REVIEW OF GREEN PROJECT MANAGEMENT PRACTICES IN THE MALAYSIAN CONSTRUCTION INDUSTRY

Wong Grace Yun Zhen[1], Low Wai Wah[2*], Vincent Lee Chieng Chen[3], Wong Kwong Soon[4] and Low Sui Pheng[5]

[1,2,3]*Department of Built Environment, Faculty of Humanities & Health Sciences, Curtin University Malaysia, CDT 250 Kuala Baram, 98009 Miri, Sarawak, Malaysia*
[4]*Department of Civil & Construction Engineering, Faculty of Engineering and Science, Curtin University Malaysia, CDT 250 Kuala Baram, 98009 Miri, Sarawak, Malaysia*
[5]*Department of Built Environment, College of Design & Engineering, National University of Singapore, 21 Lower Kent Ridge Rd, 119077 Singapore*

low.wai.wah@curtin.edu.my

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ABSTRACT

With the growing global concerns over climate change and increasing awareness of sustainable development, the importance of incorporating green principles in the construction project management processes has gained substantial traction around the world. The government of Malaysia have launched several incentives to promote and finance the implementation of sustainable practices. However, the awareness and adoption rate of green project management (GPM) practices remain low in the Malaysian construction industry. This study adopts a systematic literature review to explore the current status quo and future research directions of GPM practices in the construction industry. The findings underscore a growing scholarly interest in GPM practices in recent years, with key research themes emerging around enablers and influencers for green construction project management (GCPM), Building Information Modelling (BIM) applications, and green supply chain management (GSCM). This study suggests future studies on the development of decision-making frameworks to support the project stakeholders in implementing best GPM practices. Future research should focus on developing a BIM application framework to support automated green construction management process. This review is significant to foster a culture of sustainability and contribute to driving green initiatives and supporting sustainable agenda of the National Construction Policy 2030 in Malaysia.

1. Introduction

In the wake of rapid urbanization and population growth, the construction industry holds a pivotal role in driving global economic growth by meeting the surge-in demands for housing, infrastructure and utilities. Nonetheless, it is also a major source of global greenhouse gas (GHG) emissions coupled with high energy and natural resource consumption, contributing significantly to global climate change. According to the World Green Building Council (2022), buildings alone account for about 40% of global energy-related carbon emissions and 50% consumption of all extracted natural resources. These negative environmental effects are majorly attributed to unsustainable construction practices and uncontrolled material use (Fernando et al., 2024). This phenomenon underscores the critical need for green project management (GPM) to reduce the construction's ecological footprint and support a transition toward sustainable development. In Malaysia, the projected population growth to 41.5 million by 2040 (DOSM, 2016) further accentuate the pressing need of adopting green practices to meet the increasing demand for societal development while fostering a more resilient and sustainable built environment. In line with the Sustainable Development Goals (SDGs), the government of Malaysia have launched several incentives, including GTMP (2017-2030) and Green Technology Financing Scheme (GTFS) to promote and finance green growth through the employment of green technology.

Despite Malaysia's green initiatives, the awareness and adoption rate of green practices remains low in the construction industry (Masyhur, 2024). As discovered by the extant literature, the GPM concept is still in its infancy (Al-Qassab et al., 2019). Therefore, this study aims to conduct a systematic review of GPM practices in the construction sector and explore its future development to support green movement in Malaysia. This review provides valuable insights into the current state of GPM implementation in construction. By identifying prevailing trends and knowledge gaps, this study offers directions for future GPM research to enrich the GPM literature and increase the awareness of practicing GPM in construction. Ultimately, the findings aim to contribute to the nation's sustainable development agenda.

2. Methodology

This study employed a systematic literature review (SLR) to provide extensive insights into the status quo of GPM practices in the construction industry. As noted by Tranfield et al. (2003), SLR could minimize errors and bias by exhaustive literature as compared to the conventional unstructured review approach. The research protocol began with defining the research problem, determining keywords, and selecting a database, followed by screening, evaluating, and retrieving relevant articles for analysis (Higgins et al., 2019). As a multidisciplinary citation database that indexes a wide range of articles on GPM (Wuni et al., 2023), Scopus was selected for the literature search in this study. Its consistent use and credibility among researchers (Prasetyo et al., 2024; Wuni et al., 2023) further affirm its suitability for this study.

A literature search was performed in the "Article title, Abstract, Keywords" field using a combination keyword of "green project management" and "green construction" or "sustainable construction." As the result, a total of 2116 initial articles were identified. To capture the contemporary state of GPM in the construction industry, the review focused on publications

from 2015 to 2025. During the screening process, all the duplicates, non-English articles, articles unavailable for full-text online retrieval, and the articles that did not belong to journal articles, review articles, conference papers, books, or book chapters were excluded, resulting in 517 articles. Following a title, abstract, and keywords review, 175 articles were retained. Lastly, a full-text screening based on the research aim resulted in 149 relevant articles being finalized and included for analysis in this review.

3. Green Project Management (GPM)

Green project management is a relatively new concept but rapidly evolving that involves various environmental strategies, processes, and practices aimed at reducing environmental impacts and enhancing ecological efficiency (Al-Qassab et al., 2019). At a global level, GPM involves integrating tools and methods that align project processes with sustainability goals, seeking to balance resource use, social responsibility, and environmental conscious outcomes to support business objectives (Carboni et al., 2013, p. 8). Silvius et al. (2017) describe GPM as an environmental-friendly process that enables green-oriented decision-making at various project stages. Overall, it is discovered that the definition of GPM remains contested, with varying degrees of emphasis placed on ecological, social, and economic priorities across the contexts. In this study, GPM is defined as an integrated project management approach that prioritizes sustainability, environmental responsibility, and resource efficiency across the construction project lifecycle.

Although GPM is widely recognized as a paradigm shift towards sustainability, its implementation continues to encounter significant challenges, including scarcity of resources, lack of knowledge and awareness, technical difficulty, and inadequate regulatory support (Leo et al., 2024). As pointed out by Masyhur et al. (2024), the awareness and adoption rate of green practices remains low in the Malaysian construction industry. This scenario reflects a critical gap between conceptual advocacy for GPM and its practical realization, highlighting the need for a systematic review of current practices and exploration of potential pathways to strengthen GPM's role in advancing the nation's green development agenda.

4. Results and Findings

A total of 149 articles were reviewed and categorized into key research themes within the GPM domain as summarized in Table 2. The analysis reveals a predominant focus on enablers and influencers for GCPM, digitalization in GCPM, and GSCM. The exploration of enablers and influencers, including critical success factors (CSFs), challenges, and strategies for GCPM is identified as the most dominant research theme, with 36 publications. Digitalization in GCPM emerges as the second most prominent theme, accounting for 23 publications. This reflects growing academic and industry interest in digital technologies (DTs), particularly BIM as a green assessment and implementation tool to promote green practices in construction (Yang et al., 2024; Susanti et al., 2023). However, BIM adoption in Malaysia is still minimal due to practical execution challenges (Rahim et al. 2023). This is followed by GSCM with 19 publications, with most of the studies focused on the indicators, enablers, barriers, challenges, and strategies for implementation. This accentuates the growing emphasis on embedding environmental

considerations into supply chains to promote sustainability and entrench green practices in construction (Benachio et al. 2019).

Furthermore, green construction project performance assessment and evaluation (18 publications), risk management (15 publications), and green procurement (12 publications) represent other prominent research areas, focusing on performance indicators, green rating tools, risk identification and assessment in green building projects, as well as the enablers and barriers to green procurement implementation. This showcases a strong research interest in developing systematic approaches to enhance the green project delivery. In contrast, there is minimal research on construction waste management (CWM), green construction project design, quality management, building operation management, and health and safety management despite their pivotal roles in ensuring comprehensive sustainability throughout the project lifecycle. This gap signals a need for targeted research on these underrepresented GPM aspects. In addition, 13 articles fall under "Others," addressing diverse topics such as stakeholder-based decision-making models and interrelationships between various green concepts and project outcomes, manifesting the interdisciplinary scope of GPM.

To sum up, the review reveals a strong focus on enablers, DTs, GSCM, performance assessment and risk management which are considered as the critical drivers of successful GCPM implementation. While green construction assessment and techniques are well-explored, there remains lack of proper decision-making frameworks to guide the project managers in making sustainable choices across various project stages. Existing literature points to a similar conclusion (Sandanayake et al., 2020; Mattinzioli et al., 2022), showcasing a need for phase-oriented studies on green construction from a management perspective. Likewise, limited exploration of green design, quality, health and safety (H&S), and operation management aspects points to gaps in the existing knowledge,emp emphasising the necessity for targeted research to attain overarching sustainability throughout the project lifecycle.

Table 2 Number of publications distributed by research theme in the domain of GPM

Research Main Theme	Research Area Details	No. of publication
Enablers and Influencers for Green Construction Project Management (GCPM)	● Critical success factors or drivers ● Challenges, barriers, or influencing factors ● Strategies	36
Digitalization in Green Construction Project Management	● BIM-based GB assessment tool ● BIM application in GB projects: Factors, barriers, impacts, capabilities, and implementation practices	23
Green Supply Chain Management (GSCM)	● Enablers and barriers ● Challenges and strategies ● Indicators	19

Green Construction Project Performance Assessment and Evaluation	• Performance evaluation or assessment • Indicators • Green Building Index (GBI) or green rating tools	18
Green Construction Project Risk Management	• Risk identification in GB projects • Risk assessment in GB projects	15
Green Construction Project Procurement	• Enablers and barriers • Green procurement development index	12
Construction Waste Management (CWM)	• Challenges, strategies, and implementation practices • Performance assessment & evaluation	6
Green Construction Project Design Management	• Barriers and factors • Sustainable building design practices	3
Green Construction Quality Management	• GB quality management practices • Indicators	2
Green Construction Project H&S	• Critical success factors	1
GB Operation Management	• Status quo, problems, and strategies	1
Others	• Relationship between diverse green practices and project outcomes • Decision-making model for stakeholder management	13
Total:		**149**

5. Discussion

5.1 Status of Green Construction Project Development

As revealed by the review results, the global construction industry has experienced a notable shift toward adopting green practices to mitigate its significant ecological impact and promote sustainable development, including in Malaysia. In 2009, Green Building Index (GBI) was initiated as a green rating tool to foster sustainability in the built environment and raise awareness of environmental concerns among construction practitioners in Malaysia. Despite more than a decade of national green efforts, the awareness and adoption of green practices among Malaysian construction firms remain comparatively low (Yong et al., 2021; Hanapiah et al. 2022; Ha, Khoo, and Koo, 2023)

As of 2023, only 678 green-certified buildings have been recorded by GBI (GBI, 2023), in stark contrast to the total of 15,622 private and public construction projects that are registered with the Construction Industry Development Board (CIDB) (CIDB, 2023). This figure represents that less than 1% of the total current Malaysian building stocks are green-certified, underscoring limited adoption of green construction practices nationwide. Furthermore, the marginal increase in the number of green certified buildings from 729 in 2024 (GBI, 2024) to 741 as of March 2025 (GBI, 2025) further substantiates a minimal growth in green-certified buildings in Malaysia. This implies that the sustainable development projects in the Malaysian

construction industry remain at an early and evolving stage and have been hindered by high adoption cost, scarcity of green technologies, managerial challenges, and insufficient knowledge (Abdullah et al., 2024; Masyhur et al., 2024; Ha, Khoo, and Loh, 2023).

6. Conclusion and Future Research Directions

In conclusion, the findings of this review underscore a growing scholarly interest in GPM practices in recent years, with key research themes emerging around theoretical constructs for GCPM, BIM applications in GC projects, and GSCM. This focus reflects the recognition that green construction projects are inherently complex and dynamic, which requiring ongoing investigation into how these key drivers can be effectively adapted to diverse project contexts and the evolving industry demands. As revealed, the green development in the Malaysian construction industry remains at an early and evolving stage. Hence, this study suggests future research on the establishment of a structured decision-making framework to guide the project stakeholders in making sustainable decisions and applying best green practices to mitigate the sustainability-related issues or risks across the project lifecycle. As the construction industry advances toward Industry 5.0, future research should focus on developing a BIM application framework to support automated GC management process to contribute to meeting the goals of Malaysia's GTMP (2017-2030). Additionally, future exploration of the specific areas in GPM, including green design, quality management, H&S, and operational management aspects is suggested to promote a holistic approach to long-term sustainability goals in construction.

The identified research gaps and directions can serve as guidance for future GPM research to enrich the GPM literature and increase the awareness of practicing GPM in the Malaysian construction sector. This review is significant to foster a culture of sustainability and contribute to driving green initiatives and supporting sustainable agenda of the National Construction Policy 2030 in Malaysia, meeting the government's commitment of reaching net-zero emissions by 2050 (MGTC, 2024). Moreover, this study is limited to the articles published up to May 2025, potentially excluding the recent achievements in the construction industry. Likewise, only Scopus database was used in this study, and it is recommended to consider incorporating other databases for broader coverage in future studies.

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