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Assessing Risk Probability and Impact in Nigerian Road Construction Firms: A Structured Process Protocol-Based Approach

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Abstract

Construction projects are generally associated with a certain degree of risk because of their characteristics, and the projects are implemented in quite risky regions, particularly the developing countries, where the associated risk management process is fairly immature, as well as mostly calorimetric, thereby yielding unsatisfactory construction project performance. The specific objective of this study is to determine the level of probability and impact of risks in road construction projects at the construction phase by using the process protocol approach. The research used a quantitative method where out of the 260 questionnaires administered to road construction professionals, 165 were completed and returned. Both the frequency-based and parametric-based statistical techniques were used for the analysis of data. The research establishes that safety and security, bureaucracy of government, change in government policy had pointed to 100% among all the risk factors of the firms with mean score values >3.40. It was found that stiff environmental conditions had the highest level of impact among seen risks. The use of more formal risk management methodologies, such as the Process Protocol be imbibed in road construction process, which would result in a better and quicker achievement of the objectives of the country's road projects. The study also suggests that road construction firms should look for high risk and avert them appropriately to achieve projects objectives.

Keywords: Risk, Probability and Impact, Process - Protocol, Road projects and Construction Firms

Introduction

Road construction projects are vital to infrastructure development and significantly contribute to economic growth and societal well-being of any nation (Raveendran, Anagha & Renjith, Vadakkapaikkadu & Madhu, 2022). Road projects, especially those delivered in developing countries such as Nigeria are unique, huge, multidimensional, and involve many risk factors at each phase of the project life cycle. Nonetheless, a plethora of road projects in Nigeria have been unsuccessful, mainly because of risks that were not sufficiently identified, let alone addressed, at the project development and implementation phases. These are concerns such as costs, safety, environment, and time which are major challenges on road projects all over the world (Parera, Rameezdeen, Chileshe, & Hosseini, 2014). This poor management of risk particularly at the initial

stages of the project severely jeopardizes the effective and efficient delivery of road projects.The construction industry in developing countries is considered to be an essential part of the nation's economy because it helps to make a large share of the total Gross National Product (GNP) and is focused on the further development of the country's economy (Algremazy, Alferjany, & Akram, 2023). However, road projects are often faced with cost and time overruns and safety issues because of poor risk management plans (Parera et al., 2014, Oyekunle, 2024). According to Ezeabasili, Dim, Ezeabasi and Obiefuna, (2021), these risks are either escalated by loose or emergent risk management practices common to developing countries. Ijigah, Jimoh, and Agbo (2013) emphasised that Nigerian road projects are faced with risk and some of the risks are not well understood as to the type of risks which they are. To illustrate this, the financial risks, legal risks, environmental risks, and logistical risks are all unique and can influence project success. However, these risks have not been discussed adequately, hence leading to poor infrastructure and enhanced project delay (Ugwu, Osusanmi, & Aigbavboa, 2019). Risks in construction projects in Nigeria can lead to cost overruns, schedules not being met, and low quality of the project (Oyekunle, 2024).

Nnadi, Enebe, and Ugwu (2018) opined that, surprisingly, even with the increasing level of recognition being afforded to the concept of risk management, the majority of construction projects that are implemented in Nigeria today are not very adequately equipped with valid risk management strategies for risk identification, risk evaluation, and risk control. This is so especially when you consider the fact that risk management practices remain largely informal and mechanistic in the construction industry in Nigeria (Ezeabasili et al., 2021). Risk can also occur from sources like probability of project failure at any phase of the project life cycle as in planning and design phase, construction and development, sustainment of lifecycle amongst others (Gain, Mishra & Aithal., 2022). However, risk cannot be totally eradicated from projects, what is important is to manage it in such a way that its impact on the success of a project will be reduced (Hosseini et al., 2016).

The probability of something happening that will have impact on road construction project objectives may have either positive or negative impact and it is the combination of probability of occurrence of a defined threat or opportunity and the impact of the consequences of occurrences in the project (Aksana, 2016). The specific objective of this study is to ascertain the probability, and impact of risk in road construction firms at the construction stage using the process protocol approach.

Kagiouglo et al. (2000) and Ceric (2003) have described the process- protocol approach, which entails a phase-based framework and process for organising risk throughout the project's life cycle, as effective in enhancing coordination; and managing risks in multiple phases of constructing projects.

Though past research has targeted road construction projects with risks some of these have not captured the risks that may occur in the construction stage exclusively in Nigeria using the process protocol approach. The process protocol approach has proven to be more efficient in construction projects. This seeming gap is the goal of this study to present significant findings on the ways through which risks at the construction stage can be improved with the aim of improving project outcomes.

2.0 Literature Review

2.1 Risk in Road Projects

Risk in road construction is becoming a broad term; they are the probability that may happen at any stage of the project's life cycle (Nnadi, Enebe & Ugwu, 2018).
The construction industry, especially in developing countries such as Nigeria, can experience great difficulty when addressing these risks because there are no clear guidelines for risk management (Ugwu et al., 2019). These risks are magnified by the nature of road projects that are long duration in nature, involve multiple players from different organisations, and are subject to external factors (Gain et al., 2022). Hence, knowledge of risks characteristic of road projects is important to enhance the prospects of project success.

Several works have established that political, financial, and operational risks are highly critical when it comes to highway construction projects hence leading to time delays and cost blowouts (El-Sayegh & Mansour, 2015; Vishwakarma et al., 2016). However, these risks do not consider the impact of accumulation of the risks during the lifecycle of a project

especially at the construction phase of the project (Gain et al., 2022). Table 1 shows a list of risk identified that common to road projects.

Table 1: Risks Common to Roads Projects

S/N	Risk Categories	Identified Risk	Code
1	Financial / Market Risk	Price inflation in construction materials	R1
		Unavailability of critical resources in the local market	R2
		Payment delays / cash flow problems	R3
2	Management /Design Risk	Poor communication	R4
		Defective/ incomplete design	R5
		Improper project management	R6
		Short tendering time	R7
		Corruption and unethical/ practices	R8
		Unanticipated damage during construction	R9
		Accidents on site	R10
3	Legal Risk	Breach of contract by project partners	R11
		Improper verification of contract agreement	R12
		Lack of enforcement of legal judgment	R13
		Dispute	R14
		Change of government policies	R15
		Bureaucracy of government	R16
		Corruption/ Bribery	R17
		Religious and cultural conflicts	R18
		Environmental conditions	R19

4	Environmental Risk	Force majeure	R20
		Safety and Security	R21
		Stiff environmental regulations	R22
		Damage to materials and equipments during transportation	R23
5	Utilities / Logistics Risk	Availability of suitable labour and materials	R24
		Access to spare parts for equipment	R25

Source: Baba et al., (2021)

The biggest idea that stands out from the literature is that current research in road construction projects established that the risks are present but more work is required in integrating the management of risk frameworks within the Nigerian environment. Furthermore, information on the Process Protocol approach and its implementation in the management of risks in the construction phase of road projects remains scarce in the literature. This research therefore seeks to fill this gap by employing a structured risk management framework for the construction stage of road construction in Nigeria.

2.2 Process Protocol Approach

The Process Protocol that originated from the manufacturing domain readily applies in modelling risks in the construction domain at different stages of construction projects. This approach is preferable to a more haphazard and disparate approach to managing construction processes and is thus easily aligned with the project-based nature of construction (Cooper et al., 2005). This approach produces a finer-grained division of the construction process to assess risks at various phases of construction (Ceric, 2003).

2.3 Risk Probability of Occurrence and Impact in the Phases of Process Protocol

Risk is defined as the probability of occurrence of loss/gain multiplied by its respective impact (Iqbal, Choudhry, Holscheemacher, Ali, & Tomosaitiene, 2015). It is necessary to determine risk probability and risk impact for each identified risk in a particular phase, calculate the corresponding risk exposure, and depending on its acceptability, define a strategy of each response (Ceric, Marcic, & Ivandic, 2011). Risk is the probability that an event would occur which may lead to a change in the project objectives (Nnadi, Enebi & Ugwu, 2018)

The probability of occurrence and impact of each identified risk is normally accessed using agreed scales such as very low, low, moderate, high, and very high (Odimabo & Oduoza, 2013). The most difficult process in risk management is accessing the impacts on project objectives, although the challenges of assessing the probability and impacts of the risks can be attributed to inborn uncertainty in construction projects (Yoon, Tamer, & Hastak, 2015; Aksana, 2016).

3.0 Methodology

The study was basically a survey. Participants were selected based on a purposive sampling technique that involved selecting road construction firms with more than 30 years of experience, and who have worked on long-term and large-scale projects to

ensure they understood issues to do with risk management on such projects (Fellows & Liu, 2015).

Five road construction firms fall in this category. The number of professionals in the sample was arrived at from the various firm records and was 807; the sample of 260 was deemed statistically valid according to the Krejcie & Morgan (1970) table for this sample size. And the sample size was also the five road construction firms but the respondent was drawn at a proportionate level from all the firms as shown in Table 2.

Table 2: Number of professionals in the various firms for quantitative

Firms	**A**	**B**	**C**	**D**	**E**	**TOTAL**
Population	208	143	120	214	122	807
Respondents	67	46	39	69	39	260

Out of a total sample of 260 questionnaires distributed among the top and middle management professionals of five firms, 165 were returned usable. The data used for the study was limited to only the construction stage of the process protocol: stage 3 (production management phase 7 and construction phase 8). According to Shayan et al. (2019) there is the importance of proper risk management during the construction execution stage.

The categories and risk factors used were adopted from the study of Baba et al. (2021) as shown in table 1. A Ratio from Chileshe and Babajide (2010) was adopted and used to discuss the degree of risk probability and impact: >1.00 ≤1.80 =Very low; >1.80 ≤ 2.60 =Low; > 2.60 ≤ 3.40= Moderate; >3.40 ≤ 4.20= High and >4.20 ≤5.00 Very high. The 100% percentage proportion for high >3.40 >4.20 very high above across firms was also used for the analysis. In bold prints are the high level of probability of occurrence and impact risk >3.40 indicating high and >4.20 very high across the firms.

By selecting firms with more than 30 years of operation in the industry, the study ensured that the respondents possessed sufficient domain knowledge. Thus, respondents with 20 years and above years of experience were considered in order to get insight at different management levels. This design provides the adequate amount of data needed to evaluate risk management practices and increases the generalisability of the research.

4.0 Results and Discussions

4.1 Presentation of Data

Table 3: Probability of Occurrence of Risk at Construction Stage: Phase 7 (production management)

Risk	**Firm "A"**		**Firm "B"**		**Firm "C"**		**Firm "D"**		**Firm "E"**		**% Mean >3.40**
	Mean	**Std.**	**Mean**	**Std.**	**Mean**	Std.	**Mean**	**Std.**	**Mean**	**Std.**	
R1	**4.21**	0.69	**4.89**	0.31	**3.96**	0.83	2.42	0.92	2.79	0.41	**60%**
R2	**4.20**	0.69	**4.89**	0.32	**3.94**	0.83	2.81	1.07	3.15	0.77	**60%**
R3	**4.33**	0.68	**4.89**	0.32	**4.03**	0.78	**3.50**	0.63	**3.87**	0.79	**80%**

R4	**4.63**	0.48	**4.84**	0.37	**4.23**	0.60	2.96	0.63	2.93	0.42	**60%**
R5	**4.35**	0.48	**4.65**	0.48	**3.94**	0.83	2.46	0.94	2.92	0.61	**60%**
R6	**4.35**	0.48	**4.52**	0.50	**3.94**	0.83	2.79	1.19	2.84	0.56	**60%**
R7	**4.35**	0.48	**4.52**	0.50	**3.74**	1.02	3.25	1.34	**3.42**	0.71	**80%**
R8	**4.37**	0.53	**4.57**	0.50	3.23	1.13	3.34	1.08	**3.57**	0.92	**20%**
R9	**4.42**	0.64	**4.63**	0.58	**3.57**	0.50	1.98	0.87	2.58	0.72	**60%**
R10	**4.32**	0.74	**4.43**	0.84	**3.51**	0.50	1.84	0.81	2.68	0.72	**60%**
R11	**3.83**	0.97	**4.33**	0.83	**3.41**	0.64	2.32	0.86	2.79	0.41	**60%**
R12	**4.07**	0.80	**4.40**	0.70	**3.74**	0.91	2.48	0.88	2.80	0.48	**60%**
R13	**3.87**	0.88	**4.07**	0.96	**3.74**	0.91	2.38	0.87	2.78	0.65	**60%**
R14	3.37	1.03	**3.72**	1.07	3.40	1.01	2.50	1.06	2.64	0.63	**20%**
R15	2.71	1.13	2.99	1.11	2.75	0.88	**3.87**	0.61	3.04	0.84	**20%**
R16	**4.57**	0.50	**4.72**	0.45	**3.84**	0.88	**3.94**	0.68	3.22	0.85	**60%**
R17	**4.57**	0.50	**4.77**	0.42	**3.93**	0.84	**3.49**	1.01	2.81	0.88	**80%**
R18	**3.93**	1.19	**4.32**	1.16	**3.93**	1.00	2.21	0.67	2.42	0.49	**60%**
R19	2.43	0.85	2.96	1.17	2.95	1.26	2.38	0.87	2.59	0.49	**-----**
R20	**3.79**	0.81	**4.07**	0.72	2.81	1.02	2.98	1.30	3.06	0.98	**40%**
R21	**4.01**	0.88	**4.41**	0.64	**3.87**	1.18	**4.26**	1.11	**3.96**	1.06	**100%**
R22	**4.17**	0.78	**4.62**	0.54	**4.57**	0.69	2.56	1.05	2.56	0.50	**60%**
R23	**3.80**	0.81	**4.33**	0.63	**3.84**	0.88	2.13	0.80	2.47	0.50	**60%**
R24	**3.95**	0.93	**4.41**	0.49	**3.84**	0.88	2.06	0.83	2.56	0.50	**60%**
R25	**3.95**	0.93	**4.47**	0.50	**3.84**	0.88	1.84	0.88	2.44	0.50	**60%**

Source field survey (2024)

Table 3 above; provides the summative exhibit of risk exposure of five firms at the construction stage 3 (Phase 7 production management) with variations in the level of risk probability, based on the mean and standard deviation values. For Firms A and E the probability of risks at 100% and >3.40 mean values across firms. R21 (Safety and Security) is firm-specific and recur at a probability of 100% others show varying frequencies. At 80% proportion were R3 (Payment delays and cashflow problems); R7 (Short tendering time) and R17 (Bribery / corruption). At 60% were R1 (Price inflation in construction materials); R2 (Unavailability of critical resources in the local market); R4 (Poor communication); R5 (Defective / incomplete design); R6 (Improper project management); R9 (Unanticipated damage during construction); R10 (Accident on sites); R11 (Breach of contract by project partners); R12 (Improper verification of contract agreement); R13 (Lack of enforcement of legal judgement); R16 (Bureaucracy of government); R18 (Religious and cultural conflicts); R22 (Stiff environmental regulations); R23 (Damage to materials and equipment during transportation); R24 (Availability of suitable labour and materials) and R25 (Access to spare parts). Lastly at 20% were R8 (Corruption and unethical practices); R14 (Disputes) and R15 (Change of government policies).

Table 4: Probability of Occurrence of Risk at Construction Stage: Phase 8 (construction)

Risk	Firm "A"		Firm "B"		Firm "C"		Firm "D"		Firm "E"		% Mean >3.40
	Mean	**Std.**	**Mean**	**Std.**	**Mean**	**Std.**	**Mean**	**Std.**	**Mean**	**Std.**	
R1	2.64	0.48	2.96	0.40	**4.22**	0.69	**4.90**	0.30	**3.96**	0.83	**60%**
R2	3.03	0.86	**3.42**	0.74	**4.34**	0.68	**4.90**	0.30	**4.05**	0.78	**80%**
R3	**3.85**	0.86	**3.87**	0.79	**4.65**	0.48	**4.85**	0.36	**4.24**	0.60	**60%**
R4	2.71	0.51	2.95	0.39	**4.37**	0.48	**4.66**	0.47	**3.96**	0.83	**60%**
R5	2.69	0.65	3.06	0.56	**4.37**	0.48	**4.54**	0.50	**3.96**	0.83	**60%**
R6	2.91	0.65	3.04	0.62	**4.37**	0.48	**4.54**	0.50	**3.75**	1.02	**60%**
R7	3.23	0.87	**3.42**	0.71	**4.38**	0.54	**4.58**	0.50	**3.23**	1.13	**80%**
R8	3.28	1.05	**3.64**	0.87	**4.44**	0.65	**4.65**	0.58	**3.56**	0.50	**80%**
R9	2.43	0.63	2.85	0.79	**4.33**	0.74	**4.44**	0.84	**3.50**	0.50	**60%**
R10	2.65	0.48	2.78	0.64	**3.85**	0.98	**4.35**	0.82	**3.41**	0.64	**60%**
R11	2.68	0.54	2.83	0.46	**4.09**	0.80	**4.42**	0.69	**3.76**	0.92	**60%**
R12	2.67	0.68	2.85	0.61	**3.89**	0.89	**4.09**	0.97	**3.76**	0.92	**60%**
R13	2.23	0.42	2.58	0.57	**3.38**	1.04	**3.74**	1.07	**3.41**	1.03	**-----**
R14	2.44	0.82	2.89	0.83	2.72	1.14	3.01	1.11	2.75	0.88	**-----**
R15	**3.48**	0.99	**3.47**	0.82	**4.59**	0.49	**4.74**	0.44	**3.86**	0.88	**100%**
R16	**3.48**	0.99	**3.47**	0.82	**4.59**	0.49	**4.78**	0.42	**3.95**	0.84	**100%**
R17	3.20	1.01	3.13	0.93	**3.94**	1.20	**4.33**	1.15	**3.94**	1.00	**60%**
R18	2.38	0.49	2.28	0.45	2.43	0.85	2.98	1.17	2.97	1.28	**-----**
R19	2.42	0.50	2.82	0.45	**3.78**	0.81	**4.08**	0.73	2.81	1.02	**-----**
R20	3.06	1.20	3.30	0.93	**4.02**	0.88	**4.42**	0.64	**3.90**	1.17	**60%**
R21	**4.36**	1.14	**4.05**	1.04	**4.18**	0.79	**4.63**	0.53	**4.57**	0.69	**100%**
R22	2.39	0.49	2.72	0.45	**3.80**	0.82	**4.34**	0.63	**3.86**	0.88	**60%**
R23	2.23	0.42	2.52	0.50	**3.96**	0.94	**4.43**	0.50	**3.86**	0.88	**60%**
R24	2.10	0.30	2.63	0.48	**3.96**	0.94	**4.48**	0.50	**3.86**	0.88	**60%**
R25	2.10	0.30	2.63	0.48	**3.96**	0.94	**4.63**	0.49	**3.86**	0.89	**60%**

Source field survey (2024)

Table 4 illustrates the level of risk probability occurrence of the five firms at the construction stage (phase 8 construction) with variations, based on the mean and standard deviation values. For Firms A and E the probability of risks at 100% and >3.40 mean value across firms. R15 (Change in government policy), R16 (Bureaucracy of government) and R21(Safety and Security) is firm-specific and recur at a probability of 100% others show varying frequencies.

At 80% proportion R2 (Unavailability of critical resources in the local market); R7 (Short tendering time) and R8 (Corruption and unethical practices). 60% were R1 (Price inflation in construction materials); R20 (Force majeure); R9 (Unanticipated damage during construction); R11 (Breach of contract by project partners); R12 (Improper verification of contract agreement); R13 (Lack of enforcement of legal judgement); R17 (Corruption and bribery); R22 (Stiff environmental regulations); R23 (Damage to materials and equipment during transportation); R24 (Availability of suitable labour and materials), R25 (Access to spare parts). None was at 20% proportion.

Table 5: Impact of Risk at Construction Stage 3: Phase 7 (production management)

Risk	Firm "A"		Firm "B"		Firm "C"		Firm "D"		Firm "E"		% Mean >3.40
	Mean	**Std.**	**Mean**	**Std.**	**Mean**	**Std.**	**Mean**	**Std.**	**Mean**	**Std.**	
R1	0.94	0.53	1.11	0.31	1.68	0.81	2.34	0.89	2.77	0.43	-----
R2	0.97	0.59	1.11	0.32	1.66	0.82	2.40	0.92	2.79	0.41	-----
R3	1.77	1.22	1.79	1.25	2.06	1.22	2.80	1.08	3.15	0.77	-----
R4	3.28	1.02	**3.46**	0.94	3.38	0.83	**3.53**	0.65	**3.88**	0.80	**60%**
R5	1.82	0.80	2.07	0.81	2.50	0.61	2.96	0.66	2.91	0.43	-----
R6	1.56	0.65	1.54	0.66	2.13	0.70	2.44	0.94	2.93	0.64	-----
R7	2.11	0.92	2.03	0.92	2.62	0.96	2.76	1.18	2.80	0.58	-----
R8	2.86	1.03	2.49	0.94	3.22	1.31	3.22	1.32	**3.41**	0.73	**20%**
R9	2.89	1.30	2.67	1.11	3.01	1.20	3.37	1.12	**3.53**	0.93	**20%**
R10	1.42	0.49	1.54	0.50	1.68	0.47	1.95	0.87	2.57	0.72	-----
R11	1.56	0.65	1.63	0.64	1.77	0.60	1.82	0.80	2.74	0.73	-----
R12	1.93	0.83	1.93	0.92	2.01	0.83	2.33	0.87	2.79	0.41	-----
R13	1.93	0.83	1.93	0.92	2.01	0.83	2.47	0.88	2.80	0.49	-----
R14	2.00	0.81	1.97	0.89	2.05	0.79	2.37	0.88	2.75	0.64	-----
R15	2.63	0.90	2.53	1.16	2.61	0.93	2.49	1.05	2.63	0.63	-----
R16	**3.72**	0.68	**4.04**	0.90	**3.80**	0.63	3.87	0.62	3.02	0.82	**60%**
R17	**3.88**	0.74	**4.08**	0.91	**3.99**	0.69	3.96	0.70	3.21	0.85	**60%**
R18	**3.52**	1.17	3.36	1.42	**3.78**	1.15	3.51	1.04	2.77	0.87	-----
R19	1.79	0.63	2.00	1.15	2.10	0.81	2.21	0.69	2.42	0.50	-----
R20	2.01	0.48	1.85	0.59	2.21	0.63	2.36	0.87	2.57	0.50	-----
R21	2.75	1.36	2.46	1.27	2.83	1.24	2.97	1.31	3.03	0.98	-----
R22	**4.26**	1.31	**3.61**	1.43	**4.06**	1.27	**4.28**	1.13	**3.96**	1.06	**100%**
R23	1.91	0.50	1.68	0.47	2.07	0.64	2.52	1.03	2.53	0.50	-----
R24	1.61	0.49	1.54	0.50	1.66	0.47	2.08	0.78	2.46	0.50	-----
R25	1.61	0.49	1.54	0.50	1.66	0.47	2.02	0.81	2.53	0.50	-----

Source field survey (2024)

Table 5 illustrates the level of risk impact of the five firms at the construction stage (phase 7 production management) with variations, based on the mean and standard deviation values. For Firms A and E the impact of risks at 100% and >3.40 across firms. R22 (Stiff environmental regulation) is firm-specific and recur at impact level of 100% others show varying frequencies.

At 60% were R4 (Poor communication); R17 (Corruption/ Bribery) and R18 (Religious and cultural conflicts). At 40% proportion were R9 (Unanticipated damage during construction) and R10 (Accidents on sites). None at 80% and 40% respectively.

Table 6: Impact of Risk at Construction Stage 3: Phase 8 (construction)

Risk	Firm "A"		Firm "B"		Firm "C"		Firm "D"		Firm "E"		%Mean >3.40
	Mean	**Std.**	**Mean**	**Std.**	**Mean**	**Std.**	**Mean**	**Std.**	**Mean**	**Std.**	
R1	0.94	0.53	1.11	0.31	1.68	0.81	2.34	0.89	2.77	0.43	-----
R2	0.97	0.59	1.11	0.32	1.66	0.82	2.40	0.92	2.79	0.41	-----
R3	1.77	1.22	1.79	1.25	2.06	1.22	2.80	1.08	3.15	0.77	-----
R4	3.28	1.02	**3.46**	0.94	3.38	0.83	**3.53**	0.65	**3.88**	0.80	**60%**
R5	1.82	0.80	2.07	0.81	2.50	0.61	2.96	0.66	2.91	0.43	-----

R6	1.56	0.65	1.54	0.66	2.13	0.70	2.44	0.94	2.93	0.64	-----
R7	2.11	0.92	2.03	0.92	2.62	0.96	2.76	1.18	2.80	0.58	-----
R8	2.86	1.03	2.49	0.94	3.22	1.31	3.22	1.32	**3.51**	0.73	**20%**
R9	2.89	1.30	2.67	1.11	3.01	1.20	3.37	1.12	**3.63**	0.93	**20%**
R10	1.42	0.49	1.54	0.50	1.68	0.47	1.95	0.87	2.57	0.72	-----
R11	1.56	0.65	1.63	0.64	1.77	0.60	1.82	0.80	2.74	0.73	-----
R12	1.93	0.83	1.93	0.92	2.01	0.83	2.33	0.87	2.79	0.41	-----
R13	1.93	0.83	1.93	0.92	2.01	0.83	2.47	0.88	2.80	0.49	-----
R14	2.00	0.81	1.97	0.89	2.05	0.79	2.37	0.88	2.75	0.64	-----
R15	2.63	0.90	2.53	1.16	2.61	0.93	2.49	1.05	2.63	0.63	-----
R16	**3.82**	0.68	**4.64**	0.90	**3.86**	0.63	**3.99**	0.62	3.02	0.82	**80%**
R17	**3.88**	0.74	**4.78**	0.91	**3.69**	0.69	**3.96**	0.70	3.21	0.85	**80%**
R18	**3.52**	1.17	3.36	1.42	**3.98**	1.15	**3.71**	1.04	2.77	0.87	**60%**
R19	1.79	0.63	2.00	1.15	2.10	0.81	2.21	0.69	2.42	0.50	-----
R20	2.01	0.48	1.85	0.59	2.21	0.63	2.36	0.87	2.57	0.50	-----
R21	2.75	1.36	2.46	1.27	2.83	1.24	2.97	1.31	3.03	0.98	-----
R22	**4.16**	1.31	**3.67**	1.43	**4.36**	1.27	**4.18**	1.13	**3.99**	1.06	**100%**
R23	1.91	0.50	1.68	0.47	2.07	0.64	2.52	1.03	2.53	0.50	-----
R24	1.61	0.49	1.54	0.50	1.66	0.47	2.08	0.78	2.46	0.50	-----
R25	1.61	0.49	1.54	0.50	1.66	0.47	2.02	0.81	2.53	0.50	-----

Source field survey (2024)

Table 6 illustrates the level of risk impact of the five firms at the construction stage (phase 8 construction) with variations. For Firms A to E the impact of risks at 100% and >3.40 indicating high and very high mean values across firms. R22 (Stiff environmental regulation) is firm-specific and recur at impact level of 100% others show varying frequencies. At 60% were R4 (Poor communication) only. At 80% proportion were R16 (Bureaucracy of government) and R17 (Corruption/ Bribery) 20% proportion were R8 (Corruption and unethical / practices) and R9 (Unanticipated damage during construction).

4.2 Discussion of findings

The findings of this research are based on the analysis of the probability and impact of risks in the construction stage of road construction projects and the overall perceived risks in five road construction firms, as presented in Tables 3-6. The outcomes prove essential disparities in the measured risk levels across the firms. R15- Change in government policy had high probability of occurrence. Aiminhiefe (2022) noted that government policy promotes the growth and development of building construction and influences the economic climate of construction work invariably the change in government policy causes delays in the completion of building construction projects. R21- Safety and security risk poses a significant threat to the projects and has always received high scores in other studies (Ugwu et al., 2019; Okate & Kakade, 2019).

Other high-risk indices include R16-Bureaucracy of government, high-rated probability of occurrence, which is in line with the vices known in the construction sector in Nigeria (Ezeabasili et al., 2021).

The results show that risk impact at construction stage to be R22- Stiff environmental condition reported in Nigerian road construction projects. Such risks are also consistent with studies that portray such risks as long-standing issues in construction projects (Okate & Kakade, 2019).

5.0 Conclusion and Recommendation

The specific objective of this study was to ascertain the probability and impact of risk in road construction firms at the construction stage using the process protocol approach.The conclusion drawn from the findings is that high probability of risk at construction stage

are: Safety and security, Change in government policy and Bureaucracy of government. While the high impact risk at construction stage is Stiff environmental conditions. The Process Protocol is based on notions of structured risk management approaches with regard to a lifecycle framework. The theoretical implications proposed for this context indicate that it is possible to enhance the results of projects if such frameworks are integrated because it contributes to distress the uncertainty and coordination of the stakeholders. Thus, it is recommended that, the use of more formal risk management methodologies, such as the Process Protocol be imbibed in road construction process, which would result in a better and quicker achievement of the objectives of the country's road projects. The study also suggests that road construction firms should look for high risk and avert them appropriately to achieve projects objectives

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