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Research Article

Evaluation of Factors Affecting the Competitive Advantage of Organizations in Establishing Sustainable Project Management Post Covid-19

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Competitive advantage significantly matters for modern construction organizations as it promotes the sustainable development and safety management of projects. UK construction organizations have greatly suffered from a lack of safety and sustainability of project management in infrastructure development projects because of the COVID-19 pandemic. Post-COVID-19 UK infrastructure development projects are uncertain in the context of organizational competitive advantage as they cannot maintain sustainable project management. This study was conducted to identify, rank, and present a framework of factors influencing the competitive advantage of UK organizations. The study design involved identifying factors from the current literature, after which the most relevant factors were filtered with the help of semi-structured interviews with 15 experts. A pilot survey was conducted then, involving 192 respondents, after which a reliability test and exploratory factor analysis (EFA) were conducted on the results. A primary questionnaire survey involving 250 respondents was conducted, after which RII and confirmatory factor analysis (CFA) were conducted on the final data. A total of five subgroups were found to be significant in the CFA, such as Resources and Policies, Quality and Delays, Motivation and Expectation, Management and Environment, and Government and Business. It is recommended based on findings that the construction organizations of the UK have to consider working on identified factors to maintain a competitive advantage in establishing sustainable project management solutions for post-COVID-19 UK infrastructure development projects.

1. Introduction

Obtaining and retaining a competitive edge is of the utmost significance in the highly competitive environment of which contemporary enterprises are a part. Numerous studies, such as Eyvazpour et al. [1], Seify et al. [2], Mohammad Shafiee [3], and Farhikhteh et al. [4], have delved into the intricacies of competitive advantage across various industries [1–4]. This idea, which has been investigated in great depth, refers to the capacity of an organization to outperform its rivals by producing better goods or services, optimising its operations, or strategically placing itself in the market. Particularly focusing on the UK, the construction industry has been facing varieties of issues indicated by earlier research [5]. This industry, as demonstrated by the works of Mohammad Shafiee and Pourghanbary Zadeh [6] and Shafiee et al. [7], is no stranger to the pursuit of competitive advantage [6, 7]. However, as a result of the COVID-19 epidemic, the construction industry in the UK has been confronted with a variety of obstacles, which have caused normal methods of project management to be rendered ineffective, as acknowledged by Seify et al. [8] and Mahboobi Renani et al. [9].

The United Kingdom is working towards sustainability in the building industry because without it the nation would be unable to effectively cut costs and lessen its environmental impact. According to Armenia et al. [10], construction companies in the UK have felt the effects of the recent COVID-19 epidemic in a variety of ways, and their competitive edge is now contingent on a number of different elements [10]. The commercial and residential markets in the UK are growing rapidly, driving up construction profits dramatically. However, Ghaffar et al. [11] argued as the year 2020 approaches, various construction industry issues will become apparent [11].

In recent years, the construction industry in the UK has been confronted with issues that have never been seen before. The COVID-19 pandemic has emerged as a revolutionary force that has challenged traditional project management practices. Not only did the pandemic raise substantial health and safety issues, but it also put a pressure on the industry's capacity to manage projects in a manner that was sustainable. As a result of the pandemic, construction companies in the UK are facing uncertainties with respect to the competitive advantage they have in the infrastructure development projects they undertake. As a result, they are required to conduct a comprehensive review of the project management methodologies they use.

The construction industry is vital to the economy of the United Kingdom because of its contribution to both economic expansion and job opportunities. Nevertheless, the sector has struggled for a considerable amount of time with problems connected to project management, safety, and sustainability. These difficulties were made much worse by the COVID-19 epidemic, which brought to light the need of developing novel and long-term solutions for project management.

The study's overarching objective is to learn how post-COVID-19 issues are influencing the comparative benefit of UK construction firms. There is a need for first-hand investigation into why businesses in the United Kingdom are unable to adopt and execute corporate sustainability management solutions for infrastructure expansion and improvement initiatives. The research questions are based on critical rationale of this study, such as Research Question 1: What are the factors affecting competitive advantage of organizations in establishing sustainable project management solutions for post-COVID-19? and Research Question 2: How a framework can be established involving factors affecting competitive advantage of organizations in establishing sustainable project management solutions for COVID-19? The theoretical framework and research gaps inform the study's aims. In this part, the study's major goals are extracted and given a more nuanced interpretation. Objectives of this study are as follows. Determine how the post-COVID-19 environment affects the long-term viability of project planning in United Kingdom infrastructure building projects. Inquire into how the building industry's competitive edge has changed after the end of the COVID-19 era. To learn about the sustainability issues faced by the building industry after COVID-19. To learn how sustainable project management may be included into future infrastructure development projects in the United Kingdom by the building industry. Contribution of this study is as follows. Construction organizations of UK would be interested in maintaining highly competitive advantage in current post-COVID-19 environment by focusing on factors identified by this study. Infrastructure development projects of UK will be able to adopt sustainable project management solutions by keeping their focus on factors identified by this study.

While there have been a number of studies on the topic, there is still a dearth of empirical research on the variables determining competitive advantage in building sustainable project management solutions in the wake of COVID-19. To better understand what makes for long-term success in project management, more empirical study is required. The term "competitive advantage" is discussed a lot without being defined, which leads to ambiguity and misinterpretation. Construction organizations may benefit from developing strategies that are more in line with their values and aims if they have a deeper understanding of how corporate culture influences sustainable project management.

The purpose of this study is to conduct an in-depth investigation of the factors that contribute to the competitive advantage held by UK construction companies in the post-COVID-19 period, with a particular emphasis on the management of environmentally friendly projects. In the context of this research, having a competitive edge includes not only the capacity to complete projects effectively and on schedule but also the ability to place a premium on sustainability, safety, and the overall quality of the project. Overall, it is the aim of this research to comprehensively investigate the determinants impacting organizational competitive advantage in the context of sustainable project management solutions for UK construction organizations in the post-COVID-19 era. The research has the following objectives. (1) To identify and rank the key factors affecting the competitive advantage of UK construction organizations. (2) To develop a structured framework that presents these factors in a coherent manner. (3) To assess the relationships between the identified factors and competitive advantage using structural equation modelling (SEM). (4) To provide actionable recommendations based on the study findings, aimed at helping UK construction organizations establish sustainable project management solutions for post-COVID-19 infrastructure development projects.

After COVID-19, there has not been any other research looking at the connection between sustainable project management and competitive advantage using exploratory factor analysis (EFA), confirmatory factor analysis (CFA), and structural equation modelling (SEM). By taking into account the direct and indirect impacts of the identified variables on the latent variable, this method enables a more thorough and accurate examination of the factors determining competitive advantage [12, 13]. Through SEM, we want to shed light on the interaction between these aspects and their influence on competitive advantage, which may lead to more informed strategy formulation for businesses looking to construct long-term project management solutions beyond COVID-19.

The study fills a significant need in the existing body of research by exploring the factors that have an influence on an organization's competitive advantage within the framework of sustainable project management solutions, more especially in the period that followed COVID-19. This is an issue that has recently come to the forefront of concern for the construction industry, and the findings of the research give insights that may be useful to both construction professionals and politicians. The study provides a thorough framework that defines, ranks, and shows the primary characteristics that are responsible for a construction company's level of competitive advantage in the UK. This framework not only helps in understanding the complicated interplay of these elements but also acts as a practical tool for industry stakeholders to analyze and improve their competitive position. This is because the framework helps in understanding the complex interaction of these factors. In addition, research results provide practical advice for organizations in the construction industry in the UK. Organizations may work towards building sustainable project management solutions that will assist them in maintaining a competitive edge in the landscape that will exist after COVID-19 by concentrating their efforts on the elements that have been highlighted. The industry practitioners, policymakers, and academics have the opportunity to obtain significant insights into the intricate interplay of variables that determine competitive advantage in the ever-changing environment of UK construction. The results of this study may be used to influence strategic choices, lead the development of legislation, and inspire subsequent research that aims to improve the construction industry's sustainability and competitiveness.

2. Literature Review

There is a dearth of literature on sustainable project management systems for infrastructure development projects in the United Kingdom. Bardos et al. [14] and Alaloul and Qureshi [15] argued that in the wake of the COVID-19 pandemic, businesses will require a competitive edge greater than ever before to effectively mitigate the risks posed by the disease [14, 15]. Limited work has been done on establishing interventions for UK infrastructure development that should lead to sustainable project management, as stated by Ebekozien et al. [16]. This study is centered on creating a model that may assist the United Kingdom in establishing projects that adhere to the principles of sustainable project management.

Jeon et al. [17] showed that the pandemic has had a significant influence on the strategic edge of UK construction businesses; therefore, this issue may be regarded a highly effective impartial factor that can have an effect mostly on sustainable management for UK infrastructure projects [17]. Wang et al. [18] stated that as the pandemic has caused a lockdown scenario and it was understood that businesses might contribute more to sustainable project management, the shortage of resources is directly attributable to the poor performance of those businesses in handling the many parts involved [18]. Table 1 presents the comparative evaluation of most important research papers.

After the pandemic, Yang et al. [21] argued that the construction industry faced new challenges, and the purpose of these research studies is to better understand how these new factors are influencing the long-term viability of project management [21]. This study's results and their ramifications will be applicable only to the UK, but further study will add to our theoretical understanding and inform the practical design of treatments that may be used in infrastructure construction projects in the United Kingdom [12, 29].

From the perspective of public sector infrastructure development projects, the importance of sustainability is greater because it demands significant input from the construction industry [2]. According to Ribes [13], overall UK infrastructure development projects are not meeting the future goals at the pace which was required [13]. This has a significant effect on the solutions adopted by the project manager, as those do not contribute well to the current environment after 2020 [20–23]. According to Macklin et al. [30], delays are becoming more common, and there are multiple uncertain factors present in every infrastructure development project, which can also increase the chances of conflicts among all parties [30]. Furthermore, Bardos et al. [14] and Pereira Morais and Bacic [31] stated that it has been reported that maximization of sustainability in project management can be an effective solution, regardless of the fact that it depends on the competitive advantage of construction organizations involved in infrastructure development projects [14, 31]. According to Alaloul et al. [32], it is the reason that significant evolution is always needed in terms of improving the sustainability of solutions while considering strengthening of construction organization [32].

Table 1: Comparison with existing research.

Sr. #	Title	Findings	Methodology	Difference	References
1	Comparison of construction project risks before and during COVID-19 in Singapore: criticality and management strategies	As a direct result of the pandemic, identified adjustments in the prioritised risks, with the financial risk giving way to the labour shortage risk. In both time periods, the significance of the potential dangers to one's health and safety was emphasised.	Used questions from surveys and interviews with a semi-structured format	Focuses on the risk shift that the pandemic has brought about in the building sector. Focuses on the context of Singapore and provides a viewpoint that is more specific to the region.	[19]
2	Post-COVID-19 recovery: an integrated framework of construction project performance evaluation in China	For the post-COVID-19 project recovery, critical success factors (CSFs) and key performance indicators (KPIs) were identified. Emphasised the necessity of effective management and technical innovation, the contentment of stakeholders, and enough resource availability for the purpose of recovery.	Used a variety of research approaches, including a study of the relevant literature; interviews with subject matter experts; a questionnaire survey; factor analysis; analytic hierarchy process (AHP) analysis; and structural equation modelling (SEM)	The emphasis here is on project recovery in China after COVID-19. Places an emphasis on CSFs, KPIs, and the links between the two. In the context of Chinese construction, this article provides a road map for project recovery.	[20]
3	Construction industry post-COVID-19 recovery: stakeholders perspective on achieving sustainable development goals	Role of stakeholders in enhancing sustainable development is clarified	Quantitative method only	Method is limited and does not provide implications for future sustainable development in post-COVID-19 environment	[16]
4	Opportunities and challenges for construction health and safety technologies under the COVID-19 pandemic in Chinese construction projects	Factors identified for the post-COVID-19 environment	Quantitative method with literature review	The results are only applicable on China with limited outcomes for sustainable development	[21]
5	A framework to analyze international competitiveness: the case of construction firms of China	A valid framework is provided for Chinese construction firms with critical focus on the competitive advantage	Quantitative method with expert review	The results are valid only for China and different sample size limits the findings to be applied in UK construction post-COVID-19 environment	[22]
6	Exploring the impact of COVID-19 on the United States construction industry: challenges and opportunities	Results are provided for US construction industry indicating impact factors of pandemic	Quantitative research method	No focus on sustainable development and competitive advantage. Sample size is also different.	[23]
7	Firm size influence on construction safety culture and construction safety climate	Impact of size of firm on construction safety is evaluated in post-COVID-19 environment	Quantitative and qualitative research method	Limited focus is provided on the construction sustainability and competitive advantage	[24]
8	Impact of COVID-19 on the US construction industry as revealed in the Purdue index for construction	Results consist of detailed impact factors of impact of pandemic for US construction	Quantitative research method	There is no focus on sustainability and also the competitive advantage is the major limitation of the study	[17]
9	New partnerships for co-delivery of the 2030 agenda for sustainable development	Results are based on impact of partnerships on the sustainable development	Quantitative method	There is no outcomes for the post-COVID-19 environment and competitive advantage	[25]

Table 1: Continued.

Sr. #	Title	Findings	Methodology	Difference	References
10	Sustainable construction investment, real estate development, and COVID-19: a review of literature in the field	The results are linked with sustainable development of the firms only	Quantitative research method	There is no evidence of competitive advantage and factors that affect in COVID-19	[26]
11	New modes of operating for construction organizations during the COVID-19 pandemic: challenges, actions, and future best practices	The results are comprehensively focused on all potential factors that affect sustainable development	Quantitative research method	The evidence is not linked with any competitive advantage critical for the sustainable development of UK firms	[27]
12	Impact of COVID-19 on health and safety in the construction sector	Study explains the impact factors on construction health and safety in post-COVID-19 environment	Quantitative research method	The evidence is not linked with competitive advantage and sustainable development	[28]

Using Singapore as an example, Xu et al. [19] presented some insightful information on the effects that the COVID-19 epidemic has had on the building sector. It brings to light the dynamic shift of hazards that existed within the industry both before and after the epidemic. Notably, the analysis reveals a change in the prioritisation of risks, with labour shortages replacing financial concerns as the primary worry throughout the epidemic [19]. In addition, concerns over health and safety issues were of the utmost significance during both time periods [19]. The research highlights the efficiency of the government's relief efforts in Singapore and suggests novel approaches to risk management [19]. The study adds to understanding risk management techniques applicable to the post-COVID-19 building sector by concentrating on a particular geographic location and presenting insights that are unique to that environment [1–4]. This addresses a major area of concern for both scholars and practitioners in the field of construction.

The post-COVID-19 project recovery situation within the Chinese construction sector is the primary focus of Gao et al. [20]. It places an emphasis on the critical success factors (CSFs) as well as the key performance indicators (KPIs) that are necessary for attaining a successful recovery [20]. In this research, a robust mixed technique is used to calculate CSFs and KPIs, carry out a questionnaire survey, and investigate the variables that contribute to recovery [20]. The relevance of management and technical innovation, as well as the satisfaction of stakeholders and the availability of sufficient resources, was one of the most important conclusions. In addition to this, it provides a thorough roadmap structure for directing construction project recovery within the context of the Chinese market [20]. It provides significant assistance for stakeholders in the construction sector in China by offering a thorough study of the aspects that are crucial to post-epidemic project performance. It also has the potential to have consequences for other places that are attempting to navigate similar issues in the wake of the COVID-19 pandemic.

In accordance with Jeon et al. [17], when an organization is growing and dealing with competition in the market, it always desires to control the adverse outcomes of any project to maintain its credibility in the market [17]. The uncertainty also decreases because of the significant amount of business in the market, where it can easily negotiate with all parties, including the suppliers [6–8]. Loss of competitive advantage is linked with poor project management outcomes that can lead to negative impacts on infrastructure development projects in the UK [11]. Furthermore, Lekchiri and Kamm [22] and Kaklauskas et al. [33] stated that changes are also present that were never seen before 2020, as the whole construction industry has suffered from economic losses [33]. That is bad in terms of engaging in sustainable project management while also considering the chances of developing infrastructure development projects that can lead to better outcomes for all organizations [5, 9]. According to Karakhan et al. [24] and Pradhananga et al. [23], the presence of limited literature is always one of the main problems that affects the ability of project managers in a practical context to adopt strategies that may increase their competitive advantage [27, 28]. Furthermore, it has negative information on infrastructure development project outcomes where a positive role is required by the project management solutions as well as differentiation that is necessary that can lead to the adoption of negative methods currently available for project control [34, 35].

It is the reason that competitive advantage of organization matters from research perspective where any change in external environment has always influence on the future potential [36, 37]. That is also indicated by Mahmutaj and Grubi [38] showing that many organizations have failed because of a lack of proper competitive advantage assessment in other forms of financial crisis before, the most important of which was in 2008 [29]. Based on Lekchiri and Kamm [39] and Yang et al. [21], the need for a new study is emphasized. This highlights the potential benefits of enhancing the competitive advantage of organizations involved in UK infrastructure development projects. It acknowledges the considerable shift in the construction landscape since the pandemic [8, 26]. Additionally, as noted by Ghaffar, Burman, and Braimah [11], this shift may negatively impact overall business outcomes and contribute to ineffective project management solutions, ultimately leading to a loss of significant competitive advantage in the market [11].

3. Research Methodology

The study's methodology is predicated mostly on quantitative research techniques, since they provide the best promise of supporting the study's hypotheses and elucidating its objectives. Since the current issue necessitating sufficient explanation using data gathered from the people who are going to be impacted by this study in the future cannot be effectively tackled using the alternative technique based on secondary data, primary data must be used [3, 30]. It is a primary research technique that falls under positivist research philosophy, has everything needed to provide adequate justification for the research hypothesis, and can easily provide the approach that is very suitable for suggesting long-term strategies to the UK construction sector [26]. As the construction sector in the UK continues to grow in significance, so does the need for effective project management practices that will ensure the long-term viability of the nation's building and infrastructure. Rather than relying on already highlighted material from the existing literature, this study opted for a primary research technique since it is more likely to provide accurate results by collecting data directly from the construction industry's fundamental individuals [21].

Organizational competitive advantage in sustainable project management systems for post-COVID-19 UK infrastructure projects is the focus of this investigation. Questionnaires were employed as the study approach, and construction industry experts were studied for their insights [31, 32]. Its primary purpose is to characterize a group or phenomenon [40, 41]. If the researcher conducts a survey to identify factors affecting organizations competitive advantage in sustainable solutions, a good understanding of the construction industry and the need for mitigation or remedial systems is essential [31, 32]. The experts were selected with the understanding that they would play an active role in project execution, particularly in the roles of contractors, consultants, and clients, over the course of construction projects. Professionals in these fields might range from structural engineers to mechanical engineers to quantity inspectors and architects. As an example, it was asked from the experts, "What do you think the effects of the COVID-19 epidemic will be on the construction sector, particularly in terms of the management of projects and the advantages they will have over other businesses?" and one of the significant response was, "The pandemic caused by COVID-19 caused severe disruption to construction sector project timetables as well as supply chain operations. Because of this, there were delays, higher expenditures, and shortages of resources, all of which had an impact on our project management tactics and our edge over the competition."

Similarly it was also asked from experts, "In the years after the implementation of COVID-19, which elements do you believe have assumed an increasingly important role in ensuring that construction companies continue to enjoy a significant competitive advantage?" and the response from one expert was, "In the period that followed COVID-19, the capacity to adjust quickly and nimbly to changing circumstances within a project, as well as adaptation to working remotely and digitization of processes, has become an essential component of a competitive advantage."

As shown in Figure 1, the research methods include EFA, CFA, and SEM for framework development.

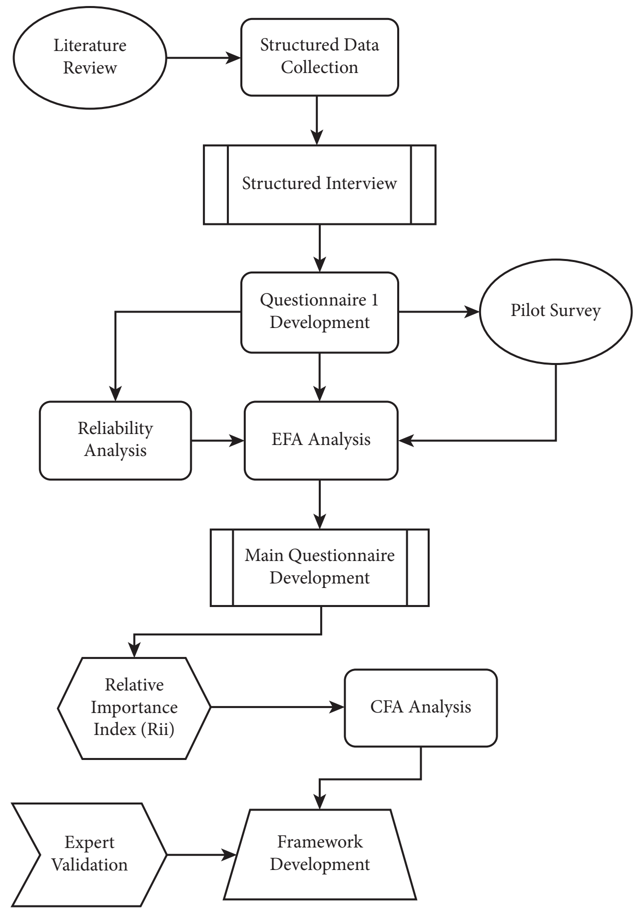

Figure 1: Flowchart of the study.

In order to evaluate the factors that determine an organization's ability to maintain a competitive edge via the implementation of sustainable project management solutions in the post-COVID-19 period, the study used a methodologically sound approach. The use of SEM proved to be an essential part of our investigation as it allowed us to investigate the connections that existed between the myriad of components that were outlined in our framework. The SEM is a well-known statistical method that enables the simultaneous estimate of various associations between variables that have been seen and variables that have been unobserved. It provides a number of benefits, one of which is the capacity to evaluate intricate multivariate interactions and test hypotheses about the power and relevance of these connections. In this particular instance, SEM made it easier to investigate the complex interactions that take place between the many aspects that determine a company's level of competitive advantage within the framework of sustainable project management solutions.

The SEM analysis was carried out with the assistance of the SmartPLS 4 program. For exploratory research such as this one, SmartPLS is a technique for SEM modelling that is both user-friendly and adaptable, and it works especially well. It offers strong capabilities for examining both the measurement model (the validity and reliability of items), as well as the structural model (the links between components). With the help of SmartPLS 4, we were able to carry out an exhaustive investigation into the aspects that had been identified as having an effect on the organizational advantage of competitiveness. In addition to this, it assisted in determining the relevance of these interactions as well as the directionality of their causality, which added to the breadth and rigour of our investigation.

Only in an environment where sustainability is a top priority can a project's long-term profitability and the customer's objectives and expectations be met. After the industry's detrimental effect on the epidemic has been mitigated, corporations will be compelled to expand into unaffected industries and develop novel responses to the crisis.

A short questionnaire survey method was used to validate the developed structural model. The main stakeholders of this study such as contractors, consultants, and clients were involved in validation survey. The aim of validation was to confirm the practical applicability of the developed structural model by which appropriate action could be taken to control the factors and help reduce their impact on competitive advantage of organizations in establishing sustainable project management in post-COVID-19 environment. Authors agree with the validation process, critical for fulfilling the purpose of this study. Twenty-three experts were invited and involved in validation survey. Six critical questions were devised to find out the validity of model, such as

Q1: are the variables presented in the model appropriate for influencing organizations' competitive advantage in implementing sustainable project management solutions for post-COVID-19?

Q2: is the model a viable way to identify the essential aspects impacting the competitive advantage of businesses in the process of building sustainable project management solutions for post-COVID-19?

Q3: are you able to properly comprehend and embrace the causality shown between constructions of components and the competitive advantage of businesses in the process of building sustainable project management solutions for post-COVID-19?

Q4: are the variables that are described in the structural model suitable for effecting the competitive advantage of businesses in the process of building sustainable project management solutions for post-COVID-19?

Q5: do you find the study results reasonable?

Q6: is it possible for the structural model presented in the study to be generalized?

3.1. Data Collection. The methodology for the study includes the collection of data in many stages. May 2023 through July 2023 was the time period during which the data required for this investigation were gathered. In the beginning, the study found significant aspects by reading existing literature and doing a thorough analysis of research linked to competitive advantage in construction and sustainable project management. Both of these methods helped us find useful information. The results of the survey were subjected to a reliability test, and an exploratory factor analysis (EFA) was also performed on them. This was done so that we could be certain that our findings were accurate. We were able to confirm the underlying structure of the identified components with the assistance of the EFA, which also assisted us in refining the measurement model.

3.1.1. Pilot Survey. Prior to analyzing the whole questionnaire, we ran a pilot study. To achieve this, we sent out the preliminary survey to 192 randomly chosen construction employees after considering all of the elements gathered from the literature research and opinions from 15 experts. Final factors considered for analysis are shown in Table 2. Experts' feedback and the results of a pilot test informed the revisions made to the final draft. It is important to evaluate the reliability and validity of a research instrument in order to get reliable findings. Understanding phenomena is the key to determining a test's validity [48, 49]. Validation of form and validation of content are two distinct analyses that examine how well a research instrument matches the intended study context. Exploratory factor analysis was also used to further confirm the instrument's validity (EFA). The sample size was 192 in this study which fits well within the outlined margin of error. The sample size is fully representative as indicated by Ghaffar et al. [11] and Seify et al. [2, 29, 38]. It was determined that breaking down these obstructions into fewer, more cohesive subscales was important for studying the dimensionality of such variables and for improving the understanding of factor loads. In addition, Cronbach's alpha was utilized to assess the instrument's consistency with study results [50, 51]. The consistency of the questionnaire is evaluated by comparing individual fields to the overall mean.

3.1.2. Main Questionnaire. The questionnaire survey was expanded upon after the pilot study to find the key factors influencing the competitive advantage of organizations in establishing sustainable project management solutions for post-COVID-19 UK infrastructure development projects. The researchers suggested that the questionnaire be used first to determine whether the questions posed are clear, concise, and correct, to create the questionnaire itself, and to gauge how much time would be required to complete the whole exercise. 250 respondents were involved in the main questionnaire concerning 23 factors with five-point Likert scale measurements. Based on the average ratings, the research compiled a list of relative importance index- (RII-) based variables and then took it a step further by doing CFA to construct the model indicating the most critical components. A statistical tool used to establish the ranks of distinct causes seems to be the RII. The event in frequency and intensity of the replies are rated on a 5-point Likert scale, and then RII is computed using equation (1). The mean and standard variance of each element were not statistically adequate for generating global rankings since they did not show any link, and hence the use of significance indices was proposed. After RII, the CFA (confirmatory factor analysis) test is done using AMOS on major questionnaire response data.

$$\sum \frac{\mathrm{ni, pi}}{\mathrm{Rv}, N} \, (0 \leq \mathrm{index} \leq 1), \tag{1}$$

where ni = percent of those who voted Pi, pi = 1 to 5 Likert scale, N = number of questionnaires returned, and Rv = ranking #1 on the Likert scale.

In the next step, we utilize the respondents' rankings to compare the three groups' perspectives on the relative significance of the criteria (clients, consultants, contractors). This ranking will allow the research to determine which aspects are most crucial in preventing businesses from gaining a competitive advantage when it comes to implementing sustainable project management services for the UK's infrastructure after COVID-19.

4. Analysis

4.1. Reliability Analysis. The data were analyzed using SPSS 24.0. We utilized Cronbach's alpha to look at the correlations between the 23 factors and ensure they were consistent.

Table 2: Factors identified from the literature.

Item code	Item name	Sources
F1	Increasing demand of resources	[39, 42]
F2	Conflicts between government and other contract parties	[6, 43]
F3	Disruption in resource management due to ongoing impact of COVID-19	[16, 34]
F4	Increasing prices of green technologies for projects	[35]
F5	Complex quality requirements by clients	[36, 44]
F6	Inappropriate delay risk management strategy	[2, 37]
F7	High inflation in construction market	[36, 38]
F8	Funding conflicts with clients	[2, 45, 46]
F9	Ineffective financial management policy	[9, 26]
F10	Ineffective leadership style	[29, 40, 47]
F11	Resistance in implementing new ideas and innovation	[18, 41, 48]
F12	Poor motivation for employees from leadership side	[17, 49, 50]
F13	Favoritism in government decisions	[21, 51, 52]
F14	Inappropriate government policies	[53, 54]
F15	Delays in resource procurement caused by suppliers	[55, 56]
F16	Higher chances of unexpected interruptions in projects	[57]
F17	Lack of effective quality management system	[24]
F18	No preparedness for external market influence on projects	[57]
F19	Poor work quality management on-site	[24]
F20	Poor compliance with environmental policies	[58]
F21	Difficult to achieve sustainability regulations	[43]
F22	Lack of trained staff for sustainability implementation	[59]
F23	Lack of sustainable methods in construction	[60, 61]

Existing research indicates that an acceptable value of Cronbach's alpha should be above 0.7. Cronbach's alpha values in Table 3 show that the 23 factors are highly correlated and dependable.

4.2. EFA Analysis. Primarily, the applicability of the exploratory factor analysis (EFA) was assessed to eliminate the likelihood of incorrect EFA findings. Necessary sample size for the EFA should be among 150 to 300; in this scenario, it is 192. Furthermore, it is crucial to emphasize a larger sample size, especially in quantitative analysis, where the sample size is determined by multiplying the number of items by the number of responses for each item. As per requirement, quantity is 115, which is less than our predetermined sample size of 192. Amount of variables used in the analysis should be minimum 20 and more than 50. Basic standard for the factor evaluation should be met. Thus, analysis was performed on 23 variable quantities parallel to factors influencing competitive benefit of UK construction project organizations [62, 63]. The topic-to-variable ratio was discovered to be 8.34 : 1.00. Larger than 5 : 1 is needed, and the legality of outcomes from factor analysis is more verified [64, 65].

PCA was employed to perform EFA evaluation, and element structure was acquired for the 23 variables [66, 67]. The varimax rotation was utilized to get the rotated element structure. EFA findings are shown in Table 3, of which 7 factors have an eigenvalue more than 1. Scree plot shown in Figure 2 suggested the same conduct of variables implicated in analysis. A cumulative variance acquired for the five components is 60.948%, which is larger than 50% along with indication of acceptable factor groups. The lowest factor loading limit of 0.4 was utilized to get the outcomes parallel to the rotated component configuration.

After analyzing the component configuration acquired from EFA analysis, the seven subcategories were conceived on the basis of number of constructs or components. They were called as "Government and Business," "Management and Environment," "Resources and Policies," "Training and Sustainability," "Planning," "Motivation and Expectation," and "Quality and Delays." The resultant mean of each factor in the subgroup was used to determine the mean for each subgroup, as demonstrated in Table 4. F17 is excluded from results because of low factor than 0.4. The final ranking of elements was done established on the mean subgroup count.

Management and Environment (mean = 3.35, rank = 1, variance = 23.320%): The first-ranked subgroup comprises factors relative to management and environment. The subgroup has four items in total such as F16 "Higher chances of unexpected interruptions in projects," F10 "Poor compliance to environmental consideration," F21 "Difficult to achieve sustainable protocols," and F20 "Ineffective leadership skills." Findings indicate that there is a need of handling unexpected interruptions in projects with more focus because it can affect the competitive advantage, as its mean is greater than other factors.

Quality and Delays (mean = 3.33, rank = 2, variance = 9.624%): The second-ranked subgroup consists of factors related to quality and delay issues in UK infrastructure development projects. A total of 3 factors lie in this subgroup, such as F19 "Delays in resource procurement caused by suppliers," F6 "Inappropriate delay risk management strategy," and F15 "Poor work quality on-site." F15 is found to have maximum mean value, which indicates high impact on competitive advantage and sustainable project management implementation in UK infrastructure development projects.

Table 3: Reliability statistics.

Factors	Item name	Cronbach's alpha
F1	Increasing demand for resources	0.702
F2	Conflicts between the government and other contract parties	0.707
F3	Disruption in resource management due to the ongoing impact of COVID-19	0.748
F4	Increasing prices of green technologies for projects	0.707
F5	Complex quality requirements by clients	0.721
F6	Inappropriate delay risk management strategy	0.745
F7	High inflation in the construction market	0.715
F8	Funding conflicts with clients	0.717
F9	Ineffective financial management policy	0.719
F10	Ineffective leadership style	0.711
F11	Resistance to implementing new ideas and innovation	0.714
F12	Poor motivation for employees from the leadership side	0.764
F13	Favoritism in government decisions	0.714
F14	Inappropriate government policies	0.711
F15	Delays in resource procurement caused by suppliers	0.756
F16	Higher chances of unexpected interruptions in projects	0.716
F17	Lack of effective quality management system	0.717
F18	No preparedness for external market influence on projects	0.741
F19	Poor work quality management on-site	0.724
F20	Poor compliance with environmental policies	0.715
F21	Difficult to achieve sustainability regulations	0.711
F22	Lack of trained staff for sustainability implementation	0.736
F23	Lack of sustainable methods in construction	0.746

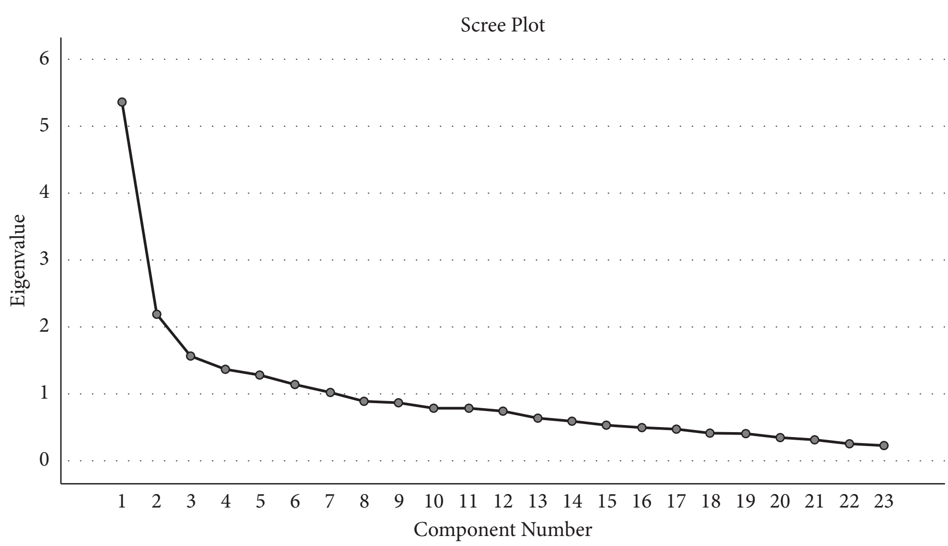

Figure 2: Scree plot.

Motivation and Expectation (mean = 3.32, rank = 3, variance = 6.864%): The third-ranked subgroup consists of factors related to changing in motivation and expectations during construction work on infrastructure development project sites. Three factors lie in this subgroup, such as F3 "Disruption in resource management due to ongoing impact of COVID-19," F12 "Complex quality requirements by clients," and F5 "Poor motivation for employees from leadership side." There is high need of focusing on F3 or mitigating disruption in resource management due to ongoing impact of pandemic, as it has significant impact on competitive advantage achievement by construction organizations of UK [68, 69].

Government and Business (mean = 3.22, rank = 4, variance = 6.010%): The fourth-ranked subgroup consists of factors relative to government and business. The subgroup has 5 items in total such as F4 "High inflation in construction business," F11 "The Resistance in implementing new ideas and innovation," F7 "Increasing prices of green technologies for projects in business," F13 "Favouritism in government decisions," and F2 "Conflicts between government and other contract parties." F4 indicates the highest mean value compared with other factors in this subgroup. It is crucial to handle inflation in the market as it is highly affecting the competitive advantage of UK-based projects.

Table 4: Rotated matrix of EFA.

Item code	1	2	3	4	5	6	7
F11	0.787						
F7	0.753						
F4	0.742						
F13	0.725						
F2	0.677						
F16		0.803					
F10		0.760					
F21		0.619					
F20		0.567					
F8			0.786				
F14			0.742				
F9			0.624				
F1			0.496				
F22				0.774			
F23				0.773			
F18					0.783		
F17							
F3						0.686	
F12						0.602	
F5						−0.479	
F6							0.817
F19							−0.448
F15							0.417

Planning (mean = 3.21, rank = 5, variance = 5.629%): The fifth-ranked subgroup consists of only one factor related to changes in planning during infrastructure development projects, such as F18 "No preparedness for external market influence on projects." As only one factor is involved in this subgroup, it is highly significant concerning UK infrastructure development projects [70, 71].

Resources and Policies (mean = 3.15, rank = 6, variance = 5.000%): The sixth-ranked subgroup consists of factors relative to changes in resources and policies in UK infrastructure development projects. The subgroup has 4 elements in total, such as F9 "Increasing demand of resources," F8 "Funding conflicts with clients," F14 "Ineffective financial management policy," and F1 "Inappropriate government policies." There is significant need of high focus on controlling the F9 or increasing demand of resources as it is affecting the ability of construction companies to achieve competitive advantage and sustainable project management implementation in infrastructure development projects [72, 73].

Training and Sustainability (mean = 3.05, rank = 7, and variance = 4.501%): As shown in Table 5. The seventh-ranked subgroup consists of factors that relates with variation in training and sustainability while any UK organization is working on infrastructure development projects in UK. A total of 2 factors are there in this subgroup, such as F23 "lack of sustainable methods in construction" and F22 "lack of trained staff for sustainability implementation." F23 is showing high mean in relation with F22. This indicates more attention should be given towards availability of sustainable construction methods.

4.3. Respondents' Features and Demographic Profiles.

In this research, the authors have classified the respondents according to their years of experience, age, current positions, education, and organization function. Table 6 presents the respondents' distribution for all demographic variables. The demographic data helped in understanding the implications of participants of this research on quality of results and also maintaining and providing justification regarding sample accuracy.

4.4. RII Analysis (Main Questionnaire).

The RII method was used to rate the importance of factors affecting competitive advantage and sustainable project management implementation in UK. Table 7 and Figure 3 provide the collected data on the factors and their ratings. A total of seven subgroups are indicated in RII results, such as "Government and Business" with 5 factors, "Management and Environment" with 4 factors, "Resources and Policies" with 4 factors, "Training and Sustainability" with 2 factors, "Planning" with 1 factor, "Motivation and Expectation" with 3 factors, and "Quality and Delays" with 3 factors.

4.4.1. Government and Business.

A total of 5 variables are in the government and business group with maximum Rii and mean value for F4 "High inflation in construction business (RII = 0.67, M = 3.35, SD = 1.39, RII Rank = 3)." Other factors achieved lowest RII, such as F11 "The resistance in implementing new ideas and innovation (RII = 0.64, M = 3.18, SD = 1.44, RII Rank = 16)," F7 "Increasing prices of green technologies for projects in business (RII = 0.66,

Table 5: Ranking of subgroups.

Subgroup	Code	Barriers	Mean	Subgroup mean	Subgroup rank
Government and Business	F11	Resistance in implementing new ideas and innovation	3.18	3.22	4
	F7	Increasing prices of green technologies for projects in business	3.28		
	F4	High inflation in construction business	3.35		
	F13	Favoritism in government decisions	3.27		
	F2	Conflicts between government and other contract parties	3.04		
Management and Environment	F16	Higher chances of unexpected interruptions in projects	3.46	3.35	1
	F10	Poor compliance to environmental consideration	3.30		
	F21	Difficult to achieve sustainable protocols	3.30		
	F20	Ineffective leadership skills	3.28		
Resources and Policies	F8	Funding conflicts with clients	3.20	3.15	6
	F14	Ineffective financial management policy	3.05		
	F9	Increasing demand of resources	3.22		
	F1	Inappropriate government policies	2.71		
Training and Sustainability	F22	Lack of trained staff for sustainability implementation	2.96	3.05	7
	F23	Lack of sustainable methods in construction	3.05		
Planning	F18	No preparedness for external market influence on projects	3.21	3.21	5
Motivation and Expectation	F3	Disruption in resource management due to ongoing impact of COVID-19	3.63	3.32	3
	F12	Complex quality requirements by clients	3.08		
	F5	Poor motivation for employees from leadership side	3.26		
Quality and Delays	F6	Inappropriate delay risk management strategy	3.22	3.33	2
	F19	Delays in resource procurement caused by suppliers	3.42		
	F15	Poor work quality on-site	3.35		

Table 6: Demographic profiles.

Variable	Level	Frequency	Percent (%)
Age	18–25	11	4.40
	26–35	59	23.60
	36–45	135	54.00
	46–55	36	14.40
	56 and above	9	3.60
Gender	Male	237	94.80
	Female	13	5.20
Education	High school	2	0.80
	Bachelor	53	21.20
	Masters	149	59.60
	PhD	31	12.40
	Other	15	6.00
Profession	Contractor	14	5.60
	Consultant	19	7.60
	Subcontractor	148	59.20
	Safety manager	12	4.80
	Other	57	22.80
Experience	Less than 5	45	18.00
	5 to 10 years	87	34.80
	11 to 15 Years	90	36.00
	16 to 20 Years	18	7.20
	Above 20 Years	10	4.00

$M = 3.28$, SD = 1.48, RII Rank = 4)," F13 "Favouritism in government decisions (RII = 0.65, $M = 3.27$, SD = 1.49, RII Rank = 7)," and F2 "Conflicts between government and other contract parties (RII = 0.61, $M = 3.04$, SD = 1.47, RII Rank = 18)." The overall group ranking based on RII is 3. Observed behaviour indicated high significance of F4 affecting the competitive advantage of construction companies.

4.4.2. Management and Environment. There are four factors in this subgroup with highest RII for F16 "Higher chances of unexpected interruptions in projects (RII = 0.69, $M = 3.46$, SD = 1.51, RII Rank = 1)." Other factors indicated low RII and mean values, such as F10 "Poor compliance to environmental consideration (RII = 0.61, $M = 3.07$, SD = 1.60, RII Rank = 16)," F21 "Difficult to achieve sustainable protocols (RII = 0.66, $M = 3.28$, SD = 1.54, RII Rank = 2)," and F20 "Ineffective leadership Skills (RII = 0.66, $M = 3.28$, SD = 1.52, RII Rank = 6)." The overall RII based subgroup rank is 1, indicating higher relativity of all of these factors with competitive advantage and sustainable project management implementation in UK's infrastructure development projects [5, 6].

4.4.3. Resources and Policies. The subgroup contains 4 factors with highest mean, and RII is achieved by F8 "Funding conflicts with clients (RII = 0.60, $M = 2.98$, SD = 1.53, RII Rank = 19)." Other factors have lower mean and SD, such as F9 "Increasing demand of resources (RII = 0.59, $M = 2.93$, SD = 1.55, RII Rank = 21)," F14 "Ineffective financial management policy (RII = 0.56, $M = 2.82$, SD = 1.55, RII Rank = 21)," and F1 "Inappropriate government policies (RII = 0.54, $M = 2.71$, SD = 1.41, RII Rank = 23)." The overall RII rank of this subgroup is 7.

4.4.4. Training and Sustainability. The subgroup contains two factors with highest RII and mean is observed in case of F23 "Lack of sustainable methods in construction (RII = 0.61, $M = 3.05$, SD = 1.45, RII Rank = 17)." The other factor F22 "Lack of trained staff for sustainability implementation (RII = 0.59, $M = 2.96$, SD = 1.39, RII Rank = 20)" has low RII and mean value which indicate less importance relative to F23. Overall RII group rank is 6, indicating less importance in terms of affecting competitive advantage and sustainable project management implementation in infrastructure development projects.

4.4.5. Planning. Only one factor is in this group, such as F18 "No preparedness for external market influence on projects (RII = 0.64, $M = 3.21$, SD = 1.63, RII Rank = 11)." The overall rank of RII group is 5, indicating moderate importance for controlling competitive advantage and sustainable project management in UK infrastructure development projects.

4.4.6. Motivation and Expectation. There are three factors in this subgroup with highest RII and mean is found for F3 "Disruption in resource management due to ongoing impact of COVID-19 (RII = 0.67, $M = 3.37$, SD = 1.55, RII Rank = 2)." Other factors indicated low RII and mean values, such as F12 "Complex quality requirements by clients (RII = 0.64, $M = 3.21$, SD = 1.53, RII Rank = 11)" and F5 "Poor motivation for employees from leadership side (RII = 0.65, $M = 3.26$, SD = 1.49, RII Rank = 8)." The overall RII group rank is 2.

4.4.7. Quality and Delays. Three factors in this subgroup have the highest RII, and mean values are indicated by F15

Table 7: Subgroup ranking based on RII.

Subgroup	Code	Factors	RII	Item mean	SD	RII rank	RII group rank
Government and Business	F11	Resistance in implementing new ideas and innovation	0.64	3.18	1.44	16	3
	F7	Increasing prices of green technologies for projects in business	0.66	3.28	1.48	4	
	F4	High inflation in construction business	0.67	3.35	1.39	3	
	F13	Favoritism in government decisions	0.65	3.27	1.49	7	
	F2	Conflicts between government and other contract parties	0.61	3.04	1.47	18	
Management and Environment	F16	Higher chances of unexpected interruptions in projects	0.69	3.46	1.51	1	1
	F10	Poor compliance to environmental consideration	0.61	3.07	1.60	16	
	F21	Difficult to achieve sustainable protocols	0.66	3.28	1.54	4	
	F20	Ineffective leadership skills	0.66	3.28	1.52	6	
Resources and Policies	F8	Funding conflicts with clients	0.60	2.98	1.53	19	7
	F14	Ineffective financial management policy	0.56	2.82	1.49	22	
	F9	Increasing demand of resources	0.59	2.93	1.55	21	
	F1	Inappropriate government policies	0.54	2.71	1.41	23	
Training and Sustainability	F22	Lack of trained staff for sustainability implementation	0.59	2.96	1.39	20	6
	F23	Lack of sustainable methods in construction	0.61	3.05	1.45	17	
Planning	F18	No preparedness for external market influence on projects	0.64	3.21	1.63	11	5
Motivation and Expectation	F3	Disruption in resource management due to ongoing impact of COVID-19	0.67	3.37	1.55	2	2
	F12	Complex quality requirements by clients	0.64	3.21	1.53	11	
	F5	Poor motivation for employees from leadership side	0.65	3.26	1.49	8	
Quality and Delays	F6	Inappropriate delay risk management strategy	0.64	3.22	1.56	10	4
	F19	Delays in resource procurement caused by suppliers	0.64	3.21	1.56	13	
	F15	Poor work quality on-site	0.65	3.23	1.58	9	

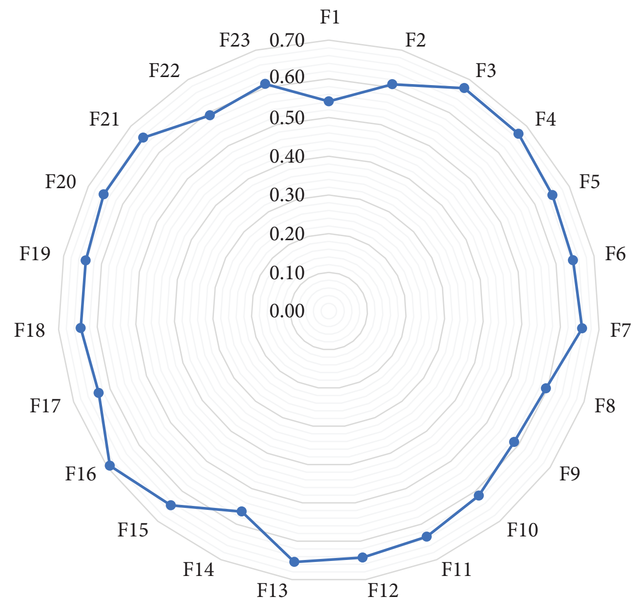

Figure 3: RII levels for all factors.

"Poor work quality on-site (RII = 0.65, $M = 3.23$, SD = 1.58, RII Rank = 9)." The remaining factors indicated low mean and RII values, such as F6 "Inappropriate delay risk management strategy (RII = 0.64, $M = 3.22$, SD = 1.56, RII Rank = 10)" and F19 "Delays in resource procurement caused by suppliers (RII = 0.64, $M = 3.21$, SD = 1.56, RII Rank = 13)." The overall RII group rank is 4.

4.5. Confirmatory Factor Analysis (CFA). CFA is performed to determine whether or not a conceptual framework involving factors is reasonable and accurate. Loadings below 0.6 were used to remove the observed variables in the CFA [74, 75]. A final fit of the measurement model involving factors affecting competitive advantage and sustainable project management implementation is shown in Figure 4. The last set of parameters/variables was organized using five conceptual frameworks: Government and Business (GB), Management and Environment (ME), Motivation and Expectation (MoEx), Resources and Policies (RP), and Quality and Delays (QD). Due to low factor loadings between the observed variable and the construct, factors F18, F20, F22, and F23 were eliminated from the final measurement model [8, 9]. Table 8 shows the reliability and validity tests for the measurement model. All reliability (CR) values are above 0.8, indicating acceptable validity [76, 77]. The goodness of fit (GOF) model fit indices for measurement are presented in Table 9. GOF indices are in acceptable ranges which indicated the high significance of the measurement model achieved from CFA analysis [78, 79]. The framework was developed at the end of the analysis based on CFA outcomes, as shown in Figure 5. The major outcomes of this research is in the form of a final framework which is developed by involving five subgroups and a total of nineteen factors [80, 81].

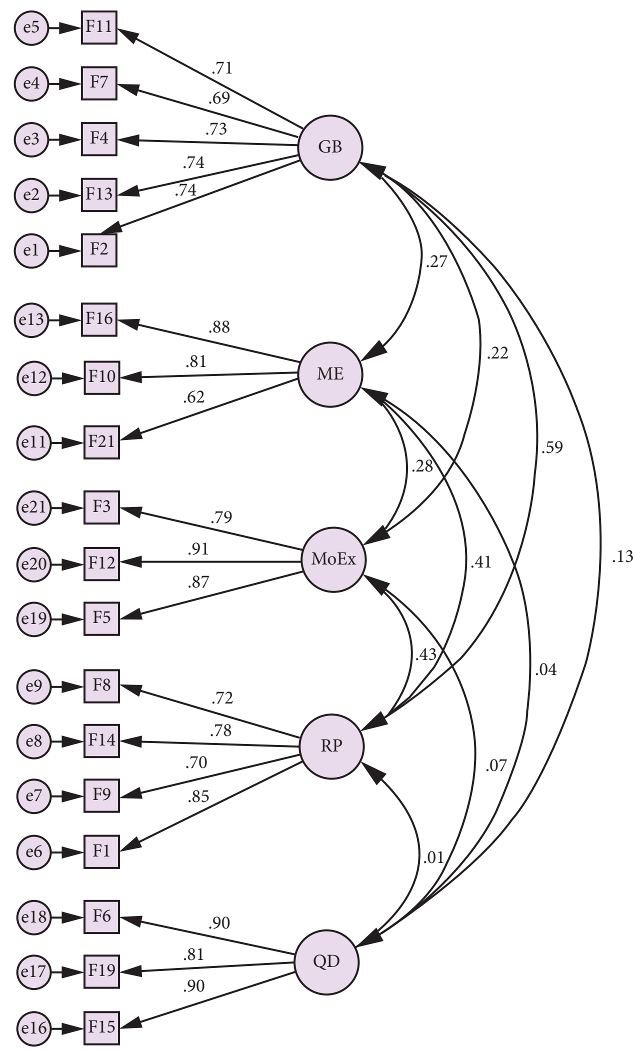

Figure 4: Measurement model for all factors.

Figure 5 indicates $P < 0.05$, and the P values in our SEM model provide an indication of the degree to which the correlations between variables are statistically significant [82, 83]. The findings indicate that all the relationships among variables are statistically considerable with $P \leq 0.001$, indicating effective proof opposed to the null hypothesis [84, 85]. The results were acquired by conducting an experiment. This lends credence to the notion that the model is a good fit for the statistics and that the connections between variables are not the result of random chance.

To get the T statistics values for each path in our SEM model, we took advantage of bootstrapping analysis in SmartPLS 4. This allowed us to represent the data more accurately. In Figure 6, a resample of the data is taken as part of the bootstrapping analysis so that several samples may be obtained, and the variability of the findings can be estimated [86, 87]. The significance and magnitude of the correlations between variables can be determined by examining the values of the T statistics that were collected [88–90]. The fact that the values of the T statistics for each path in the model are significant at the 95% confidence interval demonstrates that one can have a great deal of faith in the findings. We

Table 8: Reliability and validity of measurement model.

	CR	AVE	MSV	MaxR (H)	RP	GB	QD	ME	MoEx
RP-Resources and Policies	0.850	0.587	0.346	0.862	0.766				
GB-Government and Business	0.844	0.520	0.346	0.845	0.588	0.721			
QD-Quality and Delays	0.903	0.756	0.016	0.911	0.006	−0.128	0.870		
ME-Management and Environment	0.817	0.602	0.171	0.854	0.413	0.270	0.039	0.776	
MoEx-Motivation and Expectation	0.892	0.734	0.187	0.904	0.433	0.222	−0.073	0.281	0.856

Table 9: GOF indices for the measurement of model.

Index	Acceptance	Achieved
RMSEA	<0.08	0.076
GFI	>0.90	0.921
CFI	>0.90	0.924
TLI	>0.90	0.907
Cmin/df	$<2,3$	2.097
ChiSq	$P > 0.05$, $P > 0.01$	262.181

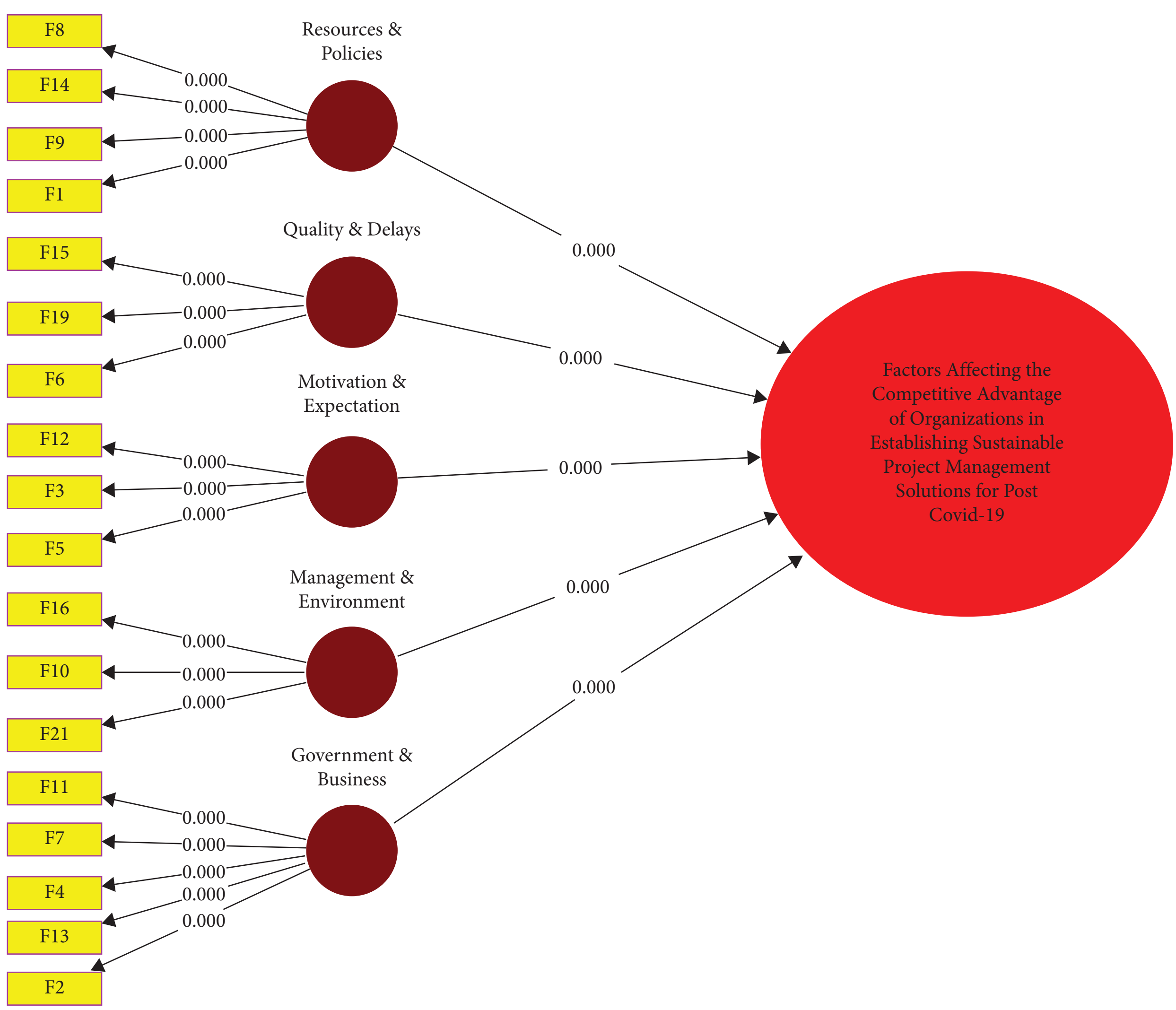

Figure 5: SEM model indicating P values.

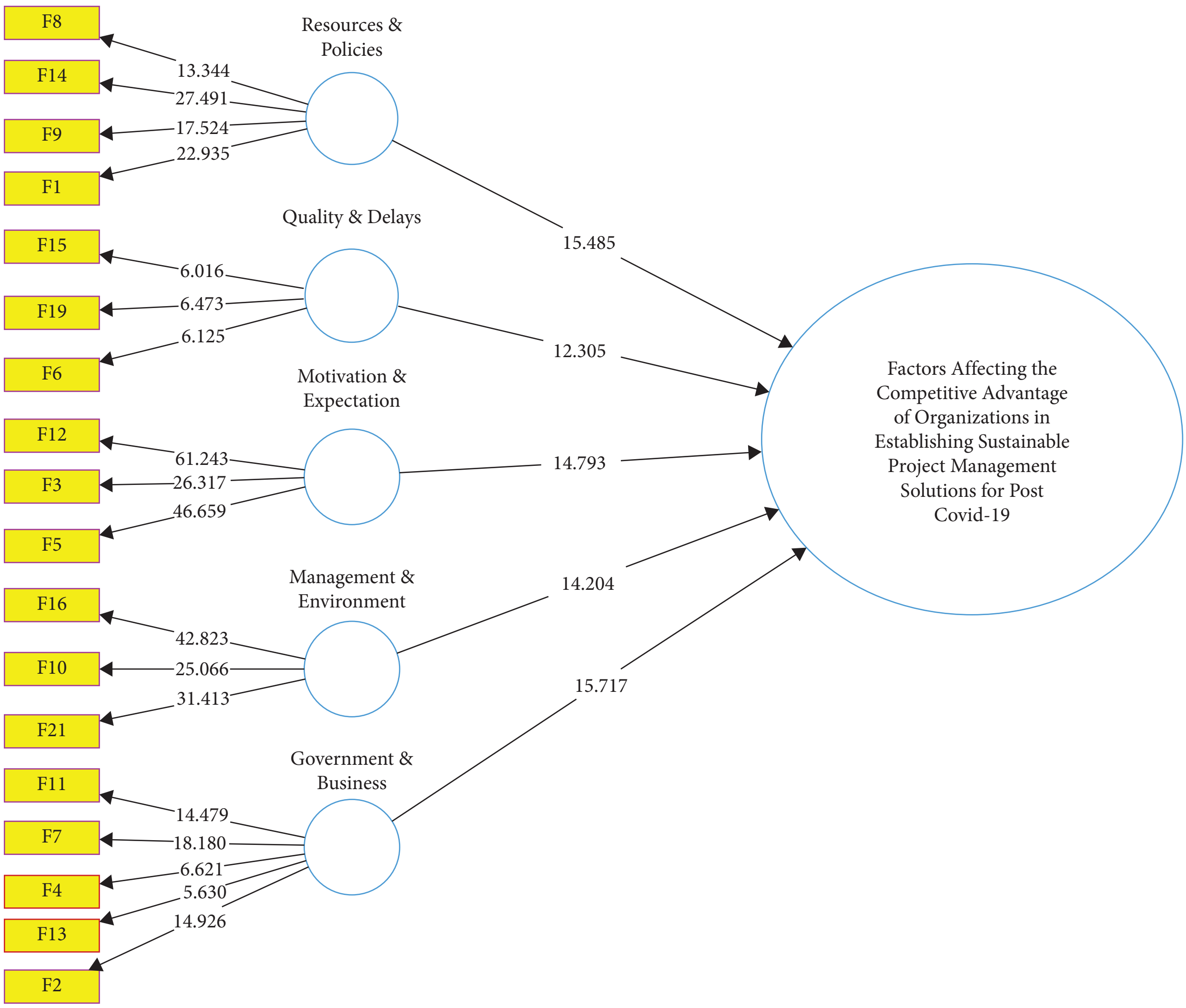

Figure 6: SEM model indicating T-statistics values.

have gotten trustworthy estimates of the values of the T statistics using the bootstrapping procedure, and as a result, we are able to draw the conclusion that the relationships between variables are meaningful and statistically significant in our model [91, 92]. Figure 7 presents the final framework of this study based on all factors and their respective constructs identified from SEM.

Table 10 displays the findings of an expert validation of a statistical model built to assess the elements impacting businesses' competitive advantage in building sustainable project management solutions for post-COVID-19. The average responses to the validation questions show that the suggested important criteria may be used, and the comments from the 23 respondents corroborate the model's idea, purpose, and conclusions [45–47]. There is a reasonable amount of truth to this study, and the resulting structural models are both conventional and general [7, 93]. The model is essential to the construction sector because, if followed. it allows customers and contractors to carry out construction projects to a predetermined quality while keeping their respective advantages safe [94, 95]. Engineers, project managers, quantity surveyors, and businesses may all use the model's data in useful ways [96–102]. Moreover, using this strategy makes sure that contractors are working to keep their edge over the competition. The respondents mostly agreed with the good findings of the survey.

5. Discussion

The study indicated the significant importance of government and business-related factors in affecting the competitive advantage of UK construction firms. In terms of government and business, this study provides a unique aspect of overall impact by including the current high inflation rate, high favoritism, conflicts, and expensive green technologies. These are the potential outcomes of the current environment after the pandemic of 2020 and are therefore highly important for effectively handling comparative advantage in maintaining sustainable product management [6, 56]. Similarly, moving further, the management and environment-related factors are also likely to be significant [103, 104]. The unique characteristic, compared to previous

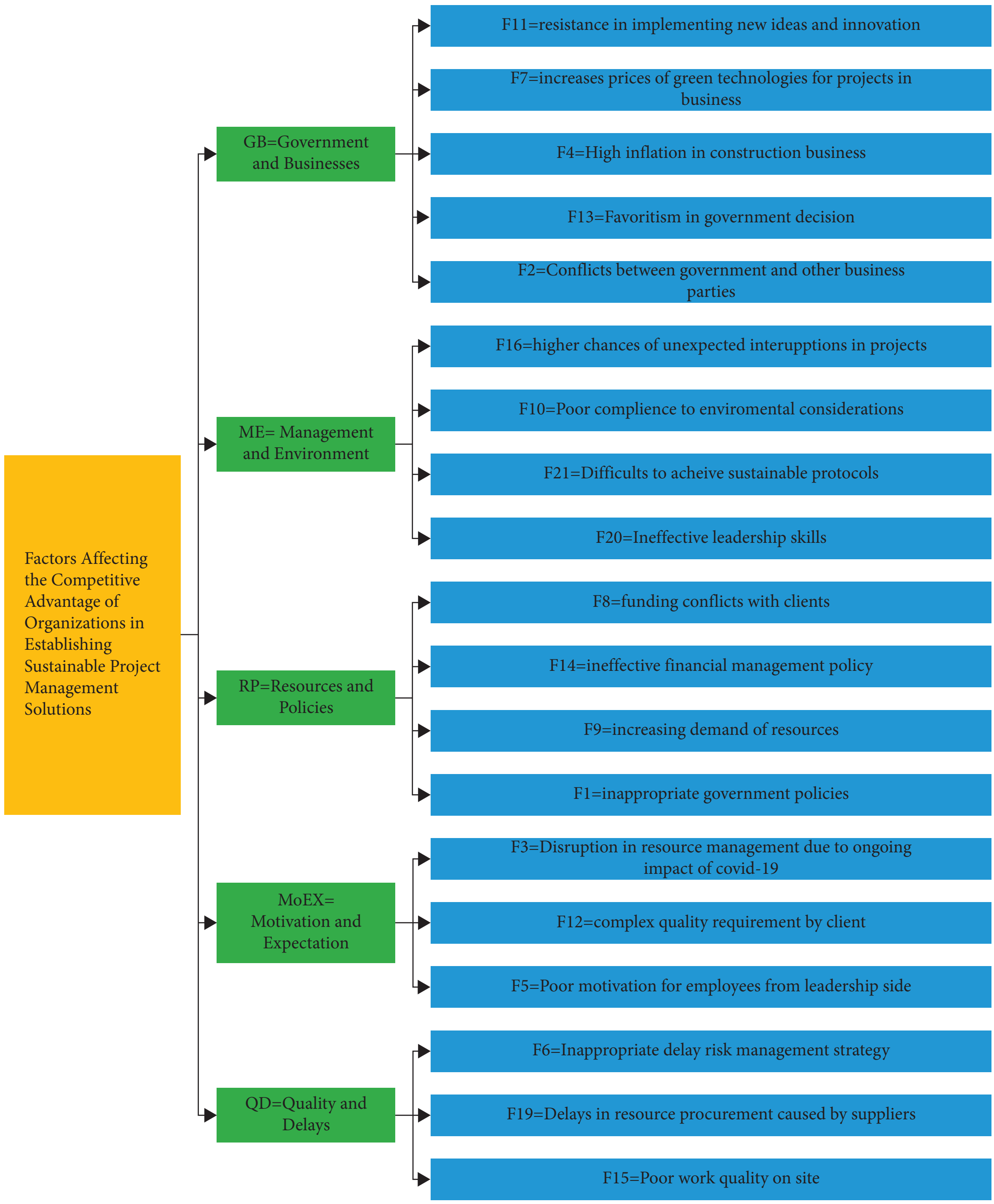

Figure 7: Framework involving all significant factors.

studies, is linked with more emphasis on higher chances of unexpected interruptions in projects and practical leadership skills [105, 106]. This type of issue is always serious from a product management perspective, and construction organizations cannot meet the standards because of their inappropriate position in the market from the perspective of competitive advantage [20, 29]. From a resources and policies perspective, it is important to place more emphasis on handling the increasing demand for resources and coping with inappropriate government policies because of political instability [5, 6, 9]. This is also unique in addressing the current situation of the competitive advantage of organizations [3, 4, 19]. It needs effective mitigation from the perspective of future theoretical research implications [21, 25]. Different resources and policies are necessary as they are always required for every project. However, because of inconsistency in the last two years in the construction industry of the UK, the infrastructure development projects

Table 10: Validation survey results.

Respondent #	Q1	Q2	Q3	Q4	Q5
1	5	4	4	4	3
2	3	5	1	4	2
3	1	5	5	2	1
4	4	5	1	4	1
5	1	5	3	4	5
6	5	2	5	4	5
7	5	5	5	5	5
8	1	1	5	5	5
9	4	5	5	5	5
10	4	3	5	5	4
11	5	4	5	5	4
12	5	5	3	2	5
13	5	4	3	2	2
14	1	4	4	5	5
15	5	5	5	3	5
16	5	5	5	4	4
17	5	1	3	5	5
18	5	4	4	5	5
19	5	5	5	5	5
20	5	5	5	3	4
21	1	5	4	5	4
22	5	5	5	5	3
23	5	5	5	4	3
Mean	3.91	4.22	4.13	4.13	3.91

cannot be completed with sustainability requirements [2, 7, 8]. It is for this reason that the results show the next crucial factor in terms of motivation and expectation. It is a reality that the client always requires complex quality requirements [107–109]. Furthermore, poor motivation can also contribute to negatively affecting the ability of organizations to maintain competitive advantage [11, 13]. It is a reason that in this contact, the unique aspect is related to decreasing motivation of construction workers over time because of the overall economic conditions of the UK [61]. Poor motivation always decreases the competitive advantage of construction organizations, which is reflected in the current state [30, 31]. From a quality perspective, it is also found that the study indicates the unique aspect of possible delays in resource management caused by suppliers that ultimately contribute to creating a negative impact on competitive advantage [35]. This can lead to a possible impact on construction forms in an effort to get more potential business output for infrastructure development projects.

6. Managerial and Empirical Implications

The study's findings have several managerial implications for businesses seeking to construct sustainable project management solutions for infrastructure development projects post-COVID-19. First, technical advances can be utilized to improve the efficacy and efficiency of project management procedures. Organizations should also consider compliance with government regulations and policies to achieve sustainable development processes. Third, firms must invest in developing a talented workforce and provide ongoing training to guarantee that employees can adapt to an ever-changing business environment. Finally, stakeholder collaboration is necessary to ensure that project management solutions correspond with the needs and expectations of the relevant stakeholders.

The empirical implications of this study suggest that additional research is required to investigate the relationship between sustainable project management and the long-term success of infrastructure development projects. Future research should examine the moderating impacts of project complexity, project type, and project size on the link between sustainable project management and competitive advantage. The study's findings could also serve as a foundation for comparison research across several nations to determine the factors influencing firms' competitive advantage in building sustainable project management solutions for infrastructure development projects.

7. Conclusion

The study's objective was to determine the important factors of competitive advantage of organizations in establishing sustainable project management solutions for post-COVID-19. Competitive advantage in the UK construction industry is complicated to maintain, as the study has identified a total of 19 factors divided into seven subgroups, such as government and business, management and the environment, resources and policies, training and sustainability, and planning. The most important subgroup is management and the environment. Only by keeping a close eye on and considering the competitive aspects of all factors identified in this study will a sustainable project management solution be implemented. The study met its objectives by providing ranked significant factors. The measurement model validation results show that the identified subgroups have a high correlation among all factors. Based on the findings of this study, it is suggested that we significantly consider the government and business management environments. Theoretically, the developed framework can be used to conduct detailed and structured reviews. It would be essential for future research to focus on effectively identifying the methods by which the problems listed in the framework can be handled. Certainly, we need to do more work to boost the competitive edge of UK construction companies, which will be beneficial for infrastructure projects. The sustainability aspect can be more focused in the future because it is indicated that the construction businesses' main compromise is being made on sustainability, due to which more effort will be needed. This can lead to the creation of better project outcomes while also reducing the chances of possible failures that may lead the project towards inappropriate outcomes. The project manager can easily consider the framework for properly identifying the problems and listing them in the project charter before developing the infrastructure development projects. Furthermore, it may also be possible for the UK construction companies to get into effective alliance with other parties in contracts of development projects so that sustainable development should not be ignored. The provided framework can also be used in conjunction with other studies that are critical for maintaining competitive advantage for UK consumption forms and ultimately leading them to maintain sustainable project management. This will be significant as well as critical for maximizing the understanding of future outcomes while also compromising on other factors critical for the success of UK construction projects. This can lead to creation of effective performance in future, and also, it will be necessary for maintaining the effective relationship between theory and practical work. Finding and selecting these elements allows scientists to create more targeted and instructive investigations. Methods such as secondary data analysis, case studies, interviews, and surveys might be used. This may provide light on the influence of shifting external circumstances on the correlation between sustainable project management and competitive advantage. While studying the connection between sustainable project management, competitive advantage, and external variables, future studies should take into account a variety of organizational scenarios. When it comes to sustainable project management and competitive advantage, for instance, the influence of external variables may look different for businesses of different sizes, in different industries, and in different parts of the world. The recommended interventions from practical and theoretical applications perspective will be helpful in aligning the project for any infrastructure development in accordance with sustainability goals of project management in UK. From a practical standpoint, these factors should be prioritised by organizations to improve competitive advantage. The analysis adequately fulfilled research outcomes, while future studies can be more inclined towards resolving all factors.

8. Limitations and Future Recommendations

Despite the study's findings, many limitations must be recognized when interpreting the data. First, the sample size was restricted to a particular industry, which may limit the generalizability of the results. Second, the study's data were acquired via self-report questionnaires, which may be susceptible to frequent technique bias. Thirdly, the cross-sectional design of the study does not permit causal inferences, and there is the possibility of reverse causality and omitted variable bias. Lastly, external issues such as political instability and economic situations were not considered. Future research could employ a bigger and more varied sample to address the limitations of this study and increase the generalizability of the findings. In addition, alternate data collection methods, such as objective measures and qualitative data, could be utilized to mitigate the influence of common method bias. Future research may also employ longitudinal designs or experimental methods to generate more convincing evidence of causal links. Future research should explore the influence of external factors on the relationship between sustainable project management and competitive advantage, thereby enhancing our understanding of the topic.

Data Availability

All data are included within the article, and any other data that the reader may need can be obtained from the corresponding authors.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Authors' Contributions

Abdulrahman S. Bageis played a key role in the study's design and provided significant revisions during the review stage. Ahsan Waqar and Nadhim Hamah Sor were primarily responsible for data collection and initial analysis, with Nadhim also contributing to manuscript drafting and revisions. Hamad Almujiba and Muhammad Basit Khan contributed to study design, data analysis, and manuscript revisions. Abdul Hannan Qureshi and Ahmed Farouk Deifalla provided valuable subject matter expertise and offered critical feedback throughout both the initial research and revision stages. P. Jagadesh made substantial contributions during the revision phase, working on feedback integration and paper enhancement. Additionally, the following authors, added during the revision stage, significantly contributed to the paper's improvement: Yakubu Dodo, Mohamed Moafak Arbili, Mohammed Awad Abuhussain, and Omrane Benjddou, actively participating in the review and enhancement of the manuscript.

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