

Exploratory Analysis of Ethical Issues in Virtual Construction Project Coordination in Nigeria

Olugbenga Timo Oladinrin^{*1, 5}, Tobiloba Sunday Eyiwumi², Lekan Damilola Ojo², Muhammad Qasim Rana³ and Angela Lee⁴

¹School of Art, Design and Architecture Faculty of Arts, Humanities and Business, University of Plymouth, UK

²Balfour Beatty, Construction Company, UK

³Department of Building and Real Estate, the Hong Kong Polytechnic University, Hong Kong

⁴School of Built Environment, University College of Estate Management, UK

⁵Cidb Centre of Excellence, Faculty of Engineering and the Built Environment, University of Johannesburg, Johannesburg 2006, South Africa

Abstract

The construction industry is often labelled with ethical issues due to its nature and the fact that multidisciplinary stakeholders are often involved in various phases of the project. The multiple participants in construction projects often make them more prone to unethical practices, and project coordination is also a daunting task. Previous studies on ethical issues primarily focused on traditional construction project coordination and processes with limited attention to construction projects coordinated virtually. As a result, this study attempts to investigate the ethical issues in virtual project coordination. This study uses a quantitative approach to obtain the opinions of construction professionals such as architects, quantity surveyors, builders, engineers, and project managers with practical involvement in virtual construction projects. The data retrieved were analysed with descriptive and inferential statistics namely mean score, standard deviation, Shapiro Wilk test, Mann-Whitney U test, and factor analysis. Based on the results of the analysis, the ethical issues in virtual project coordination were classified into communication and managerial issues, cooperation and environmental issues, and coordination and moral issues. To address the ethical issues in virtual project coordination, it is expedient for construction professionals and project stakeholders to work as a team with a common goal, select suitable project management tools and exhibit professional ethics in discharging their duties on the project. This paper investigated the ethical issues peculiar to virtual construction project coordination. This study is important in the present technological age to ensure continual delivery of construction projects with anticipated outcomes.

Keywords: Construction Projects; Coordination; Decision-Making; Ethical Issues; Virtual Environment

Introduction

Ethics-related problems leading to a breach of trust, loss of lives and properties, increase in expenses incurred on projects, and so on, has been a topical issue in the construction industry [1]. Damage of reputation and unstable economy are also denoted as long-term results of poor ethical practices in the construction industry [2]. The poor behavioural practices in the construction industry are often influenced by poor health and work standards, corrupt system, mode of payment, inadequate safety measures, and tendering methods [2]. Meanwhile, transformation in ethics is required in the construction industry due to the progressive rise in demands for practical and corporate behavioural principles in the management and coordination of projects [3].

The construction industry has unique attributes that have transformed how projects are coordinated for efficient operations [4]. Operational efficiency is possible when effective project coordination exists between the management and the subordinates [5]. Project coordination process can bridge communication gap and ensure the right distribution of limited construction resources to achieve the set goals and objectives across the project life cycle [6]. For the construction industry to maintain competitiveness in project coordination, technological advancement, creativity and innovations are essential [7]. The complexity of construction projects, uniqueness, numerous interlinks, multidisciplinary stakeholders, and numerous work packages, make it indispensable for appropriate coordination [8].

In reality, various participants from different cultural backgrounds working together to attain a mutual goal often experience ethical issues in virtual projects [9], which may make coordinating such projects more difficult. Many studies [10-13] have investigated ethical issues affecting

the traditional method of project coordination and its management, but few addressed the ethical issues in the virtual world [9]. Investigated the severity of ethical issues in virtual team in a developing nation with 58 responses during the peak of Coronavirus pandemic. [14], also attempted to link ethic and innovation through a scientiometric analysis in a bid to pave way for new research investigations. Other studies explored relationships between ethical issues and occupational health and safety [15], construction project performance [16]. The workflow of construction projects and the delivery of the project may be affected in the present decades without virtual project coordination [1]. In fact, the disruption to projects caused by the coronavirus pandemic makes virtual-based activities indispensable. Thus, investigating ethical issues in virtual project coordination is essential to provide practical measures for ameliorating ethical-related issues on construction projects. On the other hand, team spirit and collaboration required for multiple stakeholders to execute construction projects can be enhanced. In addition, continual utilisation of virtual environment in different stages of construction projects can be improved having understood the

***Corresponding author:** Olugbenga Timo Oladinrin, University College of Estate Management (UCEM), UK, Horizons, 60 Queen's Road, Reading, RG1 4BS, United Kingdom, E-mail: m.rana@ucem.ac.uk

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associated ethical issues. Therefore, this study investigated the ethical issues in virtual project coordination through the following objectives:

- Review extant literature to identify ethical issues in virtual construction project coordination.
- Assess the level of agreement on the ethical issues from construction professionals with experience in virtual construction project coordination, and
- Categorise the ethical issues in virtual construction project coordination into manageable size for ease of discussion.

In other sections of this paper, a comprehensive literature review was conducted to identify the ethical issues in virtual construction projects coordination. A questionnaire was developed with these ethical issues to elicit the opinions of construction professionals in the Nigerian construction industry's consulting and contracting organisations. The research methodology section explicitly described the approach employed to collect the data and the analyses conducted. The research findings contributing to the body of knowledge were discussed, with practical recommendations and conclusions drawn from the study.

Literature Review

Overview of Ethical Issues

A moral code provided by ethics serves as a cornerstone for promoting good organizational governance and individual behavior within the construction industry [17]. Ethical conduct is critical for ensuring transparency, fairness, and accountability in the sector, especially in an industry often fraught with complex interpersonal and organizational dynamics [18]. Ethics is a necessity to enhance and protect the confidence and interest of the public in the construction industry [19]. The contractors often bear the brunt of the poor image or reputation for bad behaviour than other participants on construction projects [3]. The unethical behavior of some construction industry actors, such as cover pricing, false declaration, bid reduction, inadequate paperwork, and so on is a concern [2]. These practices compromise not only project outcomes but also trust among stakeholders, reducing the overall effectiveness and credibility of construction practices [20]. While ethical challenges are not unique to any industry, the high percentage of incomplete and delayed projects with significant time and cost overruns, and unethical behavior or inadequate execution of ethical codes is rampant in the construction business [21]. Such practices not only threaten project success but also have far-reaching implications for the industry's reputation, organizational trust, and sustainability [22]. The ethical issues affecting the moral values and principles of stakeholders involved in the execution of construction projects also have significant impact on the sustainability of the projects, organisational reputation, trust of the industry, and so on [23]. To address this issue, the need to adopt code of conduct that describes the ethical standard and responsibilities of construction parties and organisations are often emphasised [24] [14]. Meanwhile, the characteristics and size of organisations play a key role in determining the ethical programme and the seriousness to comply to it (Lloyd and Mey, 2010). Sadly, the construction industry is the most infiltrated with unethical activities [25] because of the fragment nature of the industry [26]. On the other hand, construction projects executed using conventional method can favour ethical issues and make it difficult to identify the project actor responsible for unethical behaviours [2] [27]. Innovation brought by electronic communications and virtual platforms could be thought to lessen the occurrence of ethical issues on construction projects, but

reverse is the case [9] [28]. Unethical behaviors persist, in different forms, within virtual environments, making it critical to explore and address these challenges in the context of virtual construction project coordination.

Overview of Virtual Construction Project Coordination

Virtual construction project coordination involves the use of digital technologies to plan, design, manage, or execute activities in construction projects [29]. This innovative approach leverages cutting-edge technologies to enable seamless collaboration among project stakeholders, irrespective of their physical locations, thereby increasing efficiency and adaptability in project execution [30]. This approach allows for the involvement of expert in any specialised area to contribute remotely to any phase of the construction project [9]. The rise of virtual platforms has revolutionized traditional construction practices by offering tools for real-time information sharing, faster decision-making, and enhanced project performance in terms of time, cost, and quality [31]. These advancements, coupled with the increased reliance on digital technologies during the Coronavirus pandemic, have accelerated the adoption of virtual platforms in the construction industry [32,33]. Features such as transparent communication, automated documentation, and auditable workflows can significantly reduce the likelihood of unethical practices, fostering a culture of accountability and trust [34]. However, ethical issues occur among virtual team as well as physical team [9], [35]. In fact, [36], noted that some ethical issues are common to both virtual and physical construction team. The situation of ethical issues in construction industry of developing countries may be more severe than developed nations, making it crucial of investigation.

Ethical Issues in Relation to Virtual Construction Project Coordination

Several factors are responsible for the ethical issues could be described in micro and macro factors or constructs [37]. Micro factors investigate the connection that exists between individuals and construction participants while macro factors refer to the decision-making procedures adopted jointly by experts [38, 39]. Also, other ethical factors include legal challenges, whistle blowing, security and data protection, team member confidence, and so on [38] [40-42]. The study of [42], investigated the challenges to virtual project team performance in which team conflict, trust issue, communication and training, diversity, and characteristics of the team are reported. The presence of these ethical concerns underlines the critical importance of addressing both individual behaviors and systemic practices to ensure fairness, efficiency, and integrity in virtual project management [43]. A follow-up study using interpreted structural equation modelling by [44] further revealed that virtual team characteristics may consist of diversity in profession and environmental background.

Whistleblowing which can be viewed as a sign of disobedience or rebellion, particularly in public organisations [45, 46], which may have negative impact on the whistle blower such as losing of job or demotion [47, 48] is also reported in virtual environment [49]. Surprisingly, whistleblowing can be advantageous to the whistle-blower in some situations [50]. In a virtual environment, a whistle-blower could easily have access to documents and recordings being part of a virtual team through which perceived wrongdoing of others could be reported [51]. In fact, the advent of internet and numerous breakthroughs in technology, confidentiality is a point of concern [49], which necessitates the need for training and trust building in virtual team development [52]. On the other hand, positive synergy, i.e., cohesiveness in face-

to-face teams is more difficult to obtain in virtual teams [53, 54]. As revealed by [9], ethical issues may be common to team in face-to-face and virtual gathering. In fact, ethical issues in project management may be severe in a virtual environment [55, 56].

Majority of construction professionals have come to an agreement that team member trust is one of the greatest ethical issues in having a successful virtual team for project coordination [53][44]. Revealed that trust-related is the premise on majority of virtual ethical issues is built. People believe it is nearly impossible to trust someone that is not well known [57], while others believe it is unwise to trust someone who has not been observed in action overtime [58, 59]. Trust is an element required in the global workplace for tasks to be carried out diligently and projects delivered to meet certain expectations [60, 61]. Lack of trust among project team members can compromise precautions put in place to guarantee success among virtual team members [62, 63]. The challenge of trust can be more severe in virtual environment than a physical one. In fact, many top management officers of construction organisations are often reluctant to share vital information such as cost in virtual environment because of competitors and data protection policy [64]. However, the mindsets of construction practitioners have gradually shifted to embracing virtual platforms for numerous data exchange after the outbreak of coronavirus pandemic. The end-to-end encryption of numerous digital tools can give virtual participants confidence in the safety of personal data and organisational information. In addition, regulatory checks are in place to checkmate the actions of participants in virtual environment [65, 66].

The conflict of interest among project team members and construction stakeholders such as contractors, project manager, site engineers, and quantity surveyors and so on working in a different geographical location plays a crucial role in unethical practices in virtual project coordination [67]. This could adversely impact the quality of the project to be delivered, client's trust, and public perception of the construction industry. It is important to note that conflict of interest is one of the many moral challenges connected to unethical behaviours often encountered in the construction industry which could be masked in four dimensions such as unfair conduct, fraud, collusion, and bribery [12] [10]. Past studies also reveal that conflict of interest among project participants is the bedrock for displaying a form of opportunistic behaviour or the other. Thus, to achieve the best project outcomes, the interests of various participants on the projects should be screened with appropriate decision-making techniques [68]. Ensuring ethical alignment in decision-making processes can reduce unethical practices and foster a culture of accountability in virtual project coordination [69].

Communication is crucial to manage organisation projects or tasks [70, 71]. It is the link between members of organisation or project stakeholders, and organisation performance is greatly dependent on it as well [4]. Meanwhile, barriers to effective communication in virtual construction project coordination are often experienced, which is connected to many factors, namely the project's complexity, the project team members' values, and so on. Miscommunications easily occur among virtual project team members compared to a physical gathering [72, 73]. Adopting innovative communication tools and establishing clear protocols can help mitigate these barriers and enhance collaboration [74]. Although construction companies normally comprise of diverse employees that need to communicate and share information in a Common Data Environment (CDE) on a virtual project, communication may still be a key issue in virtual team [44]. The findings of [73] portend that the environment via which

team members discuss (virtual) may pose a crucial challenge to the team performance in a sense. Difference in geographical location with various time zones, languages, and cultural background are all factors that can also hinder effective communication among project teams [75]. Also, decision-making could be delayed as systematic steps for reaching consensus among all the team may be disrupted, especially when some team members reside in a location with unstable internet connection or have other electronic-related problems. The internet bandwidth problem may be a severe problem in developing nations, which can render web-based collaborative system proposed by [76], redundant. On the other hand, sudden exit of key member in the team may be experienced because of technical and poor internet bandwidth [9], thereby affecting the decision-making process.

Although the increase in technology has brought tremendous opportunities, companies are often faced with different challenges in achieving organisational goals, especially in developing countries where conventional methods are often embraced [42]. Information and communication technology (ICT) has made communication and coordination possible in the virtual world where "non-contact" exists through computers [77]; but it has been discovered that using it comes with ethical challenges as well [78]. To successfully create an active professional environment in the construction industry, the need for commitment to the principles that guide behaviours [79] [23], and setting up benchmark for these behaviours help in the actualisation of expectations are indispensable [80]. In reality, minimising unethical behaviours is not the sole duty of project coordinator but of every participant in the team [81]. On the other hand, the nature of the construction industry makes it necessary to put strategic monitoring and management controls in place for quality projects delivery within stipulated time and budget [82]. Such measures ensure that technological advancements contribute positively to the construction industry, even in developing nations where conventional practices often dominate [83]. Therefore, the construction industry has experienced a facelift in the management of information due to technology advancement, although some ethical issues are present, even in the virtual environment [84].

Planning construction projects is one of the most difficult tasks a project team encounters. Decisions made during this stage have a significant impact on the project successful execution [85, 86]. Planning construction projects entails operations ranging from decision-making for major assemblies and the resources required for implementation of daily written instructions. The information needed for project execution must be extracted from design/construction general and project-specific data; processed to create project knowledge required for making appropriate decisions and actions to complete the projects successfully [87]. Often time, the implementation of the decision-making process is mostly done manually, especially in developing countries. However, these innovations must be managed ethically to prevent biases and ensure equitable outcomes for all stakeholders [88]. Addressing these challenges requires a holistic approach, incorporating individual accountability, systemic reforms, and technological safeguards [74]. By fostering a culture of ethical responsibility, the construction industry can fully realize the benefits of virtual collaboration while minimizing associated risks [89]. The list of ethical issues in virtual project coordination extracted from literature and their sources is presented in [Table 1].

Research Methodology

Selecting an appropriate design for investigating research is crucial

Table 1: Ethical Issues in Virtual Project Coordination.

Ethical issues	Sources
Project management and control technique issues	Loo (2002); Sigurðarson (2009); Mishra et al. (2011).
Communication barrier	Lilian (2014); Ghaffari et al. (2014); Gupta and Pathak (2022); Zuofa and Ochieng (2017).
Lack of team member ethical training	Romious et al. (2016); Kancharla and Dadhich (2021); Jones (2009); Steele et al. (2016).
Team cohesiveness	Narayanan et al. (2006); Mpeera Ntayi et al. (2010); Riisla et al. (2021).
Legal issue or legal disconnect	Schroeder (2007); Ndekugri et al. (2022); Padroth et al. (2017); Künzle (2022).
Conflict of interest within the team.	Al-sweity (2013); Sagar et al. (2022); Sagar et al. (2023)
Ecological issues (characteristics of team members)	Sattineni and Mead (2013); Sagar et al. (2022); Sagar et al. (2023).
Team member trust	Cascio and Shurygailo (2003); Germain (2011); Lilian (2014); Gupta and Pathak (2022); Sagar et al. (2022); Sagar et al. (2023).
Issues in decision-making techniques	Oladinrin et al. (2022a); Yang (2001).
Organisational hierarchy issue	Sagar et al. (2022); Sagar et al. (2023).
Data protection	Gupta and Pathak (2022).
Cultural difference	Levasseur (2012); Lilian (2014); Yilmaz (2016); Presbitero (2020); Gupta and Pathak (2022).
Virtual trauma	Knaust et al. (2020).
Regulatory challenges	Koy (2010).
Whistle blowing	Potipiroon and Wongpreedee (2021); Marcum and Young (2019); Walle (2020).

to obtaining valid results for drawing conclusion [90]. The research design also guides the researchers to decide the source of respondents (i.e., single, or multiple source) that fit the study [91]. Therefore, in a study to investigate the ethical issues associated in virtual construction project coordination, the use of questionnaire survey is considered suitable to obtain a wide perspective from construction professionals with the required practical experience in the Nigerian construction industry. In addition, multiple respondents can have diverse opinions of the subject matter which can be demystified for extensive discussion in the study [91].

A questionnaire was designed and administered to construction professionals in the Nigerian construction industry to investigate the ethical issues in virtual construction project coordination in this study. The variables of ethical issues used in the questionnaire were obtained from extant literature. The questionnaire consisted of two parts: (1) background information of the respondents, and (2) fifteen ethical issues in virtual construction project coordination. The questions on ethical issues were asked on five-point Likert scale ranging from 1 (strongly disagree) to 5 which represented strongly agree [92]. A short definition of virtual project coordination was provided in the cover letter to the questionnaire to ensure that respondents understand the aim of the research. Besides, there is no directory of construction organisations specialised in virtual construction project coordination in the study area. Therefore, a nominal question was included in the background section of the questionnaire to identify respondents with involvement in virtual construction project coordination to shorten the length of the questionnaire. On the other hand, the study area experienced significant effect of Coronavirus pandemic which makes construction companies embrace virtual methods in construction processes. The respondents in this study include architects, builders, engineers and quantity surveyors in Lagos State, Nigeria due to the indispensable role they play in delivering construction projects successfully [93, 94]. Based on the data obtained from the Lagos chapter secretaries of the four selected construction professionals, a sample size of 369 was obtained as a representative of construction professionals from a total population of 4,827 registered construction professionals using Yemane's formula [9]. The questionnaires were administered to the target construction professionals using convenient sampling in this study. Convenience sampling technique was adopted in the study because of limited time and other resources required conducting the research [95].

A total of 101 filled questionnaire were returned, while three of the data were discarded because of inconsistency such as selecting a single opinion such as "option three (3) representing neither agree nor disagree" in all the questions. The ninety-eight (98) copies of questionnaires retained represents 26.6% of the sample size of the study. Although the response rate is small, it is adjudged suitable compared with past studies that employed smaller data which was less than fifty responses [96, 97]. The statistical analyses conducted on the variables of ethical issues in virtual project coordination include mean score, standard deviation, Mann Whitney U test, and factor analysis using Statistical Package for Social Sciences (SPSS version 26).

A Shapiro-Wilk normality test was performed to determine whether a parametric or non-parametric test would be appropriate for the dataset [98]. The p-value obtained in the Shapiro-Wilk test provides basis for choosing between T-test and Mann-Whitney U test (for two clusters of respondents) or between ANOVA and Kruskal-Wallis H test (for more than two clusters of respondents). These tests are essential for exploring any significant difference between the cluster groups of respondents in a study, which is essential for drawing interesting inferences from data. The Shapiro-Wilk test results revealed that the significant level (p-values) of all the variables is less than 0.05, implying that the data set is not normally distributed. A careful investigation of the dataset using central limit theorem of having minimum of 30 responses in a cluster also revealed that two cluster groups is suitable to deduce any significant difference in the opinion of the respondents [99]. Hence, Mann-Whitney U test, was used to determine the significant differences between construction professionals in consulting and contracting firms in the study [100]. The significant value obtained through Mann-Whitney U test can provide interesting insights to divergent opinions of respondents in consulting and contracting organisations on the ethical issues in virtual project coordination.

Thereafter, factor analysis was used to reduce the variables of ethical issues into manageable size for ease of discussion [101]. Although factor analysis is often used to reduce a large number of variables into smaller components [102], it is important to note that there is no established minimum number of variables required for factor analysis. In fact, previous studies have utilised factor analysis to reduce variables that are less than the ones used in this study [103, 104]. Therefore, the fifteen variables of ethical issues in this study can be adjudged satisfactory for factor analysis. On the other hand, the item-to-sample ratio is also essential for consideration in factor analysis,

however, there are contentious stands between scholars on it [102]. The item to sample ratio of 1:5 is often recommended as benchmark for conducting factor analysis [105], meanwhile, a ratio of 1:7 is obtained for this study, which can be considered satisfactory. The flowchart of the research methodology for the study is illustrated in [Figure 1].

Data Analysis

Background Information of the Respondents

Most of the respondents (54.1%) worked in consulting organisations while 45.9% worked in the contracting establishments. Majority of the respondents were professional staff (67.4%), with minimum of bachelor's degree (75.5), with over five years working experience in the construction industry. Furthermore, 64.4% of the respondents are quantity surveyors, 12.2% engineers, 12.2% project managers, 6.1% builders, and 5.1% architects. It is important to note that, in reality, in the Nigerian construction industry, the project managers among the respondents may belong to either of the four-target respondent. Most construction professionals obtained postgraduate degree in project management and may prefer to be addressed as a project manager, and not by their primary discipline, i.e., architect, quantity surveyor, builder, and engineer. Above 60.0% of the respondents' organisations are small-enterprises, 23.4% worked in medium-sized enterprises and 13.3% are in large scale enterprises according to means of classifications of establishments in global market [106]. In addition,

all the respondents had been involved in virtual construction project coordination [Table 2]. Although multiple questions would have been better to check the practical involvement of the respondents in virtual project coordination [107], ordinal question (such as Likert scale) or nominal question (such as yes or no question) may also provide an overview information for exploratory study as this [108, 109]. Therefore, the respondents can be adjudged to be qualified to provide valuable opinions to this study.

Descriptive Statistics and Mann-Whitney Result

The descriptive statistics of the construction professionals on the ethical issue in virtual project coordination is shown in [Table 3]. Among the construction professionals in contracting firms, 'communication barrier' ranked highest with mean score of 3.84. Both 'organisational hierarchy' and 'cultural differences' had the same mean score of 3.82 but ranked second and third position because of the different standard deviation of 0.86 and 1.03. When two or more variables have the same mean scores but different standard deviation, ranks are allotted in the descending order of the standard deviation [110]. The fourth ranked ethical issue among the contracting firms' group is 'team member training' with mean score value of 3.78. On the part of the respondents in the consulting firms, 'conflict of interest' ranked first with mean value of. 3.62, while 'team member training' ranked second with mean score value of 3.62, 'organisational hierarchy' and 'project management and control technique' ranked third and

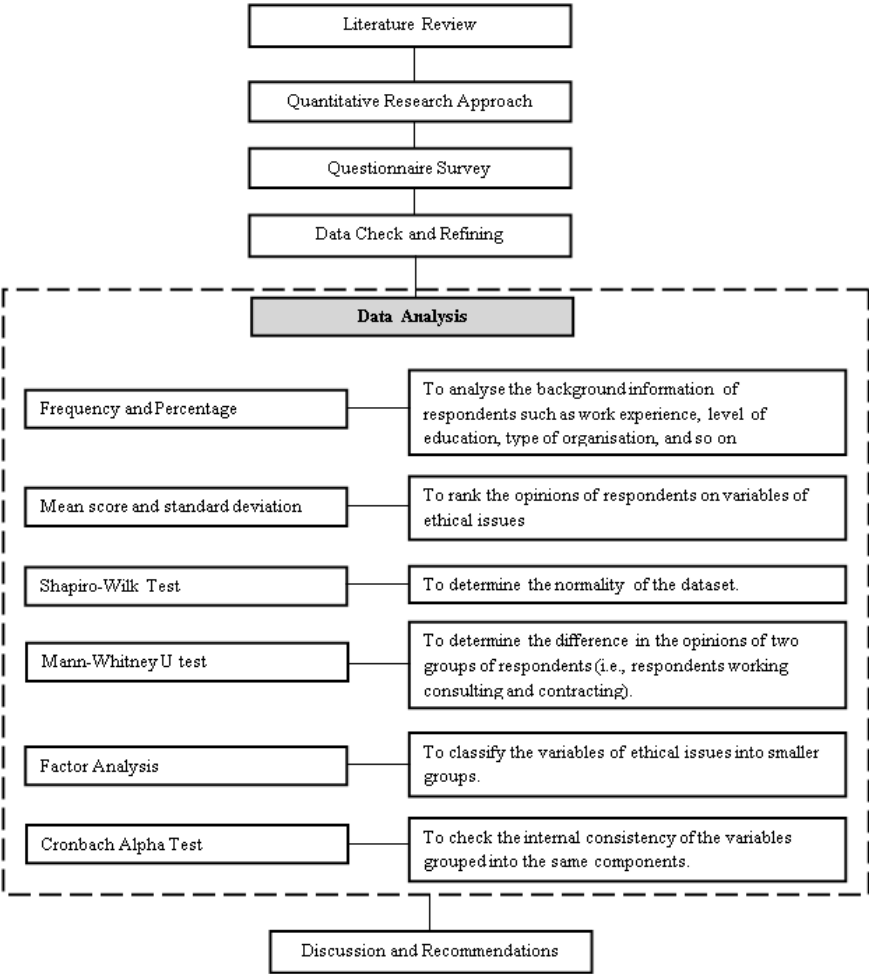


Figure 1:

Table 2: Background Information of Respondents.

Demographic variable	Category	Frequency	Percentages
Type of organisation	Consulting organisation	53	54.1
	Contracting organisation	45	45.9
Working position	Professional staff	66	67.4
	Technical staff	16	16.3
	Division head and above	6	6.1
	Clerical staff	4	4.1
	Others	6	6.1
Level of education	Ordinary national diploma (OND)	3	3.1
	Higher National Diploma (HND)	21	21.4
	Bachelor	55	56.1
	Master	17	17.4
	Ph.D.	2	2.0
Work experience	1-5 years	62	63.3
	6-10 years	24	24.5
	11-15 years	7	7.1
	16-20 years	1	1.0
	Above 20 years	4	4.1
Professional background	Quantity surveyor	63	64.4
	Builder	6	6.1
	Architect	5	5.1
	Engineer	12	12.2
	Project manager	12	12.2
Size of firm	10-50 employees	62	63.3
	50-199 employees	23	23.4
	Above 199 employees	13	13.3
Participation in virtual project coordination	Yes	98	100.0
	No	0	0.0

Table 3: Ethical Issues in Virtual Project Coordination.

Ethical issues	S-W	Overall				Contracting firms			Consulting firms			M-W
		M	S.D.	Rank		M	S.D.	Rank	M	S.D.	Rank	
Team member trust	0.000*	3.42	1.18	9		3.60	1.07	8	3.23	1.28	9	0.151
Ecological issues (characteristics of team members)	0.000*	3.13	0.97	13		3.16	0.95	13	3.09	0.99	11	0.860
Conflict of interest	0.000*	3.67	1.06	3		3.71	1.01	4	3.62	1.11	1	0.796
Whistle blowing	0.000*	3.16	1.17	11		3.42	1.06	11	2.89	1.27	13	0.035*
Data protection	0.000*	3.40	1.24	10		3.62	1.13	7	3.17	1.35	10	0.108
Issues in decision making techniques	0.000*	3.56	1.11	7		3.69	0.90	5	3.42	1.31	5	0.468
Organisational hierarchy issues	0.000*	3.69	1.04	2		3.82	0.86	2	3.55	1.22	2	0.397
Team cohesiveness	0.000*	3.42	1.13	9		3.56	1.04	9	3.28	1.22	8	0.288
Cultural differences	0.000*	3.64	1.09	4		3.82	1.03	2	3.45	1.14	4	0.092
Project management and control technique issues	0.000*	3.59	1.18	5		3.64	1.13	6	3.53	1.23	3	0.694
Legal issues	0.000*	3.42	1.08	9		3.53	1.01	10	3.30	1.14	7	0.365
Virtual trauma	0.000*	3.14	1.08	12		3.22	1.09	12	3.06	1.06	12	0.475
Regulatory challenges	0.000*	3.46	1.13	8		3.53	1.10	10	3.38	1.16	6	0.514
Communication barrier	0.000*	3.57	1.19	6		3.84	1.15	1	3.30	1.22	7	0.019*
Lack of team member ethical training	0.000*	3.70	1.23	1		3.78	1.17	3	3.62	1.29	1	0.620

Note: S-W = Shapiro Wilk, M = Mean score, S.D. = Standard deviation, M-W = Mann-Whitney

fou5rth with mean score of 3.55 and 3.53 respectively.

[Table 3], also shows the results of Shapiro-Wilk and Mann-Whitney U tests of the ethical issues confronting virtual project coordination. The results of Mann-Whitney U test revealed that the only ‘whistle blowing’, and ‘communication barrier’ had significant difference of 0.035 and 0.019 respectively among the respondents in the contracting and consulting firms. This implies that the construction professionals in both contracting and consulting organisations have different views of only whistle blowing and communication barrier.

Factor Analysis

Based on the results of the analysis, the adequacy test of the data generated a Kaiser-Meyer-Olkin (KMO) of 0.879 at significant level of 0.000 [Table 4]. The values imply that the Bartlett’s Test of Sphericity for correlation adequacy of the dataset was significant. The value of the KMO, p-value at the degree of freedom (df) of 105, and chi-square value of 848.697 indicates that exploratory factor analysis is appropriate to determine the groups of the variables in the dataset.

Table 4: KMO and Bartlett's test.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.879
Bartlett's Test of Sphericity	Approx. Chi-Square	848.697
	Df	105
	Sig.	0.000

Table 5: Factor Analysis of Ethical Issues in Virtual Project Coordination.

Factors	Ethical issues	Component			Alpha
		1	2	3	
KMO = 0.879					
Communication and managerial issues	Project management and control technique issues	0.825			0.878
	Communication barrier	0.755			
	Lack of team member ethical training	0.755			
	Team cohesiveness	0.571			
	Legal issue	0.521			
Cooperation and environmental issues	Conflict of interest		0.764		0.867
	Ecological issues (characteristics of team members)		0.748		
	Team member trust		0.684		
	Issues in decision-making techniques		0.665		
	Organisational hierarchy issues		0.608		
	Data protection		0.558		
	Cultural difference		0.531		
Coordination and moral issues	Virtual trauma			0.866	0.710
	Regulatory challenges			0.652	
	Whistleblowing			0.490	

Varimax rotation was adopted in the factor analysis to determine the groupings of the items [Table 5] Shows the factor loading of the ethical issues and the corresponding alpha values. The factor loading of all the variables is higher than 0.300 which is often regarded as minimum benchmark for convergence of items with similar characteristics. A higher factor loading of 0.5 was considered as more suitable in past studies [107]. Based on the results of the analysis, the factor loading of an item, i.e., whistleblowing was 0.490, which is higher than 0.3. Past studies suggested deleting the items with factor loading less than 0.50 and re-analysis the remaining variables in second round [111, 112], meanwhile factor loading of 0.30 could be maintained with satisfactory alpha value as well [14]. Therefore, the “whistleblowing” with factor loading of 0.490 was retained in this study. The internal consistency of the factor groups was checked with Cronbach alpha value [113]. Interestingly, the alpha value of the factor group which “whistle blowing” falls into is 0.710, while alpha values of other groups are 0.878 and 0.867 respectively. These values are above acceptable threshold of 0.6 and can be considered satisfactory for the study [114].

Discussion

Based on the results of the analysis, five ethical issues such as ‘project management and control technique’, ‘communication barrier’, ‘team member training’, ‘team cohesiveness’ and ‘legal issue’ are labelled “Communication and managerial issues”. Seven items, namely ‘ecological issues’, ‘conflict of interest’, ‘team member trust’, ‘decision-making techniques’, ‘organisational hierarchy’, ‘data protection’ and ‘cultural difference’ are named “Cooperation and environmental issues”, while the last three ethical variables, i.e., ‘virtual trauma’, ‘regulatory challenges’, and ‘whistle blowing’ are referred to as “Coordination and moral issues”. The names of the factors were chosen based on the researcher’s discretion, as [115], argue that there is no specific scientific procedure to follow when naming the grouping of items in factor analysis. The given names, on the other hand, largely represent the items that constitute the ethical issues.

Communication and Managerial Issues

The five ethical issues (i.e., project management and control techniques, communication barrier, team member training, team cohesiveness, data protection and legal issue) denote items for describing “communication and managerial issues” associated with virtual project coordination. Communication is so important in coordinating and managing a project successfully. Meanwhile, communication barriers exist in virtual working environment, especially on complex construction projects with multidisciplinary stakeholders of various nationalities [116]. Although communication ought to promote cooperation among construction participants, it could contribute a barrier to construction project coordination if the team members are not aware of the dynamics of virtual working environment and how to manage it to the advantage of the project [9]. It is worthy to note that “communication barriers” has a divergent view from the respondents in consulting and contracting organisations in this study. This may be linked to the knowledge of construction professionals on web-based collaborations software that can lessen communication-related issues among virtual teams. Thus the need for training to enhance communication among construction stakeholders in virtual team. Interestingly, lack of team member training on ethics also constitutes an ethical issue in virtual project coordination. Construction professionals are primarily trained in the coordination of construction projects in physical environments; thus, further training is required to be versatile in undertaking required professional tasks in virtual platforms [117]. The situation may be worse if the construction professional responsible for project coordination is elderly and incompetent in the use of digitalised tools and software. In fact, construction professionals often display resistance to change in use of technology [118].

On the other hand, team cohesiveness also constitutes an ethical issue in virtual project coordination in this study as well. Team cohesiveness which can be discussed within the purview of commitment is often an ethical issue in virtual environment. It is widely reported that virtual

participants are less cohesive in goals and commitment [78] [119, 120]. Given that multidisciplinary stakeholders in construction projects may be in different time zones, this may impair the virtual team members' productivity, mental attentiveness, and cohesiveness. Additionally, technical glitches leading to difficulty joining online platforms can lessen enthusiasm. However [121], asserted that improving the level of cohesiveness of remote participants requires that they share the same goals about on the project's objectives.

Cooperation and Environmental Issues

The items of "cooperation and environmental issues" in this study are ecological issues, conflict of interest, team member trust, decision-making techniques, organisational hierarchy, and cultural difference. Conflict of interest, a form of corruption, has the highest factor loading in this group. This imply that corruption is not mainly limited to traditional-based projects, construction professionals can still engage in one form of corruption or the other in virtual project [122]. Also, various parties on construction project team have various intents towards the project and can result in ethical issues in the coordination of the projects virtually. Ecological issue in virtual project coordination also has a high factor loading in this group. Environmental factors and conditions have a great effect on how human beings behave and respond to external conditions [123]. The concept of naturalistic moral judgements in paradigmatic cases revealed that ecological issues affect performances, especially in a virtual environment. In contrast to paradigmatic cases, AR-VR grounded principles frequently fail to accurately model the situational features of paradigmatic moral judgments [124].

It is also important to note that trust can be a significant issue in virtual environment because the intent and gestures of participants can be easily predicted in a physical environment [9]. The various locations of construction professionals, especially in environments where there is low internet bandwidth can make virtual participant's put-off their camera in virtual meetings while communicating verbally. Apart from this, professionals are also careful to share confidential information on virtual platforms to avoid other competitors in the industry has access to organisation secrets. In addition, organisational hierarchy and cultural difference can be critical issues in virtual project coordination [75]. Construction professionals from high-power and low-power distance countries could work on the same project being coordinated virtually. A participant from high-power distance may display silent disposition when an elderly professional is making suggestion because of the cultural background that discourage young ones from freely expression themselves. Meanwhile, other participants from low-power distance nations may freely object an older construction professional, thereby, creating wrong or supposedly unethical expression to others. Therefore, the decision-making techniques by the team leader or facilitator of a virtual environment are crucial for professionals from different cultural backgrounds to have productive discussions without infringing individual ethical stands and cultural perspectives [125].

Coordination and Moral Issues

The analysis revealed that virtual trauma, regulatory challenges, and whistleblowing represent "coordination and moral issues" connected to virtual construction project coordination. Among the digital technologies that have been identified to support coordination process on virtual construction project are the wearable technologies such as the virtual reality and other head-mounted displays. It has been identified that some professionals experience virtual trauma which is classified under the post-traumatic stress disorder after using some of these

wearable technologies. The knowledge of trauma that surrounds the use of digital technologies in a virtual setting can affect the performance of construction professionals and cause phobia as well. Likewise, the adoption of internet of things, big data and blockchain technology on construction projects has led to review of regulatory issues which could impact the privacy and rights of the people connected to the project directly or indirectly [126-151]. Although whistle blowing has the least factor loading in this study, it can also constitute ethical issues in virtual environment. Importantly, whistleblowing is indicated to have a significant difference in the opinions of respondents in consulting and contracting organisations [Table 3]. In reality, whistleblowing may be thought to thrive only in a physical environment. However, advancement in technologies could make detection of whistle-blowers easier in organisations when all employees are mandated to use firm's internet connection and digital devices [49]. The savviness of respondents in the versatility and detective capacity of digitalisation in organisations may inform the divergent opinions revealed in this study.

Recommendations and Implications of the Findings

Recommendations

This study investigated ethical issues in virtual construction project coordination via survey of construction professionals in the Nigerian construction industry. Three major categories of ethical issues were denoted in the study through factor analysis, in which practical recommendations can be provided. The study revealed "communication and managerial issue" as one of the components deduced from the analysis conducted. It is evident from the items that converged into 'communication and managerial issue' that collaboration between different team members is indispensable in virtual construction project coordination. Therefore, it is recommended to ensure that all multidisciplinary construction stakeholders collaborate effectively for the delivery of the project. As conflict which may hinder collaboration in a team is inevitable, it is advised that any issue of concern should be discussed extensively and addressed by the management or other relevant department to find the required solutions. In addition, any managerial issue that requires attention should also be disclosed or make known for prompt actions.

"Cooperation and environmental issue" are also depicted as a key factor of ethical issue in virtual construction project coordination. This factor comprises conflict of interest, team member trust, decision-making techniques, organisational hierarchy, cultural difference, and so on. It is important to note that these ethical issues have a significant impact on construction projects being coordinated virtually. Therefore, it is recommended that techniques and digital tools that can enhance cooperativeness among the team members in various disciplines and cultural orientations should be adopted in construction projects. There may be need for the entire team member to learn and know about the basic cultural values of other professionals. For example, power-distance could be a significant hindrance between professionals coming from countries with high power-distance (e.g., China) and nations with low power distance (e.g., European). On the other hand, there may be a need or circumstance for informality in the organisational hierarchy in case of urgency or emergency to enhance the outcomes of the project.

Lastly, "coordination and moral issue" are also indicated in the study as ethical issue in virtual construction project coordination. Therefore, the need for construction professionals to conduct themselves in an ethical manner is essential in virtual construction environment. The professional bodies could also ensure that the code of conduct is strictly

followed to ensure that any defaulter is sanctioned to curb menace of unethical practices in virtual construction project coordination.

Theoretical Contributions

The study contributes theoretically to ethics management literature, especially in virtual construction work environment by identifying the list of ethical issues in virtual construction project coordination, which is rare in the Nigerian construction industry. The list of ethical issues could be useful for the construction industry to understand the significant challenges confronting virtual construction project coordination in an ethical manner in developing nations. Drawing on the respondents' opinions, the findings enrich the theoretical framework of ethic management on construction projects and are valuable to developing countries. The findings of this study can be useful for industry partners, construction professional bodies, and academic institutions to channel lifelong learning approach to lessen ethical issues in virtual project coordination and to broaden the horizon of construction professionals.

Managerial Implications

Moreover, the study will further contribute to the body of knowledge by providing construction stakeholders with the issues that surround the coordination of construction projects virtually in their quest to deliver of construction projects. The knowledge of the ethical issues can also assist the management arm of construction companies to equip their construction team on the envisaged obstacles in complex construction projects with international participants. Therefore, construction organisations can continually deliver projects to the required performance in term of time, cost and quality.

Conclusion

This study investigated the ethical issues associated with virtual construction project in the Nigerian construction industry. The ethical issues in virtual project coordination have been classified into three major categories: communication and managerial issues, cooperation and environmental issues, and coordination and moral issues. To address the ethical issues on virtual construction project coordination in Nigeria, industry professionals must be ready to collaborate with professional bodies in a bid to deliver quality project. Also, industry professionals should collaborate with companies providing software's and digital tools that are compatible with project coordination virtually. In addition, strict attention should be paid for effective communication among project stakeholders and individual responsibilities of project team members engaged in the execution of the project throughout its lifecycle. The characteristics of each project which makes it unique from each other could help team members select the most appropriate methods in executing the project. Finally, project stakeholders, professional bodies and project clients should ensure those ethical standards are strictly adhered too while delivering construction project from inception to practical completion. It should be ensured that digital tools used in enhancing project coordination should conform to ethical issues provided by various construction-related professional bodies and conform with organisational standard as well. This study contributes to the body of knowledge in coordinating construction projects in virtual environments. In reality, undertaking construction processes in virtual environment is indispensable in the present decades, and ethical issues have its potential to disrupt the envisaged outcomes of construction projects coordinated virtually. Therefore, the practical recommendations and implications illustrated in this study would be essential to address ethical issues in construction work

environment.

This study is limited to ethical issues confronting virtual project coordination in the Nigerian construction industry. Although the survey distribution is limited to construction professionals in the Nigerian construction industry, a commercial hub for many African countries, the results can be applicable to other developing nations with similar construction environments. Other ethical issues apart from those identified in this study or peculiar to other construction work environment can be explored through qualitative study such as interview or case studies. The conclusion of this study was drawn from sample size that is less than one hundred obtained via online platforms, paper-based survey may be administered to construction professionals to obtain larger data which can provide other interesting findings from the ones reported in this study.

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