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Research Article

A Fuzzy Synthetic Analysis of Construction Firms' Contribution to Achieving Sustainable Development Goals in Developing Countries: A Ghanaian Case Study

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Abstract

The construction industry plays a significant role in economic development, infrastructure delivery, and social transformation, while simultaneously contributing to environmental degradation and resource depletion. Consequently, the sector is increasingly recognised as a critical stakeholder in achieving the United Nations Sustainable Development Goals (SDGs). This study evaluates the contribution of construction organisations in Ghana toward achieving the SDGs using Exploratory Factor Analysis (EFA) and Fuzzy Synthetic Evaluation Modelling (FSEM). A quantitative research design was adopted, and data were collected through a structured questionnaire administered to registered building and road contractors. Out of 357 distributed questionnaires, 250 valid responses were obtained and analysed. The findings identified five major dimensions of SDG-related activities undertaken by construction firms: Infrastructure Restoration, Health and Well-being, Social Development, Human Development, and Sports Development. The results revealed that construction organisations contribute to SDGs through activities such as sanitation support, school renovation, health screening, scholarship schemes, skills training, and community infrastructure provision. Human Development recorded the highest fuzzy index value, while Sports Development ranked lowest. However, all dimensions recorded index values below 3.0, indicating that sustainability-related activities are undertaken infrequently. The study concludes that although construction firms contribute to sustainable development, their engagement remains limited and insufficiently integrated into organisational strategies. The research contributes to sustainable construction literature by providing empirical evidence from a developing-country context and demonstrating the applicability of fuzzy synthetic evaluation in assessing SDG-related performance under uncertainty. The study recommends stronger regulatory enforcement, improved sustainability reporting frameworks, and greater integration of sustainability principles into construction practices.

Keywords

Construction Industry, Sustainable Development Goals, Fuzzy Synthetic Evaluation, Sustainability Practices, Developing Countries, Ghana

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1. Introduction

The construction industry plays a central role in economic growth, infrastructure development, and social transformation through the provision of housing, transportation systems, healthcare facilities, and educational infrastructure [1]. Beyond its economic importance, the industry significantly influences environmental sustainability, resource consumption, and community well-being [2]. Consequently, the sector has become a critical stakeholder in achieving the United Nations Sustainable Development Goals (SDGs), adopted in 2015 to address global challenges such as poverty, inequality, climate change, and environmental degradation [3].

The construction industry directly contributes to several SDGs, particularly SDG 9 (Industry, Innovation and Infrastructure), SDG 11 (Sustainable Cities and Communities), SDG 6 (Clean Water and Sanitation), SDG 7 (Affordable and Clean Energy), and SDG 13 (Climate Action) [1, 4]. Through sustainable infrastructure delivery, resource-efficient construction practices, and socially responsible initiatives, construction organisations can support broader sustainability objectives. However, despite this potential, the industry remains associated with major environmental and social challenges, including excessive energy consumption, greenhouse gas emissions, waste generation, biodiversity loss, occupational hazards, and weak stakeholder engagement [5, 6].

These sustainability challenges are more pronounced in developing countries, where institutional capacity, regulatory enforcement, and sustainability governance systems are often limited [7]. Although previous studies have highlighted the importance of sustainable construction practices, empirical evidence regarding the actual extent of construction firms' contributions toward SDG achievement remains limited, particularly within sub-Saharan Africa [4, 8]. Existing studies are also largely concentrated in developed economies, where sustainability reporting systems and environmental regulations are more advanced [9].

Furthermore, sustainability assessment within the construction sector involves uncertainty and subjective judgement because many sustainability indicators are qualitative and multidimensional. Conventional quantitative techniques may therefore be insufficient for capturing the complexity of sustainability performance. In response, fuzzy logic-based approaches have gained increasing attention due to their ability to accommodate ambiguity and imprecision in decision-making environments [10]. Fuzzy Synthetic Evaluation Modelling (FSEM) is particularly useful for evaluating sustainability performance because it integrates weighted indicators with linguistic assessment scales to analyse complex social and environmental phenomena under uncertain conditions [10, 11].

Although fuzzy evaluation techniques have been applied in construction risk assessment, safety management, and environmental performance studies [10, 11], limited research has employed FSEM to evaluate construction firms' contributions toward achieving the SDGs in developing economies. This study, therefore, examines the contribution of construction organisations in Ghana toward SDG achievement using Exploratory Factor Analysis (EFA) and Fuzzy Synthetic Evaluation Modelling (FSEM). The study identifies the major sustainability dimensions undertaken by construction firms, evaluates the frequency of these activities, and provides empirical evidence on sustainability engagement within a developing-country construction context. The findings contribute to sustainable construction literature and offer practical insights for policymakers and industry stakeholders seeking to strengthen SDG implementation within the construction sector.

2. Literature Review

2.1. Sustainable Development Goals and Sustainability Frameworks

The Sustainable Development Goals (SDGs), adopted by the United Nations in 2015, provide a globally integrated framework for addressing economic, social, and environmental sustainability challenges through 17 interrelated goals and 169 targets [1, 2]. Unlike the Millennium Development Goals (MDGs), which primarily focused on social development issues in developing countries, the SDGs adopt a broader and universal sustainability agenda that applies to both developed and developing economies [3]. The SDGs emphasise interconnectedness among poverty reduction, environmental protection, economic growth, infrastructure development, climate action, and institutional governance [4]. Consequently, achieving these goals requires coordinated participation from governments, industries, civil society organisations, and the private sector.

Scholars generally agree that the SDGs represent a transformative framework for global sustainability governance because they integrate economic, social, and environmental dimensions into a unified development agenda [5, 6]. However, debates remain regarding the practical implementation of the SDGs, particularly the challenges associated with balancing economic growth with environmental protection. While some researchers argue that the SDGs promote synergies among sustainability dimensions, others contend that substantial trade-offs persist between industrial development, resource consumption, and climate mitigation objectives [7]. This challenge is especially evident in the construction sector, where infrastructure expansion simultaneously supports economic development while contributing significantly to environmental degradation.

In response to these implementation challenges, sustainability assessment frameworks such as the Triple Bottom Line (TBL), Environmental, Social and Governance (ESG) frameworks, and circular economy principles have emerged as mechanisms for evaluating organisational sustainability performance [8]. The TBL framework conceptualises sustainability through the integration of economic prosperity, environmental stewardship, and social responsibility, commonly referred to as profit, planet, and people [9]. Although the TBL framework remains widely applied in construction sustainability studies, critics argue that it insufficiently captures governance and accountability dimensions that increasingly shape corporate sustainability performance.

Consequently, ESG frameworks have gained prominence in sustainability discourse because they incorporate governance dimensions such as transparency, ethical procurement, stakeholder engagement, labour standards, and institutional accountability [10]. Within the construction industry, ESG indicators are increasingly used to assess carbon emissions, occupational health and safety, waste management practices, energy efficiency, and community development contributions. Researchers argue that ESG frameworks strengthen sustainability reporting by providing measurable indicators capable of tracking firms' contributions toward SDG achievement [11]. Nevertheless, ESG implementation remains uneven across regions, with developing economies facing institutional limitations, weak regulatory systems, and limited sustainability disclosure mechanisms.

Similarly, sustainability indicator systems and construction sustainability indices such as LEED, BREEAM, Green Star, and Envision have become important tools for assessing environmental and social performance within the built environment [12]. These frameworks evaluate construction projects using indicators related to energy efficiency, material sustainability, indoor environmental quality, biodiversity conservation, and lifecycle performance. Although these tools have improved sustainability benchmarking in developed economies, several scholars argue that they inadequately reflect the contextual realities of developing countries, particularly in Africa, where informal construction practices, weak enforcement mechanisms, and resource constraints influence sustainability implementation [13]. This suggests the need for context-specific approaches capable of evaluating sustainability performance under uncertain and dynamic conditions.

Overall, the literature demonstrates broad consensus regarding the importance of sustainability frameworks in guiding SDG implementation within industries. However, disagreements remain concerning the adequacy of existing sustainability measurement systems, particularly their applicability within developing-country construction sectors. This limitation creates the need for empirical studies capable of assessing how construction firms operationalise sustainability objectives within resource-constrained environments.

2.2. Construction Industry and Sustainable Development Goals

The construction industry occupies a central position within sustainable development discourse due to its substantial economic, environmental, and social impacts. Globally, the sector contributes significantly to economic growth through employment generation, infrastructure development, and urban expansion, while simultaneously exerting considerable pressure on natural resources and ecological systems [14]. Researchers consistently acknowledge that the industry directly influences several SDGs, particularly SDG 9 (Industry, Innovation and Infrastructure), SDG 11 (Sustainable Cities and Communities), SDG 7 (Affordable and Clean Energy), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action) [15, 16].

Despite this recognised importance, the literature presents contrasting perspectives regarding the industry's sustainability performance. On one hand, scholars emphasise the transformative potential of the construction sector through green buildings, renewable energy integration, circular economy practices, and sustainable urban infrastructure development [17, 18]. Green construction practices have been associated with reduced operational energy consumption, improved resource efficiency, and enhanced resilience against climate-related risks. Similarly, proponents of sustainable construction argue that infrastructure development contributes positively to social welfare through improved housing, healthcare facilities, transportation systems, and educational infrastructure.

Conversely, other scholars emphasise the industry's negative environmental externalities. Construction activities remain among the largest contributors to greenhouse gas emissions, energy consumption, biodiversity loss, and construction waste generation [19]. Omer and Noguchi argued that building materials significantly influence environmental sustainability because material extraction, transportation, and disposal generate substantial ecological impacts throughout project life cycles [20]. Similarly, Mahpour contends that construction and demolition waste remains inadequately managed in many countries, thereby undermining SDG 12 and SDG 13 objectives [21]. These findings suggest that while the industry possesses substantial capacity to support sustainable development, current practices often remain inconsistent with sustainability principles.

The literature also highlights growing recognition of the construction sector's social responsibilities beyond physical infrastructure delivery. Construction firms increasingly contribute to community development through educational support, sanitation projects, healthcare initiatives, skills development programmes, and charitable interventions [16]. For example, scholarship schemes, school renovations, health screening exercises, and water provision initiatives have been linked to SDGs 3, 4, 6, and 10 [22]. Similarly, workplace safety programmes and labour protection measures align with SDG 8 by promoting decent work conditions within construction environments.

However, significant concerns persist regarding social sustainability within the industry. Studies have identified issues relating to poor labour conditions, occupational hazards, corruption, modern slavery, and weak stakeholder engagement in construction supply chains [16]. While developed economies increasingly institutionalise sustainability reporting and labour protection systems, many developing countries continue to experience weak enforcement of sustainability regulations and occupational standards. This indicates that the industry's contribution to SDGs cannot merely be assessed through infrastructure provision alone but must also consider governance quality, social inclusion, and ethical operational practices.

The environmental dimension of construction sustainability has received substantial scholarly attention. Researchers generally agree that resource efficiency, waste minimisation, and circular economy adoption are essential for improving sustainability outcomes within the sector [20, 21]. Circular economy principles encourage recycling, reuse, and lifecycle optimisation of construction materials to reduce environmental degradation and resource depletion. Nevertheless, implementation challenges remain significant in developing countries due to financial constraints, technological limitations, and low institutional capacity.

Although biodiversity conservation and ecosystem protection are increasingly recognised within sustainability discourse, these dimensions remain relatively underexplored within construction research. Opoku argued that urban development projects rarely prioritise biodiversity protection despite the sector’s substantial impact on ecosystems and land use patterns [15]. Similarly, SIDA emphasized that integrating biodiversity conservation measures such as green roofs, ecological landscaping, and habitat preservation into construction projects remains limited in many regions [23]. This demonstrates that sustainability implementation within the construction industry remains uneven across different SDG dimensions.

Another important debate within the literature concerns whether sustainability should be viewed primarily as a regulatory obligation or as a strategic opportunity for innovation and competitiveness. Some scholars argue that sustainability adoption improves operational efficiency, organisational reputation, and long-term competitiveness [24]. Others contend that many construction firms, particularly in developing economies, perceive sustainability initiatives as costly obligations that increase project complexity without generating immediate financial returns. These differing perspectives partly explain the inconsistent adoption of sustainability practices across construction sectors globally.

Overall, the literature demonstrates broad agreement that the construction industry significantly influences SDG achievement through its environmental, social, and economic impacts. Nevertheless, the extent and effectiveness of these contributions remain contested, particularly regarding the practical implementation of sustainability principles within developing-country contexts.

2.3. Sustainability Assessment Approaches in Construction

The growing complexity of sustainability challenges within the construction sector has increased the demand for robust sustainability assessment methods capable of evaluating multidimensional performance indicators. Traditional sustainability evaluation approaches have largely relied on quantitative environmental indicators such as energy consumption, carbon emissions, and material efficiency. However, scholars increasingly argue that sustainability assessment must also incorporate social, governance, and institutional dimensions to capture the full complexity of sustainable construction practices [25].

Several sustainability assessment tools have been developed to evaluate construction performance across project lifecycles. Green building certification systems such as LEED, BREEAM, and Green Star remain among the most widely adopted sustainability assessment frameworks globally [12]. These systems evaluate projects using criteria related to energy efficiency, indoor environmental quality, water conservation, waste management, and material sustainability. Researchers acknowledge that such frameworks have significantly improved sustainability awareness and benchmarking within developed construction markets.

Despite their popularity, scholars criticise these assessment tools for several reasons. First, many certification systems were developed within advanced economies and may inadequately reflect socio-economic realities in developing countries [13]. Second, most existing frameworks focus heavily on environmental indicators while paying comparatively less attention to social equity, governance quality, and community development contributions. Third, sustainability indicators often involve uncertainty, subjectivity, and qualitative judgement, making conventional quantitative assessment methods insufficient for capturing real-world sustainability performance.

To address these limitations, researchers increasingly advocate the application of fuzzy logic-based approaches in sustainability assessment. Fuzzy Synthetic Evaluation (FSE) has emerged as a particularly useful technique because it accommodates ambiguity, uncertainty, and subjective human judgement within complex decision-making environments [26]. Unlike traditional deterministic approaches, fuzzy synthetic evaluation enables researchers to evaluate sustainability performance using linguistic variables and weighted indicators, thereby improving analytical flexibility in situations where precise measurements are difficult to obtain.

Within construction research, fuzzy synthetic evaluation has been applied in areas such as risk assessment, safety management, environmental performance evaluation, and green project assessment [26, 27]. Researchers argue that FSE is particularly suitable for sustainability studies because sustainability indicators often involve qualitative assessments relating to social responsibility, community engagement, environmental protection, and organisational governance. Nevertheless, despite the growing use of fuzzy evaluation approaches within construction management research, relatively few studies have applied fuzzy synthetic evaluation to assess construction firms' contributions toward SDG achievement, particularly within African contexts.

Moreover, existing sustainability assessment studies remain predominantly concentrated in developed economies such as the United Kingdom, Europe, Australia, Singapore, and China, where sustainability regulations, ESG disclosure systems, and green certification frameworks are more mature [17, 18, 26]. Empirical evidence from developing countries remains fragmented despite the distinct institutional and socio-economic conditions influencing sustainability implementation within these regions.

This suggests that existing sustainability assessment literature remains limited in three major respects. First, many studies remain conceptual rather than empirically measuring actual sustainability practices at firm level. Second, existing frameworks inadequately capture the contextual realities of developing-country construction sectors. Third, limited studies have integrated fuzzy synthetic evaluation techniques with SDG-oriented sustainability assessment models.

2.4. Research Gap

Although substantial literature exists regarding sustainability and SDG implementation within the construction industry, important theoretical, empirical, and methodological gaps remain unresolved. Existing studies predominantly focus on the conceptual role of construction in sustainable development rather than empirically evaluating the actual extent of construction firms' SDG-related activities. Much of the literature assumes that construction organisations significantly contribute to sustainable development through infrastructure delivery and green building initiatives; however, limited empirical evidence exists regarding the frequency and practical implementation of these activities, particularly in developing economies.

Furthermore, current scholarship is heavily dominated by studies conducted within developed countries where sustainability governance systems, ESG disclosure frameworks, and environmental regulations are relatively advanced [17, 18, 26]. In contrast, empirical evidence from sub-Saharan Africa remains limited despite the region facing rapid urbanisation, infrastructure deficits, environmental vulnerability, and institutional challenges that may significantly influence sustainability practices within the construction sector.

Methodologically, previous studies have largely relied on descriptive sustainability indicators and conventional quantitative assessment approaches. Limited studies have employed fuzzy synthetic evaluation techniques to assess construction firms' contributions to SDGs under conditions of uncertainty and subjective judgement. Consequently, there remains insufficient understanding regarding how construction organisations in developing economies operationalise sustainability practices and contribute toward SDG achievement.

Therefore, this study contributes to the literature by empirically evaluating the contribution of construction organisations toward achieving the SDGs within the Ghanaian construction industry using exploratory factor analysis and fuzzy synthetic evaluation modelling. The study provides methodological, empirical, and contextual contributions by integrating sustainability assessment frameworks with fuzzy logic techniques within a developing-country context.

3. Research Design

This study adopted a quantitative research design to examine the contributions of construction organisations toward achieving the Sustainable Development Goals (SDGs) in Ghana. Quantitative research is appropriate for studies that seek to objectively measure perceptions, patterns, and relationships using numerical data and statistical analysis [1]. The study was grounded in the positivist philosophical paradigm because it enables empirical investigation and objective evaluation of observable phenomena. A questionnaire survey strategy was employed because it facilitates the collection of standardized data from a relatively large sample and is widely used in construction management and sustainability studies [2]. The study sought to identify the major sustainable development activities undertaken by construction organisations and evaluate the frequency of their engagement in such activities using Exploratory Factor Analysis (EFA) and Fuzzy Synthetic Evaluation Modelling (FSEM).

3.1. Population and Sampling Procedure

The target population for the study consisted of all registered construction firms operating in Ghana under the Ministries of Works and Housing (MWH) and Roads and Highways (MRH). The accessible population comprised contractors registered with the Association of Building and Civil Engineering Contractors of Ghana (ABCECG) and the Association of Road Contractors (ASROC). Given the heterogeneous nature of construction firms, stratified random sampling was adopted to ensure adequate representation of both building and road contractors. Stratified sampling is suitable where the population contains distinct subgroups because it improves representativeness and reduces sampling error [3]. Two strata were therefore established:

1) Building contractors
2) Road contractors

A list of contractors in good standing as of December 2024 was obtained from the secretariats of ABCECG and ASROC. During verification of the sampling frame, several firms listed in the associations' databases were found to be inactive or unreachable through the contact details provided. Such firms were excluded from the sampling frame to improve coverage accuracy. Additionally, active contractors verified through professional association referrals and industry records were included to ensure that the final sampling frame adequately reflected operational construction firms in Ghana. The final sampling frame comprised 527 road contractors and 653 building contractors.

3.2. Sample Size Determination

The sample size was determined using the Yamane formula for finite populations [4]:

$$n = \frac{N}{1+N(e)^2}$$

Where:

1) n= sample size
2) N= population size
3) e= level of precision (0.05)

A 95% confidence level and 5% margin of error were assumed following established recommendations [5]. Based on the calculation, the minimum required sample size was 298.73, approximated to 299 respondents. To improve response adequacy and account for potential non-response, the sample size was increased by 20%, resulting in 357 distributed questionnaires. This adjustment was necessary because survey response rates within the Ghanaian construction industry are generally low. Out of the 357 questionnaires distributed, 250 valid responses were received, representing a response rate of approximately 70.0%, which was considered adequate for multivariate statistical analysis and factor analysis.

3.3. Questionnaire Design and Construct Operationalisation

Data were collected using a structured questionnaire specifically developed for this study. The questionnaire was designed based on an extensive review of literature relating to sustainable construction practices and SDGs contributions within the construction industry [6-8].

The questionnaire consisted of two main sections.

Section A: Demographic Information

This section captured respondents' background characteristics, including contractor category, job position, educational qualification, years of industry experience, and years of company existence.

Section B: Sustainable Development Goals Activities

This section measured construction organisations' contributions toward SDGs using twenty indicators extracted from the literature [6-8]. The indicators were operationalised into five theoretical dimensions:

1) Infrastructure Restoration
2) Health and Well-being
3) Social Development
4) Human Development
5) Sports Development

Respondents were asked to indicate the frequency with which their organisations engaged in each activity using a five-point Likert scale:

1 = Never
2 = Very Rarely
3 = Rarely
4 = Occasionally
5 = Always

The five-point Likert scale was adopted because it provides adequate discrimination among responses while reducing respondent fatigue and improving response reliability in construction management research.

3.4. Validity and Reliability of the Instrument

To ensure content validity, the questionnaire items were developed from established literature and aligned with the theoretical dimensions underpinning the Sustainable Development Goals. The instrument was subsequently reviewed by two experts in construction management and sustainability research to assess the relevance, clarity, and comprehensiveness of the items. A pilot study involving selected construction professionals was conducted in May 2025 to assess the suitability and clarity of the questionnaire items before the main survey administration. Feedback obtained from the pilot study resulted in minor modifications to wording and item structure to improve clarity and comprehension.

Construct validity was assessed using Exploratory Factor Analysis (EFA). Prior to factor extraction, the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity were conducted to evaluate the suitability of the dataset for factor analysis. The KMO value of 0.800 exceeded the recommended threshold of 0.70, while Bartlett's Test of Sphericity was statistically significant ($p < 0.001$), confirming factorability of the correlation matrix [9, 10]. Internal consistency reliability was assessed using Cronbach's alpha coefficients. The reliability results indicated satisfactory internal consistency for all constructs, exceeding the recommended threshold of 0.70 [10]. Infrastructure Restoration recorded $\alpha = 0.821$, Health and Well-being $\alpha = 0.847$, Social Development $\alpha = 0.803$, Human Development $\alpha = 0.791$, and Sports Development $\alpha = 0.754$. The overall scale reliability was $\alpha = 0.868$.

Although Confirmatory Factor Analysis (CFA) could provide additional validation, the present study was exploratory in nature and primarily aimed at identifying latent dimensions underlying SDGs activities. Future studies are encouraged to apply CFA and Structural Equation Modelling using larger datasets for confirmatory validation.

3.5. Assessment of Response Bias and Non-response Bias

To minimise response bias, respondents were assured of anonymity and confidentiality, and participation was entirely voluntary. This approach was intended to reduce socially desirable responses and encourage honest reporting.

Non-response bias was assessed by comparing early and late respondents using independent sample t-tests on selected study variables. The analysis revealed no statistically significant differences between the two groups ($p > 0.05$), suggesting that non-response bias did not significantly affect the study findings.

3.6. Exploratory Factor Analysis

Exploratory Factor Analysis (EFA) was employed to identify the underlying dimensions of SDGs activities undertaken by construction organisations. Principal Component Analysis (PCA) was adopted as the extraction technique because the study sought to reduce a large set of interrelated variables into a smaller number of interpretable components [9, 10].

Varimax rotation with Kaiser Normalisation was applied to improve interpretability and minimise cross-loadings among variables. Only variables with factor loadings equal to or greater than 0.40 were retained for interpretation.

The extracted factors were interpreted and named based on conceptual similarity among highly loading variables and alignment with sustainable development literature. Five components with eigenvalues greater than 1.0 were retained, cumulatively explaining 70.629% of the total variance, exceeding the recommended minimum threshold of 50% [9].

3.7. Fuzzy Synthetic Evaluation Model (FSEM)

Following the identification of the underlying dimensions of SDGs activities, the Fuzzy Synthetic Evaluation Model (FSEM) was employed to assess the frequency and relative significance of the identified activities.

Fuzzy Synthetic Evaluation is suitable for handling uncertainty and subjective judgments associated with social science data and Likert-scale responses [11]. The model was implemented in four stages.

Step 1: Establishment of Factor Set

The factor set was defined as:

$$U = \{u_1, u_2, \dots, u_n\}$$

where u_n represents the SDGs activity indicators.

Step 2: Establishment of Evaluation Set

The evaluation set was expressed as:

$$V = \{v_1, v_2, v_3, v_4, v_5\}$$

representing:

1) Never,
2) Very Rarely,
3) Rarely,
4) Occasionally,
5) and Always.

Step 3: Determination of Weights

Indicator weights were computed using the normalised mean method recommended in previous studies [12]:

$$W_i = \frac{\bar{x}_i}{\sum_{i=1}^{n} \bar{x}_i}$$

where:

1) W_i= normalised weight of indicator i,
2) $\bar{x}_i$= mean score of the indicator i.

The weighting process was used to establish the relative significance of each SDGs activity based on respondents' ratings.

Step 4: Construction of Fuzzy Evaluation Matrix

Membership functions were estimated from the proportional distribution of respondents' ratings across the five-point Likert scale. The fuzzy evaluation matrix was expressed as:

$$R = \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1m} \\ r_{21} & r_{22} & \cdots & r_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ r_{n1} & r_{n2} & \cdots & r_{nm} \end{bmatrix}$$

The overall fuzzy synthetic evaluation vector was computed as:

$$B = W \times R$$

where:

1) B represents the comprehensive evaluation result,
2) W denotes the weighting vector,
3) and R represents the fuzzy evaluation matrix.

To validate the stability of the weighting structure, the normalised mean weights were compared with equal-weight estimations. The ranking patterns remained substantially unchanged, confirming the robustness of the weighting scheme.

Additionally, sensitivity analysis was conducted by varying indicator weights by ±10% to examine the stability of factor rankings. The analysis showed only marginal changes in index values with no significant changes in ranking positions, confirming the robustness and reliability of the FSEM results.

4. Data Analysis and Interpretation

4.1. Demographic Information of Respondents

The demographic profile of respondents was analysed to establish the suitability and reliability of the data collected from construction professionals. Table 1 presents the demographic characteristics of respondents based on contractor category, job position, educational qualification, years of industry experience, and years of company existence.

Table 1. Background information of respondents.

	Frequency	Percent
Respondents' category		
Road	95	38
Building	155	62
Total	250	100
Job Position		
Director	22	8.8
Managing Director	14	5.6
Safety Officer	38	15.2
Project Engineer	73	29.2
Project Manager	53	21.2
Others	50	20
Total	250	100.0
Educational Level		
PhD	3	1.2
MSC	64	25.6
BSC	91	36.4
B-TEC	30	12
HND	42	16.8
Others	20	8
Total	250	100.0
Years of Experience		
Less than 6 years	54	21.6
6-10 years	79	31.6
11-15 years	87	34.8
16-20 years	30	12
Total	250	100
Years of the existence of the company		
5-10 years	63	25.2
11-15 years	62	24.8
16-20 years	57	22.8
More than 20 years	56	22.4
Others	12	4.8
Total	250	100.0

The results indicate that building contractors constituted the majority of respondents (62%), while road contractors represented 38% of the sample. This suggests relatively higher participation from firms engaged in building construction activities. In terms of professional designation, Project Engineers formed the largest respondent group (29.2%), followed by Project Managers (21.2%) and Safety Officers (15.2%). The participation of technically experienced professionals enhances the credibility of the responses because these personnel are directly involved in project delivery and sustainability-related decision-making processes.

Regarding educational qualification, most respondents possessed Bachelor of Science degrees (36.4%) and Master's degrees (25.6%), indicating a relatively high educational background among respondents. Furthermore, the majority of respondents had between 11 and 15 years of construction industry experience (34.8%), while many firms had operated for between 5 and 15 years. These findings imply that respondents possessed adequate industry knowledge and organisational experience to provide reliable assessments of SDGs-related activities within their firms.

The demographic profile, therefore, demonstrates that the respondents were sufficiently qualified and experienced to provide valid insights into the sustainability practices of construction organisations in Ghana.

4.2. Exploratory Factor Analysis of SDGs Activities

Exploratory Factor Analysis (EFA) was conducted to identify the underlying dimensions of Sustainable Development Goals (SDGs) activities undertaken by construction organisations see Table 2. Prior to extraction, the suitability of the data for factor analysis was assessed using the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity.

The KMO value was 0.800, exceeding the recommended minimum threshold of 0.70 [9, 10], thereby confirming sampling adequacy. Bartlett's Test of Sphericity was statistically significant ($\chi^2 = 686.391$, $p < 0.001$), indicating that sufficient correlations existed among the variables to justify factor analysis.

Principal Component Analysis (PCA) with Varimax rotation was employed to extract the latent dimensions underlying SDGs activities. PCA was selected because the study aimed to reduce a relatively large number of interrelated sustainability indicators into a smaller number of interpretable components [9]. Five components with eigenvalues greater than 1.0 were extracted, cumulatively explaining 70.629% of the total variance, which exceeds the minimum threshold of 50% recommended for social science research [10].

Unlike arbitrary statistical grouping, the extracted factors exhibited strong conceptual coherence and theoretical alignment with sustainable development literature. The factor structure, therefore, demonstrates both statistical validity and logical consistency.

Table 2. *Exploratory Factor Analysis Sustainable Development Goals Activities.*

	Extraction	Component				
		1	2	3	4	5
Environmental protection education	0.674	0.473				
Provision of water	0.466	0.486				
supply of furniture to schools	0.673	0.641				
Building of community clinic	0.631	0.742				
Renovation of school	0.628	0.743				
Renovation of Hospitals	0.686	0.746				
Provision of counselling	0.706		0.556			
Health Education/Screening	0.709		0.779			
Safety Drills	0.759		0.787			
Fire prevention Education	0.721		0.837			
Building school blocks	0.526			0.415		
Support to orphanages	0.774			0.752		
support for the work of NGOs	0.850			0.819		
Medical support to the poor and needy	0.718			0.729		
Provision of Scholarship scheme	0.673				0.448	
Preservation of monuments	0.576				0.452	
Sanitation	0.622				0.705	
Provision of skills training	0.724				0.768	
Building of Recreational centres	0.466					0.455
Sponsorship of sporting activities	0.744					0.813
Total	-	*2.922*	*2.800*	*2.671*	*2.224*	*1.390*
% of Variance	-	*17.186*	*16.470*	*15.713*	*13.081*	*8.179*
Cumulative%	-	*17.186*	*33.656*	*49.369*	*62.450*	*70.629*
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	*0.800*					
Bartlett's Test of Sphericity	-					
Approx. Chi-Square	*686.391*					
df	*136*					
Sig.	*0.000*					

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization. a. Rotation converged in 9 iterations.

The scree plot demonstrates that the first five components accounted for substantial variance before the eigenvalues began to level off, confirming the appropriateness of the five-factor structure.

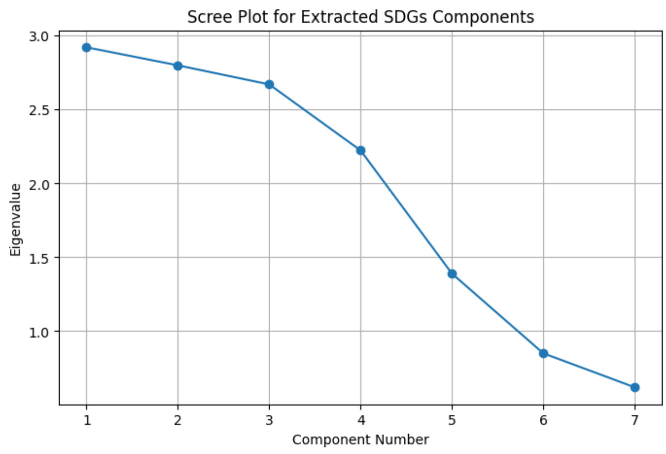

Figure 1. Scree Plot for Extracted SDGs Components.

A component loading diagram demonstrates the visualisation of the clustering of variables under the extracted factors.

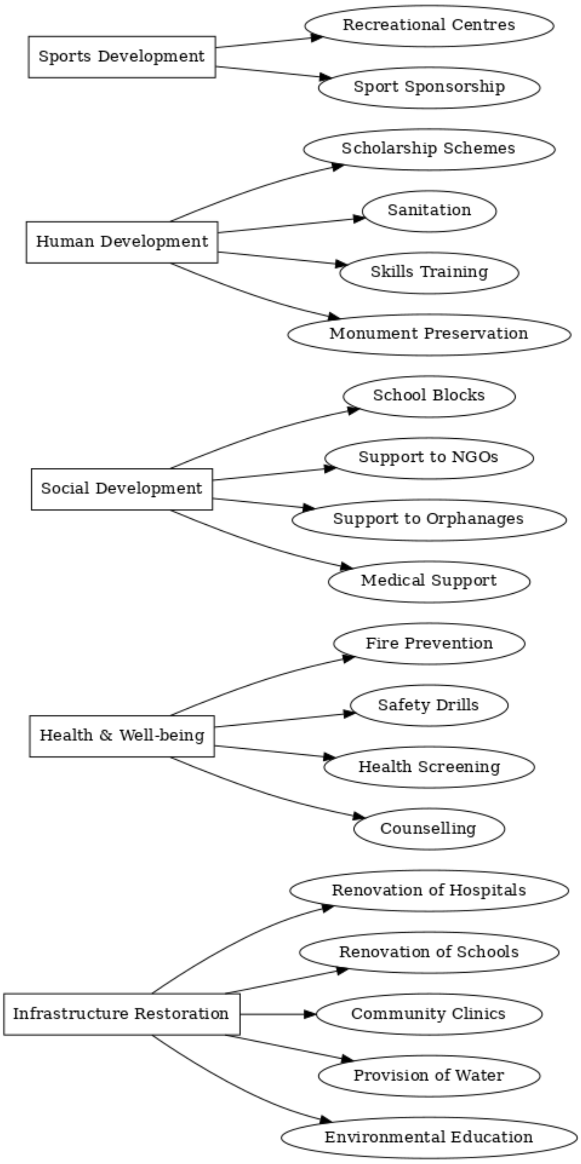

Figure 2. Component Loading Diagram.

4.2.1. Factor 1: Infrastructure Restoration

The first factor accounted for 17.186% of the total variance and comprised activities such as:

1) Renovation of hospitals
2) Renovation of schools
3) Building of community clinics
4) Provision of water
5) Environmental protection education
6) Supply of furniture to schools

These activities collectively represent investments in physical and social infrastructure aimed at improving community welfare and public services. The factor aligns closely with SDGs 3 (Good Health and Well-being), 4 (Quality Education), 6 (Clean Water and Sanitation), and 11 (Sustainable Cities and Communities).

The emergence of this factor as the dominant dimension suggests that construction firms primarily engage in sustainability activities that are physically visible, socially recognisable, and directly connected to their operational expertise. Infrastructure-related interventions are often more publicly noticeable and may therefore offer reputational benefits to firms while simultaneously fulfilling social obligations.

The relatively stronger performance of infrastructure-related activities compared to other dimensions supports findings from previous studies, which identified infrastructure delivery as one of the principal channels through which construction organisations contribute to sustainable development [6-8]. Nevertheless, the moderate frequency scores indicate that such interventions are undertaken periodically rather than systematically integrated into long-term sustainability strategies.

4.2.2. Factor 2: Health and Well-being

The second factor explained 16.470% of the total variance and included:

1) Fire prevention education
2) Safety drills
3) Health education/screening
4) Provision of counselling

This factor reflects organisational efforts aimed at promoting occupational health, safety awareness, preventive healthcare, and disaster preparedness. The activities strongly align with SDG 3 (Good Health and Well-being) and SDG 11 (Sustainable Cities and Communities).

The prominence of safety drills and fire prevention education may partly be explained by the hazardous nature of construction work and increasing regulatory attention toward workplace safety management. Consequently, many firms may implement these activities not only as sustainability initiatives but also as compliance mechanisms aimed at reducing workplace accidents and liabilities.

Although the factor demonstrates growing awareness of health and safety responsibilities among construction organisations, the moderate frequency scores suggest that health-related sustainability interventions remain insufficiently institutionalised. This implies that many firms still approach health and well-being from a reactive rather than a strategic sustainability perspective.

4.2.3. Factor 3: Social Development

The third factor accounted for 15.713% of the total variance and comprised:

1) Building school blocks
2) Support to orphanages
3) Support for NGOs
4) Medical support to the poor and needy

This factor captures philanthropic and community-oriented interventions aimed at promoting social inclusion and improving living conditions among vulnerable populations. The activities align closely with SDGs 1 (No Poverty), 4 (Quality Education), 5 (Gender Equality), and 10 (Reduced Inequalities).

The grouping demonstrates that construction organisations contribute to broader community development beyond direct infrastructure delivery. However, the relatively lower mean scores suggest that these initiatives remain occasional rather than institutionalised organisational practices.

This finding may indicate that sustainability activities within many construction firms are still heavily dependent on corporate discretion, financial capability, or short-term community relations objectives rather than formal sustainability frameworks or policies.

4.2.4. Factor 4: Human Development

The fourth factor explained 13.081% of the total variance and included:

1) Scholarship schemes
2) Sanitation support
3) Skills training
4) Preservation of monuments

This factor represents long-term investments in human capital development, environmental sanitation, and cultural sustainability. The activities correspond with SDGs 4 (Quality Education), 6 (Clean Water and Sanitation), 8 (Decent Work and Economic Growth), and 11 (Sustainable Cities and Communities).

Among all extracted dimensions, sanitation recorded the highest mean score, indicating relatively stronger engagement by construction firms in sanitation-related interventions. This finding may reflect growing public awareness regarding environmental health and waste management within Ghanaian communities.

The inclusion of skills training within this factor is particularly important because the construction industry depends heavily on skilled labour. Firms that invest in training not only contribute toward SDG achievement but also improve labour productivity and workforce sustainability.

However, preservation of monuments recorded comparatively weaker scores, suggesting that cultural sustainability and heritage preservation receive relatively limited attention within construction sector sustainability practices.

4.2.5. Factor 5: Sports Development

The fifth factor accounted for 8.179% of the total variance and comprised:

1) Building recreational centres
2) Sponsorship of sporting activities

This factor reflects contributions toward recreation, youth empowerment, and community social cohesion. The activities broadly align with SDGs 3 (Good Health and Well-being) and 11 (Sustainable Cities and Communities).

The relatively low variance explained by this factor, together with its weak mean scores, indicates that sports-related interventions are not considered strategic sustainability priorities by most construction organisations. Compared with infrastructure and sanitation projects, sports development may be perceived as less directly connected to firms' operational mandates and business objectives.

This finding suggests that construction firms tend to prioritise sustainability initiatives that provide stronger economic, reputational, or regulatory visibility.

4.3. Reliability and Internal Consistency Analysis

Table 3 shows the reliability of the extracted constructs was assessed using Cronbach's alpha coefficients. The results showed acceptable internal consistency across all dimensions, with coefficients exceeding the recommended threshold of 0.70 [10].

Table 3. *Reliability and Internal Consistency Analysis.*

Construct	Cronbach's Alpha
Infrastructure Restoration	0.821
Health and Well-being	0.847
Social Development	0.803
Human Development	0.791
Sports Development	0.754
Overall Scale	0.868

The findings confirm that the measurement items within each construct were sufficiently correlated and consistently measured the underlying sustainability dimensions.

4.4. Correlation Analysis of SDGs Dimensions

Pearson correlation analysis was conducted to examine the relationships among the extracted SDGs dimensions. The results revealed significant positive relationships among all five dimensions ($p < 0.05$), indicating that firms engaging in one sustainability activity were more likely to participate in others.

The strongest relationship was observed between Infrastructure Restoration and Human Development. This suggests that firms investing in infrastructure-related interventions also tend to support sanitation, scholarship schemes, and skills development initiatives. The findings support the assumptions of the Triple Bottom Line framework, which emphasises the interconnectedness of social, environmental, and economic sustainability dimensions.

The positive interrelationships further indicate that sustainability engagement within construction organisations is multidimensional rather than isolated to specific activities.

4.5. Regression Analysis of Factors Influencing SDGs Contributions

Multiple regression analysis was conducted to examine whether organisational characteristics influenced SDGs engagement levels.

The analysis revealed that years of company existence and respondents' years of industry experience significantly influenced SDGs engagement ($p < 0.05$). Older firms and firms managed by more experienced professionals demonstrated relatively stronger participation in sustainability activities.

This finding suggests that organisational maturity contributes positively toward sustainability awareness, stakeholder engagement, and implementation capacity. Established firms may possess greater financial resources, stronger institutional legitimacy, and increased stakeholder pressure to engage in socially responsible activities.

However, the moderate explanatory power of the regression model indicates that additional external factors, such as government policy, sustainability regulations, economic conditions, and organisational culture, may also influence sustainability engagement within the construction industry.

4.6. Fuzzy Synthetic Evaluation of SDGs Activities

Following factor extraction, the Fuzzy Synthetic Evaluation Model (FSEM) was employed to evaluate the frequency and relative significance of SDGs activities undertaken by construction organisations see Table 4.

The results revealed that Human Development recorded the highest index value (2.728), followed by Infrastructure Restoration (2.693), Health and Well-being (2.690), Social Development (2.673), and Sports Development (2.455).

Although Human Development ranked highest, all dimensions recorded index values below 3.0, indicating that sustainability activities are generally undertaken infrequently.

Importantly, the conclusion that construction organisations' contributions are "rare" was not based solely on descriptive mean scores. Rather, the interpretation was benchmarked against the linguistic scale adopted in the study and supported by comparative findings from studies conducted in developed economies, where sustainability integration appears more institutionalised and strategically embedded [6-8].

Compared with sustainability benchmarks emphasising continuous and proactive SDGs engagement, the observed scores suggest that many Ghanaian construction firms remain at an early or moderate stage of sustainability implementation. The findings, therefore, imply that sustainability activities are still largely peripheral rather than integrated into core organisational strategies.

The relatively weak sustainability performance observed across all dimensions may be attributed to:

1) limited regulatory enforcement,
2) inadequate sustainability awareness,
3) financial constraints,
4) weak institutional pressure,
5) and absence of structured sustainability reporting frameworks.

These findings suggest that sustainability engagement among construction organisations in developing economies remains largely reactive and compliance-driven rather than innovation-oriented and strategically integrated.

Table 4. *Sustainable Development Goals activities by construction organisations.*

Code		Mean	Weighting for each SDGs	Total Mean	Weighting for each CSRF
	Infrastructure restoration			16.098	0.305
SAN1	Building of community clinic	2.70	0.168		
SAN2	Environmental protection education	2.59	0.161		
SAN3	supply of furniture to schools	2.66	0.165		
SAN4	Renovation of Hospitals	2.59	0.161		
SAN5	Renovation of school	2.96	0.184		
SAN6	Provision of water	2.60	0.162		
	Health and well-being			10.695	0.202
HES1	Health Education/Screening	2.96	0.276		
HES2	Fire prevention Education	2.63	0.246		
HES3	Safety Drills	2.78	0.260		
HES4	Provision of counselling	2.32	0.217		
	Social development			10.651	0.202
RS1	Building school blocks	2.70	0.253		
RS2	Support to orphanages	2.83	0.266		
RS3	support for the work of NGOs	2.42	0.227		
RS4	Medical support to the poor and needy	2.70	0.254		
	Human development			10.530	0.199
SO1	Provision of Scholarship scheme	2.42	0.230		
SO2	Sanitation	3.46	0.328		
SO3	Provision of skills training	2.57	0.244		
SO4	Preservation of monuments	2.08	0.197		
	Sports development			4.882	0.092
SA1	Building of Recreational centres	2.26	0.464		
SA2	Sponsorship of sporting activities	2.62	0.536		
				52.856	

Table 5. Membership Function of Corporate Social Responsibility Activities.

Code		Weight	Membership Function Level 3	Membership Function Level 2
	Infrastructure Restoration			
SAN1	Building of community clinics	0.168	0.278, 0.178, 0.178, 0.300, 0.067	0.283, 0.192, 0.163, 0.277, 0.085
SAN2	Environmental protection education	0.161	0.256, 0.289, 0.122, 0.278, 0.056	-
SAN3	supply of furniture to schools	0.165	0.311, 0.233, 0.089, 0.222, 0.144	-
SAN4	Renovation of Hospitals	0.161	0.330, 0.121, 0.209, 0.308, 0.033	-
SAN5	Renovation of school	0.184	0.222, 0.122, 0.211, 0.367, 0.078	-
SAN6	Provision of water	0.162	0.308, 0.220, 0.165, 0.176, 0.132	-
	Health and well-being			
HES1	Health Education/Screening	0.276	0.200, 0.222, 0.122, 0.333, 0.122	0.277, 0.216, 0.148, 0.254, 0.105
HES2	Fire prevention Education	0.246	0.222, 0.244, 0.244, 0.256, 0.033	-
HES3	Safety Drills	0.260	0.261, 0.261, 0.068, 0.250, 0.159	-
HES4	Provision of counselling	0.217	0.456, 0.122, 0.167, 0.156, 0.100	-
	Social development			
RS1	Building school blocks	0.253	0.303, 0.213, 0.146, 0.157, 0.180	0.285, 0.208, 0.166, 0.234, 0.107
RS2	Support to orphanages	0.266	0.256, 0.156, 0.189, 0.300, 0.100	-
RS3	support for the work of NGOs	0.227	0.286, 0.297, 0.176, 0.198, 0.044	-
RS4	Medical support to the poor and needy	0.254	0.297, 0.176, 0.154, 0.275, 0.099	-
	Human development			
SO1	Provision of Scholarship scheme	0.230	0.300, 0.300, 0.178, 0.122, 0.100	0.276, 0.206, 0.162, 0.222, 0.134
SO2	Sanitation	0.328	0.100, 0.111, 0.211, 0.389, 0.189	-
SO3	Provision of skills training	0.244	0.348, 0.236, 0.101, 0.124, 0.191	-
SO4	Preservation of monuments	0.197	0.455, 0.216, 0.136, 0.182, 0.011	-
	Sports development			
SA1	Building of Recreational centres	0.464	0.374, 0.253, 0.154, 0.176, 0.044	0.324, 0.202, 0.222, 0.202, 0.050
SA2	Sponsorship of sporting activities	0.536	0.281, 0.157, 0.281, 0.225, 0.056	-

The membership function (Level 2) presented in Table 5 provided the basis for estimating the indices of the main factors (constructs). The indices were obtained from the product of the scale responses (ratios) and the membership function Level 2 matrix.

From Table 6, the first-ranked sustainable development goals activity was human development, with an index of 2.728, indicating that the activity of supporting human development was rare. The second SDGs activity was Infrastructure Development, which recorded an index of 2.693 (rarely undertaken). Health and Well-being and Social Development also recorded indices of 2.69 and 2.673, respectively, and ranked 3rd and 4th. It was observed that Sports Development activities, with an index of 2.455, were the least undertaken activity in the community.

Table 6. Overall Indices for SDGs Factors.

Items	Index	Linguistics	Rank
Human Development	2.728	Rare	1
Infrastructure Restoration	2.693	Rare	2
Health and Well-being	2.690	Rare	3
Social Development	2.673	Rare	4
Sports Development	2.455	rare	5

A bar chart was included to visually compare the fuzzy index values of the five SDGs dimensions.

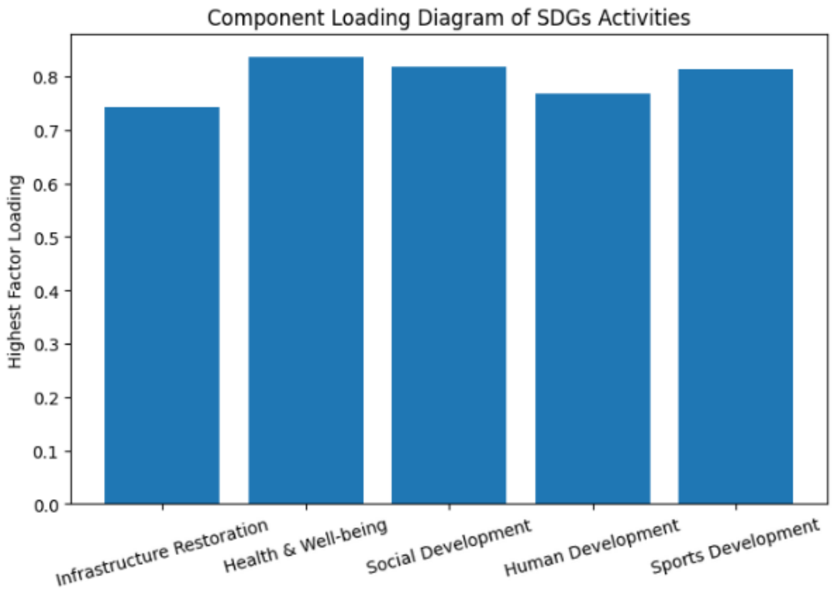

Figure 3. Bar Chart of Fuzzy Synthetic Evaluation Indices.

The radar chart reveals uneven sustainability engagement across dimensions, with relatively stronger performance in Human Development and Infrastructure Restoration and weaker performance in Sports Development.

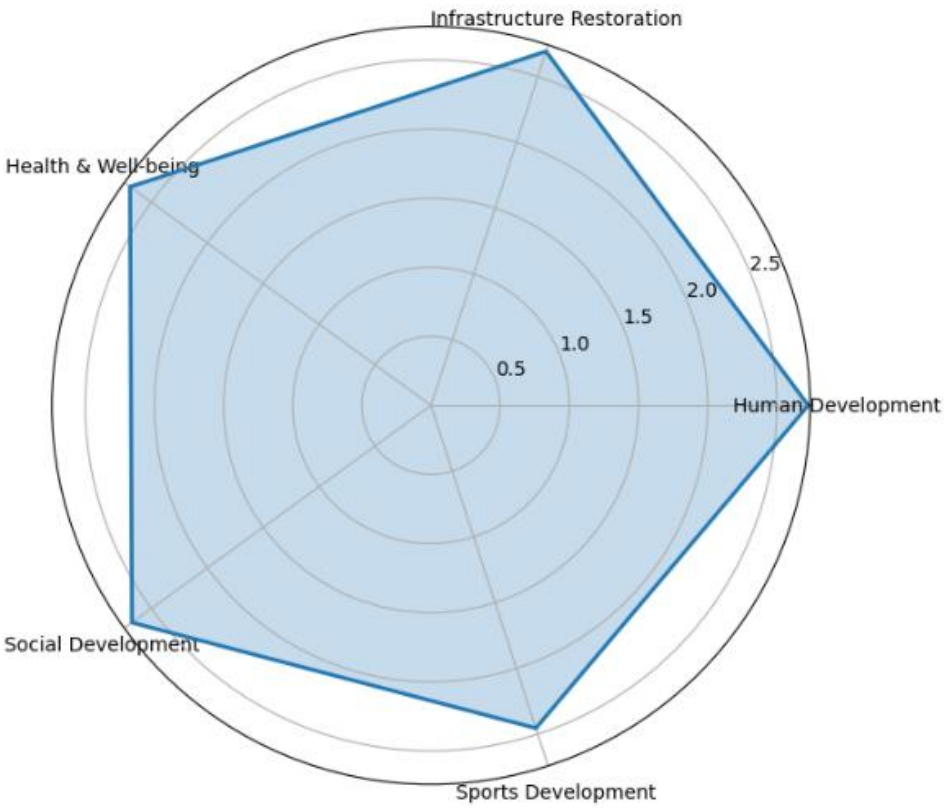

Figure 4. Radar Chart of SDGs Sustainability Dimensions.

This study found that construction organisations in developing economies, such as Ghana and similar countries, engage in activities that contribute to the achievement of the Sustainable Development Goals (SDGs). The study revealed that construction organisations mainly contribute to human development activities linked to SDG 2, SDG 13, SDG 14, SDG 6, SDG 11, and SDG 4. This was followed by infrastructure restoration activities associated with SDG 3, SDG 13, SDG 14, SDG 6, SDG 11, and SDG 4. In addition, contributions to health and well-being were linked to SDG 3, SDG 8, SDG 11, and SDG 1. Social development activities connected to SDG 2, SDG 4, SDG 5, SDG 7, SDG 10, and SDG 11 ranked as the third and fourth most common SDG-related activities undertaken by construction organisations. However, sports development activities linked to SDG 1 and SDG 9 were found to be the least prioritised among the SDG-related initiatives undertaken by construction organisations.

The findings further indicate that although construction organisations contribute to the Sustainable Development Goals, these activities occur infrequently, suggesting that their overall contribution remains limited.

These findings are supported by previous studies. [1] found that construction organisations contribute to the development of recreational centres and the sponsorship of sporting activities, which align with SDG 11 (Sustainable Cities and Communities) by promoting inclusive and equitable urban development. Similarly, [2] reported that the provision of water infrastructure projects ensures access to clean water and sanitation, thereby supporting SDG 6 (Clean Water and Sanitation), which is essential for community health and well-being. Furthermore, [3] argued that supplying furniture to schools and constructing school buildings directly support SDG 4 (Quality Education) and SDG 11 (Sustainable Cities and Communities) by improving access to quality learning environments in underserved communities.

Additionally, [4] highlighted that the construction industry's social contributions, such as scholarships for students, support for orphanages, and medical assistance for vulnerable populations, align with SDG 10 (Reduced Inequalities) and SDG 1 (No Poverty). Similarly, [5] emphasised that construction organisations contribute to several SDGs, including SDG 2 (Zero Hunger), SDG 3 (Good Health and Well-being), SDG 4 (Quality Education), SDG 6 (Clean Water and Sanitation), SDG 7 (Affordable and Clean Energy), SDG 8 (Decent Work and Economic Growth), SDG 9 (Industry, Innovation, and Infrastructure), SDG 10 (Reduced Inequalities), SDG 11 (Sustainable Cities and Communities), and SDG 13 (Climate Action).

The significance of this study lies in its contrast with previous studies that suggest construction organisations contribute substantially to the achievement of the SDGs. In contrast, the present study found that construction organisations are only minimally engaged in activities that support the SDGs, despite the significant environmental, social, and urban impacts associated with their operations.

5. Conclusion

The construction industry is uniquely positioned to influence the achievement of the Sustainable Development Goals (SDGs) through its ability to shape urban and rural environments, stimulate economic growth, and promote social development. This study provides empirical evidence of the industry's contributions within Ghana and comparable developing economies. The findings reveal that although activities supporting human development, infrastructure restoration, and health and well-being are evident, such contributions remain limited in frequency and scale.

The study identified notable contributions to SDG 6 (Clean Water and Sanitation), SDG 4 (Quality Education), and SDG 11 (Sustainable Cities and Communities). However, activities related to sports development, particularly those associated with SDG 1 and SDG 9, received the least attention. This imbalance highlights the need for construction organisations to adopt a more comprehensive and strategic approach to sustainability by focusing on areas with substantial environmental and social implications, including biodiversity conservation (SDG 15) and climate action (SDG 13).

Contrary to earlier studies that reported significant contributions of construction organisations toward achieving the SDGs, this study demonstrates that such contributions, although impactful, are relatively rare and insufficient considering the urgency of current global sustainability challenges. The findings therefore call for proactive measures to integrate sustainability principles into construction practices through capacity building, policy reforms, and cross-sector collaboration. In addition, stronger accountability frameworks and incentive mechanisms are necessary to encourage greater industry alignment with the SDGs.

In summary, although the construction industry possesses enormous potential to drive sustainable development, achieving this potential will require coordinated efforts from all stakeholders. By embracing innovation, strengthening collaboration, and addressing barriers to sustainability, the industry can transition from making occasional contributions to becoming a major force in advancing the Sustainable Development Goals and promoting a resilient and sustainable future for all.

Abbreviations

ABCECG	Association of Building and Civil Engineering Contractors of Ghana
ASROC	Association of Road Contractors
BIM	Building Information Modelling
BREEAM	Building Research Establishment Environmental Assessment Method
CFA	Confirmatory Factor Analysis

ESG	Environmental, Social and Governance
EFA	Exploratory Factor Analysis
FSE	Fuzzy Synthetic Evaluation
FSEM	Fuzzy Synthetic Evaluation Modelling
KMO	Kaiser-Meyer-Olkin
LEED	Leadership in Energy and Environmental Design
MDGs	Millennium Development Goals
MRH	Ministry of Roads and Highways
MWH	Ministry of Works and Housing
NGOs	Non-Governmental Organisations
PCA	Principal Component Analysis
SDGs	Sustainable Development Goals
SIDA	Swedish International Development Cooperation Agency
SPSS	Statistical Package for the Social Sciences
TBL	Triple Bottom Line
UNEP	United Nations Environment Programme

Author Contributions

Justice Williams: Conceptualization, Data curation, Formal Analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing

Conflicts of Interest

There is no conflicts of interest for this paper.

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