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The Negative Factors That Influence the Performance of Ghanaian Construction Projects

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Abstract

Numerous factors affect the performance of construction projects. The goal of this paper is twofold: first, to identify and determine the negative factors influencing construction projects, and second, to specify the hypothesised causal relations between the observed and hidden variables using a confirmatory factor analysis (CFA) model. A deductive research approach and a cross-sectional design method were chosen for the study. A literature review was first conducted, and 66 negative variables were identified. The factors were modified and designed into a questionnaire for data collection. The Cronbach alphas of the three components indicate a high degree of internal consistency. The measurement variables adequately measure the negative factor construct. In addition, the fit indices suggest that the postulated model sufficiently describes the dataset. Poor environmental practices (PAS2), inadequate environmental legislative framework to address modern environmental concerns in the delivery of construction projects (PAS1), and non-inclusion of occupational health and safety in contracts (PAS3) were identified as three relevant negative factors impacting project performance. The paper identified poor assessment strategies, weak management systems, and inefficient regulatory systems as the significant latent factors that affect performance. According to the findings, a poor assessment strategy is more consequential. The results of the study suggest that poor assessment strategies, weak management systems, and inefficient regulatory systems can lead to worsening health and safety conditions in the construction industry, as well as environmental violations and poor environmental practices. The government should

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enact adequate health and safety and environmental and local community protection laws to protect the environment and local communities during construction. Clients must liaise with consultants to incorporate sufficient health and safety clauses into construction contracts and ensure judicious compliance by contractors. To reduce corruption in the construction sector, the government should strengthen its anti-corruption mechanisms.

Keywords

Construction Project Performance; Negative Factors; Impact; Multivariate Analysis

Introduction

The construction industry's contribution to global gross domestic product (GDP) amounts to approximately 6% (Celik, et al., 2024). The sector accounts for approximately 5% of the GDP in developed countries. However, in developing countries, the industry accounts for a contribution of over 8% (Suwal, et al., 2019). The industry assists many nations (Anyango, 2020). In Ghana, the construction industry comprises national development and infrastructure activities and processes built around construction projects (Adzivor, Emuze and Das, 2022). The sector's contribution to the nation's economy is substantial (Blay Jnr, et al., 2023; Akomah and Ramani, 2023). It generates beneficial outputs and results (Blay Jnr, et al., 2023), and its GDP over a 5-year period (2014–2019) grew tremendously from GHS 12,183 to GHS 21,013 (Ghana Statistical Service, 2019), that is, USD 869.86 to USD 1,500.33 using the current exchange rate of Ghs 14.00561 to a dollar. The sector accounted for 14.8% of the nation's GDP in 2015 (Stasiak-Betlejewska and Potkany, 2015), making it a top contributor to the nation's economy (Akomah and Ramani, 2023; Osei-Asibey, et al., 2021). According to the African Business Information, the Ghanaian construction industry is worth approximately 5 billion dollars, making the sector a critical component of Ghana's economic development (Agyekum, Goodier and Oppon, 2022). The substantial economic impact of the industry necessitates the government and stakeholders to foster its development in order to enhance its overall performance and achieve its full potential (Babaloa and Harinarain, 2021). Nevertheless, many problems hinder the performance of construction projects in the sector (Gadisa and Zhou, 2021; Vahabi, Nasirzadeh and Mills, 2022). The study seeks to identify and determine the negative factors that influence construction projects' performance in the Ghanaian construction industry and to establish the relationship between the observed and latent variables using confirmatory factor analysis.

Negative factors that influence construction projects' performance

The evidence of the construction industry's contribution can be seen in the numerous infrastructure projects nationwide. However, the industry's major problems are poor performance, underperformance, cost escalation of projects, ceaseless delays, and poor environmental and community management (Camacho and Cruz, 2022). Ngacho and Das (2015) posited that construction projects are hardly completed on time, and even when they are, quality is undermined, and cost increases astronomically. Amoah, Ahadzie and Dansoh (2007) and Yada and Yadeta (2016) indicated that too many underlying problems can be linked to the factors that affect performance in construction.

In the Ghanaian performance environment, the factors considered are typically cost, time, quality, and occasionally safety (Agyekum, et al., 2021; Boadu, Sunindijo, and Wang, 2021). Research by Agyekum, Simons, and Botchway (2018) indicated that a myriad of factors influence the performance of construction projects. Unegbu, Yawas and Dan-Asabe (2022) identified poor project management techniques as a factor that adversely affects project performance. Contractors frequently fall short of performance expectations due to the use of inadequate and inefficient management techniques (Ahadzie, 2008). This phenomenon arises because many business managers do not understand the sector (Horvath and Szabo, 2019). Vulink (2004)

posited that a sizeable number of local construction firms do not employ people with the necessary industry expertise to manage their businesses. In addition to the several issues identified as challenges with contractors, the unstable nature of the economy also affects cost performance (Kakar, et al., 2022). Frequent economic fluctuations and disruptions often occur prior to project completion, leading to several challenges (Moyo and Chigara, 2022).

Contractors' cash flows increase when clients honour their payment obligations. In Ghana, payments for work done by contractors are most often delayed (Adaku, et al., 2023). This puts much pressure on contractors, and it is sometimes the cause of their underperformance and poor quality of work or delivery. Late payments to contractors are usually made without compensation, which affects their profitability and business operations (Tripathi, et al., 2023). This action has had a significant influence on numerous firms, rendering them ineffective.

The government's delay in compensating contractors for work adequately executed has discouraged several banks from providing financial assistance to construction firms (Fugar and Agyakwah-Baah, 2010). Construction companies face significant challenges in obtaining credit from banks due to their frequent failure to meet loan repayment deadlines. Even when they secure one, the exorbitant interest rates imposed by banks discourage many construction businesses from seeking loans (Peprah, 2016). Additionally, the government's inability to improve the financial and managerial capabilities of contractors (Das and Rangarajan, 2020) is taking a severe toll on firms. These, together with other issues, affect contractors' capital.

Several undesirable behaviours have a negative impact on project efficiency. Vahabi, Nasirzadeh and Mills (2022) averred that design briefing is occasionally disregarded but can have a crippling effect on project performance. According to Ngacho and Das (2015) and Tijani, Jin and Osei-Kyei (2021), a poor work environment also affects project performance. It sometimes slows down the pace and quality of work and risks employee safety unnecessarily. Poor construction supervision and strained relationships among project stakeholders are additional damaging elements that affect performance (Do, Nguyen and Nguyen, 2022b; Manoharan, et al., 2023). Laryea (2010) posited that insufficient contract supervision plays a significant role in the underwhelming performance of construction projects and indicated that meticulous monitoring is essential for successfully executing an organisation's plans. Yang, Huang and Griffiths (2022) and Lee, et al. (2022) identified insufficient geotechnical inspections as a detrimental factor to project performance. Excessive variations have been noted as a significant problem by Noruwa, Arewa and Merschbrock (2022) and Gurgun and Koc (2022). On the other hand, Farouk Kineber, et al. (2022) found a lack of value management as a factor in subpar project performance.

Political cronyism and corruption also have an impact on performance as well. Contracts are not sometimes awarded to contractors because they merit them; they are awarded because of political affiliation (Ameyaw, et al., 2017). In the research by Ameyaw, et al. (2017) and Agyekum, et al. (2021), cases of habitual corruption and unethical behaviour were detected among public officials, contractors, and construction professionals during the bid evaluation, tendering, and contract management stages. Akomah and Nani (2018) stated that the unethical association between public officials and contractors often leads to information leakages and unfair competition among firms. Osei-Tutu, et al. (2010) revealed that, at the contract execution stage, consultants also take bribes to grant contract variations, approve time extensions, certify defective works, or expedite wrongful payments. This action has negative implications for cost, time, and quality.

The corporate social responsibilities of firms are often disregarded (Tan-Mullins and Mohan, 2013) as a result of inadequate regulatory frameworks (Mangla, et al., 2018). This is coupled with the insufficiency of environmental frameworks and monitoring, which consistently undermines efforts to address environmental protection challenges (Marsh, Velenturf and Bernal, 2022; Mangla, et al., 2018).

Although the client, consultant, and contractor coordinate a project's execution and well-being, its health and success go beyond these three parties. Interestingly, failed projects are often perceived to arise from contractors' inefficiencies rather than a holistic assessment of the subject (Adebowale and Agumba, 2021). As previously mentioned, several factors, among many others, negatively impact project performance. The factors extracted and modified during the literature search are listed in Table 1.

Table 1. Factors that influence the performance of construction projects.

Weak contractor's managerial capacity	Costa, et al. (2024)
Lack of capital to prefinance projects	Akomah and Ramani (2024); Shang, et al. (2023)
Weaknesses in tender and contract management processes	Gamage (2023); Yeboah et al. (2023); Zerouali (2023)
Managerial challenges and leadership	Akomah and Ramani (2024); Orieno, et al. (2024)
Poor definition of scope, errors in design, and scope creep	Alhammadi, Al-Mohammad and Rahman (2024); Alzayed (2024); Doloi (2024)
Favouritism in the tendering process and contractor selection process	Quinot (2024); Akomah and Nani (2018)
Poor attitude of the government towards the growth of the construction industry	Akomah and Ramani (2024); Boadu, Wang, and Sunindijo (2020)
Poor engineering capacities of firms	Akinradewo, et al. (2022); Alkilani and Loosemore (2022)
Poor attitude of firms towards project management and management tools and processes	Ghorbani (2023); Paul, et al. (2023); Musa, et al. (2023)
Low level of knowledge of construction business management	Shayan, Pyung Kim and Tam (2022)
Unpredictable economic shocks, high interest rates, and unrealistic financial indices	Akomah and Ramani (2024)
Poor performance of the local currency against major currencies	Akomah and Ramani (2024)
Misapplication of mobilisation funds	Akomah and Ramani (2024)
Poor management practices and poor, undefined work methods	Al-Nahhas et al. (2024); Awwad and Thabet (2024)
Poor health and safety practices and perceptions	Akomah and Ramani (2023); Hagan, et al. (2021)
Inexperienced personnel, poor supervision, monitoring, and coordination	Akomah and Ramani (2024)
Cumbersome client payment processes	Akomah and Ramani (2024); Oladimeji, et al. (2023)
Poor project planning and preparation	Akomah and Ramani (2024)

Table 1. continued

Inconsistencies in tender and contract documents	Mundia (2024)
Application of the wrong contract type	Smith, et al. (2023)
Lack of safety policy, culture, and organisational safety maturity	Amirah, et al. (2024); Nævestad and Phillips (2023)
Financial institutions' reluctance to offer financial credits to contractors	Akomah and Ramani (2024); Ofori-Kuragu, Baiden and Badu (2016)
Client's restrictions and late handing over of site	Akomah and Ramani (2024); Danial and Misnan (2023)
Lack of seriousness on the part of contractors towards competitive tendering	Akomah and Ramani (2024); Vrbka and Koubkova (2023)
High level of corruption, collusion, or rigging in procurement processes	Akomah and Nani (2018); Ameyaw, et al. (2017)
Poor maintenance culture and practices	Mensah, et al. (2023); Quayson and Akomah (2016)
Unqualified skilled manpower and the loss of key employees	Costa, et al. (2023)
Inclement weather and civil unrest or strike	Giri (2023)
High number of accidents, injuries, and fatalities	Bria, et al. (2024)
Excessive political interference in public contract awards	Akomah and Ramani (2024); Oluseye (2024)
Lack of government regulatory and OHS policy for the construction industry	Akomah and Ramani (2024); Ebekozien, et al. (2023)
Fraudulent contractor–consultant activities and the consultant's incompetence	Ali, et al. (2023); Martin, et al. (2023)
Litigation among stakeholders	Abdul Nabi, Assaad and El-Adaway (2024)
Poor estimation and underestimation of time and cost to secure contracts	Chadee, et al. (2023a)
Strained relationships among stakeholders	Bhattarai (2023)
Poor or insufficient geotechnical examinations or lack of compliance with geotechnical requirements	Akomah and Ramani (2024)
Inaccuracies in geotechnical test results or poor interpretation and reporting	Akomah and Ramani (2024)
Poor contractor or worker attitude	Debataraja (2023)
Escalations in material and labour rates and the high cost of equipment hiring	Ahmed, Assefa and Kassa (2023)

Table 1. continued

Poor client or contractor financial standing or insolvency	Chadee, et al. (2023b)
Excessive variations	Smith, et al. (2023)
Poor inventory management and waste management practices	Akomah and Ramani (2024); Chawla, et al. (2024)
Poor communication among project participants or information delays or feedback systems	Abdallah, Shaawat and Almohassen (2024)
Wrong project delivery methods and poorly written contract agreements	Deacon and Kajimo-Shakantu (2024); Rueda-Benavides, et al. (2024)
Bureaucracies in clearing goods at the ports	Rucha, Ogollah and Amakobe (2024)
Selection and use of wrong or outdated equipment or technologies	Disney, et al. (2024)
Poor security and on-site housekeeping	Chinniah, et al. (2024)
Lack of quality assurance and quality control structures	Shaban, Al-Hassan and Mohamad (2024)
Poor man management	Aghimien, Aigbavboa and Aghimien (2024)
Poor integration of stakeholders' activities and negative stakeholder attitudes	Alkilani and Loosemore (2024)
Poor estimation of community interference with work or community dissatisfaction	Aigbavboa and Akinradewo (2024)
Lack of community involvement and disregard for the opinions of the local community	Aigbavboa and Akinradewo (2024); Bouadam and Chetbi (2024)
Compromised working conditions and environment	Lawani, et al. (2024)
Change in political leadership	Saka, et al. (2024)
Absence of value management	Misnan, Ismail and Yan (2024)
Lack of performance management and measurement systems and poor performance targets	Garengo and Betto (2024); Adedokun and Egbelakin (2024)
Poor work rules and restricted work practices	Radzi, et al. (2024); Kilaka (2024)
Poorly prepared bill of quantities	Nani (2021)
Poor scheduling	Akomah and Ramani (2024); Gurgun, Koc and Kunkcu (2024); Li, et al. (2022)
Unreliable cost control systems	Tembo, Muleya and Kanyemba (2024)
Neglecting the provision and use of PPE	Hanani, et al. (2024)

Table 1. continued

Neglecting local communities as stakeholders or lack of awareness of local communities as stakeholders	Corazza, Cottafava and Torchia (2023); Eikelenboom and Long (2023)
Non-inclusion of occupational health and safety in contracts	Akomah and Ramani (2024); Kukoyi, Faremi and Osuizugbo (2023); Emma-Ochu, et al. (2021); Smallwood (2020)
Poor environmental practices	Akomah and Ramani (2024); Radzi, et al. (2024)
Inadequate environmental legislative framework to address modern environmental concerns in the delivery of construction projects	Akomah and Ramani (2024); Radzi, et al. (2024);
The use of obsolete technologies	Akomah and Ramani (2024); Maqbool, Saiba and Ashfaq (2023)

Methodology

This study hinges on the positivist philosophy, which requires the use of a scientific method to measure, quantify, and explain a phenomenon and make predictions (Saunders, Lewis and Thornhill, 2019; Creswell, 2014; Newman, 2014). To reduce bias, a deductive approach was adopted to develop research solutions that fulfil the purpose of the study and lead to generalisable and replicable conclusions (Saunders, Lewis and Thornhill, 2019). This approach is more logically driven and objective (Ketokivi and Mantere, 2010) and involves a highly structured design (Johnson and Christensen, 2014). The search for a highly structured design, statistical data, and conclusions led to the selection of a quantitative method (Newman, 2014). Creswell (2014) indicated that a research strategy is influenced by the philosophy adopted, the approach, and the choice of methodology. The research strategy employed in the study is the survey strategy. This strategy is useful and effective in the management of research studies (Bryman, 2009), and above all, it allows for the random selection of research participants from a large population (Vanderstoep and Johnston, 2009).

Boote and Beile (2005) indicated that an existing body of knowledge in a particular subject area is the foundation of every research project. This is because literature provides information that develops a framework to interrogate current studies (Creswell and Plano Clark, 2018) and put them in the proper perspective (Creswell, 2014). The study commenced with an extensive literature review to identify the negative factors that impact construction projects' performance. The search led to the identification of many factors. These variables were adapted to suit the purpose of the study. The identified factors led to the generation of 66 negative factors noted to have an enervating effect on construction projects' performance. Out of these factors, a questionnaire was generated. The questionnaire was divided into the demographic and negative performance variables sections. Section 1 sought to collect the needed bio information deemed relevant to the study, while section 2 aimed at collecting data on negative factors that influence the performance of projects. The second section was created using a five-point scale, with one indicating very low influence and five indicating very high influence. This was done to increase the instrument's consistency. The increase in scale points is proportional to the instrument's consistency (Akomah and Ramani, 2023). The study included a population of 7,925 individuals. It was an all-inclusive population, comprising 2,714 contractors and 240 construction lecturers from the various technical universities who were also practitioners. In addition to the earlier mentioned figures, there were 566 architects, 439 quantity surveyors,

900 professional engineers from the Institution of Engineering and Technology, and 3,066 from the Ghana Institution of Engineering who were in good standing at the time of the data collection. Contacts with professional bodies and department heads at various technical universities provided some data sources, while the secretariats directed researchers to use institutional websites for others. The 10 technical universities were chosen because they accounted for over 50% of the universities that provide construction and building-related programs. Furthermore, they were dispersed across various regions of the country (Akomah and Ramani, 2024).

These categories of professionals were considered because of their knowledge and experience in the construction industry. Before the selection process, the lists were screened to ensure that professional members of multiple professional bodies were identified and given only one selection opportunity.

Gay, Mills and Airasian (2012) claimed that sample size becomes irrelevant beyond 5,000 and that a sample size of 400 is sufficient. Cohen, Manion and Morrison (2005) indicated that survey studies need larger sample sizes to make inferences. Bagozzi and Yi (2012) averred that robust and complex models require sample sizes above 200. Based on Bagozzi and Yi's claim, a sample of 635 was drawn from the abovementioned population. This was slightly higher than what Gay, Mills and Airasian recommended to account for non-responses and other survey-related deficiencies. Classifying the population as all-inclusive led to the use of a simple random sampling method to select the professionals, thereby creating equal opportunities for all (Edmonds and Kennedy, 2017). Without substitution, the selection of the professionals was finalised. Professionals who were chosen but did not wish to participate in the study were excluded, allowing others to be chosen. At the end of the simple random sampling process, a total of 152 quantity surveyors, 76 lecturers, 202 engineers, 63 architects, and 142 contractors were sampled. Data were collected using questionnaires administered through emails and WhatsApp, with others delivered by hand in hard copies.

The personal information of respondents was analysed using descriptive statistics. The next step was using exploratory factor analysis (EFA), a statistical data reduction method for assessing the unidimensionality and reliability of the negative factors that influence the performance of construction projects in Ghana (Watkins, 2018). Maximum Likelihood with Varimax Rotation (ML Varimax) was used for the extraction and rotation of the factors.

The threshold for factor loading was established at 0.5, which is an increment from the 0.40 value proposed by Field (2005). Items with factor loadings below 0.5 were eliminated because they did not adequately represent the measured construct. The corrected item-total correlation was extracted for items using EFA and a cutoff of 0.30.

Brown (2015) claimed that CFA is utilised for model measurement and offers beneficial knowledge on data fitness. The multivariate correlational analysis EFA was performed using SPSS version 26. However, the CFA was undertaken using AMOS version 22. The robust evaluation of the proposed CFA model was conducted using Table 2.

Results

BIODATA OF RESPONDENTS

The valid questionnaires received were 454, representing 71.50% of the 635 questionnaires distributed. Among the valid responses were 84 contractors, 134 quantity surveyors, 62 lecturers, 49 architects, and 125 engineers. The data revealed that 68 respondents who participated in the survey had 2–5 years of working experience, 126 had 6–10 years, 103 had 11–15 years, 101 had 16–20 years, and 56 had 21 years and above experience.

Table 2. Indices for robust evaluation.

Fit index	Cutoff value	Comment	Source
S – Bχ^2			Kline, 2016; Hu and Bentler, 1999
df	0≥	Acceptable	
CFI	0.90≥ acceptable 0.95≥ good fit	Good fit	
PCFI	Less than 0.80	Good fit	
RMSEA	Less than 0.08	Acceptable	
RMSEA 95% CI	0.00–0.08 "good fit"	Acceptable	
NFI	Greater than 0.90 "good fit"	Good fit	
IFI	Greater than 0.90 "good fit"	Good fit	
PNFI	Less than 0.80	Good fit	
RMR	Less than 0.05 "good fit"	Good fit	
GFI	Greater than 0.90 "good fit"	Good fit	

EXPLORATORY FACTOR ANALYSIS—NEGATIVE FACTORS

The analysis commenced with factor extraction using ML Varimax to determine whether factor analysis could be employed. The results yielded a Kaiser-Meyer-Olkin (KMO) of 0.948 and Bartlett's test of sphericity of $P < 0.000$. This indicated consistency with the recommended KMO cutoff value of 0.70 and Bartlett's test of sphericity of $P<0.05$, as Hair et al. (2010) suggested. The KMO and Bartlett's test of sphericity confirmed the dataset's factorability, indicating that factor analysis was suitable for identifying the negative factors.

After the analysis, 33 out of the 66 variables were excluded because they had factor loadings below 0.5. The factors deemed an excellent representation of the negative factor construct are presented in Table 3. For the first component, 10 items recorded thresholds of more than 0.5 and were labelled poor assessment strategies (PAS). The second component loaded 10 items and measured weak management systems (WMS). Thirteen items were loaded on the third component and were categorised as inefficient regulatory systems (IPS).

Cronbach's alphas of 0.920 for the first component (PAS), 0.853 for the second component (WMS), and 0.913 for the third component (IPS) were all above the threshold of 0.800, indicating adequate internal reliability for the extracted items (Nanually and Bernstein, 1994). Table 4 provides information on the unidimensionality and reliability of poor assessment strategies, weak management systems, and inefficient regulatory systems.

CONFIRMATORY FACTOR ANALYSIS—NEGATIVE FACTORS

The fitness of the hypothesised model was performed using CFA after the results from the EFA revealed that the constructs were unidimensional and reliable. The NF model's sample data produced an S – Bχ2 of 4.732 with 347 degrees of freedom (*df*) and a probability of $P = 0.0000$. Chi-square values of 5 or less can be used as a benchmark, according to Hanneman, Kposowa and Riddle (2013). As evidenced by the chi-square value, the deviation of the sample data from the proposed model was considerable; hence, the model is deemed a good fit.

Table 3. Negative factors that influence construction projects' performance.

Negative factors	Components		
	1	2	3
Inadequate environmental legislative framework to address modern environmental concerns in the delivery of construction projects	0.822		
Poor environmental practices	0.810		
Non-inclusion of occupational health and safety in contracts	0.789		
Neglecting local communities as stakeholders and lack of awareness of local communities as stakeholders	0.749		
Lack of community involvement and disregard for the opinions of the local community	0.740		
Absence of value management	0.701		
Poor estimation of community interference with work and community dissatisfaction	0.549		
Poor communication among project participants and information delays and feedback systems	0.518		
Inaccuracies in geotechnical test results and poor interpretation and reporting	0.507		
Excessive variations	0.506		
Inexperienced personnel, poor supervision, monitoring, and coordination		0.646	
Poor project planning and preparation		0.563	
Poor management practices and poor, undefined work methods		0.563	
Poorly prepared bill of quantities		0.554	
Strained relationships among stakeholders		0.552	
Poor engineering capacities of firms		0.534	
Managerial challenges and leadership		0.519	
Poor or insufficient geotechnical examinations and lack of compliance with geotechnical requirements		0.515	
Weak contractor's managerial capacity		0.512	
Cumbersome client payment processes		0.506	
Client constraints and late site handover			0.665
Lack of seriousness on the part of contractors towards competitive tendering			0.638
Poor maintenance culture and practices			0.619
High level of corruption, collusion, and rigging in procurement processes			0.613

Table 3. continued

Negative factors	Components		
	1	2	3
Financial institutions' reluctance to offer financial credits to contractors			0.591
Lack of government regulatory and OHS policy for the construction industry			0.591
Fraudulent contractor–consultant activities and the consultant's incompetence			0.550
Unreliable cost control systems			0.548
Application of the wrong contract type			0.539
Excessive political interference in public contract awards			0.524
Poor attitude of the government towards the growth of the construction industry			0.518
Poor health and safety practices and perceptions			0.517
Neglecting the provision and use of PPE			0.504

Table 4. Unidimensionality and reliability of the three extracted components.

Component	Latent component	Cronbach's alphas
Component 1	Poor assessment strategies (PAS)	0.920
Component 2	Weak management systems (WMS)	0.853
Component 3	Inefficient regulatory systems (IPS)	0.913

The obtained comparative fit index (CFI) value of 0.920 exceeded the cutoff limit of 0.90, indicating that the model is acceptable. As shown in Table 5, the normed fit index (NFI) value obtained was 0.983, more significant than the cutoff value of NFI ≥ 0.90. This indicates that the model is adequate. The obtained parsimony normed fit index (PNFI) value was 0.719, less than the cutoff value of 0.80, indicating a good fit (Schumacker and Lomax, 2010). The root mean square residual (RMR) value was less than 0.05, at 0.035. This suggests that the model is well-fitting (Brown, 2015; Schumacker and Lomax, 2010). The goodness-of-fit index (GFI) value, on the other hand, was 0.911 and greater than 0.090, indicating a good fit (Byrne, 2010; Schumacker and Lomax, 2010; Kline, 2016). These fit indices for the NF model suggest that the proposed model adequately describes the sample data. Table 5 shows the robust fit indices for model evaluation.

The unidimensional model for NF features can be seen in Figure 1 and Table 6. Out of the 66 indicator variables, 28 were obtained and used for the final CFA analysis. From the 454 cases analysed for this construct, 28 indicator variables made up of three components were deduced as PAS (PAS1, PAS2, PAS3, PAS4, PAS5, PAS6, PAS7, PAS8, PAS9, and PAS10), WMS (WMS1, WMS2, WMS3, WMS4, WMS6, and WMS8), and IPS (IPS1, IPS2, IPS3, IPS4, IPS5, IPS6, IPS7, IPS8, IPS9, IPS11, IPS12, and IPS13).

Table 5. Robust fit indices for adaptability and integration for negative factors.

Fit index	Cutoff value	Estimate	Comment
S – Bχ^2		4.732	
df	0≥	347	Acceptable
CFI	0.90≥ acceptable 0.95≥ good fit	0.920	Good fit
PCFI	Less than 0.80	0.752	Good fit
RMSEA	Less than 0.08	0.071	Acceptable
RMSEA 95% CI	0.00–0.08 "good fit"	0.063–0.074	Acceptable
NFI	Greater than 0.90 "good fit"	0.983	Good fit
IFI	Greater than 0.90 "good fit"	0.920	Good fit
PNFI	Less than 0.80	0.719	Good fit
RMR	Less than 0.05 "good fit"	0.035	Good fit
GFI	Greater than 0.90 "good fit"	0.911	Good fit

Table 6. Final conceptual model indicator variables for negative factors construct.

Latent component	Indicator variable	Measurement variable	Label
Poor assessment strategies (PAS)		Inadequate environmental legislative framework to address modern environmental concerns in the delivery of construction projects	PAS1
		Poor environmental practices	PAS2
		Non-inclusion of occupational health and safety in contracts	PAS3
		Neglecting local communities as stakeholders and lack of awareness of local communities as stakeholders	PAS4
		Lack of community involvement and disregard for the opinions of the local community	PAS5
		Absence of value management	PAS6
		Poor estimation of community interference with work and community dissatisfaction	PAS7
		Poor communication among project participants and information delays and feedback systems	PAS8
		Inaccuracies in geotechnical test results and poor interpretation and reporting	PAS9
		Excessive variations	PAS10

Table 6. continued

Latent component	Indicator variable	Measurement variable	Label
Weak management systems (WMS)		Inexperienced personnel, poor supervision, monitoring, and coordination	WMS1
		Poor project planning and preparation	WMS2
		Poor management practices and poor, undefined work methods	WMS3
		Poorly prepared bill of quantities	WMS4
		Poor engineering capacities of firms	WMS6
		Poor or insufficient geotechnical examinations and lack of compliance with geotechnical requirements	WMS8
Inefficient regulatory systems (IPS)		Client constraints and late site handover	IPS1
		Lack of seriousness on the part of contractors towards competitive tendering	IPS2
		Poor maintenance culture and practices	IPS3
		High level of corruption, collusion, and rigging in procurement processes	IPS4
		Financial institutions' reluctance to offer financial credits to contractors	IPS5
		Lack of government regulatory and OHS policy for the construction industry	IPS6
		Fraudulent contractor–consultant activities and the consultant's incompetence	IPS7
		Unreliable cost control systems	IPS8
		Application of the wrong contract type	IPS9
		Poor attitude of the government towards the growth of the construction industry	IPS11
		Poor health and safety practices and perception	IPS12
		Neglecting the provision and use of PPE	IPS13

The correlation values, standard errors, and test statistics for the 28 indicator variables are shown in Table 7. All the correlation values were less than 1.00, and all the *P*-values were less than the 0.05 significance level. As a result, the estimates are deemed statistically significant. The indicator with variable PAS2 had the highest standardised coefficient, with a parameter coefficient of 0.855. This is followed by PAS1, PAS3, PAS4, PAS5, PAS6, IPS1, IPS6, IPS7, IPS12, WMS6, WMS3, and WMS2 in that order.

The correlation values of most estimates indicate a strong linear relationship between the indicator variables and the unobserved variables (PAS, WMS, and IPS). Furthermore, the coefficient of determination (R^2) values indicate that the factors explain a significant proportion of the variance in the indicator variables.

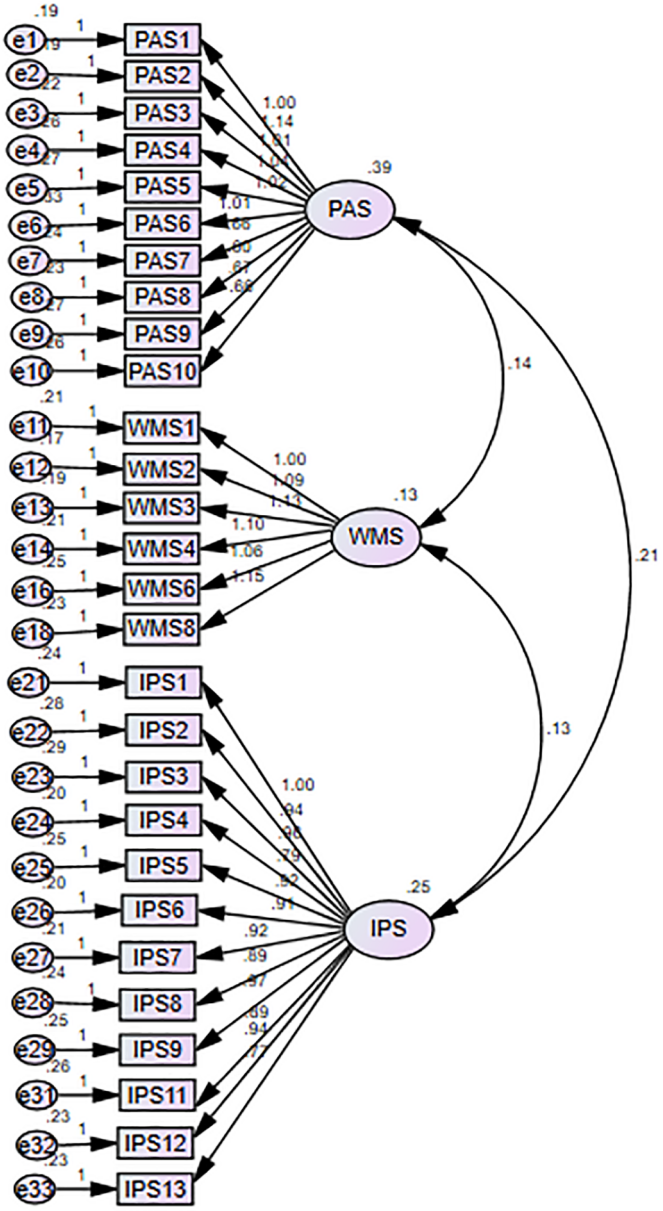

Figure 1. CFA model for negative factors that influence the performance of construction projects.

Because all of the measured variables are significantly associated with the three components (PAS, WMS, and IPS) under the negative factors that influence the performance of construction projects, the results suggest that the indicator variables predict the unobserved components.

Discussion of results

THE MULTIVARIATE DISCUSSION OF THE NEGATIVE FACTORS

The results obtained for the negative factors indicate a high correlation between the variables and their constructs. Poor assessment strategies (0.920), and inefficient regulatory systems (0.913), are found to be more highly correlated with their constructs than weak management systems (0.853) based on their

Table 7. Factor loading and *P*-value of negative factors construct.

Hypothesised relationships (Path)	Unstandardised coefficient (λ)	Standardised coefficient (λ)	*P*-value	R^2	Significant at the 5% level
PAS1 ← PAS	1.000	0.822	0.00	0.676	Yes
PAS2 ← PAS	1.138	0.855	0.00	0.732	Yes
PAS3 ← PAS	1.014	0.805	0.00	0.642	Yes
PAS4 ← PAS	1.041	0.786	0.00	0.618	Yes
PAS5 ← PAS	1.021	0.775	0.00	0.601	Yes
PAS6 ← PAS	1.010	0.739	0.00	0.546	Yes
PAS7 ← PAS	0.664	0.645	0.00	0.416	Yes
PAS8 ← PAS	0.602	0.616	0.00	0.379	Yes
PAS9 ← PAS	0.667	0.629	0.00	0.396	Yes
PAS10 ← PAS	0.660	0.627	0.00	0.393	Yes
WMS1 ← WMS	1.000	0.611	0.00	0.374	Yes
WMS2 ← WMS	1.094	0.682	0.00	0.465	Yes
WMS3 ← WMS	1.131	0.681	0.00	0.464	Yes
WMS4 ← WMS	1.103	0.648	0.00	0.419	Yes
WMS6 ← WMS	1.057	0.696	0.00	0.355	Yes
WMS8 ← WMS	1.151	0.649	0.00	0.421	Yes
IPS1 ← IPS	1.000	0.710	0.00	0.504	Yes
IPS2 ← IPS	0.941	0.664	0.00	0.441	Yes
IPS3 ← IPS	0.960	0.662	0.00	0.438	Yes
IPS4 ← IPS	0.785	0.661	0.00	0.437	Yes
IPS5 ← IPS	0.923	0.674	0.00	0.455	Yes
IPS6 ← IPS	0.908	0.710	0.00	0.504	Yes
IPS7 ← IPS	0.917	0.704	0.00	0.495	Yes
IPS8 ← IPS	0.886	0.669	0.00	0.448	Yes
IPS9 ← IPS	0.967	0.694	0.00	0.482	Yes
IPS11 ← IPS	0.894	0.658	0.00	0.433	Yes
IPS12 ← IPS	0.942	0.696	0.00	0.484	Yes
IPS13 ← IPS	0.769	0.620	0.00	0.385	Yes

Cronbach alphas. The 28 factors defining the negative factor model are grouped under the three constructs outlined above, making the hypothesised model a three-factor model. According to the CFA model in Figure 1, PAS, IPS, and WMS recorded 10, 12, and 6 subfactors, respectively. The model fit indices reveal that the model has a good fit. All the explanatory variables identified under the three constructs are statistically significant at 5%.

PAS1, PAS2, PAS3, PAS4, PAS5, and PAS6 explain more than 50% of the variances in PAS. PAS2—poor environmental practices alone describes 73.2%, the highest among the variables measuring PAS and all other constructs. IPS1 and IPS6 also explain more than 50% of the variability in IPS. PAS2 recorded the highest standardised coefficient (0.855) and R^2 (0.732 or 73.2%). This is followed by PAS1 and PAS3 with standardised coefficients of 0.822 and 0.805 and R^2 of 0.676 or 67.6% and 0.642 or 64.2%, respectively. The factor loading and *P*-values indicate that PAS variables constitute significant adversarial factors.

POOR ASSESSMENT STRATEGIES (PAS)

From the hypothesised CFA model labelled Figure 1, 10 PAS subfactors are pernicious to project performance. PAS recorded a correlation coefficient of 0.39. Out of these 10 factors, six subfactors (PAS1 to PAS6), as indicated in Table 7, are considered significant because they have high standardised coefficients. The factors include PAS2 (0.855), PAS1 (0.822), PAS3 (0.805), PAS4 (0.786), PAS5 (0.775), and PAS6 (0.739).

Moderating the environmental impact of construction activities has gained momentum over the years. Ali, et al. (2020) hypothesised that harmful environmental practices imperil the environment and reduce sociocultural and economic benefits. In light of this, Maqbool and Amaechi (2022) argued that environmental practices must strive not only to minimise negative impact but also to restore environmental, social, and economic sustainability. Environmental considerations are imperative (Naji, Gunduz and Falamarzi, 2022). Poor environmental practices should be clamped down using regulatory frameworks by establishing the standards for preventing harmful environmental practices. Stricter environmental regulations are required. It has been noted that an insufficient environmental legislative framework leads to an increase in pollution, a negative public perception, a lack of accountability, the destruction of habitat, the production of greenhouse gases, and, ultimately, climate change (Zulu, et al., 2022; Prakash, 2021). Sahu, et al. (2023) opined that environmental frameworks must ensure the adoption and implementation of eco-friendly operations by firms.

Health and safety as a critical construction subject cannot be overlooked (Dimitriou and Papakostas, 2022). It is a vital performance indicator of a successful project. The current study supports the work of Boadu, et al. (2022), who averred that adequate provisions for health and safety in construction contracts should be made. Raza, Tayeh and Ali (2022) claimed that incorporating health and safety as a contractual requirement by the client influences the contractor's behaviour and results in higher compliance with health and safety (H&S) standards.

In numerous construction initiatives, local communities are frequently neglected, alienated, or not regarded as stakeholders. In most cases, their perspectives on the sociocultural implications are not solicited. Nevertheless, Kordi, et al. (2021) and Sen, Kotlarsky and Budhwar (2020) indicated that communities are significant external constituents who should not be ignored because their feelings and disapproval can have detrimental effects on a project. The current study agrees with the findings of Dikmen, et al. (2022). They indicated that assessment is necessary for decision-making.

INEFFICIENT REGULATORY SYSTEMS (IPS)

The regression coefficient of the hypothesised CFA model is 0.25. The findings reveal that IPS is significantly influenced by 3 subfactors out of the 12: IPS1, IPS6, and IPS7, as indicated in Table 7. The

most significant are IPS1 and IPS6. Handing over the site to a successful contractor to formally commence a contractual obligation is a common attribute in construction projects. Clients, however, occasionally cause delays in this. It is a root cause of claims, according to Parchami Jalal, et al. (2019). Parikh, Joshi and Patel (2019) supported the claim and indicated that a correlation exists between late handover and legal costs. This study further reinforces the earlier findings and conclusions. Boadu, Sunindijo and Wang (2021), Donkoh and Aboagye-Nimo (2016), and Akomah, Boakye and Fugar (2010) have all bemoaned the lack of adequate regulations and policies in the Ghanaian construction industry as well as the difficulties this lack creates. They cited this as the reason for some contractors' noncompliance and blatant disregard for health and safety in their operations. According to Boadu, Sunindijo and Wang (2021), no national construction industry health and safety policy exists. The construction industry requires a distinct policy (Chigara and Moyo, 2022). The absence of policies and stringent regulations creates a hazardous workplace (Pamidimukkala and Kermanshachi, 2021). Good state regulatory systems improve health and safety performance (Ogogo, Omwenga and Paul, 2019; Hafner, 2018). Apart from government interventions to streamline health and safety in the construction industry, Ebekozien (2022) argued that companies owe their employees internal mechanisms to safeguard them from on-site dangers. Identifying IPS as a negative factor supports the findings of Jin, et al. (2022).

WEAK MANAGEMENT SYSTEMS (WMS)

Among the three latent constructs, the weak management system recorded a minimum regression coefficient (β) of 0.15. Three of the six subfactors that define WMS are considered significant negative contributors to project performance. These are the WMS6, WMS2, and WMS3. The engineering capacity of a construction firm is its ability to perform irrespective of diverse and challenging circumstances. This finding endorses the conclusions drawn by Gadisa and Zhou (2021). The authors identified poor engineering capacities of firms as the primary cause of performance problems. Ogunnusi, et al. (2021), Yap, et al. (2021), and AlMunifi and Almutairi (2021) revealed that firms with poor engineering capacity are not adaptive or proactive, often work behind schedule, and are accustomed to compromised quality. Yap, et al. (2021) posited that there is a significant association between appropriate managerial competency and high productivity rates. The study finding agrees with Do, Nguyen and Dang (2022a). They indicated that the poor performance of contractors is due to insufficient engineering capacity. Continuous capacity-building programmes are required to enhance firms' capabilities (Ayat, et al., 2021). Planning plays a crucial role in the success of a project (Irfan, et al., 2021). Yap, et al. (2021) ranked ineffective planning and poor scheduling as the most critical factors often resulting in project delays. The conclusion drawn in the study of Yap et al. is supported by the study of Durdyev (2021) and this current work. Othman, et al. (2021) posited that poor preparation is the greatest obstacle to performance achievement.

Management is at the core of every construction business operation. The study results show that poor management practices and poor, undefined work methods are inimical. Yuan, et al. (2021) avowed that good management aids efficient tracking and control. However, poor and undefined work methods create work overloads, a poor working environment, and mental stressors (Tijani, Jin and Osei-Kyei, 2021) that result in low productivity. Weak management systems increase risk and negatively influence prompt completion and the achievement of project goals (Adeleke, et al., 2019; Haron, et al., 2017).

Conclusion

The exploratory factor analysis identified inadequate environmental legislative framework to address modern environmental concerns in the delivery of construction projects, poor environmental practices, and non-inclusion of occupational health and safety in contracts as the three most relevant factors that can take a toll on project performance.

The CFA model classified negative factors under three main headings, namely, PAS, IPS, and WMS. PAS was highlighted as the factor significantly influencing performance among the three components. Its subfactors, poor environmental practices (PAS2), the inadequate environmental legislative framework to address modern environmental concerns in the delivery of construction projects (PAS1), and non-inclusion of occupational health and safety in contracts (PAS3), were recognised as the most relevant factors across the three thematic components. The findings show that environmental, health, and safety issues; prompt handover of the site to the contractor by the client; government regulatory frameworks; and occupational health and safety (OHS) policies are central to a construction project's overall performance and success. Furthermore, it is imperative for project stakeholders to refrain from imposing any limitations on projects.

Implications of the study

The results provide crucial information to bolster existing literature by expanding the subject and unearthing pertinent issues detrimental to construction projects. It serves as the foundation for future research.

The study findings also have significant practical implications because they identify the negative factors affecting construction projects' performance, which serves as a valuable source of information for all project stakeholders to avoid throughout the process from conception to delivery. The results suggest that poor assessment strategies, inefficient regulatory systems, and weak management systems can lead to poor environmental practices, violations of environmental protocols, and the erosion of contractors' health and safety consciousness. Local communities would be adversely affected if the project scope and impact were not comprehensively evaluated. In addition, the findings can lead to faulty project implementation, poor planning and coordination, and poor supervision and monitoring. These can impact and undermine the progress and success of projects, and they can affect project organisation and adherence to vital project delivery issues. The results show that project stakeholders like the government, clients, consultants, and contractors have specific roles to play in achieving the needed performance on a project.

In terms of construction sector policy, the findings identify crucial areas like the environment and health and safety, where government and client leadership and interventions are required.

Study recommendations

Based on the findings, PAS2 and PAS1, consultants must perform a thorough environmental assessment to identify the environmental factors that could affect projects, impact nearby communities, and interact with them to determine their concerns and factor them into their decision-making processes right from the project initiation phase. Communities must be viewed from the beginning as critical external stakeholders, and their views must not be ignored. The discoveries from the environmental assessment must be incorporated into the design and procurement processes, as well as the construction and decommissioning phases of a project.

Contractors must put in structures to safeguard the project environment and communities and reduce any interaction with communities and the environment that may breach identified environmental concerns to the barest minimum.

The government must purposefully develop good environmental frameworks and legislation for the construction industry to safeguard its operations and ensure sound environmental practices. This legislation must place specific responsibilities on all stakeholders, compel contractors to adhere to sound environmental practices, and prescribe appropriate sanctions for perpetrators who may violate such environmental provisions.

The government, through the Public Procurement Authority (PPA), must sanitise the procurement landscape of fraud and corruption by identifying the weaknesses in the Public Procurement Act to strengthen its anti-corruption mechanisms.

The government should create a sound financial environment by promptly fulfilling its payment commitments to contractors. This would significantly improve their prospects of obtaining loans from financial institutions.

The government must implement H&S regulatory mechanisms in the construction industry to deal with health and safety issues.

To encourage contractors to fulfil their contractual obligations to their employees, clients, and consultants, they must ensure that every construction contract includes adequate provisions for health and safety.

Firms must build their engineering capacities and adhere to good project management practices. They must view planning and preparation as a critical phase of a project. Additionally, they should organise capacity-building training for personnel to enhance their supervisory, monitoring, and coordination responsibilities.

Limitations of the study

Like every other study, this one has some limitations. The inference that poor assessment strategies, inefficient regulatory systems, and weak management systems negatively affect project performance represents the opinion of the professionals who participated in the study. This conclusion may be different in developed settings with knowledge sophistication and technology, rigorous professional training, and regulatory regimes, and in some developing countries where project conceptualisation and implementation are guided. However, the findings presented here could be helpful in jurisdictions that share similarities with Ghana.

The EFA technique used is based on the premise that there is a linear relationship between the observable variables and the underlying factors. Not meeting this assumption could have potentially resulted in erroneous EFA findings. The EPA technique requires substantial computational resources, especially when dealing with large datasets. The determination of the number of components to extract in EFA relies on subjective opinion. There is no absolute, impartial approach to determine the number of components to extract.

CFA models utilise the chi-square test to evaluate the sufficiency of models. However, it is susceptible to the impact of sample size and tends to disregard models with large samples. Furthermore, it lacks the ability to provide insights about the extent and orientation of the disagreement.

Future research endeavours should prioritise cross-national surveys with experts from diverse countries and continents to enable broader generalisation regarding the utilised variables. Subjectivity in the application of EFA and the vulnerability of the chi-square can be mitigated by employing nonlinear models and advanced deep learning algorithms.

List of abbreviations

CFI, comparative fit index
CI, confidence interval
df, degrees of freedom
GFI, goodness-of-fit index
H&S, health and safety
IFI, incremental fit index

NFI, Normed fit index
OHS, occupational health and safety
PCFI, parsimony comparative fit index
PNFI, parsimony normed fit index
χ^2, Pearson chi-squared
RMSEA, root mean square error of approximation
RMR, root mean square residual

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