Original Article

The Influence of Organizational External Factors on Construction Risk Management among Nigerian Construction Companies

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ABSTRACT

Background: Substantial empirical research has shown conflicting results regarding the influence of organizational external factors on construction risk management, suggesting the necessity to introduce a moderator into the study. The present research confirmed whether rules and regulations matter on the relationships between organizational external factors and construction risk management.
Methods: Based on discouragement and organizational control theory, this research examined the effects of organizational external factors and rules and regulations on construction risk management among 238 employees operating in construction companies in Abuja and Lagos, Nigeria. A personally administered questionnaire was used to acquire the data. The data were analyzed using partial least squares structural equation modeling.
Results: A significant positive relationship between organizational external factors and construction risk management was asserted. This study also found a significant positive relationship between rules and regulations and construction risk management. As anticipated, rules and regulations were found to moderate the relationship between organizational external factors and construction risk management, with a significant positive result. Similarly, a significant interaction effect was also found between rules and regulations and organizational external factors. Implications of the research from a Nigerian point of view have also been discussed.
Conclusion: Political, economy, and technology factors helped the construction companies to reduce the chance of risk occurrence during the construction activities. Rules and regulations also helped to lessen the rate of accidents involving construction workers as well as the duration of the projects. Similarly, the influence of the organizational external factors with rules and regulations on construction risk management has proven that most of the construction companies that implement the aforementioned factors have the chance to deliver their projects within the stipulated time, cost, and qualities, which can be used as a yardstick to measure a good project.

1. Introduction

According to the Project Management Institute [1], project risk is defined as an uncertain event that, if it occurs, will at least have a positive or negative outcome on project objectives such as scope, cost, time, and quality. Baloi and Price [2] also viewed risk as threats to project success, which are likely to occur when there is no proper management. In this research work, risk management will be delimited as a process of identifying and analyzing risk elements, which may occur as a result of management, material, design, finance, labor, and equipment risks, and solving them to attain the project aims.

Risk management in construction projects has a broad perspective and is a systematic way of identifying, analyzing, and

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responding to risk in achieving the project goals. The benefits of the risk management process include identifying and analyzing risk and improvement of construction project management processes with the effective use of resources [3].

However, improper risk management has been found to be the cause of time and cost overrun in construction projects [4]. According to Ojo [5], it is impossible to remove all risks in construction projects. Thus, there is need for a proper risk management process to manage various types of risks.

In most literature on risk, researchers further propose the definition of risk as "the probability of occurrence of any unexpected or ignored event that can hinder the achievement of project objectives, which may be in the form of management, materials, design, finance, labour and equipment risks" [6].

Preceding empirical research in Nigeria has shown that industries that provide construction services on a periodic basis do not systematically apply risk management practices in projects, which has resulted in negative consequences on the performance of projects (e.g., total abandonment of the project) [4]. Furthermore, research conducted by Ojo [5] on claims and contract disputes in many construction projects reflected the event of risk occurrence that was not well analyzed or integrated by either clients, contractors, or consultants as one of the main causes of claims and disputes in the construction projects.

Management of risk is an important role a project manager must undertake. However, a project manager's role is predominantly difficult and wasteful if good risk management policies have not been put into practice from the beginning of the project. Efficient and effective risk management approach entails implementation of proper systematic methodology, especially from the aspect of experience and knowledge. Certain empirical research results in Nigeria have shown that owners, contractors, and consultants do not systematically apply risk management practices in Nigerian construction industries, which in the long run will lead to negative consequences on the projects' performance [7]. In the same vein, Iroegbu [8] affirmed that Nigerian construction industries have failed to place more emphasis on risks during the construction project and such risks when not properly managed have added to project failure within the construction industries.

Algahtany and co-workers [9] performed a study on construction projects in Saudi Arabia and revealed that poor performance of the projects in the past three decades affected the overall performance of the construction industries in the country. The authors further argued that conventional risk management practices are not producing an intended effect toward assisting the on-time delivery of projects from the contractors within budget while setting quality expectations.

Therefore, for an efficient and effective risk management approach, it is essential to have a proper and systematic methodology and, more importantly, knowledge and experience of various types of project that has been handled before. For example, it requires knowledge on the unforeseen circumstances that may occur during the project execution, on the actions that work well or not when one of these events occurs, or on methods to evaluate a risk or estimate the probability that it will occur as soon as possible [10].

As a result of that, it has been asserted by various studies, such as Karim Jallow et al [11], Geraldi et al [12], Doloi [13], Moe and Pathranarakul [14], Abu Hassan et al [15], Simpkins [16], Ho and Pike [17], Kangari and Riggs [18], Israelsson and Hansson [19], Scupola [20], and Lewis et al [21], that specific organizational external factors (political, economic, and technology factors) have a relationship with construction risks management with moderating effects of rules and regulations as affirmed by a number of studies [7,8,10,22,23].

In many studies, rules and regulations as a potential moderator have not received significant attention, but such a consideration might enhance our theoretical understanding and render empirical evidence on how rules and regulations affect the relationship between organizational external factors and construction risk management among construction companies operating in Abuja and Lagos, Nigeria.

2. Materials and methods

2.1. Conceptualization of organizational external factors

Organizational factors were conceptualized by Kumaraswamy and Chan [24] as being intangible resources because they cannot be seen physically by any organization. According to Kumaraswamy and Chan [24], organizational external factors are a multidimensional construct that is composed of three dimensions: political, economic, and technology factors. Jabnoun and Sedrani [25] viewed political factors as the influence of environmental variables such as safety, community perception, and legal acceptability; importantly, the impact of political and social factors on a project is mostly high. It was further explained by the authors that political factors included discriminatory legislative, covering tax regimes, riots, strikes, civil unrest, wars, terrorism, invasions, and religious turmoil. In the same vein, economic factors can be seen as the accessibility of materials, finance, equipment, labor, and the degree of demands. It also includes economic growth, interest rates, exchange rates, and the inflation rate [20].

Aniekwu [26] perceived technology factors as an environment that must be considered in developing countries' strategic plans. Ojo [5] asserted that a suitable and proper construction technology can be measured by the presence of plant and equipment that are made locally, magnitude of local material resources and the level of utilization of the local construction resources, and skilled manpower resources.

However, the authors believe that there were trade-offs concerning this approach. Blalock [27], for example, argued that organization cannot attain simplicity, accuracy, and generality simultaneously. Hence, the authors opted for accuracy and generality with proper control within the organization through the use of organizational control theory.

2.2. Organizational external factors and construction risk management

Several researchers have studied the influence of organizational external factors on the company and their relationship with construction risk management. Ho and Pike [17] advocated that external factors to a company would influence the company together with the application of information technology in construction projects. This is in line with the findings of Kangari and Riggs [18] who indicated external factor as one of the factors that influenced the practice of technology in construction projects. Thus, results of studies with experts reliably indicate the influence of external factors.

In a study on factors influencing flexibility in buildings in Sweden, Israelsson and Hansson [19] discovered that in the design phase, building projects are mostly affected by political decisions, which subsequently affects decision making and flexibility in buildings. Political decision also positively influences construction risk management within the organization, by which some companies are politically connected to one another. The authors further discussed that those who are connected to the ruling party tend to receive more capital, support, and huge projects with experts, compared with those who are not. The study by Jabnoun and
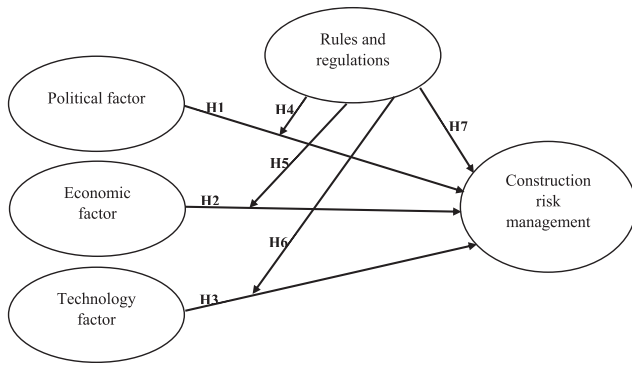
Fig. 1. Conceptual model.

Sedrani [25] established a nonsignificant relationship between political factor and construction risk management.

Similarly, Scupola [20] found that economic factors positively influence construction risk management. The author suggested that competition in the economy and the role of government would positively influence construction risk management, because the materials to be used in the construction project are not available in the market. Competition in the economy would persuade construction companies to devise a way to achieve a competitive advantage, which will make companies to be more creative in achieving their needs.

Furthermore, Israelsson and Hansson [19] affirmed a negative relationship between economic factors and construction risk management. With regard to the aforementioned conflicting results, the following direct hypotheses were formulated.

Hypothesis 1. Political factor has a positive relationship with construction risk management.

Hypothesis 2. Economic factor has a positive relationship with construction risk management.

Hypothesis 3. Technology factor has a positive relationship with construction risk management.

2.3. Rules and Regulations As a Moderator

Rules and regulations are defined as the statement, standard, or procedure of a general pertinence adopted by an organization's board that addresses certain issues related to types of construction materials to be used, process and steps involved before project execution and safety of employees [16].

Rules and regulations are well-established factors that maintain a significance influence on several actions within an organization [7].

Research also suggested that rules and regulations are positively related to proper control at work. For example, rules and regulations are connected with all aspects of construction activities, such as all protocols or measures that are involved before the initiation and closure of a project. A longitudinal study by Aniekwu [26] affirmed that organizations that duly follow the prescribed rules and regulations by the government either while procuring materials, drawing plans, or performing other activities involved in construction will record less occurrence of risk in the project [22].

In addition to being directly related to construction risk, the authors propose that rules and regulations moderate the relationship between organizational internal factors and construction management, as noted by Flamholtz et al [28]. The main principle of the organizational control theory is that organizations that

follow rules and regulations with levity hands and having low control within the organization are more likely to experience high risk during the construction process. Theoretically, rules and regulations might moderate the relationship among effective communication, team competency, and skills and active leadership (organizational internal factors) with construction risk management in various ways (Fig. 1).

In line with the empirical evidence and theoretical opinion presented in this study, it is expected that rules and regulations buffer the relationships among political factor, economic factor, and technology factor (organizational external factors) in construction project management. In other words, risk management will be stronger (i.e., more positive) for organizations that have well-established rules and regulations concerning the aforementioned factors than those without.

Hypothesis 4. Rules and regulations positively moderate the relationship between political factor and construction risk management.

Hypothesis 5. Rules and regulations positively moderate the relationship between economic factor with skills and construction risk management.

Hypothesis 6. Rules and regulations positively moderate the relationship between technology factor and construction risk management.

Hypothesis 7. Rules and regulations positively moderate construction risk management.

3. Results

3.1. Data collection and sample

This is a cross-sectional study. Data for this study were obtained (only once) from 238 contractors (i.e., contract manager, executive director, marketing manager, project manager, and engineers) operating in local, national, and multinational construction companies in Abuja and Lagos (Nigeria). Contractors were selected as the suitable respondents for this study following the previous literature because they are the best people who have an idea on what risk is all about in construction companies [29]. Besides, local, national, and multinational construction companies were selected following research guidelines [30,31].

We chose Abuja and Lagos for our study analysis because these two states are the heart of construction actives in Nigeria, as noted in two studies [30,32]. Likewise, proportionate stratified random sampling technique was used in this study, and samples were selected randomly from each stratum.

Of the total 238 respondents, there were 10.9%, 3.4%, 5.0%, 31.5%, and 30.3% contract manager, executive director, marketing manager, project manager, and engineers, respectively. Likewise, their working experience ranged from 1 year to 47 years. Both male and female respondents were included (male, 76.5%; female, 23.5%). Based on the aforementioned assertions, the respondents were knowledgeable enough to participate in this study.

Furthermore, the company's specializations were apartment buildings (36.6%), roads (54.7%), and bridges (6.7%), respectively. The types of company ownership were local, national, and multinational with 63.0%, 6.3%, and 30.3%, respectively. Their company business locations were local market areas (60.1%), within few states (3.8%), regional (2.5%), across Nigeria (16.8%), and international markets (18.4%). The total number of employees in the company ranged from 10 to 7,000. Hence, the study sample provides a reasonably representative coverage of the Nigerian construction industries.

Similarly, the organizational external factors and moderating variables (political, economic, and technology factors, and rules and regulations) were adapted from Kumaraswamy and Chan [24], and the construction risk management variables were adapted from Aibinu and Jagboro [4]. Furthermore, the scale rating—0.1 = "very low", 0.3 = "low", 0.5 = "medium", 0.7 = "high", and 0.9 = "very high"—was used to measure the feedback to the questionnaires, following [1]. This study questionnaire was shared equally among the academicians and practitioners in construction industries to be assessed to ensure its content validity, readability, and brevity, while their feedback was used to improve the questionnaire before the main survey.

3.2. Nonresponse bias and common method variance

To ascertain the likelihood of the nonresponse bias, the early responses (i.e., 143 respondents) and late responses (i.e., 95 respondents) were compared following the approach suggested by Chin et al [33]. Those that responded to the first request were regarded as early responses, whereas those that responded after the follow-up through telephone calls and e-mails were regarded as late responses, which were considered as nonresponding companies. The assessment was executed for all the variables used in this study. The results indicated that there were no significant differences (at $\alpha = 0.05$) between the early responses and the late responses. Therefore, there is no difference between responding companies and nonresponding companies, which signifies that there is no response bias in this study.

In the same vein, the issue of common method variance (CMV) was also handled because the gathered data are perceptual and were obtained from single informants (i.e., construction companies). First, the CMV was statistically assessed through the Harman single-factor test [34]. All the measures were then loaded into an exploratory factor analysis. Factor analysis showed the presence of multiple factors, and therefore, it is unlikely that the CMV may cause any bias among the variables measured. Second, Simpkins

[16] suggested anticipating the presence of CMV in the extremely high correlation range among the measures. Based on the correlation analysis, there is no extreme correlation coefficient among the variables studied. Thus, a substantial amount of CMV is not an issue in the study.

3.3. Analysis and results

Before the actual analysis, various assumptions of multicollinearity, linearity, and normality were ascertained [35]. Because these assumptions were affirmed, the authors used partial least squares (PLS) path modeling and Wold [36,37] with the use of Smart PLS 2.0 M3 and as suggested by Ringle et al [34], the theoretical model was established. The PLS path modeling is seen as a statistical technique "entailed to evaluate a network of causal relationships, based on a theoretical model, connecting two or more latent composite concepts, which each is measured through a number of observable indicators" [38].

The PLS path modeling is conceived to be the most appropriate technique in this study for respective reasons. First, PLS path modeling possesses the potential of estimating the relationships between the constructs (structural model) and the relationships among the indicators and their matching latent constructs (measurement model) at the same time [33,36,39—41]. Second, PLS path modeling is conceived properly, as the authors aimed to forecast construction risk management, which is seen as the endogenous latent variable [42—45]. Third, PLS path modeling has been conceived as a utile and favored multivariate analysis technique in psychological and social research such as in technology management, accounting, operations management, information systems, and marketing [43,45—48].

3.3.1. Measurement model

To determine the psychometric attributes of the scales adopted in the current research, individual item reliability, internal consistency reliability, and discriminant validity were determined. First,

Table 1
Measurement model assessment result

Constructs	Items	Outer loadings	Average variance extracted	Construction risk
Political factor	PL3. Our construction projects are not affected by government instability.	0.8062	0.6729	0.8044
	PL4. Government subsidies on construction materials are beneficial to our company.	0.8341		
Economic factor	EN3. In our company, inflation has no impact on construction materials.	0.6767	0.6091	0.7541
	EN4. In our company, exchange rates do not affect construction materials.	0.8719		
Technology factor	TG1. Our company makes use of new construction materials.	0.7307	0.5063	0.8038
	TG2. In our company, we use new construction method.	0.7448		
	TG3. In our company, there is technology simplicity.	0.6823		
	TG4. In our company, we use new technology.	0.6862		
Management risk	MG7. In our company, there is safety during construction.	0.7009	0.5001	0.7999
	MG8. In our company, there is a database in estimating activities.	0.7280		
	MG9. In our company, there are proper site management and supervision.	0.7230		
	MG12. In our company, there is contract negotiation.	0.6757		
Material risk	MT1. In our company, we have direct access to materials in the market.	0.7585	0.6538	0.7901
	MT2. In our company, there is fast delivery of materials.	0.8557		
Design risk	DS4. Complete designs are used in our company.	0.8083	0.5721	0.7992
	DS5. In our company, there are no delays in design information.	0.6576		
	DS6. In our company, there is adequate design team experience.	0.7942		
Finance risk	FI1. In our company, there are no delays in payment.	0.7878	0.5178	0.7619
	FI2. In our company, there is no financial failure.	0.7213		
	FI4. In our company, there is no price escalation.	0.6423		
Labor and equipment risk	LE2. In our company, there is adequate equipment productivity.	0.7529	0.5259	0.8160
	LE3. There is adequate equipment in our company.	0.6976		
	LE6. In our company, there is fast maintenance of equipment.	0.7260		
	LE7. There is new equipment in our company.	0.7234		
Rules and regulations	RG2. In our company, we obtain permission from municipality.	0.5960	0.5217	0.7633
	RG3. In our company, we wait for approval of drawings and samples of materials.	0.7988		
	RG4. In our company, we obtain the permit from the urban planning bureau.	0.7562		

individual item reliability was determined by analyzing the outer loadings of each construct's measure [44,49]. Following the rule of thumb for holding items with loadings above 0.50 [50,51], the authors deleted 10 of 53 items because their loadings were below this threshold. Thus, for the whole model, only 43 items remained as they depicted loadings between 0.596 and 0.8557 (Table 1).

Table 1 depicts the element that was used to assess construction risk management with five dimensions such as management, material, design, finance, and labor and equipment risks, while organizational external factors were assessed with political, economic, and technology factors, with rules and regulations being the moderator assessed as a one-dimensional construct.

Afterward, the composite reliability coefficient was used to determine the internal consistency reliability of measures. The reading of internal consistency reliability with the use of the composite reliability coefficients was based on the rule of thumb suggested by Bagozzi and Yi [52] and Hair et al [43], who suggested that the composite reliability coefficient must be at least 0.70 or more. Table 1 presents the composite reliability coefficients for the latent constructs. As depicted in Table 1, the composite reliability coefficient of each latent construct ranged from 0.7541 to 0.8044, respectively. As each of the latent constructs are beyond the minimum threshold of 0.70, the consistency reliability of the measures used in this study was regarded as adequate [43,52].

Finally, discriminant validity was assessed using average variance extracted (AVE) as proposed by Fornell and Larcker [53]. This was attained by equating the correlations between the latent constructs, which is achieved with the square root of the AVE [42].

To attain acceptable discriminant validity, Fornell and Larcker [53] further proposed that the square root of the AVE must be greater than the correlations between the latent constructs. As depicted in Table 2, the correlations between the latent constructs were equated with the square root of the AVEs (indicated in bold face). Table 2 also depicts that the square roots of the AVEs were all greater than the correlations between the latent constructs. Hence, this study proposed adequate discriminant validity.

3.3.2. Structural Model Results

To ascertain a significance of the coefficients for the actual model, the authors used a standard bootstrapping process with 5,000 bootstrap samples and 238 cases [43,53]. Table 3 and Fig. 2 present the significant paths for this research model. Fig. 2 depicts the diagrammatical histrionics of the results for the structural modeling analysis proposed for checking the hypothesized relationship between the latent variables. Given that the author's hypotheses are specified in a directional form and the power of one-tailed test is greater than for two-tailed test, the one-tailed test was chosen [54].

However, we are not suggesting ignoring the two-tailed test while testing a theory because we realize that there are some conditions in which a two-tailed test is suitable [55]. Zikmund et al [3], for example, pointed out that two-tailed test is more suitable when the researcher is not sure about the directionality of the study hypotheses. Hypothesis 1 anticipated that economic factor would be positively related to construction risk management. The results (Table 3) affirmed that economic factor had a significant positive relationship with construction risk management ($\beta = 0.085$, $p < 0.01$). Therefore, Hypothesis 1 was strongly supported.

Similarly, Hypothesis 2 anticipated that political factor would be positively related to construction risk management. The result affirmed that political factor is negatively related with construction risk management ($\beta = 0.0259$, $p < 0.1$). Hence, Hypothesis 2 did not support the research findings.

Hypothesis 3 also suggested that technology factor positively related to construction risk management. The result disclosed that technology factor positively influenced construction risk management ($\beta = 0.4695$, $p < 0.01$).

Likewise, Hypothesis 4 predicted that rules and regulations positively moderate the relationship between economic factor and construction risk management. The result showed that rules and regulations positively moderate the relationship between economic factor and construction risk management, which shows that the hypothesis is supported ($\beta = 0.0416$, $p < 0.1$).

Hypothesis 5 anticipated that rules and regulations positively moderate the relationship between political factor and construction risk management. The result disclosed that rules and regulations moderate the relationship between political factor and construction risk management negatively ($\beta = -0.0006$, $p < 0.1$).

More so, Hypothesis 6 proposed that rules and regulations positively moderate technology factor and construction risk management. Going by the result, a negative relationship was affirmed ($\beta = 0.04$, $p < 0.1$). Lastly, while assessing the direct effect of rules and regulations on construction risk management, the result affirmed that rules and regulations had a significant positive relationship with construction risk management, ($\beta = 0.3379$, $p < 0.01$), thus supporting Hypothesis 7.

3.3.3. Effect size and predictive relevance

Having determined the significance path coefficients for the actual research model, next, the authors evaluated the level of the R^2 values, effect size, and predictive relevance for the research model. The research model revealed 64% of the total variance in construction risk management; all the four exogenous latent variables (i.e., economic factor, political factor, technology factor, and rules and regulations), respectively, explained 64% of the variance in construction risk management. Falk and Miller [56] suggested a

Table 2
Discriminant validity (correlations among latent variables)*

	1	2	3	4	5	6	7	8	9
1. Design	**0.756**								
2. Economic factor	0.243	**0.780**							
3. Finance	0.476	0.261	**0.720**						
4. Labor & equipment	0.584	0.277	0.502	**0.725**					
5. Management	0.607	0.300	0.485	0.606	**0.707**				
6. Material	0.471	0.218	0.385	0.556	0.534	**0.809**			
7. Political factor	0.267	0.313	0.208	0.260	0.314	0.316	**0.820**		
8. Rules & Regulations	0.559	0.256	0.460	0.618	0.544	0.443	0.277	**0.722**	
9. Technology factor	0.581	0.290	0.509	0.656	0.608	0.511	0.390	0.597	**0.712**

* Entries shown in bold face represent the square root of the average variance extracted.

Table 3
Path coefficient

Items	Constructs/Variables	β	S/E	T	p	Findings
H1	Economic factor -> CRM	0.085	0.0269	3.160*	0.00	Supported
H2	Political factor -> CRM	0.0259	0.0255	1.018	0.15	Not supported
H7	R&G -> CRM	0.3379	0.0385	8.787*	0.00	Supported
H4	R&G * Economic factor -> CRM	0.0416	0.0304	1.367†	0.09	Supported
H5	R&G * Political factor -> CRM	−0.0006	0.0366	0.017	0.49	Not supported
H6	R&G * Technology factor -> CRM	0.04	0.0404	0.990	0.16	Not supported
H3	Technology factor -> CRM	0.4695	0.0389	12.066**	0.00	Supported

* Significant at 0.01 (one tailed).
† Significant at 0.1 (one tailed).
** Significant at 5% for one tails *T*-value hypothesis testing.
CRM, construction risk management (endogenous variable); R&G, rules and regulations.

value of 0.10 for an R^2 as a minimum satisfactory level. Going by Falk and Miller's [56] recommendation, it is concluded that the endogenous latent variable possesses the threshold level of R^2 values.

Effect size reveals the relative impact of a specific exogenous latent variable on the endogenous latent variable(s) through the changes in the R^2 values [51]. It is computed with the increase in R^2 of the latent variable to which the path is linked, relative to the latent variable's symmetry of unexplained variance [51]. Therefore, the effect size can be calculated using the following formula [57–59]:

$$\text{Effect size: } f^2 = \frac{R^{2\text{Included}} - R^{2\text{Exlcuded}}}{1 - R^{2\text{Included}}} \tag{1}$$

According to Cohen [57], the proposed f^2 values of 0.35, 0.15, and 0.02 can be considered as large, medium, and small effects, respectively. According to our results, the effect size for economic factor was 0.22, 0.28 for political factor, 0.38 for technology factor, and 0.24 for rules and regulations. Therefore, the effect sizes for the latent variables are small, none effect, large, and medium, respectively [57]. The present research makes use of the Stone–Geisser

test to ascertain the predictive relevance of the whole research model using the blindfolding processes [60,61].

To be specific, a cross-validated redundancy measure (Q2) was employed to check the predictive relevance of the whole research model [47,51,61]. The Q2 is a touchstone to assess how good a model predicts the data for the omitted cases [49]. According to Henseler et al [62], a study model that possess Q2 statistic(s) above zero is regarded to have predictive relevance. Likewise, a study model with higher positive Q2 values has more predictive relevance. Results affirmed Q2 statistic of 0.206 for this study's endogenous latent variable, which is more than zero, indicating predictive relevance of the model [33,62].

3.4. Testing moderating effect

The authors employed a product-indicator method using PLS structural equation modeling to observe and assess the strength of the moderating effect of rules and regulations on the relationship between organizational internal factors and construction risk management [33,62,63]. To utilize the product-indicator method, the first step necessitates the evaluation of direct effects by integrating all the exogenous latent variables and regarding the
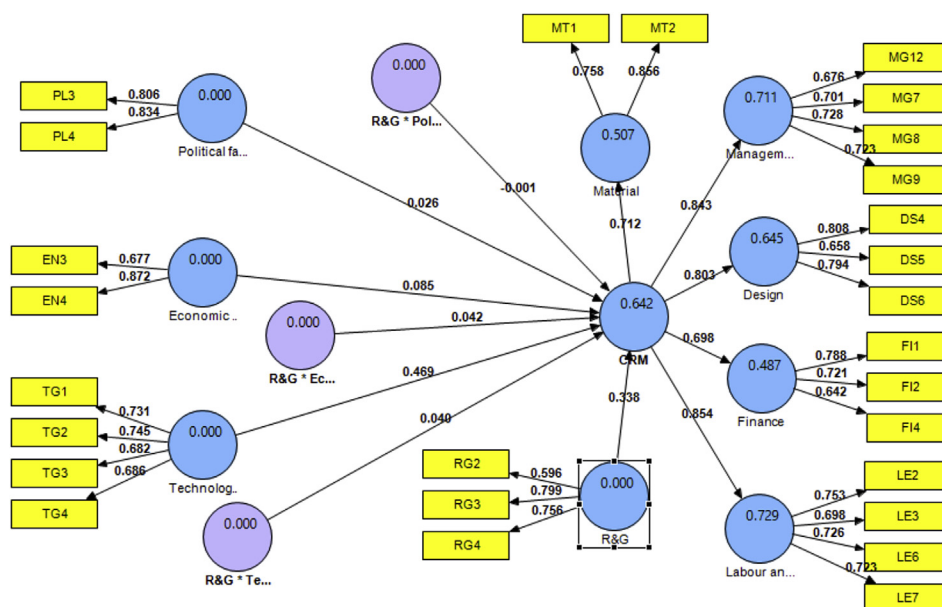
Fig. 2. Structural model. CRM, construction risk management; DS, design risk; EC, economic factor; FI, finance risk; LE, labor and equipment risk; MT, material risk or management risk; PL, political factor; RG, rules and regulations; TG, technology factor.

moderating variable as the independent latent variables in the model.

The second step necessitates the latent interaction term to be established by procreating the products of every indicator of the exogenous latent variables with every indicator of the moderating variable [62]. The third step necessitates the calculation of the standardized path coefficients to affirm whether the interaction effects are significant, such as in this research model (0.023, 0.028, and 0.037 for the economic, political, and technology factors, respectively). The last step necessitates determining the strength of the moderating effects according to Cohen's (1988) [57] proposed effect size formula.

$$\text{Effect size: } f^2 = \frac{R^2\text{model with moderator} - R^2\text{model without moderator}}{1 - R^2\text{model with moderator}}$$

(2)

Hypothesis 4 anticipated that rules and regulations would moderate the relationship between economic factor and construction risk management, such that the relationship between them would be stronger (i.e., positively significant) if there was a significant interaction effect between economic factor and rules and regulations ($\beta = 0.0416$, $p > 0.1$). Therefore, Hypothesis 4 was supported, as depicted in Fig. 3.

Hypothesis 5 proposed that rules and regulation would moderate the relationship between political factor and construction risk management, but the relationship between the hypothesis was not supported with $\beta = -0.0006$ ($p > 0.1$).

Likewise, the interaction shows a strengthening positive relationship between technology factor and rules and regulations with construction risk management as shown in Fig. 4. Hypothesis 6 predicted that rules and regulations would moderate the relationship between technology factor and construction risk management, but the relationship was not supported ($\beta = 0.04$, $p > 0.1$). Lastly, Hypothesis 7 predicted that rules and regulations have a direct relationship with construction risk management. The hypothesis was supported, indicating that it strengthens the relationship more ($\beta = 0.3379$, $p > 0.01$).

4. Discussion

The main objective of this research was to investigate whether rules and regulations have effects on the relationships between organizational external factors (economic, political, and technology factors) and construction risk management. First, in line with Hypothesis 1, results affirmed a significant positive relationship between economic factor and construction risk management, proposing that bumming economy is important among the construction industries during project execution. This result is in line with Israelsson and Hansson [19] who affirmed a significant and positive relationship between economic factor and construction risk management. However, any organization that has a bumming economy will theoretically record less risk in their construction actives.

Furthermore, the authors hypothesized that political factor would be positively related to construction risk management (Hypothesis 2). As anticipated, the finding affirmed a negative relationship between political factor and construction risk management. This shows that any country that is free from political factors will have a low probability of risk occurrence in construction activities, theoretically, because none of the examined studies revealed a positive relationship among these variables. However, as organizational control theory proposed, there must be proper control in the organization, and so this study providing a basis for a negative relationship between political factor and construction risk management is not surprising because it is in line with the ontology of the variable from the previous literature.

Hypothesis 3 revealed a significant and positive relationship between technology factor and construction risk management, which is in line with [12,64]. Furthermore, for Hypothesis 4, the authors predicted whether rules and regulations would moderate the relationship between economic factor and construction risk management. Findings from this study revealed a significant positive relationship among the variables, which shows that for every construction industry that imbibes rules and regulations, there is a probability for such industry to record less risk occurrence on projects.

In the same vein, Hypothesis 5 anticipated if rules and regulations would moderate the relationship between political factor and construction risk management. The study findings depicted that rules and regulations did not moderate (negative) the relationship. Furthermore, Hypothesis 6 predicted if rules and regulations could moderate the relationship between technology factor and construction risk management. Going by the study findings, a negative relationship was shown between the variables. Lastly, Hypothesis 7
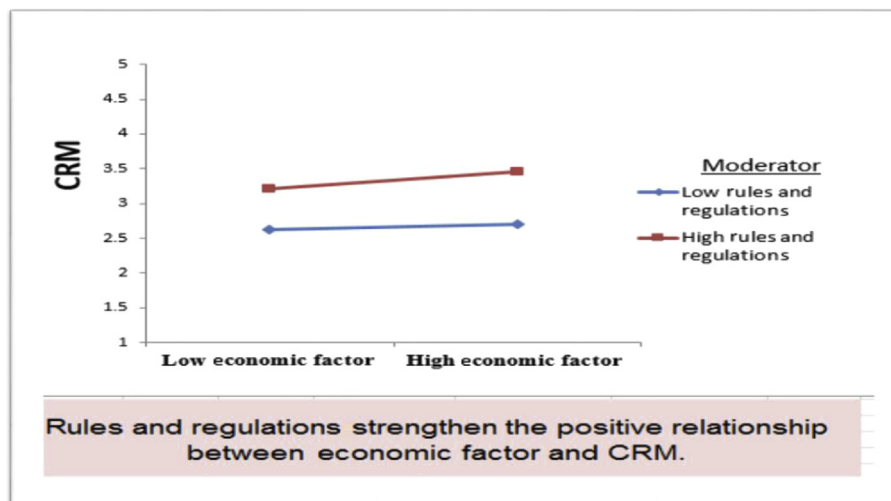

Fig. 3. The interaction between economic factor and rules and regulations in predicting construction risk management (CRM).
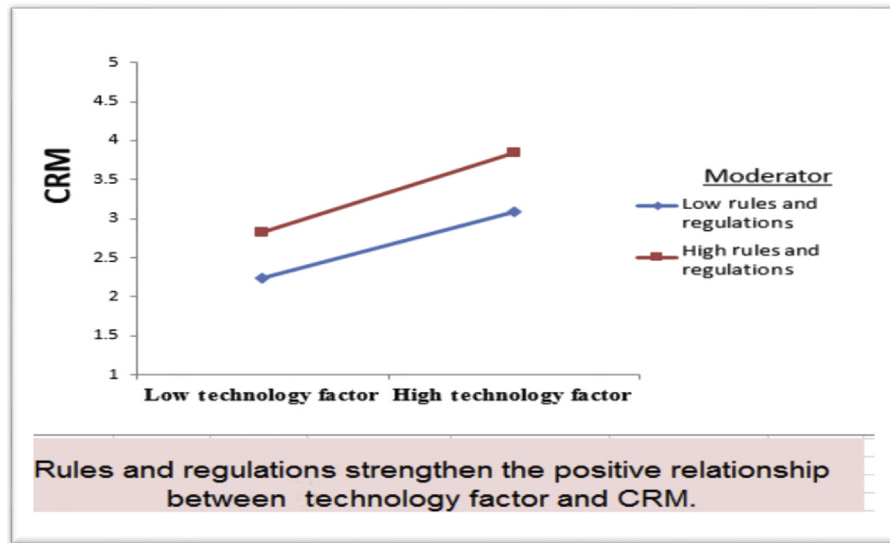
Fig. 4. The interaction between technology factor and rules and regulations in predicting construction risk management (CRM).

predicted if rules and regulations could moderate construction risk management. The study findings depicted a stronger relationship between rules and regulations and construction risk management consistent with previous studies [6,7,26].

In general, the findings of this study depicted important theoretical and practical significances. First, this research has revealed a theoretical implication ground by giving extra empirical proof in the field of organizational control. Flamholtz et al [28] and Jaworski [65] stated that economic, political, and technology factors introduced by an organization should theoretically be able to shape an employee's conduct within the organization. Instead of concentrating on the relationships among economic, political, and technology factors, this research has extended the theory by investigating a liberal range of construction risk management.

Therefore, this research has also tested the moderating role of rules and regulations in the relationships among economic, political, and technology factors with construction risk management. Various empirical studies concerning the relationships among economic, political, and technology factors with construction risk management described inconsistent findings (e.g., [66—68]). Thus, this firmly shows a theoretical gap from the deterrence literature. The current study has solved this gap by integrating rules and regulations as the moderating variable to improve the apprehension of the influence of economic, political, and technology factors on construction risk management.

Finally, our results revealed that rules and regulations were a significant moderator of control-related effects within an organization. The results propose that organizational interventions aimed at reducing the occurrence of risk on construction projects must consider the "effects of the bad apples on the barrel". For example, project managers can reduce the likelihood of risk from individuals by compensating and motivating them in every stage of construction.

Negative moderating effect of rules and regulations on the relationship between political and technology factors with construction risk management proposes the potential operation of other moderating variables. Future study may want to look at other charismatic attributes such as control. Control has been defined by Jaworski [65] as "the power to direct people or to influence their behaviour towards achieving a goal". Several studies in construction risk management, which were also in support of this study's results, affirm that employees with high level of control are less

likely to abide with rules and regulations at work, compared with those with a low level of control, which, on the long run, will improve rules and regulations within the organizations and reduce risk occurrence on construction projects [12,66,64]. Likewise, this study needs to be repeated in dissimilar views and different samples to validate the research findings.

Although this study has revealed some understanding into the relationship between organizational external factors and rules and regulations on construction risk management, it is not without limitations. First, because this research adopted a cross-sectional design, underlying inferences cannot be made to the study population. Consequently, a longitudinal design can be used in the future research to ascertain changes over time. Second, future study can also increase or widen the study area within Nigerian construction companies. More so, future researchers should try to increase the study sample from the 238 being used in this study for a better result, as it was revealed in this research that the total variance in construction risk management as the endogenous variable is 64%, therefore, future study can improve more on the variance.

Regardless of its limitations, this study was able to portray the moderating effects of rules and regulations on the relationship between organizational external factors and construction risk management. Findings of this study have revealed the importance of economic, political, and technology factors in improving construction risk management within the construction industries. However, construction risk management is negatively affected by the organizational external factors when rules and regulations are not taken into consideration with the organization. The finding also proposes a scheme toward improving construction risk management through compensation and motivation in every stage of the construction process, which will enhance productivity within the construction industries.

Conflicts of interest

The authors have no conflicts of interest to declare.

Acknowledgments

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