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The Significance Level of Critical Success Factors Affecting Contractor Performance in Winning Public Construction Tenders

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Critical Success Factors (CSFs); Contractor Performance; Public Procurement; Construction Tender

Abstract
This study analyzes the Critical Success Factors (CSFs) influencing contractor performance in public construction tendering under the Ministry of Public Works in Indonesia. Using a quantitative approach and Structural Equation Modeling–Partial Least Squares (SEM-PLS), data were collected from 597 contractors, comprising 161 small, 187 medium, and 249 large firms. The results reveal that the significance of CSFs varies across contractor classifications. For small contractors, performance is significantly influenced by Equipment Resources (X2), Technology and Innovation (X4), Competitive Pricing (X6), and Regulatory Understanding (X7). For medium contractors, the most influential factors are Company Qualification (X1), Equipment Resources (X2), Human Resources (X3), Document Quality (X5), and Competitive Pricing (X6). Meanwhile, for large contractors, performance is mainly driven by Equipment Resources (X2), Technology and Innovation (X4), Document Quality (X5), Competitive Pricing (X6), and Regulatory Understanding (X7). Across all classifications, Competitive Pricing and Equipment Resources consistently emerge as key determinants of tender success. The model fit indices (NFI = 0.712–0.759) confirm the robustness and validity of the developed models. These findings provide empirical evidence of how CSFs differ by organizational scale, offering theoretical contributions to construction management research and practical insights for improving competitiveness, transparency, and efficiency in Indonesia's public procurement system.

INTRODUCTION

The tendering process is a fundamental mechanism in the construction industry, shaping both project implementation and contractor competitiveness (Runeson & Skidmore, 1999). It requires contractors not only to demonstrate their technical qualifications but also to strategically manage resources, company reputation, financial standing, and experience with similar construction projects (Mergawy et al., 2023). In Indonesia, public construction procurement plays a particularly important role, as the Ministry of Public Works is the largest procurer of construction services, with procurement maturity levels varying significantly across regional units (Abduh et al., 2023).

A considerable body of international research has identified Critical Success Factors (CSFs) that influence success in construction projects and procurement (Chan & Chan, 2004). CSFs are essential because they represent the key organizational, technical, managerial, and regulatory capabilities that directly determine the likelihood of winning tenders and achieving superior performance. Studies emphasize the importance of company qualifications, resource capacity, cost competitiveness, document quality, and regulatory compliance as key determinants of tender success (Kasmono et al., 2025). More recently, digital innovation and e-procurement platforms have been highlighted as transformative factors in enhancing efficiency, transparency, accountability, and competitiveness. However, most existing studies originate from developed country contexts and predominantly emphasize project management in a broad sense, resulting in limited exploration of the specific mechanisms of public procurement systems (Ali 2024; Bhatta et al. 2023; Guevara et al. 2025).

Over time, the procurement of goods and services has evolved, and in the current digital era, it has increasingly shifted toward electronic-based procurement (LKPP, 2024). The government has mandated the use of national e-procurement platforms, overseen by the National Public Procurement Agency (LKPP), to increase transparency and efficiency (Amalia et al., 2023). Furthermore, the regulatory framework has undergone significant reforms, most notably through Presidential Regulation No. 12 of 2021, which amended Presidential Regulation No. 16 of 2018, introducing more stringent procurement procedures and quality assurance mechanisms (A. S. F. et al., 2020). These regulations establish uniform procedures for procurement under the Ministry of Public Works, ensuring compliance and accountability. An effective procurement process will produce high-quality service providers. Although there has been extensive research related to procurement, only a limited number of studies have focused specifically on the determinants of construction procurement, particularly how CSFs influence contractor performance (Afolabi et al. 2019; Luo et al. 2023).

Moreover, few studies provide a comparative perspective on how CSFs vary in importance across contractors of different qualification categories. Such differentiation is critical: small contractors often face constraints related to resources and rely heavily on human capital, which significantly influences tender success in Indonesia (Arifuddin et al., 2025a), while medium contractors tend to balance resource capacity with pricing strategies. In contrast, large contractors frequently rely on advanced technology, digital platforms, and established institutional relationships to maintain competitive advantage (OECD, 2016). In contrast, large contractors frequently rely on advanced technology, digital innovation, and regulatory expertise to succeed in complex, high-value projects. Understanding these differences is essential for formulating effective strategies for contractors and designing policies that support equitable competition and assist contractors in understanding the relative significance of the determinants of winning construction tenders (Adediran 2018; Aje et al. 2016; Ellis et al. 2021).

This study addresses these research gaps by examining the significance of CSFs in influencing contractor performance in public construction tenders managed by the Ministry of Public Works in Indonesia. A quantitative approach was applied using Structural Equation Modeling with Partial Least Squares (SEM-PLS), as SEM-PLS offers advantages in analyzing complex relationships, handling non-normal data distributions, and assessing models with multiple latent variables and indicators (Hair et al., 2014). The SEM-PLS methodology is particularly suitable for exploratory research and theory development in complex organizational contexts (Hair et al., 2020; Henseler et al., 2016).

The novelty of this study lies in its application of a comparative analysis across contractor qualification levels (small, medium, and large) to evaluate the differential significance of Critical Success Factors (CSFs) within the SEM-PLS framework. Specifically, the study employed separate SEM-PLS estimations for each contractor category, followed by a comparative structural analysis to identify cross-group differences in CSF significance. This approach provides new empirical evidence on how organizational scale shapes the influence of CSFs in public construction tender performance, offering more targeted and category-specific strategic insights.

This study aims to expand the international body of knowledge on CSFs by focusing on the Indonesian national procurement system, which remains underrepresented in global research. It provides a comparative analysis across contractor qualification levels, illustrating how organizational scale shapes strategic priorities and offering practical recommendations for contractors to refine tendering strategies and for policymakers to design more tailored interventions that enhance efficiency, competitiveness, and accountability in public construction procurement.

METHODS

This study employed a quantitative research design to investigate the significance of Critical Success Factors (CSFs) on contractor performance in public construction tenders managed by the Ministry of Public Works in Indonesia. Structural Equation Modeling based on Partial Least Squares (SEM-PLS) was applied, which is particularly suitable for predictive and exploratory models with multiple latent variables and indicators

The research population consisted of contractors participating in public procurement projects under the Ministry of Public Works, and purposive sampling was used to ensure representation across different qualification levels. Data were collected from 597 respondents, including 161 small, 187 medium, and 249 large contractors, drawn from western, central, and eastern regions of Indonesia to ensure geographic diversity. Respondents represented a broad cross-section of industry practitioners, including company directors, commissioners, project managers, procurement officers, and engineers, with professional experience ranging from less than 5 years to over 20 years and educational backgrounds from vocational to postgraduate degrees, enhancing the generalizability of the findings. The study examined factors determining contractor tender success, with contractor performance as the dependent variable, measured by indicators such as frequency of winning bids, project value won, consistency over multiple years, and tendering efficiency, while seven independent variables (X1–X7) were identified through literature review and contextual analysis of the Indonesian tendering environment.

RESULTS AND DISCUSSION

Profile of Respondent

Furthermore, an analysis was conducted on the respondent profiles, which includes the total number of respondents, the

Table 1. Profile of Respondent

No	Qualification	Amount of Data		Experience			Education			
		SUM	*%*	*< 5 Years*	*> 5 Years*	*> 15 Years*	*S1*	*S2*	*S3*	*Other*
1	Small	161	26,97%	98	54	9	110	26	0	25
2	Medium	187	31,32%	110	65	12	138	30	1	18
3	Large	249	41,71%	120	101	28	180	33	2	34
	Total	**597**	**100%**	**328**	**220**	**49**	**428**	**89**	**3**	**77**

These results demonstrate that the respondent data represent diverse experience and educational backgrounds across contractor categories in Indonesia.

Structural Equation Modelling Analysis

Discriminant Validity is calculated to decide the esteem of Discriminant Valitidy (Fornell Lacker Basis), which is the esteem of the relationship between the variable itself and the variable with other factors, should not be littler than other factors. The substantial respect must be more prominent than the esteem of the variable, and the other factors appear in Table V, Table VI, Table VII.

Table 2. Fornell Lacker Criterion Small Contractors

	X1.	X2.	X3.	X4.	X5.	X6.	X7.	Y
X1.	0,838							
X2.	0,612	0,813						
X3.	0,411	0,418	0,822					
X4.	0,694	0,772	0,529	0,845				
X5.	0,707	0,679	0,441	0,735	0,827			
X6.	0,609	0,693	0,413	0,703	0,629	0,832		
X7.	0,667	0,657	0,376	0,774	0,672	0,786	0,892	
Y	0,633	0,762	0,399	0,809	0,706	0,788	0,805	0,894

Table 3. Fornell Lacker Criterion Medium Contractors

	X1	X2	X3	X4	X5	X6	X7	Y
X1	0,782							
X2	0,225	0,871						
X3	0,119	0,312	0,847					
X4	0,108	0,323	0,763	0,922				
X5	0,413	0,304	0,136	0,158	0,907			
X6	0,112	0,227	0,196	0,175	0,105	0,793		
X7	0,235	0,883	0,337	0,319	0,332	0,228	0,830	
Y	0,436	0,545	0,431	0,416	0,467	0,647	0,520	0,782

Table 4. Fornell Lacker Criterion Large Contractors

	X1	X2	X3	X4	X5	X6	X7	Y
X1	0,815							
X2	0,851	0,856						
X3	0,284	0,242	0,839					
X4	0,279	0,261	0,706	0,920				
X5	0,259	0,255	0,165	0,162	0,942			
X6	0,130	0,111	0,093	0,029	0,003	0,815		
X7	0,157	0,155	0,091	0,132	0,278	0,058	0,860	
Y	0,469	0,464	0,362	0,339	0,407	0,624	0,306	0,761

Reliability Number Comes about of Reliability Checks (Composite Unwavering quality and Cronbach's Alpha), characterized as the instrument's viability in measuring the esteem of its pointers. The reliability test is carried out by looking at the Composite Reliability esteem of the build marker. The Reliability Tally Esteem (Composite Reliability and Cronbach's Alpha) will be palatable in case ≥ 0.7.

Based on the calculated results, it has shown that the computed value of Reliability (Cronbach's Alpha and Composite Reliability) for all constructs is more significant than 0.7, which indicates that the instrument has met the reliability criteria so that it can be said to be reliable and powerful to use in research.

This Reliability Test measures the consistency of the questionnaire, namely the indicators of each variable or construct. In this study, variable Y only has one needle, so there is no value for the reliability calculation results. Meanwhile, Discriminant validity is the measurement of indicators with the indicators themselves, which is carried out to ensure that each concept of each latent variable is different from other variables. For variable Y, this study only consists of 1 indicator, so there is no value for the validity calculation results Table VIII.

Table 5. Value Of Discriminant Validity (Cross Loading) Small, Medium And Large Contrators

VARIABLES	DISCRIMINANT VALIDITY		
	SMALL	MEDIUM	LARGE
X1.1	0,814	-	0,858
X1.2	0,871	0,73	0,789
X1.3	0,828	0,806	0,787
X1.4	0,839	0,77	0,86
XI.5	-	0,818	0,779
X2.1	0,767	0,848	0,822
X2.2	-	0,878	0,88
X2.3	0,813	0,909	0,895
X2.4	0,868	0,845	0,824
X2.5	0,801	-	-
X3.1	0,776	0,858	0,815
X3.2	0,824	0,85	0,852
X3.3	0,87	0,821	0,82
X3.4	0,847	0,835	0,845
X3.5	0,791	0,868	0,862
X4.1	0,86	-	-
X4.2	0,835	0,915	0,917
X4.3	0,889	0,928	0,922
X4.4	0,828	-	-
X4.5	0,811	-	-
X5.1	0,808	0,878	-
X5.2	0,844	0,933	0,948
X5.3	0,783	0,908	0,936
X5.4	0,871	-	-
X6.1	0,885	0,736	0,769
X6.2	0,801	0,794	0,8
X6.3	0,807	0,874	0,889
X6.4	-	0,831	0,833
X6.5	-	0,72	0,776

VARIABLES	DISCRIMINANT VALIDITY		
	SMALL	MEDIUM	LARGE
X7.1	0,908	0,886	-
X7.2	-	0,805	0,784
X7.3	-	0,797	-
X7.4	0,876	0,881	0,931
X7.5	-	0,774	-
Y1	0,862	-	-
Y2	0,924	0,756	0,736
Y3	0,894	0,783	0,764
Y4	-	0,779	0,764
Y5	-	0,811	0,779

The results of the validity calculation were carried out utilizing the Concurrent Legitimacy test (Normal Fluctuation Extricated). This method is to degree the Average Variance Extricated esteem with the estimation esteem (Average Variance Extricated) must meet each variable has affection, to be specific ≥ 0.5. Based on the calculated results in Table IX, Table X, Table XI the Merged Validity test (Average Variance Extricated) for all develops is more noteworthy than 0.5, so the assessed demonstration meets the discriminant validity criteria.

Table 6. Construct Reliability and Validity Small Contractors

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
X1	0,859	0,869	0,904	0,703
X2	0,830	0,841	0,886	0,661
X3	0,881	0,894	0,912	0,676
X4	0,900	0,901	0,926	0,714
X5	0,846	0,848	0,897	0,684
X6	0,777	0,783	0,871	0,692
X7	0,744	0,754	0,886	0,796
Y	0,874	0,877	0,922	0,799

Table 7. Construct Reliability and Validity Medium Contractors

	Cronbach's Alpha	Composite reliability (rho_A)	Composite Reliability (rho_c)	Average Variance Extracted (AVE)
X1	0,790	0,804	0,863	0,611
X2	0,894	0,901	0,926	0,758
X3	0,901	0,908	0,927	0,717
X4	0,824	0,827	0,919	0,850
X5	0,892	0,904	0,933	0,822
X6	0,851	0,854	0,894	0,629
X7	0,887	0,898	0,917	0,689
Y	0,788	0,789	0,863	0,612

Table 8. Construct Reliability and Validity Large Contractors

	Cronbach's Alpha	Composite reliability (rho_A)	Composite Reliability (rho_c)	Average Variance Extracted (AVE)
X1	0,873	0,881	0,908	0,664
X2	0,878	0,884	0,916	0,732
X3	0,895	0,904	0,922	0,704
X4	0,818	0,819	0,917	0,846
X5	0,874	0,879	0,940	0,888
X6	0,873	0,878	0,908	0,664
X7	0,769	0,797	0,850	0,740
Y	0,757	0,758	0,846	0,579

The SEM-PLS analysis of questionnaire data produced inner model results indicating substantial R-Square values for contractor performance, with small contractors at 0.790, medium at 0.747, and large at 0.729, demonstrating good model fit. Path coefficient analysis showed that for small contractors, the most influential factors were Technology and Innovation (X4 = 0.275), Regulatory Understanding (X7 = 0.252), and Competitive Pricing (X6 = 0.248), while for medium contractors, Competitive Pricing (X6 = 0.504), Equipment Resources (X2 = 0.277), and Document Quality (X5 = 0.224) dominated, and for large contractors, Competitive Pricing (X6 = 0.591), Document Quality (X5 = 0.245), and Regulatory Understanding (X7 = 0.206) were most significant.

Significance testing using T-statistics confirmed that for small contractors, Equipment Resources, Technology and Innovation, Competitive Pricing, and Regulatory Understanding were statistically significant ($p \leq 0.05$), and for medium contractors, Company Qualification, Equipment Resources, Human Resources, Document Quality, and Competitive Pricing significantly influenced performance. Overall, the findings highlight that competitive pricing consistently serves as the most critical determinant of contractor success across all levels, while other factors such as resource readiness, innovation, document quality, and regulatory compliance also play important roles depending on contractor size.

Table 9. Inner Model Test (Significance T-Statistic) Large Contractors

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
X1 -> Y	0,085	0,093	0,070	1,213	0,226
X2 -> Y	0,177	0,175	0,065	2,708	0,007
X3 -> Y	0,100	0,096	0,062	1,618	0,106
X4 -> Y	0,114	0,120	0,062	1,931	0,045
X5 -> Y	0,245	0,245	0,040	6,164	0,000
X6 -> Y	0,591	0,593	0,040	14,612	0,000
X7 -> Y	0,206	0,205	0,037	5,649	0,000

The inner model results for large contractors reveal that five factors significantly affect contractor performance at the $p \leq 0.05$ level: Equipment Resources ($t = 2.708$, $p = 0.007$), Technology and Innovation ($t = 1.931$, $p = 0.045$), Document Quality ($t = 6.164$, $p = 0.000$), Competitive Pricing ($t = 14.612$, $p = 0.000$), and Regulatory Understanding ($t = 5.649$, $p =$

0.000). These results indicate that efficient resource management, innovation capability, high-quality documentation, competitive bidding, and strong regulatory compliance are the primary drivers of success for large contractors in public construction tenders.

As a result of this research, we created a model and tested whether the model we created was good. To calibrate the model, the researchers used an internal model test (model fit) (see Figures 3 to 5). The internal model test (model goodness of fit) is a value that indicates how good the investigated model is. Tolerances are measured against the values displayed on NFI in PLS (See Table XVII).

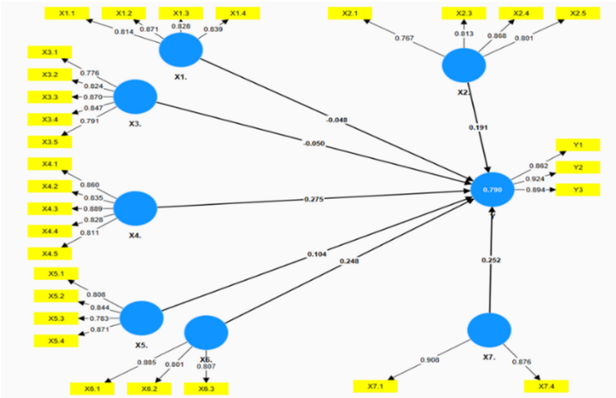

Figure 1. Inner Model Test (Model Fit) for Small Contractors

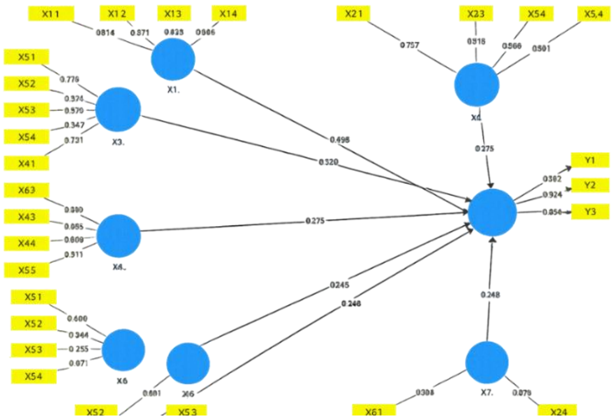

Figure 2. Inner Model Test (Model Fit) for Medium Contractors

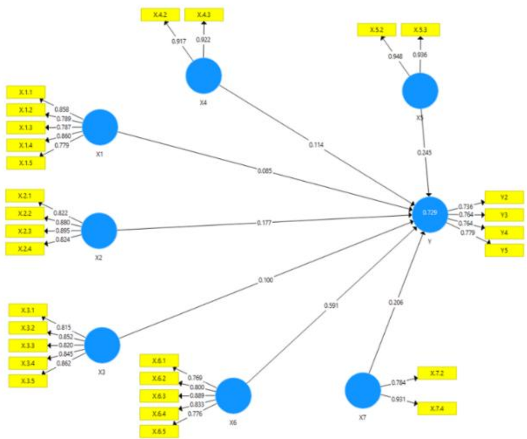

Figure 3. Inner Model Test (Model Fit) for Large Contractors

Table 10. Inner model test value (MODEL FIT)

	Saturated model			Estimated model		
	Small	***Medium***	***Large***	***Small***	***Medium***	***Large***
SRMR	0,072	0,064	0,057	0,072	0,064	0,057
d_ULS	2,411	2,187	1,429	2,411	2,187	1,429
d_G	1,302	1,189	0,782	1,302	1,189	0,782
Chi-square	1168,006	1171,586	1124,456	1168,006	1171,586	1124,456
NFI	0,712	0,733	0,759	0,712	0,733	0,759

The model fit analysis shows that the constructed models demonstrate good fit across all classifications, with NFI values of 0.712 or 71.2% for small contractors, 0.733 or 73.3% for medium contractors, and 0.759 or 75.9% for large contractors. These results indicate that the models are robust, well-calibrated, and suitable for evaluating contractor performance in public construction procurement.

Hypothesis testing is utilized to test whether there is an impact of exogenous factors on endogenous factors. The test criteria state that if T-Statistic ≥ T-table (1.96), it is famous that exogenous factors have a positive and noteworthy impact on endogenous factors. The results of significance testing are shown in Table 11.

Table 11. Inner Model Test (Significance T-Statistic)

Hypothesis	Factors	Small Contractors	Medium Contractors	Large Contractors
H1	Company Qualification	Rejected	Accepted	Rejected
H2	Equipment Resources	Accepted	Accepted	Accepted
H3	Human Resources	Rejected	Accepted	Rejected
H4	Technology and Innovation	Accepted	Rejected	Accepted
H5	Document Quality	Rejected	Accepted	Accepted
H6	Competitive Pricing	Accepted	Accepted	Accepted
H7	Regulatory Understanding	Accepted	Rejected	Accepted

The inner model results reveal that Competitive Pricing (H6) and Equipment Resources (H2) are consistently significant across all contractor classifications. For small contractors, performance is mainly driven by innovation, Equipment, pricing, and regulatory compliance. Medium contractors emphasize company qualification, Equipment, documentation, human resources, document quality and pricing efficiency. Meanwhile, large contractors are influenced by equipment resources, technological capability, document quality, and regulatory compliance, confirming structural consistency and model robustness across contractor categories.

The analysis indicates that several variables were rejected in the inner model test because they did not exhibit a statistically significant influence on tender performance within their respective contractor categories. A rejection occurs when the T-statistic falls below 1.96 or the p-value exceeds 0.05, indicating insufficient statistical support for the proposed relationship. For small contractors, Company Qualification, Human Resources, and Document Quality were not significant predictors. Among medium contractors, Technology and Innovation as well as Regulatory Understanding did not demonstrate significant effects. For large contractors, Company Qualification and Human Resources similarly showed no significant impact. These rejected variables reflect limited internal variability and indicate that the strategic roles of these factors differ across contractor scales, resulting in their reduced ability to discriminate performance outcomes within each group.

CONCLUSSION

This study empirically examined the Critical Success Factors (CSFs) influencing contractor performance in public construction tendering under Indonesia's Ministry of Public Works using Structural Equation Modeling–Partial Least Squares (SEM-PLS) with data from 597 contractors across small, medium, and large classifications. The findings reveal that the significance of CSFs varies by contractor category, reflecting differences in organizational capacity, resource allocation, and strategic orientation. Competitive Pricing (X6) and Equipment Resources (X2) were consistently significant across all groups, underscoring their central role in tender success. Small contractors are primarily driven by Technology and Innovation (X4), Competitive Pricing (X6), and Regulatory Understanding (X7), while medium contractors rely more on Company Qualification (X1), Equipment Resources (X2), Human Resources (X3), Document Quality (X5), and Competitive Pricing (X6). In contrast, large contractors depend on Equipment Resources (X2), Technology and Innovation (X4), Document Quality (X5), Competitive Pricing (X6), and Regulatory Understanding (X7), highlighting the importance of integrated systems and governance. The model demonstrated strong goodness of fit (NFI = 0.712–0.759), confirming its robustness across contractor classifications. These results contribute to the literature by offering a comparative perspective on contractor performance determinants in a developing country context; however, future research is recommended to incorporate longitudinal data, additional external variables such as market dynamics and policy changes, and cross-country comparisons to enhance the generalizability and depth of understanding of CSFs in construction procurement.

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