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Original Article

Analyzing the Attainment of Sustainable Development Goals in Construction Industry: A Case of a Developing Economy

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Abstract - *The construction industry plays a key role in economic development, infrastructure creation, employment generation, and innovation. However, it faces sustainability challenges, particularly in developing nations. This study examines the contribution of a developing country's construction industry towards achieving Sustainable Development Goals (SDGs). A quantitative approach was used, with a questionnaire survey targeting industry professionals from contractor and consultant organizations. A sample of 153 responses was analyzed using the Relative Importance Index (RII) and One-way Analysis of Variance (ANOVA) tests, based on a minimum sample size of 96 with a 90% confidence level and a 5% margin of error. The RII results revealed that the factor "sorting and recycling of materials as a potential waste minimization strategy" ranked highest with an RII value of 0.850, while the lowest ranked factor was "contribution to enhancing the quality of lifestyle" (RII = 0.796). The ANOVA test showed no statistically significant difference (p-value = 0.981) in the mean RII values across four categories: environmental conditions, carbon footprint reduction, improved structures, and quality of lifestyle, all critical for achieving SDGs in developing nations. The findings provide valuable insights for policymakers, industry leaders, and stakeholders to guide efforts towards achieving SDGs in the construction industry more effectively.*

Keywords - *Construction industry, Sustainability, Sustainable Development Goals, Developing Economies.*

1. Introduction

The growth of any nation in the world is essentially supported by the construction industry, a sector that incorporates a wide range of operations relating to the planning, extension, and maintenance of infrastructure, premises, and various other physical properties. The impact of the industry on the social environment is immense, both in terms of houses and commercial buildings, and in the development of highways, bridges, and dams. It is central to the development of infrastructure, creating job opportunities and catalyzing economic growth, as stressed by Fei et al. [1], [2]. Moreover, Ochuba et al. [3] illustrate that the industry stimulates investment, makes employment easier, and boosts innovation in various industries. Interestingly, the quality of life and the competitive advantage of a country directly depend on the accessibility and quality of infrastructure existing in it. Goubran [4], the suggests that the general flow of a construction project is generally conceptualization, designing, pre-construction planning, procurement, executing the construction project, and handing over the project each of which involves a wide variety of activities, e.g. site assessment, applying permits, conducting budgeting, planning, material procurement, preparation of site, construction work, quality assurance, and safety management.

The interconnection between sustainability and construction is profound and multifaceted, underscoring the urgency of adopting sustainable practices to mitigate environmental impact, conserve resources, and foster the building of healthier and more efficient structures and infrastructure, particularly as the sector continues to expand and evolve [5]. It is demonstrated that the construction business enhances building energy efficiency in multiple

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aspects: more efficient energy insulation, improved Heating, Ventilation, and Air Conditioning (HVAC) engineering, light-efficient energy sources, and intelligent devices that monitor and control the energy consumption [6].

Consequently, sustainable construction practices are meant to reduce the use of energy. One of the biggest concerns of construction is waste, but sustainable processes decrease waste due to prudent planning, wise material selection, and waste management strategies like recycling construction waste, reuse, and reducing unnecessary waste. The furnishing is made of renewable resources that are environmentally-friendly, such as reused materials, timber ethically sourced, low-emission materials, and non-toxic substances that enhance the indoor air quality [1]. Due to the fact that material production is a source of carbon and climate change, there is also sustainable construction that aims at reducing the embodied carbon of building materials.

This research paper looks at how the construction industry can assist the developing economies in achieving the Sustainable Development Goals (SDGs) and, at the same time, adjust to the isolated situational realities of the emerging markets. Traditional models of sustainable construction, such as Leadership in Energy and Environmental Design (LEED) [7] and Building Research Establishment Environmental Assessment Method (BREEAM) [8] accreditation systems, have largely been developed in the context of the developed economies where financial resources, technical knowledge, and regulatory frameworks are deeply institutionalised. Similarly, systems strategies such as compulsory green building regulations, schemes of carbon taxation [9], and prescriptive energy performance regulations assume strong institutional competencies and enforcement provisions, which are often immature or ad hoc in developing jurisdictions. In addition, the existing frameworks often focus on the high-cost technological options, such as high-technological photovoltaic systems [10], advanced building management systems [11], and imported environmentally friendly materials [12], which means that they place significant financial burdens on the stakeholders who have to work within the context of resource constraints. To acknowledge these limitations, the study described below provides new channels through which SDG can be integrated through a series of contextually relevant strategic interventions. To begin with, it is suggested to use a staged implementation model, where SDGs will be prioritised on the basis of the capacity and available resources of a sector, thus allowing the construction stakeholders to focus on the achievable sustainability goals before proceeding to more challenging ones. Second, the research proposes the creation of the model of the public-private partnership that is clearly designed to share the financial cost of the adoption of sustainable technology and eliminate the capital limitation that regularly hinders green construction activity. Third, a capacity-building approach is presented, which focuses on local training programmes and knowledge-transfer systems to improve workforce skills in sustainable construction approaches without excessively depending on the expensive foreign experience. Fourth, the study suggests that modified regulatory frameworks with flexibility and incentives should be developed as opposed to the strict compliance standards that are typical of the Western certification systems. Fifth, it is suggested that stakeholder integration platforms can be used to promote open communication and coordination among government agencies, contractors, developers and community representatives and break down the institutional silos that currently divide sustainability initiatives. By combining these context-specific strategies with high-quality quantitative data, the current research overcomes the shortcomings of the previous studies which only entail the implantation of the developed-world solutions into the developing-economy setting, thus providing the detailed blueprint according to which the countries like Malaysia can coordinate their construction industries to the global sustainability interests and at the same time, respond to their specific developmental needs, economic limitations, and institutional potentials.

Nevertheless, the Malaysian construction industry faces numerous challenges that hinder its orientation to sustainable development goals, which are aimed at the Sustainable Development Goals (SDGs), established by the United Nations (UN). Although the rising awareness of the issues of sustainability demands a discussion on how to improve sustainability practices within the Malaysian construction industry, the latter still struggles with the low adoption of sustainability practices in the construction industry [13]. There is a persistent tendency to apply traditional construction processes and materials and, thus, continue to suffer negative environmental consequences in terms of increasing carbon emissions, use of resources, and waste production. The shift of the industry towards more sustainable practices is faced with barriers because of the lack of a comprehensive regulatory system and the absence of sufficient mechanisms of incentivization that could stimulate sustainable construction practices [14]. Inconsistency in taking sustainability actions and high levels of unaccountability in the construction ecosystem can be explained by a lack of explicitly defined rules and norms.

Although it is impossible to ignore the need to inject more focus on social sustainability in the Malaysian construction industry, it is important to emphasise herein that environmental sustainability will always be an essential element of the larger, more encompassing sustainable development scenario [15]. Unfortunately, other problems like employee safety, labour rights, and community participation are not given much consideration in the Malaysian construction environment, thus negating its broader progress towards the achievement of sustainable development goals [16]. The different stakeholders in the construction sector, such as the government, developers, contractors, and consultants, exist in a complex system where interplay and integration are not optimally maintained, thereby hindering the unified push towards sustainable development. The coordination and communication between such heterogeneous stakeholders often remain uncoordinated and suboptimal, which leads to fragmentation and less-than-optimal sustainability outcomes. Moreover, the economic limitations of the construction industry worsen the situation, and environmentally friendly building methods are sometimes seen as too expensive [17]. Nonetheless, Iqbal et al. [18] pointed out that the initial heavy investments in the sector limit its readiness to adopt sustainable practices required to acquire sustainable materials and technologies, aggravated by the lack of sustained awareness of the ultimate cost-effectiveness that sustainable practices can achieve. The aversive economic hurdles are still impeding the fully-fledged deployment of sustainable options in the building sector.

In spite of the increasing literature on the significance of sustainability in construction, it is conspicuously missing the knowledge on how developing economies, especially Malaysia, can systematically incorporate and quantify their progress in attaining their Sustainable Development Goals in their construction sectors. Although the literature has extensively reported sustainability issues and obstacles, there is a lack of empirical, quantitative evaluations that specifically look at the real contribution of the construction industry towards the achievement of SDGs in relation to developing countries. It is especially alarming in light of the fact that current studies have mostly concentrated on conceptual frameworks and qualitative methods, leaving policymakers and the leaders of the industry with no tangible and data-driven insights to inform their sustainability efforts. Moreover, the lack of a detailed, practical framework specifically designed to fit the socio-economic and regulatory environment of a developing economy, such as Malaysia, implies that stakeholders do not have the practical instruments with which to turn sustainability ambitions into tangible results. As a result, this research paper fills these critical gaps by providing rigorous quantitative research into how the construction industry can promote Malaysia SDGs, and at the same time, comes up with a strategic framework that can bridge the gap between the theoretical sustainability discourse and practical application to provide the decision-makers with the evidence-based approach to create a meaningful sustainable change in the construction sector.

2. Materials and Methods

The research paper employed the use of a quantitative method to collect data with the aim of scrutinizing the contribution of the Malaysian construction industry to the realization of the SDGs sufficiently. Figure 1 presents a methodology flowchart that has been adopted in the present study. This approach was adopted to assess the level of industry participation in sustainable activities and how it had affected the journey towards the SDGs in Malaysia. A pilot study of sorts was conducted to determine the adequacy, readability, and validity of the questionnaire instrument. Thus, the pilot study involved a well-designed but representative sample of the target populations in the research, which were the construction professionals, who were members of contractors and consultants. The lessons learnt during the pilot study have been utilized to improve the questionnaire tool and increase its reliability. To determine the perceived significance of the construction industry in contributing to the sustainable development goals of Malaysia, a primary questionnaire survey was designed to evaluate and identify important determinants that would shape the implementation of this contribution. The survey questionnaire has been designed into different categories, including the demographic data of participants, current sustainable practices within the industry, difficulties experienced, and opportunities that can be used to improve these. Key stakeholders in the construction sector, including industry players and policymakers, were used to provide the quantitative data to get a broad perspective of their take regarding what is currently being done in terms of being sustainable within the sector, the challenges that have been encountered, and the future plans to enable the industry to further contribute towards SDG achievements in Malaysia. The utilization of the quantitative approach was favoured due to its flexibility, facilitating a profound exploration and comprehensive collection of contextual observations.

Additionally, Table 1 summarizes and presents the identified factors under four categories, such as enhancing environmental conditions, reducing carbon footprints, developing superior and improved structures, and enhancing quality of life.

The data were collected from industry professionals affiliated with contractors and consultants who possess substantial experience and proficiency in the Malaysian construction industry. To secure a representative sample, the sample size was computed utilizing Andrew Fisher's formula [19], as shown in Equation 1 for populations with unidentified characteristics, predicated on a confidence level of 90% and a margin of error of 5%. Nevertheless, the distribution of questionnaires exceeded the initially stipulated sample size to generate more expansive findings.

$$Sample\ size = \frac{(Z-score)^2 \times StdDev \times (1-StdDev)}{(Confidence\ interval)^2} \quad (1)$$

The term's score, commonly referred to as the 'standard score,' is closely linked to the concept of assurance level within a statistical analysis. In essence, when a random sample is taken from a population, the confidence level represents the probability that the confidence interval constructed from the sample will encompass the true population parameter in numerous repetitions of the sampling process. The z-score is a statistic that shows the position of a raw score or percentage against the mean of the population, expressed in standard deviations. In this survey of the experts in the construction industry, we do not have access to 100 percent of the population, and hence we have a confidence level, which we set to 90 percent [20]. The z-score is 1.65 with a standard deviation of 0.5. The level of error of the confidence interval is 5%. The sample size is 273. In fact, we distributed a larger number of questionnaires compared to the intended sample in a bid to enhance reliability and strength.

The questionnaire was sent through multi-stage systematic validation in order to attain reliability and validity. First, it has a solid theoretical basis of the instrument and content validity since it was constructed based on a thorough literature review and earlier measurement scales used in prior sustainability studies. The draft was reviewed by two professional reviewers comprising five construction management and sustainability academic experts, as well as three industry practitioners who have vast expertise in sustainable construction. Their feedback was used to make amends that made them relevant, clear, and comprehensive. An expert validation was followed by the pilot study with non-main characters in the study who were construction experts. Upon pilot testing, the given data has enabled us to evaluate the internal consistency through Cronbach's alpha pertinent to our instrument, which is more than 0.70, thereby proving that the instrument is reliable. The pilot, as well, employed the exploratory factor analysis as a test of the construct validity and to ensure that survey items loaded as they were supposed to be loaded onto the desirable constructs that they were targeted at. According to the pilot results, small adjustments were made to improve the phrasing of questions and the suitability of the response scale. This extensive validation procedure, which can be detailed in the methodology section where necessary, is what guarantees that the survey instrument is both theoretically sound and practically applicable in measuring SDG attainment in the construction context.

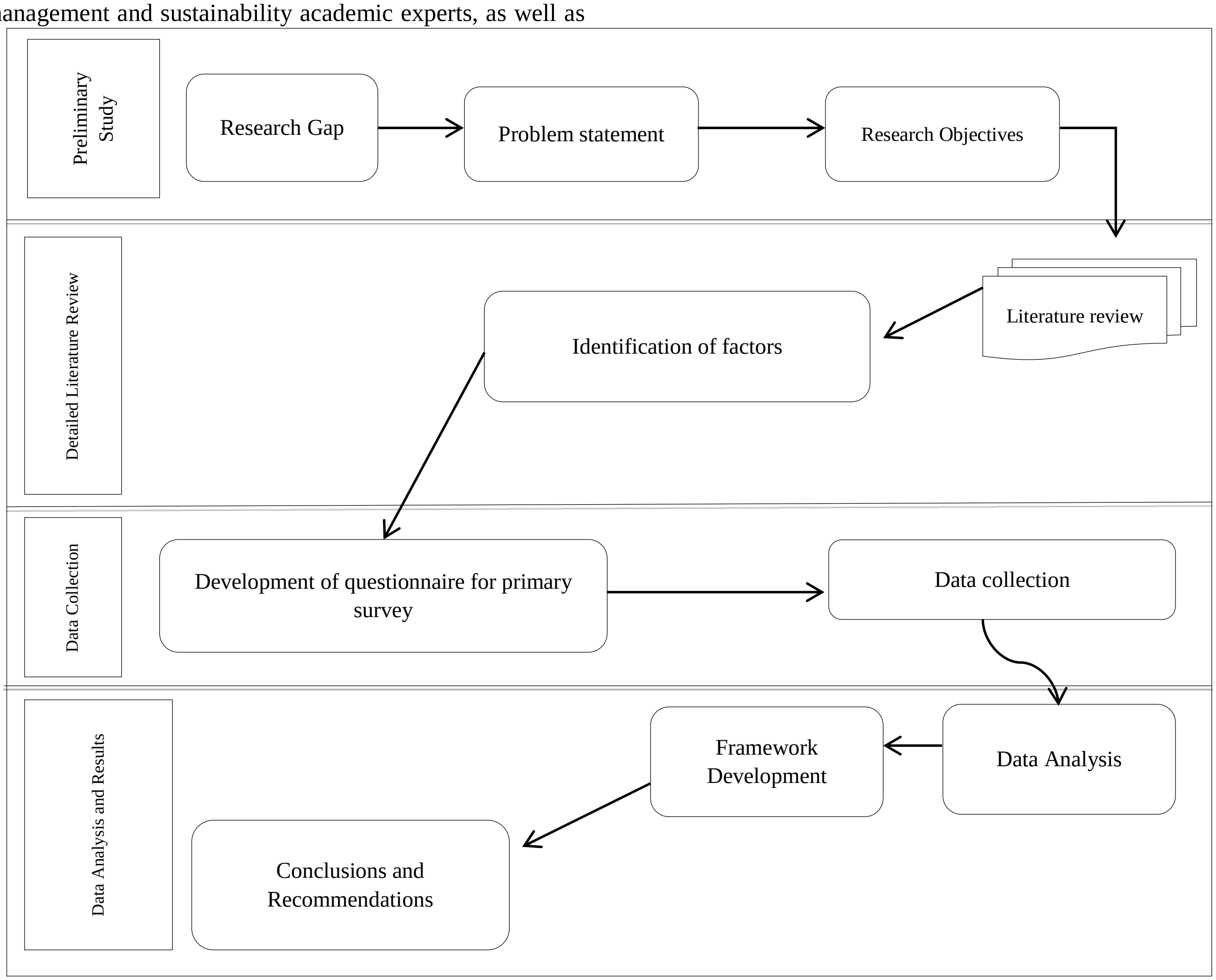

Fig. 1 Methodology flowchart

2.1. Relative Importance Index (RII)

The RII is an important statistical tool used in academic and scientific research practice to evaluate and measure the importance of various variables or factors that influence a given result under investigation. The approach allows scholars and researchers to quantify and rank the effects of all variables of a certain context, accurately assigning numerical values to every question as the result of careful survey completion or intensive data processing operations [20]. Consequently, the RII is carefully calculated by dividing the average score of each variable by the total result of all the average scores, thus providing a standardized instrument of relative rankings of importance. This index is incredibly beneficial in terms of identifying all vital factors or predictors deeply rooted in the specified dataset, thus allowing the researchers to employ their focus and their resources into the most effective variables that should be targeted. By employing the effective use of the RII, experienced practitioners can give sound decisions based on empirical data rather than on subjective opinion, and the result is that more accurate, reliable, and sound results over a vast range of academic subjects, including but not limited to the fields of marketing, psychology, economics, and social sciences will be produced [21]. To measure the RII values, Equation 2 was used in the present study:

$$Relative\ Importance\ Index\ (RII) = \sum \frac{W}{(A \times N)} \quad (2)$$

Where W is the weight of each factor, A is the highest weight of the factor, and N is the sum of the respondents.

Table 1. Identified factors from literature

No.	Identified Factors	References
	Enhance Environmental Conditions	
1	A proactive strategy for preserving limited natural resources and safeguarding ecosystems for the next generations is environmental sustainability.	[22]
2	Focuses on separating resource use and environmental deterioration from economic growth without negatively affecting people	[1]
3	It takes focused efforts to preserve, restore, and encourage the conservation and sustainable use of the ecosystem to preserve the variety of life forms that exist on land.	[1]
4	Make sure everyone has access to modern, affordable, dependable, and sustainable energy.	[1]
5	Minimizing the effects on the environment by using less water and energy	[23]
6	Minimizing the impact of the construction site on the environment	[23]
7	How can green buildings help accomplish the SDGs and provide a practical mapping tool that uses the Green Building Rating Tool (GRBT) as the average to evaluate the impact?	[23]
8	Decreasing the need for primary energy and increasing the usage of renewable energy	[23]
9	Water-related ecosystems, such as wetlands, rivers, aquifers, lakes, mountains, and forests, should be preserved and restored.	[4]
10	Enhancing HVAC systems, improving insulation, and putting passive design principles into practice	[24]
11	Heating and cooling systems, and contrast them with the set rules and requirements for energy efficiency	[24]
12	Managing the temperature by considering variables including air, temperature, relative humidity, and air velocity	[24]
13	Prevent and drastically cut down on all forms of marine pollution caused by activities that are done on land.	[4]
14	Constructing new facilities to upgrade current structures and infrastructure, and boost the resilience of locations	[4]
15	Enacting laws, guidelines, and certifications like the Forest Stewardship Council (FSC) in the building industry to guarantee the sustainable management of forests	[4]
	Reducing Carbon Footprints	
1	Businesses can accomplish this SDG by increasing energy efficiency and decarbonizing their supply chains and operations.	[4]
2	Reducing the emission of GHGs and other pollutants	[23]

3	The building industry has examined sorting and recycling materials as a possible waste-minimization approach.	[22]
4	Reduce its environmental effects by, for example, building responsibly and making sure that all operations and activities adhere to sustainability guidelines.	[22]
5	Reusing items instead of discarding them when their useful lives are coming to an end	[22]
6	By incorporating a circular design throughout a product's lifecycle, material closed loops can be accomplished.	[22]
7	Businesses can accomplish this goal by lowering the carbon footprint of their goods.	[1]
Developing Superior and Improved Structures		
1	Building robust infrastructure, encouraging equitable and sustainable industrialization, and stimulating innovation are all important tasks carried out by the construction sector.	[1]
2	Encourage equitable employment and economic expansion by achieving full and productive employment, decent work for all by 2030, and consistent, inclusive, and sustainable economic growth	[1]
3	Prefabrication and lean construction are two strategies that could be employed to attain material circularity.	[22]
4	Facilitating equal access to essential infrastructure (electricity, finance, and training) and expanding land access	[4]
5	Both new facility construction and associated network upgrades	[4]
Enhance Quality Lifestyle		
1	Important objective because poor housing has a detrimental effect on urban fairness and inclusion, safety, and possibilities for a livelihood, and poor health	[1]
2	Despite its reputation for being labor-intensive and frequently providing subpar working conditions, the construction sector can improve people's health and well-being.	[1]
3	Enhancing human health by creating wholesome interior spaces	[23]
4	Measurement instruments have been created to quantify the quantity of waste generated and energy used in construction projects.	[22]
5	Reduce the premature death rate from Non-Communicable Diseases (NCDs) by one-third through treatment and prevention, and advance mental health and wellness.	[4]
6	Encourage businesses, particularly large and multinational corporations, to use sustainable practices and incorporate sustainability information.	[4]
7	Encourage sustainable public procurement methods that align with national policies and priorities.	[4]
8	Construction of buildings, urban infrastructure, and site development. It also involves expanding and improving the infrastructure and metropolitan areas that are already there.	[4]

2.2. Analysis of Variance Test (ANOVA)

The ANOVA test is a statistical method that is used in the comparison of the differences between the means of two or more groups with the aim of determining whether there exist significant differences. It works by calculating the variance of each group and then comparing it with the variation between the groups. Based on the investigation of the test metrics, ANOVA can determine whether the variability in the means is due to chance differences or whether they are statistically significant [20]. The test has gained popularity in numerous fields of research, including psychology, biology, and economics, as a tool to compare the effect of treatment, assess the results of experiments, and reveal the connection between the variables [25]. In addition, ANOVA plays the role of a window into finding out invaluable information about the underlying nature of patterns and trends in the sets of data, thus enabling them to make sensible choices and craft sound conclusions based on a statistically valid assumption. Incorporating ANOVA as a part of the data analysis framework, the practitioners will learn to skilfully identify the impact of various factors on results and to make evidence-based proposals concerning their future study or intervention [26]. Therefore, the present research will perform an ANOVA test on the results acquired using the RII values. The factors employed in RII are categorized into four groups, and these groups are: Enhance Environmental Conditions, Reduce Carbon Footprints, Develop Superior and improved Structures, and Enhance Quality Lifestyle.

RII of these categories takes a careful process, as each category is thoroughly examined to come up with its relevance. After this calculation, one-way ANOVA was performed, which was thorough and was conducted via MS Excel®, hence ensuring accuracy and reliability of the results.

H0- There is a statistically significant difference in the average RII values across the groups under consideration.
H1- There is no statistically significant difference in the average RII values across the groups under consideration.
If the calculated p-value is below the predetermined significance threshold, typically set at 0.05, to ensure a high level of statistical confidence, researchers are compelled to reject the null hypothesis. This rejection signifies a pivotal finding, indicating the presence of statistically significant disparities in the average RII values across the different groups under investigation. On the contrary, if the computed p-value surpasses the designated significance level, researchers are advised against rejecting the null hypothesis. This scenario suggests that the data does not provide sufficient evidence to support the presence of statistically significant differences in the mean RII values between the various groups, leading to a more nuanced interpretation of the results.

3. Results and Discussion

3.1. Respondent's Demographics

As shown in Table 2, out of 153 respondents, most respondents have a bachelor's degree (75%), and the remaining have a master's degree (20%) and a doctorate (5%). 66% of the respondents work as site engineers. Meanwhile, the remaining respondents work as project managers (18%) and office engineers (16%).

The total work experience of the respondents averages from 5 to 15 years. Most of the respondents are from the contractor company background (70%); meanwhile, the remaining are from the consultant company (30%). Most of the respondents work in companies that are 10 to 20 years old (51%) and institutions with sizes from 10 to less than 20 employees (54%).

Table 2. Respondents' data

Overall Information	Number	Percentage
Education Level		
Bachelor's Degree	115	75.0
Master's Degree	30	20.0
Doctorate Degree	8	5.0
Designation		
Project Manager	28	18.0
Site Engineer	100	66.0
Office Engineer	25	16.0
Total Work Experience (Years)		
Less than 5	29	19.0
From 5 to less than 10	88	58.0
From 10 to less than 15	27	18.0
More than 15	8	5.0
Institution Type		
Contractor Company	106	70.0
Consultant Company	46	30.0
Company Years of Establishment (Years)		
Less than 10	24	16.0
From 10 to less than 20	78	51.0
From 20 to less than 30	45	29.0
More than 30	6	4.0
Institution Size (Number of Employees)		
Less than 10	21	14.0
From 10 to less than 20	83	54.0
From 20 to less than 50	39	25.0
More than 50	10	7.0

3.2. Reliability Analysis

According to the reliability test findings conducted through SPSS® software, Cronbach's alpha value was calculated as 0.819, which falls under the range of 0.7 to 0.9. Any number that falls under the range of 0.7 to 0.9 is reliable for further inferential analysis.

3.3. Ranking the Factors

The findings illustrated in Table 3 serve to emphasize the relative ranking of factors as determined through RII analysis, shedding light on the various elements at play. The questionnaire, encompassing a total of 27 factors, was divided into four categories for comprehensive evaluation. In the process of analyzing the results, it became evident that the factor deemed most significant in contributing to the crucial role of construction in attaining the SDG in Malaysia is the concept of "The construction industry has considered sorting and recycling of materials as a potential waste minimization strategy," with the highest RII value of 0.850. This factor was singled out as the most pertinent and impactful regarding the overarching goal of the construction sector in Malaysia in relation to the SDG. Following closely behind, the factors that secured the second and third rank were identified as "Improving access to land and ensuring equal access to basic infrastructures" (RII= 0.841) and "Utilizing lean construction and prefabrication as viable methods for achieving material circularity" (RII= 0.837), respectively. The lowest RII value (0.796) is attributed to the "Construction industry's contribution to enhancing the quality of lifestyle, a significant factor in progressing towards the fulfilment of SDGs". Furthermore, the highest mean RII is obtained by reducing carbon emissions (RII= 0.821), thus signifying the importance of minimizing carbon emissions in the achievement of SDGs in Malaysian construction projects.

3.4. One-Way ANOVA Test

A one-way ANOVA test was conducted on the results derived from the RII values. The 27 factors that were identified and selected from existing literature sources, subsequently utilized in the ongoing research investigation, were categorically segregated into four groups after the completion of the RII assessment process. This categorization was inherently subjective in nature, thereby implying that the factors were allocated to their respective groupings based on the personal judgment and expertise of the researchers, in addition to the comprehensive and rigorous group deliberations that took place. The mean RII values were computed as part of the analytical procedure, and leveraging the data provided in Table 3, the outcomes stemming from the ANOVA evaluation have been systematically outlined and detailed within Table 4.

Table 3. RII findings

No	Item	RII (%)	Rank	Mean RII
F01	**Enhance Environmental Conditions**			
1	Environmental sustainability is a proactive approach to conserving finite natural resources while also protecting ecosystems for future generations	0.826	10	0.816
2	Ensure access to affordable, reliable, sustainable, and modern energy for all	0.814	15	
3	Minimizing environmental impacts through reduced energy and water consumption	0.811	17	
4	Prevent and significantly reduce marine pollution of all kinds from land-based activities	0.81	18	
5	The construction industry's sustainable practices can significantly contribute to improving environmental conditions aligned with the SDGs	0.818	11	
6	The construction industry's efforts to enhance environmental sustainability have a positive impact on the achievement of SDGs positively	0.817	12	
F02	**Reducing Carbon Footprints**			
7	The construction industry has considered sorting and recycling of materials as a potential waste minimization strategy	0.85	1	0.821
8	Regeneration of products rather than their disposal at the end of their lives	0.812	16	
9	Companies should be able to reduce the carbon footprint of their products	0.803	22	
10	Integrating a circular design in the lifecycle of a product, material closed loops can be achieved	0.827	8	
11	Lean construction and prefabrication are possible methods that can be used to achieve material circularity	0.837	3	
12	The construction industry's active commitment to reducing carbon footprints is likely to contribute to the successful realization of SDGs	0.816	13	
13	The adoption of low-carbon construction methods by the industry effectively aids in reducing carbon footprints as part of SDG attainment	0.802	23	
F03	**Developing Superior and Improved Structures**			
14	The construction industry has a key role in building resilient infrastructure, promoting inclusive and sustainable industrialization, and fostering innovation	0.834	6	0.820

15	Improve access to land and ensure equal access to basic infrastructures	0.841	2	
16	Improvements in the infrastructure networks, as well as building new facilities	0.797	26	
17	Advancements in construction technologies and practices lead to the creation of improved structures that align with SDGs	0.807	20	
F04	**Enhance Quality Lifestyle**			
18	The construction industry currently plays a substantial role in successfully achieving sustainable goal development	0.835	5	0.815
19	A growing trend within the construction industry is to prioritize and invest in sustainable initiatives	0.809	19	
20	Improving human health through the design of healthy indoor environments	0.831	7	
21	Measuring tools have been developed to determine the amount of waste produced and energy usage resulting from construction activities	0.827	9	
22	This is a critical goal because inadequate housing negatively impacts urban equity and inclusion, safety, and livelihood opportunities, and negative health conditions	0.801	24	
23	The construction industry’s emphasis on creating livable and sustainable communities has a positive impact on enhancing the quality of life in line with the SDGs	0.816	14	
24	The construction industry’s contribution to enhancing the quality of life is a significant factor in progressing towards the fulfilment of SDGs	0.796	27	
25	Is the limited contribution of the construction industry a significant hindrance to the progress of sustainable goal development	0.804	21	
26	The construction industry’s limited contribution can be attributed to a lack of awareness about sustainable practices	0.835	4	
27	Increasing investment in research and innovation likely leads to a more substantial construction industry that is moving towards sustainable goal development.	0.799	25	

Table 4. One-way ANOVA test findings

ANOVA						
Source of Variation	**SS**	**df**	**MS**	**F**	**P-value**	**F crit**
Between Groups	3.55E-05	3	1.18E-05	0.059	0.981	3.13
Within Groups	0.003796	19	0.0002			
Total	0.003831	22				

The findings suggest that the p-value under consideration, denoted as 0.981, exceeds the commonly accepted significance level of 0.05.

Consequently, the null hypothesis cannot be rejected, which indicates that the means of the four groups - Enhance Environmental Conditions, Reduce Carbon Footprints, Develop Superior and Improved Structures, and Enhance Quality Lifestyle - cannot be considered significantly different. Moreover, a comparison between the F critical value (3.13) and the F-statistic (0.059) can also be made.

If the F-statistics exceed the F critical value, the null hypothesis can be rejected. However, in this case, the F-statistics are lower than the F critical value, thus supporting the conclusion that there exists no statistically significant difference in the means of the four groups. Consequently, since the p-value (0.981) exceeds the significance level of 0.05, the null hypothesis (H0) cannot be rejected.

This implies that there is insufficient data to conclude that the average RII values for the four groups - enhance environmental conditions, reduce carbon footprints, develop superior and improved structures, and enhance quality of life - differ significantly. In other words, based on the one-way ANOVA results, it can be deduced that there is no statistically significant difference in the average RII values related to the four categories of characteristics associated with the construction industry’s contribution to the attainment of sustainable development goals in Malaysia, and all four categories play a crucial role in SDGs attainment.

3.5. Discussion and Conceptual Framework

This research is designed with the primary objective of conducting an in-depth Evaluation of the Role that the Construction Industry plays in contributing towards the Attainment of SDGs in the context of Malaysia. To fulfil this overarching objective, a series of methodological approaches were employed, including the administration of questionnaires and the execution of case studies aimed at scrutinizing the various impediments and enablers that influence the realization of sustainable development goals within the Malaysian context. Drawing upon the insights garnered from the data collected through the questionnaire survey, a comprehensive inventory of all identified factors was meticulously compiled, followed by rigorous analysis and evaluation of these factors. Afterwards, a systematic structure, as exhibited in Figure 2, was worked out carefully to integrate and discuss the significant findings obtained based on the assessments carried out, thus reaching a comprehensive conclusion encompassing the full results of the work that was done in this research study.

The challenges presented in the given framework are multiple and clearly indicate that the existing baseline of the successful realization of SDGs in terms of the construction industry is quite slender. This analysis indicates a long-term tendency toward obtaining the established benchmark, which emphasizes the importance of the topic in focus. Consequently, Opoku [27] also stated that the construction industry needs to reevaluate priorities and increase its commitment to incorporating the SDGs in every aspect and on every level of construction operations. However, Kivilä et al. [28] are of the view that continuous focus on sustainability is central during initial planning and at the final project delivery stage. Results of this study show that achieving the SDGs is an evolutionary and repetitive process within the construction sector, and requires constant improvement and determination. Similarly, Holmberg and Larsson [29] gave their opinion in their work that, given the knowledge of the urgency of such a perpetual journey, institutions must integrate SDGs into the foundation of their planning frameworks in construction.

By doing so, as indicated by Buniamin [30], such businesses will not only have a massive contribution with regard to the SDGs but will also find themselves in a critical role in helping Malaysia achieve its larger mission of realizing sustainability by 2030. In essence, to integrate SDGs in the construction lifecycle is a strategic requirement, which requires a paradigm change towards the design, organization, and implementation of a construction idea [28]. The fact that the companies display the capacity to prioritize and implement sustainability targets in their practice can be seen as an indication that the companies are committed to the global goals, but also proactively oriented towards the Malaysian national strategy. The building sector can assist in changing urban areas by broadening the perspective of sustainable development and leaving a trail of responsible, versatile, and sustainable infrastructures for future generations [1].

Besides leading to sustainability, the governments of the regions ought to establish an overhauling scheme that establishes clear standards and policies for both large firms and small projects in the construction industry. The model provides an orderly way through which companies would be able to align their activities with SDGs as set by the UN. The framework can also help enshrine the significance of construction towards the accomplishment of the SDGs and serve as a driver towards universal compliance of the industry by setting standards and performance pointers. According to Jobidon [31], the governmental agencies could serve their expectations well by initiating a clear framework, which would inform any construction establishment of the direction they should take to be part of sustainable development in terms of size and scale.

The framework of the study handles the elements that influence the involvement of the construction industry in the SDGs and the challenges that can be encountered. Such a close relation demonstrates the form of change, and this means that the building industry can contribute to the achievement of the grand SDG objectives by 2030. Congruence in influencing factors and barriers is a strategic alternative in defeating constraints so as to encourage the sustainability of construction practices. The advantages that such alignment has are not only to the industry but also greatly enhance the quality of life of the general population and workers in the construction sector [31]. The application of SDGs can transform the living and working situations where cultures that favor well-being and social good are encouraged. This change gives more emphasis on social sustainability. Adherence to SDG principles can additionally help the building industry to minimize its carbon footprint, which will raise the level of social and environmental resilience [4]. By adopting sustainable approaches, the industry can contribute to expanding the social mission of climate change mitigation and ecological balance. The positive implications are better health and the general welfare of the community. Besides social and environmental values, the integration of SDGs into the thinking of the construction industry can trigger the growth of economies and performance [14]. By proactively adopting the factors identified within the research framework, these elements come to act as conduits of innovation, efficiency, and long-term financial sustainability. Nevertheless, the Malaysian construction industry experiences investment deprivation in Research and Development (R&D) despite the government's efforts to foster this investment, illustrated in Figure 2. This is mostly lacking due to the domination of Small and Medium-sized Enterprises (SMEs) in the market, which compete with scant resources.

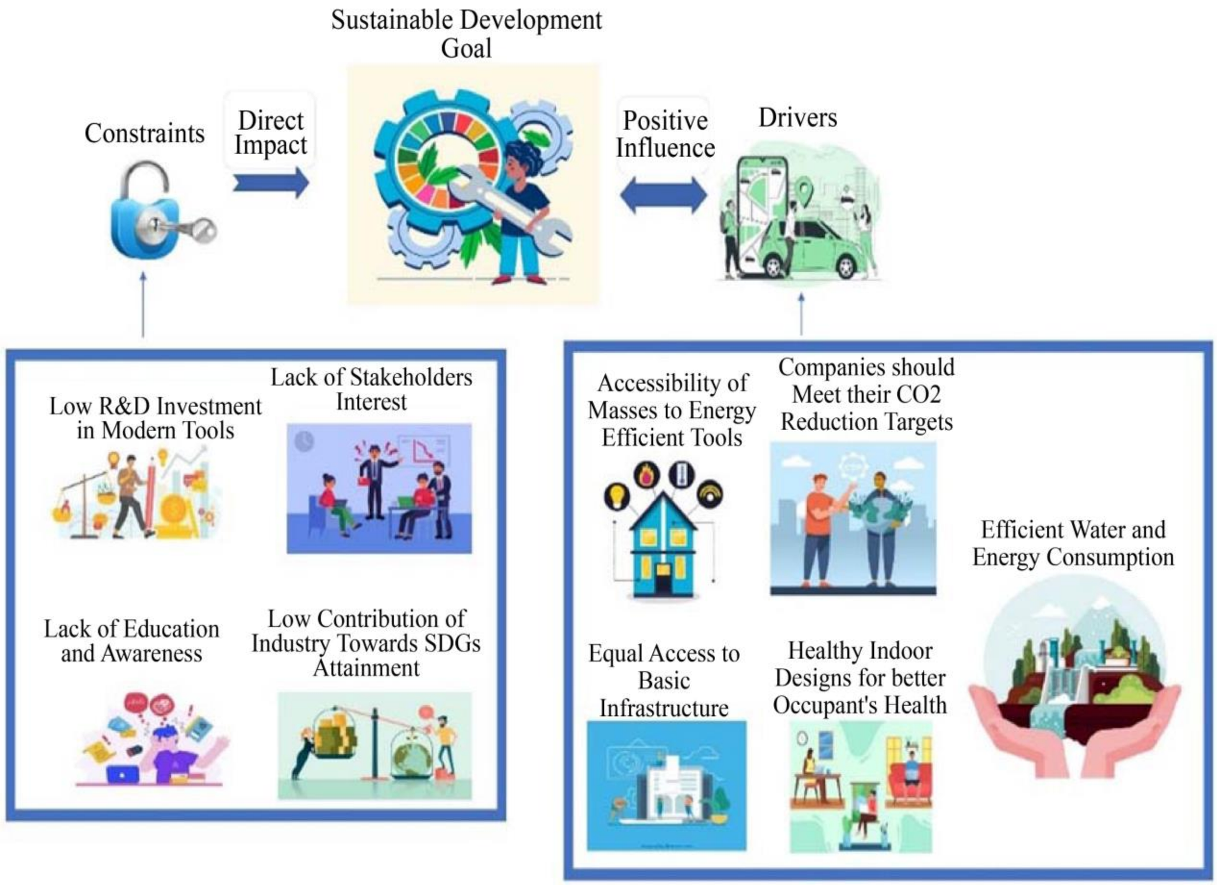

Fig. 2 Research conceptual framework

Although public awareness of sustainability is increasingly high, short-term financial benefits benefit most stakeholders more than long-term sustainable processes. This prejudice is exacerbated on the one hand by the competitive backdrop of the industry and on the other hand by the perceived increased cost associated with sustainable methodology. Despite the efforts to integrate the concept of sustainability into engineering and construction studies, there exists a significant lack of knowledge of the concept in the sector. It also means that many professionals do not profoundly understand sustainable practices and their inherent advantages [32]. The effects of the Malaysian construction industry are limited in influencing SDGs mainly due to obsessing with high rates of growth and development of mostly urban cityscapes. Although there have been concerted efforts to promote the need and practice of building environmental sustainability in construction, there still remains a significant challenge to its acceptance by the majority.

Although a significant amount of scholarly interest has been directed at sustainability in the construction sector, the originality of this study is its quantitative, holistic method of quantifying the direct impact of the construction sector on the achievement of SGGs in a developing economy. Past research has mainly taken a qualitative approach or concentrated on specific elements of sustainability, including the adoption of green buildings, the reduction of carbon emissions, or waste management practices, without attempting to address how the construction sector supports the achievement of multiple SDGs concomitantly. As an example, Ikudayisi and Adegun [33] explored the challenges to green building technologies in developing nations, with Arshad et al. [34] exploring green building project management practices, but neither article met the quantitative rigor required to measure real SDG achievement rates. The study by Aliu et al. [35] involved the sustainability knowledge and practices of the construction professionals. Mostly, the study is descriptive and lacks practical frameworks. In contrast to that, the present study based its research approach on a strong quantitative design evaluating the performance of the construction industry regarding a number of SDG dimensions, with the essential gap in the literature. The novelty of this book is in its structure, which is designed to suit policy makers and top managers in the developing economies. The current systems tend to focus on the developed world with a well-developed regulatory framework and a better economy. The paper aims to fill such a geographical and context gap that includes socio-economic weak points, bureaucratic frailty, and market-specific dynamics in developing countries by providing a realistic, context-appropriate guidance. The existing knowledge on Malaysian sustainable construction is skewed towards one-stakeholder initiatives, government policies, contractor practices, or client demands, without mentioning the multi-stakeholder aspect of the construction ecosystem. Johnson and White [36] analyzed stakeholder engagement; however, they did not determine the number of people who contribute to the SDG targets. The current research is also based on the system approach, with the role of stakeholders being considered in the context of interdependence and their total contribution to sustainability being quantified. Moreover, Researchers such as Unegbu et al. [37] had found problems, but they never applied and transferred their results to strategic, evidence-based models with the ability to bridge the research-to-practice gap. This study, therefore, presents a new paradigm in the sustainability research work in emerging economies through the provision of not only quantitative empirical information, but also a model to be used in the implementation.

The current research is not superior to the current methodologies; instead, it is locating an available gap in the previous works that are important gaps in empirical studies. Existing studies on the developing economies are based on qualitative studies, theoretical frameworks, and the analysis of barriers that do not provide quantifiable information about the SDG attainment. Although the earlier researches outline perceptions and problems, they do not go further and quantify the actual contribution of the construction industry to particular SDGs targets. And this study can be said to conquer those weaknesses in that it uses rigorous quantitative techniques to gather empirical evidence and set a baseline performance level of the Malaysian construction industry, data collected, which was previously not captured. In addition, frameworks such as LEED and BREEAM have been frequently used in developed economies, but there are very few instances where they are applicable in developing economies with limited resources. The suggested framework is more locally suitable than the Western-created frameworks by not only dealing with institutional deficiencies, financial obstacles, and coordination challenges inherent in developing countries. The main worth of the work is two-fold: it introduces data that has never been available empirically, and offers workable, context-appropriate suggestions, not giving one-size-fits-all solutions that work excellently in vastly different economies. Lastly, the fact that the study incorporates a variety of stakeholders' input and evaluation in many SDG domains makes it more representative and beneficial for use. It provides useful data to policymakers and industry executives, which will assist in the oversight of the sustainability shift in developing economies.

3.6. Study Limitations and Future Recommendations

The importance of the construction industry in the implementation of SDGs in Malaysia cannot be underestimated. It gives an idea of the way this sector can contribute to sustainable development. However, several limitations are present in the study that should be focused on. To begin with, accessibility and reliability of data present a challenge since there might be a lack of precise information in sustainability practices in the construction industry. Moreover, there are limited studies devoted particularly to the Malaysian context that can help in drawing conclusive findings. In addition, the demographics of respondents should also be analyzed in future research to determine whether various stakeholders differ in the interpretation of SDGs (or all stakeholders have a shallow view of SDGs) and how the respondents perceive the achievement of SDGs as important and relevant to them.

4. Conclusion and Recommendations

The present research paper is intended to evaluate the significance of the construction industry to the implementation of SDGs in Malaysia. The paper offers an excellent addition to the current body of research on the ways of improving the construction industry in Malaysia towards realizing the SDGs. This research uses the identification of the current practices, limitations, and opportunities in the sector to have a general idea about the situation in the sphere of sustainability. The main originality of the research is the creation of a tailored framework, which is expected to help policymakers, decision-makers, and top executives ensure the successful inclusion of SDGs in construction projects. This research is aimed at resolving the problems that are peculiar to the Malaysian construction industry and are viable to be offered with the use of the results of this study.

The findings obtained not only serve to fill an important gap in the literature, but they also provide a possible avenue for ensuring a more sustainable future in the construction industry in Malaysia. This research seeks to promote a cooperative spirit between stakeholders, making certain that economic development is in line with the agendas of environmental and social sustainability. The existing study emphasizes the role of segregation and recycling of waste materials in the reduction of waste in the construction sector in Malaysia. The highest RII of 0.850 supports it and indicates the importance of this practice. Besides, increasing accessibility of both the land and infrastructure, and adopting successful construction strategies such as lean construction and prefabrication are also significant aspects, which help in obtaining RII values of 0.841 and 0.837, respectively. Although the contribution of the industry to the quality of lifestyles has the lowest RII value of 0.796, it is also vital in the achievement of SDGs. It should be mentioned that carbon emission reduction, as an essential measure, is characterized by the RII of 0.821. Additionally, the findings of the ANOVA test (p-value = 0.981) indicate that the average value of the concentration of RII does not significantly differ across the studied groups. This signifies a controlled focus in the diverse sustainability areas. This gives an indication of the importance of embracing a holistic approach to policy-making and strategic planning to ensure sustainability in construction projects. The paper offers a useful lesson to the stakeholders seeking to enhance environmental performance and accomplish SDGs within the construction industry.

4.1. Theoretical and Practical Significance

The construction industry takes a central role in the quest by Malaysia to achieve the Sustainable Development Goals (SDGs) to promote economic growth, improve the status of attaining the development of the important infrastructural systems, and initiate environmentally friendly results. The role played by the sector in terms of employment, economic development, and development of infrastructures lies at the centre stage of consideration when analysing the realisation of the SDGs, given that their importance cannot be underscored. Besides, the industry has the capability of creating a culturally heterogeneous community through the affordability of housing and promotion of ease of access to social facilities, including medical and educational facilities, which implies the development of inclusiveness. It is true that sustainable approaches to construction activities can greatly decrease emissions, as well as the formation of waste and the depletion of natural resources. Moreover, a more rational approach could be incorporating green building technologies and sustainable design principles in the operational framework of the construction industry, since it would allow Malaysia to move on substantially in the direction of SDGs as far as climate action, responsible consumption and production, and the development of sustainable cities and communities are concerned.

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References

[1] Wenmei Fei et al., "The Critical Role of the Construction Industry in Achieving the Sustainable Development Goals (SDGs): Delivering Projects for the Common Good," *Sustainability*, vol. 13, no. 16, pp. 1-20, 2021. [CrossRef] [Google Scholar] [Publisher Link]

[2] Hirou Karimi et al., "Green Buildings: Human-Centered and Energy Efficiency Optimization Strategies," *Energies*, vol. 16, no. 9, pp. 1-17, 2023. [CrossRef] [Google Scholar] [Publisher Link]

[3] Nneka Adaobi Ochuba et al., "Innovations in Business Models through Strategic Analytics and Management: Conceptual Exploration for Sustainable Growth," *International Journal of Management and Entrepreneurship Research*, vol. 6, no. 3, pp. 554-566, 2024. [CrossRef] [Google Scholar] [Publisher Link]

[4] Sherif Goubran, "On the Role of Construction in Achieving the SDGs," *Journal of Sustainability Research*, vol. 1, no. 2, pp. 1-52, 2019. [CrossRef] [Google Scholar] [Publisher Link]

[5] Nitin Rane, "Integrating Leading-Edge Artificial Intelligence (AI), Internet of Things (IoT), and Big Data Technologies for Smart and Sustainable Architecture, Engineering and Construction (AEC) Industry: Challenges and Future Directions," *Engineering and Construction Industry: Challenges and Future Directions*, 2023. [CrossRef] [Google Scholar] [Publisher Link]

[6] KwangHoon Han, and Jensen Zhang, "Energy-Saving Building System Integration with a Smart and Low-Cost Sensing/Control Network for Sustainable and Healthy Living Environments: Demonstration Case Study," *Energy and Buildings*, vol. 214, pp. 1-38, 2020. [CrossRef] [Google Scholar] [Publisher Link]

[7] Paraskevi (Vivian) Angeletopoulou et al., "Advancing Sustainable Construction in the EU: The Role of Environmental Taxation, Financial Development and Green Energy Financing," *Sustainable Finance Review*, pp. 1-19, 2025. [CrossRef] [Google Scholar] [Publisher Link]

[8] Raslanas Sailus, Romualdas Kliukas, and Stasiukynas Andrius, "Real Estate Sustainability Assessment System based on Modified BREEAM by using AHP and SAW Methods," *Proceedings of the 30th International Conference on Advanced Engineering Technologies, Green Transition and Sustainable Development*, pp. 289-295, 2025. [Google Scholar] [Publisher Link]

[9] Kun Lu et al., "Commodity Futures Pricing of Carbon Policy Costs in Construction Projects," *Engineering, Construction and Architectural Management*, 2025. [CrossRef] [Google Scholar] [Publisher Link]

[10] Ruda Lee et al., "Comprehensive Investigation of Rooftop Photovoltaic Systems in Apartment Buildings: Focus on Installation Status and Generation Performance in South Korea," *Energy and Buildings*, vol. 345, pp. 1-23, 2025. [CrossRef] [Google Scholar] [Publisher Link]

[11] Grant Nwaogbe et al., "Green Construction Practices: Aligning Environmental Sustainability with Project Efficiency," *International Journal of Science and Research Archive*, vol. 14, no. 1, pp. 189-201, 2025. [Google Scholar]

[12] Iseoluwa Joanna Mogaji, Modupe Cecilia Mewomo, and Francis Kwesi Bondinuba, "Assessment of Barriers to the Adoption of Innovative Building Materials (IBM) for Sustainable Construction in the Nigerian Construction Industry," *Engineering, Construction and Architectural Management*, vol. 32, no. 13, pp. 1-26, 2025. [CrossRef] [Google Scholar] [Publisher Link]

[13] Ahmad Huzaimi Abd Jamil, and Mohamad Syazli Fathi, "The Integration of Lean Construction and Sustainable Construction: A Stakeholder Perspective in Analyzing Sustainable Lean Construction Strategies in Malaysia," *Procedia Computer Science*, vol. 100, pp. 634-643, 2016. [CrossRef] [Google Scholar] [Publisher Link]

[14] S.Z.H. Syed Jamaludin, S.A. Mahayuddin, and S.H.A. Hamid, "Challenges of Integrating Affordable and Sustainable Housing in Malaysia," *IOP Conference Series: Earth and Environmental Science*, vol. 140, pp. 1-9, 2018. [CrossRef] [Google Scholar] [Publisher Link]

[15] Sim Yeong Liang et al., "Towards Implementation and Achievement of Construction and Environmental Quality in the Malaysian Construction Industry," *Malaysian Journal of Civil Engineering*, vol. 26, no. 1, pp. 99-114, 2014. [CrossRef] [Google Scholar] [Publisher Link]

[16] J.A. Bamgbade, A.M. Kamaruddeen, and M.N.M. Nawi, "Malaysian Construction Firms' Social Sustainability via Organizational Innovativeness and Government Support: The Mediating Role of Market Culture," *Journal of Cleaner Production*, vol. 154, pp. 114-124, 2017. [CrossRef] [Google Scholar] [Publisher Link]

[17] Anat Anaqie Zahidy, Shahryar Sorooshian, and Zahidy Abd Hamid, "Critical Success Factors for Corporate Social Responsibility Adoption in the Construction Industry in Malaysia," *Sustainability*, vol. 11, no. 22, pp. 1-24, 2019. [CrossRef] [Google Scholar] [Publisher Link]

[18] Muzaffar Iqbal et al., "Sustainable Construction through Energy Management Practices in Developing Economies: An Analysis of Barriers in the Construction Sector," *Environmental Science and Pollution Research*, vol. 28, no. 26, pp. 34793-34823, 2021. [CrossRef] [Google Scholar] [Publisher Link]

[19] Sin-Ho Jung, "Stratified Fisher's Exact Test and its Sample Size Calculation," *Biometrical Journal*, vol. 56, no. 1, pp. 129-140, 2014. [CrossRef] [Google Scholar] [Publisher Link]

[20] Aseel Abdaljader, and Mustafa Günal, "Main Risk Factors Causing Delays in GAP Construction Projects in Turkey by using Relative Importance Index (RII) Method," *Iranian Journal of Science Technology, and Transactions of Civil Engineering*, vol. 48, no. 2, pp. 611-633, 2024. [CrossRef] [Google Scholar] [Publisher Link]

[21] Nor Syahirah Azman et al., "Relative Importance Index (RII) in Ranking of Quality Factors on Industrialised Building System (IBS) Projects in Malaysia," *AIP Conference Proceedings*, vol. 2129, no. 1, 2019. [CrossRef] [Google Scholar] [Publisher Link]

[22] Olabode Emmanuel Ogunmakinde, William Sher, and Temitope Egbelakin, *Construction Waste Management in Nigeria using the 3R Principle of the Circular Economy*, Circular Economy and Waste Valorisation: Theory and Practice, pp. 177-195, 2022. [CrossRef] [Google Scholar] [Publisher Link]

[23] Flavio Scrucca et al., "On the Role of Sustainable Buildings in Achieving the 2030 UN Sustainable Development Goals," *Environmental Impact Assessment and Review*, vol. 100, 2023. [CrossRef] [Google Scholar] [Publisher Link]

[24] Peter O. Akadiri, Ezekiel A. Chinyio, and Paul O. Olomolaiye, "Design of a Sustainable Building: A Conceptual Framework for Implementing Sustainability in the Building Sector," *Buildings*, vol. 2, no. 2, pp. 126-152, 2012. [CrossRef] [Google Scholar] [Publisher Link]

[25] Sang Choon Lhee, "Finding Significant Factors to Affect Cost Contingency on Construction Projects using ANOVA Statistical Method-Focused on Transportation Construction Projects in the US," *Architectural Research*, vol. 16, no. 2, pp. 75-80, 2014. [Google Scholar] [Publisher Link]

[26] S. Thomas Ng, Ziwei Tang, and Ekambaram Palaneeswaran, "Factors Contributing to the Success of Equipment-Intensive Subcontractors in Construction," *International Journal of Project Management*, vol. 27, no. 7, pp. 736-744, 2009. [CrossRef] [Google Scholar] [Publisher Link]

[27] Alex Opoku, *Construction Industry and the Sustainable Development Goals (SDGs)*, Research Companion to Construction Economics: Edward Elgar Publishing, pp. 199-214, 2022. [CrossRef] [Google Scholar] [Publisher Link]

[28] Jesse Kivilä, Miia Martinsuo, and Lauri Vuorinen, "Sustainable Project Management through Project Control in Infrastructure Projects," *International Journal of Project Management*, vol. 35, no. 6, pp. 1167-1183, 2017. [CrossRef] [Google Scholar] [Publisher Link]

[29] John Holmberg, and Johan Larsson, "A Sustainability Lighthouse-Supporting Transition Leadership and Conversations on Desirable Futures," *Sustainability*, vol. 10, no. 11, pp. 1-25, 2018. [CrossRef] [Google Scholar] [Publisher Link]

[30] Sharifah Buniamin et al., "Exploring SDGs Disclosure among Public Listed Companies in Malaysia: A Case of Energy-Related SDGs," *Global Business & Management Research*, vol. 13, no. 4, pp. 762-776, 2021. [Google Scholar] [Publisher Link]

[31] Gabriel Jobidon, Pierre Lemieux, and Robert Beauregard, "Building Information Modeling in Quebec's Procurement for Public Infrastructure: A Case for Integrated Project Delivery," *Law*, vol. 10, no. 2, pp. 1-16, 2021. [CrossRef] [Google Scholar] [Publisher Link]

[32] Bilal Manzoor et al., "Strategies for Adopting Building Information Modeling (BIM) in Sustainable Building Projects-A Case of Malaysia," *Buildings*, vol. 11, no. 6, pp. 1-14, 2021. [CrossRef] [Google Scholar] [Publisher Link]

[33] Ayodele Emmanuel Ikudayisi, and Olumuyiwa Bayode Adegun, "Pathways for Green Building Acceleration in Fast-Growing Countries: A Case Study on Nigeria," *Built Environment and Project Asset Management*, vol. 15, no. 3, pp. 450-466, 2025. [CrossRef] [Google Scholar] [Publisher Link]

[34] Abrar Arshad et al., “Sustainable Risk and Quality Management Practices in Green Construction Projects: A Study of the Commercial Construction Sector in Pakistan,” *Journal of Business and Management Research*, vol. 4, no. 2, pp. 230-249, 2025. [Google Scholar] [Publisher Link]

[35] John Aliu et al., “Exploring the Barriers to the Adoption of Environmental Economic Practices in the Construction Industry,” *Management of Environmental Quality: An International Journal*, vol. 36, no. 1, pp. 1-20, 2025. [CrossRef] [Google Scholar] [Publisher Link]

[36] S. Johnson and L. White, “Stakeholder Engagement in Sustainable Construction,” *Construction Management Review*, vol. 24, no. 3, pp. 40-54, 2022. [Google Scholar]

[37] H.C.O. Unegbu et al., “Measures for Overcoming Sustainable Construction Barriers in the Nigerian Construction Industry,” *Discover Civil Engineering*, vol. 2, no. 1, pp. 1-14, 2025. [CrossRef] [Google Scholar] [Publisher Link]