



INTEGRATED MCDM MODEL FOR EVALUATION TWO FILE PREQUALIFICATION TENDER AT PROCUREMENT BUREAU IN INDONESIA

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ABSTRACT

Tenders in Indonesia are managed by the government, with each province having a goods and services procurement bureau that serves as the selection committee known as POKJA (*Kelompok Kerja*). The government uses LPSE for procurement, with tender evaluations involving document verification. The lowest bid prices and complete documents from three companies are called to attend a document verification evaluation at the Office of the Procurement Bureau. The verification evaluation process is typically manual and based on the working group's opinion, with no system involved. This results in unrealistic execution times, high qualification requirements, short auction processes, and poor coordination between the Commitment Making Officer and POKJA. To address these issues, a systematic and transparent auction evaluation procedure with clear criteria is needed, with multi-criteria decision making being the most appropriate method after analysis. The study on tendering and selection integration of Multi-Criteria Decision Making (MCDM) using ANP and WASPAS methods, which are better for complex scenarios and provide accurate, error-reducing results, making the study more mathematically straightforward. The study aims to aid the government in implementing transparent e-procurement through a model developed by procurement bureau. This model will enable a more transparent tender process, resulting in clearer contractor assessment results.



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I. INTRODUCTION

Tenders in Indonesia have a strong legal basis and are included in the JDIH LKPP (Legal Documentation and Information Network of the Government Procurement Policy Agency). For the construction sector, the regulations are governed by the Regulation of the Government Procurement Policy Agency No. 20 of 2021 concerning Guidelines for the Implementation of Government Procurement of Goods/Services through Providers. Procurement of Goods/Services is an activity that starts from the identification of needs to the handover of the work results. The guidelines for the implementation of Goods/Services Procurement through Providers include the preparation activities for Goods/Services Procurement through Providers, the preparation for the selection of Providers, the implementation of the selection of Providers, the execution of the Contract, and the handover of the work results. Before the procurement implementation, a Needs Analysis and Evaluation, as well as Procurement Planning, are conducted. The implementation of Goods/Services Procurement through Providers is a continuation of the procurement planning that has been carried out by the Budget User. The procurement officer who conducts the tender selection is the POKJA/Working Group.

The Selection Working Group determines the method of selecting Providers by considering the type of Construction Work and Construction Consultancy Services, Technical Specifications/Terms of Reference, and the complexity of the work, Budget Ceiling/Estimated Price, contract draft, market analysis results, and/or consolidation results. The Selection Committee implements the method of selecting Construction Service Providers, including: Direct Appointment, Quick Tender, Tender. Tender is used when E-Purchasing, Direct Procurement, Direct Appointment, and Quick Tender cannot be utilized. In a tender, there is a qualification method. Qualification is an evaluation of competence, business capability, and compliance with requirements as a Provider. Qualification is conducted through post-qualification or pre-qualification. This research focuses on pre-qualification tenders. The qualification evaluation in pre-qualification uses a knockout system for Construction Work Providers and a direct appointment process, or a weighted system with a threshold for Construction Consultancy Service Providers.

The pre-qualification results for Construction Work Tenders require at least 3 (three) participants to pass the qualification, for the Selection of Construction Consultancy Services, at least 3 (three) and at most 7 (seven) participants to pass the qualification, or for Direct Appointments, the pre-qualification results meet or do not meet the qualification requirements. If the participants who pass the qualification for Tenders/Selections are less than 3 (three), the pre-qualification is declared failed and a re-pre-qualification is conducted. [1]. The government, through the LKPP as the highest institution in Indonesia that conducts procurement practices, established the LPSE or Electronic Auction Institution. Based on Presidential Regulation Number 54/2010 jo. Presidential Regulation Number 70/2012, the LKPP was mandated to develop the Electronic Procurement System (SPSE) [2]. The version of SPSE currently in use is SPSE v4.5. The POKJA announces the tender until the winner is announced on the LPSE website.

One of the methods discussed in this research is the tender with the 2-file prequalification method, where participants will be called to attend the evaluation stage of the bid document verification, which consists of administrative, technical, and price documents. Subsequently, the Selection Committee conducts qualification verification for participants who meet the qualification requirements after the qualification evaluation is completed. The invited companies are 3 qualified companies to verify and explain all documents. The qualification verification evaluation process consists of 3 main criteria: administration, technical, and price. The first stage is the Opening of the Administrative and Technical Offer Documents (file I), where the Selection Committee evaluates the Offer Documents based on the data inputted and uploaded in SPSE. Next, the Selection Committee opens the price offer documents (file II). The price offer documents (file II) of participants who do not pass the administrative and technical evaluations are not opened. However, if they meet the requirements, the price offer documents (file II) will be opened.

The evaluation of the qualification opening is conducted privately between the POKJA and the selected Company, which will be called according to the schedule. The assessment is carried out manually by the POKJA, with the scoring following the POKJA's Decision. To avoid fraud, a system was created in the qualification proof evaluation process to make the tender process transparent, as tender participants can understand the evaluation processes of administration, technical, price, and qualification, thereby minimizing fraud in the tender process. [3]. During the data collection through observation, the researcher found inconsistencies, such as one company lacking documents in the expert personnel section, yet the committee still deemed the documents sufficient. According to the guidelines, this company should not meet the requirements and should be disqualified. However, due to the absence of applicable criteria in this case, it was considered qualified depending on whether the company could convince the committee or not. Such practices are highly discouraged, therefore a precise, accurate, and transparent evaluation system is needed in the qualification verification process. After conducting an analysis to determine the appropriate system method in this case, it was decided to use Multi Criteria Decision Making (MCDM).

Multi-criteria decision-making (MCDM) is one of the biggest decision-making issues which seeks to discover the best alternative by considering more than one factor in the selection process. MCDM provides several tools and strategies that may be employed in a variety of sectors. This post intends to offer a survey of the MCDM Model and integration methods.[4]. Creating a complete model for tender evaluation using MCDM techniques entails including a variety of factors to enable well-informed selections [5]. The primary goal of the MCDM technique is to choose the best choice from a group of options in the face of several competing criteria. However, there is a gap in the integration of uncertainty and sensitivity analyses. Future study should concentrate on sensitivity analysis to determine decision-making resilience to modifications in criterion weights, inputs, and assumptions. Time dynamics and temporal concerns should be taken into account throughout the MCDM process with ANP and WASPAS. [6-9]. Hybrid decision-making models that include several MCDM strategies should be investigated, including synergies with other approaches such as TOPSIS, AHP, and ELECTRE. [10].

II. THEORETICAL REFERENCE

II.1 EVALUATION TWO FILE PREQUALIFICATION TENDER

Prequalification is the process of evaluating qualifications conducted before the submission of bids. Prequalification is conducted during the implementation of Construction Work Tenders for complex procurement. The result of the prequalification for Construction Work Tenders is at least 3 (three) participants who pass the qualification. The Two File Method is used for the Procurement of Other Goods/Services that require a technical assessment first, namely the Value System Evaluation Method, the Life Cycle Cost Evaluation Method, and the Lowest Price Evaluation Method that uses threshold weighting. The stages of the 2-file Prequalification process include:

Invitation to participants who pass the prequalification, downloading of selection documents, provision of explanations, submission of Bid Documents, opening of administrative and technical Bid Documents (file I), administrative evaluation, technical evaluation for those who pass the administrative evaluation, announcement of participants who pass the administrative and technical evaluations (file I), opening of Bid Documents (file II) for those who pass the technical evaluation, price evaluation, determination and announcement of the winner, objection period, and the Selection Working Group's report to the Commitment Making Officer (PPK). [1] The implementation of prequalification begins with the Announcement of Prequalification, Registration and Downloading of Qualification Documents, Provision of Qualification Explanations (if necessary), Submission of Qualification Documents, Evaluation of Qualification Documents, Qualification Proof, Determination of Qualification Results, Announcement of Qualification Results,

Qualification Objection, Follow-up on Failed Prequalification. Two Files is a method of submitting bid documents where the administrative and technical requirements are included in one (1) file, while the bid price is included in another file and uploaded separately at the same time. The form of the Administrative and Technical Offer Document (File I) is as follows. For the Technical evaluation (File I), the Administrative Offer Document includes the Offer Letter (according to SPSE) and the bid guarantee (if required). Furthermore, for the Technical Offer Document, there are the Work Implementation Method, List of Main Equipment, List of Managerial Personnel, List of Subcontracted Work Sections (if required), Construction Safety Plan Form (RKK); and other required documents (if required). The form of the Price Offer Document (File II) is the Offer Price according to the Offer Letter and the Quantity and Price List (for unit price work sections) as well as the Output and Price List (for lump sum work sections). [1]

II.2 PROCUREMENT BUREAU

The Bureau of Goods and Services Procurement (BPBJ) has the task of assisting the Assistant for Economic and Development Affairs in preparing regional policy formulation, coordinating the implementation of Regional Apparatus tasks, coordinating the implementation of Regional Apparatus tasks in the field of goods and services procurement management, managing electronic procurement services, and providing guidance and advocacy for goods and services procurement. The Bureau of Procurement of Goods and Services consists of the Goods and Services Procurement Management Section, the Electronic Procurement Services Management Section, and the Goods and Services Procurement Guidance and Advocacy Section [11]. The Goods and Services Procurement Management Division has the task of preparing materials for regional policy formulation, coordinating regional policy formulation, coordinating the implementation of goods and services procurement, monitoring and evaluating the implementation of regional policies in the field of goods and services procurement strategy management, implementing goods and services procurement, and monitoring and evaluating goods and services procurement.

The Electronic Procurement Services Management Section is tasked with preparing materials for regional policy formulation, coordinating regional policy formulation, coordinating the implementation of electronic procurement services management, monitoring and evaluating the implementation of regional policies in the field of electronic procurement system management, developing information systems, and managing procurement information for goods and services. The Procurement and Advocacy Division for Goods and Services has the task of preparing materials for the formulation of regional policies, coordinating the implementation of training and advocacy for the procurement of goods and services, monitoring and evaluating the implementation of regional policies in the field of human resource development for the procurement of goods and services, institutional development for the procurement of goods and services, and providing assistance, consultation, and/or technical guidance for the procurement of goods and services.[11]. BPBJ formed a Working Group (POKJA) team for all tenders in each region.

The Selection Working Group can adjust the Tender Documents as needed as long as it does not conflict with the laws and regulations. The identity of the selection committee as stated in the Election Data Sheet (LDP). Based on Presidential Regulation No. 16 of 2018 Article 1 number 12, the Selection Working Group (POKJA) hereinafter referred to as the Selection Working Group is the human resource designated by the UKPBJ leadership to manage the selection of Providers. According to Presidential Regulation No. 16 of 2018 Article 13, the Selection Working Group in the Procurement of Goods/Services as referred to in Article 8 letter e has the task of preparing and implementing the selection of Providers, preparing and implementing the selection of Providers for the electronic catalog, and determining the winners of the selection/Providers for the tender and selection methods. The Selection Working Group consists of 3 (three) members. In cases where the complexity of the Provider selection warrants it, the members of the Selection Working Group may be increased as long as the number is odd. The Selection Committee can be assisted by a team or experts. [12]

II.3 LPSE

This LPSE system is a system developed by the Government Goods/Services Procurement Policy Agency. (LKPP). The government, which is a non-departmental government agency under and responsible to the President, was established based on Presidential Regulation Number 106 of 2007. LKPP is the only government agency responsible for developing and formulating government procurement policies for goods/services. In carrying out its duties and functions, LKPP is coordinated by the Minister of National Development Planning. And now, the conveniences in participating in government procurement activities have been developed by LKPP (the government procurement policy agency) through the implementation of the e-procurement and e-catalog systems, which are integrated into one system called LPSE (electronic procurement service). Once registered in the LPSE system, participants are ensured to be able to engage in procurement activities throughout Indonesia.[13]

II.4 MULTI CRITERIA DECISION MAKING (MCDM)

Since the 1970s, the literature on multi-criteria decision making has grown dramatically, and a wide range of decision-making approaches and tools have been created for a variety of choice issues.[14]. The research study found that sustainable supplier selection by MCDM had considerable increase in 2019. Researchers mostly communicated their scientific discoveries through articles, accounting for 81% of the publications, followed by conference papers (14%), and book chapters (2.5%); [15]. MCDM is a decision-making approach or process that considers various options based on a number of criteria. MCDM is a part of the scientific field of operations research.

The language's emphasis mixes qualitative and quantitative components, multi-criteria that sometimes contradict each other on the achievement of performance, therefore the value of the criterion is balanced. [16]. The operationalization of MCDM techniques is generally classified into 2 categories, namely Multi Attribute Decision Making (MADM) based on discrete patterns and Multi Objective Decision Making based on continuous patterns (MODM) as well as a combination of both [17]. Multi criteria decision making (MCDM) is a well-established branch of operations research, with core ideas dating back to the 18th century. Methods like ELECTRE, AHP, TOPSIS, and PROMETHEE emerged in the latter half of the 20th century[18].

Alinezhad and Khalili highlight that only a few methodologies, like MOORA (2006) and WASPAS (2012), are widely used in business or engineering due to factors like overabundance of techniques, poor knowledge diffusion, and timescale.

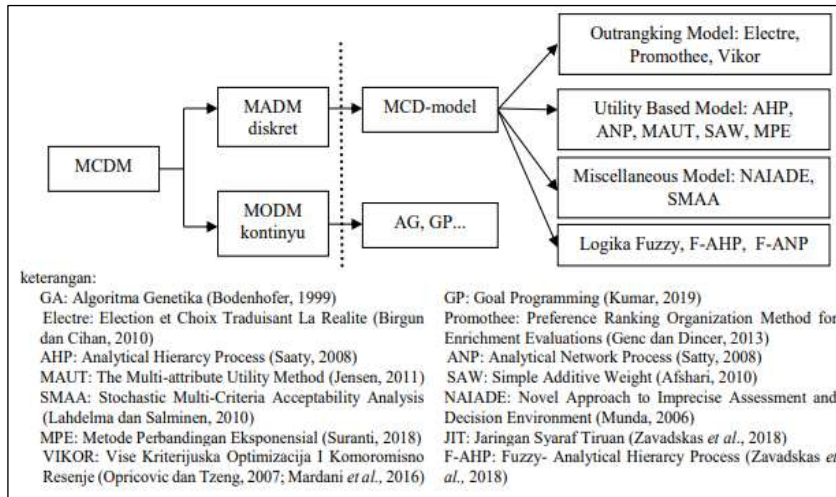


Figure 1: Structure MCDM and MCD-Model.
Source: [16].

III. MATERIALS AND METHODS

The focus of this research is solely on e-procurement tenders in the construction industry in Indonesia that use LPSE as a medium for conducting e-tenders. The object of the research is the Procurement Bureau of Goods and Services of Central Kalimantan Province. Data collected based on sources of observation, interviews, focus group discussions, and government documents related to construction tenders based on legal foundations. For the process of evaluating construction tenders based on literature studies and the experience of the tender committee/POKJA. In this study, the researcher uses two MCDM techniques to develop a multi-criteria decision support model in construction tenders to select the winning contractor. based on the literature review, 2 MCDM methods were chosen in this study, namely Analysis Network Process (ANP) and The Weighted Aggregated Sum Product Assessment (WASPAS). The research methodology framework is a crucial aspect of a research project that may clearly describe the workflow from beginning to end. As stated in the figure below, this research will be conducted in five phases, each of which will consist of 3-6 steps.

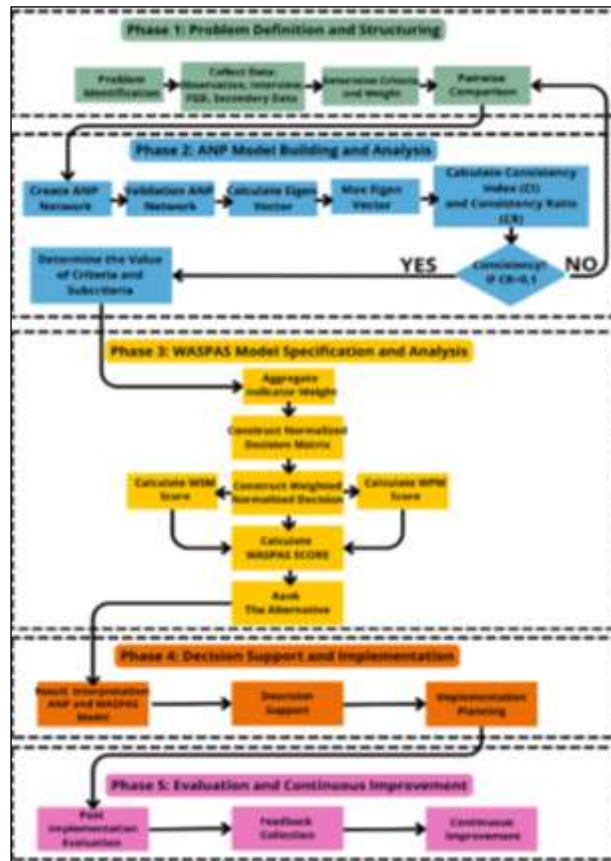


Figure 2: Research Framework.
Source: Authors, (2026).

Phase 1 to determine the criteria in the selection of contractor for a tender. Phase 2 and 3 to propose MCDM model for selection of contractor in tender evaluation. Phase 4 and 5 to evaluate the accuracy, precision, and specificity of the proposed MCDM Model in reducing biases and increase decision consistency.

IV. RESULTS AND DISCUSSIONS

After conducting analysis and data collection through observation, interviews, focus group discussions, and secondary data from BPBJ Central Kalimantan, three main criteria were identified in the implementation process of qualification proof evaluation for the two-file prequalification tender type, namely Administrative, Technical, and Price Criteria. Each of these three criteria has sub-criteria within them, as shown in the table below.

Table 1: Table Criteria & SubCriteria Two File Prequalification.

Criteria	Sub Criteria
Administrative	Tender Document (Tehcnical & Price Document); Tender Guarantee; Administrative Data; Legal Basis for Establishing a Business Entity; Business Entity Management; Business License; Business Entity Certificate; Other Certificates (if required); Financial Data (shareholding structure and taxes); Company Experience Data (last 15 years); Company Experience Data (last 3 years); Ongoing Project Data
Technical	Method of Work Execution; Main Equipment; Managerial Personnel; List of subcontracted work sections in the form of types of work subcontracted according to the SSKK provisions (if required); Construction Safety Plan Document
Price	Evaluation of Offer Price; Evaluating the completeness of the price offer documents and arithmetic corrections; The total corrected offer price compared to the HPS value; Evaluation of Price Fairness Considering price preferences for the use of domestic production (if it meets the requirements for the application of price preferences)

Source: Author (2026).

The tender evaluation is conducted using a lowest price system with a threshold. The committee evaluates the tender Documents based on the data inputted and uploaded in SPSE, except for the evaluation of the tender Guarantee, which is conducted based on the submitted tender Guarantee document. The Selection Committee conducts the evaluation of the first file offers, which includes: administrative evaluation and technical evaluation. The Selection Committee inputs the results of the first file offer document evaluation into the SPSE and displays the results of the first file evaluation through the announcement menu or other information upload menu on the SPSE.

Subsequently, the Selection Committee opens the second file offers with the following provisions: The second file offer documents of participants who do not pass the administrative and technical evaluations are not opened; The Selection Committee is not allowed to disqualify offers at the time of opening the second file offer documents, unless the second file offers cannot be opened (decrypted) based on information from the LPSE; After the second file offers are opened, the Selection Committee conducts a price evaluation.

Administrative evaluation using a knockout system. Technical evaluation has a score for each of its subcriteria, namely Method of Work Execution (44%); Main Equipment (24%); Managerial Personnel(20%); List of subcontracted work sections in the form of types of work subcontracted according to the SSKK provisions (if required)(7%); Construction Safety Plan Document(5%). Price evaluation has a score of 1-100 for each sub-criterion. Prequalification tender two files using the merit point system, with 80% for technical criteria and 20% for price criteria. Furthermore phase 2, ANP Model and analysis with 6 Step that is Create Network, Validation ANP Network, Calculate Eigen Vector, Max Eigen Vector, Calculate Consistency Index and Consistency Ratio, and Determine the Value of Criteria and Subcriteria.

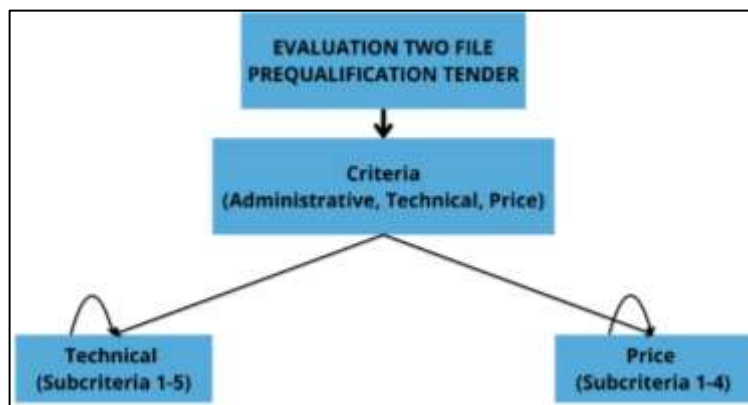


Figure 3: ANP Network.
Source: Author (2026).

The Analytic Network Process (ANP) is a decision-making method developed by Thomas L. Saaty, which enhances the Analytic Hierarchy Process (AHP) by modeling relationships among elements in a network structure. It is widely used in construction research for condition assessment, technology evaluation, and safety assessment, assisting in calculating the importance of criteria and facilitating systematic decision-making in complex scenarios [19-21]. Calculate Eigen Vector, The eigenvalue of a matrix is determined by summing the values of each column, dividing each column cell by the total column, and summing the values of each row and dividing by n. This process involves dividing by n and dividing by n.

Eigen Vector

$$X = \frac{\sum W_{i,j} / \sum W_j}{n} \quad (1)$$

Where X : *eigenvector*; Wij : column cell value in one row (i,j = 1...n); $\sum W_j$: total column; n : number of matrices being compared.

Max Eigen Vector : λ_{maks} which is the largest value of the eigenvector.

Consistency ratios verify accuracy of assessments for ANP calculations, with a CR value of less than 0.1 indicating consistency in the comparison matrix.

Consistency Index and Consistency Ratio

$$CI = \frac{\lambda_{maks} - n}{n - 1} \quad (2)$$

In a consistency matrix, practically $\lambda_{max}=n$, whereas in a matrix not every variation of will bring a change in the value of λ_{max} . The deviation of λ_{max} from n is a Consistency Index (CI) parameter. Description: CI= Consistency Index; λ_{max} = largest eigenvalue ; n = number of elements being compared

$$R = \frac{CI}{RI} \quad (3)$$

Where: CR = Consistency Ratio; CI = Consistency Index; RI = Random Index.

Phase 3 involves analyzing the WASPAS model for contractor selection in tender evaluation. The process involves aggregating indicator weight, constructing a normalized decision matrix, calculating WSM, WPM, Waspas scores, and ranking alternatives. This structured approach incorporates multiple criteria and stakeholder preferences, providing a structured approach to contractor selection.

Aggregate Indicator Weight

$$= \sum_{i=1}^n (Normalized\ Score_i \times Normalized\ Weight_i) \quad (4)$$

The aggregate indicator weight is a crucial factor in evaluating the overall performance of alternatives, aiding decision-makers in prioritizing and comparing options based on a thorough review of numerous criteria. Construct Normalized Decision Matrix : Normalized decision matrix with weighted scores reflecting the total performance of each alternative taking into account the relevance of each criterion. This matrix can be used to rank alternatives in a decision-making problem.

Normalized Decision Matrix

$$\bar{X}_{ij} = \frac{\min_i(X_{ij})}{X_{ij}} \quad (5)$$

Where: Xij: is the normalized value for a specific tuple (alternative, criterion); Xij is the original value to be normalized; $\min_i(X_{ij})$ represents the smallest value within the set of values for a specific monotonic cost criterion across all alternatives, the index i ranges from 1 to m, representing the number of alternatives.

Construct Weight Normalized Decision: Constructing the Decision Matrix MCDM challenges are characterized by sets of m choices and n criteria. As a result, an m-by-n matrix is generated with known values of the n criterion for each of the m possibilities.

Calculate WSM Score : The WSM score is calculated by adding the normalized scores and their appropriate weights for each option. This approach gives an easy way to assess and rank alternatives based on their overall performance when numerous criteria are considered. Adjust the weights and normalization procedures to meet the unique needs of the decision-making problem.

Calculate WPM Score: The WPM score is calculated by multiplying the product of the normalized scores with the weights assigned to each alternative. This approach gives an alternate method for evaluating and ranking alternatives based on their overall performance when numerous criteria are considered.

Calculate WASPAS Score: The WPM score is calculated by multiplying the product of the normalized scores with the weights assigned to each alternative. This approach gives an alternate method for evaluating and ranking alternatives based on their overall performance when numerous criteria are considered

Rank the Alternative: Ranking the results of the above calculations.

The integration of multiple Multi-Criteria Decision-Making (MCDM) methods, like F-ANP and F-WASPAS [10], can enhance the decision-making process. This approach considers a wide range of criteria and perspectives, reducing bias and ensuring a balanced, unbiased process. It also provides additional insights and validation, mitigates risks, enhances transparency, and increases stakeholder confidence in the chosen course of action, ultimately improving decision quality and resource allocation in complex scenarios.

No	Nama Peserta	K	SK	SR	B	A	T	SI	P	PT	HM	HI	SH	SA	P	PK	Alasan
1	PT TEMA KARYA MANDIRI - 01.411.611.111.00	✓	100,0	100,0	✓	✓	✓	80,0	Rp. 1.538.471.100,00	Rp. 1.538.471.100,00	Rp. 1.536.141.100,00	✓	100,0	84,72	★	★	
2	PT Prakteks Desain Konsultan - 71.011.611.111.00	✓	98,81	98,81	✓	-	-	-	-	-	-	-	-	-	-	-	
3	PT. ARPHALA WIRATAMA CONSULTANT - 01.811.011.105.00	✓	85,0	-	✗	-	-	-	-	-	-	-	-	-	-	-	tidak hadir pada saat pembukaan
4	Metro Engineering Consultant - 91.011.011.101.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
5	PT. POLA TEKNIK KONSULTAN - 81.111.711.111.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
6	pt. amoret mitra consultindo - 91.111.711.103.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
7	PT. ESA PRATAMA CIPTA SELEBER - 01.811.011.105.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Figure 4: Result Rank Evaluation from LPSE.

Source: [13].

V. CONCLUSIONS

The integration of the Analytic Network Process (ANP) and Weighted Aggregated Sum Product Assessment (WASPAS) methods involves combining the strengths of both techniques to enhance the decision-making process in Multi-Criteria Decision Making (MCDM) scenarios. The integration of ANP and WASPAS involves using the ANP framework to determine the weights and priorities of criteria and alternatives within a decision network. These values are then used in the WASPAS method to evaluate and rank alternatives based on weighted attribute values. The ANP-derived weights ensure the evaluation of alternatives reflects the relative importance of criteria. This allows decision-makers to analyze complex decision structures and prioritize alternatives based on weighted criteria values. The integration of ANP and WASPAS provides a robust approach to MCDM, combining the analytical depth of ANP with the evaluative power of WASPAS. This comprehensive approach considers structural relationships and dependencies between criteria (ANP) and the aggregation of preferences across multiple criteria (WASPAS), enabling more informed and structured decision-making in complex systems.

VI. AUTHOR'S CONTRIBUTION

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VIII. REFERENCES

- [1] J. LKPP, "Peraturan Lembaga Nomor 12 Tahun 2021," JDIH LKPP. Accessed: Dec. 27, 2024. [Online]. Available: <https://jdih.lkpp.go.id/regulation/peraturan-lkpp/peraturan-lkpp-nomor-12-tahun-2021>
- [2] S. Nadjamuddin and M. Nawawi, "EVALUASI PENERAPAN LPSE DALAM PERSPEKTIF GOOD GOVERNANCE," *Jurnal Informatics*, vol. 1, pp. 2338–9834, 2020, [Online]. Available: <http://www.lkpp.go.id/>.
- [3] Y. Salupra, "EVALUATION OF E-TENDERING IMPLEMENTATION AT REGIONAL PROCUREMENT SERVICE UNIT OF MINISTRY OF FINANCE IN SOUTH SULAWESI PROVINCE," *Jurnal Administrasi Negara*, vol. 26, no. 1, pp. 46–67, 2020.
- [4] H. Taherdoost and M. Madanchian, "Multi-Criteria Decision Making (MCDM) Methods and Concepts," *Encyclopedia*, vol. 3, no. 1, pp. 77–87, Jan. 2023, doi: 10.3390/encyclopedia3010006.
- [5] P. Ariya and K. Puritat, "The Multi-Criteria Decision Model using ANP approach for selection ERP Software of SMEs in the Upper North Region of Thailand," *2020 Joint International Conference on Digital Arts, Media and Technology with ECTI Northern Section Conference on Electrical, Electronics, Computer and Telecommunications Engineering, ECTI DAMT and NCON 2020*, pp. 206–210, 2020, doi: 10.1109/ECTIDAMTCON48261.2020.9090749.
- [6] S. Chakraborty, P. Chatterjee, and P. P. Das, *Multi-Criteria Decision-Making Methods in Manufacturing Environments Models and Applications*. CRC Press, 2023. Accessed: Jan. 03, 2024. [Online]. Available: https://books.google.com.my/books?id=gffOEAAAQBAJ&q=AHP+ANP++BOOK&lr=&hl=id&source=gbs_navlinks_s

- [7] E. Yunaeti Anggraeni and S. Hartati, "Implementasi Metode Waspas (Weight Aggregated Sum Product Assesment) Dalam Menentukan Ruko Yang Strategis," *Jurnal Teknologi Informasi*, vol. 3, 2021.
- [8] M. I. Alfariasi and M. Safii, "Penerapan Metode WASPAS Dalam Menentukan Peminatan Jurusan Pada Penerimaan Mahasiswa Baru," *Jurnal Teknologi Sistem Informasi dan Sistem Komputer TGD*, vol. 6, no. 1, pp. 274–280, 2023, [Online]. Available: <https://ojs.trigunadharna.ac.id/index.php/jsk/index>
- [9] C. Lukita, C. Nas, and W. Ilham, "Analisis Pengambilan Keputusan Penentuan Prioritas Utama Dalam Peningkatan Kualitas Mata Pelajaran Dengan Menggunakan Metode Perbandingan WASPAS dan MOORA," *Jurnal Nasional Teknologi dan Sistem Informasi*, 2019.
- [10] M. Saghari, M. Ehsanifar, and A. Babaei, "Identification and Prioritization of Optimal Places for Locating Urban Hospitals by Combin-ing the F-ANP, F-WASPAS Methods, and GIS Output in the ArcGIS Environment: Case Study: Arak City," *Theory of Approximation and Applications*, vol. 14, no. 2, pp. 13–34, 2020, doi: 20.1001.1.25382217.2020.14.2.10.4.
- [11] UKPBJ, "Tugas Pokok dan Fungsi Biro Pengadaan Barang dan Jasa Sekretariat Daerah Provinsi Kalimantan Tengah," BIRO PBJ KALTENG. Accessed: Dec. 28, 2024. [Online]. Available: <https://biropbj.kalteng.go.id/dokumen/detail/tugas-pokok-dan-fungsi-biro-pengadaan-barang-dan-jasa-sekretariat-daerah-provinsi-kalimantan-tengah>
- [12] ukpbj admin, "Dasar Hukum Kelompok Kerja Pemilihan (POKJA Pemilihan)," Bagian Pengadaan Barang/Jasa Setda Kota Depok-Pemerintah Kota Depok. Accessed: Dec. 28, 2024. [Online]. Available: <https://ukpbj.depok.go.id/?p=106>
- [13] J. Pangaribuan, Safuan, and Musa, "PENERAPAN LPSE (LAYANAN PENGADAAN SECARA ELEKTRONIK) UNTUK KEMUDAHAN KEGIATAN PENGADAAN BARANG DAN JASA," *Syntax Literate: Jurnal Ilmiah Indonesia*, vol. 7, no. 2, Feb. 2022.
- [14] J. van der Meer, A. Hartmann, A. van der Horst, and G. Dewulf, "Multi-criteria decision analysis and quality of design decisions in infrastructure tenders: a contractor's perspective," *Construction Management and Economics*, vol. 38, no. 2, pp. 172–188, Feb. 2020, doi: 10.1080/01446193.2019.1577559.
- [15] K. Khulud, I. Masudin, F. Zulfikarjah, D. P. Restuputri, and A. Haris, "Sustainable Supplier Selection through Multi-Criteria Decision Making (MCDM) Approach: A Bibliometric Analysis," Dec. 01, 2023, *Multidisciplinary Digital Publishing Institute (MDPI)*. doi: 10.3390/logistics7040096.
- [16] R. Jaya, E. Fitria, Y. Yusriana, and R. Ardiansyah, "MULTI-CRITERIA DECISION MAKING (MCDM) IMPLEMENTATION ON AGROINDUSTRIAL: A LITERATURE REVIEW," *Jurnal Teknologi Industri Pertanian*, pp. 234–343, Sep. 2020, doi: 10.24961/j.tek.ind.pert.2020.30.2.234.
- [17] R. Jaya, E. Fitria, Yusriana, and R. Ardiansyah, "Implementasi Multi Criteria Decision Making (Mcdm) Pada Agroindustri: Suatu Telaah Literatur," *Jurnal Teknologi Industri Pertanian*, pp. 234–343, Sep. 2020, doi: 10.24961/j.tek.ind.pert.2020.30.2.234.
- [18] K. Urošević, Z. Gligorić, I. Miljanović, C. Beljić, and M. Gligorić, "Novel methods in multiple criteria decision-making process (Mcrat and raps)—application in the mining industry," *Mathematics*, vol. 9, no. 16, Aug. 2021, doi: 10.3390/math9161980.
- [19] A. Septian, "Subcontractor Selection Review Industry XYZ With Analytic Network Process (ANP) Method," *IPTEK Journal of Proceeding Series No. 6 International Seminar on Science Technology (ISST)*, vol. 6, pp. 558–562, Jul. 2020.
- [20] M. Assaf, M. Hussein, S. Abdelkhalek, and T. Zayed, "A Multi-Criteria Decision-Making Model for Selecting the Best Project Delivery Systems for Offsite Construction Projects," *Buildings*, vol. 13, no. 2, Feb. 2023, doi: 10.3390/buildings13020571.
- [21] M. R. Ismail, M. Sun, and G. Bowles, "A risk-oriented tender evaluation system for construction projects in Malaysia," *Engineering, Construction and Architectural Management*, pp. 1–33, Jul. 2021, [Online]. Available: <http://mc.manuscriptcentral.com/ecaam>