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Analytical Hierarchy Process (AHP) Approach for CCTV Vendor Selection in Goods Procurement

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Abstract

Selecting CCTV devices and vendors is a complex process because it involves many criteria, such as reputation/rating, price, distance, delivery time, and warranty period. Financing companies face difficulties in conducting these evaluations because the process is still manual, there are no standard criteria, and it requires many stages of approval that hinder the process. This study designs a web-based decision support system using the Analytic Hierarchy Process (AHP) method to assist in the objective selection of CCTV equipment. This system considers three main criteria: price, delivery time, and warranty period. The calculation results show that the system produces consistent recommendations, with a consistency ratio (CR) value below 0.1. The system also addresses zero data in alternatives by replacing zero values with small (non-zero) numbers to maintain the validity of AHP calculations. Repeated testing shows stable results even with different data. Thus, this system provides an efficient, transparent, and standardized solution in the CCTV device procurement process at financing companies.

Keyword: AHP, CCTV, Consistency Test, Decision Support System, Non-Zero, Procurement of Goods and Services

1. INTRODUCTION

Financing companies are institutions engaged in the financial sector, and maintaining the security of assets, data, and daily operational continuity is a very important responsibility [1]. To support this aspect, the company has installed Closed-Circuit Television (CCTV) systems in each branch unit. However, the company faces challenges in determining the most suitable CCTV equipment and technicians. Each service provider has different prices, delivery time estimates, warranty periods, and after-sales services. This often makes it difficult for the management team to make decisions, especially when comparing vendors with dissimilar characteristics. In addition, the lack of a centralized database of previously used technicians and devices further complicates the evaluation and decision-making process. Currently, the selection of technicians and equipment is still done manually using spreadsheets such as Excel. This approach is considered suboptimal in terms of efficiency because it lacks standard comparison criteria and still relies on multiple approval stages, including from the Head Support level, to avoid errors or potential fraud from branches or technicians. In addition to process constraints, there are also technical constraints related to the data to be used in the Analytic Hierarchy Process (AHP) method. One of the technical problems that arises is the presence of zero values in the alternatives, for example, technicians who provide services free of charge (price = 0) or vendors who do not yet have a rating value. This problem is an obstacle in the AHP method, because zero values cannot be directly used in the AHP method, as this can cause inconsistencies in the calculation process in the comparison matrix [2]. Therefore, the non-zero principle is applied in AHP by replacing the zero value with a very small positive number such as 0.1. This approach is taken to ensure that the calculation process remains valid and the results are consistent, without changing the substance of the data used. The application of this principle is also the reason for choosing the AHP method, because this method is able to handle zero values in alternatives and provides a structured approach. According to Harahap et al [3] the AHP method helps break down problems into several criteria, assigns weights based on priority levels, and generates recommendations for technicians and CCTV devices that are most relevant to operational needs. AHP has the ability to address complexity, provide a clear structure for decision making, and allow for subjective preferences to be taken into account [4]. The establishment of this system can reduce the risk of fraud, optimize costs, and improve the quality of monitoring services across the entire branch network of the financing company.

2. RELATED WORK

The AHP method is a multi-criteria decision-making method that has been widely applied in various fields, including in the selection of technological devices and supporting services. [5]. According to Hakim & Setiawan [6] AHP is used to break down complex problems into a hierarchical structure consisting of objectives, criteria, sub-criteria, and alternatives, then weighting is carried out through pairwise comparisons, whereas Sianipar et al. [7] confirms its ability to handle significant differences between alternatives. The advantages of AHP include its ability to handle qualitative and quantitative criteria, as well as the existence of consistency tests to ensure the reliability of the results [8].

In addition to AHP, various other Multi-Criteria Decision Making (MCDM) methods are also widely used, such as Simple Additive Weighting (SAW), Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), VlseKriterijumska Optimizacija I Kompromisno Resenje (VIKOR), and MABAC [9]. SAW is known for being simple and easy to implement, but it lacks a consistency testing mechanism and is less effective when there are a large number of criteria. TOPSIS and VIKOR excel at accommodating trade-offs between criteria and are more suitable for automated systems with clear numerical data. MABAC is relatively new and stable, but sensitive to changes in criterion weights. Study results [9] shows that AHP offers a balance between simplicity, transparency, and the existence of a consistency testing mechanism, making it suitable for use in decision-making contexts involving qualitative and quantitative criteria, especially when the evaluation process is carried out manually.

In the context of security device procurement, the application of AHP has been discussed by Rozali et al. [4] which emphasizes its ability to provide optimal recommendations by considering various factors, such as device quality, cost, after-sales support, and technician reputation. Hidayat et al. [10] states that AHP helps simplify the vendor evaluation process with a systematic analysis structure. The study by Harahap et al. [3] also confirms the effectiveness of AHP in selecting solutions that suit a company's operational needs, especially when alternative data has significant differences Sudrajat et al. [11] shows the effectiveness of AHP in selecting CCTV brands based on quality, price, and after-sales service. Whereas Kristianingsih et al. [12] using AHP for supplier evaluation in the manufacturing and software industries with transparent and systematic results.

Additionally, in the financial and service industries, AHP is widely used to improve the objectivity of the procurement process. Ulya & Bakhtiar [2] Identifying the problem of zero values in alternatives (e.g., price or technician ratings) that can interfere with AHP calculations. To overcome this, a non-zero principle approach is used, namely, replacing zero values with very small numbers (0.1) to maintain mathematical validity without changing the meaning of the data. Abdillah et al. [13] shows that AHP is effectively used in DSS to assess the success of teaching, creating more systematic and flexible documentation.

Research conducted by Nguyen et al [14]. The study discusses the evaluation and selection of suppliers in software companies. Supplier selection is a critical task in supply chain management, and choosing the right supplier is one of the most challenging responsibilities. Decision makers must consider various criteria and priority criteria in the decision-making process. Therefore, this study focuses on purchasing decisions for laptops using AHP. The study uses several criteria such as product quality, supplier credibility, price and payment terms, supply and delivery capabilities, service quality, information sharing, and strategic alignment and coordination. The results of the study show that supplier 1 ranks first for the purchase of laptops with a supplier weight of 0.4027.

Another study was conducted by Kraugusteeliana & Violin [15] which discusses the Decision Support System for evaluating delivery service performance in the e-commerce industry. Evaluating delivery service performance is very important to ensure customer satisfaction and operational efficiency. Therefore, this study developed a Decision Support System model using AHP. The criteria used were price (C1), packaging (C2), delivery (C3), service (C4), and number of branches (C5), and there were alternatives used such as JNE (A1), J&T Express (A2), SiCepat Express (A3), and Ninja Express (A4). The results of the study show that A1 ranks first, A2 ranks second, A3 ranks fourth, and A4 ranks third.

Further research was conducted by Haris et al [16] who selected air conditioner brands at PT. Gemilang. Selecting the optimal air conditioner brand for PT Gemilang faced complex challenges because it involved evaluating various criteria such as quality, cost, energy efficiency, and after-sales service. Therefore, the study applied AHP to determine the air conditioner brand based on the existing criteria. The results of the study showed that Brand B was the best choice with a weight of 0.72, while Brand A ranked second after Brand B with a weight of 0.65, followed by Brand C with a weight of 0.63.

Another study was conducted by Nindyasari et al [17], which discussed a decision support system for conducting business feasibility analysis for batik entrepreneurs in Lasem. The main problem is that entrepreneurs do not have an information platform that can provide knowledge about business feasibility analysis. Therefore, this study developed a decision support system that assists in their business decision-making by applying AHP. Marketing criteria for product results are the main priority used as a determining factor. Then, it is analyzed based on the actors involved in product development efforts, investors, downstream industries, and financial institutions as the main priorities. The results of the study show that the alternative Batik product, Fabric, ranks first with a value of 0.356, followed by slipcover with a value of 0.336, scarf with a value of 0.147, bag with a value of 0.111, and finally accessories with a value of 0.050.

Various studies related to decision support systems (DSS) also show the important role of AHP as a main analysis component. According Wijaya et al. [18] DSS facilitates faster, more accurate, and more documented decision-making processes, for both structured, semi-structured, and unstructured problems. According to Imam et al. [19] Case studies involving AHP-based DSS show increased efficiency and transparency, for example in technician evaluation, vendor ranking, and selection of technology devices that meet specifications.

Specifically in the field of CCTV (Closed Circuit Television), Ahmad Tantoni et al. [20] emphasizes that device selection should take into account camera quality, durability, after-sales service, compatibility, and price. Study by Goncalves et al. [21] shows that components such as surveillance cameras, storage systems, and network infrastructure have a significant impact on the availability and reliability of the surveillance system where variations in the Mean Time To Failure (MTTF) and Mean Time To Repair (MTTR) of each component directly affect the stability of the system operation. According to Slama et al [22], The combination of AHP and DSS in selecting CCTV equipment has been proven to provide consistent and budget-friendly recommendations, as reported in previous studies that addressed procurement processes in large corporate environments.

Based on the literature review, it can be concluded that the integration of the AHP method with a web-based decision support system is an effective approach to improving the quality of decision-making in the procurement of equipment and services. This study adopts these principles, focusing on the application of AHP to the selection of CCTV technicians and equipment at PT. Sinarmas Multifinance, while implementing a non-zero solution to address the constraint of zero alternative values.

3. RESEARCH METHODOLOGY

3.1. Introduction

PT. Sinarmas Multifinance, as a national-scale financing company, views security systems as an integral part of its business operations. To support its security strategy, the company implements a modern CCTV system that requires a precise selection process for equipment and technicians. This selection involves complex factors such as quality, price, after-sales service, technician reputation, and technical compatibility with existing infrastructure. Therefore, this study applies the AHP method, which enables systematic decision-making through criteria weighting and alternative evaluation based on pairwise comparisons.

3.2. Research Design

This research uses a quantitative approach using the AHP method to systematically solve the problem of selecting CCTV equipment and technicians. The quantitative approach was chosen because it can transform subjective assessments into numerical data that can be analyzed objectively. The research design stages include in Figure 1.

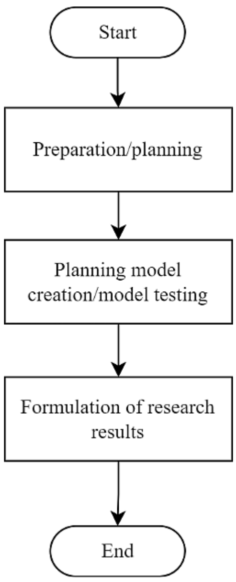

Figure 1. Research Flowchart

Figure 1 shows the general flow of the research conducted. This study integrates qualitative and quantitative data in decision-making using the AHP method. The initial stage begins with preparation/planning with criteria and subcriteria, where the selection of technicians considers factors such as quality, price, rating, and distance, while the selection of devices considers quality, price, delivery time, and warranty. In addition, data collection was carried out through questionnaires based on the AHP scale (1–9) and interviews with relevant parties. The data obtained was used to create a model/test model by performing an analysis to calculate the weight of each criterion and subcriterion using AHP software, accompanied by a Consistency Ratio (CR) check to ensure the consistency of the results. The analysis results were then validated by comparing them with the company's actual decisions. The final stage involved formulating the research results by compiling a report containing the analysis results and recommendations related to the selection of CCTV devices and technicians.

3.3. Data Collection

This study did not use sampling techniques in either the validity test or the interviews with the Head of System Engineering and Support and the Head of IT Program and Security. This was because it referred to the study by Nguyen et al [14], which did not use sampling techniques in interviews or questionnaire distribution. Data collection in this study was conducted through two main methods. First, through the distribution of questionnaires compiled based on previously identified criteria and subcriteria. Respondents were asked to provide assessments using a comparison scale of 1–9 according to the AHP method, so that the data obtained could be processed quantitatively. Second, through in-depth interviews with the Head of System Engineering and Support and the Head of IT Program and Security Management. These interviews aimed to strengthen understanding of the technical and operational context, while also ensuring the relevance of the criteria used. Data from the questionnaires and interviews were then used to create a pairwise comparison matrix that served as the basis for calculating priority weights.

3.4. Implementation Plan

The design of the implementation of a decision support system for selecting CCTV technicians and equipment based on the AHP method is visualized through a Context Diagram as shown in Figure 2,This diagram illustrates the interaction between external actors, namely Admin and User (Regional/Branch), with the system. Admin has full authority in data management, including the creation, editing, and deletion of user accounts, inputting data on regions, technicians, and CCTV devices. Users play a role in inputting data on technicians and devices for their respective regions, while also accessing the results of the AHP calculations generated by the system. The system processes all received data to perform criteria weighting, pairwise comparison matrix calculations, normalization, and generate priority weights and alternative rankings. The system outputs recommendations for the best technicians and CCTV devices, which are displayed to Admin and User.

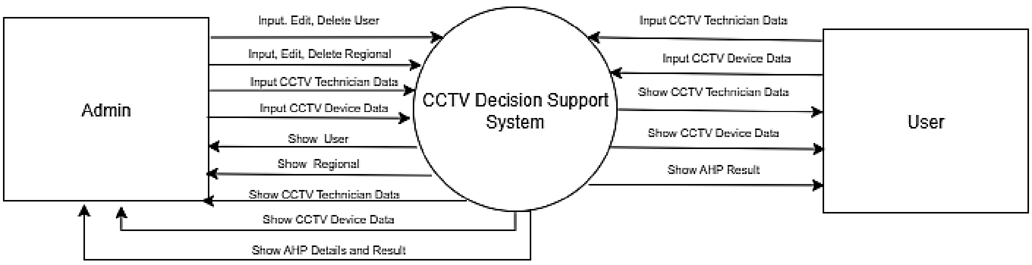

Figure 2. Diagram AHP CCTV

3.5. AHP Implementation Stages

The stages of implementing the AHP method in this study were carried out systematically to ensure that the final results obtained were valid and reliable (see Figure 3). The process began with establishing the primary decision-making objective, namely, determining the best CCTV equipment and technician for PT. Sinarmas Multifinance. A hierarchical decision structure was then constructed, consisting of three levels: objective, criteria/subcriteria, and alternatives.

The next step was to create a pairwise comparison matrix for each level of the hierarchy. Respondents were asked to rate each element based on the AHP priority scale (1–9) [23]. From this matrix, priority weights were calculated using the eigenvector method for each criterion, subcriterion, and alternative.

The CR was then calculated to ensure that respondents' assessments were not contradictory. If the CR value is ≤ 0.1, the assessments are considered consistent. The resulting consistent weights are then used to combine the priorities of each criterion into a final weighted alternative. The alternative with the highest weight is selected as the recommendation.

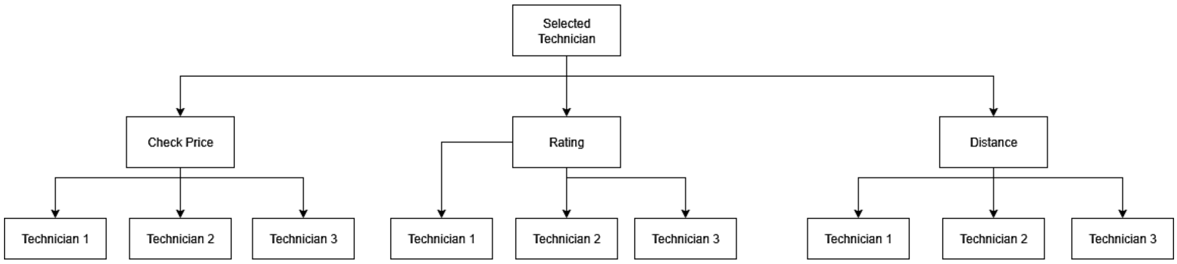

Figure 3. Technician Hierarchy Diagram

3.6. Model Testing and Validation

Testing and validation were conducted to ensure the AHP model provided accurate, relevant, and consistent recommendations. This stage included validity and reliability testing.

Validity testing was conducted by comparing the results of the technician and CCTV equipment selection process from the AHP model with actual decisions made by PT. Sinarmas Multifinance. This process included collecting real-world decision data, comparing model results with manual calculations, analyzing suitability, and drawing conclusions regarding the model's validity. The model was considered valid if the results aligned with the company's actual decisions.

Reliability testing aimed to ensure the consistency of the model's results. This step involved repeating pairwise comparisons with the same data, recalculating priority weights, and evaluating the CR. The model was considered reliable if the CR <0.1. If the results were inconsistent or the CR exceeded the threshold, adjustments were made to the comparison matrix. This testing ensured the AHP model's reliability as a decision support system for selecting technicians and CCTV equipment at PT. Sinarmas Multifinance.

4. RESULT AND DISCUSSION

This study implements the AHP method in a web-based decision support system to help PT. Sinarmas Multifinance objectively select CCTV technicians and equipment. The results presented include an application overview, case studies in several branches, instrument validity and reliability tests, calculation consistency tests, and the application of the non-zero principle. The following is a description of the AHP calculation in this study:

1. Compiling a Pairwise Comparison Matrix
   The comparison matrix is compiled by including each identified criterion, where each element is compared with other elements at a similar level. The AHP rating scale ranges from 1 to 9, with 1 indicating equality between two elements and 9 indicating that one element is far more important than the other [23]. The weighting for this system was taken from the results of interviews with two division heads in the IT field The Technician Importance Level scale can be seen in Table 1.

Table 1. Technician Selection Scale

Criteria	Rating	Check Price	Distance
Rating	1	3	4
Check Price	0.333	1	2
Distance	0.250	0.500	1

The Device Importance Scale is based on research Nguyen et al [14]. Table 2 shows the device selection scale.

Table 2. Device Selection Scale

Criteria	Price	Delivery Time	Warranty
Price	1	2	3
Delivery Time	0.5	1	2
Warranty	0.3	0.5	1

2. Performing Pairwise Comparisons
   The assessment is conducted by CCTV technicians/ vendors and stakeholders who understand the context and needs of the Company. Data Input: The results of each pair comparison are entered into a pairwise comparison matrix.

3. Calculating Relative Weights
   Calculating Eigenvectors: From the paired comparison matrix, eigenvectors are calculated to obtain the relative weights of each criterion and subcriterion. These weights describe the relative importance

of each element in the decision-making process. Matrix Normalization: The comparison matrix is normalized to ensure that the sum of each column of the matrix is 1, which is then used to calculate the average value of each row to determine the relative weight.

4. Consistency Test
   a. Consistency Index (CI)
      Perform calculations to measure the level of consistency in paired comparison assessments. The CI formula in equation (1) according to Nguyen et al [14] is:

$$CI = \frac{(\lambda_{max} - n)}{n - 1} \tag{1}$$

      where λmax refers to the maximum eigenvalue of the comparison matrix, and n is the number of elements compared.
   b. Consistency Ratio (CR)
   c. Calculated to verify that the assessment remains consistent. The CR formula in equation (2) according to [14] is:

$$CR = \frac{CI}{RI} \tag{2}$$

      Table 3 is of the random consistency index (RI) according to Krisnaningsih et al [12]:

Table 3. Random Consistency Index (RI)

n	1	2	3	4	5	6	7	8	9	10
RI	0	0	0,58	0,9	1,12	1,24	1,32	1,41	1,45	1,49

      where RI refers to the Random Index, with values adjusted based on the number of elements being compared.
   d. Consistency Limit
      The assessment is considered consistent if the CR is less than 0.1; however, if the CR exceeds 0.1, the assessment needs to be reviewed and possibly revised.

5. Validation of Results
   a. Review by Stakeholders: The results of the pairwise comparison and the calculated relative weights must be reviewed and validated by stakeholders to ensure that the results are reasonable and in line with the company's priorities.
   b. Adjustments if Necessary: If inconsistencies or inappropriate assessments are found, the pairwise comparison assessment can be adjusted and recalculated.

The application interface is designed with a modern dashboard display that differentiates the roles of admin and branch users. Figure 4 shows the admin dashboard, which provides a user management menu, regional data, technician data, device data, and an AHP calculation module for technicians and devices. Admins can manage all branch data and monitor recommendation results comprehensively. Meanwhile, Figure 5 displays a dashboard for branch users, which focuses on filling in technician and device data, running AHP calculations, and viewing recommendation results in their respective regions.

In the Bima Branch case study, AHP calculations were performed to determine the best technician based on three main criteria, namely rating, inspection price, and distance. The alternatives compared included CV. H Group Indonesia, LAWADUE ELEKTRONIK, and Musa CCTV. The analysis results showed that CV. H Group Indonesia obtained the highest score of 0.6338 and ranked first, followed by LAWADUE ELEKTRONIK with a score of 0.2992 in second place, and Musa CCTV with a score of 0.0670 in third place. The CR value of 0.0158 indicates that the pairwise comparisons conducted are consistent (CR < 0.1).

For the case study of devices in the Bandung Branch, calculations were performed on the 2MP Indoor Camera category by considering three criteria, namely price, delivery time, and warranty. The alternatives compared were CV. Candi Sejahtera, PT. Glenz Security Indonesia, and BGTECH CCTV. The results showed that CV. Candi Sejahtera was the best choice with a score of 0.5905, followed by PT. Glenz Security Indonesia with a score of 0.3170, and BGTECH CCTV with a score of 0.0925. The calculation CR of 0.0079 confirms that the comparison matrix meets the AHP consistency standards.

Validity testing was conducted to ensure the questionnaire instrument used was able to measure the criteria accurately. Testing using Pearson Product-Moment correlation at a significance level of 5% ($\alpha = 0.05$) showed that all items in the technician and device questionnaires had a calculated r greater than the table r. For example, in the Bima Branch for the technician questionnaire, the check price criterion had a calculated r of 0.957, rating of 0.998, and distance of 0.976, all of which exceeded the table r value of 0.878. Similar results were found in the device validity test at other branches, so the instrument was declared valid.

Reliability testing was performed by repeating the calculations using the same dataset at three different times, namely July 23, 24, and 25, 2025. The results showed that the scores and rankings in each test were identical, and the CR value remained below 0.1. For example, in the 2MP Indoor Camera category at the Bandung Branch, the alternative scores and rankings did not change across the three test times, with a consistent CR of 0.0079. This indicates that the system produces stable output over time.

In terms of consistency, all calculations in various branches show a CR value < 0.1, so the assessment is logical and meets the AHP consistency criteria. Meanwhile, the application of the non-zero principle is carried out to overcome the presence of zero values in alternative data, such as price 0, rating 0, or warranty 0. The zero value is replaced with a very small positive number, namely 0.1, to avoid undefined division in the comparison matrix. This approach is proven to maintain the mathematical validity of the calculation without changing the natural order of preferences.

Overall, the application of the AHP method in this web-based system is able to provide consistent, objective, and well-documented recommendations for technicians and equipment. Validity and reliability tests ensure that the measurement instruments are suitable for use, while the application of the non-zero principle ensures smooth calculation processes even in the presence of missing data. A limitation of this study lies in the limited number of criteria, so expanding the technical criteria and setting user-adjustable non-zero values has the potential to improve accuracy in the future. Table 4 below shows a comparison between this study and previous studies.

Figure 4. Admin View

Figure 5. User View

Table 4. Research Comparison

Author and Year	Title	Results
Nguyen et al., (2024) [14].	Evaluating and Selecting Suppliers Using the AHP Method: Case Study at a Software Company	Supplier 1 ranked first for the purchase of the laptop device with a supplier weight of 0.4027
Alexander (2025)	Analysis of CCTV Device and Vendor Selection Using the AHP Method, with Criteria of Price, Rating, Distance, Delivery Time, and Warranty in the Procurement Process of Goods and Services	In the Bima branch case study for best technicians, CV. H Group Indonesia received the highest score of 0.6338 and ranked first. Meanwhile, in the Bandung branch case study for devices, CV. Candi Sejahtera was the best choice with a score of 0.5905

Based on the comparison of studies in Table 4, each has its own contribution, such as the study by Nguyen et al, which contributes to enabling companies to select the right suppliers for software companies.

Meanwhile, this study contributes to making it easier for financing companies to determine CCTV equipment and vendors based on existing criteria.

However, this study has limitations in that it did not test such as User Acceptance Test (UAT). This is crucial in determining whether the system is truly accepted by users and meets their operational needs in the field. In addition, the distance field feature in the system allows for inaccuracies because the distance values are entered manually without integration with digital maps, so the accuracy of the distance from origin to destination is not guaranteed.

5. CONCLUSION

Based on the design, implementation, and testing of a decision support system based on the AHP method at PT. Sinarmas Multifinance, it can be concluded that the developed system successfully assisted the company in selecting technicians and CCTV equipment more objectively, quickly, and accurately. Testing at several branches demonstrated that the system was able to process alternative data and generate recommendation rankings according to predetermined criteria. The applied AHP method was effective in weighting criteria and prioritizing alternatives, with all weighting and ranking calculations within the consistency limits (CR <0.1), thus ensuring reliable recommendations.

This system also reduced the potential for subjectivity and the risk of error in the technician and vendor selection process, as evidenced by the transparent, standardized, and integrated presentation of comparative data, ensuring that each branch followed the same assessment format. Furthermore, the centralized database that was developed stores information on technicians, equipment, assessment criteria, AHP calculation results, and decision history, supporting future evaluation consistency and facilitating system performance monitoring across all branches.

Overall, this decision support system has proven effective in improving the efficiency, accuracy, and consistency of evaluation results across PT. Sinarmas Multifinance can be a reliable digital solution for the procurement process of goods and services.

REFERENCES

[1] R. Restika and E. Sonita, “Tantangan Keamanan Siber Dalam Manajemen Likuiditas Bank Syariah : Menjaga Stabilitas Keuangan Di Era Digital,” *Krigan J. Manag. Sharia Bus.*, vol. 1, no. 2, p. 25, 2023, doi: 10.30983/krigan.v1i2.7929.

[2] N. H. Ulya and A. Bakhtiar, “Analisis Performansi Supply Chain Menggunakan Metode Supply Chain Operation Reference (SCOR) dan Analytical Hierarchy Process (AHP) (Studi Kasus PT Starcam Apparel Indonesia Factory B),” *Ind. Eng. Online J.*, vol. 12, no. 4, pp. 1–14, 2023.

[3] A. R. Harahap, N. H. M. Simbolon, R. A. Agata, and S. Sunarsih, “Metode Fuzzy AHP (Analytical Hierarchy Process) untuk Pemilihan Metode Pembelajaran Demi Menunjang Pembelajaran Matematika,” *J. Sains dan Edukasi Sains*, vol. 5, no. 1, pp. 9–17, 2022, doi: 10.24246/juses.v5i1p9-17.

[4] C. Rozali, A. Zein, and S. Farizy, “Penerapan Analytic Hierarchy Process (Ahp) Untuk Pemilihan Penerimaan Karyawan Baru,” *JITU J. Inform. Utama*, vol. 1, no. 2, pp. 32–36, 2023.

[5] N. Meisarah, Fachrudin, and Jasmir, “Implementasi Metode Analytical Hierarchy Process (AHP) Dalam Sistem Pendukung Keputusan Untuk Rekomendasi Biro Perjalanan Umroh Di Kota Jambi,” *J. Inform. dan Rekayasa Komput.*, vol. 5, no. April, pp. 1445–1454, 2025, doi: 10.33998/jakakom.v5i1.

[6] A. N. Hakim and D. Setiawan, “Analisis Multi-Criteria Decision Making (MCDM) pada Pengambilan Keputusan Pemilihan Vendor dengan Metode Analytical Hierarchy Process (AHP),” vol. 02, no. 02, pp. 10–21, 2025.

[7] B. Sianipar, P. S. Hasugian, D. Tarigan, and M. M, “Evaluasi Kriteria Pemilihan Lokasi Pembangunan Perumahan Baru dengan Menggunakan Metode Analisis Hirarki Process(AHP),” *J. Soc. Sci. Res.*, vol. 4, pp. 10147–10155, 2024.

[8] M. I. Mustajib, U. Ciptomulyono, and N. Kurniati, “A novel multi-criteria sorting model based on ahp-entropy grey clustering for dealing with uncertain incoming core quality in remanufacturing systems,” *Appl. Sci.*, vol. 11, no. 6, 2021, doi: 10.3390/app11062731.

[9] D. P. Putro, P. E. Suryani, and S. Amri, “Komparasi AHP, SAW, TOPSIS, VIKOR, dan MABAC pada Sistem Pengambilan Keputusan Pemilihan Supplier Obat,” *J. Transform.*, vol. 23, no. 1, pp. 1–11, 2025.

[10] J. T. Hidayat and D. A. Diartono, “Perancangan Sistem Pendukung Keputusan Pemilihan Supplier dengan Metode Analytical Hierarchy Process (AHP) Pada CV. Safina Abadi,” *J. Indones. Manaj. Inform. dan Komun.*, vol. 5, no. 3, pp. 2877–2887, 2024, doi: 10.35870/jimik.v5i3.968.

[11] A. Sudradjat, M. Sodiqin, and I. Komarudin, “Penerapan Metode Analytical Hierarchy Process Terhadap Pemilihan Merek CCTV,” *J. Infortech*, vol. 2, no. 1, pp. 19–30, 2020, doi: 10.31294/infortech.v2i1.7660.

[12] E. Krisnaningsih, A. Brillian, and S. Dwiyatno, “Analisa Multi-Criteria Pemilihan Pemasok Baja

Slab," *J. InTent*, vol. 5, no. 1, pp. 1–13, 2022, [Online]. Available: http://ejournal.lppm-unbaja.ac.id/index.php/intent/article/view/2096

[13] M. K. Abdillah, D. Hartama, R. A. Nasution, S. Tunas Bangsa, and G. Artikel, "Sistem Pendukung Keputusan dalam Menentukan Tingkat Keberhasilan Guru Mengajar Menggunakan Metode AHP Decision Support System in Determining the Level of Success of Teaching Teachers Using the AHP Method," *JOMLAI J. Mach. Learn. Artif. Intell.*, vol. 2, no. 2, pp. 2828–9099, 2023, doi: 10.55123/jomlai.v2i2.2399.

[14] V. Nguyen, K. H. Nguyen, and T. U. Le, "Evaluating and Selecting Suppliers Using the AHP Method: Case Study at a Software Company," *Int. Conf. Green Technol. Sustain. Dev.*, no. February, 2024, [Online]. Available: https://www.researchgate.net/publication/388953258

[15] K. Kraugusteeliana and V. Violin, "Application of Decision Support in Performance Assessment of Delivery Services in the E-Commerce Industry," *J. Galaksi*, vol. 1, no. 1, pp. 53–61, 2024, doi: 10.70103/galaksi.v1i1.6.

[16] M. Haris, A. Zulherry, I. E. Limbong, M. Abdi, and P. Tanjung, "Implementation of AHP method in decision support system for AC brand selection at PT. Gemilang," *J. Intell. Decis. Support Syst.*, vol. 7, no. 3, pp. 256–263, 2024.

[17] R. Nindyasari, T. Khotimah, and N. Ermawati, "Decision support system to provide business feasibility analysis for batik entrepreneur in Lasem," *J. Phys. Conf. Ser.*, vol. 1943, no. 1, 2021, doi: 10.1088/1742-6596/1943/1/012106.

[18] M. Wijaya and B. Hakim, "Sistem Pendukung Keputusan Penentuan Supplier Pada Purchasing Berbasis Website Menggunakan Simple Additive Weighting," vol. 4, pp. 968–980, 2025.

[19] N. Imam, T. Yadi, L. Hadjaratie, and T. N. Roman, "Sistem Pendukung Keputusan Dalam Penentuan Penerima Dana Bantuan Menggunakan Metode Analytical Hierarchy Process - Topsis (Studi Kasus : Kantor Desa Bakti)," vol. 5, no. 2, pp. 68–77, 2025.

[20] Ahmad Tantoni and Mohammad Taufan Asri Zaen, "Sistem Keamanan Pemantauan CCTV Online Berbasis Android Pada Rumah Cantika Syifa Masbagik," *J. Inform. Rekayasa Elektron.*, vol. 3, no. 1, pp. 40–47, 2020.

[21] I. Gonçalves, L. Rodrigues, F. A. Silva, T. A. Nguyen, D. Min, and J. W. Lee, "Surveillance system in smart cities: A dependability evaluation based on stochastic models," *Electron.*, vol. 10, no. 8, pp. 1–19, 2021, doi: 10.3390/electronics10080876.

[22] H. Ben Slama, R. Gaha, M. Tlija, S. Chatti, and A. Benamara, "Proposal of a Combined AHP-PROMETHEE Decision Support Tool for Selecting Sustainable Machining Process Based on Toolpath Strategy and Manufacturing Parameters," *Sustain.*, vol. 15, no. 24, 2023, doi: 10.3390/su152416861.

[23] R. V. Françozo *et al.*, "A web-based software for group decision with analytic hierarchy process," *MethodsX*, vol. 11, no. June, 2023, doi: 10.1016/j.mex.2023.102277.