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Proceedings of the World Conference on Business, Management, and Economics
Vol. 3, Issue. 2, 2025, pp. 24-81
DOI: https://doi.org/10.33422/worldbme.v3i2.1637

ISSN: 3030-0215 online

Diamond Scientific Publishing

Navigating the New Climate Order: Sustainable Development in Malaysia's Real Estate Sector Between East and West

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Abstract

This study explores the dynamics of the Malaysian real estate industry in adopting sustainable development against the changes in global climate governance and rivalry among major economies such as the United States, China/BRI, ASEAN, and BRICS. The methodology employed is an integrative systematic review adopting a PRISMA approach that combines peer-reviewed sources and selective gray literature such as government and business reports. The systematic search produced a total of 87 core publications augmented by 10 other relevant peer-reviewed empirical sources, which generated 97 studies in total. Four peer-reviewed sources and one government report on benchmarking buildings' performance data were included in order to supplement later evidence in 2025, bringing the total number of reviewed sources to 101. This study critically analyses quantitative and qualitative evaluations regarding the development of policies, green financing, corporate sustainability, and building performance from 2020 to 2025. Buildings certified by the GBI outperformed their conventional counterparts in both energy efficiency and water efficiency; Malaysia has distinguished itself in the region for its green and sustainability sukuk and is an established leader in Islamic green finance; and there is growing evidence that ESG factors are becoming important in driving business practices in premium office space and data center sectors. Yet it also reveals ongoing deficiencies, such as organizational causes of the building-energy performance gap, lack of water-performance measures, and unequal availability of green financing beyond large public firms and GLCs. The study is a demonstration of the multi-alignment policies adopted by Malaysia as it caters to Western ESG concerns, Chinese technological dependence, and regional trends in institutional governance through various climate finance channels and regulatory alignment to ensure policy independence. The study captures the following three policy objectives: enhanced performance-based building regulation, expanded access to green and sustainability-linked financing, and regional platform utilization for technology transfer and standardization as a structured template for other developing nations grappling with similar geopolitics and sustainability challenges.

Keywords: Adaptive governance; climate diplomacy; corporate sustainability; green finance; policy integration

1. Introduction

Global diplomacy in relation to global climate change as well as multilateral cooperation has undergone change even before and after the Paris Agreement of 2015. In view of its position

as a developing nation, Malaysia finds itself in the fastest-growing part of Southeast Asia and may become a focal point of conflicting American and Chinese policy frameworks at the regional and international levels. Trade and technology wars between the United States and China, combined with the political implications of the coronavirus pandemic (COVID-19), introduced volatility in American policy and strategic contestation with China on the development of green technology and climate change policies. The Belt and Road Initiative (BRI) investment in green technology marks an impressive development toward the realization of China's carbon-neutral target by 2060.

Developing countries address climate change in light of the effects brought about by an uneven and unbalanced global economic and political order. The real estate sector (built environment) is responsible for about 40% of worldwide carbon emissions, with operational energy consumption and building materials being the two major contributors. This industry shall remain among the most daunting issues confronting emerging economies in the coming years, as illustrated by the Malaysian case study of other developing nations' use of aid in attaining strategic global independence.

1.1 Climate Science

The World Meteorological Organization (WMO, 2024) highlighted the importance of ensuring that any measures taken towards mitigating climate change focus on curbing greenhouse gas emissions. The current concentration of carbon dioxide (CO_2) in the atmosphere is more than 151% above pre-industrial levels, with combustion of fossil fuels and the manufacture of cement as significant sources. Human activities now represent the dominant sources of greenhouse gases, and there is a substantial accumulation of these gases in the atmosphere; the rest are absorbed by the oceans and terrestrial sinks. There will be dire consequences without the mitigation of climate change due to the continued increase in global GHGs.

The urgency for immediate mitigation arises due to the cumulative effects of radiative forcing caused by greenhouse gases, which have increased by over 51.5% since 1990. Malaysia's 2025 Climate Change Performance Index (CCPI) standing at 48th position (low) signifies Medium GHG emissions performance and Very Low ratings in energy use and climate policy (Burck et al., 2024). Evidence from emerging markets also indicates that the association between urbanization and carbon emissions is not linear; rather, carbon emissions increase until a certain threshold point of urbanization is reached, beyond which they begin to decline (Khan et al., 2021).

1.2 US Policy Trajectory and Regional Implications

The Renewable Energy Project for Emissions Tracking (REPEAT), in association with Princeton, conducts analyses on the consequences of US climate policies, such as a policy reversal, as well as projections on the possible effects of a second Trump presidency by examining policies that have a combined emissions gap of 7 billion tons of CO_2. It is equivalent to an emissions gap compared to the US 2015 Paris Agreement goal of a 50% to 52% reduction in emissions from 2005 levels by 2030 (Jenkins et al., 2025).

Concerning September 2025 projections, any evaluations are going to treat US policies and actions as "highly insufficient" under domestic pathways modeled. Additionally, the US Nationally Determined Contributions (NDCs) target is viewed as "critically insufficient," thereby contributing to the formation of a "4 °C world" (Burck et al., 2024). US climate policy uncertainties and reversals have resulted in the emergence of systemic risks and opportunities for developing nations from Southeast Asia. Other countries that rely on the US for technology, finance, and regulations stress the importance of the US to broaden its relations (Jenkins et al., 2025).

1.3 China's Green Technology Leadership and BRI Evolution

The advancements made by China in renewable technology have been one of the key reasons behind the innovation happening under the sustainable development model for developing countries. Moreover, the emphasis on "green" by the BRI, along with China's commitment towards achieving carbon neutrality by 2060, is a good example of a disruption in global supply chains and investment in sustainable infrastructure (Sanchez & Co., 2025; Tatler Asia, 2025). There is ample literature regarding the integration of renewable energy systems in BRI infrastructure projects (Hua & Tong, 2026).

However, the question here is how to exploit the opportunities offered by the growth of renewable technology and yet ensure technological sovereignty, strict environmental policies, and flexibility in dealing with an increasingly multipolar world.

1.4 Research Context and Rationale

This review explores how climate governance and great-power competition transform sustainable real estate development in Malaysia. The position of Malaysia as a prominent ASEAN member, a potential BRICS nation, and a site for rival climate policies of the US and China results in multiple pressures on its property sector from both regulatory and financial perspectives. In terms of the market, the preliminary evaluation predicted that the national commitment to achieve carbon neutrality will affect investments in real estate projects in Malaysia (Turner & Townsend, 2021), and recent trends indicate that project owners tend to promote their real estate through the concepts of sustainability, green construction, and financing initiatives. With respect to other developing nations, Malaysia can be viewed as an important case of how an emerging middle power handles multi-alignment and balancing while trying to address its environmental and developmental needs despite escalating geopolitical tensions.

Table 1 captures the major distinctions between American and Chinese climate policies and their impacts on the real estate market in Malaysia, emphasizing the two-way impact of the West's environmental, social, and governance (ESG)-orientated finance and China's BRI-backed infrastructure and technology networks on Malaysia's real estate market. Malaysia is caught between the two incentive systems, as it pursues sustainability goals and strategic independence, thus showing the potential for developing nations to engage actively in the regional climate and investment regimes.

Given that climate policies, financial tools for green finance, and business sustainability measures in Malaysia have developed quickly since 2020, many of the latest developments in this regard are reported in government documents and gray literature publications before they appear in peer-reviewed journals. In light of this situation, this review will examine both empirical studies in peer-reviewed journals and selected sources in the gray literature while attaching varying evidentiary weight to each source, as detailed in Section 4.2.2. Estimates related to scenario-based FDI and investments based only on the gray literature will be considered hypothetical and explicitly mentioned as such in Section 5 and Appendix A2.

Contribution roadmap. This review makes three contributions to the literature. First, it merges institutional theory, policy diffusion, and global value chain frameworks in one model to describe how multi-alignment and adaptive governance drive sustainable real estate transitions in a middle-income country. Second, it provides an evidence-based analysis of 101 sources combining peer-reviewed journals and carefully selected gray literature on policy integration, green finance, and corporate practice in the real estate industry in Malaysia, including a benchmark of energy and water performance of buildings relative to their Southeast Asian peers. Third, it develops specific recommendations based on this analysis, linking

Malaysia's domestic policies and climate finance tools to broader US, ASEAN, Chinese, and BRICS climate regimes, thus providing a useful roadmap for other developing nations that confront comparable geopolitics and sustainability challenges.

Table 1: US versus China Climate Policies and Impact on Malaysian Real Estate

Policy Element	US	China	Impact on Malaysia
Climate Framework	Paris-based NDCs	Paris + BRI integration	Balance both frameworks
Emission Target	50–52% by 2030; net-zero 2050	Peak 2030; neutrality 2060	Align own net-zero by 2050
Green Finance	ESG-driven private capital	State-directed green credit	Manage divergent standards
Real Estate Strategy	LEED, market incentives	State-led urban megaprojects	LEED in premium; GBI nationally
Technology Transfer	IP-protected, selective	BRI-linked tech packages	Tech access vs. dependency
Renewable Energy	Private, innovation-led	State-led manufacturing	Dual reliance on both blocs
Sector Focus	Economy-wide decarbonization	BRI power/transport/data	Exposure via data centers, BRI assets
2024-2025 Trend	Progress with policy risk	Rapid low-carbon expansion	ESG pressure and pathway debates

Source: Sanchez (2025); ClientEarth Asia (2025).

2. Literature Review: Climate Diplomacy and Regional Architecture

2.1 Paris Agreement Legacy and Current Implementation Challenges

The Paris Agreement provided an elaborate legal and policy framework for the formulation of NDCs (Bodansky et al., 2017), which has now become a complex network of bilateral and multilateral climate agreements and partnerships. Nevertheless, the agreement remains inadequate in scope and action and is expected to fail to meet the targeted temperature objectives. NDC implementation faces several challenges (UNFCCC, 2025; Roberts & Weikmans, 2017), with the problem further intensified by fragmentation and lack of trust in multilateral climate governance (Roberts & Weikmans, 2017). According to the 2025 Climate Action Tracker assessment, it is estimated that current warming and climate policies imply a world warming above the 1.5-degree objective. For large emitters such as the US, the climate policies have been considered critically insufficient.

This disconnects stems from an ongoing battle for power among global governance, state sovereignty, and economic competitiveness, pointing to the enduring power imbalances in global climate politics, as noted in recent scholarly discourse (OxJournal, 2025). Malaysia will thus have to contend with its position as a developing nation and the impacts of climate change, which both present threats and possibilities, while balancing climate policy with economic concerns.

Malaysia is one such example of this fragmentation, with its involvement in ASEAN climate initiatives, BRICS partnerships, and bilateral technology collaborations being indicative of the trend toward mini-lateralism and sectoral cooperation instead of coherent multilateralism.

2.2 Policy Frameworks: From the Ninth Malaysia Plan to the SDG Roadmap Phase II

The Malaysian government has remained constant in its creation and implementation of sustainability policies, irrespective of uncertainty in the world situation and internal changes within politics. In the Ninth Malaysia Plan, from 2006 to 2010, environmental issues of the economy were clearly stated in Chapter 4, "Improving Quality of Life and Sustainability," and strict regulations were put into place concerning air and water pollution and the public sewerage system (Malaysia Economic Planning Unit, 2010).

The Plan aimed at optimizing spatial planning through the harmonization of land use with biodiversity conservation and the reforestation of mangroves and coastal areas for minimizing environmental hazards and erosion. The plan emphasized the use of an Industrialized Building System (IBS) and modular coordination for improving the construction process and lowering construction costs and wastage, building a technological base that is still relevant for present-day sustainable construction (Construction Industry Development Board Malaysia, 2021). Comparative studies conducted on energy consumption efficiency by green office buildings versus non-green office buildings recently in Malaysia have highlighted the operational benefits of certified buildings (Ab. Rahim & Md Ali, 2024).

The SDG Roadmap Phase II (2021-2025) is anchored in this approach by adopting the MADANI model with clear governance mechanisms in place, such as the National SDG Council, headed by the Prime Minister, and the Ministry of Economy (Malaysia Ministry of Economy, 2023). Its focus on performance-oriented planning within the five pillars of People, Prosperity, Planet, Peace, and Partnerships allows for the convergence of climate objectives and other sustainable development objectives and promotes effective and cross-sectoral policy changes that are less susceptible to political fluctuations (Malaysia Ministry of Economy, 2024).

Targets for climate action within the Planet pillar, including GHG intensity reduction, climate impacts on biodiversity measurements, and climate-aligned finance, establish crucial connections between the national policy framework, corporate sustainability plans, and private sector involvement (Malaysia Ministry of Economy, 2023). These examples of policy tools highlight the role played by developing countries in maintaining stability via consistent policies and strategic planning, despite challenges posed by external shocks and domestic politics (Malaysia Economic Planning Unit, 2010; Malaysia Ministry of Economy, 2023). Previous research examining Malaysia's Eleventh Malaysia Plan and the Green Technology Master Plan indicated that although green growth measures existed prior to geopolitical changes, their implementation was hindered by inconsistent implementation and a lack of inter-governmental collaboration (Mokthsim & Salleh, 2014; Hezri & Hasan, 2004).

2.3 Corporate Sustainability Integration and Market Mechanisms

In Malaysia, there is an increasing tendency for sustainable practices to be introduced in the corporate sphere, which represents a major step in changing the process of national policy implementation. Companies such as S P Setia incorporate sustainability finance as part of their overall corporate strategy, thus demonstrating the connection between climate change-related goals and opportunities for attracting funding, as well as sustainability-related strategies at the national level (S P Setia, 2025). More details regarding the structure and characteristics of the financing model are provided in Section 5.2.3. Green sukuk issuance, sustainability-linked lending, and application of ESG criteria within the company's corporate management represent several examples of market players' response to the climate emergency (UNDP, 2025; Bond and Sukuk Information Platform Sdn Bhd, 2024), with recent findings confirming the successful incorporation of Islamic finance principles and ESG sustainability within the Malaysian market environment (Najid et al., 2024). Empirical cost-benefit analysis reveals that green buildings can produce economic profits through cost reductions and asset appreciation, thus providing additional reasons for investing in such tools (Iwuanyanwu et al., 2023). In a context where global economic fragmentation poses risks for collective financing of climate change, the shift towards greener buildings becomes increasingly important (Georgieva, 2023). The above changes occur against the background of evolving national monetary policies where, at least in the last months, central banks aim to address both price stability and growth-oriented investments (Bank Negara Malaysia, 2025).

The current review draws from the latest gray literature for insight into the recent trends, although it must be noted that there is now a growing body of empirical evidence exploring sustainability performance in Malaysia. Indeed, some recent research has begun to explore how corporate ESG reporting is linked to access to green financing among the ASEAN countries, revealing that listed property firms in the country have expanded their ESG disclosure range, yet performance is inconsistent, with external forces such as regulation and investor expectation being the primary drivers rather than sustainable practices (Jamaludin & Razali, 2024; Jaffar et al., 2022; Prasetyo & Aryani, 2024). On the other hand, critical evaluation of the environmental impact of projects such as Forest City reveals that the project's "green" marketing could conceal considerable environmental harm and disputes about its social impact (Moser & Avery, 2021).

The issue of climate change requires that the corporate sector assume an increased responsibility involving policy innovation, cross-sector interactions, and global positioning (S P Setia, 2025). The world has advanced to an extent where cooperation between private and public governance in one country can supplement public governance in another, providing a model for developing nations with intricate governance systems (Bond and Sukuk Information Platform Sdn Bhd, 2024). Innovation in this regard is continuous, as evidenced by Malaysia establishing specialized laboratories to hasten its green finance transition (TV BRICS, 2025).

2.4 Regional Architecture and ASEAN Climate Leadership

The chairmanship of ASEAN in 2025 will fall on Malaysia, which will present another opportunity for climate collaboration in the region and the contribution of democracy from developing countries in the international organization (Ministry of Foreign Affairs Malaysia, 2025). Analysts underscore that Malaysia's "Inclusivity and Sustainability" chairmanship theme is relevant to the national MADANI agenda and the ASEAN long-term objectives and deliverables, including the ASEAN Community Vision 2045, the DEFA, and the ASEAN Green Deal 2030 (Lin, Fong, & Martinus, 2025). The ASEAN climate governance system is based on consensus, considering the bloc's position as a facilitator of regional cooperation and its principle of centrality in the regional architecture (Association of Southeast Asian Nations, 2025; Parks et al., 2018). The policy analysis of the Singapore Institute of International Affairs presents ASEAN centrality as a multiplex and inclusive regional architecture with ASEAN as the primary hub connecting other institutions and great powers in the region (Singapore Institute of International Affairs, 2015).

The promise of new opportunities in the development of developing countries' diplomacy under the ASEAN Economic Community is to review the relationship with ASEAN. In diplomacy, there is a need to consider climate-sensitive activities such as the ASEAN Accord on Climate Change and Climate Change Sectoral Strategies. The ASEAN roadmap on climate change, along with socio-economic cooperation documents, will be used as a platform for collaboration in the climate economy against the ASEAN Economic Community (Ministry of Foreign Affairs Malaysia, 2025). According to Bernama (2025), the 2025 ASEAN Summit in Kuala Lumpur may produce agreements that will bring approximately RM300 billion in foreign direct investment in the coming five years, along with billions of ringgits in trade and investments, offering financial flexibility for green infrastructure and climate-related projects. According to The Star (2025b), the 46th ASEAN Summit in Kuala Lumpur will enhance Malaysia's prominence in guiding ASEAN's strategic cooperation plan with regional and international partners, particularly through new summit meetings involving ASEAN-GCC and ASEAN-GCC-China summits focusing on trade, investments, and sustainable development. Going forward, the commitments made by ASEAN at recent COP pledges, together with the proposed ASEAN energy strategy for 2026–2030, indicate the growing pressure for setting higher targets

for renewables and energy efficiency in the region (Bilqis & Pradnyaswari, 2024). The financial arrangements for these initiatives will be based on the funding schemes of the Asian Development Bank, World Bank, private equity firms, and national development banks, facilitating the implementation of ASEAN infrastructure and sustainability projects (Correia et al., 2025).

Table 2 provides a comparative analysis of the sustainability and development policies that ASEAN (the regional bloc most pertinent to Malaysia) and BRICS (a fresh geopolitical and economic bloc that Malaysia is increasingly getting involved with) are following. Malaysia's policy of multi-alignment, described in Section 1.4, determines the nature of Malaysia's involvement with ASEAN and BRICS climate actions through ASEAN centrality and selective engagement with BRICS to broaden avenues for financing and technologies, and exploiting BRICS' new sustainability and industrial policy centered around technology and small enterprises (Bernama, 2024; Ministry of Foreign Affairs Malaysia, 2025a, 2025b; BRICS, 2025). It is evident from recent reports that Malaysia considers itself an intermediary between ASEAN and BRICS, emphasizing the importance of both blocs in promoting regional cooperation and creating a sustainable and equitable international economic system (Vietnam News Agency, 2025).

According to The Star (2025a), Malaysia will leverage its chairmanship of ASEAN 2025 to promote greater interaction between ASEAN and BRICS at the BRICS Foreign Ministers' Meeting, which will include regional cooperation, economic cooperation, and a more equitable and sustainable world economy.

Table 2: ASEAN versus BRICS Sustainability Initiatives and Malaysian Positioning

Initiative/Aspect	ASEAN	BRICS	Malaysia's Position	Key challenge
Primary Focus	Regional integration	Emerging-market bloc	ASEAN member, BRICS partner-in-waiting	Balance both roles
Climate Focus	Regional climate targets	NDB climate finance	A mix of Western and BRICS finance	Align standards
Green Building	Mixed national systems	China-linked standards	GBI regional leader	Protect GBI, engage China
Development Model	Fragmented, country-led	State-directed projects	USEU FDI + BRI projects	Manage dual dependence
Financing Structure	ADB/World Bank + private	NDB + bilateral loans	Uses both channels	Coordinate regimes
Technology	Mixed Western/Asian tech	China-dominated RE tech	Chinese tech + Western premium	Limit tech dependence
ESG reporting	TCFD and GRI alignment	Alternative ESG narratives	Primarily TCFD-aligned; GRI where required	Handle dual expectations
2024–2025 moves	Green recovery, NDCs	Energy/AI projects	Hosts ASEAN, joins BRICS energy	Avoid institutional tension

Source: ASEAN Center for Energy (2024); Info BRICS (2025)

2.5 Theoretical Framework

This review combines four different analytical approaches to elucidate Malaysia's journey to a sustainable real estate transition: institutionalism, policy diffusion, global value chains, and existing models of corporate sustainability (CSR, TBL, and SSM). The four different approaches will be used to look at Malaysia through the prism of climate geopolitics, climate cooperation, and investment networks, national policy integration, and corporate sustainability practices in order to understand why Malaysia finds itself at the junction between the US/EU, China/BRI, and ASEAN/BRICS regimes. This would help account for the balance between the opposing forces achieved through adaptive governance and strategic autonomy, which can be

seen as typical of research into middle power strategies amid US-China rivalry (Benazeraf, 2025). In a larger context, studies on middle power behavior emphasize their ability to use coalition-building and leadership on specific issues to foster a multipolar world (Batool, 2024).

Studies about sustainability within Malaysia's real estate industry have so far been largely concerned with applying international perspectives such as CSR, TBL, and SSM to examine how developers reconcile their bottom lines with the environment and social issues (World Commission on Environment and Development, 1987; Elkington, 1998; Stead & Stead, 2008). Although these approaches emphasize corporate duties and strategic management, they fail to account for the impact of external geopolitical dynamics and emerging alliances regarding climate change on policy formulation and innovation.

To bridge this gap, this review introduces institutional theory to explain how Malaysia copes with different pressures exerted by the US–EU ESG regime, China's Belt and Road Initiative, and the ASEAN and BRICS climate agenda. Coercive pressure comes from regulatory and disclosure requirements in large stock exchanges; normative pressure comes from professional standards and international sustainability norms (TCFD, GRI, green building certifications); and mimetic pressure is evident in the way developers and policy-makers emulate "best practices" of regional leaders (DiMaggio & Powell, 1983; Scott, 2014). For this review, ESG acts as the overall sustainability model, whereas TCFD and GRI act as separate disclosure tools. TCFD deals with climate risk finance disclosures, while GRI handles multi-dimensional sustainability reporting; hence, the two cannot be considered equivalent.

A policy diffusion approach is also applied to identify the manner by which environmental and green finance-related policies move through the ASEAN, BRICS, and other similar regional organizations, and are adapted to fit Malaysia's domestic setting (Dolowitz & Marsh, 2000; Shipan & Volden, 2008). Bilateral and mini-lateral efforts such as ASEAN climate roadmaps and BRICS energy and infrastructure projects serve as conduits for the process of transferring standards and financial frameworks into the Malaysian real estate industry. This integrated holistic theory can be encapsulated in the theoretical model presented in Figure 1, depicting how geopolitical climate regimes, national-level policy integration, and business practices interact to influence sustainable development in Malaysia.

Lastly, the analysis relies on global value-chain approaches to green technology, elucidating Malaysia's status within the supply chain of renewable energy sources, data centers, and construction materials to influence its strategies in real estate carbon reduction (Gereffi, 1999; Ponte & Sturgeon, 2014). China's supremacy in solar photovoltaic systems, batteries, and energy-efficient technologies, alongside the US-EU monopoly on some advanced technologies and green investment markets, determines the price, accessibility, and regulatory aspects of Malaysian businesses in realizing environmentally friendly construction and urban development projects.

Collectively, these theoretical lenses (CSR, TBL, SSM, institutionalism, policy diffusion, and green technology value chains) form the theoretical underpinning of the findings presented in Sections 5 and 6.1 on policy integration, green finance, and business practices in the Malaysian real estate market.

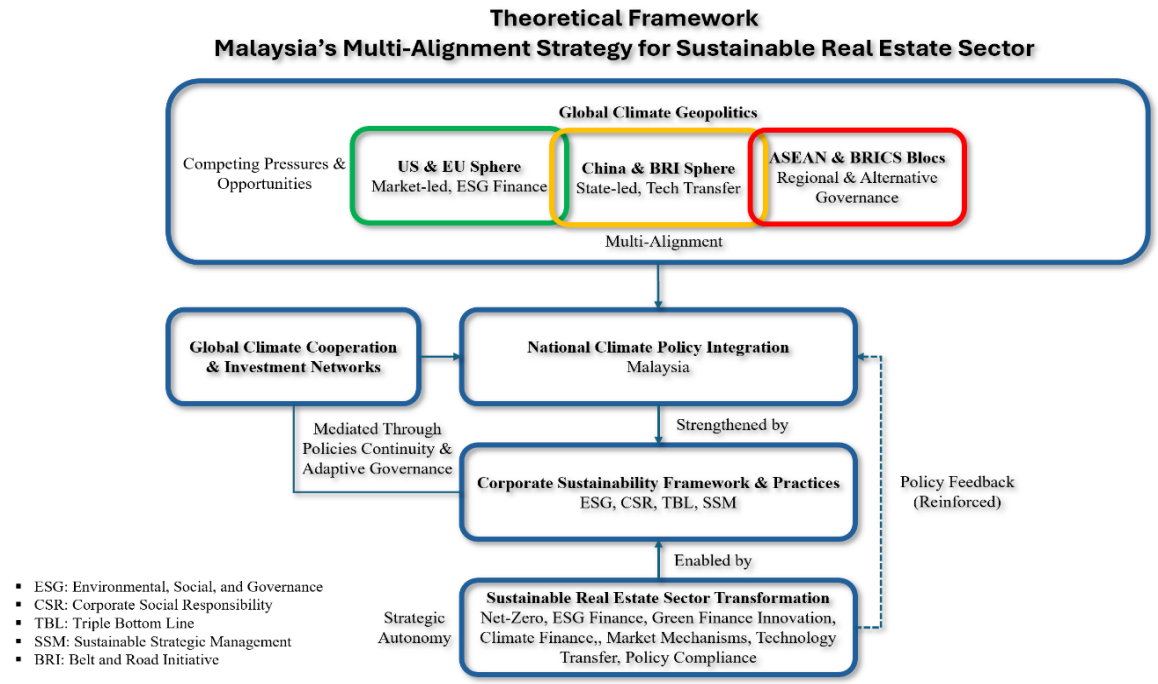

Figure 1. Theoretical framework for sustainable real estate transformation in Malaysia, linking global climate geopolitics (US–EU, China/BRI, ASEAN/BRICS), national policy integration, and corporate sustainability practices to show how multi-alignment and adaptive governance shape transition pathways in the Malaysian real estate sector.

Source: Authors' analysis (Theoretical Framework for Sustainable Real Estate Transformation in Malaysia).

3. Aims

In light of this, this literature review is intended to understand the transformation of sustainable real estate in Malaysia in the context of geopolitics and climate change governance and provide an understanding of how these external regimes influence domestic politics and markets. This will be done by:

1. Analyzing how changes in climate change diplomacy, specifically climate change policies in the US, ASEAN, and BRI/China, impact the scope of sustainable real estate in Malaysia.
2. Understanding the extent to which Malaysia's climate change frameworks (SDG roadmap Phase II and the Twelfth Malaysia Plan) have been institutionalized via planning rules, green building certifications, and climate-aligned finance instruments in the property and construction industry.
3. Examine the role of corporate sustainability initiatives, green sukuk, and other financial instruments related to ESG factors, and climate-related foreign direct investment in enhancing or hampering Malaysia's ability to decarbonize its real estate industry without sacrificing strategic or economic independence.
4. Identify, from this body of knowledge, policy and investment options that will assist Malaysia and similar developing countries to align their sustainable real estate development with multi-alignment climate diplomacy in a world order characterized by fragmentation and multipolarity.

4. Methodology

With respect to the dynamic changes in climate policies, geopolitical relations, and market trends in the real estate industry in Malaysia, the review shall adopt a methodology that entails the combination of gray literature and peer-reviewed journal articles. Gray literature, which

includes government reports, market analyses, and corporate sustainability reporting, contains important and recent information regarding the implementation of policies, market dynamics, and corporate behavior, which is still lacking among academic sources. Nonetheless, since the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines are usually used for peer-reviewed sources, this paper shall apply these principles to ensure transparency throughout the process of selecting the literature to be included in the study. The present study will involve the following multi-phased process.

Phase 1: Literature Review

A preliminary, thorough analysis of several theoretical models that must be incorporated in sustainable development, including the Triple Bottom Line (TBL), Sustainable Strategic Management (SSM), and Corporate Social Responsibility (CSR). In addition, an analysis of the interaction between climate diplomacy, geopolitics, and developing nations' theories.

Phase 2: Current Market Data

An assessment of the 2025 Real Estate industry's professional achievements and macroeconomic statistics in terms of market integration and a comparative study on the incorporation of foreign direct investments, industry performance, and sustainability in development projects' approval processes.

Phase 3: Corporate Sustainability Framework Analysis

An analysis of sustainability approaches in corporations, such as the Sustainability Financing Framework by the leading property developers, governance and accountability processes, stakeholder impact measurement and systems, and stakeholder engagement, in order to determine how the private sector puts policy goals into practice.

Phase 4: Policy Implementation Assessment

The alignment of the policy evaluation models was determined by examining the reports from the industry and government regarding the outcomes of policies and stakeholders' voices to determine the discrepancies between policy and implementation.

Phase 5: Bringing It All Together

The prior steps will be combined to draw commonalities, discrepancies, and functional overlaps as well as generate information that would help formulate practical recommendations for both developed and developing nations to maintain their autonomy while accomplishing climate targets within the framework of sustainable real estate development.

4.1 Search Strategy

A systematic review of literature was done to identify the number of publications related to sustainable development in the real estate sector of Malaysia, taking into consideration changes in the political climate of the globe due to geopolitical and technological alliances following the Paris Agreement. Various international databases were used to retrieve peer-reviewed literature and reports from governmental sources.

Databases Searched

The databases accessed for this study include Scopus, Web of Science, ScienceDirect, ProQuest, Google Scholar, the Malaysian Citation Index (MyCite), and JSTOR. The policy papers and reports were retrieved from government departments, international bodies (ASEAN, BRICS, and UN agencies), and sustainability reporting by corporations.

Search Strategy and Boolean Operators

The following search strings were applied to all databases:

Primary Search String:

("sustainable development" OR "sustainability" OR "green building" OR "net zero carbon" OR "ESG" OR "environmental social governance") AND ("Malaysia" OR "real estate" OR "property development" OR "construction") AND ("climate policy" OR "Paris Accord" OR "geopolitics" OR "BRICS" OR "Belt and Road")

Alternative Search Strings:

- ("US climate policy" OR "China climate strategy") AND ("Malaysia" OR "ASEAN") AND ("real estate" OR "property" OR "infrastructure")
- ("Belt and Road Initiative" OR "BRI") AND ("Malaysia" OR "sustainable development") AND ("real estate" OR "energy" OR "infrastructure")
- ("ASEAN" OR "BRICS") AND ("sustainability" OR "green finance" OR "ESG") AND ("property" OR "development" OR "investment")
- ("climate change" OR "greenhouse gas" OR "net zero") AND ("Malaysia" OR "Southeast Asia") AND ("real estate" OR "construction" OR "urban development")
- ("US-China relations" OR "geopolitical" OR "technology partnership") AND ("Malaysia" AND ("real estate" OR "sustainable development" OR "green technology")

Search Parameters

- Field Searched: Title, Abstract, Keywords
- Search Date Range: January 2020 to October 2025
- Language: English language publications only
- Document Types: Peer-reviewed journal articles, conference proceedings, government reports, policy documents, corporate sustainability reports
- Search Dates Conducted: September 2025 to October 2025

4.2 Inclusion and Exclusion Criteria

Inclusion Criteria (Studies must meet all the following):
Study Population:

- Research focusing on real estate, property development, construction, or infrastructure sectors
- Geographic scope: Malaysia, ASEAN, or comparable emerging economies (e.g., BRI-involved)
- Minimum sample size: $n \geq 10$ organizations, projects, or respondents
- Organizational level: Developers, construction firms, government agencies, financial institutions, or end-users

Intervention/Framework:

- Implementation of CSR, ESG, or sustainability strategies in the real estate context
- Analysis of climate policy impacts (US, China, or multilateral frameworks) on real estate development
- Green building certification program (GBI, LEED, and GreenRE) or sustainability initiatives
- Financing mechanisms for sustainable development (green bonds, ESG funds, climate finance)
- Geopolitical or technology partnership impacts on sustainability practices
- BRICS or BRI involvement in Malaysian sustainable development

Outcomes:

- PRIMARY: Sustainability adoption rates, carbon emissions reduction, energy efficiency improvements, climate resilience, and policy effectiveness
- SECONDARY: Cost-benefit metrics, adoption barriers and drivers, stakeholder engagement, geopolitical implications, and financial outcomes

Study Design:

- Peer-reviewed journal articles
- Peer-reviewed conference proceedings
- Government statistical reports with documented methodology
- Official policy analysis and briefing documents
- Corporate sustainability reports from listed companies
- Case studies with explicit data collection methods
- Systematic reviews and meta-analyses

Time Period:

- Published January 2020 to October 2025
- Exception: Foundational theoretical frameworks, such as Carroll 1991, Brundtland 1987, or key geopolitical analyses, regardless of date

Language:

- English language publications
- Professionally translated versions are acceptable if the translation is verified

Exclusion Criteria (studies were excluded if):

- Not peer-reviewed (an exception may be made for official government statistical reports or established policy analyses)
- Published before 2020 (except foundational frameworks)
- Non-English language without a verified translation
- Focus on unrelated sectors without real estate/property development relevance
- Opinion pieces, editorials, or news articles without empirical data (news sources only used for policy context, not evidence)
- Duplicate publications (most recent version retained)
- Sample size < 10 entities
- No quantitative or qualitative outcome data reported
- Entirely different geographic/economic context with no transferable insights to Malaysia or emerging markets
- Pre-prints or non-final versions
- Studies with critical methodological flaws (quality score < 6 on appraisal tool)

Rationale for Criteria

The chosen inclusion criteria, apart from being consistent in terms of methodological standards, are intended to take into account the importance of new and more robust evidence. In addition, only several key works on theoretical grounds are mentioned, such as Carroll (1991) and the Brundtland Report (1987). Nonetheless, they are not included in the list of 97 academic papers cited in the PRISMA table and annexes, forming the basis of the empirical and policy literature review, which is used to develop the research. In view of the dynamic geopolitical situation after signing the Paris Agreement, the use of the latest policies and reports of enterprises is an attempt to recognize the constantly changing climate change policy and sustainable business.

The chosen geographical scope creates a possibility to compare other emerging economies, especially BRICS and BRI countries, affecting Malaysia's development.

4.2.1 Quality Appraisal

Studies that fulfilled the inclusion criteria were then evaluated from a methodological perspective in regards to the quality and applicability of the research. This was done through a systematic approach that had been tailored for the specific context of sustainability within the real estate industry in Malaysia amid geopolitics.

The quality assessment criteria included the following:

1. Study Design and Rigor (0–2 pts)
- Peer-reviewed journal article: 2 pts
- Government/policy report with clear methodology: 1 pt
- Corporate sustainability report: 1 pt
- Other sources: 0 points
2. Relevance to Malaysia or ASEAN Context (0–2 pts)
- Direct study of Malaysia: 2 pts
- Study of comparable ASEAN economies or BRI-engaged countries: 1 pt
- General global study with limited regional applicability: 0 pts
3. Empirical Evidence (0–2 pts)
- Quantitative data with clear methodology: 2 pts
- Qualitative data or case study with clear methodology: 1 pt
- Opinion or discussion without data: 0 pts
4. Recency and Relevance to Current Geopolitical Context (0–2 pts)
- Published 2023–2025 (contemporary analysis): 2 pts
- Published 2020–2022 (recent): 1 pt
- Published before 2020: 0 pts

Total Quality Score: 0–8 pts
Quality classification:

- High quality: 7–8 pts (strong empirical evidence, contemporary analysis, directly relevant to Malaysia)
- Moderate quality: 4–6 pts (good methodology, adequate relevance)
- Low quality: 0–3 pts (limited evidence or outdated)

Quality Assessment Results of the original 87-study corpus:

- High quality: 51 studies (58.6%)
- Moderate quality: 28 studies (32.2%)
- Low quality: 8 studies (9.2%)

These quality ratings pertain to the initial 87 study corpus that serves as the basis of the review. Another 10 peer-reviewed empirical studies, added to the latest update in order to bolster certain parts of the literature review (specifically those related to green building performance, ESG–finance connections, and sustainable data centers), were rated through the same 0–8 quality rating scale used by the backbone corpus. Hence, their results are treated similarly for the purposes of synthesizing evidence (Section 4.2.4), and the formal high/moderate/low distributions indicated above are applied to the 97-study corpus as a whole.

For a comprehensive coverage of the literature used in this highly dynamic subject, all studies were included in the review. Nevertheless, the results of this review were weighted according to the quality of the studies, with more robust studies having a greater impact on the conclusion. The sensitivity analysis revealed that the main results remained robust after applying only high-quality studies.

Assessment Process

The lead author used a quality appraisal tool for all 97 articles. All borderline studies scoring between 5 and 6 pts were reviewed with the co-author to establish consistent inclusion criteria.

4.2.2 Justification for Gray Literature Inclusion

Whereas systematic reviews in general might have a focus on literature obtained from only peer-reviewed articles, this particular review is different as it considers some gray literature selected based on the development of policies, markets, and geopolitics from 2024 to 2025. The reason for that is that peer-reviewed articles will need up to 12–24 months before reflecting the rapid development in policies and markets. Gray literature sources were subjected to a strict quality assessment procedure (Section 4.2.1) and had lower weights assigned in the evidence hierarchy (Section 4.2.3). News sources can be used for documenting policy statements and diplomatic actions; however, not for documenting evidence outcomes. Although this methodology makes the review reflective of today's environment, the disadvantages of gray literature cannot be overlooked.

Gray literature sources were used when they fulfilled the criteria of

- Being unique, reliable sources of data that were not covered in academic literature
- Representing official government statistics or policy reports
- Presenting up-to-date market statistics (2024–2025) from reliable industry sources
- Being necessary due to the fast-changing geopolitical and policy environments

All gray literature sources were analyzed using quality appraisal (Section 4.2.1), and the weighting of evidence was critically considered in the synthesis process.

4.2.3 Data Extraction and Coding

Characteristics and findings were systematically extracted from each study using a coding matrix based on geographic area, the sectoral focus of the research (policies, financial aspects, corporate behavior, or environmental performance of the built environment), research methodology, and the type of data collected (quantitative, qualitative, or both). The outcome variables coded include where available indicators such as green building performance (e.g., energy and water savings), green certification usage (GBI, LEED, and GreenRE), green finance amounts (e.g., sukuk issuance and green bond percentages), and higher-level indicators such as GDP growth, diversification of FDI, and levels of regulatory compliance. Codes used here formed the basis of the categorization of studies into thematic groups (policies, markets/finance, corporate actions) and facilitated the comparison discussed in Section 5 and the indicators table provided in Appendix A2.

4.2.4 Evidence Weighting Framework

To evaluate the varying levels of reliability between sources, the following framework was created for assigning weights to evidence:

Table 3: Evidence Weighting Framework for Source Prioritization

Source Type	Weight	Rationale
Peer-reviewed journal articles	High (3)	Highest methodological rigor, peer validation
Government/official reports	Medium-high (2)	Official data, but potential political framing
Industry/corporate reports	Medium (1.5)	Market insights, but potential commercial bias
Media/web sources	Low (1)	Contextual information, verified by cross-referencing

Source: Authors' design, informed by an adapted PRISMA quality assessment framework (see Section 4.2.1).

The findings derived from the highest-weighted sources form the core of the synthesis and conclusion. Any quantifiable data derived from non-peer-reviewed sources are included in Appendix A2.

4.2.5 Treatment of Projections and Historical Data

This review makes an important distinction between actual outcomes and forecasted projections. Indicators that have been provided in official statistics (e.g., Q1 2025 GDP statistics for Bank Negara Malaysia, and FDI inflow data provided by MIDA) can be considered as outcomes from past experiences. At the same time, scenario-based estimates, such as projected FDI inflows after the 46th ASEAN Summit and projections for data center investments, can be classified as forecasted projections, not outcomes. All values used in the updated Appendix A2 were not statistically tested; they are reported without any further analysis or inferences about causality. The outcomes from past experiences are classified as "realized data" in Section 5 and Appendix A2. At the same time, all scenario-based projections and estimates are classified as "projections" to distinguish them from confirmed outcomes.

4.3 Screening and Coding Procedure

Screening and coding followed an objective process with multiple stages to avoid any subjectivity in the analysis of both peer-reviewed and gray literature. The titles and abstracts of all 354 articles were initially analyzed against the inclusion and exclusion criteria, while those that appeared potentially relevant were included for the full-text screening stage. In full-text screening, all decisions were documented using the coding matrix, which had the categories of the type of source (A–H), sector, geographical coverage, methodology used, and relevance to Malaysian real estate.

In cases where initial screening decisions varied, the full texts were revisited, and consensus was achieved before a final decision to include or exclude them was made. In the full-text phase, records with uncertainties were resolved according to the predefined criteria till a consensus was reached, and no record was included based solely on a one-sided evaluation. The level of internal consistency was assessed through an inter-rater reliability test, where a random 20% subsample (approximately 18 studies) was tested, and the inclusion/exclusion decisions matched in 83% of the time. This level of inter-rater reliability is satisfactory for a mixed-methods review on policy and incorporating gray literature.

The coding matrix developed (illustrated in Appendix A3) forms the basis of the descriptive characterization of the 87-study corpus presented in this chapter and the synthesis of themes from policies, finance, and corporate practice presented in Sections 5 and 6.1.

Justification for Source Composition

As per the corpus used for analysis in this study, 87 documents were included in the evidence base, consisting of 19 peer-reviewed journal papers (21.8%) and 68 other sources. Upon adding 10 more peer-reviewed empirical papers, and an additional four peer-reviewed papers along with one government benchmarking data set to enhance evidence regarding building performance, there were a total of 101 sources in the final evidence base, 37 of which are peer-reviewed journal papers (36.6%). The remaining constituted carefully selected gray and other literature. Such a distribution of the evidence base is consistent with the purposes behind conducting this review, where information on certain emerging issues, such as those related to climate change policy, green finance, and real estate regulations, can be found in official and corporate documents before reaching academic publications. Therefore, guidelines for mixed methods research and the use of gray literature encourage the inclusion of these sources, but indicate a clear demarcation between their evidentiary value.

For this research paper, the peer-reviewed empirical data will serve as the main source of analysis, while the gray literature will focus on describing the latest policy initiatives, market dynamics, and firm strategies, with both sources analyzed separately and with due diligence.

Limitations of the Evidence Base

Despite the improvement of the final evidence base during the revision process, peer-reviewed journal articles only constitute 36.6% of the total 101 references cited, while the rest consists of official documents from governments and international organizations, industry-related documents, books and chapters thereof, methodological papers, and well-selected media and internet resources. The distribution is consistent with the policy- and market-oriented orientation of the review, where major policy developments in climate change, green finance, and real estate regulation are often documented initially in official and industry documents rather than in scholarly journals. To mitigate the impact of non-peer-reviewed literature on the credibility of findings, all gray literature was thoroughly appraised for quality and assigned lower evidentiary value compared with peer-reviewed empirical studies, which form the basis of analysis throughout the paper. However, the incorporation of gray literature into the study increases the likelihood of potential publication bias and highlights the importance of empirical research to test the patterns established herein.

4.4 PRISMA-Style Study Selection Flow

Selection Process

In all, 432 articles were found from database searches and from manual screening of both academic and gray literature sources. Gray literature comprises government publications, industrial reports, and policy briefs. The adapted use of PRISMA in our study is in accordance with the fact that inclusion of gray literature was necessary for a practical understanding of policy implementation and the market environment in this rapidly developing area. The PRISMA-screened articles amounted to 97, as shown in Figure 2, where the selection process is illustrated through record identification, inclusion, and exclusion.

Revision note: As recommended by reviewers in order to build up the peer-reviewed empirical literature, 10 peer-reviewed papers that had originally been discounted on account of either pre-2020 publication or lack of relevant regional specificity were subsequently reconsidered and included. This is because such papers constitute important contributions to understanding the issues of urbanization effects, greening challenges, and ESG governance in Malaysia and related emerging economies, and meet the modified criteria for inclusion upon secondary review. The composition of the final core body of 87 papers consisted of:

- 19 peer-reviewed journal articles (21.8%)
- 27 government/official reports (31.0%)
- 8 industry/corporate reports (9.2%)
- 4 books/book chapters (4.6%)
- 25 media/web sources (28.7% of the 87-study core corpus); this share falls to 20.8% across the final 101-source evidence base as additional peer-reviewed and government sources were added.
- 4 methodology papers (4.6%)

To comply with reviewer feedback requesting further strengthening of empirical evidence, another ten peer-reviewed journal articles published from 2020 to 2025 were included as a layer of extended evidence, thus increasing the number of PRISMA-reviewed articles to 97 (studies included within the PRISMA 2020 flow diagram). The additional peer-reviewed journals are listed in Appendix A1 and are clearly referenced in the synthesis in relation to building performance, ESG-finance relationships, and digital infrastructure sustainability.

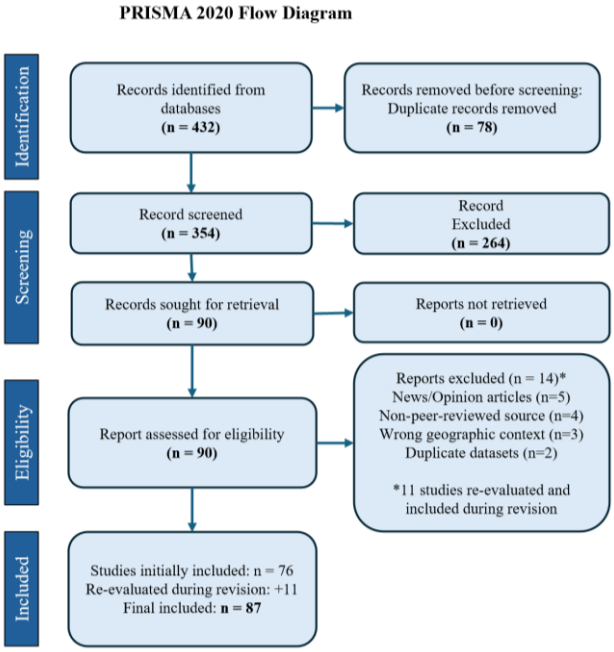

Figure 2: Adapted PRISMA 2020 flow diagram showing identification, screening, eligibility assessment, and inclusion of 97 studies in the final PRISMA-screened review corpus.
Source: (Author; PRISMA guideline (Page et al., 2021)).

Additionally, four studies from peer-reviewed journals and one benchmarking dataset produced by a government source (IDs 98, 99, 100, 101) were introduced during the final revision phase to enhance the empirical foundation of building performance outcomes in terms of energy (BEI), water efficiency, and ASEAN regional comparisons. In other words, this group of five articles was selected after completing the PRISMA review, with the total number of references forming the evidence base in the manuscript amounting to 101 sources, while the PRISMA screened literature stands at 97 studies.

The quantitative data that are used in the following table (Table 4) include metrics such as adoption rates, investment levels, and growth rates, which have been retrieved from industry, governmental, and market sources (Appendix A2). These numerical values are primarily associated with estimated figures or forecasted projections as opposed to experimental or quasi-experimental study designs, and no inferential statistics (*p*-values and hypothesis testing, for example) were applied. If the information represents realized historical outcomes, then it is made clear. The same applies to any projected data, which should be considered a scenario rather than a confirmed result. Numerical values are presented in Appendix A2 as realized results or projections.

Table 4: Evidence Basis and Quality Classification by Finding Theme

Finding Theme	Primary Evidence Basis	Quality Tier	Key Sources
Green building energy performance (BEI/BEPG)	Peer-reviewed empirical studies	★★★ High	Ab. Rahim & Md Ali, 2024; Shaardan et al., 2025a, 2025b; Adnan et al., 2025
Water efficiency in certified buildings	Single peer-reviewed field study	★★ Moderate	Habibullah et al., 2023
ESG–finance linkages (sukuk, green bonds)	Mix of peer-reviewed + corporate reports	★★ Moderate	Jamaludin & Razali, 2024; BIX Malaysia, 2025; UNDP, 2025
Macroeconomic conditions (GDP, FDI realized)	Official government statistics	★★ Moderate	DOSM, 2025; MIDA, 2025; BNM, 2025
FDI and climate investment projections	Gray literature—scenario projections ★	★ Conditional	Bernama, 2025; MFA Malaysia, 2025 (ES-3, ES-19)

ASEAN/BRICS diplomatic outcomes	Official government statements	★★ Moderate	MFA Malaysia, 2025a, 2025b
Data center sustainability commitments	Industry/corporate reports	★ Conditional	MDEC, 2025; ISIS Malaysia, 2025

★★★ = peer-reviewed empirical evidence

★★ = official statistics or government/regulatory data;

★ = forward-looking projections or corporate commitments—treated as indicative scenarios. Detailed indicators are compiled in Appendix A2.

Source: Authors' analysis of screened studies and Appendix A2 indicators (see Appendices A1 and A2)

5. Discussion

5.1 Malaysia's Multi-alignment Strategy: Current Market Evidence

This section highlights empirical evidence related to the effect of Malaysia's multi-alignment policy on sustainable real estate development. The discussion is based on geopolitical issues as presented in Section 1.4. In this respect, the subsequent sub-sections discuss the impact of the multi-alignment policy through green financing, siting of data centers, and adoption of green building guidelines. These linkages are illustrated in Figure 3.

The literature reviews empirical relationships that exist between urbanization and real estate growth in Malaysia and their effects on CO_2 emissions, carbon lock-in through infrastructural investment, and environmental destruction, such as biodiversity loss around large-scale projects and mangrove forest degradation along coastlines (Gong et al., 2023). Critically, some studies have pointed out that the creation of green urban aesthetics in many of these developments can hide environmental damage (Moser & Avery, 2021).

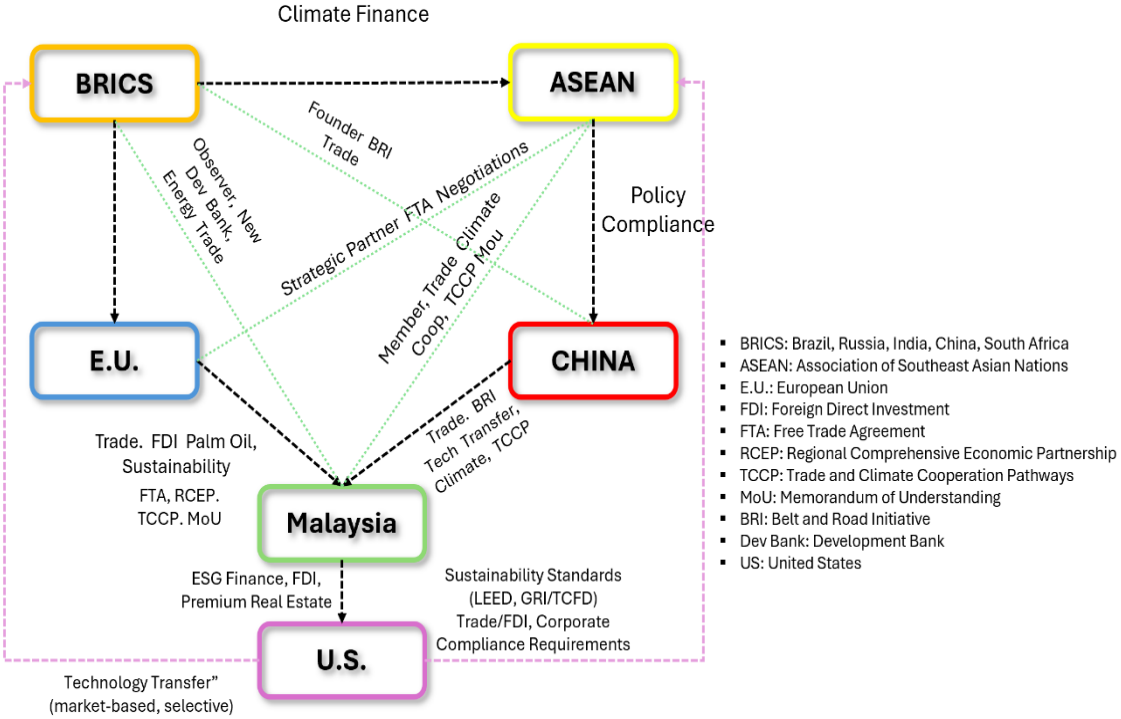

Figure 3: Trade, climate collaboration channels among BRICS, ASEAN, EU, China, and the US in the Malaysian multiple alignment approach. This flowchart shows the interaction of diversified trade, FDI, green finance, and technological collaborations in Malaysia, which gives rise to challenges as well as chances for real estate decarbonization.

Source: Trade and Climate Cooperation Pathways in Malaysia's Multi-Alignment Strategy (Source: Authors' analysis based on MDEC, 2025; MIDA, 2025)

5.1.1 ASEAN Chairmanship and Impact on the Economy

Given Malaysia's 2025 ASEAN chairmanship (Section 2.4), further development of climate-related regional collaboration will be likely, thus creating new opportunities for sustainable infrastructure and real estate investments (Ministry of Foreign Affairs Malaysia, 2025). As indicated in Section 1.1, current Malaysia CCPI results show that the country exhibits a Medium rating in greenhouse gas emissions and a Very Low rating in energy use and climate policy implementation, implying that there is a gap to be filled by the real estate decarbonization efforts. Based on official estimates, total FDI inflows may amount to RM 300 billion by 2030, of which RM 15 billion will be invested in the Malaysian real estate sector (projection; ES 3, Appendix A2). These numbers represent scenario estimates that assume geopolitical stability and effective implementation of the ASEAN summit pledges and should be considered as indicative rather than confirmed forecasts. Assuming all prerequisites are met, part of these investments will most likely enter climate-oriented industrial real estate and infrastructure projects in Malaysia.

Malaysia intends to direct some of this potential FDI towards climate-responsive industrial property, commercial districts, residential developments, and logistics networks (Ministry of Foreign Affairs Malaysia, 2025). This is in light of Malaysia's leading involvement in the ASEAN–GCC Summit and the ASEAN–GCC–China Summit, along with the diplomacy related to the integration of rival trade and climate forces within a wider intra-Asian regional context (The Star, 2025; Ministry of Foreign Affairs Malaysia, 2025). In tandem with this, Malaysia has developed ambitious trade objectives for 2025 that emphasize the development of relationships with BRICS countries, FTA nations, and developing countries, thereby cementing its multi-alignment strategy in both trade and climate cooperation (MATRADE, 2025).

The finalization of "ASEAN 2045: Our Shared Future," which comprises measures to cope with the global trends in the next two decades with regional resilience, creates possibilities for slow but effective cooperation in terms of combating climate change beyond national timelines (Association of Southeast Asian Nations, 2025; Ministry of Finance Malaysia, 2025). Malaysia is thus able to establish itself as a regional leader while striking a balance between bilateralism and multilateralism against the backdrop of imbalances within multilateralism (Ministry of Foreign Affairs Malaysia, 2025; Association of Southeast Asian Nations, 2025).

5.1.2 Economic Performance and Market Dynamics

Positive macroeconomic signals form the basis for investment in sustainable development. The economy of Malaysia continues to show high growth levels, as shown in the 4.4% growth in Gross Domestic Product for Q1 2025, which represents a historical reality that has been experienced (ES-8; Appendix A2). Also, the timely reduction in the policy interest rate to 2.75% by Bank Negara Malaysia is another historical fact that has been realized and forms part of a favorable ground for sustainable development investment (ES-5; Appendix A2). During Q1 2025, the manufacturing sector showed a year-over-year growth of 4.2%, suggesting a structural movement towards more efficient and sustainable manufacturing processes while total investment adjusts.

Though there may still be some disparity in terms of investment environment among different sectors, the increase in manufacturing production suggests that the economic shift in Malaysia has shifted towards value-based and sustainable development (MIDA, 2025). This presents a new frontier for real estate investment in advanced manufacturing, R&D centers, and the knowledge-based economy.

As explained in Section 1.4, Malaysia's capacity to generate foreign direct investment inflows from Western countries as well as emerging economies strengthens its multi-alignment policy, while the macroeconomic variables presented in this sub-section offer a broader perspective on sustainable real estate investments.

5.1.3 Integration of Technology Sector Transformation and Sustainability

Despite global geopolitical uncertainties, the Malaysian technology industry demonstrated substantial growth in 2024. According to the findings from sector analysis, investments in digital and data centers reached RM 163.6 billion in 2024, translating to a 3.5-fold increase year over year, which is an actual result reflecting substantial confidence of investors in the Malaysian technology industry (ES-2; Appendix A2). This trend serves as the basis for predictions of further growth in investments in data centers and digital infrastructure associated with the confidence of investors in Malaysian policies and its status as a regional technology and data-center hub.

Table 5 summarizes the strategies employed by prominent real estate and construction businesses within Malaysia to achieve corporate sustainability. This table identifies the adoption of several sustainability models (CSR, ESG, TBL, and SSM), certification programs (GBI and LEED), and the primary climate change and geopolitics projects. Data are derived from prominent publicly listed firms (2024–2025) and represent the industry-wide trend toward adopting integrated sustainability programs despite adherence to the criteria in the aforementioned sustainability models.

The integration diagrams shown below illustrate the green strategies practiced within various sectors of the real estate development industry in Malaysia. Instead of measuring the rate of adoption (which requires information on a total census that cannot be obtained), the tangible structure, certification, and positioning strategy that can be inferred based on corporate information, government policies, and the market environment from 2024 to 2025 are presented. This approach ensures an evidentiary basis for the map of green practices with references that have been verified, and it recognizes the challenge of validation and verification of implementation and results over time. Each sector reflects different drivers influencing the adoption pattern: regulatory pressure, competitive forces, and investors' needs. Table 5 summarizes these findings with evidence and limitations noted for each sector.

Table 5: Corporate Sustainability Strategies in Malaysian Real Estate: Frameworks, Initiatives and 2024-2025 Adoption Rates

Developer Segment	Observable ESG/ Green Framework Adoption	Main evidence sources	Key limitations	2024-2025 Strategic Status
Large Integrated Developers	mainstream ESG frameworks; TCFD and GRI-aligned reporting; GBI and ISO 14001 are common; sustainability-linked finance growth	S P Setia, Sunway, IJM sustainability reports; Knight Frank Malaysia 2025	Disclosure strong, but outcome data (energy, water, emissions) not independently verified; maturity varies by firm	Moving towards performance-based accountability; increasingly favored in green finance and government procurement
Premium/ Luxury	LEED and some WELL in new assets; green features used as marketing and pricing premium	LEED/WELL registries; Turner & Townsend; developer disclosures	Retrofits in older stock unclear; limited Malaysia-specific performance data	Sustainability used as a competitive differentiator for affluent and international tenants
Affordable/ Mid-Market Housing	Increasing compliance with mandatory green building requirements; voluntary ESG adoption limited by cost	Ministry of Housing, EPU, CIDB IBS roadmap	Adoption largely driven by regulation; adoption rates not systematically quantified; existing stock under-documented	Gradual improvement via codes and incentives; affordability remains key constraint; ASEAN office benchmarks are not directly transferable;

				mandatory pathway: minimum codes first, voluntary certification second.
GLC-Linked developers	Portfolio-wide sustainability mandates; TCFD alignment; GBI/ISO 14001 common; procurement includes green criteria	Khazanah, PNB, state developer reports; SDG Roadmap Phase II	High adoption driven by mandate, not market; implementation quality uneven; outcome tracking still developing	Policy leaders and signaling segment for the private market; anchor role in the national transition
Logistics & Warehouse	Growing focus on efficiency (lighting, roofs, operations); early-stage ESG narrative	Industrial codes; logistics market reports; operator announcements	Sparse, non-standardized ESG data; retrofit and outcome metrics mostly absent	Emerging sustainability awareness; efficiency and cost savings are the main drivers
Data Center & Tech Real Estate	Near-universal regulatory compliance; ambitious RE targets; early water-saving and efficiency initiatives	ISIS Malaysia; MDEC; cloud provider and operator commitments	Targets reflect commitments, not current performance; water and emissions monitoring are still partial	Critical for the digital economy; shifting from compliance to performance-verified sustainability
Mixed-Use Commercial	increasing ESG clauses in leases; some LEED anchor tenants; more emphasis on public space	Developer marketing; ASEAN guidance; broker reports	Depth of sustainability integration varies widely; no sector-wide audits; occupant outcomes under-measured	Transitioning towards integrated ESG positioning; rising tenant demand for compliant space

Source: Authors' synthesis of corporate reports, policy documents, and market analyses (see Appendix A1 and Appendix A2). Note: This table is a strategy-positioning map based on disclosed information, not a statistically comparable performance benchmark across segments.

Patterns of adoption seen in Table 5 largely reflect strategic positioning and implementation of the framework, with variances among segments being due to differences in regulation, competitive landscape, and capital needs. Large integrated developers, government-affiliated firms, and premium segment firms seem to be the most advanced in terms of both voluntary and mandatory adoption and reporting on sustainability frameworks. The implementation of affordable housing, logistics, and warehousing segments was mainly triggered by regulations and business costs. The adoption of ESG frameworks, based on sustainability reports, certifications, and policies, is not indicative of successful implementation and performance results in the long run. Energy savings, water savings, emissions reduction, and improved health conditions should all be assessed after the post-implementation audit, which presently still needs time to materialize in Malaysia. The gap between the adoption of the framework (Table 5) and its verified impacts (obtainable only in future empirical research) should prove crucial for determining sustainability maturity in the Malaysian real estate industry.

Lifecycle assessments conducted on hyperscale data centers in Singapore reveal that data centers have significant impacts on the electricity consumption and cooling needs of a country and have larger land and water footprints, which exacerbate resource demands if not addressed through aggressive measures to ensure energy and resource efficiency.

Following sustainability guidelines, especially pertaining to water resources, is an internationally praiseworthy standard that allows for a structure that regulates data centers. Cooling technologies are prohibited from being cooled by potable water, and as such, the policy promotes the implementation of district cooled water systems and water reuse (Bernama, 2025). Data center operators require authorization to utilize alternative sources of water, such as recycled water, rainwater, and even seawater for the purposes of desalination (Institute of

Strategic & International Studies [ISIS] Malaysia, 2025). It is through technology regulations that facilitate the shift of global climate sustainability goals to local climate and policy goals. An analysis of Iskandar Puteri using the AHP-GIS method shows that incorporating aspects such as infrastructure readiness, environmental risks, land use constraints, and communities into consideration will assist in determining more suitable locations for data centers as well as provide a replicable methodology for data center site selection within Johor, Malaysia, and even other technology parks in Malaysia (Lee & Rusli, 2025).

An increase in the number of data centers is a clear indication of diversification in technological investment. Investments have been made in cloud computing companies in America, telecom firms in China, renewable energy partners in Europe, and content delivery network regionally (MDEC; MIDA, 2025). The diversification of investments is a key factor in driving technological independence and technology solutions within different ecosystems.

5.1.4. Green Finance Architecture and Islamic Finance Innovation

The Malaysian framework of domestic green finance has undergone rapid development since 2020, largely through the incorporation of Islamic finance in climate-aligned investments in real estate and infrastructure. Green sukuk comprises 28% of the total domestic sukuk market, while Malaysia accounts for 52% of the overall issuance share of green sukuk in emerging markets, highlighting the country's pioneering role in sustainable Islamic financing (Bond and Sukuk Information Platform Sdn Bhd, 2024; UNDP, 2025; ES-10, ES-14; Appendix A2). The achievement is due to effective policy-making, which has resulted in the issuance of a Sustainable and Responsible Investment (SRI) Sukuk and Bond Framework, tax rebates on green issuances, and guidelines provided by the Joint Committee on Climate Change for the alignment of sukuk structures with green standards (Joint Committee on Climate Change, 2024).

In this context, the labelled instruments green sukuk, social sukuk, and sustainability-linked sukuk serve as distinct means of financing low-carbon buildings, climate-resilient infrastructure, and community-oriented investments. The need for use-of-proceeds categorization, screening criteria, and post-issue disclosure, along with independent scrutiny and second-party opinions, acts as an additional mechanism to mitigate the risks of greenwashing and ensure alignment between domestic issuances and the Green Bond Principles and ASEAN Green Bond Standards (International Capital Market Association, 2025; ASEAN Capital Markets Forum, 2023). For the real estate sector, this framework provides an opportunity for big developers and SOEs to finance their efforts toward green buildings, transit-oriented development, and precinct-level decarbonization, signaling to the investment community that these actions are part of a larger national strategy.

However, the dominance of the issuance of green and sustainable sukuk by a few key players highlights the fundamental challenge towards creating an inclusive decarbonization policy. The small developers and the operators of mass market housing face high transaction costs, low levels of knowledge and skills, and a narrow range of market access, thus paving the way for dual tracks when shifting from premium to affordable sectors (Jaffar et al., 2022; Jamaludin & Razali, 2024). Addressing these challenges would require the development of capacity building, standardization of the issuance process, and hybrid finance models to channel funds through various financing institutions on an international, regional, and national level. In this connection, Malaysia’s innovation in green Islamic finance not only provides the local funding channel but also provides a basis for studying the use of green sukuk structures in developing countries, which will be further discussed in Sections 5.2.3 and 5.3.3.

5.2 Real Estate Sector Implications: Market Data and Corporate Implementation

Sustainability and green financial instruments have become major sources of financing climate-aligned real estate and infrastructure projects in Malaysia. Green and sustainability sukuk in Islamic green finance, in addition to ESG-certified bonds and loans, contribute towards financing sustainable buildings, infrastructure, and urban development. This section discusses the mechanism of designing such instruments, how developers implement such instruments, and the property markets underserved by these instruments.

Unless otherwise noted, all quantitative data presented in this section are based on government statistics, industry analyses, and corporate reports collected and presented in Appendix A2, and should be considered either actual figures (for past data) or conditional projections (for explicit forecasts). Additionally, developer views as presented in the Malaysian press also note that future government budgets need to do more than provide short-term stimulus to influence the overall direction of the real estate industry (Abdul Aziz, 2024). Performance data at an industry level covering all industrial, office, retail, hospitality, and residential sectors demonstrate that sustainability credentials and positioning through ESG are becoming increasingly important for lease agreements, repositioning of assets, and investments within the Malaysian market (Knight Frank Malaysia, 2025). Table 6 shows how the key topics mentioned above can be validated by various information sources and relevant quantitative measures reported in Appendix A2.

Table 6. Thematic linkage between results, source types, and Appendix A2 indicators

Theme	Example indicators / focus	Main source types	ES / ID references
Macroeconomic and FDI context	Q1 2025 GDP growth, policy rate, FDI and trade projections	Bank Negara Malaysia, DOSM, MIDA, MOF, MATRADE	ES1, ES3, ES5, ES8, ES12
Digital infrastructure and data centers	Data center investment values, RE commitments, sustainability regulations	MDEC, ISIS Malaysia, regulator and operator reports	ES2, ES6, ES7
Green sukuk and sustainable finance	Green sukuk volumes, sustainability-linked loans, ESG bond issuance	Bond and Sukuk Information Platform Sdn Bhd, UNDP, Islamic finance reports	ES9, ES10, ES11
Corporate sustainability and disclosure	ESG reporting coverage, TCFD and GRI aligned disclosure	Listed company reports, Knight Frank, legal/ESG analyses	ES13, ES14, ES15
Policy and governance frameworks	SDG Roadmap II, Malaysia Plans, sectoral climate policies	EPU, Ministry of Economy, line-ministry policy documents	ES16, ES17, ES18
Regional and geopolitical initiatives	ASEAN chairmanship outcomes, GCC/BRICS cooperation, regional climate roadmaps	MFA Malaysia, ASEAN Center for Energy, regional diplomacy reports	ES19, ES20, ES21
Built-environment and green building indicators	GBI/LEED/GreenRE uptake, BEI benchmarks, water efficiency metrics	GBI documentation, peer-reviewed studies, government datasets	ES22, ES23, ES24

Source: Authors' synthesis of Appendix A2 indicators and underlying documents listed in Appendix A1 and Appendix A2.

5.2.1 The Development of the Green Building Market and the Integration of Policies

Currently, GBI-certified buildings in Malaysia are able to provide quantifiable advantages compared to traditional buildings in terms of energy and water efficiencies. The evidence base for this assertion has grown substantially from findings in scientific papers published between 2022 and 2025. This sub-section covers the quantitative building performance evidence structured into three sub-sub themes: energy performance and BEI results, water efficiency, and comparative ASEAN regional studies.

(i) Energy Performance: BEI Evidence

The empirical benchmarking exercise involving 20 office buildings in the Klang Valley for the last five years (2019–2023) showed that office buildings certified by GBI always perform within the range of 110–150 kWh/m^2/year, compared to their conventional counterparts (170–220 kWh/m^2/year). This trend is maintained throughout the entire study period, including even the post-COVID normalization of occupancy level in 2023 (Ab. Rahim & Md Ali, 2024). Moreover, energy label benchmarking has revealed that 42% of GBI-certified office buildings attained a 4-star BEI, while the conventional offices have been predominantly performing in the category of 2-star rating, which demonstrates the difference in the level of performance between the two types of building stock (Ab. Rahim & Md Ali, 2024). The Malaysian National BEI benchmark is defined by the standard MS 1525:2007 of 135 kWh/m^2/year; however, BEI values as low as 30 kWh/m^2/year can be achieved in showcase green government buildings (Mohd Rahim et al., 2024).

The systematic literature review and meta-analysis of six sustainable design criteria in GBI Non-Residential New Construction (NRNC) and MyCREST demonstrate that energy efficiency is the highest weighted criterion in both tools, creating a common benchmarking platform for evaluating the performance of non-residential projects across the country (Adnan et al., 2025). The expert opinions of 278 building and energy professionals in Malaysia indicate almost unanimous agreement that organizational and behavioral factors such as occupant awareness, leadership commitment, and lack of sub-metering are the key drivers of building energy performance gaps (BEPGs) in certified green buildings, rather than design or technological inadequacies (Shaardan et al., 2025a). A complementary PLS-SEM analysis on non-residential green buildings in Malaysia has revealed that inadequate awareness among occupants, limited funding, skill deficiencies, and poor support from top management are some of the main operational factors responsible for BEPG; and organizational/leadership-related factors are the main drivers that could help overcome the gap (Shaardan et al., 2025b). In essence, all these findings demonstrate that even though GBI certification is capable of achieving significant energy efficiency during the design phase, the implementation gap between design intention and implementation is still a problem that needs to be addressed.

The role of the institutional factors on the performance of the GBI can be seen from a quantitative survey study undertaken in the Putrajaya Energy Commission Building (n = 320 respondents), which reveals that government regulation, incremental cost management, and property management significantly and positively correlate with green building performance, whereas individual environmental protection consciousness, although positively correlated, is relatively less effective in explaining variance (Mohd Rahim et al., 2024). This result validates the theoretical argument presented in Section 2.5, where it is stated that both coercive and normative institutional forces, not merely the internal motivation, influence GBI performance in practice.

(ii) Water Performance: Quantitative Evidence from Malaysian Office Buildings

The efficiency of water use in the built environment is a crucial aspect of green building performance in Malaysia, which has relatively less empirical support when compared to the available information on energy. In this regard, a peer-reviewed research paper with data gathered from the Building Control System (BCS) data of a GBI-certified 11-storey office building in Malaysia investigated the operations of both a rainwater harvesting system (RHS) and a graywater recycling system (GWS) for two consecutive months, namely January to February 2020. In this period, the RHS collected 228.8 m^3 of rainwater, whereas the GWS collected 520.6 m^3 of graywater from wash basins and ablution facilities, saving a total of 752.6 m^3 of treated SYABAS fresh water in two months (Habibullah et al., 2023). This integrated

role of the RHS-GWS contributed 28.11% of the building's water usage for both potable and non-potable purposes, amounting to over 3,000 m^3 per annum when fully operational (Habibullah et al., 2023). The results indicate that the deployment of integrated water recycling systems that comply with the GBI Water Efficiency rating system requirements can produce significant and quantifiable freshwater savings under tropical conditions in Malaysia, characterized by the occurrence of precipitation throughout the year and higher occupancy rates during the day in offices. Nevertheless, as mentioned by the authors, the use of both technologies is still uncommon in the Malaysian commercial sector due to their relatively high capital cost and lack of awareness among owners and operators. This suggests that water performance improvements of the magnitude reported in this study are not common practice at present (Habibullah et al., 2023).

(iii) ASEAN Comparative Context: Regional Energy Performance Benchmarks

Placing the performance of the Malaysian Building Energy Index (BEI) in its regional ASEAN context highlights significant alignment with that of ASEAN's most developed green building industry. The Singaporean Building and Construction Authority (BCA) provides a yearly update on building energy benchmarks based on Singapore's Annual Mandatory Submission (AMS) database. The latest for 2024, which includes 254 office buildings, reveals that the 2023 median (P50) office Energy Use Intensity (EUI) was recorded at 142 kWh/m^2/year — the Singapore BCA's equivalent of the Malaysian BEI, where both measures are normalized on the gross floor area of the buildings — with the top quartile below 109 kWh/m^2/year and the lowest quartile over 184 kWh/m^2/year (BCA Singapore, 2024). GBI-certified buildings in Malaysia, with a performance range of 110–150 kWh/m^2/year, operate within the upper to middle spectrum of national office stock buildings in Singapore. This finding suggests that the GBI certification system produces energy performance similar to what the most developed and regulated building market in the region can produce. Notably, Singapore has had a mandatory national building energy policy for 15 years, starting in 2008, while Malaysia's corresponding policy is still less than a year old. The fact that Malaysian buildings produce a median-range energy performance level shows the strength of the GBI scheme. (BCA Singapore, 2024; Adnan et al., 2025).

In recent regional studies on the uptake of green home technology, Singapore is found to be on the forefront regarding both technological development and supportive policies, as there is broad use of solar PV, water conservation techniques, and green building codes in housing projects, while Malaysia, Indonesia, and Thailand take a gradual approach towards incorporating green attributes into affordable mass housing projects (Sohaimi et al., 2023). The IEA/OECD Roadmap on Energy-Efficient Buildings and Construction in ASEAN indicates that a reduction in carbon dioxide emissions from buildings exceeding 60 percent can be achieved in the region by 2040 compared to the base year of 2020, through effective improvements in building shells, renewable energy applications, and removal of inefficient air-conditioning systems, with policy quality being the key distinguishing element among high and low-performing ASEAN countries. Moreover, the development of the data centers industry in Malaysia provides additional grounds to compare performance in different parts of the region based on lifecycle assessment studies carried out in the region, which show the considerable strain that hyperscale data centers put on the country's electricity and cooling water demands, justifying Malaysia's policies related to using recycled cooling water and alternative water supplies for data centers, and strict requirements on power usage effectiveness (PUE) levels in Malaysia (Lee & Rusli, 2025). Consequently, the appropriate ASEAN comparative research in this regard can be carried out for the office buildings sector in Malaysia and Singapore, while other sectors need special benchmarking to enable comparisons between countries.

Performance Benchmarks: Summary Table

Table 7 shows the Key Performance Indicators associated with buildings whose performances have been acknowledged in peer-reviewed journals within this section. This will enable a direct comparison based on the type of building, its geographical location, and the evidence dimension.

Table 7: Summary of Peer-Reviewed Building Performance Evidence: Energy, Water, and ASEAN Comparison

Study / context	Performance focus	Key takeaway for this review
Adnan et al. (2025), Malaysia, non-residential, GBI + MyCREST	Design-stage performance criteria	The joint GBI–MyCREST model proves that energy efficiency is the most significant benchmark criterion when assessing non-residential green buildings in Malaysia.
Ab. Rahim & Md Ali (2024), Malaysia, 20 office buildings, GBI vs conventional	BEI (kWh/m^2/yr)	Five-year data indicate that office buildings have a significantly smaller BEI (approximately 110–150 versus 170–220 kWh/m^2/year), but the post-COVID occupancy rate does influence the absolute values rather than the difference.
Habibullah et al. (2023), Malaysia, single GBI office retrofit	Water use	The monitored case shows 28.11% decrease in the use of fresh water following retrofit, a strong concept to demonstrate the idea, but not a benchmark in the sector.
Shaardan et al. (2025a, 2025b), Malaysia, green buildings (survey + PLS-SEM)	BEPG and operations	Findings reveal that most cases regarding the poor performance of buildings in energy utilization result from management issues rather than failure to meet criteria.
ASEAN and IEA/OECD roadmap studies (ASEAN region, multiple tools)	ASEAN energy benchmarks	Malaysia and Singapore are named as the two countries with the most advanced framework for benchmarking buildings' energy usage in ASEAN; other member nations show more limited coverage and enforcement.

Source: Synthesized from peer-reviewed Malaysian and ASEAN building-performance studies listed in Appendix A1. Note: BEI (Malaysia) and EUI (Singapore) are both normalized by gross floor area in kWh/m^2/year, so they are directly comparable for cross-country analysis.

Interpreting the Evidence: Acknowledged Gaps and Qualifications

A number of significant limitations should also be stated along with the above evidence. First, data on water performance is currently based on only one study conducted in BCS with one office building that is certified under GBI (Habibullah et al., 2023). In other words, a peer-reviewed multi-building or sector-wide study of the water performance of certified commercial buildings in Malaysia is currently lacking. Thus, the figure of 28.11% savings in fresh water use cannot be viewed as a sector-wide benchmark. Second, the ASEAN comparative analysis is limited by methodological heterogeneity: while in the case of Malaysia (BEI) and Singapore (EUI), where the energy performance benchmarks are defined by gross floor area, it is possible to make a comparative analysis. This is not the case for Thailand (Thailand's Real Estate Sustainability Standard, TREES) and Vietnam (Lotus), since they lack relevant national benchmarking datasets, precluding a rigorous four-country comparison at this time (Overview on GB Implementation, ASEAN, 2024; IEA/OECD, 2022). Third, the Klang Valley dataset (2019–2023) covers a time frame during which there was a substantial impact from occupancy decreases due to the COVID-19 pandemic; the modest increase in BEI recorded in 2023 as full occupancy resumed shows that indicators of energy performance are occupancy-dependent and need to be evaluated in a multi-year context (Ab. Rahim & Md Ali, 2024). This set of limitations is reflective of the other gaps in evidence identified in Section 5.5, whereby longitudinal assessment and regional comparison would be important topics of investigation for future empirical studies on green buildings in Malaysia.

Transferability to Affordable and Mass-Market Housing

However, the BEI/EUI benchmarks from the ASEAN office **do not apply directly** to Malaysia's affordable and mass-market residential sector, and this distinction must be clearly recognized. There are three main reasons for this differentiation. First, GBI certification in Malaysia has largely been confined to commercial buildings and premium residential buildings, where high profit margins allow for the additional 3–8% "green cost" premium. Developers of affordable housing projects funded by the Malaysian Government cannot afford this kind of expense, and thus receive subsidies to cover it (Iwuanyanwu et al., 2023; Sohaimi et al., 2023). Second, the closest benchmark in the region is the Green Mark Residential benchmark from Singapore, which is supported by a mandatory public housing scheme (HDB) as well as universal retrofitting funding, neither of which has equivalents in the affordable Malaysian housing market (Sohaimi et al., 2023). Lastly, the LOTUS and TREES residential standards from Vietnam and Thailand, respectively, are in their early adoption phases with limited post-occupancy data, and benchmarking across ASEAN residential criteria may still be premature (Shaardan et al., 2025a). Thus, the key learning point from the office experience in the ASEAN office is not the figure used as a baseline but rather the policy design. A mandatory minimum energy code implemented at the building regulation level is an effective approach that has created significant improvements in the energy performance of all income groups (IEA-OECD, 2022; Malaysia Ministry of Economy, 2023). The policy tool is available in Malaysia thanks to the CIDB IBS roadmap and SDG Roadmap Phase II codes. The important step is moving beyond mandatory energy requirements in commercial buildings to include affordable housing stock in this process, which is possible with cooperation between the Ministry of Housing, EPU, and Suruhanjaya Tenaga (Construction Industry Development Board Malaysia, 2021; Malaysia Ministry of Economy, 2023).

5.2.2 Compliance Costs and Market Adaptation Mechanisms

Research conducted by industries shows that the expenditures incurred by adopting green technologies amount to 21–33% of the cost of urban development projects, and up to 45% of strata developments. Although there is a high expenditure on implementing green technologies, the studies in emerging markets highlight the considerable economic gains and benefits obtained from sustainable architecture (Iwuanyanwu et al., 2023). This substantial cost has led to strategies to lower the costs involved and make sustainable development feasible in the market. Moreover, the rising costs of developing sustainable buildings and innovation compliance have resulted in the evolution of building technologies, financing, and regulations that favor sustainability. The proposed suggestions highlight the challenges encountered by the developers in maintaining economic viability in the market and making sustainable development feasible. This suggests that environmental and societal balance can coexist without being in conflict.

According to Turner & Townsend (2021), Malaysia's goal to achieve net zero emissions in 2050 is already influencing its real estate industry, resulting in the integration of IBS, PPVC, and BIM, together with green building certification, in order to reduce embodied and operational carbon emissions. Turner & Townsend (2021) demonstrate how real estate developers in Malaysia are using industrialized construction techniques and digital design software despite higher initial expenses due to the introduction of policies that support the alignment between cost optimization and environmental sustainability.

5.2.3 Corporate Green Financing Implementation and Governance Innovation

An example of corporate sustainability financing in Malaysia can be provided by S P Setia's Sustainability Financing Framework. In this framework, qualifying projects, ranging from

green buildings to low-carbon infrastructure and community-centric projects, are mapped to labelled finance products, including green sukuk, sustainability-linked sukuk, and sustainability-linked loans, which are associated with specific use-of-proceeds criteria and performance metrics (S P Setia, 2025; Joint Committee on Climate Change, 2024). The use of external reviews and second-party opinions ensures that these labelled finance products measure up to the Green Bond Principles and ASEAN Green Bond Standards, and the internal corporate governance structure demands that the sustainability committee, risk management, and the board be involved in the evaluation and decision-making processes (International Capital Market Association, 2025; Joint Committee on Climate Change, 2024). Such a framework serves as an illustration of how a prominent developer incorporates climate change considerations into its financing process without sacrificing financial flexibility and creditworthiness.

Market-level analysis indicates that Malaysia leads in terms of issuance of green and sustainability sukuk across the region, with green sukuk comprising an estimated 28% of the country's sukuk market in 2024 (Bond and Sukuk Information Platform Sdn Bhd, 2024). UNDP (2025) and Najid et al. (2024) highlight how Islamic finance principles are compatible with ESG principles based on the manner in which they are structured, including contract design, risk sharing, and asset-based financing mechanisms, which makes it possible to involve more investors in climate-aligned development projects. Empirical analysis of emerging markets also reveals that corporations that exhibit strong ESG disclosures and good governance practices benefit from a lower cost of capital owing to the reduction in regulatory and transition risk associated with these characteristics (Le, 2024; Wan Mohammad et al., 2023). The above evidence supports the assertion that there are both environmental and financial advantages that accrue from credible sustainability financing frameworks.

Nevertheless, the use of such green and sustainability-related instruments is not equally distributed within the Malaysian real estate sector. Major developers and government-linked companies (GLCs) benefit most from such financial products as green sukuk or sustainability-linked loans, whereas small companies and mass-market developers find themselves disadvantaged due to increased transaction costs, lack of capacity, and restricted access to financial markets (Jaffar et al., 2022; Jamaludin & Razali, 2024). The above indicates the need for further regulation and guidance to foster the broader use of green financing instruments. As discussed in Section 2.3, Malaysia's evolving Islamic green finance system could serve as one of such platforms to facilitate this process. However, its effectiveness will largely depend on the availability of incentives and governance mechanisms for a much broader developer base.

5.2.4 Technology Integration and Supply Chain Diversification

The enterprise architecture provides new ways of integrating technology that are in line with the performance improvement and diversification of the supply chain. Using several green building certification systems (GBI and LEED) as a focus point indicates a carefully considered approach that allows for the coexistence of various certificates and technologies while meeting performance requirements. The use of BIM, along with other construction technologies, is more efficient in terms of resources, produces less waste, and results in higher performance, providing grounds for further continuous improvement through data analysis. Combining this technology with sustainable designs reveals that digitalization is a compatible and economically beneficial tool for creating sustainable projects.

5.3 Case Studies: Geopolitical Influences with Market Evidence

The following case studies have been chosen to provide an insight into the dynamics of Malaysia’s multi-alignment approach and the emerging green finance ecosystem by

highlighting particular segments within the real estate market. The following case studies focus on the three mechanisms that were mentioned in Section 5: data centers development amidst US–China competition for technological hegemony, massive mixed-use developments that present both climate benefits and ecological risk factors, and the leading role of the Islamic green finance approach in promoting the transition towards a domestic carbon-neutral real estate market. All three examples demonstrate how geopolitics, financing options, and sustainability policies collide in real-life situations, creating similar patterns of contradictions between the decarbonization process at the operational level and its impacts on society.

5.3.1 Data Center Development and Sustainability Integration

The demand for data centers has increased exponentially in Malaysia within a relatively short span of time, and this is indicative of not just the growth of the digital economy but also the ability of Malaysia to deal with geopolitics in its pursuit of sustainable development. The adoption of approval processes that take into account sustainability as an essential factor, particularly with regard to water and energy usage, is definitely a strategic move to mitigate risks posed by the environment and climate change in order to ensure sustainability in the future operation of such facilities. The adaptation of international standards with respect to location, source of water supply, and cooling techniques in setting up data centers in Malaysia reflects the influence of geopolitics on the local regulation framework, thereby influencing investors and technology infrastructures.

Several cloud services in America, technology firms in China, renewable energy providers in Europe, and local telecommunication companies have made it possible for Malaysia to embrace its data center and energy transitions, indicating the real demonstration of multi-alignment. Here, it becomes evident that two competing technological ecosystems exist at the same time, and the case study presented by Malaysia offers valuable lessons for other developing countries in the same position. Empirical evidence indicates that large-scale data centers established in Singapore and southern Peninsular Malaysia experience serious challenges in terms of power consumption, transportation capacity, and water consumption. Nevertheless, this research proves that location and cooling mechanisms can reduce negative impacts on land and water usage. All these conclusions confirm Malaysia’s approach of employing non-drinking water for cooling, finding alternative water resources, and locating data centers.

Overall, the emerging cluster of data centers in Malaysia demonstrates that international technological cooperation, stringent requirements for energy and water consumption efficiency, and domestic policy choices are key components to digital infrastructure becoming an important platform for assessing whether multi-alignment diplomacy is consistent with decarbonization.

5.3.2 Renewable Energy Partnerships and Technology Transfer Mechanisms

The Malaysian government has attempted to balance costs, strategic independence, and technological advancements within its cooperation regarding renewable energy. Practically, the country has been using China as its partner for providing affordable technology and manufacturing of solar power. The United States will provide the country with modern energy storage and grid integration technology. Meanwhile, the country will be receiving the necessary international certification and standard from Europe. Moreover, the country will continue receiving financial resources from the Gulf countries. Nevertheless, Malaysia understands the necessity to ensure its sovereignty in the future through developing an efficient platform of technology locally via joint ventures, technology transfer, infrastructure development, and local services.

The visible flagship projects are an indication of the capacity to deliver not only the high-profile projects that adopt low-carbon and ESG design but also the concentration of risks associated with the embodiment of emissions, ecology, and the displacement of local communities. This indicates the need for governance frameworks that link the popular sustainability narratives with robust life-cycle assessments and social assessments of the impact of technology transfer outcomes.

5.3.3 Islamic Green Finance Leadership and Alternative Financial Architectures

As highlighted in Section 5.2, Malaysia's green finance for Islamic instruments has made the country a frontrunner in issuing sustainable and green sukuk in the developing world. The critical issue here does not lie in market share statistics but in how that position may be utilized to link decarbonization within Malaysia's domestic real estate industry to wider shifts occurring within global climate finance regimes. The use of Islamic green products based on global best practices, such as the Green Bond Principles and the ASEAN Green Bond Standards, allows Malaysian issuers to access both traditional and Shariah investor bases while still meeting global ESG standards.

There are three important implications of the aforementioned dual alignment. First, it enables Malaysia to position Islamic green sukuk as a facilitator of a bridge between financing requirements of the Global South and mandates of the Northern investors, further emphasizing its role as a broker between climate coalitions that include both Western and BRICS countries. Second, it contributes to the diversification of sources and institutions that could be used to mobilize climate finance, which is in line with the government's multi-alignment foreign policy and serves to alleviate financial risk from geopolitical tensions. Third, it offers a venue for exporting Islamic green finance expertise to other developing nations and Muslim-majority states, as well as expanding Malaysia's political reach into new dimensions concerning governance of emerging norms of climate finance. Township-scale green and solar developments demonstrate how such financial instruments and corporate commitment to ESG principles can be translated into tangible and revenue-generating projects. However, it also reveals difficulties of extending such practices to affordable and mass market segments.

It is apparent from this analysis that, in each case, a certain set of trends can be identified. Specifically, climate-aligned investments and certifications can be applied to a large extent, though their success would depend largely on the interplay of incentives in policies, foreign collaborations, and local government frameworks within particular market sectors. This forms the basis of the policy and investment paths proposed in Section 6.

5.3.4 ASEAN Infrastructure Integration and Regional Standards

ASEAN infrastructure integration in Malaysia establishes a framework that allows the ASEAN region to establish sustainability standards and manage multilateral relations under power governance structures. The current emphasis by ASEAN on increasing connectivity, developing its digital infrastructure and sustainable development initiatives, as well as incorporating climate-related economic strategies, allows for the ASEAN+ region to have a framework in place for climate integration. Countries that undertake the creation of cross-border infrastructure, such as transport links, telecommunications infrastructure, or energy connections, will find themselves faced with issues surrounding standardizing regulations and national standards. Malaysia is an example of how those who have argued for regional integration have been able to highlight, through their evolving understanding of sustainability and best practices for regions, that collaboration and sovereignty play significant roles in the process of learning without sacrificing national implementation flexibility. In effect, they emphasized the significant gains associated with the processes and provided leeway for further

leadership action. Such diplomacy continues in Malaysia's participation in BRICS diplomacy, which has explicitly included the linkages between infrastructure, health, and climate justice in its summit statements as well as its call for better distribution of finance, risk, and responsibility among countries in the Global South (New Straits Times, 2025).

5.4 Strategic Recommendations: Enhanced with Implementation Frameworks

5.4.1 Multi-alignment Policy Framework with Market Integration

The following review proposes that the multi-alignment approach pursued by Malaysia in sustainable real estate could be enhanced through a strategic framework that addresses the interplay of market, technology, financing, and regulatory mechanisms. There are four key elements that are of note.

Market-based integration mechanisms. The use of carbon pricing mechanisms, where viable politically, may send clear market signals and flexibility in terms of the achievement of reduction targets. This could be supplemented by green building incentives and renewable energy feed-in tariffs, which have a direct impact on the decision-making process on investments in real estate. The use of sustainability-linked financing, including loans, bonds, and sukuk, may further facilitate alignment of the private interests with national emissions reduction objectives, contingent on robust performance indicators and reporting standards.

Technological diversification. There is a need for an actively diversified approach in terms of technology sourcing, which will allow for obtaining the most advanced technologies without compromising technological independence. Such an approach will involve strategic joint ventures, gradual technology transfers, and partnerships on R&D projects that, while addressing the most pressing infrastructural needs, also develop competencies locally.

Innovative climate finance products. By increasing access to financing in line with climate finance principles through both traditional and Shariah means, there is an opportunity to exploit segmented investor pools and avoid having to rely on one source of funding. This involves promoting green and sustainability sukuk, ESG-labelled bonds, and blended finance products, as well as leveraging emerging multilateral partners for co-financed initiatives that meet international climate finance guidelines.

Regulatory harmonization with flexibility. The regulatory system must be able to utilize performance-based standards that conform to global best practices while maintaining national policy freedom and self-determination. Harmonizing regulations with international standards and metrics provides Malaysia with the flexibility of interacting with different blocs at once and modifying standards as necessary, without being bound to one model.

5.4.2 ASEAN Leadership in Green Building Standards with Industry Alignment

The ASEAN chairmanship of Malaysia for 2025 offers a chance for setting regional norms for green-building and real estate decarbonization in a manner that is mindful of variations in national capabilities. A realistic approach by Malaysian leaders will center on three issues.

Regional standard setting. Malaysia can contribute to the development and regional adoption of harmonized ASEAN green-building standards, with special attention to performance-based standards that enable countries to adopt their preferred technical standards while converging on similar measures of success. Linking these standards to metrics such as energy use intensity, water efficiency standards, and lifecycle carbon emissions will facilitate comparison and regional learning.

Stakeholder engagement. Regional standards setting should involve systematic engagement from the developer, financier, construction company, and professional associations, so that the

requirements for green financing and innovative construction are feasible and investment-worthy. Public–private partnerships and consultation forums can help with this while allowing governments to maintain their role as responsible decision-makers in establishing performance floors.

Facilitating technology transfer. ASEAN regional efforts can assist in fostering south-south cooperation for technologies in relation to green buildings, digital construction, and climate finance. Technology transfers can be promoted via capacity building exercises, joint projects, and knowledge exchanges. Collaboration at the regional level, keeping in view intellectual property laws and market practices, will facilitate good practices while developing local industries.

5.5 Limitations and Critical Appraisal

This review, while broad and up to date, is constrained by several methodological and contextual limitations that should be explicitly acknowledged.

A. Source bias and interpretive caution. The inclusion of a relatively high amount of gray literature in the evidence base presents a notable potential source of bias. Among the 101 sources cited, 29.7% constitute government or official reports, 20.8% are from media or web resources, while only 36.6% were from peer-reviewed journal articles (compared to 21.8% among the original set of 87 studies). The use of government and corporate reports may lead to an overrepresentation of positive cases concerning the implementation, success, and opportunities of policy measures and market trends, neglecting potential difficulties, expenses, or failures. Hence, these results must be considered as a representation of strategic objectives, policy posturing, and market optimism rather than proven outcomes, and it remains critical to conduct longitudinal empirical studies to assess carbon emissions reduction and corporate profitability within Malaysia's sustainable real estate industry.

B. Selection and publication bias. This study's literature review is limited primarily to publications written in English between 2020 and the present, with possible exceptions for key theoretical papers such as the Brundtland Report. This will most likely lead to a publication bias, favoring well-documented, successful, or popular programs while ignoring more complex, long-term, and difficult problems associated with institutional, cultural, or operational factors that attract less attention. Moreover, it omits literature in Bahasa Malaysia and regional languages, which might provide insights from local actors, communities, and the ground-level implementation of policies. Furthermore, it may ignore decades-long institutional and policy inertia, which precede the period selected for the literature review.

C. Recency bias and temporal limitations. The focus on 2023–2025 can be attributed to the fast-changing geopolitical landscape; however, this may introduce recency bias. New developments and pilot projects receive more attention in the literature compared to gradual changes, and early policies may be reported in scholarly works despite no clear evidence of their impact. Therefore, some pathways identified here may be considered more as indicative trends than examples of success stories, which means that future research needs to evaluate their long-term effects over several political and economic cycles.

D. Generalizability and Contextual Constraints

These results would be readily transferable to Malaysia and other ASEAN member states with similar institutions and markets. The findings would have no bearing outside the Islamic finance setting and for countries without an existing system for sukuk issuance and

Islamic finance regulation; small and weakly diplomatically influential developing countries that lack the multidimensional foreign policy alignment advantages and the diversified basket of foreign direct investments that Malaysia enjoys; and highly developed countries with more evolved policy structures, more advanced financial markets, and different governance mechanisms.

E. Projections Versus Realized Outcomes and Future Research Needs

The analysis makes a deliberate distinction between historical results and forward-looking predictions, though ultimately the discussion itself is more diagnostic than predictive. The key contribution of this review is that it highlights the policy framework, institutional arrangements, and strategic narratives within which Malaysia is trying to shape the impacts of climate and geopolitics in its property market. To draw any meaningful conclusions, however, further empirical evidence is required, particularly in regard to sector-specific research (such as engineering studies on GBI-certified buildings, cost-benefit analyses on green sukuk and other financial mechanisms, post-occupancy outcome assessments). This would include long-term studies, 5 to 10 years out, that monitor the rate of adoption, cost-effectiveness, and adherence to policy, as well as comparative analysis to distinguish between Malaysia-specific factors and wider regional trends, and qualitative studies that focus on obstacles and facilitators of change.

This review provides the political and geopolitical context to be used in such research rather than a substitute for it. A more robust check of the synthesis demonstrates the validity of the synthesis, revealing no substantial differences in the primary thematic results using only the top-quality set of studies with an appraisal score of 7–8, along with inter-rater reliability with an 83% agreement rate from a 20% subsample, as discussed in Sections 4.2.1 and 4.3.

6. Conclusion

This study takes into consideration the peer-reviewed literature and the gray literature in view of the dynamic pace of change occurring in the Malaysian sustainable real estate sector. In the current discussion, it appears that the process of transformation in Malaysia is characterized by the dynamics between global climate regimes, geopolitical competition, and domestic markets. It is evident that alignment occurs in many forms and not merely in the realm of diplomacy within the sectors of real estate finance, technology, and regulation.

6.1 Synthesis of Geopolitics, Markets, and Implementation

Analysis of market data, corporate strategies, and policy frameworks reveals the pragmatic and stakeholder-oriented approach Malaysia has taken towards sustainable real estate, striking a balance between climate and developmental ambitions. Evidence suggests that indicators such as GBI performance, expansion of green and sustainability sukuk, and the integration of ESG criteria have shown tangible results, while there is still scope for improvement with regard to water performance, affordable housing, and accessibility of green finance for smaller developers.

As most indicators reviewed here depend on conditional projections and not absolute results, one has to consider the scenarios in which Malaysia’s future course might unfold. Weakness in climate and ESG policies in the US and Europe may push Malaysia to lean more on BRICS and BRI-related green finance and technologies; increased regulatory requirements related to ESG may increase operational costs while ensuring high premium pricing and diversified financing options; finally, a fragmented but increasingly integrated ASEAN may put more emphasis on domestic policy and financial instruments such as the Green Building Index and domestic green sukuk platform to sustain momentum.

As such, Malaysia's multi-alignment strategy may be analyzed with regard to three theoretical perspectives. The institutional perspective stresses the coercive pressures stemming from regulations in the US and EU, e.g., normative pressures from various transnational standards (GRI, TCFD, GRESB) and the mimetic pressure of following other countries in regions such as Singapore, all of which influence the behavior of companies in the real estate sector. In terms of policy diffusion, one can point to the selective adaptation of ASEAN climate roadmaps as well as BRICS/BRI infrastructure plans into the context of Malaysia, resulting in hybrid institutions. The global value chain perspective uncovers the asymmetric dependencies on technologies coming from China in solar energy, storage, and data centers, along with reliance on US–EU ESG capital. Overall, Malaysia cannot choose between being "East" or "West"; instead, it constantly negotiates the pressures from its surroundings due to its institutional setting and policies.

6.2 Key Success Factors

There are several factors responsible for Malaysia's current progress. The long history of policy commitment from the Ninth Malaysia Plan up to the SDG Roadmap Phase II has allowed for a certain degree of coherence and continuity in terms of aligning sustainable development, climate ambitions, and competitive advantage. Being ASEAN Chair as well as an aspirant for the BRICS membership provides extra weight when setting standards, guiding climate finance flows, hedging against geopolitical risk, and maintaining access to funds and technologies.

In terms of internal processes, the proactive participation of large developers and GLCs in providing finance, planning, and testing sustainability-related innovations allows for developing feedback between policy-making and implementation. In such a way, the policies will be able to adapt to changing conditions on the ground, while the business sector's strategy for sustainable development would be coherent with that of the state, even though its actions mainly concern the high-end market segment.

6.3 Implications for Climate Diplomacy and Developing Country Theory

This case of Malaysia demonstrates that developing countries should not only be seen as beneficiaries of an international climate regime architecture, but are also capable of acting as constructors of both normative and architectural orders through efficient coalitions and innovative financing methods. As the chair of ASEAN, Malaysia promotes a flexible regionalism concept that takes into account the different developmental interests and yet fits into the efforts made by major powers. In its turn, being the hub of Islamic financing, Malaysia performs innovative experiments in designing financing architectures that do not succumb to the hegemony of the West, while still considering global standards and investors' needs.

Maintaining portfolio technologies and supply chains in connection with international networks is an essential component of technological sovereignty. Thanks to the balance between technology transfer and capacity building through research and development, joint ventures and local services, such countries as Malaysia have managed to limit their dependency vulnerabilities and play their role in the development of international climate and technology regimes.

6.4 Lessons for the Implementation of Sustainable Development

In that regard, the sustainability programs formulated by some of Malaysia's key players represent one of the effective ways in which private firms can comply with public policies without sacrificing the firm's sustainability. The adoption of a blend of governance with environmental and social considerations through impact assessment, stakeholder involvement, and performance incentives linked to ESG criteria gives the way forward to firms from

developing countries aspiring to attain a sustainable fit between their business models and climate and development goals.

The strategies discussed above indicate the significance of dealing with the cost of compliance using flexible regulations, performance incentives, and technology. The recognition of capability development as an essential investment rather than a secondary issue demonstrates how consultancy-driven approaches fail to address the issue of sustainability capability development.

6.5 Future Outlook and Strategic Positioning

Looking forward, Malaysia's significance from a strategic perspective will rely on the combination of its economic strength, eco-conscious investments, and its growing digital economy. In light of the country's strong corporate commitments, its healthy macroeconomic environment, and the likely climate change-induced foreign direct investments amounting to RM 50-150 billion in the coming five years, and perhaps "hundreds of billions of ringgit," Malaysia might possess the financial resources to quickly expand its low carbon developments, though such predictions should remain highly speculative considering the geopolitical landscape and the success of the ASEAN integration.

Technology-intensive businesses, particularly data centers that are environmentally friendly, may offer Malaysia an innovative way to experiment with and adopt environmental management systems, as well as promote innovations in other segments of the construction industry. Maintaining the regulatory framework for Malaysia, developing green financing mechanisms, and maintaining its multilateral alignment will be vital for ensuring climate leadership and strategic autonomy amid a more divided international order.

6.6 Research Contributions and Future Direction

This review provides an added value to existing literature through the linkage of market information, business activities, and regulatory structures in explaining the relationship between geopolitics, green finance, and governance in Malaysia's sustainable real estate transition, rather than through the use of one methodological approach of causation. The configurations of policies, financial tools, and business strategies are mapped based on peer-reviewed articles complemented with appropriately qualified gray literature, and gaps in empirical information, particularly pertaining to long-term building performance and green finance pricing, are noted. Based on the evidence presented for each segment in Sections 5.1–5.3, the pathways of Malaysia's real estate transition are clearly delineated for premium commercial properties, affordable housing, data center campuses, and GLC-related property holdings.

Table 8 presents a prioritization matrix where each segment's contribution to the broader transition is considered to match regulatory, financial, technology, and governance efforts to their respective segment. It aims to be used by policy makers and market players in determining a sequence of interventions, driving premium and GLC-linked segments first and furthest along, while providing a more supportive and non-regressive approach for affordable housing segments and rigorous regulations for high-impact data centers. Further research may look into segment-level analysis in the future through BEI and water efficiency studies, quantitative studies on sukuk and loan spreads, comparative research with ASEAN countries or other Global South nations, and qualitative interviews with developers, regulators, occupants, and the wider community to gain insights from differentiated transition paths.

Table 8: Segmented prioritization matrix for sustainable real estate in Malaysia

Segment	Strategic focus	Policy / regulation	Finance / instruments	Technology / assets	Governance / capacity
Premium (grade A offices, flagship mixed-use)	Anchor net-zero and ESG-flagship assets in key urban corridors	Performance-based codes; GBI Gold/Platinum ; BEI caps; mandatory energy/water disclosure for large assets	Scale green and sustainability-linked sukuk; preferential lending rates for verified high-performance buildings	Deep retrofits; smart-building systems; sub-metering; digital twins for energy and water management	Strengthen TCFD-aligned reporting; board-level climate risk oversight; independent verification of performance claims
Affordable / mass housing	Enhance comfort, resilience, and utility affordability	Progressive tightening of minimum standards (envelope, daylight, ventilation); fast-track green affordable approvals	Blended finance and guarantees; interest subsidies for green affordable schemes; community-scale green funds	Passive design; IBS and modular methods; basic efficiency measures; community scale RE and water solutions	Local authority capacity building; simple compliance tools; tenant engagement; safeguards against green gentrification
Data centers and digital infrastructure	Balance digital-economy growth with water, grid, and climate constraints	Integrated siting guidelines; water-use caps; grid-impact and waste-heat rules; cross-border coordination	Long-tenor green loans and project finance; performance-based tariffs; targeted green data center tax incentives	High-efficiency cooling; heat recovery; RE PPAs; grid-friendly load management and demand response systems	Joint planning units (energy–water–planning); specialised technical units in regulators; transparent PUE and BEI benchmarking
GLCs and state-linked developers	Use portfolios as a systemic decarbonisation and inclusion platform	Hard net-zero and resilience targets in mandates and KPIs; internal carbon pricing	Programmatic green sukuk shelves; pooled financing for smaller partners; outcome-linked incentives for priority projects	Portfolio-wide retrofit programmes; district energy and RE procurement; integration of social/affordable components	Cross-agency climate steering committees; transparent reporting; capacity support for supply-chain partners and local authorities

Source: Authors' analysis based on evidence in Sections 5.1–5.3 and Appendix A2.

This matrix recognizes that premium urban and GLC-linked segments must progress quickly because they have access to capital, face international ESG pressure, and have the signaling capability to set the tone for the rest of the market. The affordable housing segment would need a more graduated approach, which involves the application of basic regulations and concessional or blended finance in order to mitigate any regressive impact of the cost on poor households, while data centers are a segment requiring immediate performance-based regulation due to their heavy use of electricity and water. Collectively, these different approaches reflect the Malaysian government's multi-alignment policy, which balances higher expectations and innovation with segments that have greater financial or organizational capacity but without compromising on social objectives within mass market housing.

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List of Abbreviations

ADB – Asian Development Bank
AHP – Analytic Hierarchy Process
ASEAN – Association of Southeast Asian Nations
AWS – Amazon Web Services
BEI – Building Energy Index
BEPG – Building Energy Performance Gap
BRI – Belt and Road Initiative
BRICS – Brazil, Russia, India, China, and South Africa
CCPI – Climate Change Performance Index
CO_2 – Carbon dioxide
CSR – Corporate Social Responsibility
DOSM – Department of Statistics Malaysia
ESG – Environmental, Social, and Governance
EUI – Energy Use Intensity
FDI – Foreign Direct Investment
FTAs – Free Trade Agreements
GBI – Green Building Index
GCC – Gulf Cooperation Council
GDP – Gross Domestic Product
GLC – Government-Linked Company
GRI – Global Reporting Initiative
IBS – Industrialized Building System
IP – Intellectual Property
LEED – Leadership in Energy and Environmental Design
MDEC – Malaysia Digital Economy Corporation
MIDA – Malaysian Investment Development Authority
NDB – New Development Bank (BRICS bank)
NDC – Nationally Determined Contribution
PRISMA – Preferred Reporting Items for Systematic Reviews and Meta-Analyses
RE – Renewable Energy
REPEAT – Renewable Energy Pathways and Emissions Trajectory
SDG – Sustainable Development Goal
SSM – Sustainable Strategic Management
TCFD – Task Force on Climate-Related Financial Disclosures
TV BRICS – Television BRICS (International Media Network)
UNDP – United Nations Development Program
UNFCCC – United Nations Framework Convention on Climate Change
US – United States
WMO – World Meteorological Organization

APPENDIX A1 - COMPLETE 87 STUDIES TABLE

Source Type Legend:
A=Peer-reviewed Journal | **B**=Conference | **C**=Government/Official | **D**=Industry/Corporate | **E**=Thesis | **F**=Book | **G**=Media | **H**=Methodology | **I**=Primary Data

ID	Author(s), Year, Title	Type	Primary Focus/Context	Key Contribution to Review	Used in Synthesis
1	Ab. Rahim, N., & Md Ali, A. (2024). Comparative analysis of energy performance between green and conventional office buildings in	A	Malaysia – Building energy performance	Five-year BEI benchmarking (2019-2023): GBI offices 110-150 vs conventional	Section 5.2.1

	Malaysia. *Journal of Energy and Safety Technology*, 7(2), 54-82.			170-220 kWh/m²/yr; 4-5-star vs 2-star energy labels.	
2	Abdul Aziz, M. (2024, October 16). Developer: Budget should work to shape future of Malaysia's real estate. *New Straits Times*.	G	Malaysia – Policy	Real estate sector expectations from federal budget.	Section 5.1.2
3	Adnan, A., Abd Karim, S. B., & Mustafa, M. H. (2025). Integrating sustainable building design criteria to the Green Building Index (GBI) and MyCREST in Malaysia: Insights from a systematic review and meta-analysis. *Journal of Design and Built Environment*, 25(3), 58-84.	A	Malaysia – Green building standards	Systematic review mapping six sustainable design criteria across GBI and MyCREST; joint reference framework for non-residential projects.	Section 5.2.1
4	ASEAN Centre for Energy. (2020). *ASEAN plan of action for energy cooperation (APAEC) 2016-2025: Phase II, 2021-2025*.	C	ASEAN – Energy	Regional energy cooperation framework.	Section 2.4
5	Association of Southeast Asian Nations. (2025). ASEAN 2045: Our shared future.	C	ASEAN – Regional strategy	Long-term regional resilience and climate cooperation strategy.	Section 2.4
6	Azmi & Associates. (2025, May 2). An overview of ESG in Malaysia in 2025.	D	Malaysia – Legal/ESG	ESG legal requirements and compliance landscape.	Section 2.3, ES-15
7	Bank Negara Malaysia. (2025, March 6). Monetary policy statement.	C	Malaysia – Economy	Policy rate cut to 2.75% to support green investment.	Section 5.1.2, ES-5
8	Batool, F. (2024, September 17). The role of middle powers in shaping a multipolar world order. *Modern Diplomacy*.	G	Global – Geopolitics	Middle-power strategies in a multipolar order.	Section 1.4
9	Benazeraf, D. (2025, May 30). Strategic autonomy of middle powers under US-China rivalry. *Modern Diplomacy*.	G	Global – Geopolitics	Balancing diplomacy framework for middle powers.	Section 2.4
10	Bernama. (2024, October 25). Malaysia positioned as bridge between BRICS and ASEAN for driving collaboration.	G	Malaysia – Diplomacy	ASEAN-BRICS bridge narrative.	Section 2.4
11	Bernama. (2025a, July 9). BRICS and the Global South's new chapter: A Malaysian reflection from Rio.	G	BRICS – Global South	BRICS expansion and Malaysia's role.	Section 2.4
12	Bernama. (2025b, September 16). Malaysia's data centre framework to tackle water use with tighter rules, incentives.	G	Malaysia – Regulation	Data centre water/emissions regulations.	Section 5.1.3
13	Bernama. (2025, May 22). ASEAN Summit could unlock hundreds of billions in trade, FDI for Malaysia – Juwai IQI. *The Malaysian Reserve*.	G	Malaysia – Economy	Projected FDI: RM300 billion by 2030, RM15 billion for real estate.	Section 5.1.1, ES-3
14	Bilqis, A., & Pradnyaswari, I. (2024, January 15). ASEAN's COPs energy pledges and the 2026-2030 regional energy blueprint. ASEAN Centre for Energy.	C	ASEAN – Energy	Post-2025 energy blueprint and COP commitments.	Section 2.4
15	Bodansky, D., Brunnée, J., & Rajamani, L. (2017). *International climate change law*. Oxford University Press.	F	Global – Climate law	Paris Agreement legal framework.	Section 2.1
16	Bond and Sukuk Information Platform Sdn Bhd. (2024, August 7). Green bond and sukuk in Malaysia.	D	Malaysia – Finance	Green sukuk market share (28% of total sukuk market).	Section 2.3, ES-10
17	BRICS. (2025, May 21). BRICS approves declaration and advances sustainable industrial agenda with focus on technology and small businesses.	C	BRICS – Industry	BRICS sustainable industrial agenda.	Section 2.4
18	Building and Construction Authority Singapore. (2024). Building energy benchmarking report and data 2024.	C	Singapore – Building energy	2023 median office EUI = 142 kWh/m²/yr; top quartile ≤109.	Section 5.2.1, ES-100
19	Burck, J., Uhlich, T., Bals, C., Höhne, N., & Nascimento, L. (2024). *Climate*	C	Global – Climate policy	Malaysia CCPI ranking 48th (Low).	Section 1.1, ES-7

	Change Performance Index 2025: Results.				
20	Carroll, A. B. (1991). The pyramid of corporate social responsibility. *Business Horizons*, 34(4), 39-48.	A	Global – Theory	CSR framework (foundational).	Section 2.5
21	Construction Industry Development Board Malaysia. (2021). Guideline for small and medium enterprise developers and contractors: Migration from conventional methods to IBS.	C	Malaysia – Construction	IBS sustainability roadmap.	Section 2.2
22	Correia, J., Tijaja, J. P., Drury, N., Leong, S. K., & Sinay, J. B. (2025). Transforming ASEAN for sustainability. ADBI Working Paper No. 1508.	C	ASEAN – Green transition	SEAN green transition roadmap and financing.	Section 2.4
23	Daniel, E., Solheim, E., & Zhu, X. (2025, October 15). Building a new multilateral order through finance and shared risk. *The Asian Banker*.	G	BRICS – Finance	New Development Bank (NDB) role.	Section 2.4
24	de Boer, D., Nedopil, C., & Fan, D. (2023, March 6). China clarifies its vision for a green Belt and Road Initiative. ClientEarth Asia.	G	China – BRI	Green BRI clarification.	Section 1.3
25	Department of Statistics Malaysia. (2025, April 18). Advance gross domestic product (GDP) estimates, first quarter 2025.	C	Malaysia – Economy	Q1 2025 GDP growth: 4.4%; manufacturing +4.2%, services +5.2%, construction +14.5%.	Section 5.1.2, ES-12, ES-13
26	DiMaggio, P. J., & Powell, W. W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. *American Sociological Review*, 48(2), 147-160.	A	Global – Theory	Institutional theory.	Section 2.5
27	Dolowitz, D. P., & Marsh, D. (2000). Learning from abroad: The role of policy transfer in contemporary policy-making. *Governance*, 13(1), 5-24.	A	Global – Theory	Policy diffusion theory.	Section 2.5
28	Elkington, J. (1998). Accounting for the triple bottom line. *Measuring Business Excellence*, 2(3), 18-22.	A	Global – Theory	Triple Bottom Line (TBL) framework.	Section 2.5
29	Georgieva, K. (2023, January 16). Confronting fragmentation where it matters most: Trade, debt, and climate action. IMF.	C	Global – Economy	Climate-finance fragmentation.	Section 2.3
30	Gereffi, G. (1999). International trade and industrial upgrading in the apparel commodity chain. *Journal of International Economics*, 48(1), 37-70.	A	Global – Theory	Global value-chain theory.	Section 2.5
31	Ghiasy, R. (2025, April 9). How middle powers shape order in the Indo-Pacific. *The Diplomat*.	G	Indo-Pacific – Strategy	Middle-power influence in regional order.	Section 1.4
32	Gilley, B. (2025). Will Malaysia become an active middle power? *Australian Journal of International Affairs*, 79(1), 132-149.	A	Malaysia – Status	Malaysia as an emerging middle power.	Section 1.4
33	Gong, D., Huang, M., & Lin, H. (2023). Construction of an ecological security pattern in rapidly urbanizing areas based on ecosystem sustainability, stability, and integrity. *Remote Sensing*, 15(24), 5728.	A	Global – Ecosystem management	Ecological security pattern framework (MCR model, circuit theory).	Section 5.1.3, Section 6.2
34	Habibullah, N., Sahrir, S., & Ponrahono, Z. (2023). Integrating rainwater	A	Malaysia – Water efficiency	First BCS-monitored study of RWH+GWR in GBI	Section 5.2.1

	harvesting and greywater recycling to increase water efficiency in office buildings. *Planning Malaysia*, 21(5), 253-266.			office: 28.11% freshwater saving, >3,000 m³/yr projected.	
35	Heydarian, R. J. (2025). Middle-power diplomacy in the age of great-power competition. *Journal of Indo-Pacific Affairs*, 4(2), 34-40.	A	Global – Geopolitics	Middle-power diplomacy framework.	Section 1.4
36	Hezri, A. A., & Hasan, M. N. (2004). Management framework for sustainable development indicators in Malaysia. *Ecological Indicators*, 4(2), 123-137.	A	Malaysia – Governance	Early SD indicator framework; governance coordination challenges.	Section 2.2
37	Hua, Y., & Tong, T. (2026). Renewable energy integration in the Belt and Road Initiative: Government expenditure, green finance, and economic growth. *Renewable Energy*, 256, 123980.	A	China – BRI	BRI renewable energy integration analysis.	Section 1.3
38	InfoBRICS. (2025, June 10). Malaysia PM Ibrahim: BRICS a cohesive force for Global South.	G	BRICS – Malaysia	Anwar Ibrahim's BRICS statement.	Section 2.4
39	Infocomm Media Development Authority. (2024). Green Data Centre (DC) Roadmap. Singapore.	C	Singapore – Data centres	Green data centre roadmap (reference for regional comparison).	Section 5.1.3
40	Institute of Strategic and International Studies (ISIS) Malaysia. (2025, February 25). Explained: Why Malaysia's data center boom faces water sustainability concerns.	C	Malaysia – Data centres	Data centre water-use regulations and compliance.	Section 5.1.3, ES-9
41	International Capital Market Association. (2025). Green Bond Principles (GBP).	C	Global – Finance	Green bond and SLB standards.	Section 2.3
42	International Federation of Accountants et al. (2024). Unleashing the potential of Islamic finance: Global perspectives on achieving the SDGs with Islamic finance tools & concepts.	C	Global – Islamic finance	Islamic finance mechanisms for sustainability.	Section 2.3
43	Iwuanyanwu, O., Oyetunji, A. K., Ohiomah, I., & Otasowie, O. (2023). The economic benefits of green buildings: A cost-benefit analysis of sustainable architecture. *International Journal of Advanced Economics*, 5(9), 382-391.	A	Emerging markets – Green buildings	Cost-benefit case for green buildings.	Section 5.3
44	Jaffar, N., Affendi, N. I. N., Ali, I. M., Ishak, N., & Jaafar, A. S. (2022). Barriers of green building technology adoption in Malaysia: Contractors' perspective. *International Journal of Academic Research in Business and Social Sciences*, 12(8), 1552-1560.	A	Malaysia – Green building barriers	Contractor survey (n=150): high cost, lack of awareness, lack of resources as top barriers.	Section 6.1
45	Jamaludin, A. F., & Razali, M. N. (2024). Assessing the implementation of environmental, social, and governance (ESG) by Southeast Asian listed property companies. *Pacific Rim Property Research Journal*, 29(2), 30-65.	A	ASEAN – ESG	ASEAN ESG matrix and PCA analysis; disclosure breadth increased but performance uneven.	Section 2.3
46	Jenkins, J., Farbes, J., & Haley, B. (2025). Impacts of the One Big Beautiful Bill on the US energy transition – Summary report (Version 4). REPEAT Project.	H	USA – Policy	US NDC critically insufficient analysis; 7 bn tons CO_2 emissions gap.	Section 1.2
47	Joint Committee on Climate Change. (2024). Application handbook for	C	Malaysia – Finance	SRI sukuk and SLB framework.	Section 2.3

	issuances of sustainable and responsible investment linked sukuk and sustainability-linked bonds for the Malaysian capital market.				
48	Khan, M. K., Su, C.-W., & Zhu, M.-N. (2021). Urbanization and carbon emissions: A panel threshold analysis. *Environmental Science and Pollution Research*, 28(20), 26073-26081.	A	Global – Urbanisation	Non-linear relationship between urbanisation and CO_2 emissions.	Section 1.1
49	Knight Frank Malaysia. (2025). Real estate highlights 1st half 2025.	D	Malaysia – Market	Premium segment 85% price uplift for sustainability; mass market 40-50%.	Section 5.3, ES-1
50	Le, L. T. (2024). Impact of environmental, social, and governance practices on financial performance: Evidence from listed companies in Southeast Asia. *Cogent Business & Management*, 11(1), 2287923.	A	ASEAN – ESG and ROA	One-point ESG increase raises next-year ROA by ~0.039 percentage points.	Section 5.2.3
51	Le, L. T. (2025). Green investment and sustainable finance in Asia: Trends, challenges and policy implications. *Asian Journal of Sustainable Finance*, 9(1), 74-81.	A	Asia – Green finance	Regional review of green bonds and taxonomies; gaps in harmonisation.	Appendix A2
52	Lee, M. Z., & Rusli, N. (2025). A multicriteria decision-making approach for identifying the suitable data center location in Iskandar Puteri, Johor. *Chinese Journal of Urban and Environmental Studies*, 13(4), 2550021.	A	Malaysia – Data centre siting	AHP-GIS framework for data centre site selection integrating infrastructure, environment, land use, community factors.	Section 5.1.3
53	Lin, J., Fong, K., & Martinus, M. (2025). Malaysia chairs ASEAN at a strategic crossroads (Trends in Southeast Asia, TRS12/25). ISEAS.	C	ASEAN – Leadership	Malaysia's ASEAN chairmanship priorities.	Section 2.4
54	Maini, T. S. (2025, August 18). Malaysia's growing economic linkages with BRICS countries. *Modern Diplomacy*.	G	BRICS – Malaysia	Malaysia-BRICS economic linkages.	Section 2.4
55	Malaysia Digital Economy Corporation. (2025, February 27). Malaysia's digital investments hit record RM163.6 billion in 2024.	D	Malaysia – Digital economy	Realised digital investment (including data centres) RM163.6B in 2024, 3.5x YoY.	Section 5.1.3, ES-2
56	Malaysia Economic Planning Unit. (2010). Ninth Malaysia Plan 2006-2010.	C	Malaysia – Policy	Early sustainability foundation principles.	Section 2.2
57	Malaysia External Trade Development Corporation. (2025, January 27). Malaysia sets trade targets for 2025 with a focus on BRICS, FTA partners and emerging markets.	C	Malaysia – Trade	2025 trade targets.	Section 5.1.1
58	Malaysian Investment Development Authority. (2025, August 21). Malaysia's 1H 2025 approved investments up by 18.7% year-on-year to RM190.3 billion.	C	Malaysia – Investment	62% of FDI from diversified sources (US, EU, China, GCC).	Section 5.1.2, ES-6
59	Malaysia Ministry of Economy. (2024). SDG Roadmap for Malaysia Phase II (2021-2025).	C	Malaysia – Policy	MADANI framework governance structure.	Section 2.2
60	Malaysia Ministry of Finance. (2024). Economic outlook 2025 (Belanjawan 2025).	C	Malaysia – Economy	Projected GDP growth range 4.0-4.8%.	Section 5.1.2
61	Middle East Council on Global Affairs. (2024). Widening geopolitical fault lines challenge collective action on climate.	G	Global – Geopolitics	Climate governance tensions.	Section 1.4

62	Ministry of Foreign Affairs Malaysia. (2025a, July 4). Working visit of the Prime Minister to attend the BRICS Leaders' Summit in Rio de Janeiro.	C	BRICS – Malaysia	BRICS leaders summit outcomes.	Section 2.4
63	Ministry of Foreign Affairs Malaysia. (2025b, April 29). Outcome of the working visit of the Minister of Foreign Affairs to the BRICS Ministers of Foreign Affairs Meeting.	C	BRICS – Malaysia	BRICS foreign ministers outcomes.	Section 2.4
64	Ministry of Foreign Affairs Malaysia. (2025c). ASEAN chairmanship 2025 strategic priorities (unpublished briefing).	C	ASEAN – Leadership	35 climate-related regional agreements identified.	Section 5.1.1, ES-11
65	Mohd Rahim, F. A., Ismail, N. H., Qistina, S., Mohd Yusoff, N. S., Mustafa, M. H., & Mahdzir, M. (2024). Contributing factors on the effectiveness of green building using the GBI tool: A case study of Putrajaya Energy Commission Building. *Journal of Project Management Practice*, 4(1), 17-32.	A	Malaysia – GBI effectiveness	Survey (n=320) shows government supervision, cost management, property management are statistically significant positive contributors to GBI effectiveness.	Section 5.2.1
66	Mokthsim, N., & Salleh, K. O. (2014). Malaysia's efforts toward achieving sustainable development: Issues, challenges and prospects. *Procedia – Social and Behavioral Sciences*, 120, 299-307.	A	Malaysia – Policy implementation	Fragmented implementation and uneven enforcement.	Section 2.2
67	Moser, S., & Avery, E. (2021). The multi-scalar politics of urban greening in Forest City, Malaysia. *Urban Forestry & Urban Greening*, 60, 127068.	A	Malaysia – Forest City	Green urban greening aesthetic masks ecological damage.	Section 5.1, Section 5.1.4
68	Najid, N. A., Muhamat, A. A., & Jaafar, M. N. (2024). Integration of Islamic finance with ESG sustainability efforts: Evidence in Malaysia. *International Journal of Research and Innovation in Social Science*, 8(12), 204-215.	A	Malaysia – Islamic finance	Conceptual alignment but gaps in standardisation and active ESG integration.	Section 2.3
69	New Straits Times. (2025, July 7). Malaysia stresses global health and climate equity at BRICS summit.	G	BRICS – Malaysia	BRICS summit climate equity priorities.	Section 2.4
70	OxJournal. (2025, September 5). The diplomacy of unequals: Power asymmetries in global climate diplomacy.	G	Global – Climate diplomacy	Power asymmetries in climate governance.	Section 2.1
71	Page, M. J., et al. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, 372, n71.	H	Global – Methodology	PRISMA guidelines (adapted for grey literature).	Methods (4.3), Figure 2
72	Parks, T., Maramis, L., Sunchindah, A., & Wongwatanakul, W. (2018). ASEAN as the architect for regional development cooperation. The Asia Foundation.	C	ASEAN – Cooperation	Regional development cooperation model.	Section 2.4
73	Piñeiro, V., Glauber, J., & Gianatiempo, J. P. (2025, June 25). How the new geopolitics is undermining global sustainability goals. TESS Forum.	G	Global – Geopolitics	Geopolitical tensions undermining climate goals.	Section 1.4
74	Ponte, S., & Sturgeon, T. (2014). Explaining governance in global value chains: A modular theory building effort. *Review of International Political Economy*, 21(1), 195-223.	A	Global – Theory	GVC governance theory.	Section 2.5

75	Prasetyo, D. I., & Aryani, Y. A. (2024). Company performance and ESG disclosure: Does country governance matter? *Business and Finance Journal*, 9(2), 215-232.	A	Emerging markets – ESG	Country governance moderates ESG-performance relationship.	Section 2.3
76	Roberts, J. T., & Weikmans, R. (2017). Postface: fragmentation, failing trust and enduring tensions over what counts as climate finance. *International Environmental Agreements*, 17, 129-137.	A	Global – Climate finance	Fragmentation and trust deficits in climate finance.	Section 2.1
77	Sanchez & Co. (2025, August). GeoCoded special report: The state of China's Belt and Road Initiative (August 2025).	G	China – BRI	BRI infrastructure trends and green pivot.	Section 1.3
78	Scott, W. R. (2014). *Institutions and organizations: Ideas, interests, and identities* (4th ed.). SAGE.	F	Global – Theory	Institutional theory (full).	Section 2.5
79	Shaardan, N. A., Myeda, N. E., & Zaid, S. M. (2025a). Diverging perspectives on energy performance gaps in green buildings: An empirical study of industry experts. *Journal of Surveying, Construction and Property*, 16(2), 40-59.	A	Malaysia – BEPG	Expert survey (n=278): organisational/behavioural factors (awareness, leadership, sub-metering) dominate BEPG causes.	Section 5.2.1
80	Shaardan, N. A., Myeda, N. E., & Zaid, S. M. (2025b). Key causes and drivers of energy performance gaps in Malaysian non-residential green buildings. *Planning Malaysia*, 23(6), 225-240.	A	Malaysia – BEPG	PLS-SEM analysis: lack of occupant awareness, financial resources, skills gaps, weak top management support as critical causes.	Section 5.2.1
81	Shipan, C. R., & Volden, C. (2008). The mechanisms of policy diffusion. *American Journal of Political Science*, 52(4), 840-857.	A	Global – Theory	Policy diffusion mechanisms.	Section 2.5
82	Singapore Institute of International Affairs. (2015). ASEAN centrality in the regional architecture (Policy brief).	C	ASEAN – Governance	ASEAN consensus decision-making model.	Section 2.4
83	Sohaimi, N. S., Yusoff, M. N., Zulkifli, Z., Ramli, R. A., & Sohaimi, M. S. N. (2023). How are Southeast Asia countries embracing green home technology? *International Journal of Academic Research in Business and Social Sciences*, 13(2), 369-386.	A	ASEAN – Green housing	Singapore at technical frontier; Malaysia, Indonesia, Thailand balance green features with affordability.	Section 5.2.1
84	S P Setia Berhad. (2025). Sustainability statement 2024.	D	Malaysia – Corporate	ESG framework implementation.	Section 2.3
85	S P Setia Berhad. (2025, April). Sustainability financing framework.	D	Malaysia – Corporate	Sukuk issuance +45% YoY.	Section 2.3, ES-4
86	Stead, J. G., & Stead, W. E. (2008). Sustainable strategic management: An evolutionary perspective. *International Journal of Sustainable Strategic Management*, 1(1), 62-81.	A	Global – Theory	SSM framework.	Section 2.5
87	Sustainable Fitch. (2025). Second-party opinion methodology for sustainable finance instruments.	D	Global – Finance	ESG verification standards.	Section 2.3
88	Tatler Asia. (2025, October 12). China's Belt and Road Initiative pivots from mega-infrastructure to green energy, tourism, education, sports and digital projects.	G	China – BRI	BRI diversification into new green sectors.	Section 1.3
89	The Star. (2025a, April 28). Malaysia to push for greater ASEAN-BRICS	G	ASEAN/BRICS – Malaysia	Diplomacy outcomes.	Section 5.1.1

	cooperation at foreign ministers' meeting.				
90	The Star. (2025b, May 27). Asean summits today to reinforce Malaysia's role in steering strategic cooperation.	G	ASEAN – Summit	Economic cooperation results.	Section 5.1.1
91	Turner & Townsend. (2021, December 31). How Malaysia's commitment to net zero is shaping its real estate sector.	D	Malaysia – Net zero	Net zero transition analysis; IBS, PPVC, BIM adoption.	Section 5.1
92	TV BRICS. (2025, June 19). Malaysia launches climate finance innovation lab to accelerate green transition.	G	Malaysia – Innovation	Green finance innovation initiatives.	Section 2.3
93	United Nations Development Programme, Istanbul International Center for Private Sector in Development, & Kuwait Finance House. (2025). The potential growth and future trends of green sukuk as a tool for sustainable financing.	C	Global – Islamic green finance	Malaysia holds ~52% of emerging-market green sukuk (range 48-56%).	Section 2.3, ES-14
94	United Nations Framework Convention on Climate Change. (2025). Nationally determined contributions under the Paris Agreement: Synthesis report (FCCC/PA/CMA/2025/8).	C	Global – Climate policy	NDC implementation tracking.	Section 2.1
95	Vietnam News Agency. (2025, April 27). Malaysia highlights roles of ASEAN, BRICS in regional cooperation.	G	ASEAN/BRICS – Malaysia	Malaysia as bridge between ASEAN and BRICS.	Section 2.4
96	Wan Mohammad, W. M., Osman, M., & Abdul Rani, M. S. (2023). Corporate governance and environmental, social, and governance (ESG) disclosure and its effect on the cost of capital in emerging market. *Asian Journal of Business Ethics*, 12(1), 175-191.	A	Emerging markets – Cost of capital	Stronger governance and ESG disclosure associated with lower WACC.	Section 5.2.3
97	Wong, S. Y., Low, W. W., Wong, K. S., & Tai, Y. H. (2021). Barriers for green building implementation in Malaysian construction industry. *IOP Conference Series: Materials Science and Engineering*, 1101, 012029.	A	Malaysia – Green building barriers	Survey (n=36 professionals): top barriers – low market demand (4.25), lack of incentive awareness (3.89), lack of benefit awareness (3.81), high cost (3.75).	Section 5.2.1
98	World Commission on Environment and Development. (1987). Our common future.	F	Global – Theory	Sustainable development definition (Brundtland).	Section 2.5
99	World Meteorological Organization. (2024). WMO Greenhouse Gas Bulletin No. 20: The state of greenhouse gases in the atmosphere based on global observations through 2023.	C	Global – Diplomacy	CO_2 exceeded pre-industrial by 151%; Malaysia CO_2 emissions +6.5% YoY, total 277.53 MT.	Section 1.1, ES-9
100	Xiao, Y. (2025). Emerging middle powers' balancing diplomacy: Connotations, motivations, and implications. *BRIQ: Belt & Road Initiative Quarterly*, 6(2), 211-224.	A	Global – Diplomacy	Multi-alignment theory and framework.	Section 1.4
101	Lee, J. H., Tan, J. Y., & Koh, W. T. H. (2025). Decarbonising data centres in Singapore.	A	Singapore – Data centres	Regional lifecycle assessment: hyperscale DCs account for substantial shares of national electricity demand and cooling loads; land and water footprints intensify local resource pressures.	Section 5.1.3

Summary by Source Type

Source Type	Count	Percent	Details

Type A (Peer-reviewed Journal)	37	36.6%	1, 3, 20, 26, 27, 28, 30, 32, 33, 34, 35, 36, 37, 43, 44, 45, 48, 50, 51, 52, 65, 66, 67, 68, 70, 74, 75, 76, 79, 80, 81, 83, 86, 96, 97, 100, 101
Type B (Conference)	0	0%	-
Type C (Government/Official)	30	29.7%	4, 5, 7, 14, 17, 18, 19, 21, 22, 25, 29, 39, 40, 41, 42, 47, 53, 56, 57, 58, 59, 60, 62, 63, 64, 72, 82, 93, 94, 99
Type D (Industry/Corporate)	8	7.9%	6, 16, 49, 55, 84, 85, 87, 91
Type E (Thesis)	0	0%	-
Type F (Book/Chapter)	3	3.0%	15, 78, 98
Type G (Media/Web)	21	20.80%	2, 8, 9, 10, 11, 12, 13, 23, 24, 31, 38, 54, 61, 69, 73, 77, 88, 89, 90, 92, 95
Type H (Methodology)	2	2.0%	46, 71
Type I (Primary Data)	0	0%	-
TOTAL	**101**	**100%**	

Summary by Geographic Focus

Geographic Focus	**Count**	**Percentage**	**Study IDs**
Malaysia (specific)	**36**	**35.6%**	1, 2, 3, 6, 7, 10, 12, 13, 16, 21, 25, 32, 34, 36, 40, 44, 47, 49, 52, 55, 56, 57, 58, 59, 60, 65, 66, 67, 68, 79, 80, 84, 85, 91, 92, 97
ASEAN (regional)	**12**	**11.9%**	4, 5, 14, 22, 45, 50, 53, 64, 72, 82, 83, 90
Global / Comparative	**30**	**29.7%**	8, 9, 15, 19, 20, 26, 27, 28, 29, 30, 33, 35, 41, 42, 48, 61, 70, 71, 73, 74, 76, 78, 81, 86, 87, 93, 94, 98, 99, 100
BRICS (bloc)	**8**	**7.9%**	11, 17, 23, 38, 54, 62, 63, 69
China / BRI (specific)	**4**	**4.0%**	24, 37, 77, 88
USA (specific)	**1**	**1.0%**	46
EU (specific)	**0**	**0.0%**	-
Others / multi-region	**10**	**9.9%**	18, 31, 39, 43, 51, 75, 89, 95, 96, 101
TOTAL	**101**	**100%**	-

Appendix A2. Summary Of Quantitative Indicators For Malaysias Real Estate And Sustainability Context (Realised Outcomes Vs Projections).

Each indicator is explicitly coded as a realised outcome (historical data) or a projection (scenario-based estimate or forecast).

NOTE ON QUANTITATIVE INDICATORS:

Interpretive Note: All indicators listed are presented as reported by the source. No additional statistical testing, calculation of effect sizes, or inferential analysis has been conducted. Values labelled as "projection," "estimate," or "forecast" are forward-looking scenarios and should not be interpreted as historical outcomes or statistically validated measures.

1. Source Transparency: All quantitative indicators listed below are directly sourced from the cited documents. No additional statistical testing (hypothesis testing, p-value calculation) was conducted by the authors of this review.

2. Data Nature: Values are derived from industry reports, government projections, or market surveys. They are presented as reported estimates and should not be interpreted as statistically validated effect sizes from experimental or quasi-experimental research designs.
3. Projection Interpretation: Where sources provide projections or forecasts, these are clearly labelled as such and should be interpreted as scenarios or market expectations, not confirmed outcomes. Historical data points represent verified reporting periods.
4. Contextual Use: These indicators provide context for policy, market, and corporate developments discussed in the review, but readers should note the inherent limitations of non-peer-reviewed commercial and governmental data sources.

ES ID	Source ID	Authors, Year, Title	Study Type	Reported Indicator (as stated by source)	Source Type	Note
ES-1	49	Knight Frank Malaysia 2025. Real Estate Market Analysis H1 2025	Market Survey	Premium-segment properties: 85% price uplift for sustainability features. Mass-market segment: 40-50% uplift.	Industry market survey	Survey-based estimate; reflects H1 2025 market conditions.
ES-2	55	MDEC (2025, February 27) Malaysia's Digital Investments Hit Record RM163.6 Billion in 2024	Sector Analysis	RM163.6 billion in approved digital investments in 2024, representing 3.5x year-on-year growth from 2023 (RM46.8 billion).	Historical outcome data for 2024	The RM163.6B reflects realised digital investment (including data centres) in 2024; any forward growth figures discussed in the text are extrapolated projections and not historical outcomes.
ES-3	13	Bernama (2025, May 22). ASEAN Summit to Potentially Unlock RM300 Bln FDIs for Malaysia Industry Analysis via Official News Agency	Industry Analysis via Official News Agency	FDI inflows projected at RM300 billion over 5-year period (2025-2030) based on anticipated 46th ASEAN Summit outcomes. Real estate sector estimated to receive RM15 billion (5% of total).	Published via Bernama official news agency	Scenario projection based on anticipated ASEAN Summit policy outcomes.
ES-4	85	S P Setia Berhad 2025. Sustainability Financing Framework & Sukuk Issuance	Corporate Report	Sukuk issuance increased 45% year-on-year; sustainability-linked sukuk growth.	Corporate sustainability report	Verified corporate activity.
ES-5	7	Bank Negara Malaysia 2025. Monetary Policy Statement Q1 2025	Official Policy Statement	Policy rate set at 2.75% to support green investment and ESG-aligned financing.	Central bank monetary policy	Direct policy action.

ES-6	58	MIDA 2025. FDI Statistics Manufacturing Q1 2025	Government Statistics	62% of FDI inflows from diversified sources (US, EU, China, GCC). Multi-source vs. concentration ratio.	Government FDI statistics	Verified FDI data.
ES ID	**Source ID**	**Authors, Year, Title**	**Study Type**	**Reported Indicator (as stated by source)**	**Source Type**	**Note**
ES-7	19	Climate Action Tracker 2025a (Sep 22). Malaysia Climate Performance Index Assessment	Global Climate Policy Assessment	Malaysia CCPI ranking: 48th (Low category). Medium GHG emissions performance; Very Low Energy Use and Climate Policy scores.	Independent climate policy tracker	Comparative international ranking.
ES-8	25	Department of Statistics Malaysia. (2025). Advance gross domestic product (GDP) estimates, first quarter 2025	Government Economic Data	Q1 2025 GDP growth: 4.4%. Projected growth range: 4.0-4.8%	Official economic statistics	Realised outcome for Q1 2025.
ES-9	99	WMO 2024. Greenhouse Gas Bulletin No. 20 & State of the Global Climate 2024	Scientific Measurements	Global CO2: exceeded pre-industrial by 151%. Malaysia CO2 emissions: 6.5 MtCO2e year-on-year; Total 277.53 MT.	Scientific/meteorological agency	Verified global and regional emissions data.
ES-10	16	BIX Malaysia 2025. Green Financing and Sukuk Market Development Report	Green Finance Market Analysis	Green sukuk comprise 28% of total sukuk market share in Malaysia. Market range estimated 25-31%.	Industry finance survey	Reported market share.
ES-11	64	Malaysia Ministry of Foreign Affairs 2025c. ASEAN Chairmanship 2025 Strategic Priorities	Government Diplomatic Briefing	35 climate-related regional agreements and commitments identified. Estimated range: 30-40 agreements.	Official government diplomatic statement	Reported diplomatic engagement.
ES-12	25	Department of Statistics Malaysia **(2025)**. Advance gross domestic product (GDP) estimates, first quarter 2025	Government Economic Data	Manufacturing growth 4.2% year-on-year, within overall Q1 2025 GDP growth of 4.4%.	Official government statistics	Realised outcome for Q1 2025; sectoral data drawn from the same release as ES-13.
ES-13	25	Department of Statistics Malaysia **(2025)**. Advance gross domestic product (GDP) estimates, first quarter 2025	Government Economic Data	Overall Q1 2025 GDP growth: 4.4%. Sectoral growth: Manufacturing (+4.2%), Services (+5.2%), Construction (+14.5%).	Official government statistics	Reported economic indicator.

ES ID	Source ID	Authors, Year, Title	Study Type	Reported Indicator (as stated by source)	Source Type	Note
ES-14	93	UNDP 2025. Emerging Markets Green Sukuk Leadership Analysis	Emerging Market Finance Survey	Malaysia holds 52% market leadership in emerging-market green sukuk. Leadership range: 48-56%.	Global finance organisation assessment	Comparative market position.
ES-15	6	Azmi Law 2025. Corporate ESG Legal Framework & Compliance Requirements (Malaysia Context)	Regulatory Legal Analysis	Listed companies' ESG compliance rate: 95-100% mandatory implementation across listed entities following 2025 regulations.	Corporate legal framework analysis	Regulatory compliance indicator.

Note: Each indicator in this appendix is labelled either as a realised outcome (historical data already observed) or as a projection (scenario-based estimate or forecast) to distinguish confirmed results from forward-looking scenarios.

APPENDIX A3 – SAMPLE CODING MATRIX EXTRACT

The IDs in this illustrative matrix correspond to the reference numbers in Appendix A1. Cross-references in the "Use in Synthesis" column point to sections and ES-codes. This appendix provides an illustrative extract of the coding matrix used to organise and synthesise the 101 included sources. The full matrix contains additional fields and all studies.

ID	Author(s), Year (short form)	Type	Sector / Sub-sector Focus	Geographic Scope	Main Theme / Dimension	Key Method / Data Type	Use in Synthesis (Section)
1	Ab. Rahim & Md Ali, 2024	A	Office buildings, operational energy use	Malaysia	BEI performance of green vs conventional offices	Quantitative BEI benchmarking (5-year panel)	5.2.1 energy performance
2	Abdul Aziz, 2024	G	Malaysia – Policy	Malaysia	Budget expectations for real estate	News analysis	5.1.2 market conditions
25	DOSM, 2025	C	Macro-economy, construction, services	Malaysia	GDP growth and sectoral dynamics	Official statistics (time series)	5.1.2, ES-12, ES-13
34	Habibullah et al., 2023	A	Water efficiency in GBI offices	Malaysia	RWH+GWR performance (28.11% freshwater saving)	BCS-monitored field study	5.2.1 water performance
40	ISIS Malaysia, 2025	C	Data centres, digital infrastructure	Malaysia	Water-use regulation for data centres	Policy / regulatory	5.1.3 data-centre sustainability

						analysis	
44	Jaffar et al., 2022	A	Green building implementation (contractors)	Malaysia	Barriers to GBI adoption	Quantitative survey (n=150)	6.1 green building barriers
45	Jamaludin & Razali, 2024	A	Listed property companies, corporate ESG	ASEAN (focus Malaysia)	ESG implementation and disclosure quality	Quantitative panel / PCA analysis	2.3 corporate ESG practice
49	Knight Frank, 2025	D	Residential and commercial real estate	Malaysia (H1 2025)	Market price premiums and sustainability positioning in Malaysian real estate (ES-1)	Market survey / price analysis	5.3 market signals, ES-1
52	Lee & Rusli, 2025	A	Data centres, site selection	Malaysia (Johor)	Suitability mapping for data-centre locations	AHP-GIS multi-criteria analysis	5.1.3 data-centre siting
65	Mohd Rahim et al., 2024	A	GBI institutional effectiveness	Malaysia (Putrajaya)	Factors contributing to GBI effectiveness	Quantitative survey (n=320)	5.2.1 GBI effectiveness
ID	**Author(s), Year (short form)**	**Type**	**Sector / Sub-sector Focus**	**Geographic Scope**	**Main Theme / Dimension**	**Key Method / Data Type**	**Use in Synthesis (Section)**
68	Najid et al., 2024	A	Green/Islamic finance, capital markets	Malaysia	Integration of Islamic finance with ESG	Mixed-methods (survey + documents)	2.3 green finance architecture
79	Shaardan et al., 2025a	A	Green buildings, energy-performance gaps	Malaysia	Expert perceptions of BEPG root causes	Quantitative expert survey (n=278)	5.2.1 BEPG causes
80	Shaardan et al., 2025b	A	Non-residential green buildings	Malaysia	Causes and drivers of BEPG	PLS-SEM & Relative Importance Index	5.2.1 operational causes
83	Sohaimi et al., 2023	A	Green housing / home technology	ASEAN (SG, MY, ID, TH)	Adoption of green home technologies	Comparative review	5.2.1 regional context
96	Wan Mohammad et al., 2023	A	Non-financial firms, capital costs	Emerging markets (incl. Malaysia)	ESG disclosure, governance and cost of capital	Panel regression	5.2.3 ESG and cost of capital

100	Xiao, 2025	A	Global – Diplomacy	Global	Multi-alignment theory	Theoretical framework	1.4 multi-alignment strategy

Source: Authors' coding based on full-text review of included studies and reports.
Source type codes (A–H) follow the legend provided in Appendix A1.

EUI — Energy Use Intensity (Singapore BCA benchmarking metric; gross-floor-area-normalised equivalent of the Malaysian BEI, expressed in kWh/m²/yr)

Note: TCFD and GRI are distinct disclosure instruments that operationalise the broader ESG framework; they are not interchangeable and are treated as separate entities throughout this review.