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Thematic Section - Challenges in Production Economics Towards Sustainability and Digitalization

Construction sustainability: attitudes, practices, and performance in Indonesian firms

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Abstract

Paper aims: This study explores sustainability adoption in Indonesian construction firms by (a) describing current levels of the three sustainability pillars, (b) analyzing associations between key variables influencing sustainability performance, and (c) providing managerial insights and recommendations for improving sustainable construction practices in Indonesia.

Originality: It extends the literature by proposing and testing a theoretical model that explains the interaction between sustainability attitudes, practices, and performance, tailored to the Indonesian construction context.

Research method: A cross-sectional, self-administered survey targeted Indonesian construction firms, achieving a 22.8% response rate with 104 usable responses. Moderation analysis evaluated the association of 'sustainability attitudes' and 'sustainability performance' with 'management practices' as the moderating variable.

Main findings: Management practices partially moderate the association between sustainability attitudes and performance. Firms prioritize compliance-driven environmental sustainability, internal stakeholder well-being, and short-term economic benefits but lack strategic vision and sustainability teams.

Implications for theory and practice: The study contributes to the theoretical understanding of sustainability performance in construction by extending the Attitude–Behavior (A–B) framework to a firm-level context. It also addresses practical gaps in sustainability practices among firms in emerging economies. Findings highlight Indonesian construction firms' priorities and challenges, guiding intervention strategies such as policy reforms, market incentives, and capacity-building programs.

Keywords

Construction sustainability. Indonesia. Management practices. Sustainability attitudes. Sustainability performance.

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Conflict of Interest
The authors have no conflict of interest to declare.

Ethical Statement

All respondents voluntarily participated in the study and provided informed consent. As the data collected relate to organizational practices and do not involve personal or sensitive information, formal ethical approval was not required under the applicable institutional guidelines.

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1. Introduction

The construction industry plays a crucial role in Indonesia's economic development, contributing significantly to the country's Gross Domestic Product (GDP) (Badan Pusat Statistik, 2024). The construction industry accounts for approximately 9.92% of Indonesia's GDP, with projections from the World Economic Forum indicating that this number could rise to 14.7% by 2030 (Pradoto et al., 2022). This impact is further amplified by the industry's capacity to generate employment, attract investment, and promote the growth of auxiliary industries, including manufacturing and engineering services (Dlamini, 2014). Beyond its direct economic contributions, the construction industry produces substantial secondary effects across various industrial sectors by improving mobility and access (Gorgulu et al., 2023). Infrastructure developments, such as highways and bridges, improve the efficiency of transporting goods, services, and people, resulting in increased productivity in logistics, retail, and tourism (Ponomarev, 2022). Furthermore, these infrastructure projects improve access to essential services, including healthcare and education, thus promoting regional development and supporting socioeconomic progress (Kaiser & Barstow, 2022).

However, the construction industry faces significant challenges due to its highly fragmented nature that complicates coordination and sacrifices efficiency across projects. Profit margins in the sector tend to be low (Killingsworth & Mehany, 2018), further impairing construction firms' ability to remain in the industry for the long term. Hypercompetition also forces firms to aggressively compete for contracts, which can lead to prioritizing short-term survival over long-term strategic planning, resulting in a myopic focus that limits innovation and growth.

The construction industry faces criticism for its adverse impacts, including environmental damage and exacerbation of economic and social inequalities (Tokbolat et al., 2020). Construction projects and follow-on operations contribute to significant carbon emissions and resource depletion, highlighting their negative role in environmental degradation (Othman, 2017; Czernik et al., 2022). Along with the mining and manufacturing sectors, the construction industry accounts for the largest industrial sources of world greenhouse gas and carbon dioxide emissions (Bashmakov et al., 2022). Furthermore, construction projects frequently disrupt daily operations, causing noise pollution, traffic congestion, and interruptions to local businesses and activities in nearby communities. These negative effects disproportionately affect vulnerable communities, as these groups have limited capacity to mitigate the impact of construction, further widening the economic and social gaps.

Sustainability, introduced in construction discourse in the mid-1990s (Det Udomsap & Hallinger, 2020), now emphasizes reducing environmental harm while addressing social and economic responsibilities (Lima et al., 2021). Contemporary ideas of construction sustainability attempt to simultaneously address the trifecta of environmental, social, and economic concerns, often referred to as the "triple bottom line." As such, the sustainability concept encompasses the life-cycle of the construction activities and deliverables, including various stages: engineering, procurement, construction, commission, operations and maintenance, and disposal. Thus, incorporating sustainable practices at each stage of construction projects is expected to reduce resource consumption, minimize carbon emissions, enhance social equity, and ensure long-term economic viability.

In parallel, innovation in sustainable construction materials continues to evolve. These advancements reflect the growing role of technology in supporting sustainable practices. Recent developments include graphene-enhanced concrete, which improves durability and reduces cement use, helping to cut carbon emissions (Cunningham et al., 2023). Similarly, mycelium composites offer eco-friendly insulation with acceptable structural performance (Ghazvinian & Gursoy, 2022), while bio-composites made from hemp fibers and lime are both biodegradable and carbon-negative during production (Steyn et al., 2025).

For construction firms, adopting sustainability principles offers various opportunities. Early compliance with sustainability regulations could offer a competitive edge, enabling firms to stay ahead in a sustainable-aware industry. Sustainable practices enhance firm's reputation by showcasing environmental stewardship and alignment with global trends. It also addresses the industry's negative image regarding environmental, social, and economic impacts. This reputational advantage can attract clients and investors concerned with sustainability, fostering strong stakeholder relationships. Additionally, integrating sustainable practices may lead to operational efficiencies and cost savings in the long term (Alassaf, 2024). As sustainability trends grow, construction companies that proactively implement these principles will gain a distinctive market position and an enhanced public standing.

Sustainable construction requires strict adherence to standards throughout the project life cycle, starting with the design phase, where client expectations, quality standards, and technical specifications are documented. Early integration of sustainability at this stage enables efficient material usage, energy-saving technologies, and enhanced health and safety protocols for workers (Wu et al., 2017). Economically, it supports long-term financial viability by improving resource efficiency, reducing operational costs, and proactively meeting regulatory standards, which can provide a competitive advantage. Socially, it enhances workforce safety and health while creating safer, more liveable environments for communities affected by construction projects (Silvius & de Graaf,

2018). Environmentally, it protects ecosystems by reducing waste, conserving resources, minimizing emissions, and aligning with ecological goals (Silvius & de Graaf, 2018).

Despite these benefits, implementation varies widely due to differences in national context. Emerging economies face common barriers such as low public awareness (Pradhananga et al., 2021), economic and technical constraints, and weak regulatory support (Omopariola et al., 2024). However, country-specific challenges also play a role. In the UAE, economic volatility, management issues, and cultural complexity hinder progress (El-Sayegh et al., 2021; Ahmed & El-Sayegh, 2022; Wuni, 2024). In Singapore, although adoption is driven by regulation, skepticism limits voluntary commitment (Lau & Chen, 2022). China faces issues related to stakeholder coordination and high upfront costs (Zou et al., 2007), while the United States struggles with financial limitations and knowledge gaps (Fitriani & Ajayi, 2022; Shaker et al., 2022). In Indonesia, sustainable construction is still emerging, and efforts are constrained by economic and social challenges (Fitriani & Ajayi, 202). Strengthening procurement systems and regulatory frameworks is essential to drive broader adoption (Hapsari et al., 2022; Business Indonesia, 2024).

Although interest in sustainable construction is growing globally, progress and engagement remain uneven. Research output continues to be dominated by developed countries such as the USA, UK, and several European nations, while contributions from Southeast Asia—including Indonesia—are still limited (Det Udomsap & Hallinger, 2020). Malaysia has made visible strides in the region, but Indonesian-based studies indexed in international databases remain scarce. This underrepresentation is particularly notable considering the country's growing infrastructure demands and vulnerability to environmental and social challenges.

In terms of research focus, most studies emphasize technical aspects such as alternative materials, project management practices, and impact measurement tools like life cycle assessment (Det Udomsap & Hallinger, 2020). Although many studies claim to address the three pillars of sustainability—environmental, economic, and social—environmental concerns continue to dominate the discourse (Whang & Kim, 2015), while social considerations are often underexplored. Moreover, little attention has been given to the behavioral dimension—how firms perceive sustainability, how that perception influences their internal practices, and how these factors collectively affect sustainability outcomes. Quantitative approaches that connect these behavioral factors to performance in a structured, theory-based model remain rare, particularly in the Indonesian context.

Several studies have examined the factors influencing sustainability performance in construction firms by looking at variables such as sustainability attitudes, management practices, and environmental behaviors. Some of these studies suggest that sustainability attitudes act as a driving factor that shapes internal practices, which in turn influence overall sustainability outcomes (Wu, 2017; Yu et al., 2018). While many report positive relationships among these variables, the findings across the literature are not always consistent. This may be due to differences in research settings—especially between developed and developing countries—as well as variations in methodological approaches, sample sizes, and how sustainability is measured (Durdyev et al., 2018; Willar et al., 2021). For instance, research in developed economies often highlights regulatory support and technological readiness as key enablers, while studies in developing contexts point to limited institutional capacity, resource constraints, and differing cultural views on sustainability (Damoah & Kumi, 2018).

This study responds to that need by examining how construction firms' sustainability attitudes and management practices contribute to sustainability performance. While these variables have been studied before, this research introduces a more structured and theory-driven perspective by adapting the Attitude–Behavior (A-B) framework that commonly used at the individual level to the organizational level in the context of construction firms. By focusing on Indonesian firms and using a theory-based, quantitative approach, the research aims to provide both empirical evidence and practical guidance for improving sustainability implementation in the construction sector. Incorporating the three pillars, as suggested by Mavi et al. (2021), the study highlights the often-overlooked social aspects of sustainability in construction—an area still underexplored in the Indonesian context.

In addition to the theoretical framework, this study applies Partial Least Squares Structural Equation Modeling (PLS-SEM) together with group profile analysis. While PLS-SEM is used to examine causal relationships and test hypotheses between key constructs, group profile analysis provides a descriptive comparison across different types of firms. These combined approaches allow the study to produce both explanatory and practical insights.

This study aims to (a) describe the current levels of three pillars of sustainability (social, economic, and environmental) in Indonesian construction firms, (b) quantitatively examine the possible association between key variables influencing sustainability performance, and (c) provide managerial insights and recommendations for improving sustainable construction practices in Indonesia. Scientifically, it contributes to the literature by extending the A-B model to a firm-level context, developing and testing a theoretical model that explains the relationship between sustainability attitudes, practices, and performance in a developing country. Practically, the study presents empirical evidence on construction firms' priorities, attitudes, management practices, and performance across

different firm types, and offers context-specific strategies to support the wider adoption of sustainable practices in the Indonesian construction sector.

2. Theoretical works

2.1. Theoretical framework

This study adopts a classical, individual-level conjecture which suggests possible linkages between 'attitude,' 'practice,' and 'performance.' The proposed association is rooted in the attitude-behavior (A-B) theory, which further extend with the theory of reasoned action (TRA) and its subsequent variants (Ajzen & Albarracín, 2007). TRA suggests generic interrelationships between 'attitude,' 'intention,' 'behavior,' and 'performance' at the individual level.

Contemporary studies provide compelling empirical evidence to support these linkages. Glasman & Albarracín (2006), through a meta-analysis (n = 4,598), found significant positive correlations between attitudes and future behavior in certain attitudinal contexts (e.g., easily recalled, consistent over time). Bechler et al. (2021), using a combined offline (n = 4,101) and online dataset (n = 321,000), identified significant non-linear (S-curve-like) associations between attitudes and behaviors. Zaremohzzabieh et al. (2021), through a meta-analytic SEM (90 studies, 94 samples, n = 38,622), supported the association between consumer attitude and green purchase intention. Within the construction industry setting, Johari & Jha (2020) found a direct and positive relationship between behavior and performance (n = 109 construction workers).

For this study, the theories and conceptual linkages are extended and adjusted to a specific context: (a) applying to a firm level; (b) focusing on firms' 'attitude' towards 'construction sustainability'; (c) 'behavior' is reflected by 'management practice' of construction firms about sustainability values; (d) 'performance' is reflected by construction firms' metrics pertinent to sustainability. Details of elaboration can be found in Ibrahim & Hartono (2023). The theoretical framework of this study (Figure 1) posits the association between 'sustainability attitude' and 'sustainability performance' is mediated by 'management practice,' in line with the A-B theory. This adjustment reflects a theoretical contribution by applying a well-established individual-level framework to explain firm-level sustainability behavior in a developing country context.

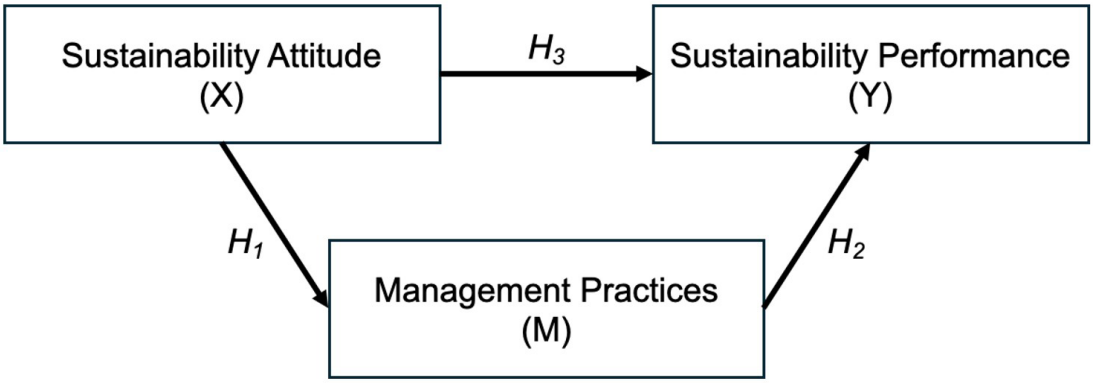

Figure 1. Theoretical Framework.

2.2. Hypotheses

Myers (2005) observed that, despite various initiatives to promote sustainable development in the construction industry, only a few major companies have actively embraced sustainability and corporate social responsibility. The study highlighted how the fragmented and diverse nature of the construction sector complicates the transition toward more sustainable practices. In contrast, more recent studies show emerging positive links between sustainability attitudes and management practices. For instance, Zhang & Yang (2021) demonstrated that sustainability attitudes influence company decisions on sustainability and establish a sustainable orientation in management practices. The more recent studies showed that firms with higher sustainability awareness tend to achieve better

sustainability performance, even though attitudes may not differ much across firm sizes (Chang et al., 2018). In addition, Ajibike et al. (2021) emphasized that managerial attitudes, when supported by organizational culture and social responsibility, significantly contribute to environmental performance. Based on these findings, we propose:

H_1: There exists a positive association between 'sustainability attitude' and 'management practice.'

Research also shows that management practices positively influence sustainability performance. For example, green supply chain management practices improved environmental outcomes (Çankaya & Sezen, 2019; Ahmad et al., 2022). Moreover, the role of management practices, particularly those related to sustainability, can positively impact sustainability performance (Maqbool & Amaechi, 2022). Hence, we conjecture:

H_2: There exists a positive association between 'management practice' and 'sustainability performance.'

Myers (2005) also highlighted the mediating role of management practices in the relationship between sustainability attitudes and performance in construction companies. Additionally, Ahmed & El-Sayegh (2022) identified critical barriers to implementing sustainability practices, noting how economic priorities often overshadow environmental goals. In this study, we explore the mediating role of management practices to understand how sustainability attitudes, as the independent variable, influence performance as the dependent variable through internal processes.

The selection of 'management practices' as a mediating variable is rooted in their pivotal role in aligning sustainability attitudes with sustainable performance. Practices such as risk management and performance measurement can help firms drive resource efficiency and balance economic and environmental objectives, improving sustainability outcomes (Ahmed & El-Sayegh, 2022). Hence, we propose

H_3: There exists a positive association between 'sustainability attitude' and 'sustainability performance.'

3. Methodology

This study used a cross-sectional, self-administered quantitative survey, with the unit of analysis being firm-level construction firms with business activities in Indonesia. Due to the difficulty of determining the sample frame, purposive sampling was employed. Middle-to-upper management was considered firm representatives, as they influence the organizational culture and can act as agents of change, promoting sustainability within their organizations.

3.1. Operationalization of constructs

To guide the development of the survey instrument, the key constructs, which are sustainability attitude, managerial practices, and sustainability performance, were operationalized based on prior literature. Table 1 presents the operational definitions of the three key variables. The 'attitude' and 'performance' are divided into three dimensions. In total, there are 58 assessment indicators for all three key variables.

3.2. Instrument developments

The survey instrument was developed through adoption, two-way translation, and a qualitative pilot study. English-language questionnaires were translated into Indonesian using a two-way translation protocol. To ensure face validity, a qualitative pilot study was conducted to assess the instrument's clarity, coherence, and suitability. This process involved examining terminology, identifying typographical errors, assessing potentially sensitive data, estimating survey duration, and ensuring logical flow. Pilot respondents, consisting of both practitioners and academics, were invited to participate. One respondent completed the main questionnaire first, followed by the pilot study instrument, after which feedback was used to revise the questionnaire before it was provided to the next respondent. This iterative process continued until comment saturation was reached, meaning no additional feedback was provided by the final respondent. A total of 6 respondents participated in the pilot study.

Initial validity and reliability tests were conducted. Validity was assessed using a simplified multi-trait multi-method (MTMM), similar to Hartono et al. (2014). Convergent validity was observed when the intra-correlation values were large and statistically significant, while discriminant validity was observed when the inter-correlation values were not as strong as those of intra-correlation (Wijaya & Hartono, 2013). Reliability was measured using Cronbach's Alpha (α) (Uyanto, 2006). Results (Table 2) suggest the instrument is valid and reliable, through further tests are needed to ensure rigor and accuracy.

Table 1. Operational Definitions.

No	Variable	Operational Definition	Dimensions	No. Items	References
1	Sustainability Attitude (X)	The perceived collective commitment of a construction firm towards integrating/ aligning sustainable values into its operations. The commitment includes prioritizing environmental bearability, economic viability, and social equitability through construction projects being performed.	Environment (X.1)	8	[1], [2], [3], [4], [6]
			Economic (X.2)	8	[2], [3], [4], [6]
			Social (X.3)	8	[1], [2], [3], [4], [5], [6]
2	Management Practices (M)	Firm-level strategies, policies, procedures, operational practices, and evaluations to maintain alignment with and support sustainability values. It is perceived by middle-up management.	M	10	[1]
3	Sustainability Performance (Y)	Measurable outputs of a construction company's efforts to implement concepts of sustainable construction projects. It is reflected by perceived environmental impacts (e.g., energy efficiency, renewable energy utilization), economic benefits (e.g., construction cost reduction, profitability), and social impacts (e.g., cultural engagement, workers' welfare)	Environment (Y.1)	8	[1], [2], [3], [4], [6]
			Economic (Y.2)	8	[2], [3], [4], [6]
			Social (Y.3)	8	[1], [2], [3], [4], [5], [6]

Ref: [1] Adetunji et al. (2003), [2] Chang et al. (2018), [3] Khanapure & Shastri (2023), [4] Li et al. (2018), [5] Rivai et al. (2023), [6] Whang & Kim (2015).

Table 2. Results of Initial Reliability Tests.

Variable		Cronbach's Alpha	Number of Items (n)	Interpretation*
X	Sustainability Attitude	0.968	24	Excellent
M	Management Practices	0.979	10	Excellent
Y	Sustainability Performance	0.975	24	Excellent

*George & Mallery (2019) provided the rules of thumb for reliability scores: excellent ($\alpha > 0.9$), good ($0.8 < \alpha < 0.9$), acceptable ($0.7 < \alpha < 0.8$), questionable ($0.6 < \alpha < 0.7$), poor ($0.5 < \alpha < 0.6$), and unacceptable if $\alpha < 0.5$.

The main analysis used the Partial Least Square-Structural Equation Modeling (PLS-SEM). The variance-based PLS method was chosen for its suitability with the current theoretical framework (Hair Junior et al., 2017), ability to handle a relatively limited sample size (Chin, 1998), robust validity and reliability analysis (Hair Junior et al., 2011), and less restrictive data assumptions (Hair Junior et al., 2017). PLS-SEM was used to test the hypothesized relationships and identify empirically supported pathways among sustainability attitudes, management practices, and sustainability performance.

To complement the SEM results, descriptive statistical procedures, including mean comparisons and group profile analysis, were also performed. These techniques provided an additional layer of interpretation by illustrating how different clusters of firms (e.g., leading, lagging, and average performers) varied in terms of their sustainability attitudes, managerial practices, and sustainability performance. The mean comparisons helped identify significant gaps in sustainability-related practices across different types of firms, while the group profile analysis served to illustrate current sustainability conditions and benchmark performance. This descriptive insight complements the causal insights from SEM, helping to identify priority areas for policy and managerial intervention.

4. Results and discussions

4.1. Respondents' characteristics

The response rate (Table 3) for this study is 22.8%.

Table 4 provides information about firms' categories from which the respondents originated. Most respondents represent firms specializing in specific construction works, while approximately 40% represent more integrated (end-to-end) operations.

Table 5 depicts the firms' size distribution. The majority of firms are considered large. Accordingly, the results of this study may tend to represent larger organizations.

The respondents' designation (Table 6) indicate middle to senior managerial positions, with 38% occupying top-level positions. Hence, the respondents are appropriate representations of their respective firms.

Table 3. Questionnaires Distribution and Response Rate.

Method	Platform	Distributed	Return	Response Rate
Indirect	LinkedIn & Email	548	68	12.4%
Direct	Direct	76	74	97.4%
Total		624	142	22.8%

Table 4. Firms' Category (n=104).

Types of Companies	Number	Percentage
Specific construction works	57	55%
Integrated construction work	41	39%
Others	6	6%
Total	104	100%

Table 5. Firm's Size (n=104).

Firm's size*	Annual Income (IDR)	Number	Percentage
Micro	<50 Million	5	5%
Small	50 – 500 Million	21	20%
Medium	500 Million – 10 Billion	17	16%
Large	>10 Billion	61	59%
Total		104	100%

*Size classification refers to Law of the Republic of Indonesia Number 20 of 2008 on Micro, Small, and Medium Enterprises (Indonesia, 2008).

Table 6. Respondents' Current Designations (n=104).

Designations	Number	Percentage
Top Management	40	38%
Project-based Manager	28	27%
Operations-based Manager	36	35%
Total	104	100%

4.2. Instrument evaluation

Validity and reliability tests were conducted using the outer model testing. The three key variables were considered reflective measurements. Hence, this study examines outer model loadings, indicator reliability, composite reliability, and convergent and discriminant validity.

Table 7 presents the outer loadings, t-statistics, p-values, composite reliability, Cronbach's Alpha, and average variance extracted (AVE). All observed indicators achieved high and statistically significant outer loadings for their respective variables, with values exceeding 0.7 for outer loadings (Hair Junior et al., 2017).

Table 7 reveals that 8 of the 58 indicators fall below the 0.7 threshold. These indicators were not removed immediately, as the AVE and composite reliability values were assessed. Overall, the variable indicators demonstrated high consistency, with Cronbach's Alpha values exceeding the 0.7 threshold (Hair Junior et al., 2017), and the composite reliability also achieved values above the 0.7 threshold proposed by Bagozzi & Yi (1988). Therefore, each indicator significantly reflects the measured aspects and presents valid data in the analysis of latent variables.

Discriminant validity is measured by using cross-loading values. Discriminant validity is achieved if the loading value of an item on its construct is higher than the loading value on other constructs. The data (not shown here) suggests that all items meet the cross-loading criteria, indicating good discriminant validity.

Table 7. Outer Model Analysis.

Variable	Indicators	Loadings	t-Statistics	p-values	Composite Reliability	Cronbach's Alpha	AVE
Sustainability Attitude (X)	X.1.1	0.694	15.206	<0.05	0.982	0.979	0.846
	X.1.2	0.838	32.411	<0.05			
	X.1.3	0.757	19.430	<0.05			
	X.1.4	0.769	14.808	<0.05			
	X.1.5	0.864	37.595	<0.05			
	X.1.6	0.805	23.112	<0.05			
	X.1.7	0.888	54.921	<0.05			
	X.1.8	0.723	13.535	<0.05			
	X.2.1	0.692	12.864	<0.05			
	X.2.2	0.635	8.903	<0.05			
	X.2.3	0.678	10.877	<0.05			
	X.2.4	0.851	31.194	<0.05			
	X.2.5	0.863	27.838	<0.05			
	X.2.6	0.877	31.740	<0.05			
	X.2.7	0.729	18.054	<0.05			
	X.2.8	0.885	51.072	<0.05			
	X.3.1	0.653	10.663	<0.05			
	X.3.2	0.785	19.452	<0.05			
	X.3.3	0.731	15.222	<0.05			
	X.3.4	0.673	10.409	<0.05			
	X.3.5	0.799	22.929	<0.05			
	X.3.6	0.827	29.488	<0.05			
	X.3.7	0.779	21.520	<0.05			
	X.3.8	0.869	42.233	<0.05			
Management Practices (M)	M.1	0.953	98.029	<0.05	0.974	0.972	0.611
	M.2	0.934	89.321	<0.05			
	M.3	0.906	66.495	<0.05			
	M.4	0.906	40.634	<0.05			
	M.5	0.957	73.706	<0.05			
	M.6	0.954	119.354	<0.05			
	M.7	0.966	139.294	<0.05			
	M.8	0.937	58.324	<0.05			
	M.9	0.890	43.401	<0.05			
	M.10	0.782	26.893	<0.05			
Sustainability Performance (Y)	Y.1.1	0.804	24.719	<0.05	0.978	0.977	0.655
	Y.1.2	0.853	34.033	<0.05			
	Y.1.3	0.788	23.948	<0.05			
	Y.1.4	0.885	46.999	<0.05			
	Y.1.5	0.864	30.651	<0.05			
	Y.1.6	0.887	48.850	<0.05			
	Y.1.7	0.881	48.218	<0.05			
	Y.1.8	0.733	12.664	<0.05			
	Y.2.1	0.877	36.702	<0.05			
	Y.2.2	0.803	20.606	<0.05			
	Y.2.3	0.719	11.667	<0.05			
	Y.2.4	0.873	36.628	<0.05			
	Y.2.5	0.871	40.840	<0.05			
	Y.2.6	0.912	73.557	<0.05			
	Y.2.7	0.714	16.680	<0.05			
	Y.2.8	0.858	38.292	<0.05			
	Y.3.1	0.715	14.673	<0.05			
	Y.3.2	0.805	22.954	<0.05			
	Y.3.3	0.772	20.273	<0.05			
	Y.3.4	0.726	18.285	<0.05			
	Y.3.5	0.675	14.790	<0.05			
	Y.3.6	0.827	27.702	<0.05			
	Y.3.7	0.682	15.245	<0.05			
	Y.3.8	0.819	31.881	<0.05			

4.3. Sustainability attitudes and performance

Figure 2 juxtaposes the values of sustainability attitude and performance across environmental, economic, and social aspects. The results indicate that attitudes score higher than actual performance. While construction companies' attitudes reflect a strong managerial commitment to sustainability, the lower performance values suggest this commitment is not fully translating into measurable outcomes.

Figure 2 also shows that construction companies in Indonesia recognize the economic factor (with an average score of 4.09, max=5) as the most important aspect. Firms also acknowledge the importance of social and environmental factors, as reflected by the average scores of 4.04 and 3.88 for social and environmental factors, respectively.

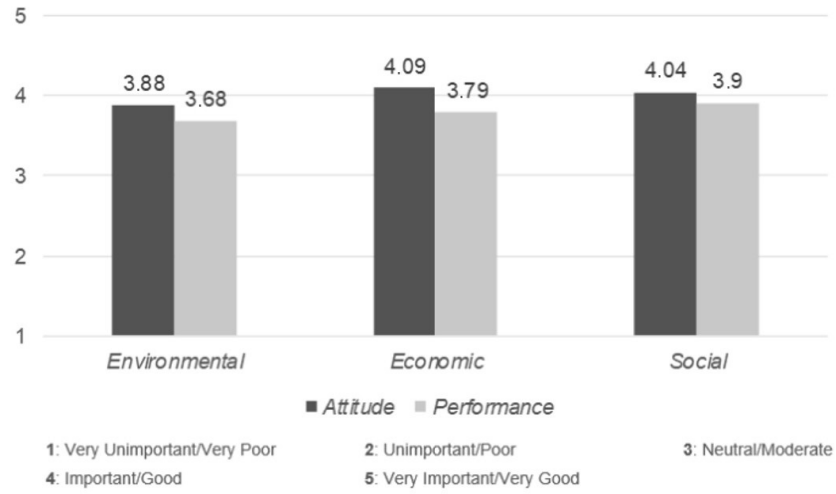

Figure 2. Values of sustainability attitude and performance across aspects.

4.3.1. Environmental aspects

Figure 2 shows the overall sustainability attitude score for the environmental aspect is 3.88 (max. 5). Table 8 ranks attitude and performance for eight environmental items, revealing a correlation between the two. Five out of the eight factors score below 4, suggesting limited awareness among Indonesian construction companies of environmental sustainability.

The highest attitude score is for compliance with environmental regulation that can be seen as a positive outcome of effective government intervention in promoting sustainable practices. Companies align their social and environmental responsibilities with mandated sustainability standards, responding proactively to regulations and creating more sustainable project environments.

High ratings for energy efficiency from construction to operational stages and land use efficiency, reflect the proactive attitude. However, challenges remain in using environmentally friendly materials, resource management, and construction waste management, which rank lower in attitude and performance. Emphasizing environmentally friendly materials selection and waste management practices is important to improve performance in these areas.

4.3.2. Economic aspects

Table 9 presents eight key factors on attitude and performance in economic aspects. Direct, short-term economic factors such as productivity/profitability and construction cost rank the highest, while longer-term aspects (e.g., life cycle cost) and intangible dimensions (e.g., innovation and knowledge management) rank lower. The result reflects a lower priority on sustainability's long-term and intangible economic aspects, aligning with the myopic tendencies of Indonesian construction firms, which favor short-term exploitation over long-term exploration strategies (Hartono et al., 2017).

Table 8. Levels of Attitude and Performance for the Environmental Aspect.

Code	Indicator	Attitude		Performance	
		Mean	Rank	Mean	Rank
1.8	Compliance with environmental development rules and regulations	4.65	1	4.57	1
1.1	Energy efficiency from development to operation stages	4.41	2	4.16	3
1.3	Land use efficiency	4.25	3	4.21	2
1.7	Efficient use of materials by engineering building structures	3.95	4	3.75	4
1.6	Efficient use of transportation in delivering materials	3.82	5	3.58	5
1.4	Reduction, reuse, and recycling of construction wastes	3.51	6	3.13	7
1.2	Use of environmentally friendly materials and resources	3.47	7	3.26	6
1.5	Use of renewable energy sources	2.95	8	2.80	8

Table 9. Attitude and Performance for the Economic Aspect.

Code	Indicator	Attitude		Performance	
		Mean	Rank	Mean	Rank
2.2	Productivity or profitability	4.81	1	4.35	1
2.3	Construction cost	4.63	2	4.27	2
2.1	Competitiveness	4.57	3	4.13	4
2.7	The adaptability of development to the changing needs	4.27	4	4.22	3
2.6	Quality management for construction durability	4.07	5	3.75	5
2.5	Innovation/R&D	3.79	6	3.38	6
2.4	Life cycle cost	3.32	7	3.01	8
2.8	Knowledge Management	3.27	8	3.19	7

Table 10 highlights the highest attitude scores for employee safety and physical comfort, reflecting companies' high commitment to prioritize safety and welfare within the organization. However, lower scores are seen for providing local job opportunities and community benefits.

4.3.3. Management practices

Table 11 indicates that Indonesian construction companies prioritize corporate social management practices. Social or ethical standards rank second, reflecting efforts to codify ethical values that must be upheld during corporate activities. Additionally, sustainability issues as contract procurement criteria rank third, suggesting that clients are gradually considering sustainability elements when selecting contractors.

Table 10. Attitude and Performance in the Social Aspects.

Code	Indicator	Attitude		Performance	
		Mean	Rank	Mean	Rank
3.4	Pay attention to employee safety	4.64	1	4.40	2
3.7	Provide physical comfort to construction users	4.52	2	4.48	1
3.3	Employee well-being	4.32	3	4.18	3
3.2	Employee training	4.18	4	3.83	6
3.5	Respect for the cultural values of the surrounding community	4.18	4	4.10	4
3.8	Pay attention to aesthetic aspects and functionality	3.88	6	3.92	5
3.1	Provide local job opportunities	3.35	7	3.13	8
3.6	Provide economic benefits to the surrounding community	3.27	8	3.17	7

Table 11. Management Practice Levels.

Code	Indicator	Mean	Rank
M.10	Our company monitors and evaluates its social performance (staff minor/major accidents, etc.)	4.32	1
M.9	Our company has written social or ethical standards	4.03	2
M.4	Clients increasingly use sustainability issues as part of contract procurement criteria	3.72	3
M.1	Our company commits to implementing sustainable construction in the company	3.65	4
M.7	Our company has a written environmental policy	3.64	5
M.5	Our company has a written policy for managing the economic aspects of sustainability	3.63	6
M.8	Our company monitors and evaluates its environmental performance using industry-recognized indicators (energy, water use etc.)	3.56	7
M.6	Our company monitors and evaluates its economic performance using industry-recognized indicators	3.47	8
M.2	The Sustainable Project implementation strategy in our company is very ready	3.10	9
M.3	Our company has a special team whose job is to transform company projects into Sustainable Projects	3.00	10

4.3.4. Sustainable construction vs. Firm's size

A sub-group analysis was performed for construction firms of different sizes. Table 12 suggests that micro-construction companies have a relatively lower sustainability attitude. Small construction companies show a slightly higher attitude level, followed by medium and large firms. It indicates that the larger the construction company, the higher the attitude towards sustainability. A post-hoc statistical analysis confirms the differences.

A similar pattern is observed for management practices. The highest score for managerial practices belongs to large construction companies. The result suggests a reduced commitment to sustainability practices in smaller firms. Figure 3 depicts a detailed visualization of sustainability profiles at the item level across different firm sizes.

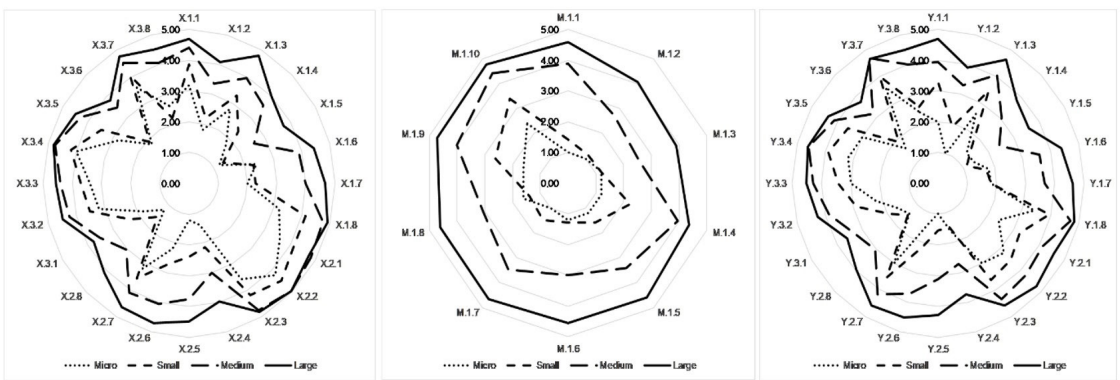

Figure 3. Sustainability Profiles (attitude, practices, performance) across Different Firms' Sizes.

While these results highlight variations across firm sizes, it is important to note that the sample composition is predominantly composed of large firms. This may influence the generalizability of the findings, as larger firms typically have greater access to resources, higher regulatory exposure, and stronger stakeholders pressure, which can drive higher sustainability adoption. On the other hand, smaller firms may face structural and financial constraints that limit their ability to implement sustainable practices. Future research should consider a more balanced sample to better capture variations across firm sizes.

4.3.5. Sustainable construction vs. Firm's Type

Another sub-group analysis was performed for three types of construction firms, as shown in Table 13. It is revealed that integrated construction firms dominate specific firms in all three sustainability dimensions (attitude, practice, and performance). Figure 4 depicts the graphical representation.

Organizational type seems to have a significant association with the firm's size. Larger construction firms with more resources and expertise could offer clients a greater variety of services. They also tend to have wider in-house expertise, hence a broader scope of work. Accordingly, integrated business systems likely belong to larger construction firms. Further study is needed to observe the firms under the 'Other' category, which yields the highest scores of the three aspects.

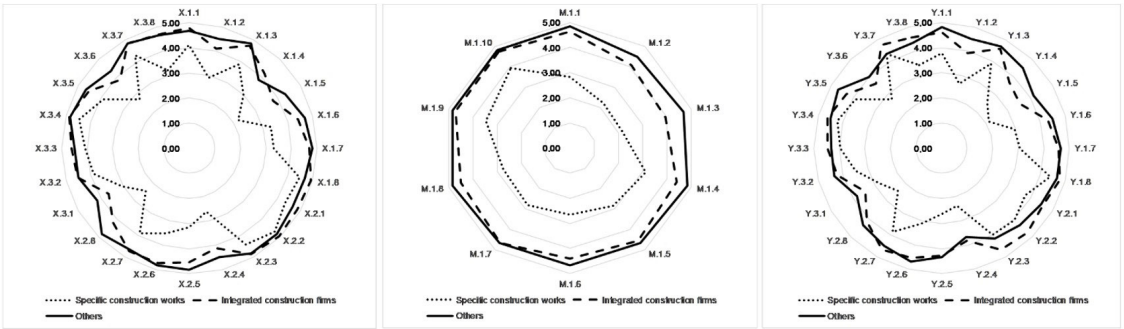

Figure 4. Sustainability Profiles across Different Firms' Types.

Table 12. Sustainability (attitude, practice, and performance) Profiles across Different Firms' Sizes.

	n	Attitude Mean (SD)	Practice Mean (SD)	Performance Mean (SD)
Micro (Mi.)	5	2.59 (1.16)	1.34 (0.80)	2.21 (1.07)
Small (Sm.)	21	3.01 (1.25)	1.77 (1.14)	2.65 (1.16)
Medium (Me.)	17	4.01 (1.01)	3.44 (1.13)	3.76 (1.10)
Large (Lrg.)	61	4.46 (0.73)	4.48 (0.70)	4.32 (0.77)
Total	**104**	4.00 (1.13)	3.61 (1.47)	3.79 (1.19)
Post-Hoc		Mi. vs. Me.	Mi. vs. Me.	Mi. vs. Me.
M-U Test (<0.05)		Mi. vs. Lrg.	Mi. vs. Lrg.	Mi. vs. Lrg.
		Sm. vs. Me	Sm. vs. Me	Sm. vs. Me
		Sm. vs. Lrg	Sm. vs. Lrg	Sm. vs. Lrg
		Me vs. Lrg	Me vs. Lrg	Me vs. Lrg

Table 13. Sustainability Profiles across Different Firms' Types.

	n	Attitude Mean (SD)	Practice Mean (SD)	Performance Mean (SD)
Specific construction works (Spec.)	57	3.58 (1.22)	2.88 (1.52)	3.35 (1.29)
Integrated construction firms (Int.)	41	4.51 (0.73)	4.46 (0.76)	4.31 (0.80)
Others	6	4.62 (0.59)	4.73 (0.45)	4.39 (0.62)
Total	**104**	4,00 (1.13)	3.61 (1.47)	3.79 (1.19)
Post-Hoc		Spec. vs Int.	Spec. vs Int.	Spec. vs Int.
M-U Test (<0.05)		Spec. vs. Others	Spec. vs. Others	Spec. vs. Others
			Int vs. Others	Int vs. Others

4.4. Theoretical Model Testing

The Goodness of Fit (GoF) validates the overall structural model. The proposed model yields a GoF value of 0.789, classified as large according to Hair Junior et al. (2014). The result indicates that the model produces a high degree of fit.

Table 14 shows high R^2 values for M and Y, indicating strong explanatory power of predictors. Table 14 also suggests Q^2 of 0.713 and 0.595, confirming the model's good predictive relevance.

Table 15 presents the effect size (F^2) values. As can be seen, two relationships, X → M and X → Y, are considered to possess strong effects, while M → Y has a moderate effect (Cohen, 1998).

A series of path analyses for the entire theoretical model was conducted to examine the hypotheses (Table 16). There is substantial empirical evidence to support positive and significant associations between 'attitude' vs. 'practices,' 'practices' vs. 'performance,' and 'attitude' vs. 'performance.' Hence, H1, H2, and H3 are supported, respectively.

This study performs a mediation analysis using a protocol suggested by (Hair Junior et al., 2021). The path analysis (Table 16 Panel A) identifies a significant direct effect between the predictor (i.e., 'attitude') and the dependent variable (i.e., 'performance'). It also reveals a significant indirect effect via the suggested mediator (i.e., 'management practices'), as seen in Table 16 Panel B. Since both direct and indirect effects are significant, it could be concluded that 'management practices' *partially* mediate the relationship between 'attitude' and 'performance.'

Table 14. R2 and Q2 Scores for Inner Model Analysis.

Variables	R^2	Interpretation	Q^2	Interpretation
Management Practices (M)	0.851	85.1% of the variability in the 'management practices' variable can be explained by the 'sustainability attitude'	0.713	Good predictive relevance.
Sustainability Performance (Y)	0.921	92.1% of the variability in the 'sustainability performance' variable can be explained by the 'sustainability attitude' and 'management practice'	0.595	Good predictive relevance.

Note: Threshold on R2 values according to Chin (1998): weak (0.19 < R2 < 0.33), moderate (0.33 < R2 < 0.67), and strong if R2 > 0.67.

Table 15. Effect Size (F2 Scores).

Relationship	F^2 Scores	Interpretation
Sustainability Attitude (X) → Management Practices (M)	5.696	Strong Influence
Management Practices (M) → Sustainability Performance (Y)	0.235	Moderate Influence
Sustainability Attitude (X) → Sustainability Performance (Y)	0.739	Strong Influence

Note: Threshold on F2 values according to Cohen (1998): weak (0.02 < F2 < 0.15), moderate (0.15 < F2 < 0.35), and strong if F2 > 0.35.

Table 16. Inner Model Path Analysis.

	Original Sample	Sample Mean	SD	t-statistics	p-values	Interpretation
A. Direct Effect						
H1: Sustainability Attitude (X) → Management Practices (M)	0.922	0.925	0.014	66.355	< 0.01	Significant
H2: Management Practices (M) → Sustainability Performance (Y)	0.353	0.347	0.063	5.577	< 0.01	Significant
H3: Sustainability Attitude (X) → Sustainability Performance (Y)	0.95	0.952	0.011	88.225	< 0.01	Significant
B. Indirect Effect						
Sustainability Attitude (X) → Sustainability Performance (Y) via Management Practice (M)	0.325	0.321	0.058	5.593	< 0.01	Significant

5. Managerial insights

This section presents the findings based on two complementary analytical approaches, PLS-SEM and group profile analysis. PLS-SEM was used to examine the relationships between sustainability attitude, management practices, and sustainability performance. Additionally, the group profile analysis provides a clearer picture of the current situation by comparing sustainability-related characteristics across different types of firms. The discussion in

the following sections focuses on key patterns identified through both methods. Combining these approaches helps improve the interpretation of the results and supports more targeted recommendations for different firm groups.

The study offer insights for the governments, construction firm leaders, and sustainability advocates in the construction industry. Data shows higher commitment, awareness, maturity of managerial practices, and sustainability-related performance among larger firms. The initiatives often led by large or internationally connected private entities, such as the Sinar Mas Group, for pursuing green-certified projects. Also, such initiatives mostly focus on large cities, urban areas, and developed regions (Hapsari et al., 2022).

Data on sustainability attitude and performance provides an effective proxy for construction firms' collective commitment, priority, and real sustainability performance. The findings highlight a direct effect of a 'sustainability attitude' towards 'performance' and an indirect effect mediated by 'management practices'. In effect, practitioners need to be aware that superior sustainability performance (a) *partially* results from a direct effect of the attitude or (b) be manifested via management practices.

5.1. Sustainability attitudes and performance

Analysis of the environmental aspect of sustainability attitude and performance reveals regulatory compliance as the firms' top priority. The next two items on the top priority list of environmental aspects are land and energy efficiency. These two items reflect the economic-inclined environmental aspects of construction. The priority is reasonable, given that construction firms are profit-oriented entities. The last two priorities are using environmentally friendly materials and renewable energy. The low commitment to environmentally friendly materials contrasts with global trends where material innovation and circular economy practices are gaining traction (Lima et al., 2021). The attitude may stem from the perception that implementing specific materials and renewable energy for construction would require unique competence, advanced technology, and significant initial financial investment.

From the economic aspect, most construction firms prioritize direct and short-term financial rewards. Productivity or profitability, construction cost, and competitiveness become the most important economic considerations. Firms overlook strategic opportunities like innovation, research and development, life cycle assessment (LCA), and knowledge management. The tendency of indirect and intangible benefits of such strategic dimensions becomes the barriers to sustainability adoption, requiring interventions such as financial incentives and capacity-building programs to shift industry priorities.

The finding is rather discouraging because, for instance, the LCA is considered a crucial foundation of sustainable construction practice (Ortiz et al., 2009) since the LCA provides a sufficient and objective assessment tool (Lima et al., 2021). By taking a long-term view, the LCA is capable of examining the effects of construction beyond on-site works (Zabalza et al., 2013), encompassing "cradle to grave" (Peris Mora, 2007). Despite being pervasive in scholarly discourses (Sharrard et al., 2008), LCA implementations have just emerged in the Indonesian construction setting.

From a social perspective, construction firms emphasize the internal stakeholders' well-being. Those include safety, physical comfort, and welfare of employees and clients. As such, a wider view of the social benefits of construction projects is overlooked. The lowest priority includes providing local job opportunities and economic benefits to the surrounding community. Providing job opportunities to locals may be challenging due to a limited pool of competent local talents. Hence, construction firms look elsewhere to fulfil workforce requirements. Furthermore, alleviating the local community may not be a strong suit for construction firms.

5.2. Comprehensive sustainability interventions

This study proposes three major aspects of interventions, namely (a) policy and regulation, (b) market incentives, and (c) capacity building. The comprehensive solutions are intended to drive the existing slow growth and to significantly improve uptakes on construction sustainability by covering areas beyond major firms (of contractors and clients) performing projects in developed regions.

5.2.1. Policy and regulations

The findings indicate that external drivers significantly shape firms' attitude and commitment to environmental and economic sustainability practices. Hence, government mandates (i.e., regulatory frameworks) are necessary.

The Indonesian Government has enacted pro-sustainability policies and regulations. For instance, the Law No. 32 of 2009 on environmental protection and management presents a comprehensive regulatory foundation

for environmental preservation and includes principles of sustainable practices. More specifically, the Law No. 28 of 2002 on building standards and energy efficiency dictates the utilization of building standards and energy efficiency in the construction sector. Ministry-level green building standards also have been introduced (IQSI, 2024), including The Ministry of Public Works and People's Housing (PUPR) Regulation No. 01/SE/M/2022 which provides guidelines for green building certification (Husin et al., 2024). It emphasizes energy savings, water efficiency, renewable energy use and cost planning, with a focus on retrofitting office buildings to enhance sustainability (Husin et al., 2024).

However, most sustainability-related regulations have been amended by introducing Law No. 11 of 2020 – i.e., the Omnibus Law. The recent law was meant to streamline environmental regulations and integrate them into broader regulatory frameworks, encompassing multiple aspects to attract business investors. The new law has been criticized for weakening environmental protections by reducing requirements for impact assessment, limiting public consultations, and downgrading oversights (Albold, 2021). Kine (2020) asserts that the new law applies obsolete economic concepts hindering sustainability progress.

Despite efforts by the Indonesian Government, regulatory challenges remain observable. The concepts on which the regulations are grounded seem to be obsolete. The enforcement of the regulations remains weak, resulting in firms complying only minimally with sustainability standards. Moreover, awareness and understanding of sustainability policies and regulations are not distributed evenly across the nation. Large construction firms mostly implement sustainability principles for major clients in selected cities.

The Indonesian Government could learn from the neighboring country of Malaysia and more advanced nations elsewhere. The Malaysian Government implements a more comprehensive Green Technology Master Plan 2017-2030 (KeTTHA, 2017), which integrates principles of construction sustainability and incentives under the Construction Industry Transformation Program (CITP) (Construction Industry Development Board Malaysia, 2018).

Along with this finding, the Indonesian Government could develop a more robust sustainability regulatory framework, ratify and socialize clear and coherent regulations, and strengthen regulatory enforcement. Such a framework needs to be grounded on a contemporary economic model of sustainability. A mandatory client request during contract writing to adopt elements of sustainability practices is also necessary. Regulations may also be required to motivate construction firms and their clients to adopt a life-cycle analysis perspective.

5.2.2. Market incentives

The Indonesian Government has issued multiple financial incentives for adopting construction sustainability. The current incentives include Green Building Incentives (Bramayusa & Adi, 2024), Green Bonds (Asian Development Bank, 2022), Climate Finance Facilities (Asian Development Bank, 2022), and Sustainable Asset Valuation Integration (SAVi) (Bechauf, 2021). Unfortunately, incentives are not widely implemented across areas and projects, hindering nationwide acceptance (Bramayusa & Adi, 2024).

The Indonesian Government has also established various non-financial incentives for the market. In addition to the Greenship rating system managed by the Indonesia Green Building Council (GBCI), several cities have implemented local regulations to support sustainability. For example, Jakarta and Penajam Paser Utara have adopted the Green Building Performance Assessment or BGH rating system to regulate energy consumption and encourage green building practices (Sari et al., 2024). However, green certification remains largely concentrated in major cities, such as Jakarta, Surabaya, and Bandung.

The scope of those incentives needs to be expanded beyond selective, large-scale, and high-profile construction projects. Many smaller construction firms, especially from non-major cities, are unaware of and cannot access the (financial and non-financial) incentives. A streamlined procedure to apply for the benefits would also be required. In addition, a study by (Bramayusa & Adi, 2024) identifies additional potential incentives, which include land/building tax deductions, technical assistance for applications, and promotions. Incentives could also be specifically tailored to target smaller firms (Yudelson Associates, 2007).

5.2.3. Capacity building

The government must also facilitate firms' capacity building about construction sustainability, especially for smaller construction firms in smaller cities and rural areas. The finding suggests that the lower awareness among smaller firms may hinder a nationwide adoption of sustainability principles. A shortage of dedicated sustainability advisors, advocates, and professionals could exacerbate the problem.

A government-sponsored training/education programs are deemed necessary. Top management in targeted construction firms needs to learn strategic thinking. Those knowledge/skills include developing a long-term vision

that considers sustainability, appreciating the intangible benefits of sustainability, sustainable management maturity models, and life-cycle cost analysis (LCA). Relevant training could raise awareness of the importance of a balanced strategy in the construction business: short-term vs. long-term economic goals and tangible vs. intangible objectives. Firms may also need the capability and opportunity to access financial incentives and Greenship certifications.

Possible interventions for the social drawbacks may originate from multiple stakeholders. Government assistance in talent scouting could also be useful in matching job demand and talent supply. A more structured program of local talent upskilling and acquisitions utilizing corporate social responsibility could be established for the local community. Firms could collaborate with the Government and NGOs to help elevate affected communities. A training program on diversity awareness may also be beneficial (Hartono et al., 2020).

The possible multiple interventions, as elaborated earlier, would inevitably involve trade-offs. For instance, an intervention that aims to elevate the local community near the construction site (social aspect) would require additional costs for construction firms (economic aspect). Hence, it is important to devise a set of coherent sustainability interventions to optimize overall outcomes.

6. Conclusions

This study has developed a conceptual model and provided empirical evidence to support it. The theoretical model, grounded in the Attitude–Behavior (A–B) framework, explains the association between sustainability attitude, management practices, and sustainability performance. The findings expand the application of the A–B theory to a new context and offer practical insights for construction practitioners and sustainability advocates. The SEM-PLS analysis was used to empirically confirm the model, while the group profile approach provided descriptive insights by identifying patterns and gaps across different types of construction firms.

The research finding offers unique practical insights for construction practitioners and sustainability advocates. It is found that firms' size and type become determinants for attitude, practice, and performance, respectively. Larger and more integrated construction firms report higher sustainability attitudes, practices, and performance scores than their smaller, more fragmented counterparts. The Indonesian Government needs to prioritize its efforts to drive sustainability towards smaller/fragmented firms. The focused effort is especially important because most Indonesian construction firms fall under this category.

Indonesian construction firms that participated in the survey recognize all three contemporary aspects of sustainability attitude and performance: economic, social, and environmental. Of the three aspects, firms tend to put environmental concerns at the bottom of the list. In addition, most firms would consider the environmental aspect only to comply with the regulations. Regarding the social aspect of sustainability, firms tend to focus on the social well-being of internal stakeholders and overlook those of the community. The economic attitude towards sustainability is directed toward myopic, concrete gratifications rather than the long-term, intangible, strategic benefits.

This study describes the preferences, priorities, managerial practices, and real performance of Indonesian construction firms as a key stakeholder. The finding adds discussions to an important but limited body of literature about conflicting priorities and attitudes among stakeholders towards sustainability in construction as identified by (Lima at al., 2021).

Regarding sustainability practices, Indonesian construction firms demonstrate a rather limited level of maturity. Managerial practices lack institutionalization as a key indicator of organizational maturity (Hartono et al., 2018, 2019a, b) – e.g., long-term strategy and a dedicated team. On the other hand, an effort to codify ethics standards is evident despite its motive driven by contractual obligation.

This study also found compelling evidence that the positive association between 'attitude' and 'performance' is partially mediated by 'management practice'. As such, top management of construction firms could employ multi-path strategies to improve their respective sustainability-related performance.

Based on the findings, three classes of interventions are proposed: policy and regulations, market incentives, and capacity building. A comprehensive approach is needed to consider trade-offs among possible solutions and develop optimized outcomes.

Despite the effort to improve the sample size, this study yields a limited sample size. Thus, the study employs the partial least square (PLS) method for the main analysis. Studies suggest that a PLS model is relatively robust against a small sample size (Hair Junior et al., 2011). Nevertheless, the limited sample size may adversely affect the result generalization. The profiles of the respondents also suggest a tendency towards larger firms, resulting in a possible bias.

Subsequent studies could be administered to provide follow-ups, which include: (a) identification and empirical assessment of determinants affecting sustainability attitudes or management practices; (b) evaluation of possible moderating variables affecting sustainable performance; (c) evaluation of a possible linkage between firm's sustainability performance and overall performance.

Data availability

Research data is not available.

Artificial Intelligence Use Statement

ChatGPT was used during the revision process to improve the readability and language of several paragraphs in the Introduction, Theoretical Framework, and Managerial Insights sections. The authors reviewed and edited the resulting text before including it in the manuscript. The authors take full responsibility for the content of this publication.

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