# Analysis of Vendor Selection for Cash Recycle Machine using the Analytical Hierarchy Process Method at PT.X

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Abstract:- Selecting the right vendor for the Cash Recycle Machine (CRM) is a key factor for the sustainability of PT X in the banking business, as most banking tasks are carried out by vendors. Therefore, the vendor selection process is one of the main and crucial processes. This research aims to determine the weight of criteria, and sub-criteria, and analyze the best vendor selection for the Cash Recycle Machine Implementation Project at PT X using the Analytical Hierarchy Process (AHP) method. The number of respondents in this study was eight, consisting of the Project Director, Project Manager, and Division Heads who are the decision-makers in vendor selection. The research was conducted through structured interviews using Saaty's scale comparison questionnaires for criteria selection and rating scale assessment for vendor evaluation. The criteria evaluated based on the Vendor Performance Indicator (VPI) are Quality, Cost, Delivery, Flexibility, and Responsiveness, with the most influential sub-criteria being Price Reduction, Product Reliability, and Demand Adjustment. The selected vendor for the Cash Recycle Machine implementation project is PT ZZZ with a score of 40% out of 100%, followed by PT YYY with a score of 32%, and PT XXX with a score of 28%.

*Keywords:- Component; AHP, Vendor Selection, VPI, Cash Recycle Machine* 

#### I. INTRODUCTION

The banking industry is one of the rapidly growing and highly competitive sectors in Indonesia (2). With technological advancements, the banking industry has undergone significant transformations in providing services to customers. Technology has become key in enhancing the efficiency, speed, and accessibility of banking services. One technological aspect that is increasingly developed and applied in modern banking is the use of Cash recycling machines (CRMs). A CRM is a machine that can automatically count and sort the cash deposited by customers and then 'recycle' it for reuse by other customers (10). The use of CRMs is expected to improve efficiency by reducing operational costs and the provision of cash for ATMs (9).

Given the positive impact of CRMs, there is a need for CRM procurement projects across Indonesia to create more efficient banking services and contribute to financial inclusion and overall economic growth. Since 2019, PT X has been implementing CRM procurement projects in various regions of Indonesia. To date, PT X has successfully managed several thousand CRMs distributed across different locations in Indonesia.

PT X is a company specializing in IT services, particularly the procurement of CRMs. With five consecutive years of experience in handling CRM projects, the company is required to deliver quality projects that meet time, cost, and quality targets. In executing its projects, PT X collaborates with vendors. The company strives to maintain business effectiveness and efficiency by ensuring that every vendor working on its projects adheres to the established standards or Key Performance Indicators (KPIs). This control is carried out by evaluating vendor performance based on Vendor Performance Indicators (VPIs) such as Quality, Cost, Delivery, Flexibility, and Responsiveness.



g 1: Vendor Performance Evaluation for Cash Recycle Machir Source: PT X Evaluation Data 2019-2023

Figure 1 shows that many vendors' performance evaluations for CRMs are below average. The vendor evaluation uses a four-interval Likert scale questionnaire with criteria such as work quality, timeliness, health and safety performance, and cleanliness and tidiness. To date, the company has not set a standard for evaluation scores, resulting in vendors with below-average scores still being used in ongoing projects.

Selecting the right vendor is also crucial for maintaining PT X's reputation and ensuring that customers receive the best service. Mistakes in vendor selection can negatively impact the company's image and reduce customer trust. Additionally, by choosing the right vendor, PT X can ensure better operational continuity and more efficient cost management. In the increasingly competitive banking industry, the ability to provide superior services at efficient costs is a highly valuable competitive advantage.

In the context of vendor selection, the Analytical Hierarchy Process (AHP), developed by (8), is a highly useful tool for prioritizing and making better decisions by systematically organizing and analyzing data through a hierarchical structure consisting of goals, criteria, subcriteria, and alternatives. AHP has been widely used by decision-makers and researchers (11). Ultimately, AHP can be used by PT X to evaluate and compare various vendors based on a set of relevant criteria. The hierarchical structure of AHP helps visualize the relationship between the main goal (selecting the best vendor) and the underlying criteria and sub-criteria (12). Once the hierarchical structure is established, AHP uses pairwise comparisons to assess the importance of each criterion relative to others, resulting in numerical weights for each criterion based on its level of importance (13). This process involves input from various stakeholders to ensure that the assessments reflect PT X's priorities and needs. Each vendor is then evaluated against the determined criteria and sub-criteria using the calculated weights to produce an overall score for each vendor. This score helps identify the vendor that best meets PT X's needs and requirements.

In CRM procurement projects, vendor selection is a key factor that can influence project success. Choosing the right vendor is crucial to ensure that the selected vendor has the capability and resources to address various challenges that may arise during the procurement, delivery, and installation of CRMs. Therefore, using the AHP method in vendor selection can help PT X prioritize vendors based on various criteria such as quality, price, reliability, and logistical capacity. By using AHP, PT X can ensure that vendor selection decisions are made in a structured and transparent manner, based on thorough and systematic analysis. This approach allows PT X to select vendors that can provide high-quality and reliable CRMs, supporting the success of CRM procurement projects and fostering mutually beneficial long-term partnerships.

Based on the above, the author has titled this paper "Analysis of Vendor Selection for Cash Recycle Machine Using the Analytical Hierarchy Process Method at PT X" to gain a deeper understanding of vendor selection criteria and how AHP can be used to choose the best vendor to meet PT X's needs.

#### II. LITERATURE REVIEW

#### A. Project Management

The success of a project is influenced by good team collaboration, meticulous planning, and effective management skills of a project manager (6). Project success relies on key success factors that, when properly arranged, can lead to a successful outcome. Project management (PM) is a crucial culture for businesses and offers various methodologies and tools to achieve competitive advantage and success (Pirotti et al., 2022). PM is one of the most widely used transformation methods in management (Locatelli et al., 2023). A project is an activity that involves quality standards, cost standards, and time standards that must be completed within a specified period (6).

#### B. Procurement Management

Procurement is the company's activity that manages the supply chain through effective contract negotiations, cost and price management, quality, and other critical aspects of provision (3). Procurement contributes by providing the goods or services needed in the production process or other activities within the company (5). According to (1), procurement is a process where price, quality, and other factors are considered in selection and evaluation to reduce negative impacts and enhance longterm performance and value in construction.

#### C. Subcontractor Selection

Technological advancements have led to increasingly varied customer preferences (4). This requires companies to focus not only on cost and quality but also on the flexibility and capability of vendors to meet ever-changing needs.

Evaluation criteria can be established, such as speed in completing tasks, quality of execution, customer satisfaction (7), performance according to budget, ability to minimize job changes and plan effectively, qualifications, technical capacity, and the ability to assess and mitigate risks (7). These are important factors used to evaluate the performance or capability of contractors, suppliers, or service providers in a project or business activity. By considering these criteria, companies can make more accurate decisions in selecting partners that meet their needs and desired standards.

#### D. Analytical Hierarchy Process

The Analytical Hierarchy Process (AHP) is a decision-support model developed by Thomas L. Saaty. This decision support model breaks down complex multi-factor or multi-criteria problems into a hierarchy. According to and reinforced by Catur Medilasito & Jasan Supratman (2022), it addresses decision problems that involve various complexities, such as diverse criteria. The Analytical Hierarchy Process is a decision-making method developed to prioritize several alternatives when multiple criteria must be considered. It allows decision-makers to organize complex problems into a hierarchical structure or a series of integrated levels.

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In essence, the Analytical Hierarchy Process is a method used to solve complex and unstructured problems by breaking them down into their components, organizing these components into a hierarchy, and then assigning numerical values to replace human perception in making relative comparisons. According to Saaty (8), three main principles guide one in solving problems using the Analytical Hierarchy Process (AHP): Decomposition, Comparative Judgments, and Synthesis of Priorities.

#### E. Vendor Performance Indicator (VPI) Framework

One of the VPI frameworks is QCDFR, introduced by (14) in their journal article titled "A New Measure for Vendor Performance Evaluation." QCDFR is an acronym frequently used in vendor selection analysis to assess various important aspects of the vendor selection process. This framework includes several key criteria considered by companies when selecting a vendor, namely Quality, Cost, Delivery, Flexibility, and Responsiveness. QCDFR is a comprehensive VPI framework used to evaluate vendors based on these five crucial criteria for the success of business relationships with vendors. By using QCDFR, PT X can perform a more structured and thorough analysis of vendor selection, thus aiding in better decision-making.



Fig 2: Research Framework

#### III. METHODS

This study is centered on PT X, focusing on the process of determining the criteria for selecting the best vendor accurately. The study employs a descriptive quantitative research method based on the Analytical Hierarchy Process (AHP) method. Descriptive quantitative research is a study that collects data in numerical form and is also supplemented with qualitative data as support, such as words or sentences arranged in a questionnaire (14).

In vendor selection using the AHP method, this study uses 5 criteria divided into 10 sub-criteria. The breakdown of AHP criteria and sub-criteria for vendor selection is presented in Table 1 below.

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No	Criteria	Sub-Criteria	Definition	Measurement
				Scale
1	Quality	Specification Compliance	The vendor can meet the material specification	Comparison
			requirements	Scale (8) to
		Product Reliability	The vendor can ensure the reliability of the material	calculate the
2	Cost	Price Compliance	The vendor's price proposal meets the required price	weights of
		Price Reduction	The vendor's price proposal includes significant	Criteria and
			discounts	Sub-Criteria
3	Delivery	Delivery Item Compliance The vendor can deliver items that meet the required		
		quantity		
		Timeliness of Delivery	ry The vendor can complete the job within the specified	
			timeframe	
4	Flexibility	Demand Adjustment	Vendor can adjust to out-of-scope demands	
		Technical Problem Adaptability	Vendor can address issues according to location	
			criteria	
5	Responsiveness	Response Time	The vendor can meet the required response time	
		Problem-Solving Capability	Vendors can resolve field issues effectively.	

Source: (Syifa & Nurhasanah, 2023)

#### A. Population and Sample

The respondents of this study are individuals at PT X who hold positions or play roles in the vendor selection or evaluation process and are related to vendors as verification. These positions include, but are not limited to, Project Director, Project Manager, and Division Heads, as presented in Table 2. The sampling technique used is purposive sampling, which is a sampling technique determined by the researcher under the research objectives (15). In the application of the AHP method, the quality of the data from respondents is prioritized over its quantity. Therefore, AHP assessment requires experts as respondents in decision-making to select alternatives. These experts are competent individuals, who have thorough mastery, influence policy-making, or possess the required information. There is no specific formula for the number of respondents in the AHP method, but the minimum limit is two participants (17).

No.	Position	Respondent
1	Project Director	1
2	Project Manager	3
3	Kepala Divisi	4
	Total	8

Source: Researcher's Processed Results

#### B. Data Collection Method

In this study, data collection is carried out through two main sources: primary data and secondary data. The primary data collection method primarily involves questionnaires distributed to respondents. These questionnaires are designed following Saaty's comparison format to calculate the weights of criteria using the AHP (Analytic Hierarchy Process) method. Additionally, the questionnaires include vendor assessments using a Likert scale. Meanwhile, secondary data is obtained from various literature sources such as books, scientific journals, previous related research, and processed vendor data from PT XYZ. This secondary data is used as a basis for constructing the items to be compared in the questionnaire, including criteria, sub-criteria, and relevant alternatives (vendors) in the vendor selection process.

The literature study method is used to search for theories, concepts, and results that can serve as a theoretical foundation for the conducted research. The theoretical foundation is used to ensure the research has a solid base.

#### C. Data Analysis Method

Data processing and analysis utilize descriptive analysis and the Analytical Hierarchy Process (AHP). Descriptive analysis is used to identify the workflow of the Cash Recycle Machine project at PT X. Meanwhile, the Analytical Hierarchy Process (AHP) is used to evaluate PT X's vendors. The application used in this research is for processing AHP data from the questionnaire results and Microsoft 365 for respondent data tabulation.

- > The Steps in Vendor Selection are as Follows:
- Constructing the hierarchy structure of the problem, as shown in Figure 2.
- Creating a pairwise comparison matrix that shows the relative contribution of each element to the criteria at a higher level.
- Determining the weights or priorities for each variable at level 2 (criteria), which are Quality, Cost, Delivery, Flexibility, and Responsiveness.
- Calculating the Consistency Index.
- Calculating the Consistency Ratio.

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- Determining the weights/priorities of each variable at level 3 (sub-criteria) for each criterion in vendor selection, similar to step 3 above.
- Determining the weights/priorities of each sub-criteria at level 4 (assessment scale), which is the weight of each vendor compared to each sub-criteria.
- After calculating the normalized priority weights for each element in the AHP hierarchy, the next step is synthesizing the solution for the vendor selection problem.



Fig 3: Problem Hierarchy Structure

### IV. DISCUSSION AND RESULTS

## A. General Description of the Location or Object of Research

PT X is engaged in providing integrated IT solutions established in 2019 with a vision to become a leading technology service provider company that provides continuous positive value through innovative and effective solutions by prioritizing customer satisfaction with a mission to become a trusted partner of customers through optimal effective services that guarantee solutions. PT X's business processes include IT service providers and Cash Recycle Machine Implementation services. The challenges faced are intense and competitive competition and demands from customers who are increasingly critical of both service and good product quality at competitive prices. In addition, PT X also faces industry dynamics in the development of technology that is very fast so innovation and breakthroughs are needed in adapting and following the latest developments to remain competitive.

#### B. Data Analysis

Criterion Level Priority Weighting and Consistency Test.

This study collected data from 8 respondents who were involved in the vendor selection process for the CRM project at PT X. The respondents were project managers and decision-makers in vendor selection. The respondents are project managers and decision-makers in vendor selection. This research uses a structural questionnaire to assess the consistency of respondents, by ensuring the Consistency Ratio (CR)  $\leq 0.1$ . The data is then analyzed using AHP to identify or select respondents. The results were analyzed using Priority Vectors, eigenvectors, Consistency Index (CI), and Consistency Ratio (CR) as described in the study. The results of the pairwise comparison matrix between criteria can be seen in Table 2. the Consistency Ratio (CR) value is obtained as 0.0036 or CR less than equal to 0.1 which means that the value of the pairwise comparison matrix for 5 criteria is declared consistent and acceptable.

Criteria	Quality	Cost	Delivery	Flexibility	Responsiveness	Priority
Quality	1,0000	0,7774	2,3630	1,2228	1,4750	0,2310
Cost	1,2864	1,0000	3,7948	1,7927	2,5188	0,3370
Delivery	0,4232	0,2635	1,0000	0,4301	0,4967	0,0863
Flexibility	0,8178	0,5578	2,3248	1,0000	1,2510	0,1918
Responsiveness	0,6780	0,3970	2,0134	0,7993	1,0000	0,1539
Total	4,2054	2,9957	11,4960	5,2450	6,7415	1,0000
EIGEN						5,0163
CI						0,0041
RI						1,1200
CR						0,0036
Status						CONSISTENT

Table 3: Results of Pairwise Comparison Matrix between Criteria

Source: Processed Research Data

The next stage is to weigh the priority of criteria with iteration calculations (matrix multiplication). The iteration calculation is carried out repeatedly or until the difference in priority values between the two iterations is relatively small or <0.00001 (Romadhoni & Prapanca, 2022). This

research calculates the criteria level iteration up to the 2nd iteration. The results of the iteration can be seen in table 3.2 Iteration continues until a new matrix is formed with priority weights that do not change when compared to the priority weights in the previous iteration.

Criteria	Quality	Cost	Delivery	Flexibility	Responsiveness	Priority
Quality	126,5303	86,6435	339,4809	151,4759	190,0795	0,2309
Cost	184,9098	126,6242	496,1107	221,3699	277,7887	0,3375
Delivery	47,1597	32,2932	126,5334	56,4584	70,8478	0,0861
Flexibility	105,0432	71,9314	281,8359	125,7561	157,8077	0,1917
Responsiveness	84,2333	57,6818	226,0054	100,8445	126,5483	0,1537
Total	547,8763	375,1742	1469,9663	655,9048	823,0720	1,0000

Source: Processed Research Data

Thus, it can be concluded that the iteration calculation will bring up a matrix with a new priority weight value for each criterion. The results of the second iteration calculation have the same priority weight as the calculation results with the first iteration, so the iteration calculation can be declared valid. The calculation results also show that the Cost criterion is the top priority in selecting CRM vendors, then Quality, Flexibility, Responsiveness, and Delivery as the final priority.

#### C. Priority Weighting and Consistency Test at Sub-Criteria Level

The AHP method involves the calculation of Geometric Mean, Priority Vector, Eigen Vector, Consistency Index, and Consistency Ratio, which are then used to compare the survey results with the overall results. Based on the table of weighting results and consistency tests on each sub-criteria, the weighting results for the entire sub-criteria level are declared valid because the overall consistency test shows a CR value of less than 0.1. Thus, after the weight of each sub-criteria is obtained, the next stage is the determination of global priorities by multiplying the priority weight with the priority weight of the level above. The following is an overall table of the weighting of criteria and sub-criteria.

Kriteria	Weight	Priority	Sub-Criteria	Weig ht	Prior ity	Global Weight	Globa Priori
Quality	0.2200	П	Specification Conformance	0,335 3	II	0,0774	VI
Quanty	0,2309	11	Product Reliability	0,664 7	Ι	0,1535	II
Cost	0 2275	т	Price Conformance	0,248 3	II	0,0838	V
Cost	0,5575	1	Price Reduction	0,751 7	Ι	0,2537	Ι
Deliment	0,0861	V	Appropriateness of Goods Delivery	0,258 3	II	0,0222	Х
Denvery			Delivery Timeliness	0,741 7	Ι	0,0638	VII
Floribility	0 1017	III	Demand Adjustment	0,799 4	Π	0,1533	III
Flexibility	0,1917	111	Technical Problem Adaptability	0,200 6	Ι	0,0385	VIII
Basponsivonoss	0 1527	137	Response Time	0,799 4	Π	0,1229	IV
Responsiveness	veness 0,1537	IV	Problem Handling Capability	0,200 6	Ι	0,0308	IX

Source: Processed Research Data

#### D. Best Vendor Alternative Decision Making

The final step is to make the best subcontractor alternative decision using a rating scale pairwise assessment. The data used at this stage are the priority weights of each sub-criteria and the results of respondents' scores on vendors using a rating scale questionnaire with Outstanding (5), Good (4), Average (3), Fair (2), and Poor (1) value criteria. The data used is also the result of the assessment of respondents who have worked with or assessed vendors. The first stage is the calculation of the best alternative vendor decision making whose results are described in table 5. The second stage is to determine the pairwise ranking scale assessment matrix on priority in Table 2 with the value of the sub-criteria with the vendor whose results are described in Table 6. The third stage is to create a weight matrix with criteria, sub-criteria, global weight sub-criteria, and global weight priority with a rating scale matrix for each vendor whose results are described in Table 7.

Sub Vuitorio	Vendor PT XXX	Vendor PT YYY	Vendor PT ZZZ
Sub-Kriteria	Rating Scale	Rating Scale	Rating Scale
Specification Conformance	3	2	4
Product Reliability	3	3	4
Price Conformance	4	4	3
Price Reduction	4	4	3
Appropriateness of Goods Delivery	2	3	4
Delivery Timeliness	1	3	4
Demand Adjustment	1	3	3
Technical Problem Adaptability	2	2	3
Response Time	1	2	4
Problem Handling Capability	2	2	4

Table 6: Results of Respondents' Assessment of Vendors with Rating Scale Ratings

Source: Processed Research Data

Table 7: Ranking Scale Matrix with Priority

Sub Unitaria	Vendor PT XXX		Vendor PT YYY		Vendor PT ZZZ			
Sub-Killeria	Rating Scale	Priority	Rating Scale	Priority	Rating Scale	Priority		
Specification Conformance	3	0,1344	2	0,0678	4	0,2602		
Product Reliability	3	0,1344	3	0,1344	4	0,2602		
Price Conformance	4	0,2602	4	0,2602	3	0,1344		
Price Reduction	4	0,2602	4	0,2602	3	0,1344		
Appropriateness of Goods	2	0.0678	3	0.1344	4	0.2602		
Delivery	-	0,0070	-		-	0,2002		
Delivery Timeliness	1	0,0348	3	0,1344	4	0,2602		
Demand Adjustment	1	0,0348	3	0,1344	3	0,1344		
Technical Problem	2	0.0678	2	0.0678	3	0.1344		
Adaptability	2	0,0078	2	0,0078	5	0,1344		
Response Time	1	0,0348	2	0,0678	4	0,2602		
Problem Handling	2	0.0678	2	0.0678	1	0.2602		
Capability	2	0,0078	2	0,0078	4	0,2002		

Source: Processed Res	search Data
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Table	8:	Ranking	Scale	Matrix	with	Priority
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Criteria	Weight	Sub-Criteria	Weight	Global Weight	Global Priority	Vendor PT XXX		Vendor PT YYY		Vendor PT ZZZ	
						Priority	Global Weight	Priority	Global Weight	Priority	Global Weight
Quality	0,231	Specification Conformance	0,335	0,077	VI	0,134	0,010	0,068	0,005	0,260	0,020
		Product Reliability	0,665	0,154	п	0,134	0,021	0,134	0,021	0,260	0,040
Cost	0,338	Price Conformance	0,248	0,084	v	0,260	0,022	0,260	0,022	0,134	0,011
		Price Reduction	0,752	0,254	I	0,260	0,066	0,260	0,066	0,134	0,034
Delivery	0,086	Appropriateness of Goods Delivery	0,258	0,022	x	0,068	0,002	0,134	0,003	0,260	0,006
		<b>Delivery</b> Timeliness	0,742	0,064	VII	0,035	0,002	0,134	0,009	0,260	0,017
Flexibility	0,192	Demand Adjustment	0,799	0,153	III	0,035	0,005	0,134	0,021	0,134	0,021
		Technical Problem Adaptability	0,201	0,038	VIII	0,068	0,003	0,068	0,003	0,134	0,005
		Response Time	0,799	0,123	IV	0,035	0,004	0,068	0,008	0,260	0,032
Responsiveness	0,154	Problem Handling Capability	0,201	0,031	IX	0,068	0,002	0,068	0,002	0,260	0,008
Total Score							0,137		0,159		0,194
Normalisation							0.280		0.325		0.396

Source: Processed Research Data

The Result of 0.010 Global Weight Vendor PT XXX with Specification Conformity with the Following Calculation:

Global Weight Vendor: Global Weight Sub-criteria X Nilai Priority Vendor

#### 0,077 × 0,0134 = 0,010

The largest number of vendors is PT ZZZ with a total value of 0.396.

#### E. Discussion

The calculation stage of the weight of criteria and subcriteria and vendor assessments shows that the cost criteria are the top priority with a weight of 0.388. Then quality becomes the second priority with a weight of 0.231 and the third priority is Flexibility with a weight of 0.192 After that, the Responsive criteria with a weight of 0.154, and the last is the delivery criteria with a weight of 0.086. The results of testing the level of consistency show that the answers that meet the consistent criteria CR < 0.1 are 100% of all respondents' answers. This shows that answers that meet the consistent criteria are eligible to continue in the next calculation process so that this research can be declared appropriate. The following is a summary of the level of criteria, sub-criteria, and vendor selection results.



Fig 4: Results of Vendor Selection Criteria Weighting



Fig 5: Results of Vendor Selection Sub-Criteria Weighting



Fig 6: Weighted Results of Vendor Selection for Cash Recycle Machine Implementation Project Source: Processed Research Data

#### V. RECYCLE MACHINE IMPLEMENTATION PROJECT

Next, the researchers conducted a sensitivity analysis because this study used multi-criteria analysis with AHP (Muanley et al., 2022). Sensitivity testing in this study was carried out by simulating an increase or decrease in the weight of the criteria by 10% because 10% reflects a significant but not extreme change as used by Muanley et al. (2022). The results of the sensitivity analysis using criteria sensitivity graphs showing the initial weights, weights after a 10% increase, and weights after a 10% decrease (after normalizing) are shown in Figure 9 below.



Fig 7: Criteria Sensitivity Graph

Source: Processed by researchers using Excel

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Figure 9 can be interpreted that although the weights for the Quality, Cost, Delivery, Flexibility, and Responsiveness criteria are stated to be the same for both the 10% increase and 10% decrease conditions, the total result does not change. So, it can be concluded that changes in the criteria weights do not affect the total weight. Even though there is a 10% increase, the criteria weights remain the same. This means that there is no significant impact on the decision results even though the weights are indicated to increase. Despite a 10% decrease, the criteria weights remain the same. This means that the decrease in weight does not affect the decision results.

#### VI. CONCLUSION AND RECOMMENDATION

#### A. Conclusion

Analysis using AHP showed that the main criterion in vendor selection for CRM projects was Cost with a weight of 34%, followed by Quality (23%), Flexibility (19%), Responsiveness (15%), and Delivery (9%). The most important sub-criteria are Price Reduction, Product Reliability, and Project Demand Adjustment, while subcriteria such as Delivery Suitability, Problem Handling Capability, and Technical Issue Adaptability have lower significance. Based on this analysis, the most recommended vendor is PT ZZZ with a score of 40%, followed by PT YYY with a score of 32%, and PT XXX with a score of 28%, with PT ZZZ excelling in key subcriteria. The use of AHP method has provided structure and transparency in the vendor selection process, enabling PT X to select vendors with adequate capabilities and resources to face the challenges of CRM procurement, delivery, and installation, thus providing a competitive advantage in providing quality and efficient banking services.

From the researcher's direct experience with this study, some limitations have been identified namely: 1) The number of respondents of eight is not enough to describe the overall situation of the company; and 2) This study only focused on the vendor for the implementation work, while other aspects of the CRM project also require attention. The researcher provides the following recommendations: 1) PT X should expand their focus not only on Cost criteria, but also consider Flexibility and Delivery, as these factors are important for project implementation despite Cost being the main concern; 2) If in the future new relevant criteria, subcriteria, or vendor alternatives emerge, PT X should update those elements and recalculate them using the AHP method; and 3) The AHP method can be applied to other or multi-criteria multi-alternative decision-making problems to determine the best option in various decisionmaking scenarios.

#### B. Recommendation

PT X is advised to continue considering other criteria such as Flexibility and Delivery. Although Cost is the main priority in the selection process, flexibility and delivery remain important aspects of project execution. In the future, if there are new criteria, sub-criteria, or alternative options relevant to the company or in line with new corporate policies, the company can replace the criteria, sub-criteria, or vendor alternatives used in this research and then recalculate using the same Analytical Hierarchy Process (AHP) method. In addition to selecting priority vendors, the company can also use the Analytical Hierarchy Process (AHP) method to solve problems related to determining the best option among multiple criteria or alternatives in decision-making references.

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