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ASSESSING SDG 7 PERFORMANCE: IDENTIFYING RELEVANT KPIS FOR THE SRI LANKAN CONSTRUCTION INDUSTRY

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ABSTRACT

The construction industry is the primary driver in achieving Sustainable Development Goals (SDGs), especially SDG 7 – affordable and clean energy. However, the progress towards SDG 7 in Sri Lanka is unclear, and there is not enough consideration given to the construction industry. This highlights the need for measurable indicators related to the Sri Lankan Construction Industry. Therefore, this study aims to assess the relevance of six United Nations (UN) established key performance indicators (KPIs) in achieving SDG 7 in the Sri Lankan construction industry and to examine perception among three different professional groups such as Architect, Engineer and Quantity Surveyor (QS). A quantitative research approach was adopted, and a questionnaire was administered to collect the information from industry professionals. In data analysis, the analyse of differences in perception across professional groups was done by Kruskal-Wallis and post-hoc tests based on the normality of the data. Significant differences in perception were identified regarding Access to Electricity (K1) and Renewable Capacity per Capita (K6), suggested the diverse priorities in promoting sustainable energy practices. Furthermore, Relative Importance Index (RII) was utilized to rank the KPIs. The results revealed that Renewable Capacity per Capita (K6), Renewable Energy (K3), and International Financial Flows (K5) are the most relevant KPIs, whereas Access to Clean Cooking (K2) and Access to Electricity (K1) are ranked as least important. The study highlights the KPIs that can effectively measure and accelerate SDG 7 achievements in Sri Lanka's construction industry. These findings provide a path to policymaker to guide the sustainable energy integration within the construction industry.

Keywords: *Construction Industry; Key Performance Indicators (KPIs); Sri Lanka; Sustainable Development Goals (SDGs).*

1. INTRODUCTION

According to the United Nations (1987), Sustainable Development (SD) meets current needs without compromising the ability of the future to meet its own. To promote sustainable development in a global context, the Sustainable Development Goals (SDGs) were introduced by the United Nations (UN) in 2015 (United Nations, 2015). 17 Sustainable Development Goals (SDGs) have been established with 169 targets to be achieved by 2030 (Patuelli & Saracco, 2022).

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Among them, SDG 7 focuses on promoting sustainable practices related to affordable and clean energy to all (Ogunmakinde et al., 2022). Affordable and clean energy resources are essential to achieve a consolidated and stable world economy (Wijayarathne, 2023). In line with this goal, Sri Lanka has made notable progress in expanding electricity access across the country (International Energy Agency et al., 2024). Even though Sri Lanka has renewable energy options such as solar, wind, hydropower, coal and others, the country's energy sector remains heavily reliant on fossil fuels (Nijam & Nazar, 2017). This dependency has led to both economic challenges (Ministry of Energy, 2022) and environmental concerns (Velayutham, 2023). To address these issues, it is crucial to develop the government policy, increase investment (Wijayarathne, 2023), enhance the indicator system (Nhamo et al., 2020), technological advancement (Zia & Aslam, 2024) and follow other relevant sustainable practices.

Several studies have explored the relationship between SDG 7 and Sri Lanka. For instance, Nhamo et al. (2020) analysed the progress and challenges of achieving SDG 7 in South Asia, including Sri Lanka. Similarly, Zia & Aslam (2024) examined strategies to accelerate SDG 7 implementation in South and Southwest Asia, while Wijayarathne (2023) proposed policy recommendations to achieve SDG 7 in Sri Lanka by 2030. However, those studies failed to give priority to the specific sectors in Sri Lanka.

The progress towards SDG 7 has been identified globally and locally, comprising the contribution of all the sectors such as construction, manufacturing and energy production (Ogunmakinde et al., 2022). Similar to different nations, different sectors also have their own level of priority to attain SDG 7 (Patuelli & Saracco, 2022). Since the construction industry is a significant energy consumer and a key driver of national energy demand (United Nations, 2015), it is crucial to assess the achievement of SDG 7 in Sri Lanka through the lens of the construction sector.

To effectively monitor and evaluate the achievement of SDG 7, the UN has established six Key Performance Indicators (KPIs): access to electricity, access to clean cooking, renewable energy, energy efficiency and financing and investment needs (Ministry of Energy (2022). However, these general indicators do not fully reflect the energy challenges and opportunities in the construction sector. Identifying KPIs tailored to the Sri Lankan construction sector can provide a more accurate measurement framework and accelerate progress toward SDG 7.

Studies done by Watts (2024), Júnior et al. (2024), Wieser et al. (2019) and Blay Jnr et al. (2023), assess the performance of SDG 7 in the construction industry in United Kingdom (UK), Brazil, Australia and Ghana, respectively. However, there is a lack of studies that assess the performance of SDG 7 in the Sri Lankan construction industry. Therefore, this study aims to identify the KPIs related to SDG 7 in the Sri Lankan construction industry through below mention objectives.

1. Examine the variations in perception among the different professional groups regarding the KPIs related to SDG 7 in the Sri Lankan construction industry.
2. Extract the relevance of KPIs in achieving SDG 7 in Sri Lankan construction industry.

2. LITERATURE REVIEW

The United Nations (1987) defined the concept of Sustainable Development (SD) as "meeting the needs of the present without compromising the ability of future generations to meet their own needs" (p.41). The report further provides a general direction to the public to work towards balancing social, environmental and economic factors (Júnior et al., 2024). Building on this foundation, Sustainable Development Goals (SDGs) were established with the ability to address a wide range of issues through 17 goals and 169 targets (Watts, 2024).

Among these, SDG 7 focuses on affordable and clean energy. Affordable energy refers to energy that is accessible at an affordable cost for all (Kamal et al., 2021), while clean energy refers to the energy that is produced and consumed in ways that minimize environmental impact (Elavarasan et al., 2024). Moreover, affordable and clean energy enhances living standards (Júnior et al., 2024), improves health outcomes and promote educational opportunities (Watts, 2024). Therefore, this goal is crucial in promote economic growth and reduce environmental impact while maintaining the broader sustainability objectives.

2.1 IMPORTANCE OF AFFORDABLE AND CLEAN ENERGY IN SRI LANKA

Sri Lanka relies heavily on fossil fuels to meet its energy demand, despite having limited domestic reserves of coal and natural gas (Nijam & Nazar, 2017). Therefore, the country is highly dependent on fuel imports (Caldera et al., 2023). However, Sri Lanka has several renewable energy options including solar power, wind energy, hydropower, biomass, natural gas and coal ((International Energy Agency et al., 2024)). Expanding the use of renewable energy could reduce reliance on fossil fuels.

According to the Ministry of Energy (2022), nearly half of Sri Lanka's export income is spent on importing fuel, leading to a severe economic crisis. When comparing the cost of the energy system, using renewable energy is estimated to cost about 206 billion euros by 2050, whereas relying on fossil fuels would cost much more than 290 billion euros in Sri Lanka (Caldera et al., 2023).

Beyond economic benefits, the shift to affordable and clean energy significantly reduces carbon dioxide emissions. It is expected to reduce carbon emissions by 14.5 % by 2030 in Sri Lanka (Zia & Aslam, 2024). According to research, 1% increase in clean energy usage results in 0.21% carbon dioxide emission reduction in Sri Lanka (Velayutham, 2023). Further, the author emphasized that affordable and clean energy helps mitigate climate change, improve the economy of the country through new job opportunities and enable more efficient use of land compared to fossil fuels.

Despite progress, the Sri Lankan energy sector continues to face persistent issues such as limited government incentives, supply interruptions, low private investment, and the ongoing economic crisis (Rajapaksha et al., 2024; Yahanpath et al., 2024). Nevertheless, the construction industry offers a significant opportunity to advance SDG 7 by addressing energy sustainability within its operations.

2.2 SDG 7 IN THE SRI LANKAN CONSTRUCTION INDUSTRY

The construction industry is one of the major contributors to Sri Lanka's national economy, accounting for 28% of the industrial sector's GDP (Central Bank of Sri Lanka, 2022). Therefore, it can be identified as one of the major energy consuming sectors in the country, which is approximately 40% of total energy use in global context (Chhabra & Grover, 2024).

However, the construction industry negatively impacts the environment through high energy and resource consumption (Opoku et al., 2022), land development, waste generation, biodiversity and climate change during the development (Wieser et al., 2019). With the rapid urbanization and infrastructure development, Sri Lanka is experiencing a rising demand for energy (Wijayarathne, 2023).

Given the significant sustainability impact of the construction industry, the adoption of sustainable practices is strongly recommended to reduce its high carbon footprint (Opoku et al., 2022), high energy usage and greenhouse gas emissions (Wieser et al., 2019). These influences are mitigatable through the usage of renewable energy systems and energy efficiency practices (Júnior et al., 2024; Opoku, 2022).

As a result, currently in Sri Lanka, the integration of renewable energy systems and energy efficiency practices is increasingly recognized as essential to achieve SDG 7 (Júnior et al., 2024; Opoku, 2022). Despite this recognition, the Sri Lankan construction industry faces challenges in implementing these practices, creating doubt about achieving SDG 7 successfully in Sri Lanka due to high initial capital costs, the economic crisis, and technological and regulatory barriers, among others (Rajapaksha et al., 2024; Yahanpath et al., 2024).

2.3 KPIS FOR SDG 7

Key Performance Indicators (KPIs) serve as a tool to effectively monitor and evaluate the achievement of SDGs (Kanie, 2020). These KPIs act as measurable metrics that reflect progress towards specific targets within the SDGs framework (Schokker et al., 2022).

The United Nations has established specific KPIs for each target of SDG 7, which are shown in Table 1.

Table 1: KPIs for SDG 7
Source: (International Energy Agency et al., 2024)

No	KPIs	Indicator description	Codes
1	Proportion of population with access to electricity.	Access to electricity	K1
2	Proportion of population with primary reliance on clean fuels and technology.	Access to clean cooking	K2
3	Renewable energy share in the total final energy consumption	Renewable energy	K3
4	Energy intensity measured in terms of primary energy and GDP	Energy efficiency	K4
5	International financial flows to developing countries in support of clean energy research and development and renewable energy production, including in hybrid systems.	International financial flows	K5
6	Installed renewable energy-generating capacity in developing and developed countries (in watts per capita).	Renewable capacity per capita	K6

As shown in Table 1, UN established KPIs for SDG 7 are focusing on access to electricity, access to clean cooking, renewable energy, energy efficiency and financing and investment needs.

2.3.1 Current Progress of SDG 7 in Sri Lanka

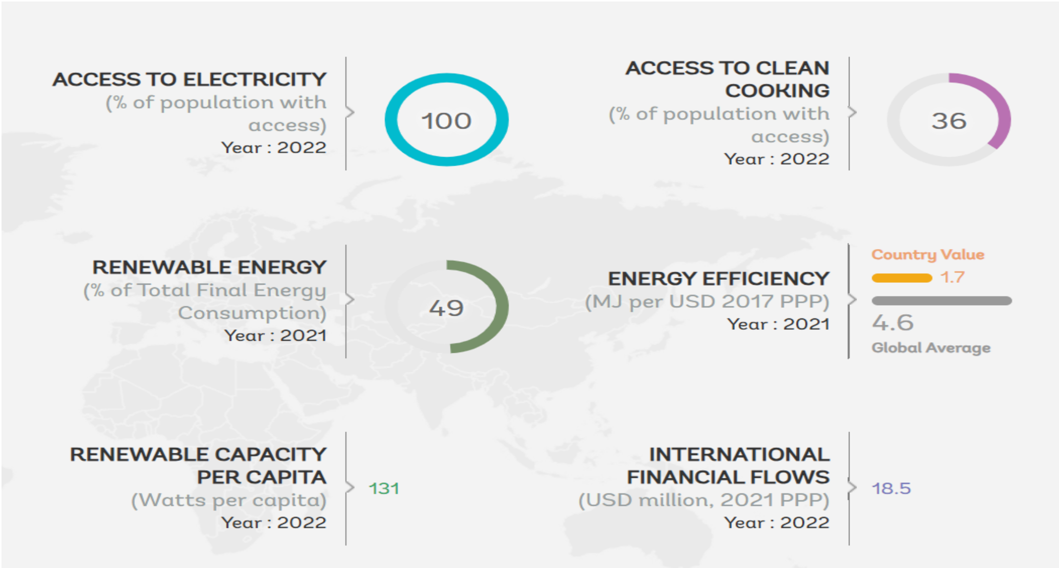

Figure 1: Current progress of SDG 7 in Sri Lanka
Source: Energy Sector Management Assistance Program (ESMAP), 2024

Figure 1 shows the progress towards SDG 7, comprising the contribution of all the sectors such as construction, manufacturing, energy production and others. Further, the progress rate indicated the necessity of accelerating progress towards SDG 7. Since the construction industry is a significant energy consumer and a key driver of national energy demand (United Nations, 2015), identifying the most relevant KPIs for Sri Lanka's construction sector and implementing targeted actions will be crucial for successfully accelerating progress toward SDG 7 in the country.

3. RESEARCH METHODOLOGY

The study adopts a quantitative research approach because it statistically analyses (Nufus et al., 2023) the perceptions of three professional groups on SDG 7's KPIs and then ranks the KPIs based on their relevance to the Sri Lankan construction industry.

The Figure 2 shows the developed research design of this study. Initially, a literature review was conducted to identify the UN established KPIs related to SDG 7. The target population of this study consists of construction professionals such as architects, engineers and quantity surveyors with knowledge on SDG 7. The sample frame is drawn from registered professionals associated with recognized organizations and industry associations such as the Green Building Council of Sri Lanka, the Institute of Engineers Sri Lanka, the Sri Lanka Institute of Architects, and other similar industry associations. Further, purposive sampling was used to get views only from people who have knowledge of research objectives (Huwae et al., 2024).

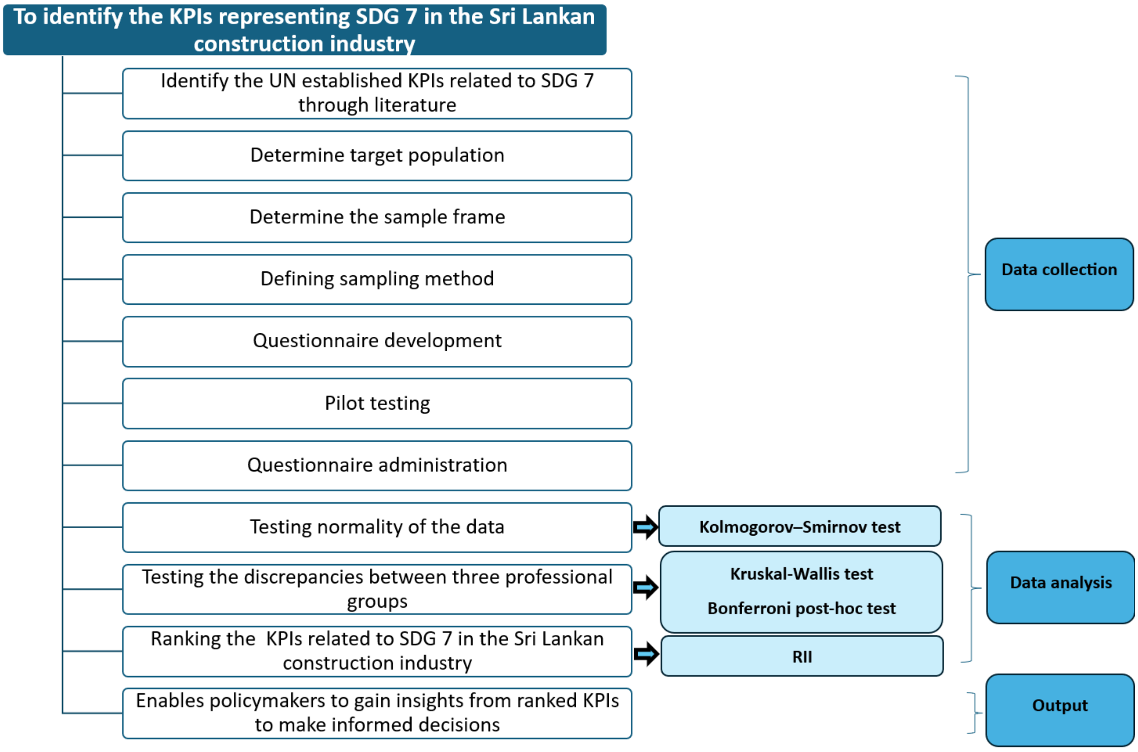

Figure 2: Research design

Since, the questionnaire survey allows data to be collected from a larger set of respondents within a shorter period (Ahmed et al., 2018), a questionnaire was administered as a data collection instrument. Before initiating the main data collection, a pilot survey was carried out among the construction industry professionals who are aligned with the sample frame. According to Ullah et al. (2023), the minimum number required for pilot testing is 20. Thus, 20 construction professionals were selected for the pilot test to check the face value of the instrument.

Following the pilot testing, a questionnaire survey was administered to 100 construction industry professionals to collect data, as it is sufficient to get a moderate response rate of 30-50% (Faleiros et al., 2016). The questionnaire consisted of 2 main sections. 1st section is used to collect the demographic information of the respondents, and 2nd section is used to gather insights into KPIs from the respondents. A 1- 5 Likert scale was utilized in the questionnaire to assess the perceived relevance of each KPI to the construction industry. The questionnaires were administered via Email, LinkedIn, and WhatsApp to enhance accessibility and encourage participation.

After the data collection, a normality test was conducted to check the normality of the data. Kolmogorov–Smirnov test was conducted to check the normality of the data as the sample size (n) > 50 (Mishra et al., 2019). Hypotheses of the Kolmogorov-Smirnov test are as follows:

- Null hypothesis (H_0): Data follows a normal distribution.
- Alternative hypothesis (H_1): Data does not follow a normal distribution.

If $p > 0.05$ the null hypothesis is accepted. Otherwise, the null hypothesis is rejected.

The Kruskal-Wallis test is a nonparametric test that does not require the data to be normally distributed (Cabral & Lucena, 2020). Since the collected data was not normally distributed, a nonparametric test was conducted to compare the means of three specific groups: quantity surveyors, architects and engineers. Hypotheses of the Kruskal-Wallis test are as follows:

- Null Hypothesis (H_0): There is no statistically significant difference between the ideas of the groups.
- Alternative Hypothesis (H_1): There is a statistically significant difference between the ideas of the groups.

If $p > 0.05$, the null hypothesis is accepted. Otherwise, null hypothesis is rejected.

Kruskal-Wallis test only identifies that there is a different perception of the groups, but it does not specifically identify between which pair of groups the difference lies. Therefore, a post hoc test was conducted to compare pairs of groups and identify where the significant difference lies (Barriocanal et al., 2016).

- Null Hypothesis (H_0): There is no statistically significant difference between the specific pair of groups being compared.
- Alternative Hypothesis (H_1): There is a statistically significant difference between the specific pair of groups being compared.

If $p > 0.05$ the null hypothesis is accepted. Otherwise, the null hypothesis is rejected.

Even after the post hoc test, there is a possibility of having Family Wise Error Rate (FWER) in the results. To eliminate the FWER, the Bonferroni Correction method was applied (Armstrong, 2014).

After the Bonferroni Correction, if still $p < 0.05$, it ensures that the identified differences are truly significant and not due to random chance from multiple comparisons (Armstrong, 2014). Hence, there is a difference between the perceptions of the group of professionals.

3.1 RANKING KPIS

Relative Importance Index (RII) is a technique that is used to rank the factors (Azman et al., 2019). Therefore, RII is employed to rank the KPIs based on their perceived importance in achieving SDG 7 in the Sri Lankan construction industry. The formula for RII is:

$$RII = \frac{\sum W}{A \times N} \qquad \text{(Equation 1)}$$

Where, W = weight assigned by respondents, A = highest weight on the scale and N = total number of respondents.

The KPI with the highest relative index was ranked first, while the KPI with the lowest relative index was ranked last.

4. RESULTS AND DISCUSSION

4.1 RESPONDENT'S DEMOGRAPHIC INFORMATION

For the pilot questionnaire survey, 20 pilot questionnaires were distributed, and 15 were returned with valid responses, resulting in a response rate of 75%. Subsequently, the main questionnaires were distributed to 100 construction professionals, of which 57 were returned with valid responses, achieving a response rate of 57%. According to Taherdoost & Madanchian (2024), the sufficient average response rate for business and management related studies is 51%. Both survey response rates exceed this threshold.

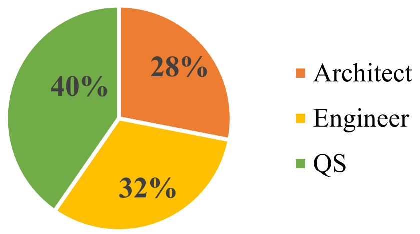

Figure 3: Respondent's profession

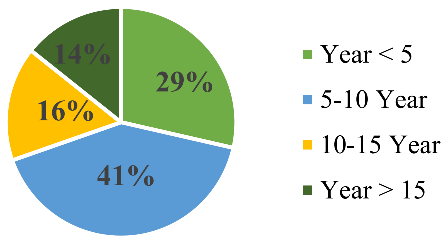

Figure 4: Respondent's experience

As shown in Figure 3, the data was collected from three categories of construction professionals such as architects, engineers, and quantity surveyors. Among the main survey respondents, the majority were Quantity Surveyors.

Further, Figure 4 illustrates the years of experience of the respondents. The average years of experience of the respondents was 11 years. All the respondents had a minimum educational qualification of a degree in a relevant field.

Moreover, as per the demographic analysis of the study, the average years of experience and minimum qualifications suggest a sufficient level of expertise and knowledge, which ensures the ability of respondents to accurately understand and respond to the questionnaire.

4.2 VARIATIONS IN PERCEPTION AMONG THE DIFFERENT PROFESSIONAL GROUPS

UN established 6 KPIs were identified, and their relevance to the Sri Lankan construction industry was evaluated through a questionnaire survey. The identified KPIs encompass access to electricity, access to clean cooking, renewable energy, energy efficiency, international financial flows and renewable capacity per capita (see Table 1).

Initially, a pilot survey was conducted to assess the clarity, relevance, and comprehensiveness of the questionnaire before its distribution for the main data collection. After the pilot survey, only a few minor changes in terminology were made to improve the clarity of the questionnaire.

The main questionnaire was then administered to construction industry professionals, and the data were collected. After data collection, the normality of the data was tested using the Kolmogorov-Smirnov test. The results of the Kolmogorov-Smirnov test are presented in Table 2.

Table 2: Normality test and Kruskal Wallis test

KPIs	Code	Kolmogorov-Smirnova test Sig.	Kruskal Wallis Test Asymp. Sig.
Access to electricity	K1	0.015	0.014
Access to clean cooking	K2	0.020	0.512
Renewable energy	K3	0.000	0.605
Energy efficiency	K4	0.001	0.473
International financial flows	K5	0.001	0.310
Renewable capacity per capita	K6	0.003	0.033

According to Table 2, all significance (Sig.) values from the Kolmogorov-Smirnov test are less than 0.05 ($p < 0.05$). Thus, the null hypothesis is rejected, indicating that the data does not follow a normal distribution.

Subsequently, Kruskal-Wallis test was applied to determine whether there are differences in perceptions among these groups. Except for Access to electricity (K1) and Renewable capacity per capita (K6), all other KPIs had $p > 0.05$. This indicates that there is no statistically significant difference in perceptions among the groups regarding K2, K3, K4, and K5.

However, the Kruskal-Wallis test results showed a statistically significant difference in perceptions among the groups regarding K1 and K6. Therefore, a post hoc test was conducted to compare pairs of groups and pinpoint where the significant differences occurred. The results of the post hoc test are presented in Table 3.

Table 3: Post hoc test and Bonferroni correction

Code	Pairs of groups	Significance	Adjusted significance*
K1	Architect - Engineer	0.146	0.437
	Architect - QS	0.004	0.011
	Engineer - QS	0.157	0.470
K6	Architect - Engineer	0.010	0.029
	Architect - QS	0.094	0.283
	Engineer - QS	0.271	0.812

**Bonferroni correction*

According to Table 3, the post hoc test shows the following.

- For Access to electricity (K1), the Architect and QS pair have a discrepancy between their ideas ($p < 0.05$).
- For Renewable capacity per capita (K6), the Architect and Engineer pair has a discrepancy between their ideas ($p < 0.05$).

Even after conducting a post hoc test, the possibility of errors due to FWER remains. The Bonferroni adjustment was done to test whether the p-value of K1 and K6 becomes significant due to the FWER.

As shown in Table 3, even after Bonferroni adjustment, the significant values remain below 0.05 for the Architect and QS pair (K1) and the Architect and Engineer pair (K6).

Thus, these differences are genuinely significant and not due to random chance from multiple comparisons. This confirms that there is a difference in the perceptions of the groups of professionals. Interdisciplinary collaboration gaps within the construction industry may contribute to this variation. Construction professionals from different backgrounds often have specialized skills and knowledge unique to their respective disciplines (Faris et al., 2024). As a result, this may create varying levels of exposure towards the sustainable concepts and might influence their attitudes towards access to electricity and renewable energy integration. For instance, according to ESMAP (2024), Sri Lanka had achieved near-universal access to electricity by 2022. Since Quantity Surveyors are often involved in project costing, they may be more aware of national electrification coverage and funding compared to Architects. This may lead to differences in their perceptions regarding K1.

4.3 RELEVANCE OF KPIS IN ACHIEVING SDG 7 IN SRI LANKAN CONSTRUCTION INDUSTRY

To identify the relevance of the identified KPIs in achieving SDG 7 within the Sri Lankan Construction Industry, an assessment was carried out using the Relative Importance Index (RII) method to rank the KPIs based on their perceived significance by industry professionals. The results of the RII method are presented in Table 4.

Table 4: Relative Importance Index (RII) for KPIs

KPIs	Code	Total Weight	Relative Index	Rank
Renewable capacity per capita	K6	232	0.814	1
Renewable energy	K3	231	0.811	2
International financial flows	K5	228	0.800	3
Energy efficiency	K4	209	0.733	4
Access to clean cooking	K2	185	0.649	5
Access to electricity	K1	178	0.625	6

As shown in Table 4, RII results identified that Renewable Capacity per Capita (K6) and Renewable Energy (K3) are the most critical KPIs related to the Sri Lankan construction industry, ranking 1st and 2nd, respectively. It demonstrates the industry's attention to increasing renewable energy sources and their per capita availability. Additionally, the Sri Lankan government has launched several solar projects, such as the Thanamalwila Solar Power Project and the Wishwin Solar Energy Project, as well as wind energy projects like the Westgate Wind Power Project and the Wind Will Wind Power Project, to promote renewable energy adoption in the country (Sri Lanka Sustainable Energy Authority, 2025). These initiatives may have influenced industry professionals to prioritize renewable energy-related KPIs. In contrast, Access to Electricity (K1) was ranked the lowest, illustrating less attention towards this KPI from the Sri Lankan construction industry. According to ESMAP (2024), Sri Lanka has already achieved near universal access to electricity. As electricity access is nearly complete, construction professionals may have ranked this KPI the lowest, shifting their focus toward renewable energy expansion and energy efficiency improvements.

The RII ranking results show alignment with global trends, where countries prioritize energy goals based on their specific needs and development status. For instance, developed nations such as Germany, UK, Iceland, Sweden and others prioritize renewable energy expansion (Climate Council, 2022). In contrast, countries like Nigeria and Kenya focus on increasing electrification rates in their energy policies (International Energy Agency et al., 2024). Sri Lanka, despite being a developing country, is aligning with global sustainable energy practices due to its existing electricity coverage and increasing focus on clean energy solutions. These results highlight the importance of identifying KPIs based on a country's economic context, policy frameworks, and existing energy infrastructure.

5. CONCLUSION

In Sri Lanka, the construction industry significantly contributes to national development while being a major energy consumer. This highlights the importance of integrating SDG 7, which promotes affordable and clean energy, into the sector. To support this effort, the present study identified six key performance indicators (KPIs) in achieving SDG 7 within the Sri Lankan construction industry and explored variations in perception among different professional groups, such as architects, engineers and QSs. Understanding the difference between perceptions is important since professionals play different roles in the design, planning and implementation of construction projects, their influence in the integration of sustainable energy practices may vary. The findings revealed that there is a significant difference in perception among the professionals regarding Access to Electricity (K1) and Renewable Capacity per Capita (K6). The notable differences in perception between Architects and QSs for Access to electricity (K1) and between Architects and Engineers for Renewable capacity per capita (K6) suggest the varying priorities of different professional groups in advancing sustainable energy practices. Furthermore, ranking the KPIs helps prioritize areas of focus for improving SDG 7 performance in the Sri Lankan construction sector. As per RII results, Renewable Capacity per Capita (K6) and Renewable Energy (K3) are identified as the most relevant KPIs for the Sri Lankan construction industry, securing the 1st and 2nd positions, respectively. Conversely, Access to Clean Cooking (K2) and Access to Electricity (K1) were ranked the least important (5th and 6th), suggesting that these aspects receive relatively less attention within the industry. However, the study was limited to 6 KPIs identified by the UN, excluding other locally relevant indicators. Identifying more targeted, construction industry-specific indicators could enhance the precision of progress measurement. This presents a direction for future research to expand the KPI scope and compare findings across other developing countries. Moreover, the study contributes to academic knowledge by filling the gap in research on SDG 7-related KPIs within the Sri Lankan construction industry, and to industry practice by supporting accelerated progress toward SDG 7 through the implementation of these KPIs and by informing policymaking.

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