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PERFORMANCE EVALUATION OF SUSTAINABLE DEVELOPMENT IN CONSTRUCTION PROJECTS IN KURDISTAN REGION: STAKEHOLDER KNOWLEDGE, EFFECTIVENESS, AND END-USER FEEDBACK

HAVAL M. SALIH[1,*], DALSHAD KAKASOR[1], AHMET OZTAS[2]

[1]College of Engineering, Salahaddin University, Erbil, Iraq
[2]Epoka University, Tirana, Albania
*Corresponding Author: haval.salih@su.edu.krd

Abstract

Significant environmental problems, such as excessive waste, pollution, and deforestation, have resulted from the Kurdistan Region's (KR) lack of related knowledge and sustainability standards in the projects. In order to direct reform efforts, this unique, comprehensive evaluation conducted throughout the KR finds performance gaps and evaluates project sustainability. This study aims to assess three crucial aspects of project sustainability performance in the KR: social acceptance, project execution efficiency, and stakeholder knowledge. Five hundred eighteen questionnaires were delivered successfully out of the 900+ stakeholders that received an online Google Forms questionnaire used for collecting data. The excellent data reliability of the survey was validated by SPSS analysis, with a Cronbach's Alpha of 0.9. Significant gaps in performance were found by SPSS analysis: familiarity with sustainability information was neutral, with a mean of 3.8, but sustainability training programs were recognised as poor, with a mean of 2.7. Key performance indicators throughout the implementation stage included plan clarity with a mean of 3.1, standards compliance with a mean of 3.3, and top management commitment, with a mean of 3.4. Social and end-user feedback on the sustainability of the finished project also scored poor ratings (3.3). The results indicate the urgent need for improved sustainability procedures, stakeholder education, and government action to raise the environmental results and project performance of the Kurdistan Region, Iraq.

Keywords: Construction performance; Social acceptance; Sustainability performance; Public awareness.

1. Introduction

Project performance is essential in the construction industry for evaluating if the project is moving properly [1-3]. Sustainability performance is a combination of a company's economic, social, and environmental performance in every aspect of corporate sustainability. Creating value without sacrificing the needs of future generations is the concept of sustainability [4]. This means using resources to meet current needs while protecting and, if possible, enhancing the basis of natural resources for future generations [5]. The understanding that the planet is our only home and that we must preserve it for the sake of the next generations [6, 7].

Nations around the world have succeeded in advancements in raising awareness and adopting legislation that mitigates the negative impact on the environment [8, 9]. The goal of the 2015 Paris Agreement was to keep the rise in global temperatures between 1.5 and 2 degrees Celsius over pre-industrial levels [10]. The UN, European Environmental Agency, OECD, German Advisory Council on Global Change, European Union, and national governments have released reports and policy programs supporting sustainability transitions and calling for "transformative change" in recent years [11].

To minimise the negative impacts of projects on environmental and public health, these countries have enacted thorough laws and strict regulations [12]. From the study conducted by Ascione et al. [13], 33% of the world's energy use, 40% of all raw material consumption, 40% of all solid waste generation, and 7% of all CO_2 emissions are produced by the construction industry. In the modern world, a company's ability to succeed depends not only on how well its projects are completed but also on how they affect society and the environment over the long run [14].

Integrating sustainability into projects can improve the image of a company, as it may lead to new market opportunities [15]. For regions, countries, and the entire planet to be sustainable, construction projects need to perform better in terms of sustainability. The environmental, social, and economic pillars of sustainability are generally recognised in design but are less common in their construction phase [16]. Ahmed and El-Sayegh [17] state that using sustainable construction techniques reduces the construction development's overall environmental impact.

The KR faces difficulties in ensuring that its construction projects meet globally recognised sustainability standards, leading to numerous environmental and social issues. Despite the increasing worldwide focus on sustainable development, KR's projects frequently do not meet accepted standards, showing a limited use of environmentally friendly practices and materials. As per Zolfagharian et al. [18], the absence of government oversight and implementation of sustainability guidelines results in environmental problems such as excessive waste, dangerous materials, elevated dust levels, diminished greenery, and light and noise pollution.

There is a lack of awareness and understanding among regional professionals involved in KR's construction industry regarding international sustainability frameworks like Leadership in Energy and Environmental Design (LEED) certification and BREEAM, resulting in the infrequent application of fundamental concepts such as energy efficiency, waste management, and pollution control. Zebari and Ibrahim [19] verified that the KR's building sustainability performance is still unsatisfactory. The use of inexperienced labourers who lack expertise in sustainable construction is another issue with Kurdistan's buildings. The lack of

government regulations that can be enforced, along with insufficient oversight, escalates problems like the generation of excessive waste, increased dust levels, noise and light pollution, and reduced green spaces. These deficiencies not only play a role in environmental deterioration but also result in public dissatisfaction regarding completed projects.

Azapagic [20] stresses that decision-makers and executives may make decisions on future actions based on sustainable conditions by evaluating construction sustainability performance. Key obstacles to sustainable construction in the KR were identified by Shawkat et al. [21] including initial costs that were 2 - 7% higher than those of conventional buildings, a lack of laws and regulations, a lack of awareness among stakeholders, sociocultural resistance to change, technical limitations such as shortages of materials, and leadership deficiencies that affected the implementation of sustainable strategies.

In particular, the lack of professional expertise and clients' ignorance of the advantages of sustainability constitute the awareness barrier. According to Kamil et al. [22], Iraqi consumers reject sustainable constructions since they are 2-6% more expensive, even if they offer advantages including lower energy usage, improved public safety, and eco-friendly features.

To educate the public about the benefits and distinctions of sustainable building, the study underlined the necessity of extensive awareness programs that are carried out by municipalities, universities, and schools in coordination with the Environment, Energy, and Information Ministries. Furthermore, Iraq lacks a suitable building rating system that may handle important problems like energy use and water management during the continuing electrical crisis in the country. Therefore, the objectives of this study are to assess the current project sustainability performance in the KR construction sector, highlight weaknesses, and guide decision-makers in applying practical strategies into action.

2. Research Method

2.1. Data sourcing

The questionnaire is a powerful method as a primary tool to collect the data [23]. A combination of structured and unstructured questions has been used to collect data. The researchers have adopted a 7-point Likert scale, derived from the study of Joshi et al. [24]. The seven-point scale offers greater detail of accuracy compared to the 5-point Likert scale. The interpretation values of the obtained means were calculated, as per the defined Likert scale [25, 26], and further detailed in Table 1.

Table 1. Likert scale mean values and their interpretation.

Likert scale	Mean value Ranges	Difference	Interpretation
1	1.00 - 1.85	0.85	*
2	1.86 - 2.71	0.85	*
3	2.71 - 3.57	0.85	*
4	3.58 - 4.43	0.85	*
5	4.44 - 5.29	0.85	*
6	5.30 - 6.15	0.85	*
7	6.16 - 7.00	0.85	*

*For this study, the interpretation will be: Very Poor (1) to Very Good (7), section 3.3; Strongly Disagree (1) to Strongly Agree (7), Section 3.4 and Section 3.5.

2.2. Pilot study

As per Connelly [27], pilot studies often follow the same protocols and methodologies as the larger study in future phases. The pilot study of this research used a Google Forms online survey, using the same approach as the primary data collection methodology. Seven experts (three academics and four professionals) participated; they were chosen for their professional experience and pertinent educational backgrounds. These experts were supplied with each survey component for a thorough analysis.

Prior to widespread deployment, the evaluation prioritised a methodical examination of every survey component to guarantee instrument validity and methodological soundness. As a consequence of the pilot study, the questionnaire was significantly refined, with mistakes and inaccuracies fixed, offensive statements eliminated, new, necessary statements added, and the framework rearranged overall. The final survey instrument's increased clarity, accuracy, and scientific precision were guaranteed by these enhancements.

2.3. Sample design and sample size calculation

For the sampling, KR citizens will be considered as the population. Individuals who are involved in the construction industry directly or indirectly will be considered the targeted population [28]. According to Kirby et al. [29], the study's power is 80%, and the formula for the calculation was taken from the Cochran study [30], as shown below:

$$n_0 = \frac{Z^2\, p.q}{d^2} \tag{1}$$

where n_0 = minimum sample size. Z = Z-score corresponding to the confidence level (95% in this study, the Z-score is 1.96); p = estimated proportion of the population (if unknown, use 0.5 for maximum variability); q = 1-p; d^2 = margin of error (expressed as a decimal, e.g., 0.05 for 5%)

$$n_0 = \frac{1.96^2\ X\ 0.5X0.5}{0.05^2} = \frac{0.9604}{0.0025} = 384$$

Adjusting for finite population: The finite population correction formula can be used to modify the sample size (Lumley [31]).

$$n = \frac{n_o}{(1+(n_o\text{-}1))/N} \tag{2}$$

where n = adjusted sample size; n_o = initial sample size (384); N = population size (20,000), resulting in adjusted sample size, n as

$$n = \frac{384}{1 + (384 - 1)/20{,}000} = \frac{384}{1.01915} = 377$$

3. Results and Discussion

3.1. Reliability analysis, cleaning and screening of collected data

The process of data cleaning included removing illogical responses and improving accuracy. Replies that had zero or almost zero standard deviation across statements were considered uniform in order to identify unreasonable responses. (e.g.,

selecting the same scale for all items, such as consistently choosing 4 or 7). These answers were probably the consequence of careless filling, random clicking, or non-serious participation [32, 33]. Following data cleaning, 502 respondents represented the final sample size, which is larger than the minimum required 377.

This bigger sample size lowers the margin of error, improves the study's statistical power, and makes the results more reliable. According to Schrepp [34], higher Cronbach's Alpha values are indicative of greater reliability. As per the reliability criteria established by George and Mallery [35], Alpha values more than 0.7 were regarded as acceptable, ones above 0.8 as good, and those higher than 0.9 as excellent. From the SPSS analysis, the overall reliability of this study is considered excellent, with a value of 0.903, as shown in Table 2.

Table 2. Cronbach's Alpha (α) and reliability level.

Sub-Section	α	N of Items	Reliability Level
Individual Knowledge and Awareness	0.756	4	Acceptable
Project Implementation Strategy and Completion	0.933	5	Excellent
People's awareness and social acceptance	0.761	8	Acceptable
Overall	0.903	17	Excellent

3.2. Demographic characteristics

The respondents' gender, age, city, position, experience, professional certifications, and degree of education are all shown by the demographic data. Understanding these characteristics is essential to determining the data's reliability and representativeness. From the collected data, Males represented 85% of the respondents, with only 15% representing females. The fact that almost 70% of responders were older than 36 suggests that the sample was somewhat experienced.

The majority of respondents (76%) were from Erbil, the capital city of the Kurdistan Region, where a significant proportion of construction activities are concentrated. Approximately 70% of the respondents held a bachelor's degree, while a further 20% possessed a master's degree. This educational background suggests that the respondents were generally well qualified to provide informed opinions on the subject matter. Engineers and project managers constituted a substantial portion of the sample, representing 50% and 25% of respondents, respectively, both of whom play key roles in construction projects. In addition, more than 55% of the respondents had over 10 years of professional experience, indicating a relatively experienced participant group.

3.3. Individual knowledge and awareness

As per Fig. 1 presented data, the respondents agree that training associated with sustainability is of low quality, with the lowest mean value of 2.7 out of 7. Possible reasons for this gap include limited participant interest, a lack of standardised processes, a lack of qualified instructors, and inadequate training program design. Likely, the project team's mean score of 3.3 indicates that their expertise in implementing sustainability concepts is almost inadequate, and their knowledge of typical green buildings is also poor. In general, the data shows low levels of awareness and expertise.

The most startling finding is that none of the assessed domains, such as knowledge of sustainability principles, green building certifications, organisational development, and real-world application, achieves even a moderate degree of competence. The critical need for thorough educational and strategic interventions is shown by the lowest score, which is 2.7. This evaluation emphasises the urgent need for focused initiatives that can close the significant knowledge gap, improve organisational training, and foster the development of useful skills in sustainability practices.

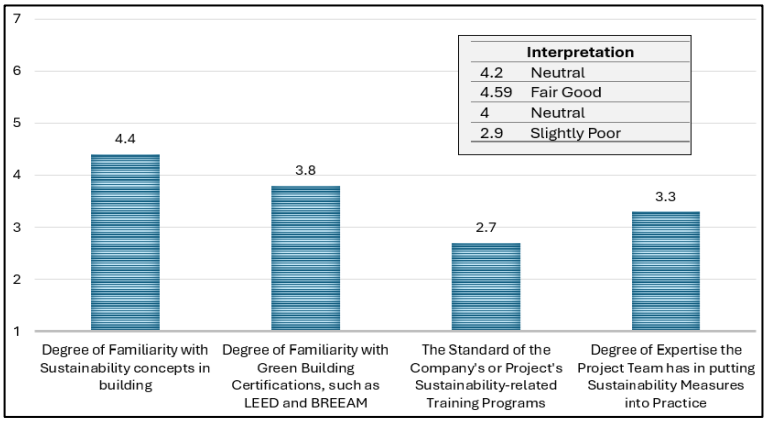

Fig. 1. Participant's sustainability-related knowledge and awareness.

3.4. Project implementation strategy and completion

According to the results, all of the scores fall under the mean range of 4, which indicates a poor level of sustainability practices during the project implementation phase and completed tasks. These values show that people somewhat agree that the sustainability planning is unclear, employees are not participating in sustainability-related decisions, there is a lack of systematic improvement, and the completed tasks do not comply with sustainability concepts. Figure 2 shows the participants' level of agreement with statements; the respondents agree that top management is not committed to the sustainability principles during the execution stage.

The majority of participants agree that the assessed sustainability features in the implementation stage are poor, probably as a result of the absence of consistent guidelines, plans, or procedures to direct employees and the restricted chances for staff involvement in decision-making. Moreover, Eco-friendly materials, energy efficiency, and renewable energy concepts are not sufficiently prioritised by top management. Initiatives for improvement, include reusing materials or rethinking procedures to cut waste, are also lacking. Consequently, completed projects frequently fall short of social responsibility or environmental criteria, underscoring implementation gaps in sustainable practices.

3.5. People's awareness and social acceptance

Analysis results in Fig. 3 indicate a strong awareness and implementation issues exist in the organisation's sustainability environment. End-user satisfaction with finished sustainability practices is still low, with 3.4, despite workers' neutral

understanding of sustainability's workplace applications, with 3.8 and companies' inadequate measurement competencies for social project acceptance, with 3.5. On the other hand, buyers' readiness to pay extra (4.2) and the essential importance of sustainability (4.2) are moderately agreed with. Furthermore, there is general agreement regarding the importance of eco-friendly materials (5.8), the impact of sustainability on project success (5.6), and the long-term financial advantages surpassing initial costs (5.7).

These findings demonstrate a high level of theoretical awareness that has not fully translated into practical implementation and stakeholder satisfaction. The gaps that have been found highlight important issues, such as the fact that many employees lack the skills and information needed to appropriately adopt and implement sustainable practices. These problems eventually restrict the successful integration of sustainability in projects and are caused by a lack of consumer demand for green initiatives.

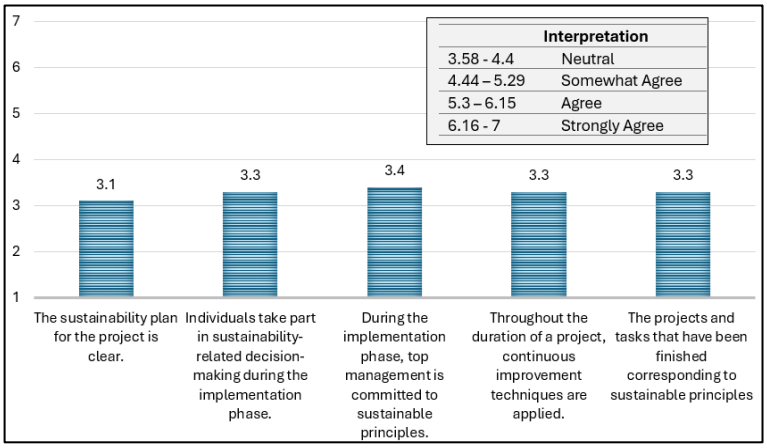

Fig. 2. The mean of sustainability-related statements during execution.

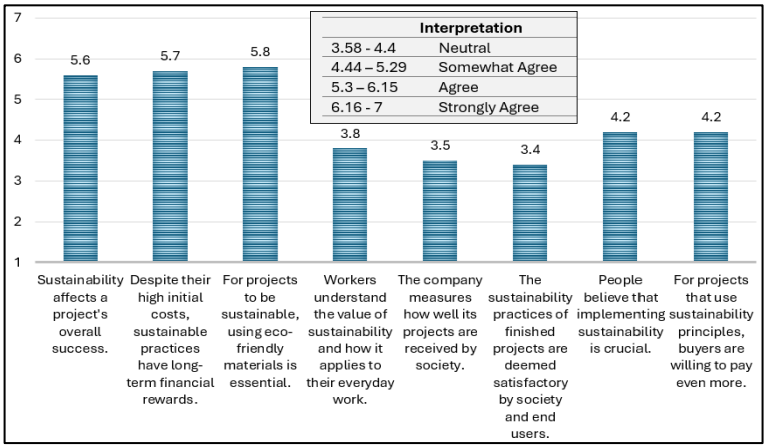

Fig. 3. Evaluating social feedback on sustainability and people awareness.

3.6. Analysis of the indicators intercorrelation

This section discusses the strength of correlation of the social acceptance, implementation, and knowledge in sustainability performance. Using Pearson's r, the correlations between the variables were analysed ($p < 0.05$ or 0.01), as described in Table 3. The correlation strength can be categorised as follows, using Meghanathan's [36] study: 0.80-1.00 is Very Strong, 0.60-0.79 Strong, 0.40-0.59 Moderate, 0.20-0.39 Weak, and 0.00-0.19 Very Weak.

The study shows two significant correlations that impact company outcomes: employee sustainability awareness (v3.3.4) and training quality (v3.1.3) show a fairly positive correlation ($r = 0.459$). This is due to the fact that while organised training immediately increases awareness of sustainable practices, engagement may be further increased by utilising interactive strategies like case studies. Furthermore, societal satisfaction (v3.3.6, $r = 0.509$) and team experience (v3.1.4) are significantly correlated.

Teams with more experience are better able to match projects to the needs of the community, which implies that regular community evaluations could enhance outcomes to satisfy evolving expectations. Both results demonstrate the importance of targeted training and community-based strategies to improve organisational effectiveness. According to the results, there are three strong, statistically significant relationships: managerial commitment (v3.2.3) and perceived relevance of sustainability (v3.3.7, $r = 0.386$) moderately correlate.

This is due to the fact that perceived management fosters a culture that values sustainability, while exposing management's sustainability objectives could increase their impact. Following sustainability principles (v3.2.5) shows a strong correlation with societal satisfaction (v3.3.6, $r = 0.608$). This is because principled initiatives naturally align with the needs of society; proactive stakeholder involvement is recommended to adapt compliance strategies to local goals.

Additionally, the evaluation of public acceptance (v3.3.5, $r = 0.561$) is greatly impacted by continuous improvement processes (v3.2.4) since continuous feedback loops improve responsiveness; however, the use of real-time digital tools (such as surveys) may increase the effectiveness of data collection. To improve engagement, the analysis suggests formalising collaborative frameworks like focus groups. It also finds that employee participation (v3.2.2) has a strong correlation with societal satisfaction (v3.3.6, $r = 0.562$), suggesting that inclusive decision-making fosters socially acceptable outcomes.

Clear sustainability plans (v3.2.1, $r = 0.630$) and continuous improvement (v3.2.4, $r = 0.593$) are strongly predicted by training quality (v3.1.3), which is positively correlated with project execution because excellent training enhances the capacity for practical planning and adaptability. Similarly, well-defined plans (v3.2.1, $r = 0.678$) and management commitment (v3.2.3, $r = 0.639$) are significantly correlated with team experience (v3.1.4), which significantly enhances execution.

This is due to the fact that skilled teams reduce risks and link leadership priorities with sustainability goals. Establishing expertise through cross-functional cooperation and mentorship programs is advised. This analysis highlights how important it is to connect project implementation with social acceptance through stakeholder participation, leadership, and training. Weak

financial connections point to the need for improved communication of the economic benefits of sustainability.

Table 3. Project sustainability performance correlation matrix: pairwise correlation among individual knowledge, execution, and customer satisfaction.

Table 3. Section (a) from s3.1.1 to s3.2.5.

Correlation		s3.1.1	s3.1.2	s3.1.3	s3.1.4	s23.2.1	s3.2.2	s3.2.3	s3.2.4	s3.2.5
	Pearson Correlation	1	.554**	.303**	.343**	.303**	.293**	.289**	.351**	.269**
s3.1.1	Sig. (2-tailed)		.000	.000	.000	.000	.000	.000	.000	.000
	N	502	502	502	502	502	502	502	502	502
	Pearson Correlation	.554**	1	.431**	.397**	.373**	.246**	.266**	.331**	.261**
s3.1.2	Sig. (2-tailed)	.000		.000	.000	.000	.000	.000	.000	.000
	N	502	502	502	502	502	502	502	502	502
	Pearson Correlation	.303**	.431**	1	.672**	.630**	.554**	.521**	.593**	.507**
s3.1.3	Sig. (2-tailed)	.000	.000		.000	.000	.000	.000	.000	.000
	N	502	502	502	502	502	502	502	502	502
	Pearson Correlation	.343**	.397**	.672**	1	.678**	.658**	.639**	.659**	.619**
s3.1.4	Sig. (2-tailed)	.000	.000	.000		.000	.000	.000	.000	.000
	N	502	502	502	502	502	502	502	502	502
	Pearson Correlation	.303**	.373**	.630**	.678**	1	.767**	.734**	.737**	.694**
s23.2.1	Sig. (2-tailed)	.000	.000	.000	.000		.000	.000	.000	.000
	N	502	502	502	502	502	502	502	502	502
	Pearson Correlation	.293**	.246**	.554**	.658**	.767**	1	.753**	.728**	.704**
s3.2.2	Sig. (2-tailed)	.000	.000	.000	.000	.000		.000	.000	.000
	N	502	502	502	502	502	502	502	502	502
	Pearson Correlation	.289**	.266**	.521**	.639**	.734**	.753**	1	.806**	.747**
s3.2.3	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000		.000	.000
	N	502	502	502	502	502	502	502	502	502
	Pearson Correlation	.351**	.331**	.593**	.659**	.737**	.728**	.806**	1	.726**
s3.2.4	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000		.000
	N	502	502	502	502	502	502	502	502	502
	Pearson Correlation	.269**	.261**	.507**	.619**	.694**	.704**	.747**	.726**	1
s3.2.5	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	
	N	502	502	502	502	502	502	502	502	502
	Pearson Correlation	.258**	.158**	.056	.122**	.086	.073	.087	.111*	.054
s3.3.1	Sig. (2-tailed)	.000	.000	.214	.006	.055	.101	.052	.012	.229
	N	502	502	502	502	502	502	502	502	502
	Pearson Correlation	.209**	.167**	-.030	-.033	.003	-.007	-.004	.033	-.031
s3.3.2	Sig. (2-tailed)	.000	.000	.506	.456	.949	.879	.932	.461	.495
	N	502	502	502	502	502	502	502	502	502
	Pearson Correlation	.169**	.131**	-.033	-.056	.000	-.035	.009	.014	-.038
s3.3.3	Sig. (2-tailed)	.000	.003	.456	.207	.994	.429	.843	.752	.394
	N	502	502	502	502	502	502	502	502	502
	Pearson Correlation	.166**	.218**	.459**	.509**	.548**	.573**	.580**	.568**	.565**
s3.3.4	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000
	N	502	502	502	502	502	502	502	502	502
	Pearson Correlation	.247**	.195**	.467**	.525**	.548**	.589**	.611**	.561**	.638**
s3.3.5	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000
	N	502	502	502	502	502	502	502	502	502
	Pearson Correlation	.232**	.231**	.491**	.509**	.562**	.562**	.599**	.599**	.608**
s3.3.6	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000
	N	502	502	502	502	502	502	502	502	502
	Pearson Correlation	.241**	.220**	.299**	.347**	.354**	.378**	.386**	.399**	.379**
s3.3.7	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000
	N	502	502	502	502	502	502	502	502	502

	Pearson Correlation	.132**	.136**	.329**	.338**	.344**	.355**	.364**	.376**	.381**
s3.3.8	Sig. (2-tailed)	.003	.002	.000	.000	.000	.000	.000	.000	.000
	N	502	502	502	502	502	502	502	502	502

Table 3. Section (b) from s3.3.1 to s3.3.8.

Correlation		**s3.3.1**	**s3.3.2**	**s3.3.3**	**s3.3.4**	**s3.3.5**	**s3.3.6**	**s3.3.7**	**s3.3.8**
	Pearson Correlation	.258**	.209**	.169**	.166**	.247**	.232**	.241**	.132**
s3.1.1	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.003
	N	502	502	502	502	502	502	502	502
	Pearson Correlation	.158**	.167**	.131**	.218**	.195**	.231**	.220**	.136**
s3.1.2	Sig. (2-tailed)	.000	.000	.003	.000	.000	.000	.000	.002
	N	502	502	502	502	502	502	502	502
	Pearson Correlation	.056	-.030	-.033	.459**	.467**	.491**	.299**	.329**
s3.1.3	Sig. (2-tailed)	.214	.506	.456	.000	.000	.000	.000	.000
	N	502	502	502	502	502	502	502	502
	Pearson Correlation	.122**	-.033	-.056	.509**	.525**	.509**	.347**	.338**
s3.1.4	Sig. (2-tailed)	.006	.456	.207	.000	.000	.000	.000	.000
	N	502	502	502	502	502	502	502	502
	Pearson Correlation	.086	.003	.000	.548**	.548**	.562**	.354**	.344**
s23.2.1	Sig. (2-tailed)	.055	.949	.994	.000	.000	.000	.000	.000
	N	502	502	502	502	502	502	502	502
	Pearson Correlation	.073	-.007	-.035	.573**	.589**	.562**	.378**	.355**
s3.2.2	Sig. (2-tailed)	.101	.879	.429	.000	.000	.000	.000	.000
	N	502	502	502	502	502	502	502	502
	Pearson Correlation	.087	-.004	.009	.580**	.611**	.599**	.386**	.364**
s3.2.3	Sig. (2-tailed)	.052	.932	.843	.000	.000	.000	.000	.000
	N	502	502	502	502	502	502	502	502
	Pearson Correlation	.111*	.033	.014	.568**	.561**	.599**	.399**	.376**
s3.2.4	Sig. (2-tailed)	.012	.461	.752	.000	.000	.000	.000	.000
	N	502	502	502	502	502	502	502	502
	Pearson Correlation	.054	-.031	-.038	.565**	.638**	.608**	.379**	.381**
s3.2.5	Sig. (2-tailed)	.229	.495	.394	.000	.000	.000	.000	.000
	N	502	502	502	502	502	502	502	502
	Pearson Correlation	1	.649**	.558**	.123**	.043	.067	.249**	.188**
s3.3.1	Sig. (2-tailed)		.000	.000	.006	.340	.135	.000	.000
	N	502	502	502	502	502	502	502	502
	Pearson Correlation	.649**	1	.620**	.020	-.038	.030	.204**	.123**
s3.3.2	Sig. (2-tailed)	.000		.000	.653	.396	.506	.000	.006
	N	502	502	502	502	502	502	502	502
	Pearson Correlation	.558**	.620**	1	.057	-.021	.001	.179**	.091*
s3.3.3	Sig. (2-tailed)	.000	.000		.202	.634	.974	.000	.041
	N	502	502	502	502	502	502	502	502
	Pearson Correlation	.123**	.020	.057	1	.603**	.602**	.385**	.348**
s3.3.4	Sig. (2-tailed)	.006	.653	.202		.000	.000	.000	.000
	N	502	502	502	502	502	502	502	502
	Pearson Correlation	.043	-.038	-.021	.603**	1	.710**	.400**	.403**
s3.3.5	Sig. (2-tailed)	.340	.396	.634	.000		.000	.000	.000
	N	502	502	502	502	502	502	502	502
	Pearson Correlation	.067	.030	.001	.602**	.710**	1	.453**	.373**
s3.3.6	Sig. (2-tailed)	.135	.506	.974	.000	.000		.000	.000
	N	502	502	502	502	502	502	502	502
	Pearson Correlation	.249**	.204**	.179**	.385**	.400**	.453**	1	.538**
s3.3.7	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000		.000
	N	502	502	502	502	502	502	502	502
	Pearson Correlation	.188**	.123**	.091*	.348**	.403**	.373**	.538**	1
s3.3.8	Sig. (2-tailed)	.000	.006	.041	.000	.000	.000	.000	
	N	502	502	502	502	502	502	502	502

3.7. Analysis and key findings

According to the statistical results and the discussions above, this study pinpoints a number of critical elements that have a direct impact on the sustainability performance of building projects in KR. The most important of these are:

- Project sustainability performance is strongly linked to top management commitment. Strong statistical ties to key implementation aspects, particularly a strong association with continuous improvement approaches (r = 0.806) and a strong link to adopting team experience (r = 0.639), serve as evidence of this. Additionally, this dedication directly raises the project's social legitimacy, as evidenced by its strong associations with both the successful assessment of community acceptance (r = 0.611) and societal satisfaction (r = 0.599). In the end, this strategic leadership makes sure that sustainability priorities are successfully converted into tangible results on the ground and approved by end users. Our results directly verify the findings of Siagiana et al. [37] and Mughal et al. [38], who concluded that performance is significantly improved by top management commitment.
- The implementation of the continuous improvement method (v3.2.4) directly enhances project implementation, which improves overall sustainability performance. Through focused training (v3.1.3, r = 0.593) and the team's practical expertise (v3.1.4, r = 0.659), this method of operation is supported. End user satisfaction is considerably higher as a result of this integrated strategy, which includes expert execution and adaptive management (v3.3.6, r = 0.599). Our findings support those of Othman et al. [39] and Gómez et al. [40], who found that development and adaptation are enhanced by ongoing improvement.
- Project sustainability performance is directly improved by sustainability awareness and knowledge. The development of well-defined sustainability plans is highly expected using targeted training (v3.1.3) (v3.2.1, r = 0.630), and onsite commitment to sustainability principles is ensured by team experience (v3.1.4) (v3.2.5, r = 0.619). This relationship between improved individual competency and successful execution directly correlates with increased societal satisfaction (v3.3.6, r = 0.509), indicating that knowledgeable teams are essential to producing worthwhile sustainability results. Toledo [41] found that specialised training directly and favourably improves project performance, which is consistent with our findings.

4. Conclusions

An assessment of the current status of project sustainability performance in the KR construction sector has been performed and successfully highlighted weaknesses and produced a guide for decision-makers in applying practical strategies. The collected data is reliable for any purpose of analysis using any statistical software and for any purpose of evaluating project performance in KR. Statistical data analysis indicates below average and is regarded as being in a risky zone.

Three crucial aspects of construction project sustainability performance in the KR, including social acceptance, project execution efficiency, and stakeholder knowledge, have been statistically evaluated and analysed. The following conclusions are drawn:

- KR's professionals' level of familiarity with sustainability norms is regarded as neutral to somewhat inadequate, with the lowest score of 2.7, which emphasises the need for comprehensive educational and strategic initiatives.

- Every component of the implementation stage had a score below 4, indicating serious issues with sustainability performance. The sustainability performance of delivered projects is poor due to a lack of a sustainability plan.
- Completed projects that do not adhere to sustainability principles, a lack of employee participation in sustainability-related decision-making, and a lack of commitment from upper management to environmentally friendly projects.
- People in KR are not happy with how sustainable projects are, and they are also not prepared to pay more for sustainable projects.
- Three main elements determine how effectively KR construction projects perform in terms of sustainability: dedicated top management, professionally organised continuous improvement procedures, and expert sustainability knowledge.

It is recommended that further research include determining the causes of the current gap and investigating practical ways of reducing it. By integrating best practices and approaches that address the challenges that have been identified, this framework should be focused on achieving social acceptance. Future studies can result in substantial enhancements in project performance by providing priority to these areas.

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Nomenclatures

d	Margin of error
n	Adjusted sample size
n_0	Minimum sample size
N	Population size
p	p-value
r	Pearson Correlation
Z	Z-score

Greek Symbols

α	Cronbach's Alpha

Abbreviations

BREEAM	Building research establishment environmental assessment method
KR	Kurdistan Region

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