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Determining Factors of Contractor Tender Winning in Construction Projects

Rosmariani Arifuddin*, Ezra Artahsasta, Muh Rifan Fadlillah, Syarif Burhanuddin

Department of Civil Engineering, Faculty of Engineering, Universitas Hasanuddin, Gowa, Indonesia

*Email: rosmarianiarifuddin@unhas.ac.id

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Abstract

Many participants experience failure because they cannot handle the associated risks. Some do not even know the risks that can derail their tenders. The purpose of the study was to investigate the influence of construction service providers' bidding strategies. Data collection was carried out through a literature study of previous research to identify influential factors in winning contractor tenders. A questionnaire survey was then conducted to determine which factors were most influential, and these were analyzed using the SmartPLS application. The study's result reveal some important insights into the factors affecting tender success in Indonesia, including the high influence of financial factors (87.0% for medium qualifiers and 88.2% for significant qualifiers), the strong influence of technology and information systems factors (72.5% for medium qualifiers and 69.5% for significant qualifiers), the significance of factors between intermediate and large qualifying contractors such as human resources having a more significant influence on intermediate qualifiers (64.8%) than large qualifiers (54.7%), and the high significance of construction safety plan factors (68.1% for intermediate qualifiers and 55.9% for significant qualifiers). An in-depth understanding of these factors and their interactions can help contractors develop more effective tendering strategies and improve Indonesia's construction industry's quality and efficiency.

Keywords: Bidding Strategy, Contractor, Tender winning, Procurement.

1. Introduction

One of the processes for obtaining construction project work is by participating in tenders [1]. An auction is required to choose a qualified contractor. A tender is a series of bidding activities that aim to determine which contractors or companies are suitable and feasible to complete a work package [2]. Tender is an activity that aims to select, obtain, determine, and appoint the most feasible company on a work package [3]. Based on Presidential Regulation Number 16 of 2018 concerning Government Goods/Services Procurement, state-financed construction is procured through an e-procurement electronic tender [4]. Usually, the tender winner is the party offering the lowest price among other tender participants [5]. This assessment system needs to be improved in the tender results process and evaluation because it does not account for other technical values, resulting in unfairness in assessing a prospective partner [6].

In contrast, certain prospective partners are directed to win [7]. Many participants experience failure because they cannot handle the associated risks. Some do not even know the risks that can derail their tenders [8]. Common mistakes made by contractors so that the auction competition loses include, volume calculation errors, lack of accuracy in conducting field surveys, inappropriate allocation of risk costs, not taking into account opportunities canbring profits during the implementation period, for example price escalation, claims for differences in conditions between tender documents and field reality, competing with bidders whose company size is very different, and a competitor's strategy of offering prices that other bidders are unlikely to follow [9].

This study aims to investigate the factors determining the winner of a contractor tender in a construction project. It aims to model these determinants using Structural Equation Modeling-Partial Least Square (SEM-PLS) and analyze their significance. The objectives of this study are to identify the factors that contribute to the success of contractor tenders, evaluate the modelling of these determinants, and analyze the significance of these factors in construction projects. This research seeks to provide valuable insights into the contractor tender selection process and shed light on the factors that play an essential role in determining the winner. By understanding

these determinants, it is possible to optimize the selection process and increase the success rate of contractor projects in the construction industry.

A construction project is a series of activities that are carried out only once, generally have a short time, and provide the final result in the form of a building [10]. Construction projects must simultaneously address the issues of geography, site conditions, community, physical environment, existing infrastructure, and various stakeholder requirements [11]. Construction projects are sometimes built where the organization's primary business operates. Still, they can also be built in remote environments, sometimes opposite the open sea, below the earth's surface, and soaring high into the sky [12]. An auction is a series of activities to provide goods/services by creating healthy competition among equal and qualified providers, based on specific methods and procedures that have been determined and followed by the parties concerned obediently, so that the best provider is selected tendering [13]. The implementation of a building in the field of construction services contracting, also known as an auction, is a system of procuring materials and services. In the field of construction services, the implementation tender is carried out by the assignor/project owner by inviting several contractor companies to get one winner who can carry out the work according to the specified requirements at a reasonable price and can be accounted for both in terms of quality and implementation time [14].

Construction service providers are persons or entities that receive and carry out work following the costs set out in the plans, regulations, and conditions [15]. The main requirement for construction service providers to participate in the auction is to have a business entity certificate and an expert certificate or skilled person certificate issued by the Construction Services Development Institute, in accordance with their field of expertise [16]. An offer is a proposal by one party to do something for the other party's benefit according to predetermined and mutually agreed terms [17]. In selecting providers of goods or construction services, there are various methods for submitting bid documents. The one-cover method procures goods or services with standard prices and precise specifications. The two-cover method is used for more complex procurements that require the assessment of technical requirements and bid prices separately to prevent prices from affecting technical assessments. The two-stage method procures construction work or other complex services with specific performance criteria. It may require consideration for ease of operation and maintenance, or multiple alternatives for technology application. These methods help ensure a fair and efficient procurement process for goods and services [18].

2. Methodology

This article presents a research study that uses descriptive methods and survey techniques, using qualitative and quantitative approaches. This research aims to describe a symptom, event, or occurrence that is happening now. The data analysis involves processing the available data using statistical methods to answer research problems. Partial Least Square uses the bootstrapping or random doubling method, which eliminates the need for normality assumptions and allows the use of small sample sizes. This study shows how it can be used as a practical analysis technique when the sample size is limited or normality assumptions still need to be met. The research conceptual framework can be seen in Fig. 1.

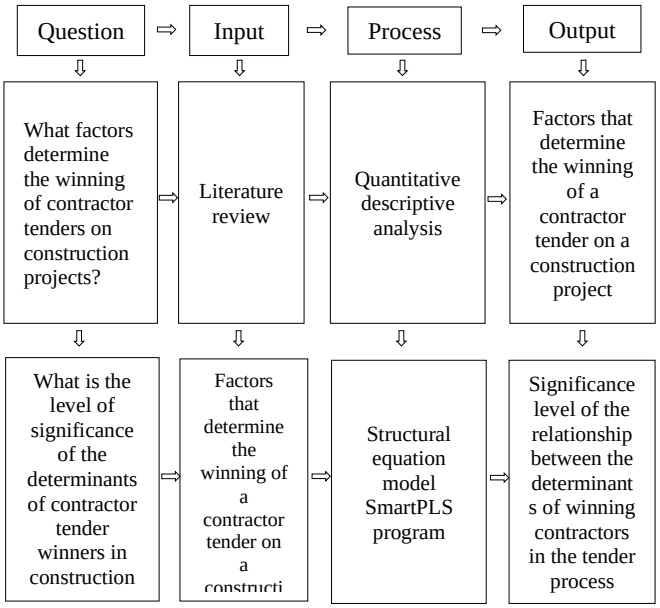

Figure 1. Research operational framework.

The researchers plan to use both primary and secondary data in this study. Primary data refers to data collected directly from the source, such as through research instruments or observing the object of research. The primary data includes previous research mapping and the results of questionnaires distributed to selected contractors in Indonesia. The mapping of previous research aims to find influential factors in contractor tender wins, which are then adapted to the context of construction projects in Indonesia. This modification was done to consider the differences in tender regulations and requirements in Indonesia. Secondary data, on the other hand, refers to supporting data derived from historical reports, such as archives or published/unpublished documents. Secondary data in this study includes information from relevant journals, previous research, and activity reports. Specifically for research questions 1 and 2, secondary data comes from the Central Bureau of Statistics and the Electronic Procurement Services data.

The population in this study is all contractor companies registered with the e-procurement system in Indonesia for the last five years. These contractor companies cover various business scales, from minor to medium to large contractors. This research focuses on contractors with a track record of participating in construction project tenders in the public and private sectors. The sample size in this study was determined based on the Slovin formula approach to ensure the representativeness of the large population. With an estimated population of 500 contractor companies active in tenders in Indonesia, the sample size was calculated using a 5% margin of error. From the calculation results, the sample used amounted to approximately 223 contractors. The study used a stratified random sampling method to ensure a balanced proportion of medium and large contractors. Each stratum was selected based on the classification of qualification levels regulated by the

government, namely medium and large qualifications, taking into account the number of projects handled and the value of the project. This method aims to obtain a fair representation of the various contractor groups relevant to the context of this study.

The research questionnaire was designed using a 5-point Likert scale approach, where respondents were asked to indicate their level of agreement with the given statements. The questionnaire consisted of four main sections, each covering the determinants of winning tenders based on a literature review and adaptations from previous research.

- The company profile and tender experience contained questions regarding the type of company, business qualifications, work experience participating in tenders, number of projects won, and the size of the company based on the number of workers and the value of projects handled in the last five years.
- Financial aspects include questions related to the company's financial strength, ability to submit a competitive bid, and capacity to fulfill the financial requirements needed in the tender process.
- Equipment and human resources include questions regarding the availability and capacity of the company's equipment, the experience of its human resources, certifications held by key personnel, and the company's ability to meet the requirements of experts in the project.
- Technology and work safety plan measures how well the company utilizes the project management information system and its commitment to preparing and implementing work safety plans during project implementation.

The questionnaire contained 30 items, each covering factors identified in the relevant literature, such as company qualifications, financial strength, technology, and human resources. The questionnaire was distributed online through an online survey platform to all contractors who met the sample criteria. Data collection was conducted over three months, with regular reminders to increase the response rate. Out of 223 questionnaires sent out, 200 were returned in full, resulting in a response rate of 90%.

3. Result

Table 1 describes the variables obtained from the selected articles. The factors influencing the effectiveness of contractor tender winner determination in Indonesia were obtained and then mapped, consisting of nine main factors.

Table 1. Research variables.

Variables	Code	Indicators	References
(X.1) Regulations	X.1.1	Understanding of legal rules and regulations	[17]
	X.1.2	Compliance with Construction Services Procurement rules	[19]
(X.2) Company Qualification	X.2.1	Ability to complete the legality of the business entity (establishment/adoption deed and management)	[20]
	X.2.2	Ability to complete business licenses in the field of construction services	[20]
	X.2.3	Ability to complete the business entity certificate	[21]
	X.2.4	Basic skills of the company working on the Project, based on work experience in the last 15 years	[20],[21]
	X.2.5	Have similar work experience based on the classification sub-field (last 15 years)	[19], [21]
	X.2.6	Work experience in the sub-fields of classification/services and the required scope of work (last 15 years)	[19], [21]
	X.2.7	Company experience in construction within the last 4 years	[19], [21]
	X.2.8	Total work being carried out (for calculation)	[20], [21]
	X.2.9	Ability to follow in a year/remaining ability package based on the most number of experiences/years in the last 5 years	[22]
	X.2.10	Has the remaining ability package to 2015 follow in a year/remaining ability package based on the amount of experience at most/year in the last 5 years	[20], [21]
	X.2.11	Have a quality management certificate, an environmental management certificate, and an occupational safety and health certificate	[23]
	X.2.12	Have a taxpayer identification number with an identification status based on the results of confirmation	[20], [21]
	X.2.13	Length of time working in the construction sector	[3]
	X.2.14	Frequency of failure to complete contracts on time/contractor reputation	[20], [21, [22]
(X.3) Administration	X.3.1	Validity and completeness of the offer letter	[20], [21]
	X.3.2	Ability to provide bid security	[20], [21]
	X.3.3	Appropriateness of the planned timeframe for completion of work	[23]

	X.3.4	Conformity of the offered method with the work Method	[23]
(X.4) Equipment Resources	X.4.1	Understanding of equipment requirements	[20]
	X.4.2	Ability to offer minimum equipment type, capacity, composition, and quantity	[24]
	X.4.3	Ability to provide proof of ownership/proof of support for equipment	[20], [21]
(X.5) Human Resources	X.5.1	Understanding of managerial personnel requirements	[20, [21]
	X.5.2	Ability to fulfill the requirements of the work competency certificate and the certificate of personnel	[12]
	X.5.3	Ability to offer managerial personnel competencies, including length of work experience	[20], [21]
	X.5.4	Ability to offer managerial personnel who are not currently working on other/ongoing work packages	[20], [21]
(X.6) Subcontractor Work (Value > 25 M)	X.6.1	Ability to submit the subcontracted worklist in accordance with the required amount and type of work	[20], [21]
	X.6.2	Ability to provide subcontractors	[20], [21]
(X.7) Constructions Safety Plan	X.7.1	Ability to complete elements	[20], [21]
	X.7.2	Ability to complete the commitment pact signed by the highest management of the service provider company.	[20], [21]
(X.8) Financial	X.8.1	Knowledge of the base price	[20], [21]
	X.8.2	Ability to make unit price analysis	[20], [21], [22]
	X.8.3	Ability to prepare quantity and price list	[20], [21], [22]
	X.8.4	Ability to bid responsive and competitive prices	[3]
	X.8.5	Ability to fulfill capital requirements (bid guarantee, administrative costs, equipment, and personnel)	[3]
(X.9) Technology and Information Systems	X.9.1	Understanding and mastery of PBJ implementation technology	[19, [20]
(Y) Determinants Of Contractor Tender Winner	Y.1	Projects won by contractors in the tender process in Indonesia	[21]

The initial step taken is a measurement that determines how much the measure correlates positively with alternative measures on the same construct. Assessment can be done using the processed data through the loading factor. To conduct research in the early stages, a loading value measurement scale of 0.7 was developed.

After setting the loading factor limit of 0.7, the data analysis processed can be seen in Table 2.

Table 2. Convergent validity.

Intermediate Qualification		**Grand Qualification**	
Variables	Loading Factor	Variables	Loading Factor
X.1.1	0.953	X.1.1	0.987
X.1.2	0.980	X.1.2	0.977
X.2.1	0.814	X.2.1	0.780
X.2.2	0.846	X.2.2	0.744
X.2.3	0.830	X.2.3	0.814
X.2.4	0.813	X.2.4	0.800
X.2.6	0.863	X.2.6	0.731
X.2.7	0.852	X.2.7	0.871
X.2.8	0.797	X.2.8	0.827
X.2.9	0.845	X.2.9	0.861
X.2.10	0.792	X.2.10	0.841
X.2.11	0.818	X.2.11	0.831
X.2.12	0.786	X.2.12	0.836
X.2.13	0.865	X.2.13	0.838
X.2.14	0.814	X.2.14	0.831
X.3.1	0.919	X.3.1	0.885
X.3.2	0.942	X.3.2	0.964
X.3.3	0.939	X.3.3	0.821
X.3.4	0.838	X.3.4	0.877
X.4.1	0.972	X.4.1	0.885
X.4.2	0.819	X.4.2	0.964
X.4.3	0.816	X.4.3	0.821
X.5.1	0.923	X.5.1	0.962
X.5.2	0.889	X.5.2	0.927
X.5.3	0.887	X.5.3	0.897
X.5.4	0.849	X.5.4	0.778
X.6.1	0.995	X.6.1	0.884
X.6.2	0.810	X.6.2	0.953
X.7.1	0.890	X.7.1	0.995
X.7.2	0.966	X.7.2	0.831
X.8.1	0.752	X.8.1	0.884

X.8.2	0.821	X.8.2	0.953
X.8.3	0.922	X.8.3	0.884
X.8.4	0.883	X.8.4	0.953
X.8.5	0.861	X.8.5	0.884
X.9.1	1.000	X.9.1	1.000
Y	1.000	Y	1.000

The next stage is to assess convergent validity through the AVE (Average Variance Extracted) value. If a model has an AVE value above 0.6, the model is categorized as having high convergent validity. After elimination of the loading factor, which is below 0.6, the model has an AVE value, as shown in Tables 3 and 4.

Table 3. AVE value (intermediate qualification).

Variables	AVE
X1 (Regulations)	0.934
X2 (Company Qualification)	0.684
X3 (Administration)	0.871
X4 (Equipment Resources)	0.761
X5 (Human Resources)	0.787
X6 Subcontractor Work (Value > 25 M)	0.823
X7 Constructions Safety Plan	0.862
X8 Financial	0.722
X9 Technology and Information Systems	0.799

Table 4. AVE value (grand qualification).

Variable	AVE
X1 (Regulations)	0.965
X2 (Company Qualification)	0.667
X3 (Administration)	0.789
X4 (Equipment Resources)	0.823
X5 (Human Resources)	0.799
X6 Subcontractor Work (Value > 25 M)	0.845
X7 Constructions Safety Plan	0.841
X8 Financial	0.683
X9 Technology and Information Systems	0.965

Assessing the model with PLS starts by looking at the R-square for each latent dependent variable. The coefficient of determination (R-squared) can be a way to assess how much exogenous constructs can explain endogenous constructs. The expected value of the coefficient of determination is between 0 and 1. Table 5 shows the results of the R-squared estimation. After obtaining the R-squared value, the model for intermediate and grand qualifications can be seen in Fig. 2 and Fig. 3.

Table 5. R-square.

Y	R Square Value
Intermediate Qualification	0.775
Grand Qualification	0.759

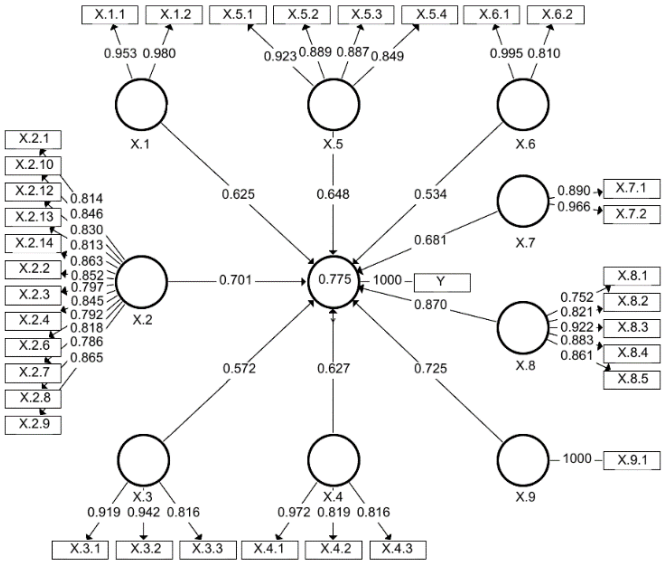

Figure 2. Intermediate qualification model.

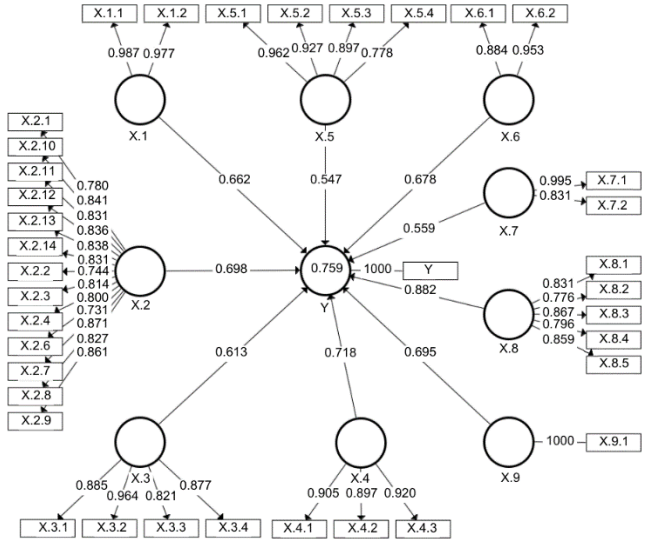

Figure 3. Large qualification model.

Hypothesis testing is used to test whether there is an influence of exogenous factors on endogenous factors. The test criteria state that the T-statistic ≥ T-table (1.96). In this case, exogenous factors have a positive and significant influence on endogenous factors. The results of the significance test are presented in Tables 6 and 7.

Table 6. Calculation model (intermediate qualification).

Hypothesis	T-statistics	P-value	Results
X1 -> Y1	2.223	0.023	Accepted
X2 -> Y1	3.015	0.000	Accepted
X3 -> Y1	3.318	0.000	Accepted
X4 -> Y1	2.010	0.011	Accepted
X5 -> Y1	5.023	0.022	Accepted
X6 -> Y1	2.318	0.000	Accepted
X7 -> Y1	2.893	0.032	Accepted
X8 -> Y1	2.541	0.011	Accepted
X9 -> Y1	2.257	0.025	Accepted

Table 7. Calculation model (intermediate qualification).

Hypothesis	T-statistics	P-value	Results
X1 -> Y1	3.106	0.000	Accepted
X2 -> Y1	2.159	0.012	Accepted
X3 -> Y1	4.963	0.020	Accepted
X4 -> Y1	2.026	0.005	Accepted
X5 -> Y1	4.396	0.018	Accepted
X6 -> Y1	2.097	0.032	Accepted
X7 -> Y1	2.620	0.027	Accepted
X8 -> Y1	4.424	0.090	Accepted
X9 -> Y1	3.245	0.029	Accepted

This study analyzes the influence of various variables on the determinants of winning contractor tenders in Indonesia. The results show that several factors have a significant influence on the results. The regulation influences 62.5%, the company qualification has an influence of 70.1%, the administration has an influence of 57.2%, the equipment resources has an influence of 62.7%, the human resources has an influence of 64.8%, the subcontracting work (value>25 M) variable has an influence of 53.4%, the construction safety plan has an influence of 68.1%, the financial has an influence of 87.0%, and the information technology & systems has an influence of 72.5%.

Similarly, large qualification contractors, found that the regulation has an influence of 66.2%, the company qualification has an influence of 69.8%, the administration has an influence of 61.3%, the equipment resources has an influence of 71.8%, the human resources has an influence of 54.7%, the subcontracting work (value > 25 M) has an influence of 67.8%, the construction safety plan has an influence of 55.9%, the financial has an influence of 88.2%, and the technology & information systems has an influence of 69.5%. These results highlight the importance of these factors in determining the winner of contractor tenders in Indonesia.

4. Discussion

In both intermediate and primary qualifications, finance was the highest value that influenced the determination of tender wins, followed by information systems and technology. This is by Mohammedet al. [2] which explains that finance is a top-ranked factor significantly influencing the successful tendering of construction projects in north-central Nigeria that can be used to gain competitive advantage when strategically applied by contractors in accordance with the main themes of resource-based and procurement theories, and dynamic capability theory which are harmoniously agreed upon by construction stakeholders. Contrary to the results of Abimantara and Purwito [14], which define that the mismatch of the remaining package capabilities (administration) and lack of supplier support are the most dominant factors causing failure, while other factors are factors that need to be considered as well to anticipate or minimize the occurrence of failure.

This study identified the determinants of successful contractor tenders through several stages: a) Systematic literature review: We reviewed 50 scientific articles related to construction tenders published in the last 15 years from the Scopus and Web of Science databases. b) Content analysis: From this review, we identified and categorized factors that frequently emerged as determinants of tender success. c) Synthesis: We combined similar factors and came up with nine main factors that form the basis of this study.

Although the factors identified are derived from international literature, their applicability to Indonesia shows some significant differences: a) The factor 'Technology and Information Systems' has a more significant influence in Indonesia (72.5% for medium qualification) compared to the findings of previous studies in other countries. It may be due to the rapid adoption of e-procurement in Indonesia since Presidential Regulation Number 16/2018 was enacted. b) The 'Construction Safety Plan' factor also shows higher significance (68.1% for medium qualification) than other countries' studies. It may reflect the increased focus on safety in the Indonesian construction industry in recent years. c) In contrast, the 'Company Experience' factor, which is often found to be highly significant in international studies, has a relatively lower influence in the Indonesian context. This may be due to the tender evaluation system in Indonesia, which emphasizes financial and technical aspects more than the company's track record.

To ensure the relevance and validity of the identified factors in the Indonesian context, we conducted a multi-stage validation process: a) In-depth interviews: We conducted interviews with 20 Indonesian construction industry experts, including ten senior project managers, five academics, and five government procurement officials. These interviews aimed to get feedback on the relevance, comprehensiveness, and contextualization of the factors. b) Focus Group Discussion (FGD): We organized 2 FGD sessions with 15 participants from various backgrounds in the construction industry to discuss and refine the operational definitions of each factor. c) Pilot study: We conducted a pilot test of the questionnaire on 50 contractors (25 medium qualifiers and 25 significant qualifiers) to test the research instrument's comprehensibility, applicability, and reliability. d) Statistical analysis: We used Confirmatory Factor Analysis (CFA) to validate the proposed factor structure and assess the construct validity of the research instrument. This validation process resulted in some critical adjustments:

- Addition of a sub-factor, 'Understanding of E-Procurement Regulation,' under the 'Regulation' factor.
- Modification of the operational definition of the 'Human Resources' factor to emphasize digital competencies more.
- Merging the 'Company Experience' and 'Company Qualification' factors into one more comprehensive factor.

Based on the research, administrative systems that are important in winning tenders for construction projects include the completeness of the bid letter, the ability to provide a bid guarantee is a critical factor in tender administration, planning by the proposed time frame is very important in the assessment, and the proposed method must be by the work method required by the project.

While this approach helps bridge the gap between theory and practice, we recognize that there are still limitations. Further research may be needed to explore other unique factors that may be specific to the Indonesian context but have not been identified in the international literature; conduct longitudinal studies to understand how the influence of these factors changes over time, especially with regulatory and technological changes, and analyze regional variations in the determinants of tender success, given Indonesia's geographic and economic diversity.

5. Conclusions

Based on the results of the study, which revealed some important insights into the factors that influence the success of contractor tenders in Indonesia, it was found that the influence of financial factors (87.0% for medium qualifications and 88.2% for ample qualifications) indicates that financial stability and competitive bidding strategies are crucial elements in winning tenders. It emphasizes the importance of effective financial management and careful budget planning for contractors looking to improve their chances of tender success. Significant role of technology and information systems: The strong influence of the technology and information systems factor (72.5% for medium qualifiers and 69.5% for significant qualifiers) reflects the ongoing digital transformation in Indonesia's construction industry. It suggests that contractors invest in technology infrastructure and improve the digital competencies of their staff to remain competitive in the tendering process. Variation between qualifications: The difference in the significance of factors between medium and large qualification contractors illustrates the diversity of challenges faced at different project scales. For example, the human resource factor had a greater influence on medium qualifiers (64.8%) than large qualifiers (54.7%), which may signal the importance of team efficiency and flexibility on medium-sized projects. Importance of construction safety: The high significance of the construction safety plan factor (68.1% for medium qualifiers and 55.9% for significant qualifiers) indicates the increasing awareness and regulations related to work safety in the Indonesian construction industry. It emphasizes the need for contractors to develop and implement robust safety protocols as part of their tendering strategy. Implications for practitioners and policymakers: The findings underscore the need for a holistic approach in tender preparation. Contractors must optimize their financial aspects, technological capabilities, human resource management, and safety practices. For policymakers, these results demonstrate the importance of developing comprehensive tender evaluation criteria reflecting the complexity and diversity of critical success factors. Future research directions: While this research has identified key factors, further studies are needed to understand how these factors interact and change over time. Longitudinal research and comparative analysis across regions in Indonesia could provide deeper insights into the dynamics of construction tendering in the country.

In summary, success in construction tenders in Indonesia depends on competitive bidding and contractors' ability to integrate technology, manage human resources effectively, and prioritize safety. An in-depth understanding of these factors and their interactions can help contractors develop more effective tendering strategies and improve Indonesia's construction industry's overall quality and efficiency.

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Conflict of interest

The authors confirm that publishing this paper does not produce any conflicts of interest.

Author Contribution Statement

Rosmariani Arifuddin, Ezra Artahsasta, and Muh Rifan Fadlillah proposed the research problem.

Rosmariani Arifudin, Ezra Artahsasta, Muh Rifan Fadlillah, and Syarif Burhanuddin developed the theory and performed the computations.

Rosmariani Arifuddin, Ezra Artahsasta, and Syarif Burhanuddin verified the analytical methods, investigated, and supervised the findings of this work.

All authors discussed the results and contributed to the final manuscript.

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