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EFFECTIVE CONFLICT MANAGEMENT IN CONSTRUCTION INDUSTRY AND ITS IMPACTS ON LABOR PRODUCTIVITY

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Abstract: Despite the economic importance of construction industry, it is not, however, impervious to conflicts resulting from a variety of factors, such as divergent stakeholder interests, disagreements over contracts and cultural or ethnic disparities among project participants. This research therefore aims to evaluate the impact of conflict management on labor productivity in Nigeria construction industry. An in-depth examination of the scientific literature was conducted prior developing a survey questionnaire to collect data to determine the evaluate the steps for conducting electrical hazards risk assessment, which was administered to construction professionals after expert review. Fuzzy synthetic evaluation (FSE) was used to analysed the received data. Significant findings are found in five major clusters of the research on the impact of conflict management on labor productivity in the construction industry: Enhanced communication and collaboration, utilizing resources efficiently, strengthened team cohesion and unity, enhanced work quality and retention, cost-cutting and innovation. Every cluster emphasizes how important it is to handle conflicts well in order to improve several facets of worker productivity. Construction organizations may greatly increase labor productivity and project performance by addressing communication, quick resolution, resource allocation, organizational culture, cost management, and innovation.

Keywords: conflict, labor, fuzzy synthetic evaluation, productivity

1. INTRODUCTION

An essential component of organizational dynamics is conflict management, especially in sectors with complicated operations and a wide range of stakeholders. Effective dispute resolution is extremely important in the Nigerian construction sector because it can affect worker efficiency, project timeliness, and overall project success. According to Ilori (2022), the Nigerian construction industry is essential to the nation's economic development since it creates jobs, develops infrastructure, and increases GDP. It is not, however, impervious to conflicts resulting from a variety of factors, such as divergent stakeholder interests, disagreements over contracts, problems with resource distribution, and cultural or ethnic disparities among project participants (Ahad et al., 2020).

Unresolved disagreements can have a negative impact on construction projects, leading to delays, cost overruns, quality problems, and even project abandonment, as previous studies have shown (Alazemi et al., 2019; Molwus et al., 2016; Awan and Saeed, 2015). In addition to interfering with workflow, these disputes also sour relations between the project team, contractors, subcontractors, and other stakeholders, which lowers morale and reduces productivity (Caputo et al., 2018). In order to mitigate these negative effects and create a favorable work atmosphere that encourages collaboration and productivity, effective conflict management techniques are crucial (Ejohwomu et al., 2016). There is still a deficiency in the literature about the specific context of Nigeria, despite the fact that numerous researchers have looked at conflict management techniques in the construction industry globally (Jimoh et al., 2019).

It is critical to investigate how conflict management strategies customized for the local context can affect labor productivity outcomes given the distinct socio-cultural, economic, and institutional elements driving construction projects in Nigeria (Alazemi et al., 2019). This study intends to gather important information that might influence practice, policy, and decision-making in the construction industry by gaining insights into the different kinds of conflicts that frequently arise in

Nigerian projects and the tactics used to resolve them. Furthermore, it is strategically critical for all parties involved in the construction industry, such as project managers, contractors, policymakers, and regulatory agencies, to comprehend the connection between labor productivity and conflict management (Jimoh et al., 2019). Stakeholders can proactively address conflict-related difficulties and improve project outcomes by identifying effective conflict resolution techniques and their impact on productivity indicators, such as work hours, output quality, and project completion rates (Caputo et al., 2018).

The goal of this study, taking these factors into account, is to investigate the connection between labor productivity and conflict management techniques in Nigeria's construction industry. In doing so, this study intends to offer practical insights and suggestions for boosting labor productivity in the Nigerian construction sector and refining conflict management procedures. In the end, the findings of this research may help the construction industry grow sustainably and become more competitive, which would help Nigeria achieve its larger socioeconomic development objectives.

2. LITERATURE REVIEW

As stated by Kirk and Vaux (2018). Conflict in relationships has a negative effect on construction management performance and productivity, affecting schedules, cognition, teamwork, and team morale. Inadequate communication, antiquated mindsets, and lump sum agreements are the main culprits, with owners, subcontractors, and superintendents frequently implicated, according to interviews with 25 experts. It was determined that developing trust and having effective communication were essential for reducing these problems. Using information from 111 projects, Ghodrati et al. (2018) investigate the effects of human resource and construction-related management practices on safety performance in construction projects. The findings show that while "communication" has a detrimental impact on safety, "labor management," "supervision and leadership," "planning," and "management of construction" have positive effects. Project managers can learn how to increase productivity without sacrificing safety by examining the study's findings that the interconnections between various tactics do not always favor security.

The impact of conflict management on team effectiveness in multicultural temporary organizations in East Asia, particularly in the Malaysian construction sector, is examined by Tabassi et al. (2017). The analysis of 378 team members', 126 team leaders', and supervisors' data shows that cooperative conflict management improves team performance, especially when there is strong team synchronization. The performance of Pakistani construction enterprises is examined by Tariq and Rehman (2020) in relation to organizational characteristics and the mediating role of conflict management effectiveness. Performance is found to be highly impacted by labor productivity, decentralization, perceived organizational politics, and relationship problems, according to an analysis of survey data from 450 employees in Lahore and Karachi. In an effort to avert disagreements, Charehzehi et al. (2017) suggest employing Building Information Modeling (BIM) to proactively handle and manage conflicts in building projects. Through survey data analysis and the use of the Multi-Attribute Utility Technique (MAUT) and Analytical Hierarchy Process (AHP), the research finds important conflict factors in the Malaysian construction industry, including poor scheduling and design flaws. The importance of BIM features like clash detection, 4D scheduling, and 3D visualization is emphasized as crucial for efficient conflict resolution.

Similarly, Femi (2014) investigates how conflicts in Nigeria's construction sector are complicated and shaped by a range of cultural and ethnic backgrounds. It finds five serious consequences, such as miscommunication and psychological harm, and 10 main causes of conflict, such as win-lose situations and different viewpoints, using a questionnaire study of contractors and project managers. Lu and Wang (2017) investigate how task conflict moderates the relationship between owners and contractors in construction projects, as well as how various conflict management strategies affect the quality of this relationship. The integrating method improves relationship

quality, whereas the compromising style lowers it, according to data from 165 questionnaires. The beneficial effects of the avoiding style on relationship quality are strengthened, and the favorable effects of the obliging style are weakened by increased task conflict. Aveiga et al. (2011) investigate the effects of conflict and communication on the productivity of Hispanic workers in construction crews. Results show that friction on the job site, especially when it comes to language difficulties, has a detrimental effect on output, security, and the caliber of the work. The impact of conflict management techniques and national culture differences (NCDs) on the performance of international construction joint ventures (ICJVs) is examined by Liu et al. (2020). It concludes that although high NCDs can have a detrimental impact on ICJV performance, this impact can be lessened by employing a cooperative conflict management method, while it can be increased by utilizing a competitive one.

Using a survey of 36 main contractors, Naoum (2016) evaluates developments in the field of construction productivity research and pinpoints the key variables influencing site productivity. Pre-construction activities, design flaws, and leadership style are important concerns that highlight the industry's need for more innovation and better technology. In their study of the effects of conflict management techniques on organizational performance in a textile company in Bangladesh, Sadat et al. (2022) discover a strong positive association between collective bargaining, confrontation, compromise, and accommodation. Competition and avoidance are examples of non-integrative tactics that have a detrimental impact on performance, underscoring the significance of fair conflict resolution for improving organizational outcomes. A 5D CAD model that integrates time, cost, and location data is introduced by Rohani et al. (2018) to address workspace conflicts in building projects. Through the use of visual simulation and an innovative conflict resolution algorithm, the model optimizes project schedules by removing conflicts and cutting costs and time. The effect of dispute resolution techniques on project performance in Nigeria's construction sector is examined by Ilori (2022). It concludes that time, client satisfaction, and health and safety outcomes are much enhanced by techniques like smoothing/accommodating and compromising/negotiating, and it suggests using these techniques more frequently to improve project outcomes. Using ordinal regression analysis, Irfan et al. (2019) quantify the effect of stakeholder conflicts on project limitations in the construction sector. It concludes that while conflicts have a favorable impact on cost, time, and resources, they have a negative impact on quality, productivity, and safety. The study provides important insights for managing project restrictions by highlighting key elements that significantly contribute to these disputes, such as inadequate communication and rework.

3. METHODOLOGY

The main goal of this study is to evaluate the impact of conflict management on labor productivity in Nigeria construction industry. In order to achieve this, an in-depth examination of the scientific literature was conducted prior developing a survey questionnaire to collect data to determine the impact of conflict management on labor productivity, which was then grouped into five categories. To ensure the accuracy of the questionnaire's content, pre-testing was conducted with a group of professionals and seasoned researchers who understood questionnaire design in the area covered by the current study. Expert review is a useful pre-testing approach to identify problematic grammatical structures in survey questions and other possible measurement mistakes before questionnaires are disseminated, as recommended by Oni et al (2024). Since only a few expert reviewers are needed for validating a questionnaire, the questionnaire was assessed by fifteen expert reviewers with extensive academic and research backgrounds in related fields. All reviewers had to have a minimum of five years of research expertise and hold an academic position at the university in order to reduce heterogeneity in the experts' background traits. The identities of the reviewers were kept secret from one another, and these specialists were instructed to conduct

their evaluation independently. In the area provided on the survey form, reviewers were requested to rate each question and offer thorough written comments and any necessary revisions. Small changes were made to the questions to improve their clarity in accordance with their feedback. For instance, some reviewers recommended combining some variables and deleting others that did not fit the study. The reviewers also recommended changing the measuring scale from a six-point to a five-point Likert scale because the latter has an obvious midpoint that makes it simple for respondents to express how much they agree with a question.

This particular research strategy was adopted with the intention of managing a large number of respondents, obtaining a wide range of replies from them, and improving the generality of the findings. To accomplish the study's aims, a cross-sectional method of surveying was employed to examine the subject matter. With this approach, investigators can characterise the opinions, beliefs, deeds or characteristics of the broader public. A survey is performed on the whole populace or on a representative sample of people (Bryman, 2016). To collect the primary data, a convenient sampling procedure was utilised. The strategy is appropriate when there is not enough information obtainable regarding the entire populace and sample size. Even though the findings of the study have the potential to not be broadly applied, they may nevertheless provide a good picture of the larger population. "Following the central limit theorem (CLT), an average of 30 observations is enough for the purpose of statistical assessment (Oni et al., 2022)", indicating that the 217 responses for this investigation are adequate.

A two-part, closed-ended questionnaire was designed in order to gather data. Section A provides background information on the respondents, while Section B enumerates the impact of conflict management on labor productivity in construction industry. Participants were provided with the opportunity to score their opinion on a Likert scale of one to five, where 5 represented very significant, 4 significant, 3 partially significant, 2 less significant, and 1 not significant, the questionnaire was distributed to professionals working in the construction industry in Nigeria. Nevertheless, after multiple notifications spread through an eight-month time frames, 217 filled-out questionnaires were collected by the due date. To analyze the gathered data, "the fuzzy synthetic evaluation technique (FSE)" was employed.

FSE is an unbiased method of assessing data that quantifies the language constituent of the information provided in order to support effectual policymaking (Nwaogu et al., 2021). FSE is a technique for assessing various choices that aids in dispelling uncertainty and misleading data regarding choices made by a number of participants (Oni et al., 2023). "Health administration (Oni et al., 2023)" and "construction risk management (Ameyaw and Chan, 2016; Zhao et al., 2016)" are two major fields that have adopted the FSE. Respondents' evaluations of the importance of different criteria are usually based on subjective perceptions (Owusu et al., 2019). FSE, however, can be applied to get rid of this subjectivity. FSE was employed in this research to classify the important success criteria for sustainable health and safety practices in the construction industry since it is an objective tool for evaluating points of view. According to Oni et al. (2023), the following actions need to be taken in order to perform FSE in factor evaluation: "constructing the primary factors"; "establishing an evaluation index structure"; "figuring out the variables' membership grade (first level)"; "computing the variables' weighing functions"; "constructing the multi-criteria and multi-level FSE model"; and "estimating the general significance indices of the factor constructs (FACs)".

4. DATA ANALYSIS

Respondent profile

According to the data presented in Figure 1, it can be observed that the survey respondents encompass a diverse range of positions within the company. Site supervisors constitute the largest proportion, accounting for 30.0% of the respondents. Engineers represent 26.7% of the respondents, while project managers make up 6.9% of the sample. Additionally, architects comprise

13.4% of the respondents, quantity surveyor also comprise 15.7% and builders constitute 7.4% of the sample. These findings indicate that the respondents represent various key positions within the company's upper hierarchy, suggesting that they possess significant knowledge regarding skilled labour in the construction industry.



Figure 1: Designation of respondents

Furthermore, it was found that 7.8% of the participants possessed over 20 years of professional experience. Additionally, 38.7% of the respondents reported having between 6 and 10 years of experience while 17.5% of the respondents reported having between 11 and 15 years of experience, and 12.0% had between 16 to 20 years' experience. The figure also shows that only 24.0% indicated having between 1 to 5 years of experience in construction work. This substantial level of experience positions these individuals favorably to provide accurate responses to the survey questions, given their extensive knowledge and expertise in the field (see Figure 2).

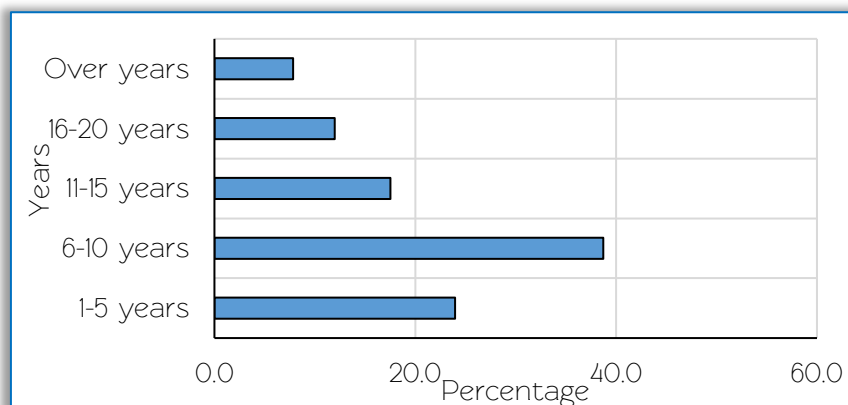


Figure 2: Year of experience

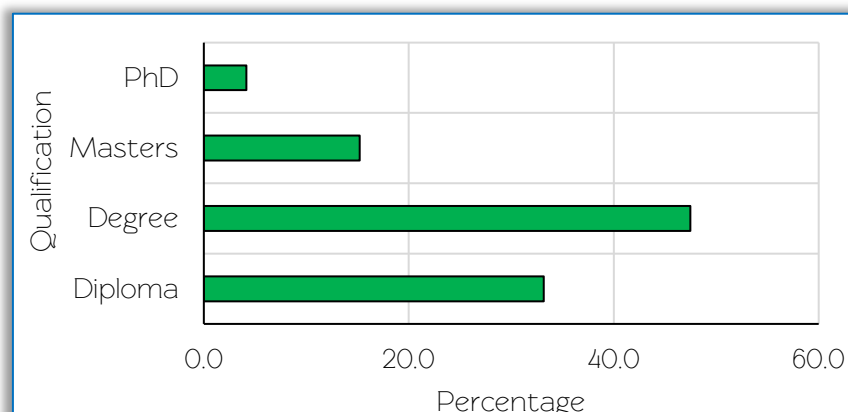


Figure 3: Academic qualification

In a similar vein, it can be inferred that majority of the participants had achieved an advanced educational attainment of a degree and above while only 33.2 had diploma. This finding further enhances the assurance that they possessed sufficient qualification to accurately respond to the survey inquiries (Figure 3).

Fuzzy synthetic evaluation technique (FSE)

— Constructing the primary factors

The questionnaire was designed, and the 20 components were divided into five constructs. Table 1 contains details about the factor constructs (FACs). Since the factors in the FSE have two primary purposes, they are categorized into constructs:

- ≡ identify the input variables required to calculate the impact of conflict management on labor productivity;
- ≡ determine which factor constructions are most crucial to consider while making choices.

Table 1: Mean score and Fuzzy Synthetic Evaluation Weightings of the Strategies

Code	Factors (FA) and their Factor Construct (FAC)	Mean of FA	Total mean of FAC	Weighting of FAs W_{FAi}	Weighting of FACs W_{FACi}
FAC1	Enhancing Communication and Collaboration				
ECC1	Effective conflict management fosters better communication and collaboration among team members, leading to a more harmonious work environment.	4.10		0.25	
ECC2	Clear communication of roles, responsibilities, and expectations reduces misunderstandings and errors, thereby improving productivity.	3.98		0.25	
ECC3	Prompt resolution of conflicts minimizes work stoppages and disruptions, ensuring continuous workflow.	4.21		0.26	
ECC4	A conflict-free environment enables workers to concentrate on their work, enhancing their productivity and output quality.	3.94	16.23	0.24	0.20
FAC2	Strengthened Team Cohesion and Unity				
STCU1	Resolving conflicts in a fair and transparent manner enhances worker morale and motivation, leading to higher productivity.	3.98		0.25	
STCU2	Workers feel valued and respected when their concerns are addressed, increasing their commitment and efficiency.	4.14		0.26	
STCU3	Effective conflict management contributes to a positive organizational culture where workers feel supported and valued, enhancing their productivity.	4.06		0.25	
STCU4	Workers develop trust in leadership when conflicts are handled effectively, fostering a productive and cooperative work environment.	3.96	16.14	0.25	0.20
FAC3	Utilizing Resources Efficiently				
URE1	Effective conflict management ensures that resources, including labor, are allocated efficiently, reducing waste and improving productivity.	4.00		0.25	
URE2	Preventing conflicts over resources helps in their optimal utilization, ensuring that workers have what they need to perform their tasks effectively.	4.07		0.25	
URE3	Cost savings from avoided disruptions and reduced downtime can be reinvested in productivity-enhancing measures.	4.18		0.26	
URE4	Effective conflict management can reduce the need for expensive legal interventions and arbitration, directing resources towards productive activities.	3.98	16.23	0.25	0.20
FAC4	Enhanced Work Quality and Retention				
EWQR1	Addressing issues quickly prevents prolonged disputes that can cause significant delays and reduce labor productivity.	4.00		0.25	
EWQR2	Workers are less likely to take unscheduled leave or be absent when conflicts are managed effectively, ensuring consistent labor availability.	3.98		0.25	
EWQR3	Addressing conflicts early prevents them from escalating into bigger issues that could significantly disrupt labor productivity.	4.11		0.26	
EWQR4	Implementing proactive strategies helps in identifying and mitigating potential conflicts before they impact productivity.	3.97	16.06	0.25	0.20
FAC5	Cost-cutting and innovation				
CCI1	Effective conflict management ensures that work is completed to a high standard without the compromises that unresolved conflicts might cause.	4.22		0.26	
CCI2	Workers are more likely to pay attention to detail and adhere to quality standards when they are not distracted by ongoing conflicts.	4.03		0.25	
CCI3	A conflict-free environment encourages innovation and creative problem-solving among workers, leading to more efficient work practices.	4.10		0.25	
CCI4	Workers are more likely to engage in constructive problem-solving when conflicts are managed, contributing to productivity improvements.	3.96	16.31	0.24	0.20

— Establishing an evaluation index structure

The FACs served as the first stage rating system, stated as $v_{fac} = (v_{FAC1}, v_{FAC2}, v_{FAC3}, v_{FAC4}, v_{FAC5})$ (Nwaogu et al., 2021, Oni et al., 2023). An assessment procedure was constructed in order

to extract the index from the five constructs. Every component of the second stage rating system is a factor (FA). The FSE's input variables are the first and second systems. The second-level rating system is presented as follows: $vFAC1 = (vECC1 - vECC4)$; $vFAC2 = (vSTCU1 - vSTCU4)$; $vFAC3 = (vURE1 - vURE4)$; $vFAC4 = (vEWQR1 - vEWQR4)$; $vFAC5 = (vCCI1 - vCCI4)$

— Figuring out the variables' membership grade FA and FAC (first level)

According to fuzzy set theory, a component's extent of membership in a particular fuzzy set, denoted by a value ranging from 0 to 1, indicates the extent to which the component belongs to the fuzzy set (Owusu et al., 2019). In accordance with the participants' degree of concurrence with each component, a 5-point evaluation system ranging from not significant (1) to very significant (5) was used to define the linguistic word employed in assessing the input variables (i.e., factors) against their significance (Ameyaw and Chan, 2016; Owusu et al., 2019). $S = (1, 2, 3, 4, 5)$ is the rating scale that is used to determine the criticality level according to the parameters. S1 stands for not significant, S2 for less significant, S3 for partially significant, S4 for significant, and S5 for very significant. Based on this rating system, the membership (MF) of any particular FA, SF_{FAin} , is computed utilizing formula (1) below:

$$MF_{SF_{FAin}} = \frac{X1_{FAin}}{S1}, \frac{X2_{FAin}}{S2}, \frac{X3_{FAin}}{S3}, \frac{X4_{FAin}}{S4}, \frac{X5_{FAin}}{S5} \quad (1)$$

Whereby n stands for the nth factors of a certain FAC i ($i = sFAC1, sFAC2, sFAC3, sFAC4, sFAC5$); $X1_{FAin}/S1$ is expressed as a proportion, and Xj_{FAin} ($j = 1, 2, 3, 4, 5$). Following substitution, the membership function for any given FA will thus be written as given in Eq. (2):

$$MF_{SF_{FAin}} = X1_{FAin}, X2_{FAin}, X3_{FAin}, X4_{FAin}, X5_{FAin} \quad (2)$$

As mentioned before, $MF_{SF_{FAin}}$ normally ranges between [0,1] and has to add up to one, which denotes unity.

Therefore,

$$\sum_{j=1}^5 Xj_{FAin} = 1 \quad (3)$$

As a result, using ECC1 as a stereotyped representation and entering it into Eq. (1) based on respondents' evaluations (i.e., 0.00%, 0.01%, 0.25%, 0.47%, 0.27%), we obtain:

$$MF_{pp1} = MF_{FAC1} = \frac{0.00}{\text{Not significant}}, \frac{0.01}{\text{Less significant}}, \frac{0.22}{\text{Partially significant}}, \frac{0.54}{\text{Significant}}, \frac{0.00}{\text{Very significant}} \quad (4)$$

Hence, the MF is expressed as $MF_{SF_{FAin}} = (0.00, 0.01, 0.25, 0.47, 0.27)$ in the form of Eq. (3). The FAs for the remaining membership functions were calculated using the same procedure, as shown in Eqs. (2) and (3).

— Computing the variables' weighing functions for the FAs and FACs

The standardized mean method was employed to ascertain the relative weights of every factor in the component construct. Therefore, the individualized weighting of the FA and FAC was obtained using the formulae given in (Owusu et al., 2019):

$$\frac{M_i}{\sum_{i=1}^5 M_i}, 0 < W_i < 1 \text{ and } \sum_{i=1}^n W_i = 1 \quad (5)$$

where a factor's (FA) or factor construct's (FAC) weighing function is represented by W_i ; A particular FA's or FAC's mean score, as determined by the respondents' answers, is represented by M_i . The weighing function set is provided as follows:

$$W_i = (W_1, W_2, W_3, \dots, W_n) \quad (6)$$

We view the mean score substitution in Eq. (5) as crucial, using ECC1 as a template to show how to calculate the weightings of various components within a factor construct. subsequently, Equation (5) is applied to derive Equation (7):

$$W_{ECC1} = \frac{4.10}{4.10 + 3.98 + 4.21} = \frac{4.10}{16.23} = 0.25 \quad (7)$$

The weightings of the outstanding FAs inside individual FAC were gotten by utilizing the processes detailed in Eqs. (5) and (7) (refer to Table 1), which can then be entered into Eq. (6) and verified to make sure that $\sum_i^n = 1$, $w_i = 1$.

$$W_{FAC1-4} = (0.25, 0.25, 0.26, 0.24)$$

$$\sum_i^n = 1 \quad w_i = (0.25+0.25+0.26+0.24) = 1.00$$

Table II. Weightings and MF for the FAs and FACs based on Fuzzy Synthetic Evaluation

Code	Weighting of FAs	Weighting of FACs	MF of each FA at level3	MF of each FACs at level 2	CL for FACs	MF of all FACs at level 1	Overall CL
FAC1		0.20		0.00, 0.01, 0.28, 0.46, 0.24	3.92	0.00, 0.02, 0.26, 0.46, 0.26	3.99
ECC1	0.25		0.00, 0.01, 0.25, 0.47, 0.27				
ECC2	0.25		0.01, 0.02, 0.34, 0.43, 0.20				
ECC3	0.26		0.00, 0.00, 0.27, 0.44, 0.29				
ECC4	0.24		0.00, 0.01, 0.26, 0.50, 0.22				
FAC2		0.20		0.00, 0.01, 0.27, 0.48, 0.25	3.99		
STCU1	0.25		0.00, 0.01, 0.31, 0.47, 0.22				
STCU2	0.26		0.00, 0.00, 0.29, 0.43, 0.28				
STCU3	0.25		0.00, 0.01, 0.27, 0.48, 0.24				
STCU4	0.25		0.00, 0.03, 0.20, 0.53, 0.24				
FAC3		0.20		0.00, 0.01, 0.29, 0.48, 0.22	3.94		
URE1	0.25		0.00, 0.04, 0.29, 0.44, 0.24				
URE2	0.25		0.00, 0.01, 0.28, 0.50, 0.21				
URE3	0.26		0.00, 0.00, 0.41, 0.41, 0.17				
URE4	0.25		0.00, 0.00, 0.18, 0.56, 0.26				
FAC4		0.20		0.00, 0.02, 0.24, 0.46, 0.29	4.04		
EWQR1	0.25		0.00, 0.03, 0.24, 0.47, 0.27				
EWQR2	0.25		0.00, 0.02, 0.22, 0.48, 0.28				
EWQR3	0.26		0.00, 0.01, 0.27, 0.45, 0.26				
EWQR4	0.25		0.00, 0.02, 0.23, 0.42, 0.33				
FAC5		0.20		0.00, 0.02, 0.24, 0.43, 0.30	4.01		
CCI1	0.26		0.00, 0.02, 0.23, 0.46, 0.29				
CCI2	0.25		0.00, 0.04, 0.24, 0.40, 0.31				
CCI3	0.25		0.00, 0.02, 0.27, 0.38, 0.33				
CCI4	0.24		0.00, 0.01, 0.22, 0.50, 0.27				

FA = Factors; FAC = Factor Construct; MF = membership function; CL = criticality level

Considering that 80.97 is the total of all FACs' mean values ($v_{FAC1} = 16.23$, $v_{FAC2} = 16.14$, $v_{FAC3} = 16.23$, $v_{FAC4} = 16.06$, $v_{FAC5} = 16.31$) (see Table 1). Thus, Eqs. (5) and (7) were used to normalize the mean of each FAC i.

$$W_{FAC1} = \frac{16.23}{16.23 + 16.14 + 16.23 + 16.06 + 16.31} = \frac{16.23}{80.97} = 0.22$$

To determine the weighting function of the remaining FACs ($W_{FAC2} = 0.20$, $W_{FAC3} = 0.20$, $W_{FAC4} = 0.20$, $W_{FAC5} = 0.20$), the same process was used (see Table 1). Furthermore, the total of all normalized weights equals one. For instance, $0.20 + 0.20 + 0.20 + 0.20 + 0.20 = 1$.

— Constructing the multi-criteria and multi-level FSE model

In order to assess the impact of conflict management on labor productivity in the construction sector, it is necessary to identify the FACs that are most important. following equation 2, the MFs of the FAs within individual FAC can be describe using Eq. (8), and the components are indicated by X_{jFAin} :

$$K_i = \begin{matrix} MF_{Si1} \\ MF_{Si2} \\ MF_{Si3} \\ \dots\dots\dots \\ MF_{Sin} \end{matrix} = \begin{matrix} L1_{Si1} & L2_{Si1} & L3_{Si1} & L4_{Si1} & L5_{Si1} \\ L1_{Si2} & L2_{Si2} & L3_{Si2} & L4_{Si2} & L5_{Si2} \\ L1_{Si3} & L2_{Si3} & L3_{Si3} & L4_{Si3} & L5_{Si3} \\ \dots\dots\dots & \dots\dots\dots & \dots\dots\dots & \dots\dots\dots & \dots\dots\dots \\ L1_{Sin} & L2_{Sin} & L3_{Sin} & L4_{Sin} & L5_{Sin} \end{matrix} \quad (8)$$

As an example, consider FAC1 in Table 1. The elements are denoted in fuzzy matrix form as stated in Eq. (8), so we have:

$$K_i = \begin{matrix} MF_{ECC1} \\ MF_{ECC2} \\ MF_{ECC3} \\ MF_{ECC4} \end{matrix} = \begin{matrix} 0.00 & 0.01 & 0.25 & 0.47 & 0.27 \\ 0.01 & 0.02 & 0.34 & 0.43 & 0.20 \\ 0.00 & 0.00 & 0.27 & 0.44 & 0.29 \\ 0.00 & 0.01 & 0.26 & 0.50 & 0.22 \end{matrix} \quad (9)$$

The FSE consists of three membership function phases that progress from the third to the first. Here, calculations are performed to get to stage 2 of the FSE model. The fuzzy matrix, represented by E_i , is produced through the multiplication of the weighting function set $W_i = \{w_1, w_2, \dots, w_n\}$ (refer to Eq. 6) of the FAs inside a FAC by the MFs (derived utilising Eq. 9) of the FAs inside each FAC.

$$\text{So, } E_i = W_i * K_i \quad (10)$$

$$(e_{in}, e_{in\dots}, e_{in}) = (w_{i1}, w_{i2}, \dots, w_{in}) * \begin{matrix} MF_{Si1} \\ MF_{Si2} \\ MF_{Si3} \\ \dots\dots\dots \\ MF_{Sin} \end{matrix}$$

Equivalent to:

$$\begin{aligned} (e_{in}, e_{in\dots}, e_{in}) &= (w_{i1}, w_{i2}, \dots, w_{in}) * \begin{matrix} L1_{Si1} & L2_{Si1} & L3_{Si1} & L4_{Si1} & L5_{Si1} \\ L1_{Si2} & L2_{Si2} & L3_{Si2} & L4_{Si2} & L5_{Si2} \\ L1_{Si3} & L2_{Si3} & L3_{Si3} & L4_{Si3} & L5_{Si3} \\ \dots\dots\dots & \dots\dots\dots & \dots\dots\dots & \dots\dots\dots & \dots\dots\dots \\ L1_{Sin} & L2_{Sin} & L3_{Sin} & L4_{Sin} & L5_{Sin} \end{matrix} \\ &= (e_{i1}, e_{i2}, e_{i3}, e_{i4}, \dots, e_{in}) \end{aligned} \quad (11)$$

where "*" denotes the fuzzy composition operation, si with respect to a given FAC i , and e_{in} stands for the grade alternative (Ameyaw and Chan, 2016). With reference to FAC1, we have:

$$\begin{aligned} E_{FAC1} &= (0.25, 0.25, 0.26, 0.24) * \begin{matrix} 0.00 & 0.01 & 0.25 & 0.47 & 0.27 \\ 0.01 & 0.02 & 0.34 & 0.43 & 0.20 \\ 0.00 & 0.00 & 0.27 & 0.44 & 0.29 \\ 0.00 & 0.01 & 0.26 & 0.50 & 0.22 \end{matrix} \\ &= (0.00, 0.01, 0.28, 0.46, 0.24) \end{aligned}$$

The same process was applied to establish the MF of the other FACs at stage 2 (refer to Table 2). The subsequent action is to calculate the criticality level (CL) of each FAC. The underlying equation (Eq. 12) is utilized to achieve that:

$$CL_i = \sum_{i=1}^5 1 (E_{in} * S) = (e_{i1}, e_{i2}, e_{i3}, e_{i4}, e_{i5}) * (1, 2, 3, 4, 5) \quad (12).$$

where $1 \leq CL_i \leq 5$

Equation (11); is utilised to estimate the criticality level (CL) for all the FACs (refer to Table 2). As an example, the CL of FAC1 to FAC3 is calculated as shown below.

$$\begin{aligned} CL_{FAC1} &= (0.00, 0.01, 0.28, 0.46, 0.24) * (1, 2, 3, 4, 5) = \\ &= ((0.00*1)+(0.01*2)+(0.28*3)+(0.46*4)+(0.24*5)) \\ &= 0.0+0.2+0.84+1.84+1.22 = 3.92 \end{aligned}$$

$$\begin{aligned}
 CL_{FAC2} &= (0.00, 0.01, 0.27, 0.48, 0.25) * (1, 2, 3, 4, 5) = \\
 &((0.00*1)+(0.01*2)+(0.27*3)+(0.48*4)+(0.25*5)) \\
 &= 0.0+0.2+0.8+1.92+1.24 = 3.99 \\
 CL_{FAC3} &= (0.00, 0.01, 0.29, 0.48, 0.22) * (1, 2, 3, 4, 5) = \\
 &((0.00*1)+(0.01*2)+(0.29*3)+(0.48*4)+(0.22*5)) \\
 &= 0.0+0.02+0.88+1.92+1.11 = 3.94
 \end{aligned}$$

— Estimating the general significance indices of the factor constructs

The total criticality level of the FACs was determined using the weighted mean approach for three reasons: (i) Taking into account that the parameter weightings and their constructs have been standardised, it possesses the highest limit of one. (ii) It also retains the efficacy effect of the factors and their constructs. (iii) Finally, it is commonly utilized in fuzzy multi-criteria choice-making assessment (Oni et al., 2023). As per Nwaogu et al. (2021), the weighted mean technique is produced by utilizing the formulas given in Eq. 13:

$$e_{in} = \sum_{i=1}^m W_{in} X_{psin}, n = (1, 2, 3, \dots, p) \quad (13)$$

From the resulting evaluation matrixes, the fuzzy matrix for $\bar{R}_i$ is built to evaluate the total criticality level of the impact of conflict management on labor productivity, $E_i (i=1, 2, 3)$

$$\bar{R}_i = \begin{matrix} E_{FAC1} \\ E_{FAC2} \\ E_{FAC3} \\ \dots \\ E_{FAC5} \end{matrix} = \begin{matrix} FAC1_1 & FAC1_2 & FAC1_3 & FAC1_4 & FAC1_5 \\ FAC2_1 & FAC2_2 & FAC2_3 & FAC2_4 & FAC2_5 \\ FAC3_1 & FAC3_2 & FAC3_3 & FAC3_4 & FAC3_5 \\ \dots & \dots & \dots & \dots & \dots \\ FAC5_1 & FAC5_2 & FAC5_3 & FAC5_4 & FAC5_5 \end{matrix} \quad (14)$$

where, E_{FAC1} to E_{FAC5} denotes the MF of the FACs documented at the level 2 (refer to Table 2). Then, $\bar{R}_i$ is standardized by means of Eq. (10,11) with the weighing function set of $(\bar{W}\{w_1, w_2, w_3\})$ for the FACs in order to accomplish the goal.

$$\bar{E} = \bar{W}_i * \bar{R}_i$$

$$(w_1, w_2, w_3, w_4, w_5) * \begin{matrix} FAC1_1 & FAC1_2 & FAC1_3 & FAC1_4 & FAC1_5 \\ FAC2_1 & FAC2_2 & FAC2_3 & FAC2_4 & FAC2_5 \\ FAC3_1 & FAC3_2 & FAC3_3 & FAC3_4 & FAC3_5 \\ FAC4_1 & FAC4_2 & FAC4_3 & FAC4_4 & FAC4_5 \\ FAC5_1 & FAC5_2 & FAC5_3 & FAC5_4 & FAC5_5 \end{matrix} \quad (15)$$

$$(0.20, 0.20, 0.20, 0.20, 0.20) * \begin{matrix} 0.00 & 0.01 & 0.28 & 0.46 & 0.24 \\ 0.00 & 0.01 & 0.27 & 0.48 & 0.25 \\ 0.00 & 0.01 & 0.29 & 0.48 & 0.22 \\ 0.00 & 0.02 & 0.24 & 0.46 & 0.29 \\ 0.00 & 0.02 & 0.24 & 0.43 & 0.30 \end{matrix}$$

$$\bar{E} = (0.00, 0.02, 0.26, 0.46, 0.26)$$

Finally, Equation (16) below was utilized to ascertain the total criticality level of the impact of conflict management on labor productivity in the construction sector (refer to Tables II):

$$CL_{overall} = \sum_{i=1}^5 "1 (E * S) = (e_1, e_2, e_3, e_4, e_5) * (1, 2, 3, 4, 5)" \quad (16).$$

where $1 \leq CL_i \leq 5$

$$CL_{overall} = (0.00, 0.02, 0.26, 0.46, 0.26) * (1, 2, 3, 4, 5)$$

$$CL_{overall} = (0.00*1+0.02*2+0.26*3+0.46*4+0.26*5)$$

$$CL_{overall} = 3.99$$

5. DISCUSSION

— Cluster 1: Enhanced Communication and Collaboration

In the construction industry, effective communication and teamwork are essential to project success. If disagreements are not settled, cooperation may break down and miscommunications may grow into serious delays. The existence of dispute resolution processes lessens the possibility of misunderstandings by providing a way to define responsibilities, roles, and expectations. Projects with open lines of communication are less likely to incur expensive delays due to miscommunications, claim Vaux and Kirk (2018). Having open lines of communication among all parties results in a smoother workflow. This is particularly important in the construction industry because of the interconnectedness of jobs, which means that delays in one area can have a ripple effect on the entire project. Furthermore, Ahad (2020) emphasizes that resolving conflicts in a fair and open manner raises morale by demonstrating to staff members that their concerns are taken seriously. This understanding is essential in the high-stress setting of construction, where output is directly impacted by morale. Employees are more driven to help the project succeed when they feel valued and heard. According to Tariq and Rehman (2020), this kind of setting encourages a culture of involvement and accountability, where workers are dedicated to producing their best work. Finally, improved productivity and morale lead to better project performance.

— Cluster 2: Utilizing Resources Efficiently

Construction resource management requires careful balancing. Under or incorrect use of personnel, equipment, or materials can result in inefficiencies that drive up prices and lengthen schedules. By ensuring that arguments over resource allocation are quickly resolved and that resources are allocated in accordance with plan, effective dispute resolution plays a crucial role in avoiding these dangers. According to Femi et al. (2014), avoiding conflicts over resources enables their best usage, guaranteeing that employees have the equipment and supplies they need to complete their jobs effectively. By doing this, downtime is decreased and the cascading effect that might happen when a single project component is delayed because of insufficient resources is avoided. Additionally, as Ghodrati et al. (2018) point out, a conflict-free and stress-free work atmosphere allows employees to focus entirely on their jobs. Because unresolved issues do not interfere with workers' ability to complete their jobs, the result is not only increased productivity but also higher-quality output. Conflict-free teams are better able to focus on innovation and process improvement, avoiding distractions from resource disputes. A climate of trust and cooperation promotes better decision-making and more efficient use of the resources at hand, which eventually helps the project be completed successfully.

— Cluster 3: Strengthened Team Cohesion and Unity

Team cohesion is essential in the construction industry, where a project's success hinges on the seamless integration of multiple teams and specialists. If disputes are not handled appropriately, they can split teams apart and cause a lack of trust and collaboration. Effective dispute resolution promotes unity by resolving conflicts before they get out of hand, especially through mediation and negotiation. According to Lu and Wang (2017), teams are more likely to cooperate to achieve shared objectives when conflicts are handled skilfully. This cooperative spirit depends on the high levels of coordination needed for building projects, where many teams frequently need to coordinate their efforts to stay on schedule. As noted by Sadat et al. (2022), early dispute resolution keeps problems from turning into significant disruptions. Proactively resolving issues helps to head off future disagreements and keeps the team focused on the project's goals. Creating a more unified work environment is another benefit of using effective conflict management to promote a culture of collaboration. Teams that collaborate well are more creative, more capable of overcoming obstacles, and more likely to reach or surpass project objectives. Additionally, a cohesive workplace fosters a sense of belonging among staff members and increases worker engagement.

— Cluster 4: Enhanced Work Quality and Retention

Employee retention is a major concern in the construction sector, where high employee turnover can cause delays and increased costs. Unresolved disputes may be a significant contributing factor in employee departures. This problem is addressed by effective conflict management, which lowers employee turnover and keeps talented workers on staff by fostering a supportive and respected work environment. According to Rohani et al. (2018), workers can concentrate on producing high-quality work when they are not sidetracked by continuing conflicts. In the construction industry, where even minor mistakes can have expensive repercussions, a harmonious work environment is essential for maintaining attention to detail and adherence to quality standards. Resolving conflicts in an efficient manner guarantees that employees are not only productive but also generate the best possible work. Companies that have effective conflict management procedures are better at keeping experienced workers, according to Irfan et al. (2019). The success of the project depends on the skills and knowledge that experienced workers bring, so keeping them on board is essential. Furthermore, continuity is ensured by a stable workforce, which lowers the possibility of interruptions brought on by the requirement to hire and train new workers. Higher client satisfaction and more consistent project outcomes are the results of this stability plus a quality-focused approach.

— Cluster 5: Cost-cutting and innovation

The construction sector is increasingly focused on innovation as a strategy to increase efficiency and cut costs. However, innovation requires a work atmosphere that stimulates creativity and problem-solving. This is made possible by effective conflict management, which frees up workers to concentrate on coming up with fresh concepts and solutions by removing the distractions and bad vibes that lingering disagreements can provide. Effective dispute resolution, according to Liu et al. (2020), reduces the need for pricey court cases and arbitration, freeing up funds that can be used for innovation. Less disagreements can save money, which can then be used for new technology, educational initiatives, or productivity-enhancing process upgrades. Additionally, a collaborative culture is fostered in a conflict-free workplace, where people are more inclined to share ideas and work together to solve problems. According to Ilori (2022), employees are more likely to participate in productive problem solving when disagreements are managed efficiently, which results in more efficient work procedures. In addition to increasing productivity, this proactive approach to conflict resolution guarantees that the project will be finished on schedule and under budget. A friendly and courteous work atmosphere also recruits and keeps talent, further fostering innovation and project success.

6. CONCLUSION

In conclusion, incorporating efficient conflict resolution methods in the construction industry greatly improves project results by addressing five essential aspects. Enhanced communication and collaboration result in more precise communication and well-defined responsibilities, reducing misunderstandings and enhancing teamwork. Furthermore, the efficient utilization of resources guarantees the most advantageous distribution and minimizes inefficiency, directly enhancing productivity. Likewise, actively managing conflicts promotes team unity and cohesion, which enhances collaboration and allows teams to effectively work together towards common objectives. Additionally, the enhancement of employee retention and work quality may be attributed to the presence of a nurturing work environment that fosters a sense of appreciation among employees. This, in turn, results in the production of superior outputs and the maintenance of a stable workforce throughout time. Ultimately, the promotion of innovation and cost reduction is accomplished by reallocating resources from expenses linked to conflict towards efforts that enhance productivity. The results show that raising labor productivity in the construction sector requires efficient conflict resolution. These highlight how crucial it is to incorporate effective conflict

resolution techniques into construction project management' procedures in order to guarantee a peaceful and effective working environment. It also demonstrates that using effective dispute resolution procedures not only enhances productivity but also establishes a basis for a more organized, creative, and profitable construction process. The implications of the research highlight the need for comprehensive conflict management techniques in the construction sector. Construction companies may greatly increase labour productivity and project performance by addressing communication, quick resolution, resource allocation, organizational culture, cost management, and innovation

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