Analytical Study on the Rational Challenges Project Engineering Managers Encounter prior to Achieving Sustainability in the UK Construction Industries

ABSTRACT

Aim: The essential purpose of the current research was to identify the challenges faced by project engineering managers in the UK construction industry while seeking to achieve sustainability.

Study Design: The current study was built upon six important subjects in order to accomplish this goal. In the current study, the researcher opted to do both qualitative and quantitative analysis. The quantitative analysis comprised frequency analysis, correlation analysis, and regression analysis and was based on data collected through questionnaires.

Place and Duration of Study: This study was carried out in Bristol United Kingdom for an investigative period of six (6) Months including the research question distribution and collection time as well as the interview and interaction sections with the Construction Project Engineering Managers.

Methodology: In light of the nature of the current research, the researcher selected the mixed research design. Mixed research design is the method used in collecting and analyzing data by using both qualitative and quantitative research methodologies.

Results: The results of the present study showed that effective health and safety management systems are necessary for sustainable construction. However, the UK construction industry lacks these systems. The study also identified lack of education and training as a hindrance. The proper understanding of the project and its processes can only be attained through training and education, and managers have to deal with the problem of being unable to successfully complete sustainable building owing to lack of such resources. However, with the right on-the-job training and efficient monthly meetings that include training and education sessions, this can be improved.

Conclusion: The study resolved that policies should be put in place to guarantee that advancement in the building sector follows economic integration. It has been revealed from the findings that construction is heavily dependent on conventional methods in most rising economies, including the UK, which makes the adoption of novel techniques more challenging and stressful. An important barrier to attaining sustainable construction is clients' and other stakeholders' lack of support for innovative construction techniques. The findings further revealed that the implementation of eco-friendly building practices by the construction sector has the tendency to reduce an asset's overall environmental impact and promote sustainable economic growth.

Keywords: Project Engineering, Sustainability, Engineering Management, construction industry

1.0 INTRODUCTION

Ayarkwa et al. (2022) [1] identified suitability as known to be increasingly discussed in the construction industry due to the requirement for minimization of adverse influences. The authors have further indicated that an important area of focus related to sustainability includes the issue of project management teams as a result of their involvement from the inception of the project to its completion.

According to Ershadi et al. (2021), [2] Sustainable procurement management (SPM) is recognised as an approach for the integration of sustainability into the project procurement based on the social, ecological, as well as economic outcomes related to the procurement decisions. Ayarkwa et al. (2022) [1] believe that inadequate training and education, as well as reduced awareness related to the green technologies, and increased initial costs associated with green construction practices and materials are observed to be the fundamental challenges in the implementation of sustainable building processes by the project management teams. Ershadi et al. (2021) [2] elaborated on the existence of two categories of intra-organizational and extra-organizational barriers in the construction industries; the intra-organisational barriers that have an association with the mechanisms, resources, as well as capacities within an organisation while extra-organizational barriers are associated with the broader environment that allows an organization to interact with the stakeholders in an integrated supply chain.

Yu et al. (2018) [3] believe that reduced understanding and measurement related to sustainable project planning demonstrates the inadequate availability of effective and applicable methods to ensure the involvement of sustainable elements in the projects. The authors believe that sustainable project planning has a fundamental role in the realization of objectives related to sustainability in construction engineering projects. Project planning has been identified to be previously explored and accessed from a variety of perspectives that include schedule, and budget, as well as scope on the basis of compositions related to planning in addition to its processes.

Although research related to the drivers in the construction industry has been observed to be extended, not many studies are known to cover the diversity of drivers of several categories associated with the life cycle of the whole building and from the perspectives of all the stakeholders. Therefore, this study may be regarded as an important step forward as it aims to provide new knowledge relevant to the development of a sustainable, inclusive, as well as resilient building standard from the perspective of all stakeholders including Project Engineering Managers [4].

Sustainable development is defined as "development that fulfils the existing requirements without compromising future generations' ability to meet their own requirements. Stanitsas et al, (2021) [5] also mentioned various additional authors for the definition of sustainability principles and sustainable development. Economic and social development for their people should be promoted in accordance with the principles of environmental sustainability and within the framework of a completed international market, strengthened cohesion, and environmental protection, as stated in the Amsterdam Treaty (1997). Policies should be implemented to make sure economic integration is followed by progress in the construction industry.

Construction in most emerging economies, such as the UK, is highly reliant on standard approaches, which makes the adoption of innovative techniques more difficult and stressful. The lack of support for new construction methods from clients and other stakeholders is a key obstacle to achieving sustainable construction [6]. The construction sector is interested in sustainable building, despite the fact that they stated this in their study. Additionally, the study focused on the difficulties of contractors adopting sustainable practices. The construction sector in most developing nations is unwilling to surpass the client's needs, making the business extremely complex to manage [7]. As long as a green building method fits into the rules of traditional construction, most clients will support it [8].

The construction industry's adoption of sustainable building might lower a developed asset's environmental effect during its entire existence and lead to sustainable economic development [9]. According to current studies, the concept of sustainability has a substantial impact on people's quality of life, making the construction sector an important part of the sustainable development of the UK. [10].

This study aims to address the identified gaps as it is a necessity for the development of interventions and strategies to ensure sustainability in the construction industry by overcoming the challenges experienced by project engineering managers.

2 MATERIALS AND METHODOLOGY

2.1 Conceptual Framework

Based on the above review of literature, the following challenges have been identified and required to be investigated in the present study.

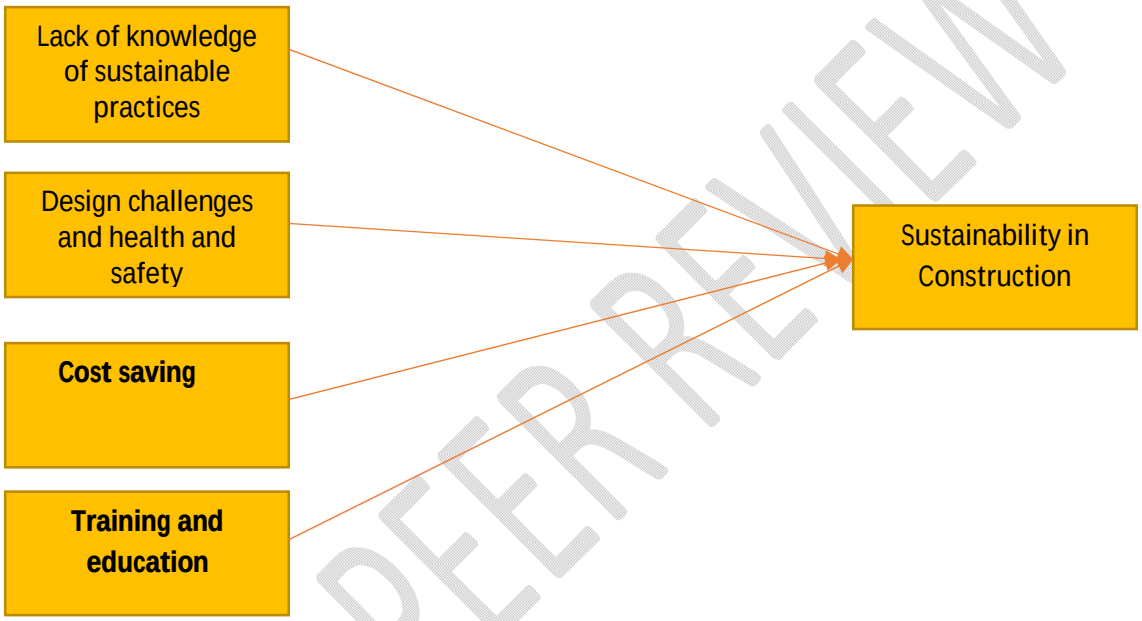

Figure .1: Design of Conceptual Framework

2.2. Research Design

It has been recognised from the study conducted by Quinlan (2019) [11] that research design is a critical component of research methodology since it enables researchers to gain particular processes and procedures that are used in investigations. Research design effectively contributes to performing research in a specified manner. Quantitative research design, mixed method research design, and qualitative research design are all methods of research design to examine. In light of the nature of the current research, the researcher has selected the mixed research design. Mixed research design is the method used to collect data and analyse it using both qualitative and quantitative research methodologies. Combining data sets can help with issue comprehension and produce more thorough proof, giving the investigator both depth and breadth. As a result, researchers are able to combine theory development and hypothesis testing within a single study [12]. The researcher's use of a mixed research approach in this study has allowed the research to sufficiently gather insights from the research

participants chosen to highlight the obstacles that project engineering managers face in achieving sustainability in the UK construction industry.

2.3. Data Collection Procedure

In the words of Boros (2018) [13] data gathering is well-known to be an important component of research technique. It has been determined from the study that the data gathering technique is extremely important, as no research can be completed without considering suitable and pertinent information [13]. The classes of data gathering procedures are divided into two groups: secondary and primary techniques. The data in the primary method is obtained from a variety of sources, involving focus groups, observation, experimentation, and interviews [12]. On the other hand, the secondary technique is based on empirical literature, books, papers, journals, and sites [14]. Given that the current study is based on primary findings, the researcher chose to collect data using the primary collecting approach. As a result, the researcher conducted interviews in order to collect primary data for the study. For the motive of executing interviews, the data was gathered from the engineering managers of the construction industry to determine the managers' responses towards the attainment of sustainability in the industry. Other than this, interviews were conducted by the author with the motive to understand the different challenges which had influenced the engineering managers in achieving sustainability in the UK construction industry. Furthermore, interviews enabled the researcher to acquire in-depth data from the managers and as such, the researcher was able to obtain detailed information from the engineering managers through interviews. To gather quantitative data of the mixed research, a survey was conducted as surveys can be used to determine how representative each person's opinions and experiences are. When conducted properly, surveys offer precise data about people's beliefs and actions that may be utilised to inform significant choices.

2.4. Research Approach

It has been recognised that inductive and deductive research are two broad classifications of research approaches widely employed in the area of research. It is believed that the consideration of the research approach should be determined by the research's nature. According to Sekaran and Bougie (2016) [15], the methodological approach in a research preserves the study's validity and integrity to provide effective and reliable research. In order to verify the present study's validity, the author used the technique of inductive approach to identify the challenges experienced by the project engineering managers while achieving sustainability in the UK construction industry. In addition, the inductive technique has been considered to achieve observations about the challenges and their impact on construction industry engineering managers concerning the attainment of sustainability. Moreover, the current study has a great deal of information regarding manager's personal experiences, which has been examined in order to provide an even efficient analysis.

2.5. Sample Size and Sampling Strategy

As per the study conducted by Sharma (2017) [16], sampling technique is referred to as the recognition of specific procedures that lead to the selection of sample items. Moreover, the term "sampling strategy" refers to the strategies, tools, and procedures used to pick a group of participants from the population based on the research's estimated sample size for data collection [17]. For the goal of gathering data, snowball sampling was used in the current study. The chosen respondents of the present research were project engineering managers working in the construction industry in the region of the United Kingdom. For this study, the researcher conducted semi-structured interviews. The sample size for this study was chosen to be 6-8 managers from the construction industry in the United Kingdom. It was ensured that the managers working had approximately 3 years of experience so that the outcomes of the research were enriched with their experiences. To gather quantitative data, snowball sampling was used and a survey was conducted from 50 engineering managers. A total of 65 survey questionnaires were distributed; however, only a total of 50 responses were obtained. For the characterized impact analysis of the grouped challenges, a total 100 questionnaires were distributed to capture the ideal response of engineering project managers from a wider point of view.

2.6. Data Analysis Techniques

In light of the study by Christensen et al (2011) [18], a diverse selection of instruments for data analysis is considered to have a successful analysis of the acquired data in the research. The author of the present study has proposed thematic analysis as a data analysis technique in context to the current research owing to the fact that the present study relies on a primary collection approach and a qualitative research design. As a result, thematic analysis is the most appropriate approach, as the interviews contain a variety of themes related to the factors involved in the challenges of the project engineering managers towards achieving sustainability in the UK construction industry. Moreover, as per the opinion of Ridder (2014) [19], thematic analysis sheds light on the concept and characteristics of the individual's responses by identifying themes. In addition to the aforementioned assertion, the researcher chose to do quantitative analysis, which was based on data gathered through surveys and included frequency analysis, correlation analysis, and regression analysis.

3. RESULTS AND DISCUSSION

3.1 Quantitative results

In this study, reliability of the variables were tested by the researcher individually. Frequency analysis was done on the demographic details of the participants that interpreted the age, gender, education status and experience of the managers that attempted the survey questionnaire. Whereas the correlation analysis identified the association between dependent and independent variables, SPSS software was used for the analysis of the data. The p value of correlation analysis in between 0.1- 0.3 highlights the weak association between dependent and

independent variables whereas value between 0.3 – 0.7 highlight the moderate association and value between 0.7 – 1 identifies the strong association between variables. Regression analysis identified the accuracy of the model implied as well as highlighted the predictability of independent variables with respect to dependent variables.

3.1.1 Frequency analysis of the variables

For the first question of the survey questionnaire, 50% participants agreed that there is lack of knowledge about sustainable construction, 14% of the participants strongly agreed to the latter whereas 16% participants were neutral. 14% participants from the selected sample disagreed with the statement that there is lack of knowledge and 6% participants strongly disagreed.

Figure 2: Bar Chart representation of Lack of Knowledge about Sustainable Construction

For the second question, 6% and 58% participants strongly agree and agree that there is lack of supply chain knowledge on recycled resources whereas 8% and 4% participants disagree and strongly disagree with the statement. 24% of the participants remained neutral.

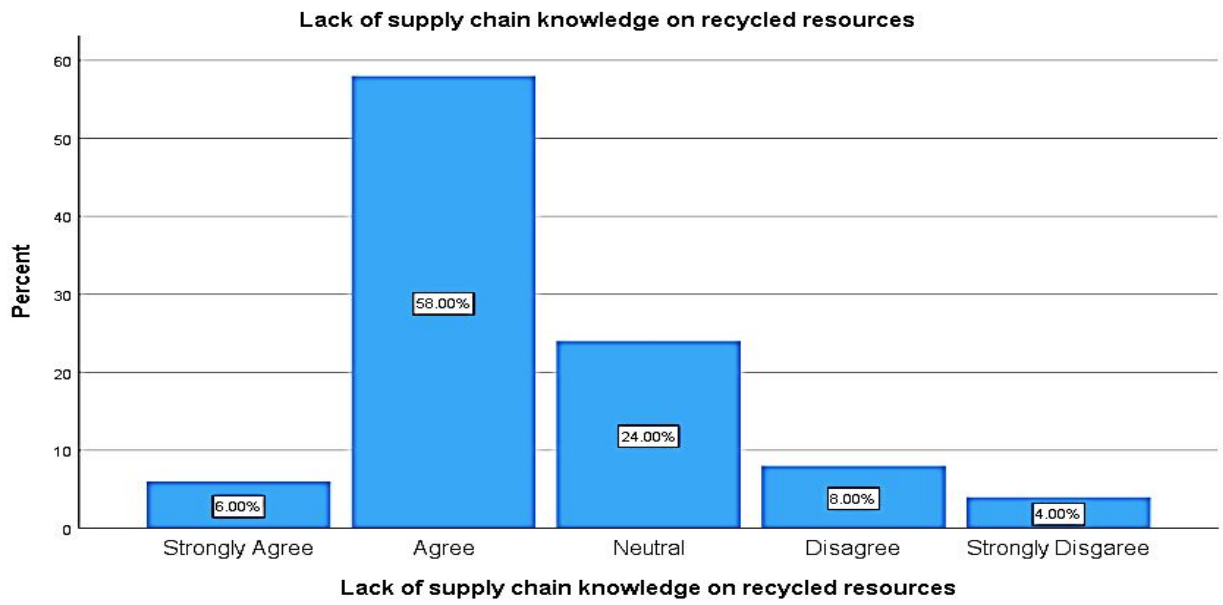

Figure 3: Bar Chart representation of Lack of Supply chain knowledge on recycled resources.

Among the selected participants, 38% and 40% participants strongly agree and agree with the statement that there is lack of planning for health and safety during sustainable construction. 4% participants disagree and strongly disagree with the statement. 18% participants remain neutral.

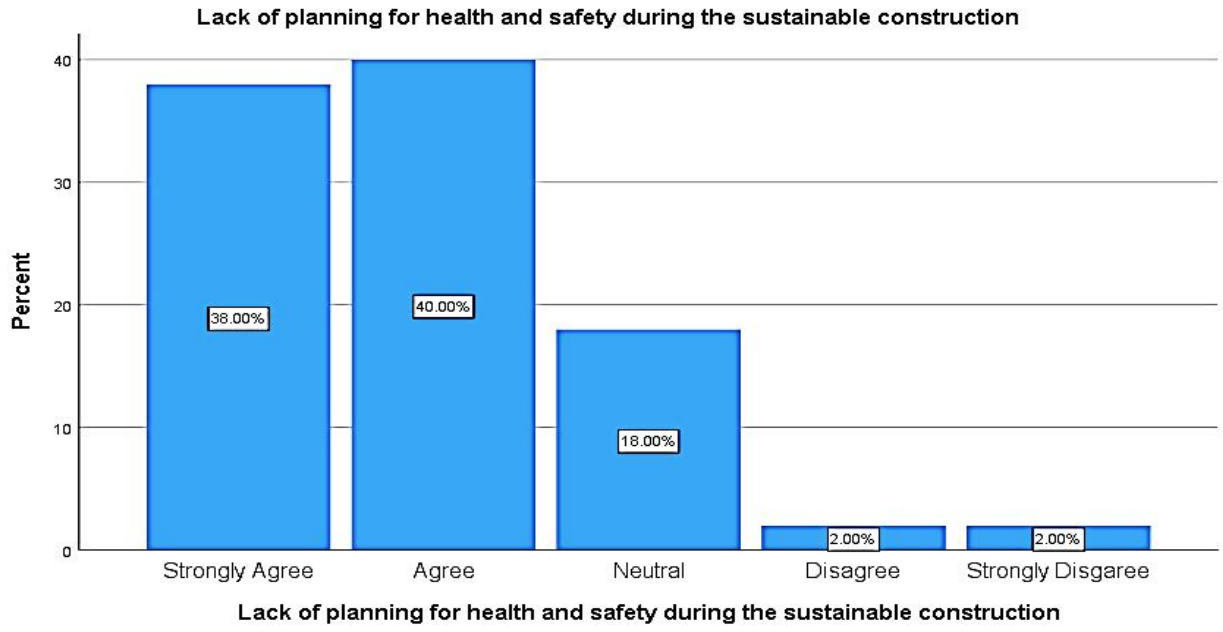

Figure 4: Bar Chart representation of Lack of planning for health and safety during the sustainable construction

28% of the participants agree with the statement that there is lack of knowledge about sustainable design specifications of the project and 10% strongly agree with the statement. 24% and 2% participants disagree and strongly disagree with the statement. Whereas 36% participants' opinion was neutral.

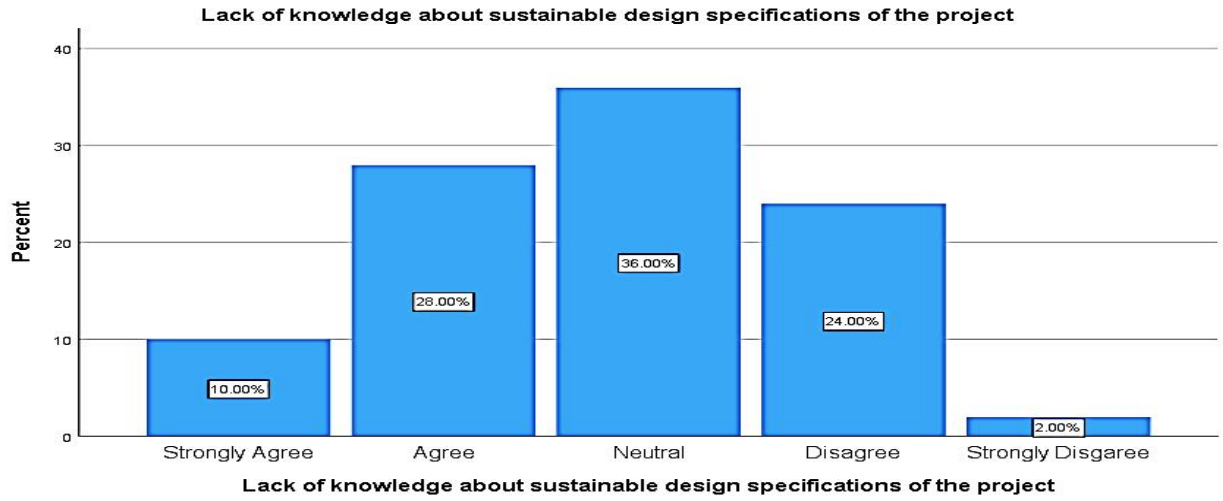

Figure 5: Bar Chart representation of Lack of Knowledge about sustainable design specifications of the projects

34% of participants agreed that they found it difficult to manage the sustainable construction risks that contribute to excessive project costs. 10% strongly agreed with the statement as well. However, 24% disagreed with the statement and 2% strongly disagreed. 30% participants stayed neutral.

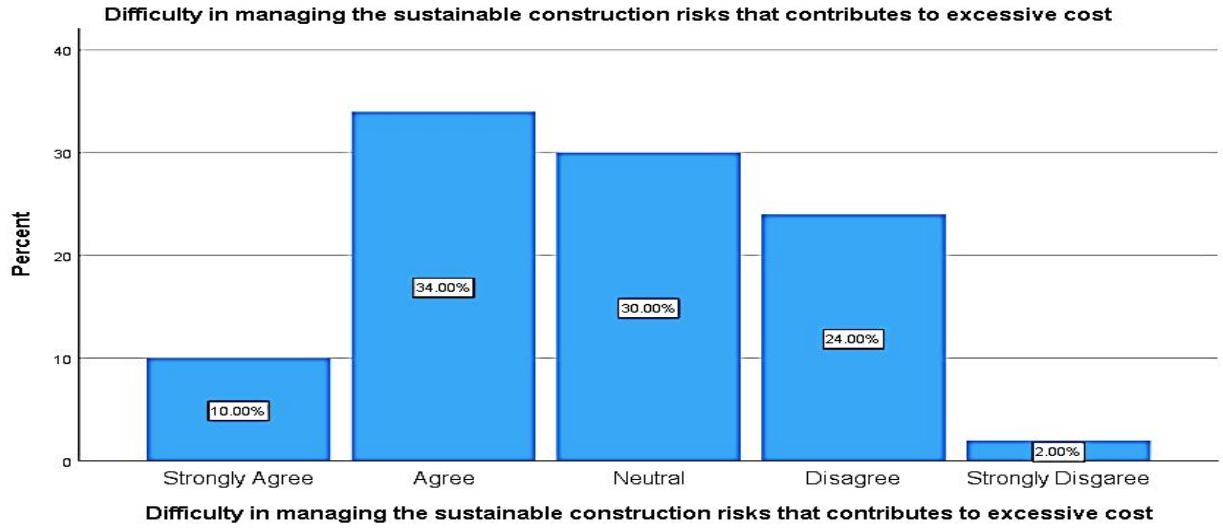

Figure 6: Bar Chart representation of Difficulty in managing the sustainable construction risks that contributes to excessive cost.

44% of the participants strongly agree that they are facing difficulty in limiting risks associated to costs due to low budget and 28% participants agree to the statement as well. 22% participants remained neutral on the statement whereas 6% participants disagree with the statement.

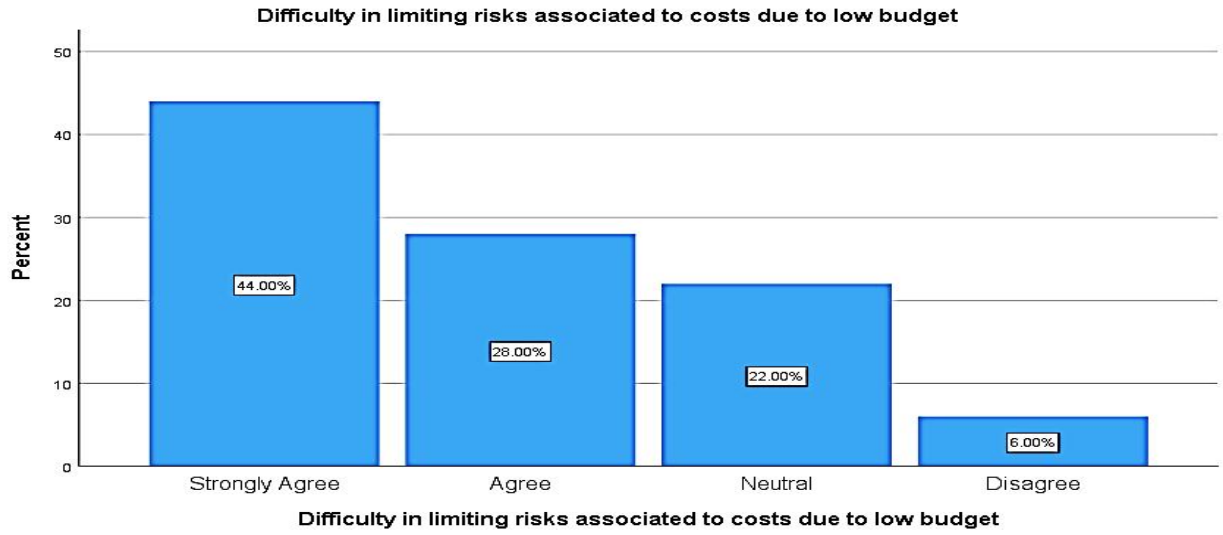

Figure 7: Bar Chart representation of Difficulty in limiting risks associated to costs due to low budget

22% participants amongst the selected ones strongly agreed that there is lack of on-the-job training and 44% participants also agreed to the statement. Whereas 6% and 2% participants disagreed and strongly disagreed and the remaining 29% participants stayed neutral.

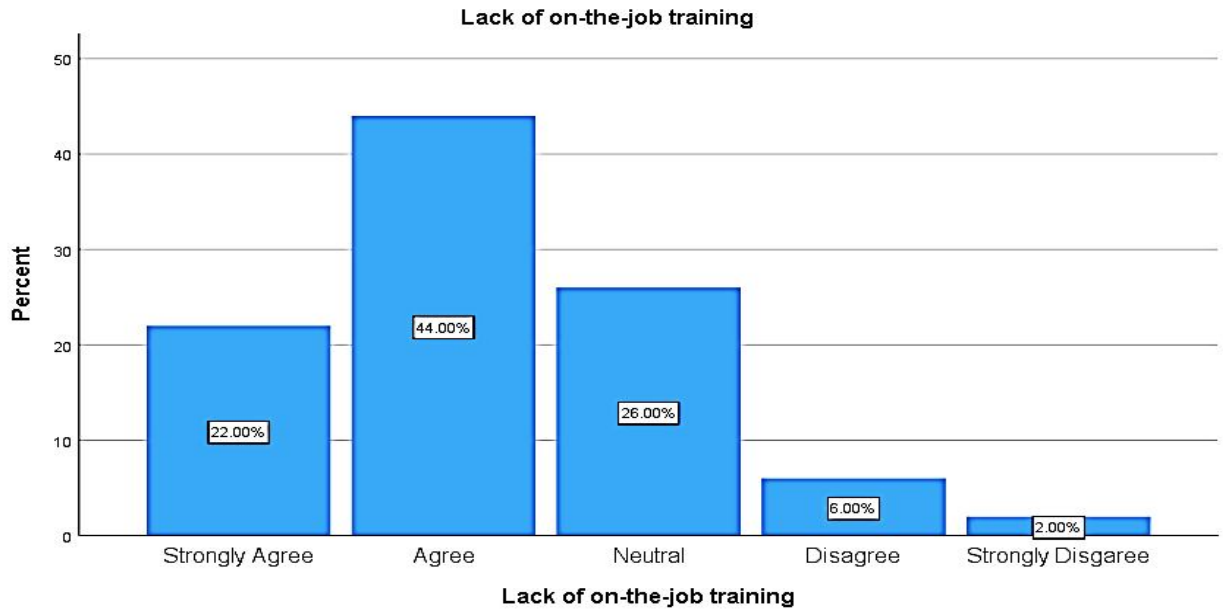

Figure 8: Bar Chart representation of Lack of on the job training

32% participants strongly agree with the statement that there is lack of monthly meeting that includes sessions of education on sustainable construction for the workers. 36% also agree with the statement. However, 6% and 2% disagree and strongly disagree whereas 24% of the participants stayed neutral.

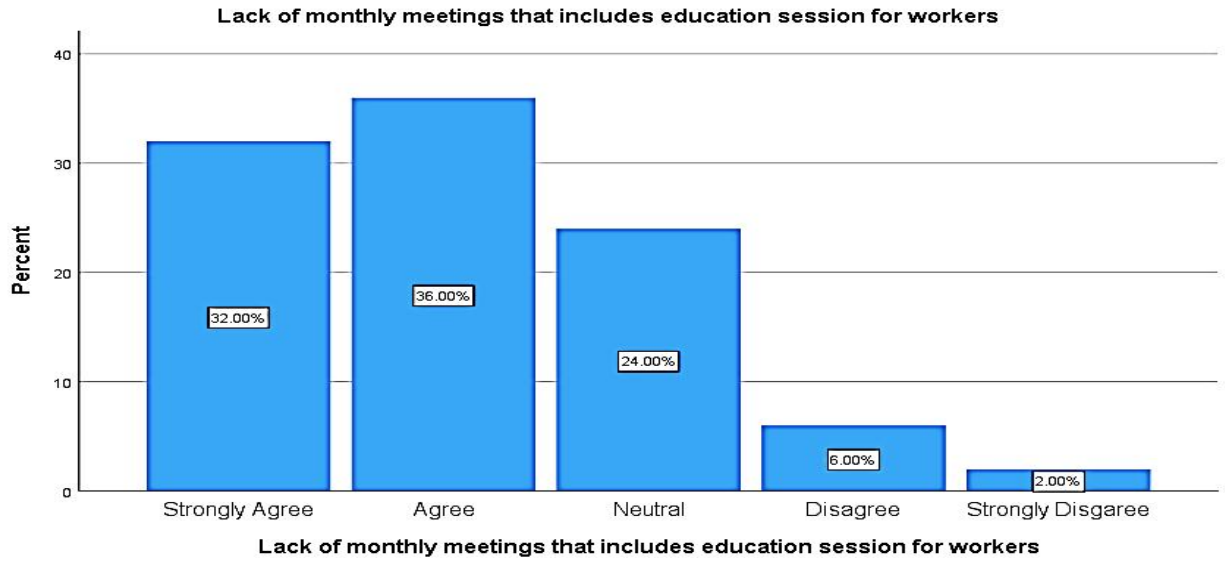

Figure 9: Bar Chart representation of Lack of monthly meetings that includes education session for workers

60% of the participants agreed that there is insufficient understanding about sustainable buildings materials and methods. 12% of the participants strongly agreed to the statement. 22% and 6% disagreed and strongly disagreed.

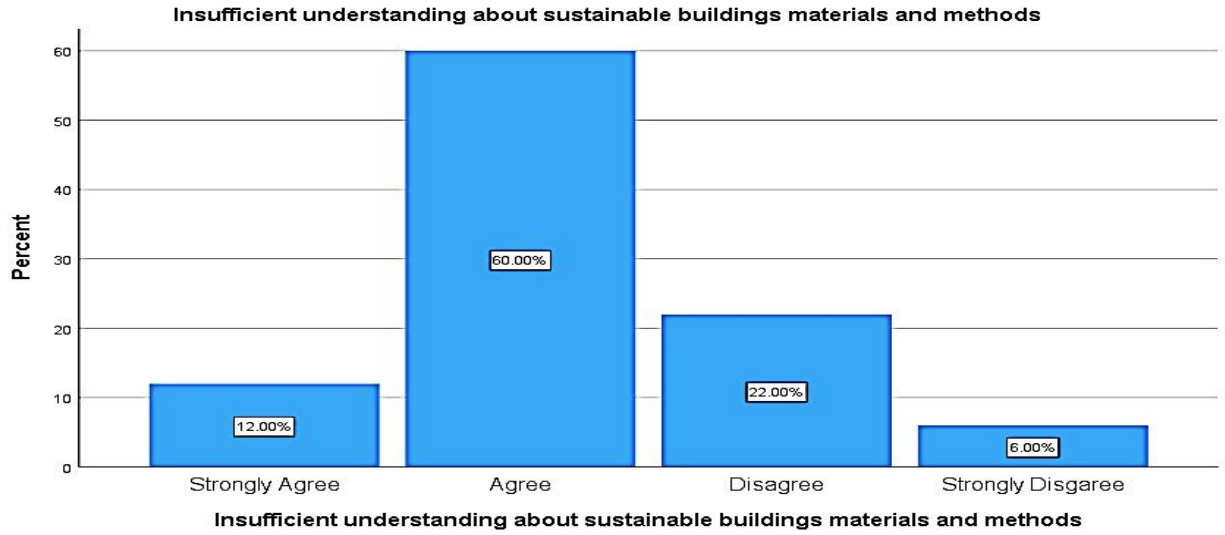

Figure 10: Bar Chart representation of insufficient understanding about sustainable buildings materials and methods

46% participants strongly agreed that design, health and safety challenges are paramount barriers in achieving sustainability in construction industry. 26% participants also agreed with the statement. However, 16% participants disagreed and 4% participants strongly disagreed. Among selected participants, 8% remained neutral on this statement.

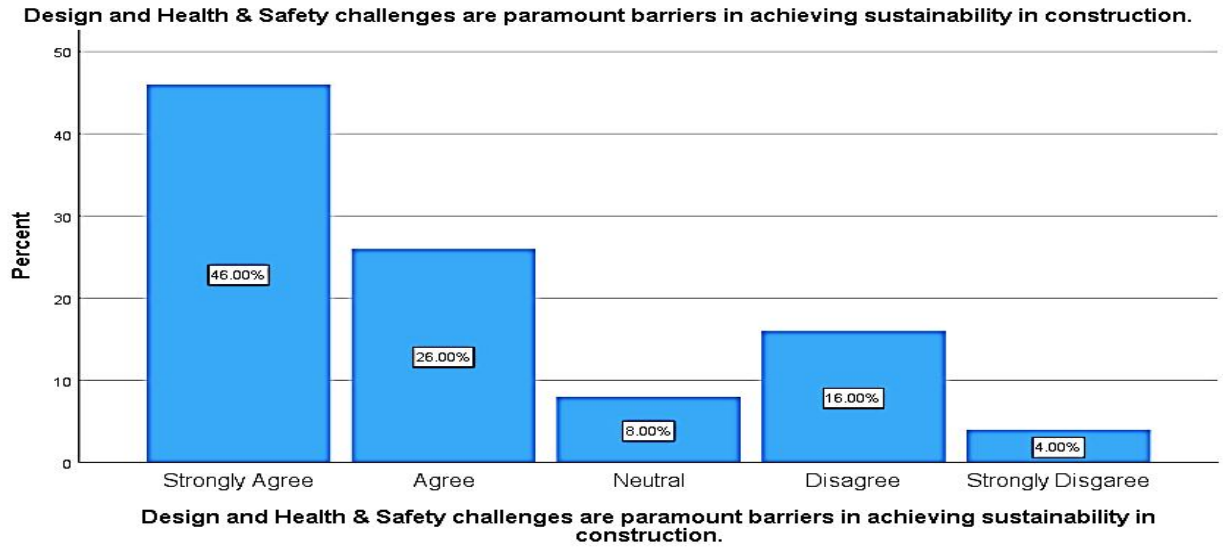

Figure 11: Bar Chart representation of design and health safety challenges as paramount barriers in achieving sustainability in construction

36% of the participants strongly agree that there is lack of awareness regarding the appropriate finance and cost and considered it to be the prominent challenge in achieving sustainable construction. 36% participants also agreed to the statement. 22% participants remained neutral whereas 6% participant disagreed with the statement.

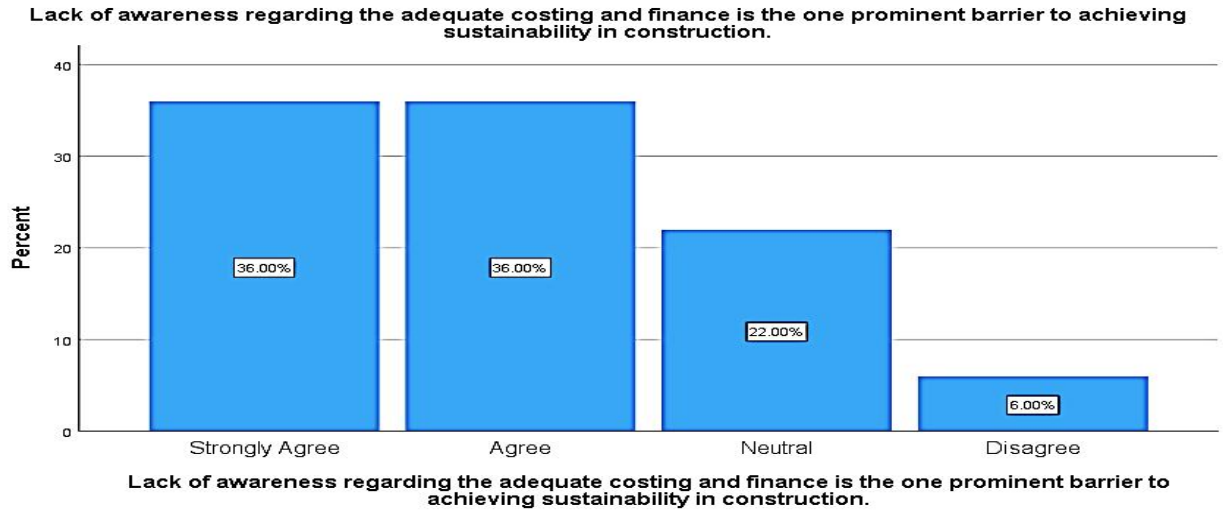

Figure 12: Bar Chart representation of Lack of awareness regarding the adequate costing and finance as a prominent barrier to achieving sustainability in construction.

30% participants agreed that there is lack of adequate infrastructure in achieving sustainable construction and also lack of appropriate practices for training and development. 44% participants also agreed with the statement. 22% participants remained neutral whereas 4% disagreed with the statement.

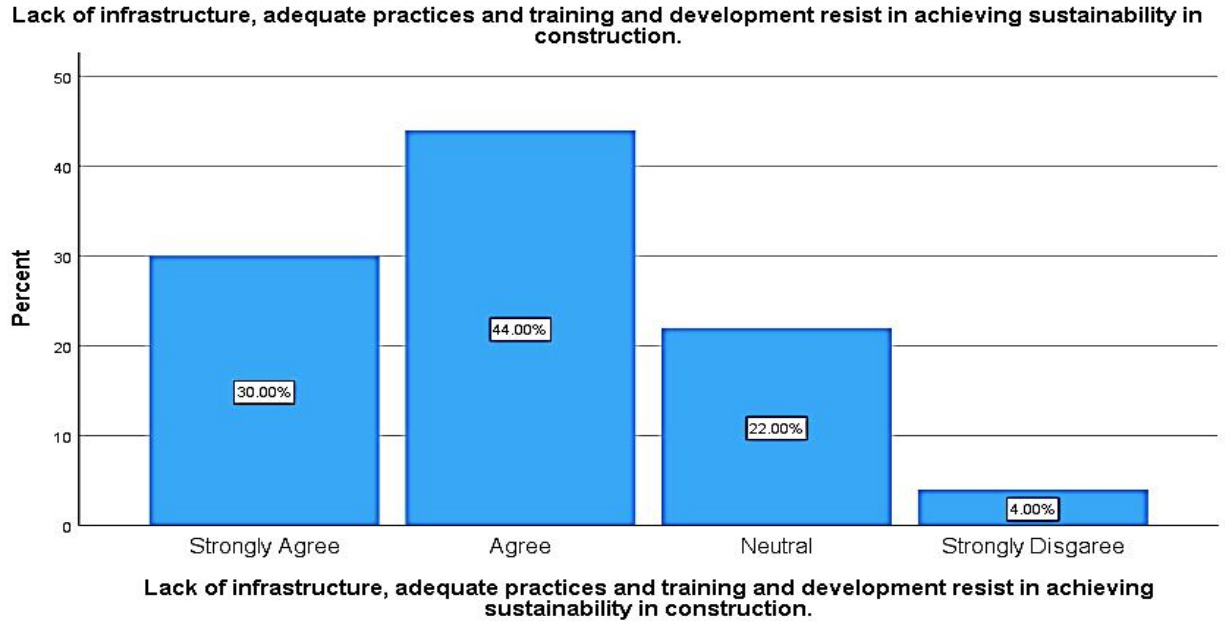

Figure 13: Bar Chart representation of Lack of infrastructure, adequate practices and training and development resist in achieving sustainability in construction.

3.2 Correlation Analysis

Table 1: Correlation Summary for Challenge Factors on Pairwise Comparison

Correlations

		Lack of knowledge of Sustainable Practices	Design Challenges and Health and safety	Cost saving	Training and education	Sustainability in Construction
Lack of knowledge of Sustainable	Pearson Correlation	1	0.090	0.115	0.245	0.240

Practices	Sig. (2-tailed)		0.534	0.427	0.087	0.093
	N	50	50	50	50	50
Design Challenges and Health and safety	Pearson Correlation	0.090	1	.866**	.711**	.510**
	Sig. (2-tailed)	0.534		0.000	0.000	0.000
	N	50	50	50	50	50
Cost saving	Pearson Correlation	0.115	.866**	1	.872**	.740**
	Sig. (2-tailed)	0.427	0.000		0.000	0.000
	N	50	50	50	50	50
Training and education	Pearson Correlation	0.245	.711**	.872**	1	.890**
	Sig. (2-tailed)	0.087	0.000	0.000		0.000
	N	50	50	50	50	50
Sustainability in Construction	Pearson Correlation	0.240	.510**	.740**	.890**	1
	Sig. (2-tailed)	0.093	0.000	0.000	0.000	
	N	50	50	50	50	50

****. Correlation is significant at the 0.01 level (2-tailed).**

According to Williams et al. (2020) [20], the threshold for person correlation is 0.05. For the first independent variable i.e. Lack of knowledge of Sustainable Practices valued as 1 with respect to dependent variable i.e. sustainability in construction with a value of .240 which shows that there is weak correlation between dependent and independent variables. For the second variable, the value of dependant variable was .510 which showed that there is moderate association between variables. For third variable, the value was .740 which showed the strong correlation between the dependent and

independent variables. For the fourth variable, the value was .890 which also showed a strong correlation between training and education and sustainability construction.

3.2.1 Regression analysis

To test the validity of the model and to analyse the predictability ratio of independent variables with the dependent variables, regression analysis technique was used. The p value 0.05 is the threshold and the values less than that predicts the model is significant. The coefficient analysis showed which variables showed strong significant challenges while achieving sustainability in construction industry.

Table 2: Summary of Regression Analysis Results

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.909[a]	0.827	0.812	0.43785

a. Predictors: (Constant), Training and education, Lack of knowledge of Sustainable Practices , Design Challenges and Health and safety, Cost saving

Interpretation: The R value of the model summary identifies the adequacy of model used and the R square describes the predictability of independent variables with respect to dependent variables**.** The R value of the model summary table i.e. 0.909 shows that the model is 90.9 suitable for the quantitative analysis. The R square value in the table i.e. 0.827 shows that the 82.7% independent variables are predicting dependent variable.

Table 3: Summary of Regression Analysis using ANOVA.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	41.259	4	10.315	53.804	.000[b]
	Residual	8.627	45	0.192		
	Total	49.886	49			

a. Dependent Variable: Sustainability in Construction

b. Predictors: (Constant), Training and education, Lack of knowledge of Sustainable Practices , Design Challenges and Health and safety, Cost

saving

Interpretation: The p value in Anova table i.e. 0.000 which is less than 0.05 is the threshold. This indicates that the model used in analysis is significant.

Table 4: SPSS Result Summary for Coefficients

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	0.132	0.199		0.665	0.510
	Lack of knowledge of Sustainable Practices	0.023	0.097	0.015	0.233	0.817
	Design Challenges and Health and safety	-0.469	0.168	-0.352	-2.795	0.008
	Cost saving	0.305	0.261	0.215	1.170	0.248
	Training and education	1.043	0.149	0.948	7.013	0.000

a. Dependent Variable: Sustainability in Construction

Interpretation: The p- value of lack of knowledge is 0.817, whereas p value for design challenges and health and safety is 0.008. P value for cost saving is .248 and p value for training and education is 0.000. The variables with values less than 0.05 indicates that they are significant challenges i.e. design

challenges and health and safety (p=0.008) and training and education (p=0.000), in achieving sustainable construction.

4.0 CONCLUSION

The primary aim of the present study was to identify the challenges experienced by the project engineering managers while achieving sustainability in the UK construction industry. It has been revealed from the findings that construction is heavily dependent on conventional methods in most rising economies, including the UK, which makes the adoption of novel techniques more challenging and stressful. An important barrier to attaining sustainable construction is clients' and other stakeholders' lack of support for innovative construction techniques. The findings further revealed that the implementation of eco-friendly building practices by the construction sector has the tendency to reduce an asset's overall environmental impact and promote sustainable economic growth. In a nutshell, the present study has evaluated that the building industry is crucial to the UK's sustainable growth since the idea of sustainability significantly affects people's quality of life. Moreover, regression analysis was utilized in the research to examine the predictability ratio between the independent and dependent variables and to test the model's validity. The cutoff point is 0.05, and values below that indicate that the model is significant. The coefficient analysis identified the variables that presented the greatest obstacles to achieving sustainability in the construction industry. On the other hand, correlation analysis revealed that a lack of understanding of sustainable practices has a value of 1, and its value in relation to the dependent variable, sustainability in construction, is 0.240, indicating a poor correlation between the dependent and independent variables. The dependent variable for the second variable has a value of 0.510, indicating a moderate relationship between the variables. A value of 0.740 for the third variable indicated a high degree of correlation between the dependent and independent variables. The fourth variable, with a value of 0.890, similarly demonstrated a substantial association between education and training and sustainable building practices.

The study was also able to identify the factors involved in the challenges of the project engineering managers towards achieving sustainability in the UK construction industry. The results of this study show that there are several difficulties faced by project engineering management teams when implementing sustainable construction practices. The study has highlighted that lack of knowledge about sustainable technologies is among the biggest issues. The findings revealed that project engineering managers do not appear to grasp enough about environmentally friendly building practices and materials. The study has also stressed the notion that it is the duty of the engineering management team to ensure that the overall output does not deviate from the performance standards. Moreover, it has been evaluated that lack of acquaintance with sustainable technology has a detrimental impact on the overall project outcome and performance. The findings have also highlighted that the lack of expertise in the sustainable supply chain, recyclable materials, and sustainable design requirements presents a challenge to project engineering management teams in the field of sustainable construction. They are compelled to speak with these types of professionals on a regular basis. Lack of time to implement sustainable building practices on construction sites due to the numerous contract types used for project delivery has been cited as another difficulty. Moreover, it is also evaluated that conflicts of interest and poor communication amongst project engineering co-workers are additional difficulties.

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