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DETERMINING WEIGHTCRITERIA/SUB-CRITERIA IN SELECTING PUBLIC CONSTRUCTION WORK CONTRACTOR

Mardiamaan

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Abstract

Determining weight criteria and sub-criteria in selecting public construction work contractors was a crucial point for project success. Various countries have practice methods of choosing a construction work contractor in e-procurement. The lowest-price process causes problems. The combination of price evaluation and technical capability is considered preferable. However, the determination of the ability to weight the criteria and sub-criteria is still unclear. Determining each criterion and sub-criteria weight makes it easier for the government to select contractors with good performance. Besides, the contractor feels that the selection in the construction tender has not fair and transparent. The method of determining the total weight of the criteria and sub-criteria for deciding on the winner of a construction tender uses a hierarchical analysis of the suitable process. The distribution of questions containing the criteria and sub-criteria was carried out to 101 purposively: government officer (9), contractor (37), consultant (15), construction services association (24), state-owned construction company (16).

Participants choose the level of importance based on pairwise comparisons of each criterion and sub-criteria using the Saaty scale. The period for collecting the Questioner was a month in January 2020. Distributed question sheets are written in a google.doc and distributed via email and WhatsApp. From the analysis of the answers that have been collected using the analytical hierarchic process (AHP), the results of the weight of financial performance criteria are obtained (0,436), technical performance (0,343), health and safety policy (0,115) dan past performance (0,106). Simultaneously, the highest sub-criteria was Stabilitas financial stability (0.374), the lowest unsuitable experienced(0,041). This result stressed the importance of proper input criteria and sub-criteria to assess the awarded contractor to deliver the project in e-procurement. the implication for the study, the government shared the elected criteria and sub-criteria by doing socialization to a contractor that involved in bidding

Introduction

Determining weight criteria and sub-criteria in selecting public construction work contractors was a crucial point for project success. The selection system influences the Failure and success of any public projects. Selection based on price has been widely implemented. First, offer the lowest price and the price

closest to the average bid price (Mechegiaw, 2012). The result brought about the problem of delays, cost overruns (Shrestha, 2015). (Arifin & Juwanti, 2013) examined that the elected winner in competitive bidding with offering value approaching 80 percent of the base value that previously set. (Suatan, et al., 2012) stated that the lowest bid should not be a significant criterion in evaluating offers construction services. Variety of approaches for decision making in selecting a contractor in some countries (Marzouk, et al., 2013). The determination of auction winners is based on the lowest price applied in some countries such as Nepal (Shrestha, 2015) Pakistan; (Khan, 2015)

Another alternative is to determine the competitive bidding winner by combining the technical capacity value system and the contractor's bid price. Technical capability includes a set of defined criteria. Each criterion is broken down into sub-criteria. However, the determination of the ability to weight the criteria and sub-criteria is still unclear. Indonesia applies 80% of the technical capacity value and 20% of the bid price. However, in the value system, the multi-criteria and sub-criteria have not been weighted with certainty. It brings uncertainty and confusion to construction stakeholders. Determination of the weight offered based on personal desires includes contractors, consultants, clients, construction associations, and state-owned construction companies. (Sharma & Batra, 2016) express that the AHP methods helpful for deciding on a multi-criteria basis. (Kusuma, Syairudin and Achmadi, 2018) describe that the AHP principle is conducting pairwise of the determine variables in taking the process of decision making. The analytical hierarchy process has already been implemented in prequalification to select a contractor based on the last determined criteria for the next evaluation (Polat, Kaplan and Bingol, 2015). The weight value is significant to know to get the right contractor.

Literature Review

Construction Stakeholder

Some of the members of the stakeholders of the construction service provider consist of state officers, contractors, consultants, construction service associations, supplier, legislative, etc. Each stakeholder has labor, whether skill or expert. The number of member stakeholders: contractor firm a 137383; consultant a 9289; construction association a 42 and certificate labor a 670957 (Www. LPJKN.net, 2020). Construction companies have an essential role in infrastructure development. Infrastructure funding is quite large in Indonesia, so the procurement of construction works needs to be regulated in regulations as a guideline to determine the winner of construction work. The principle of providing is efficient, effective, transparent, open, competitive, fair, and accountable. The competitive tendering system was implemented by two-stage prequalification and bid evaluation for investigating and assessing a contractor's capability to carry out work. The tender process for contractor choosing is done by E-Procurement (Tanubrata, 2011). The technical ability offering a weight of 60% to 70% and prices of 30% to 40%

Some researchers have examined the selection of contractors based on multi-criteria and sub-criteria with various methods. (Marzouk, et al., 2013) examines ten criteria and 46 sub-criteria to select sub-contractors;

(Tochaiwat, 2014) using eight criteria for selecting contractors in the housing sector. (Rashid, et al., 2018) using 43 criteria to determine the selection of contractors with the relative index method. Various systems select the winning contractor, such as elimination and scoring system (Puspitasari, et al., 2018) use twenty sub-criteria to measure the criteria. Sometimes it is found that measurement criteria and sub-criteria the contractor's election based on perceptions of clients (Wong, et al., 1999). (Bachmid, 2017) determining the tender winner in competitive bidding use criteria financial performance, technical performance, health and safety policy and past performance. Besides (Hatash and Skitmore, 1997) stated that the most suitable method of selecting a contractor must be well-known binding Criteria and sub-criteria

Financial Performance (C₁)

The ability of the contracting company to carry out construction work is determined by financial readiness. Financing for construction work can be in the form of own money, loans, and a combination of loans and own money. (Orkun & Nesrin, 2017) set criteria for financial credibility; financial strength. The contractor finances project resources according to the cash flow needs every day in pursuing the work progress that has been prepared. Evaluation of the contractor company finances needs to be done so that the project runs. It is often encountered that projects stop because funding is late in coming from the head office to the project site. Money in the form of cash is beneficial in procuring resources at the project site. Financial performance evaluation which was based on an investigation of measures such as net assets, earnings and several financial ratios including debt to equity, current ratio and ability to carry construction losses (Zedan & R., 1997); (Orkun & Nesrin, 2017); (MANIDEPAK, et al., 2009)

Health and safety policy

Safety and health policies contribute to the success of the project. The use of work safety equipment and personal protective equipment must be applied to mitigate work accidents. Work guidelines, socialization of work safety, work procedures contribute to reducing work accidents. The occupational safety and health plan should be prepared by the contractor to win the construction tender. The selection of contractors in the tender includes health and safety policy criteria. (Rashid, et al., 2018), (Orkun & Nesrin, 2017); (MANIDEPAK, et al., 2009) break down the criteria into sub-criteria including Health and Safety Experience; Accident Rate; Safety Rate, safety plan and safety record termination of construction work quality reference

Experience Performance

The more contractors doing construction work, the more they know how to solve the project site's problems. The type, level of difficulty, and size of the construction work affect the contractor in completing construction. Failure and success in achieving the previous construction work make it easier for the contractor to do the next construction job. Experience performance criteria include Past job performance; Past similar experience; Staff experience, work experience document; similar work experience (Orkun & Nesrin, 2017); Experience in the region; Past Failure; Size of past projects. a number of past projects (Rashid, et al., 2018). (Hatash

and Skitmore, 1997); Technical Performance; (Orkun & Nesrin, 2017); (MANIDEEPAK, et al., 2009).

Company competency

Construction companies must have reliable resources to be able to do construction work well. Company competencies include staff qualification; quality management; staff competency; work method; technology (Rashid, et al., 2018). The technical ability of the contractor must be evaluated by determining the technical equivalent price for each contractor (Hatush and Skitmore, 1997; (Orkun & Nesrin, 2017); (MANIDEEPAK, et al., 2009)

Analytical Hierarchy Process (AHP)

Hierarchy has been applied in determining the ranking of winners of construction service partners (Hartono, et al., 2016). The hierarchy starts from set objectives, criteria, and sub-criteria used and determines tender construction work winner based on the total value of the weight obtained by the contractor participating in the tender. AHP can also be used to assess Supplier (KARGI, 2016) conduct a study that the selection of suppliers for textiles can be made by the method of Fuzzy Topsis. (Ding, 2011) added that the selection of mining equipment. (Yavuz, 2016) explain that the alternatives used are ranked according to their tendency to make decisions. According to (Jacob 2017) that in the selection of a contractor in a government project, it must meet the principles of good government in the procurement process and be closely monitored. The AHP method is very suitable to be applied to make decisions about choosing criteria and sub-criteria based on the weight

Research Method

Distribution of technical competence question forms containing criteria and sub-criteria in selecting competitive tender was conducted in a month in January 2020. The question comprises four criteria and 30 criteria (table 3). Respondents were asked to choose one criterion with other criteria in pairs. In the same way, selecting one sub-criterion with other sub-criteria for each criterion. Scale values from 1 to 9 use the current scale: equal importance (1); intermediate values between a dan 1 (2); weak importance (of one over the other) (3) intermediate values between 3 dan 5 (4); strong importance (5); intermediate values between 5 dan 7 (6); demonstrated importance over the other (7); intermediate values between 8 dan 9 (8); absolute importance

The number of respondents 101 includes public clients (9). contractor (37), consultant (15), construction services association (24), company-owned state (BUMN) (16), the respondent from inside and outside of the capital of Indonesia. The determination of respondents was done by purposive sampling. The distribution of questionnaires was done online on google.doc through WhatsApp media and email.

Table 1 List of criteria and sub-criteria for selecting contractors

No	Criteria	code	Sub criteria	code
1	Financial Performance	(C ₁)	<ul style="list-style-type: none"> • Financial stability • Working capital • Financial support from banks and guarantees 	(SC ₁₁) (SC ₁₂) (SC ₁₃)

			<ul style="list-style-type: none"> • The total value of last year's debt • Operational cost 	(SC ₁₄) (SC ₁₅)
2	Technical Performance	(C ₂)	<ul style="list-style-type: none"> • Number of permanent workers • Workshop Ownership • Ability to define work references • Competency of worker • Worker experience • Availability of equipment • Communication / coordination skills • Quality assurance • Competence in information technology 	(SC ₂₁) (SC ₂₂) (SC ₂₃) (SC ₂₄) (SC ₂₅) (SC ₂₆) (SC ₂₇)) (SC ₂₈)) (SC ₂₉)
3	Health and safety policy	(C ₃)	<ul style="list-style-type: none"> • The number of experts is still K3 • Worker insurance guarantee • Realization of zero accident in project implementation • The level of compliance with K3 policy in the field • the number of workers who have received K3 training • Completeness of technical equipment & K3 • Work accident ratio 	(SC ₃₁) (SC ₃₂)) (SC ₃₃) (SC ₃₄)) (SC ₃₅) (SC ₃₆)) (SC ₃₇)
4	Past Performance	(C ₄)	<ul style="list-style-type: none"> • General contractor's experience in construction • Number of contracts obtained • Highest contract value • Work completion as scheduled in the contract • Work completion according to cost in the contract • Work realization following the specifications in the contract • Quality of completed projects • Relevancy of experience • Experience is not the same 	(SC ₄₁) (SC ₄₂) (SC ₄₃) (SC ₄₄) (SC ₄₅) (SC ₄₆) (SC ₄₇) (SC ₄₈) (SC ₄₉)

Finding Research

Financial Performance(C₁)

Financial Performance Criteria has a weighting of the 5 stakeholders (0,436); Government (0,416); Contractor (0,405) consultant (0,484); association (0,527) and BUMN (0,485). The highest value of financial performance weights in the Association (0.527). While for the highest sub-criteria, financial stability (SC₁₁) by the government and the lowest. The total value of last year's debt (SC₁₄) of Association. For the lowest combined expectations are also the total value of last year's debt SC₁₄)

Table 2 Criteria dan sub-criteriaweight for Financial Performance(C1)

CI	0,01	0,01	0,01	0,01	0,01	0,01
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SC	comb	Weight				
		Govt	cont	const	Asosiasi	BUMN
C1	0,436	0,416	0,405	0,484	0,527	0,485
SC11	0,374	0,423	0,403	0,322	0,422	0,352
SC12	0,296	0,75	0,262	0,329	0,318	0,277
SC13	0,129	0,086	0,126	0,14	0,115	0,143
SC14	0,082	0,074	0,086	0,077	0,053	0,100
SC15	0,119	0,142	0,123	0,132	0,092	0,128

Technical Performance(C₂)

Financial Performance Criteria has a weighting of the 5 stakeholders (0,346); Government (0,365); Contractor (0,372) consultant (0,328); association (0,278) and BUMN (0,2795). The highest value of technical performance weights is expected by the consultant (0.372). While for the highest sub-criteria(SC22) by the government and the lowest (SC₂₆) of Association. For the lowest combined expected weight SC₂₈.

Table 3 Criteria Weight and Sub Criteria Technical Performance(C₂)

CI	0,01	0,01	0,01	0,01	0,01	0,01
SC	comb	Weight				
		Govt	cont	const	asosiasi	BUMN
C2	0,343	0,365	0,372	0,328	0,278	0,279
SC21	0,137	0,102	0,104	0,143	0,186	0,166
SC22	0,163	0,193	0,147	0,151	0,279	0,184
SC23	0,195	0,167	0,215	0,165	0,148	0,172
SC24	0,161	0,171	0,16	0,179	0,175	0,136
SC25	0,119	0,166	0,127	0,114	0,09	0,099
SC26	0,073	0,071	0,08	0,098	0,039	0,073
SC27	0,089	0,062	0,1	0,088	0,045	0,1
SC28	0,063	0,068	0,067	0,062	0,038	0,07

Health and safety policy(C₃)

Financial Performance Criteria has a weighting of the 5 stakeholders (0,346); Government (0,115); Kontraktor (0,116) konsultan (0,116); asosiasi (0,089) dan BUMN (0,122). The highest value of weights (C₃) expected by the government (0.116). While for the highest sub criteria (SC31) for government (0.292) and lowest (SC37) of association. For the lowest combined expected weight SC37 (0.069).

Table 4 Criteria Weight and Sub Criteria Health and safety policy(C₃)

CI	0,01	0,01	0,01	0,01	0,01	0,01
SC	comb	Weight				
		Govt	cont	const	asosiasi	BUMN
C3	0,115	0,116	0,116	0,089	0,098	0,122
SC31	0,204	0,292	0,152	0,22	0,291	0,257
SC32	0,177	0,183	0,156	0,195	0,157	0,158
SC33	0,197	0,154	0,202	0,189	0,195	0,197
SC34	0,178	0,159	0,221	0,152	0,209	0,143

SC35	0,093	0,07	0,106	0,1	0,058	0,099
SC36	0,082	0,075	0,09	0,068	0,054	0,084
SC37	0,069	0,067	0,072	0,076	0,036	0,062

Safety and health competency merupakan peringkat ke 5 dari 43 kriteria yang dipilih

Past Performance(C₄)

Financial Performance Criteria has a weighting of the 5 stakeholders (0,106); Government (0,104); Contractor (0,099) consultant (0,097); association (0,089) dan BUMN (0,114). The highest value of weights (C₄) expected by the consultant (0,107). While for the highest sub criteria(SC41) oleh BUMN (0,234) and lowest (SC49) by BUMN (0,032). For the lowest combined expected weight SC49 (0,032).

Table 5 Criteria Weight and Sub Criteria *Past Performance(C₄)*

CI	0,01	0,01	0,01	0,01	0,01	0,01
SC	comb	Weight				
		Govt	cont	const	asosiasi	BUMN
C ₄	0,106	0,104	0,107	0,099	0,097	0,114
SC41	0,202	0,168	0,198	0,192	0,203	0,238
SC42	0,147	0,093	0,119	0,143	0,22	0,247
SC43	0,107	0,081	0,083	0,12	0,169	0,116
SC44	0,133	0,147	0,138	0,134	0,123	0,109
SC45	0,109	0,157	0,112	0,116	0,085	0,075
SC46	0,098	0,111	0,117	0,111	0,047	0,065
SC47	0,088	0,113	0,105	0,076	0,045	0,067
SC48	0,075	0,089	0,086	0,063	0,059	0,051
SC49	0,041	0,041	0,042	0,045	0,049	0,032

From the four criteria of the combined stakeholders obtained financial weights Performance (0.436), Technical Performance (0.343), Health and safety policy (0.115), and Past Performance (0.106). Meanwhile, for the highest sub-criteria of financial stability (0.374), the lowest experience is not the same (0.041).

From the government criteria obtained financial performance (0.416), technical performance (0.365), Health and safety policy (0.116), and past performance (0.104). Meanwhile, the highest sub-criteria was SC11 (0.423); the lowest was SC49 (0.041).

From the contractor criteria obtained financial performance (0.484), technical performance (0.372), health and safety policy (0.116), and past performance (0.117). Meanwhile, the highest sub-criteria were SC11 (0.403); the lowest was SC49 (0.042).

From the consultant criteria, it was obtained financial performance (0.405), technical performance (0.328), Health and safety policy (0.089), and past performance (0.099). Meanwhile, the highest sub-criteria was SC12 (0.329); the lowest was SC49 (0.045).

From the criteria of the Association, the figures are financial performance (0.527), technical performance (0.278), health and safety policy (0.098), and past performance (0.097). Meanwhile, the highest sub-criteria were SC11 (0.422); the lowest was SC37 (0.036).

The BUMN in criteria obtained financial performance (0.485), technical performance (0.279), health and safety policy (0.122), and past performance (0.114). Meanwhile, the highest sub-criteria was SC11 (0.352); the lowest was SC37 (0.032).

Discussion

The analysis results show that the weight of criteria and sub-criteria in the contractor selection process is different. From data processing on the elements that are compared, there is a massive difference in the weight suitable with perceptions among stakeholder members. This study's results are supported by (Wong, Holt, and Harris, 1999), who found that construction clients' opinions about the process of selecting contractors based on project-specific sub-criteria criteria would differ according to their interests. Moreover (Bachmid, 2017) found that in projects owned by state-owned companies such as Pertamina using the weight criteria of each criterion *financial performance* (0,057). Meanwhile (Rashid, et al., 2018) stated that cash in hand ranks 1 out of 42 criteria. The money on hand can be used quickly to pay for resources. Furthermore, other criteria in a row, *technical performance* (0,122). *Health and Safety Policy* (0,263). In (Rashid, et al., 2018) Safety and health competency are ranked 5th out of 43 selected criteria and *past performance* (0,558). The researcher proposes list of suitable criteria and sub criteria . construction stakeholder can use them jointly. So the results obtained in the study show that considering other attributes of contractors in the contractor selection process for public building works can be useful in evaluating experienced, capable, and qualified candidate contractors and eliminating incompetent, inexperienced, or underfinanced contractors during the bidding process. According to (Jacob, 2017) Successful implementation of government procurement of goods and services is determined by commitment, and the government meets the principles of good government in the procurement process and is closely monitored. Contrary to (Hatush and Skitmore, 1997), Failure to carry out construction work because there is no exchange of information between the project owners, especially between the contractors where the contractor works simultaneously, each client treats and groups the contractor differently. Inaccuracies in appointing contractors to work below standard, being late, rejecting, and even bankruptcy, some criteria need to be emphasized and considered more carefully. The consistency of the outcome obtained using the AHP approach can also be checked.

Indeed, in determining the tender winner, there are sources of risk that must be considered (Suatan, et al., 2012). The socialization of criteria and sub-criteria weights by the government needs to be done so that contractors who wish to win tenders can prepare themselves before participating in tenders. In this way, it is hoped that the fulfillment of the project implementation objectives of construction work can be met for the project's success.

Conclusion

The weight of the criteria and sub-criteria obtained in the study shows differences between one stakeholder member and another member. This is due to the interests and expectations of stakeholders regarding the tendered construction work

In selecting contractors, the stakeholder members will be involved so that the weight used is the combined weight of the perceptions of all stakeholders. It is expected that knowing the importance of each criterion and sub-criteria will help the contractor prepare himself to be able to win in the tender

The criteria for the highest combined stakeholders are Financial Performance (0.436) followed by Technical Performance (0.343), Health and safety policy (0.115), and Past Performance (0.106). Meanwhile, the highest weighting sub-criterion is. The number of experts is still K3 (0.204).

The selection of the right contractor avoids construction failures, which are detrimental to the project owner and the contractor itself.

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