ISCU stands as a proud testament to our collective dedication toward academic excellence, professional collaboration, and youth empowerment in the field of surveying.

I extend my heartfelt appreciation to RISM for its unwavering support, to the hardworking ISCU 2025 Organising Committee, and to all 16 partnering universities across Malaysia for their commitment and contributions. Your efforts have shaped this conference into a dynamic platform for knowledge exchange, innovation, and professional growth.

To the academicians and practitioners present, your insights are invaluable in bridging the gap between academic theory and real-world practice. To our undergraduate participants, your passion, curiosity, and commitment are the very foundation of our future. May this conference not only deepen your academic journey but also ignite a spirit of leadership, integrity, and sustainable thinking.

Let this gathering serve as more than an academic milestone. May it foster lifelong networks, inspire transformative ideas, and chart new directions in our shared professional journey.

Wishing everyone a rewarding and inspiring conference experience.

Sr Dr. Nurul Fadzila Zahari
Project Director
RISM 17th ISCU 2025

HARNESSING GREEN PROCUREMENT FOR SUSTAINABLE EXCELLENCE IN THE MALAYSIAN CONSTRUCTION INDUSTRY

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ABSTRACT

Achieving sustainable excellence in the Malaysian construction industry requires a fundamental shift in procurement practices. Conventional procurement methods contribute to excessive carbon emissions, resource depletion and environmental degradation, posing significant sustainability challenges. Despite growing awareness of sustainability, the adoption of green procurement remains limited due to various industry constraints. This study aims to investigate green procurement in Malaysian construction projects by identifying prevalent practices and examining key drivers influencing adoption. A quantitative research design is employed using a structured questionnaire for data collection. A pilot test was conducted with 30 respondents, including developers, consultants, and contractors. The preliminary findings are presented in this paper after the data has been analysed using SPSS software. The findings suggested that the primary green procurement practices currently adopted in the Malaysian construction industry are waste management and recycling, giving preference to certified products and procuring non-toxic and low-volatile organic compounds (VOCs) materials. Similarly, the key drivers of green procurement practices are regulations and standards of green procurement, availability of green products and services, and availability of green suppliers alongside environmental sustainability. These findings will support the development of strategic policies, frameworks, and best practices to enhance green procurement implementation across the sector. This study has significant implications for policymakers, industry professionals, and stakeholders by offering evidence-based recommendations to integrate green procurement into standard construction practices. By fostering environmental responsibility, promoting resource efficiency, and enhancing long-term resilience, this study contributes to the ongoing discourse on sustainability in the construction industry. The originality of this study lies in its focus on quantifying key determinants of green procurement adoption in Malaysia, bridging the gap between theoretical discussions and practical applications in sustainable construction.

Keywords: Green procurement, sustainable excellence, environmental sustainability, construction industry, procurement strategies

I. INTRODUCTION

Pervez et al. (2021) highlight that the construction industry contributes approximately 13% of the global gross domestic product (GDP) and this percentage is expected to rise quickly to 14.7% by 2030. Although the construction industry is vital to economic growth, there are severe environmental issues associated with it. In many developing nations, rapid physical development is undertaken in order to meet the growing demands of the population. However, this rapid expansion also frequently results in environmental degradation, carbon dioxide (CO_2) emissions, waste generation and water pollution (Tawfik Alqadami et al., 2020)

Sustainable development was introduced to address significant environmental challenges by emphasising resource and energy conservation, material recycling, lowering toxic emissions and enhancing indoor living conditions while preserving the capacity of the ecosystem (Alqadami et al., 2020). In the meantime, the United Nations developed Sustainable Development Goals (SDGs) to provide a worldwide framework for attaining sustainable development by 2030 in terms of the environmental, social and economic domains. In order to

facilitate the achievement of SDG 12, green procurement practices were implemented in the industry (Opoku et al., 2022).

In Malaysia, green procurement is integrated into environmental management strategies through key policies such as the 11th Malaysia Plan (2016–2020), Construction Industry Transformation Programme (CITP) 2016–2020 and National Construction Policy 2030 (NCP2030) (Anuar et al., 2021). However, despite its potential, the widespread adoption of green procurement remains a challenge, as conventional procurement methods continue to dominate the Malaysian construction sector (Abdul Hadi et al., 2022).

Numerous international studies have been conducted with an emphasis on green procurement in the construction industry. For instance, Opoku, et al. (2022) investigate the factors that encourage and hinder the use of sustainable procurement in the Chinese construction sector and its impact on achieving SDG 12. Similarly, Mungkung, et al. (2021) examine the context, policy and practice of GPP in Thailand to assess the progress towards Sustainable Consumption and Production (SCP) of the country. In contrast, Khaderi, et al. (2022) focus on assessing the challenges to implementing green procurement from the developer's perspective. Despite growing awareness of green procurement, there remains a significant gap in understanding the actual implementation of green procurement practices in the construction industry and the key factors driving their adoption. Existing studies often focus on the theoretical benefits of green procurement rather than examining its real-world application, leaving industry stakeholders with limited insights into effective strategies for implementation. To bridge this gap, this study first assesses the current green procurement practices within the Malaysian construction industry. Once a clear understanding of these practices is established, the study then identifies the key drivers influencing their adoption. By doing so, this study aims to provide actionable insights that support the development of targeted strategies to enhance green procurement adoption and improve the industry's overall sustainability performance. Hence, this study aims to address the following study questions:

1. What are the green procurement practices currently adopted in the Malaysian construction industry?
2. What are the drivers influencing the adoption of green procurement practices in the construction industry?

II. LITERATURE REVIEW

A deductive approach was used to identify and shortlist relevant papers for the literature review, focusing on green procurement practices and their drivers in the construction industry. This process led to the identification of 15 green procurement practices and 21 drivers, as illustrated in Figures 1 and 2, respectively. These figures provide a comprehensive overview of key insights from the literature. According to Tawfik Alqadami et al. (2020), green procurement in construction entails acquiring products and adopting practices that comply with regulations, with the aim of minimising environmental impact throughout the construction process.

2.1 Green Procurement Practices

2.1.1 Conventional Green Procurement Practices

In the construction industry, the qualification of stakeholders based on their knowledge and experience significantly impacts the green performance of projects (Khahro et al., 2021; Yap et al., 2024). Furthermore, a study conducted by Pesta et al. (2020) highlights that approximately 34% of construction waste on sites is made up of packaging materials. This study emphasises the significance of reducing material packaging rather than ones that end up in landfills or incineration.

In addition, procuring non-toxic and low-volatile organic compounds (VOCs) materials is essential to minimise air pollution and improve healthier indoor environments (David & Niculescu, 2021; Kwon et al., 2021). Moreover, choosing materials with eco-certifications assures that manufacturers adopt environmentally responsible practices to mitigate the environmental impact of their products (Yousif et al., 2023).

According to Balasubramanian (2020), the adoption of local suppliers further contributes to sustainability by minimising the transportation-related carbon footprint with a potential reduction of approximately 6 to 8%. Furthermore, purchasing green products and services is essential for promoting sustainability and environmental responsibility in construction projects. This approach is often reinforced by incorporating green specifications into contracts to ensure contractors comply with defined sustainability requirements (Athigakunagorn et al., 2024).

Value for money is achieved by prioritising long-term benefits over immediate cost savings. Hence, clients or consultants increasingly favour contractors and suppliers who fulfil the required environmental standards, even when there is a minor increase in cost (Khan et al., 2024).

In line with energy conservation efforts, the adoption of energy-efficient machinery and equipment has become increasingly significant in the mechanisation of modern construction projects. The growing emphasis on sustainability has led to a shift in procurement practices that now favour technologies such as hybrid or electric vehicles and energy-saving equipment. Furthermore, effective waste management can mitigate environmental degradation (Nwaogbe et al., 2025).

2.1.2 Innovative Green Procurement Practices

The worldwide information technology (IT) revolution has led to the adoption of e-procurement in the public sector by nearly every country (Opoku et al., 2022). In the meantime, prefabrication and modular construction help accomplish the objectives of green procurement through the reduction of greenhouse gas emissions, dust production and material waste by limiting on-site construction activities (Liu et al., 2022). Furthermore, the utilisation of renewable energy sources and technologies has become a priority in sustainable construction projects. According to Khan & Al-Ghamdi (2021) and Chen et al. (2024), the adoption of solar panels and wind turbines can lessen the demand for fossil fuels, which subsequently reduces greenhouse gas emissions. With advancements in technology, Building Information Modeling (BIM) enhances communication and decision-making by integrating 3D models, allowing for comprehensive environmental performance evaluations and the implementation of sustainability solutions (Ferdosi et al., 2023). Additionally, procuring green building technologies not only addresses climate-related concerns but also provides substantial long-term economic benefits by reducing operational costs (Lai et al., 2023).

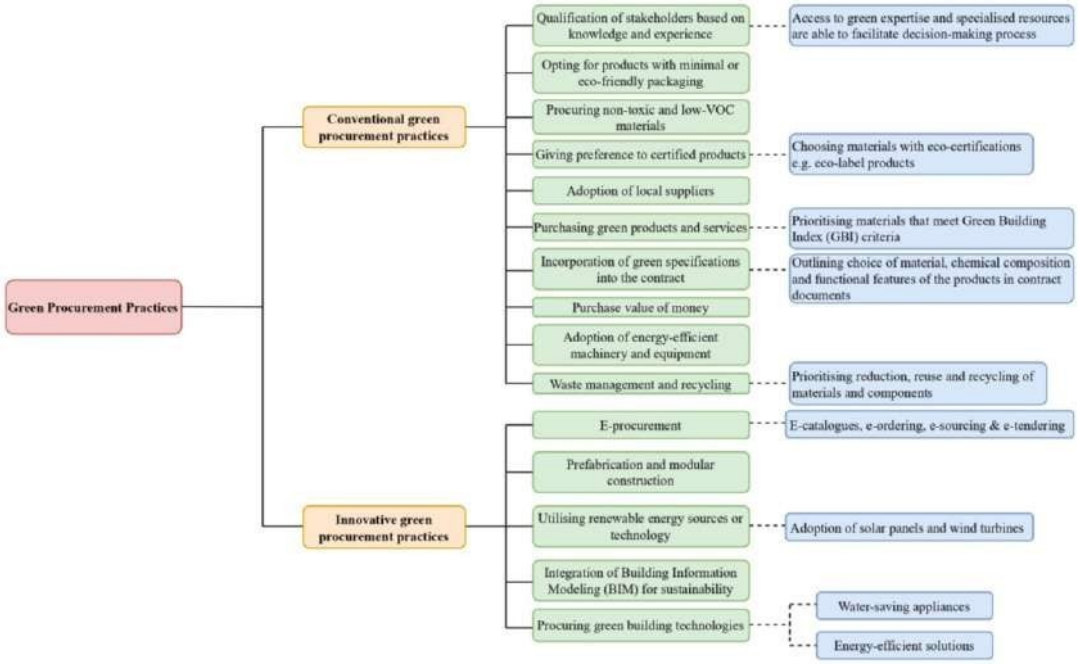

Figure 9.0 Green Procurement Practices

2.2 Drivers of Green Procurement Practices

2.2.1 Policy and Governance Support

Government policies and guidelines can cultivate a way of thinking that will dedicate the particular rules and regulations at the project level (Aida Bidin et al., 2020). Moreover, efficient regulation and standards are essential for improving the application of green procurement and advancing sustainability. Ahmed et al. (2023) highlights that outdated green building codes and regulations pose significant barriers to sustainable construction. By providing both financial and non-financial incentives, the government can encourage environmentally friendly procurement practices. However, the effective adoption of green procurement practices in construction firms of each country is correlated with the awareness of and familiarity with policies, guidelines, regulations and standards. Hence, additional campaigns and workshops should be offered (Razali et al., 2021).

2.2.2 Leadership and Corporate Strategy

Successful integration of green procurement into current corporate practices requires commitment from top management. This commitment is affected by the environmental vision of the company and the dedication of executive leadership (Razali et al., 2021). A study in China indicates that the integration of Corporate Social Responsibility (CSR) with green procurement practices significantly aids in lowering carbon dioxide emissions and enhancing ecosystem sustainability (Avotra et al., 2021). Furthermore, green procurement practices enhance a company's image and foster long-term customer loyalty.

2.2.3 Economic and Market Dynamics

There are significant long-term financial benefits for green procurement practices even though the initial cost of implementing these practices is frequently greater than those of conventional approaches (Adebayo et al., 2024). Simultaneously, the growing market demand for green products encourages developers to recognise the potential advantages of implementing green procurement, further driving its adoption in the construction industry (Sajjad et al., 2021). Liu et al. (2020) also highlight that developers who take a proactive role in integrating green building standards into their projects can help firms gain marketing benefits.

2.2.4 Environmental and Social Responsibility

In the construction industry, green procurement practices are largely driven by environmental sustainability. Bohari et al. (2024) underscore that various innovative green practices are required to be adopted in sector in order to help to slow down the natural resource depletion. Furthermore, implementing green practices and procedures minimises absenteeism and adverse effects on workers' health (Yap et al., 2023). Beyond the workplace, these efforts contribute to broader societal benefits, thereby enhancing public health and overall quality of life (Shurrab et al., 2019).

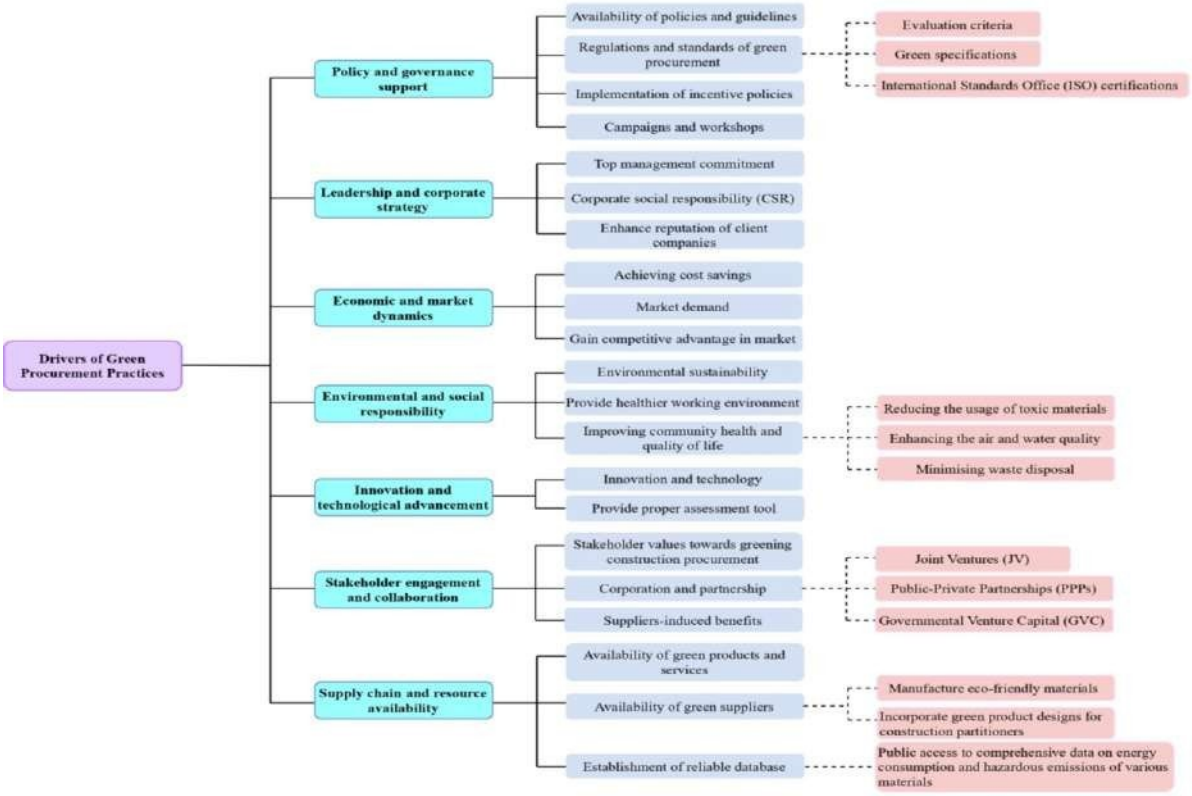

Figure 10.0 Drivers of Green Procurement Practices

2.2.5 Innovation and Technological Advancement

Saudi et al. (2019) highlight that green innovation involves developing environmentally friendly products integrated with sustainable practices to reduce energy use, emissions and waste while enhancing efficiency and financial benefits. At the same time, the availability of proper assessment tools can provide substantial information for construction team members throughout the design process by assessing the potential effects of a project (Aida Bidin et al., 2020).

2.2.6 Stakeholder Engagement and Collaboration

According to Aida Bidin et al. (2020), stakeholder perceptions have a substantial impact on the outcomes of construction projects while stakeholder commitment, capability and motivation are necessary components for project success. In addition, collaboration between corporations and strategic partnerships further strengthens the transition toward green procurement. Moreover, supplier-induced benefits are a significant driver of green procurement as construction firms shift from mere transactions to shared environmental responsibility (Ali et al., 2023).

2.2.7 Supply Chain and Resource Availability

Yap et al. (2024) highlight that high costs and limited incentives often deter developers from embracing green procurement in construction. However, the dynamics of supply and demand in the market may cause prices of these products and services to decline as their availability rises. Equally important is green suppliers' commitment to sustainable production, which accelerates the industry's shift toward eco-friendly construction. Additionally, establishing a reliable database is essential for informed decision-making.

III. METHODOLOGY

This study adopts a pragmatic research paradigm and employs a quantitative research approach using a field survey due to its cost-effectiveness, speed, and ability to gather data from a large sample. A non-probability sampling method, particularly convenience and snowball sampling with stratification, will be used to target construction practitioners, including clients, consultants, and contractors, within the Klang Valley region. The Klang Valley is selected as it represents a major hub for construction activity in Malaysia, contributing significantly to the total construction value of RM34.1 billion in the fourth quarter of 2023, with Selangor and the Federal Territories accounting for RM8.6 billion and RM4 billion, respectively (The Sun, 2024). Figure 3 illustrates the research plan of this study.

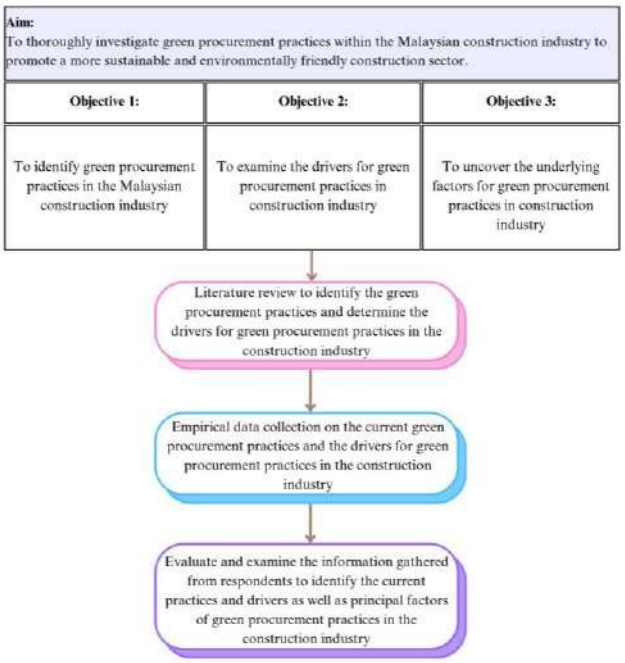

Figure 11.0 Research Plan

3.1 Questionnaire Design

The questionnaire comprises a series of statements developed from Figures 1 and 2 and derived from the literature review to assess:

(a) the implementation of green procurement practices in the Malaysian construction industry; and
(b) the drivers of green procurement in the Malaysian construction industry.

Each part, Section A and B, comprises 15 and 21 statements, respectively, evaluated using a five-point Likert scale. Detailed descriptions of both sections are provided in Appendix 1 and Appendix 2 at the end of this paper.

Furthermore, the questionnaire will collect demographic information from respondents, including the nature of organisations, years of experience and the types of projects they are predominantly involved in.

IV. PRELIMINARY FINDINGS

A pilot study was conducted with a target of 30 respondents as part of a larger study effort with a final sample size of 140. Initially, a total of 35 questionnaires were distributed to construction practitioners via WhatsApp and

social media, yielding 30 completed responses – an approximate response rate of 86%. Table 1 presents the demographic profile of respondents.

Table 1.0 Demographic Profile of Respondents

Parameter	Categories	Total	Percentage (%)
Nature	Developer	7	23.3
	Consultant	14	46.7
	Contractor	9	30.0
Working Experience	< 5 years	20	66.7
	5 – 10 years	5	16.7
	11 – 15 years	2	6.7
	> 15 years	3	10.0
Type of Project	Private	27	90.0
	Public	3	10.0

4.1 Reliability of Scale Used

Cronbach's alpha reliability test is conducted to assess whether the gathered data is consistent and reliable.

Table 2.0 Summary of Reliability Analysis

Category of Variables	Number of Items	Alpha Value
Green Procurement Practices	15	0.806
Drivers of Green Procurement Practices	21	0.901

As shown in Table 2.0, the alpha values for each variable surpassed the threshold of 0.70, indicating strong internal consistency. Thus, the collected data is deemed to exhibit good to excellent reliability.

4.2 Ranking of Practices and Drivers

Mean score and standard deviation are used to determine the top three most significant practices and drivers based on their ranking. As shown in Appendix 2, the top three green procurement practices in the construction industry are 'waste management and recycling', 'giving preference to certified products' and 'procuring non-toxic and low VOC materials'.

Waste management and recycling emerged as the most widely adopted practice with a mean of 4.37. According to Opoku et al. (2022), the construction industry is a major contributor to waste generation in most countries. The Construction and Demolition Waste (CDW) predominantly consists of concrete, ceramics, mortar, masonry and packaging such as paper, plastic and wood, while timbers, bricks, steel and plastics are commonly generated as construction waste in Malaysia. Thus, effective waste management not only reduces the volume of waste and the cost of landfill disposal but also mitigates environmental degradation. This is supported by Mohammed et al. (2020) who highlights that effective waste management can minimise environmental impact by prioritising the reduction, reuse, and recycling of materials and components.

The second-ranked practice is giving preference to certified products. This finding aligns with a previous study by Yuan (2023) which emphasises that selecting eco-label products can improve indoor air quality and foster a better interior environment during manufacturing and consumption. Moreover, eco-labelling details the manufacturers' approach to addressing the environmental impact of the products, thereby providing valuable guidance to construction stakeholders in selecting the most appropriate green products and services for their projects (Yousif et al., 2023). The emphasis on eco-labelling suggests that construction stakeholders are increasingly prioritising products with verified environmental benefits, indicating a shift towards more informed and responsible procurement decisions.

Procuring non-toxic and low-VOC materials is ranked as the third most significant practice in the construction industry. VOCs, such as formaldehyde and benzene, are classified as human carcinogens and are commonly found in laminate flooring, paints, adhesives, furniture finishes and various coatings applied to walls, ceilings and floors (Mai et al., 2024). Malik & Sarkhel (2024) highlight that low-VOC coatings have a reduced concentration of VOCs compared to traditional paints, as they are formulated with water or other environmentally safe solvents. This leads to lower emissions of harmful substances during both application and curing. Consequently, reducing VOC emissions enhances indoor air quality and helps prevent the formation of ground-level ozone, which is associated with respiratory issues and other health concerns. The preference for these materials reflects a heightened awareness of the health risks associated with VOC exposure, such as respiratory problems and other adverse health effects.

On the other hand, Appendix 3 shows that the top drivers of green procurement practices are 'regulations and standards of green procurement', 'availability of green products and services', 'availability of green suppliers' and 'environmental sustainability'.

Regulations and standards of green procurement are the primary drivers, with a mean of 4.57. Efficient standards such as green building codes and International Standards Office (ISO) certifications provide clear guidelines to assist construction projects in meeting predetermined environmental performance benchmarks (Jamoussi et al., 2022). Furthermore, Shurrab et al. (2019) highlight that ISO certification is increasingly included as part of the environmental criteria during the pre-qualification phase of the tendering process. This suggests that green procurement practices are becoming a prevalent trend among organisations across various industries as they strive to comply with governmental environmental regulations.

The availability of green products and services is ranked as the second driver, with a mean of 4.53. As the construction industry increasingly seeks to achieve sustainability targets, the accessibility of environmentally friendly materials and technologies plays a crucial role in reducing the ecological footprint and mitigating environmental degradation (Lau et al., 2023). However, Yap et al. (2024) underscore that high costs and limited incentives often deter developers from embracing green procurement in construction. Thus, expanding the availability of green products and services can enhance market competition, thereby making them more affordable and accessible.

The availability of green suppliers and the emphasis on environmental sustainability were jointly ranked as the third most critical drivers. In conventional practices, the selection of suppliers for construction projects often omits ecological efficiency in favour of technological and financial efficiency. However, due to the greater dedication to environmental conservation and the long-term implications for business, construction firms now prioritise suppliers' environmental consciousness when selecting suppliers for a particular project (Konys, 2019). As a result, green suppliers are actively involved in producing greener products in an environmentally friendly manner to improve the environmental performance while maintaining profitability (Mardani et al., 2020). Moreover, the successful implementation of green procurement practices has been aided by the increased public understanding of environmental sustainability (Bohari et al., 2024). As affirmed by Opoku et al. (2022), increased environmental awareness encourages contractors to adhere to environmental regulations which further reinforces the shift towards sustainable construction practices.

4.3 Assessing Data Normality

Normality test is used to assess whether the collected data is normally distributed. In this study, SPSS analysis yielded a p-value of less than 0.001 for both green procurement practices and drivers, indicating a significant deviation from normality. Consequently, non-parametric tests, such as the Kruskal-Wallis H test, are appropriate for further analysis.

4.4 Perception Differences Among Respondent Groups

The Kruskal-Wallis H test was conducted to examine differences in perceptions of green procurement practices among clients, consultants, and contractors. As shown in Appendix 2, the result indicated that only "purchase value of money" shows a statistically significant difference among the groups. Developers place greater emphasis on value over cost when making procurement decisions compared to consultants and contractors. This finding aligns with the study of Zakaria et al. (2020) who highlighted that over half of the surveyed developers in the Malaysian construction sector were inclined to invest in future costs, with around 37% already employing Life Cycle Costing (LCC) or equivalent approaches. Similarly, Lines et al. (2022) highlight that by focusing on value, developers are more likely to select contractors with proven expertise and reliability, thereby reducing the risk of project delays, cost overruns, and quality issues. Furthermore, developers tend to prioritise quality, efficiency, and maximum value in terms of both financial performance and project outcomes.

However, there is no significant difference in all of the drivers of green procurement practices amongst the respondents. This suggests that the respondents from each group share a relatively similar understanding of green procurement drivers, which may be attributed to consistent exposure to industry standards and regulatory requirements. Nevertheless, the absence of significant differences might also be due to the limited sample size in this preliminary study, as pilot studies often lack the statistical power to detect significant effects (Bujang, 2021). This study only presents the pilot results, and the main survey is still in progress, which may provide more definitive insights once a larger sample size is obtained.

CONCLUSION

The Malaysian construction industry faces escalating sustainability challenges due to its continued reliance on conventional procurement practices, which drive high carbon emissions, resource depletion, and environmental degradation. In response, green procurement practices have been introduced to mitigate these impacts by promoting resource efficiency, reducing waste, and encouraging the use of environmentally responsible materials and technologies. Strengthening the adoption of green procurement practices is essential to advancing sustainability within the industry. As part of a larger study involving 140 respondents, a pilot study was conducted

among key stakeholders to assess the current adoption of green procurement practices in the construction industry and gather their perceptions. As shown in Figure 4, this study presents preliminary findings based on the quantitative analysis, which identified the three most significant practices as 'waste management and recycling', 'giving preference to certified products' and 'procuring non-toxic and low VOC materials'. Similarly, the analysis ranked the three most influential drivers as 'regulations and standards of green procurement', 'availability of green products and services', and 'availability of green suppliers' alongside 'environmental sustainability'. The findings also indicated that stakeholder perceptions were largely consistent across most areas, with a notable exception regarding the 'purchase value of money'. Developers placed greater emphasis on value over cost when making procurement decisions compared to consultants and contractors.

This study can make a worthwhile contribution to the Malaysian construction industry and beyond. It provides valuable insights into the adoption and drivers of green procurement practices in the Malaysian construction industry. The identification of green procurement practices reflects the industry's growing awareness of environmental issues and the shift towards more sustainable construction methods. Similarly, the recognition of drivers highlights the importance of having a supportive policy framework and market readiness in driving the adoption of green procurement practices. This study offers valuable insights for policymakers, industry professionals and stakeholders by delivering evidence-based recommendations to embed green procurement into conventional construction practices. By encouraging environmental responsibility, improving resource efficiency and strengthening long-term resilience, this study advances the broader sustainability agenda within the construction sector. The significance of this study lies in its effort to quantify the key determinants of green procurement adoption in Malaysia, thereby bridging the gap between theoretical knowledge and practical implementation in sustainable construction.

Future studies should address the limitations of the Likert scale in capturing stakeholder perceptions, as individual interpretations may vary, potentially affecting response consistency and accuracy. While the Likert scale remains one of the most effective tools for psychometric measurement and assessing respondent perceptions, its sole reliance may limit analytical depth. Incorporating alternative measurement techniques or mixed methods, such as interviews and focus groups, would allow for deeper probing to capture the rich experiences of industry professionals, providing more nuanced insights into the rationale behind responses. Additionally, this study focused on stakeholders in Klang Valley, which may restrict the generalisability of the findings. Expanding future study to other states in Peninsular Malaysia, as well as Sabah and Sarawak, is crucial, as these regions may exhibit differing levels of economic development, technological awareness, and industry maturity, which could influence the adoption of green procurement practices. Moreover, industry stakeholders can leverage these findings to develop targeted strategies that enhance the adoption and integration of green procurement practices in construction projects, ultimately contributing to a more sustainable industry.

Figure 4.0 Overview of Green Procurement Practices and Drivers in the Malaysian Construction Industry

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APPENDIX 1: Questionnaire

Section A

The table below shows a list of green procurement practices commonly adopted in the construction industry. In your opinion, please indicate the extent to which you agree that each of these practices is effectively adopted within the construction industry.

| 1 – Strongly Disagree | 2 – Disagree | 3 – Neutral | 4 – Agree | 5 – Strongly Agree |

Categories	Ref	Statement
Conventional green procurement practices	P1	Qualification of stakeholders based on knowledge and experience
	P2	Opting for products with minimal or eco-friendly packaging
	P3	Procuring non-toxic and low Volatile Organic Compounds (VOCs) materials
	P4	Giving preference to certified products (e.g., eco-labelled products)
	P5	Adoption of local suppliers
	P6	Purchasing green products and services
	P7	Incorporation of green specifications into the contract
	P8	Purchase value of money (e.g., emphasizing the importance of value over cost)
	P9	Adoption of energy-efficient machinery and equipment
	P10	Waste management and recycling
Innovative green procurement practices	P11	E-procurement (e.g., e-catalogues, e-ordering, e-tendering)
	P12	Prefabrication and modular construction
	P13	Utilising renewable energy sources or technology
	P14	Integration of Building Information Modeling (BIM) for sustainability
	P15	Procuring green building technologies

Section B

This section seeks the respondent's perceptions of the drivers for adopting green procurement practices within the Malaysian construction industry.

| 1 – Strongly Disagree | 2 – Disagree | 3 – Neutral | 4 – Agree | 5 – Strongly Agree |

Categories	Ref	Statement
Policy and governance support	D1	Availability of policies and guidelines (e.g., Government Green Procurement (GGP) guidelines)
	D2	Regulations and standards of green procurement (e.g., ISO certifications)
	D3	Implementation of incentive policies
	D4	Campaigns and workshops
Leadership and corporate strategy	D5	Top management commitment
	D6	Corporate Social Responsibility (CSR)
	D7	Enhance reputation of client companies
Economic and market dynamics	D8	Achieving cost savings (e.g., long-term financial benefits)
	D9	Market demand
	D10	Gain competitive advantage in market
Environmental and social responsibility	D11	Environmental sustainability
	D12	Provide healthier working environment
	D13	Improving community health and quality of life
	D14	Innovation and technology

Innovation and technological advancement	D15	Provide proper assessment tool (e.g., GBI, LEED, BREEAM)
Stakeholder engagement and collaboration	D16	Stakeholder values towards greening construction procurement
	D17	Corporation and partnership (e.g., Joint Ventures (JV), Public-Private Partnerships (PPPs))
	D18	Suppliers-induced benefits
Supply chain and resource availability	D19	Availability of green products and services
	D20	Availability of green suppliers
	D21	Establishment of reliable database

Appendix 2: Means And Ranking of Green Procurement Practices

Ref	Practices	Overall (N = 30)			Developer (N = 7)			Consultant (N = 14)			Contractor (N = 9)			X^2	Asymp. sig
		Mean	SD	Rank	Mean	SD	Rank	Mean	SD	Rank	Mean	SD	Rank		
Conventional green procurement practices															
P1	Qualification of stakeholders based on knowledge and experience	3.97	0.615	12	4.14	0.690	9	3.79	0.579	14	4.11	0.601	7	2.271	0.321
P2	Opting for products with minimal or eco-friendly packaging	4.33	0.711	4	4.29	0.756	8	4.50	0.650	1	4.11	0.782	9	1.617	0.446
P3	Procuring non-toxic and low VOCs materials	4.33	0.661	3	4.43	0.787	6	4.21	0.699	9	4.44	0.527	1	0.820	0.664
P4	Giving preference to certified products	4.33	0.606	2	4.43	0.535	4	4.43	0.646	2	4.11	0.601	7	1.774	0.412
P5	Adoption of local suppliers	3.97	0.669	13	3.86	0.690	13	4.07	0.616	11	3.89	0.782	13	0.670	0.715
P6	Purchasing green products and services	4.23	0.568	7	4.00	0.577	10	4.36	0.497	5	4.22	0.667	5	1.695	0.429
P7	Incorporation of green specifications into the contract	4.17	0.747	10	3.86	0.690	13	4.43	0.756	4	4.00	0.707	11	3.678	0.159
P8	Purchase value of money	3.97	0.718	14	4.57	0.787	3	3.79	0.579	14	3.78	0.667	15	6.292	0.043*
P9	Adoption of energy efficient machinery and equipment	4.10	0.759	11	4.57	0.535	1	3.86	0.770	13	4.11	0.782	9	4.331	0.115
P10	Waste management and recycling	4.37	0.765	1	4.57	0.535	1	4.36	0.842	6	4.22	0.833	6	0.622	0.733
Innovative green procurement practices															
P11	E-procurement	4.30	0.651	6	4.43	0.535	4	4.43	0.646	2	4.00	0.707	11	2.514	0.285
P12	Prefabrication and modular construction	3.93	0.785	15	3.86	0.900	15	4.00	0.784	12	3.89	0.782	13	0.125	0.939
P13	Utilising renewable energy sources or technology	4.17	0.648	9	4.00	0.577	10	4.14	0.663	10	4.33	0.707	3	1.199	0.549
P14	Integration of BIM for sustainability	4.23	0.858	8	4.00	1.155	12	4.29	0.914	8	4.33	0.500	2	0.336	0.846
P15	Procuring green building technologies	4.30	0.596	5	4.29	0.488	7	4.29	0.611	7	4.33	0.707	3	0.104	0.949

N = Sample size, SD = Standard Deviation.
Note: *. The mean difference is significant at the 0.05 level of significance.

Appendix 3: Means And Ranking of Drivers of Green Procurement Practice

Ref	Drivers	Overall (N = 3 0)			Developer (N = 7)			Consultant (N = 14)			Contractor (N = 9)			X^2	Asymp. sig
		Mean	SD	Rank	Mean	SD	Rank	Mean	SD	Rank	Mean	SD	Rank		
Policy and governance support															
D1	Availability of policies and guidelines	4.13	0.507	10	4.00	0.000	16	4.21	0.579	9	4.11	0.601	12	1.008	0.604
D2	Regulations and standards of green procurement	4.57	0.568	1	4.29	0.756	3	4.71	0.469	1	4.56	0.527	2	2.091	0.351
D3	Implementation of incentive policies	4.27	0.691	6	4.14	0.690	6	4.43	0.646	6	4.11	0.782	13	1.403	0.496
D4	Campaigns and workshops	3.73	0.828	21	4.14	0.690	6	3.64	0.842	21	3.56	0.882	20	2.665	0.264
Leadership and corporate strategy															
D5	Top management commitment	4.03	0.669	15	3.86	0.378	18	4.00	0.784	16	4.22	0.667	9	1.613	0.446
D6	Corporate Social Responsibility (CSR)	3.93	0.691	17	4.00	0.000	16	3.93	0.730	17	3.89	0.928	16	0.174	0.917
D7	Enhance reputation of client companies	3.93	0.944	18	4.14	0.690	6	3.86	0.770	18	3.89	1.364	19	0.695	0.706
Economic and market dynamics															
D8	Achieving cost savings	3.87	1.008	20	4.29	1.113	4	3.86	0.864	19	3.56	1.130	21	2.929	0.231
D9	Market demand	3.97	0.809	16	3.86	1.069	20	4.07	0.616	13	3.89	0.928	16	0.138	0.933
D10	Gain competitive advantage in market	3.87	0.900	19	4.14	1.069	11	3.71	0.726	20	3.89	1.054	18	1.835	0.400
Environmental and social responsibility															
D11	Environmental sustainability	4.40	0.563	3	4.14	0.378	5	4.50	0.519	3	4.44	0.726	4	2.370	0.306
D12	Provide healthier working environment	4.17	0.747	9	4.00	0.577	12	4.21	0.893	10	4.22	0.667	9	0.637	0.727
D13	Improving community health and quality of life	4.23	0.504	7	4.00	0.577	12	4.29	0.469	7	4.33	0.500	5	1.713	0.425
Innovation and technological advancement															
D14	Innovation and technology	4.40	0.621	5	4.29	0.488	1	4.50	0.650	4	4.33	0.707	7	0.980	0.613
D15	Provide proper assessment tool	4.17	0.648	8	4.00	0.577	12	4.14	0.663	11	4.33	0.707	7	1.199	0.549
Stakeholder engagement and collaboration															
D16	Stakeholder values towards greening construction procurement	4.10	0.803	13	3.86	0.378	18	4.29	0.825	8	4.00	1.000	15	2.891	0.236
D17	Corporation and partnership	4.13	0.730	11	4.29	0.488	1	4.07	0.829	15	4.11	0.782	13	0.292	0.864
D18	Suppliers-induced benefits	4.07	0.740	14	3.57	0.976	21	4.14	0.663	11	4.33	0.500	5	3.476	0.176
Supply chain and resource availability															
D19	Availability of green products and services	4.53	0.571	2	4.14	0.690	6	4.64	0.497	2	4.67	0.500	1	3.586	0.166
D20	Availability of green suppliers	4.40	0.563	3	4.14	0.690	6	4.43	0.514	5	4.56	0.527	2	1.760	0.415
D21	Establishment of reliable database	4.10	0.662	12	4.00	0.577	12	4.07	0.616	13	4.22	0.833	11	0.602	0.740

N = Sample size, SD = Standard Deviation.

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