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Selecting The Best Service Provider for Cash Replenishment & First Level Maintenance Atm Procurement Project at Bank BJB Using Analytical Hierarchy Process (AHP)

Fahmi Pahlevi, Utomo Sarjono Putro
Institut Teknologi Bandung, Indonesia
E-mail: fpahlevi93@gmail.com

Abstract

PT Bank Pembangunan Daerah Jawa Barat dan Banten, Tbk (*Bank BJB*), the largest regional development bank in Indonesia, aims to maintain ATM cash services and increase customer satisfaction by selecting the best service provider for its ATM Cash Replenishment (*CR*) and First Level Maintenance services. The bank manages over 1,000 ATMs, making the correct selection of service providers critical to prevent delays in service, customer dissatisfaction, and reputational risks. This study seeks to evaluate and select the most suitable service provider from six alternatives using the Analytic Hierarchy Process (*AHP*). The research employs *PESTEL* analysis and in-depth interviews with Subject Matter Experts (*SMEs*) to identify the key parameters influencing Cash Replenishment and First Level Maintenance. These parameters were analyzed using *AHP*'s Pairwise Comparison Model to determine the optimal service provider. The findings indicate that Provider B is the best alternative, providing the highest value when compared to other options. Sensitivity analysis further confirms that Provider B is robust and remains the top choice across different scenarios. This study demonstrates the effectiveness of *AHP* in making informed decisions in service procurement, offering valuable insights into how banks can ensure operational efficiency and customer satisfaction through proper service provider selection.

Keywords: Service Provider, ATM Cash Replenishment (CR) & First Level Maintenance (FLM), Analytic Hierarchy Process (AHP)

INTRODUCTION

In the highly competitive banking industry, operational efficiency and customer satisfaction are key determinants of a bank's credibility and growth (Li et al., 2021). As one of Indonesia's leading regional banks, Bank BJB is committed to delivering reliable and high-quality services. This commitment is supported by an extensive ATM network of over 1,000 Automated Teller Machines (ATMs) and Cash Recycling Machines (CRMs). This network is a vital component of Bank BJB's customer service infrastructure, offering convenient access to cash withdrawals, deposits, and a wide array of financial transactions (Tan & Liu, 2022). The implementation of ATM and CRM systems has a significant impact on customer satisfaction, as they provide seamless and efficient banking services (Jansen & Smith, 2021). Furthermore, digital banking and service delivery efficiency are key drivers of Bank BJB's growth and service excellence (Nguyen & Wu, 2020). The bank's investment in these systems ensures that it remains competitive and meets the evolving needs of its customers (Sukmawati & Kusuma, 2023). In addition, customer satisfaction and loyalty are closely linked, particularly in the Indonesian banking sector, where service quality remains a critical factor in business success (Hassan & Zain, 2021).

To ensure optimal functionality and ongoing cash availability, Bank BJB relies on third-party service providers for cash replenishment (CR) and first level maintenance (FLM) across its ATM and CRM fleet. These outsourced providers are required to meet stringent qualifications in areas such as licensing compliance, infrastructure readiness, human resource competency, geographic reach, adherence to Service Level Agreements (SLAs), and robust business continuity planning (Anderson & Thompson, 2021). However, selecting suitable service providers presents significant challenges (Barton & Miller, 2022). The current procurement process involves a comprehensive, time-intensive evaluation across multiple critical criteria, often taking up to one to two months just for the assessment phase (Chavez & Li, 2023). Strategic outsourcing is essential for financial institutions, but it requires careful consideration of numerous factors (Davenport & Aiken, 2021). Hargrave & Potter (2022) note that effective procurement and selection strategies can mitigate risks associated with service quality and efficiency. Additionally, robust business continuity planning and compliance with SLAs are crucial to ensure seamless operations in outsourced banking services (Jordan & Anderson, 2023).

This extensive timeline is primarily attributed to the reliance on manual evaluation procedures, which are vulnerable to inconsistencies and biases among assessors. The challenge of simultaneously evaluating numerous parameters contributes to delays that can disrupt ATM operations and adversely impact customer satisfaction and trust (Anderson & Chen, 2022). Inconsistencies in the selection process risk inefficiency and service lapses, as well as undermining the bank's commitment to operational excellence (Brown & Wilson, 2023). As Lee & Zhang (2021) observe, manual evaluations are prone to human error and bias, which can negatively affect the speed and quality of ATM operations. Moreover, implementing automation in evaluation processes can significantly improve operational efficiency and service delivery (Davis & Kim, 2023). Miller & Patel (2020) highlight that such inefficiencies, if left unchecked, can lead to service quality degradation and customer dissatisfaction. Wong & Tan (2021) further assert that addressing evaluation inconsistencies is crucial for maintaining high service standards and ensuring customer trust in the banking system.

Given these pressing challenges, there is an urgent need for an improved, structured approach to guide the evaluation and selection of service providers. The development of an effective *decision support system* (*DSS*) tailored to *Bank BJB*'s operational requirements would streamline and accelerate the provider assessment process, ensuring more consistent and objective decision-making. By doing so, the bank can enhance procurement efficiency, maintain superior service quality, and strengthen its position in the highly competitive banking industry.

Previous studies have explored the challenges in service provider selection in various industries, including banking. For instance, Zadeh & Rastegar (2018) examined *decision support systems* (*DSS*) in supplier selection for manufacturing industries, focusing on how these systems can reduce decision-making time and enhance the accuracy of evaluations. However, this study did not consider the specific operational and service parameters relevant to the banking sector, especially in managing a network of *ATMs* and *CRMs*. Similarly, a study by Sari & Subekti (2020) applied the *Analytical Hierarchy Process* (*AHP*) to evaluate service providers in the logistics sector,

but it failed to integrate key criteria like business continuity planning and geographical reach, which are critical in the context of banking services.

This study aims to improve the procurement process at *Bank BJB* by developing a more structured and effective *decision support system* (*DSS*) that uses *AHP* for evaluating service providers. The benefits of this research include enhancing operational efficiency by reducing procurement delays, ensuring the selection of highly qualified service providers, and improving overall customer satisfaction with *ATM* services. By addressing these critical issues, this study contributes to the bank's commitment to operational excellence and its competitiveness in the banking sector.

RESEARCH METHODS

This study employed a mixed-method research approach, combining both qualitative and quantitative techniques to analyze the ATM Cash Replenish (*CR*) and First Line Maintenance (*FLM*) service provider selection process at *Bank BJB*. The research was based on a descriptive and exploratory design, aiming to identify the key factors that influenced the selection of the most suitable service provider. The study began with identifying the business issue, as discussed in section 1.3, by considering various parameters and variables that could have impacted the project implementation. Following this, a comprehensive data collection process was undertaken, with a primary focus on obtaining detailed insights from interviews and in-depth questionnaires, complemented by secondary sources such as internal company data, relevant academic journals, and other online resources.

The population for this research included key stakeholders within *Bank BJB* who were involved in the ATM *CR* and *FLM* service provider selection process. The target respondents were Group Heads and Managers who were directly engaged in project planning, procurement, and vendor selection. These individuals were familiar with the end-to-end business processes and understood the impacts of each stage in the selection procedure. The sampling technique employed was purposive sampling, where participants were chosen based on their relevance to the research objectives and their authority within the organization. This approach ensured that the data gathered was both accurate and comprehensive, allowing the researcher to gain meaningful insights into the decision-making process.

Data collection was conducted through in-depth interviews with selected respondents, followed by the distribution of structured questionnaires. Both primary and secondary data sources were utilized to ensure a well-rounded analysis. The interviews were analyzed qualitatively to understand the rationale behind the service provider selection, while quantitative data from the questionnaires was analyzed using statistical methods. Data analysis techniques included descriptive statistics to summarize the data and exploratory factor analysis (*EFA*) to identify key factors influencing provider selection. The software tools used for data analysis included *SPSS* for statistical analysis and *NVivo* for qualitative data coding. The findings from both data sources were triangulated to draw conclusions and recommendations for improving the service provider selection process at *Bank BJB*.

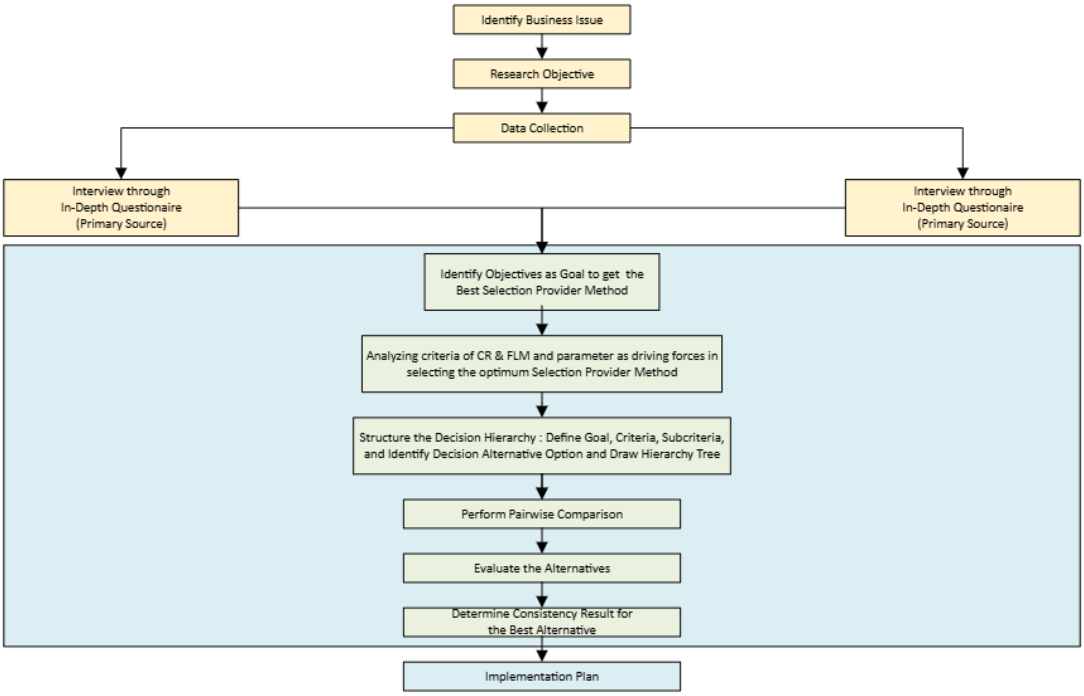


Figure 1. Research Design

The first step in the research design of this study was identifying the business issue by considering several parameters and variables that could have impacted the project implementation. After identification, this was followed by data collection to obtain detailed and comprehensive information as input for the author to analyze, ensuring that any scenario plan taken would be the optimum recommended strategy to select the best provider for ATM Cash Replenish (*CR*) and First Line Maintenance (*FLM*) at *Bank BJB*.

For data collection, it was necessary to gather information from primary sources, mainly through interviews using in-depth questionnaires, and from secondary sources originating from internal company data or other sources such as related journals and the internet. In implementing interviews through in-depth questionnaires as primary sources, the selection of interviewees or respondents was very important to determine at an early stage, with the aim of ensuring information accuracy, completeness of viewpoints, relevance to objectives or topics, as well as credibility and authority.

Interviewees or respondents in this research needed to be familiar with the end-to-end business process of the project sequence steps, starting from project planning and the procurement process, and ending with the selection of the best provider for ATM Cash Replenish (*CR*) and First Line Maintenance (*FLM*) at *Bank BJB*. Therefore, various resource persons or respondents were selected from the relevant functions, and most of them were Group Heads or Managers who knew exactly the impact of each stage of the selection process. In line with this, a literature review of related sources was conducted as a secondary source to enrich the references when analyzing the data from the interviews, the results of the questionnaires, and the literature study.

RESULT AND DISCUSSION

Interview through In-depth Questionnaire

Based on Author Analysis, preliminary analysis to find any factors criteria or parameter that have the potential threat or an opportunity for Bank BJB as reference to develop Question List of In-depth Questionnaires related with target in a project, shall be mitigated using PESTEL analysis as follows:

Table 1. Potential Driving Force to run Cash Replenishment & First Level Maintenance ATM

No.	Factor	Parameter As Driving Force	General Description
1	Political	Regulation of rupiah banknotes, licensing	Projects are required to follow the provisions of Bank Indonesia (PJPUR), national banking regulations, as well as legal and governance requirements, including operating permits and standardized SOPs. There is a special cooperation and document requirements between the Bank and the selected vendor with a strict technical assessment mechanism. There is legal protection in cooperation agreements and dispute resolution mechanisms through arbitration.
No.	**Factor**	**Parameter As Driving Force**	**General Description**
2	Economic	Economic Cost, SLA	ATM management is optimized to reduce downtime, improve customer service, and streamline operational costs. Vendors are responsible for penalties if SLAs are not met, as well as performance-based service payment adjustments. There are also provisions on insurance, the use of resources, vehicles, and compensation of fines in the event of default, all of which have an impact on the stability and economic efficiency of the bank.
3	Social	24/7 ATM Services	ATM services must be on standby 24/7, technicians and officers must meet security, professionalism, and integrity standards. There is strict supervision on cash handling, confidentiality of customer data, and protection against potential crime/sabotage. The accuracy of reporting and handling card and cash problems is the main point in maintaining customer satisfaction and bank reputation.
4	Technological	Technology innovation	ATMs are required to be connected to real time monitoring applications, CCTV, snapshots and protective hardware (UPS, stabilizers, etc.). Technology is used for authorization, backup/restore transaction data (EJP), SLA implementation and digital reporting, to physical security and ATM networks. Technology is also key in auditing, service reliability, and problem tracing.

No.	Factor	Parameter As Driving Force	General Description
5	Environmental	Business Continuity Plan	Document aware of disaster risks (floods, earthquakes, fires, etc.) in force majeure management. Vendors are required to have mitigation, proper operational vehicles, and 24-hour standby to ensure that ATM networks continue to run in various regions even when environmental conditions are disrupted. The vendor's work environment is also regulated to keep it clean, safe and proper according to SOPs.
6	Legal	Legal Contract compliance.	Each party is bound by a contract and is obliged to comply with the Service Level Agreement, BI regulations and national trade laws. There are rules on data confidentiality, periodic audits, and sanctions in the event of negligence, default, or violation. Legal risks are managed through fine arrangements, termination of agreements, and blacklists if vendors violate. The entire process is subject to regular internal and external audit procedures.

Based on table 1 above, there are several driving factors that will be included in the questionnaire. Questionnaire and will be asked to respondents to find out the respondents' opinions regarding what criteria or parameters have a major influence as a driving factor for carrying out the ATM Cash Replenishment (CR) & First Level Maintenance procurement project. The questionnaire will highlight the dominant specific questions regarding what are the most important provisions that should be considered in the project, what are the most important parameters that should be considered in the project, what parameters should be considered to ensure minimizing potential delays, high budgets, specifications and what are the types of parameters or criteria/sub-criteria that have a major impact or uncertainty to execute the Cash Replenishment & First Level Maintenance ATM procurement project.

Developing Criteria

As explained in Figure 1 Research Design, the author will set a goal to get the best natural Provider Analytic Hierarchy Process (AHP) model. Then, the author compiles the criteria to achieve these goals. the author makes criteria to achieve goals by considering 7 criteria as listed in the Term of Reference document to achieve goals and also as the company's main targets that must be considered by the procurement project team in carrying out the ATM Cash Replenishment (CR) & First Level Maintenance procurement process.

Defining Alternative Provider of CR & FLM

The CR & FLM (Cash Replenishment ATM & First Level Maintenance) Procurement Project determines the best and competent Service Provider so that it can have a significant impact on the budget, and services to customers using ATM machines. Choosing a service provider has considered various variables such as the licensing of the Rupiah Money Management Service

Provider (PJPUR), good facilities and infrastructure, competent human resources, large coverage area, Service Level Agreement that is maintained, adequate insurance, supporting SOPs, a supporting Business Continuity Plan and performance and experience from previous projects. Referring to supporting documents from internal companies, there are 6 ATM Cash Replenishment (CR) & First Level Maintenance Service Providers who have passed the administrative requirements and meet the criteria to participate in the CR & FLM service procurement project at Bank BJB, including the following:

1. Provider Advantage SCM (then we refer to it as Provider A)
2. Provider Andalan Artha Lestari (then we refer to it as Provider B)
3. Provider Bringin Gigantara (then we refer to it as Provider C)
4. Provider Kelola Jasa Artha (then we refer to it as Provider D)
5. Provider Swadharma Sarana Informatika (then we refer to it as Provider E)
6. Provider Usaha Garda Arta (then we refer to it as Provider F)

Structure the Decision Hierarchy of Analytic Hierachy Process (AHP)

The relationship between the alternatives and the criteria's is developed in the form of a hierarchical tree, based on The Research Design Flow as explained in chapter III.1 above, which aims to determine the decision. It is described in AHP Hierarchy structure as below:

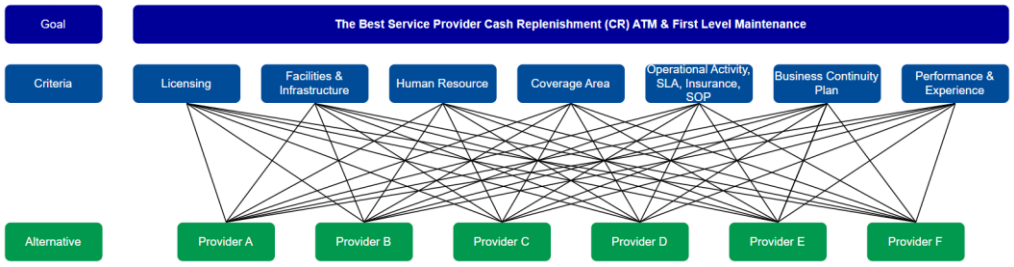


Figure 2. AHP Hierarchy Structure for Service Providers of CR & FLM

Making a Pairwise Comparation of AHP Model

Pairwise comparisons are delivered in the form of a questionnaire collected from several Subject Matter Experts (SME) which are closely related to end-to-end project phase, starting from the project planning, ATM Machine handover and takeover stage, implementation stage until reporting stage. Those SMEs come from the related functions that have responsibility and position related with typical experience in compliance project Cash Replenish (CR) ATM & First Level Maintenance, as described below:

Table 2. List of Subject Matter Expert (SME) in compliance project of Cash Replenish (CR) ATM & First Level Maintenance

No	Name	Position
1	Mr. MYN	Group Head Digital Banking - Digital Banking Division - Digital Banking Operations as Project Owner

2	Mr. YA	Manager Digital Banking - Digital Banking Division - Digital Banking Operations as Project Owner
3	Mr. GC	Group Head Digital Banking -Digital Banking Division - Digital Performance & QA as Supervisory of Project
4	Mr. NF	Manager Digital Banking - Digital Banking Division - Digital Performance & QA as Supervisory of Project
5	Mr. RMY	Group Head General Division - Procurement of Logistics, IT & Other Services
6	Mr. WW	Manager General Division - Procurement of Logistics, IT & Other Services

The correspondents will provide views on potential criteria that integrate the best potential alternatives. Using a fundamental scale of value (Pairwise Numerical rating) which represents the intensity of the assessment as shown in table 3.

Table 3. Pairwise Numerical Rating

Intensity of Importance	Definition	Explanation
1	Equal importance	Two activities contribute equally to the objective
3	Moderate importance	Experience and judgment slightly favor one activity over another
5	Essential importance	Experience and judgment strongly favor one activity over another
7	Very strong importance	An activity is favored very strongly over another; its dominance shown in practice
9	Extreme importance	The evidence favoring one activity over another is of the highest possible level of affirmation
2, 4, 6, 8	Intermediate values	When compromise is needed between two

Table 4. Pairwise Comparison for Criteria

Criteria	Pairwise Comparison																		Criteria
	>=9.5	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	>=9.5	
Licensing																				Facilities & Infratructure
Licensing																				Human Resource
Licensing																				Coverage Area
Licensing																				Operational Activiy, SLA, Assurance, SOP
Licensing																				Business Continuity Plan
Licensing																				Performance & Experience
Facilities & Infratructure																				Human Resource
Facilities & Infratructure																				Coverage Area
Facilities & Infratructure																				Operational Activiy, SLA, Assurance, SOP
Facilities & Infratructure																				Business Continuity Plan
Facilities & Infratructure																				Performance & Experience
Human Resource																				Coverage Area
Human Resource																				Operational Activiy, SLA, Assurance, SOP
Human Resource																				Business Continuity Plan
Human Resource																				Performance & Experience
Coverage Area																				Operational Activiy, SLA, Assurance, SOP
Coverage Area																				Business Continuity Plan
Coverage Area																				Performance & Experience

Operational Activity, SLA, Assurance, SOP																			Business Continuity Plan
Operational Activity, SLA, Assurance, SOP																			Performance & Experience
Business Continuity Plan																			Performance & Experience

Table 5. Pairwise Comparison Alternative on Licensing Criteria

Criteria	Pairwise Comparison																		Criteria
	>=9.5	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	>=9.5	
Provider A																				Provider B
Provider A																				Provider C
Provider A																				Provider D
Provider A																				Provider E
Provider A																				Provider F
Provider B																				Provider C
Provider B																				Provider D
Provider B																				Provider E
Provider B																				Provider F
Provider C																				Provider D
Provider C																				Provider E
Provider C																				Provider F
Provider D																				Provider E
Provider D																				Provider F
Provider E																				Provider F

Table 6. Pairwise Comparison Alternative on Facilities & Infrastructure Criteria

Criteria	Pairwise Comparison																		Criteria
	>=9.5	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	>=9.5	
Provider A																				Provider B
Provider A																				Provider C
Provider A																				Provider D
Provider A																				Provider E
Provider A																				Provider F
Provider B																				Provider C
Provider B																				Provider D
Provider B																				Provider E
Provider B																				Provider F
Provider C																				Provider D
Provider C																				Provider E
Provider C																				Provider F
Provider D																				Provider E
Provider D																				Provider F
Provider E																				Provider F

Table 7. Pairwise Comparison Alternative on Human Resource Criteria

Criteria	Pairwise Comparison																		Criteria
	>=9.5	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	>=9.5	
Provider A																				Provider B
Provider A																				Provider C
Provider A																				Provider D
Provider A																				Provider E
Provider A																				Provider F
Provider B																				Provider C
Provider B																				Provider D
Provider B																				Provider E
Provider B																				Provider F
Provider C																				Provider D

Provider C																		Provider E
Provider C																		Provider F
Provider D																		Provider E
Provider D																		Provider F
Provider E																		Provider F

Table 8. Pairwise Comparison Alternative on Coverage Area Criteria

Criteria	Pairwise Comparison																		Criteria
	>=9.5	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	>=9.5	
Provider A																				Provider B
Provider A																				Provider C
Provider A																				Provider D
Provider A																				Provider E
Provider A																				Provider F
Provider B																				Provider C
Provider B																				Provider D
Provider B																				Provider E
Provider B																				Provider F
Provider C																				Provider D
Provider C																				Provider E
Provider C																				Provider F
Provider D																				Provider E
Provider D																				Provider F
Provider E																				Provider F

Table 9. Pairwise Comparison Alternative on Operatioanl Activity, SLA, Insurance & SOP Criteria

Criteria	Pairwise Comparison																		Criteria
	>=9.5	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	>=9.5	
Provider A																				Provider B
Provider A																				Provider C
Provider A																				Provider D
Provider A																				Provider E
Provider A																				Provider F
Provider B																				Provider C
Provider B																				Provider D
Provider B																				Provider E
Provider B																				Provider F
Provider C																				Provider D
Provider C																				Provider E
Provider C																				Provider F
Provider D																				Provider E
Provider D																				Provider F
Provider E																				Provider F

Table 10. Pairwise Comparison Alternative on Business Continuity Planning Criteria

Criteria	Pairwise Comparison																		Criteria
	>=9.5	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	>=9.5	
Provider A																				Provider B
Provider A																				Provider C
Provider A																				Provider D
Provider A																				Provider E
Provider A																				Provider F
Provider B																				Provider C
Provider B																				Provider D
Provider B																				Provider E
Provider B																				Provider F

Provider C																		Provider D
Provider C																		Provider E
Provider C																		Provider F
Provider D																		Provider E
Provider D																		Provider F
Provider E																		Provider F

Calculation

Using data from the results of the questionnaire where the correspondents are dominant in determining the selection of criteria and alternatives based on personal judgement which refers to knowledge, skills, and experience. The correspondents are coming from functions that have responsibility and position related with cash replenishment & first level maintenance service provider procurement project. In doing calculation of pair wise comparison result for having weight sum of each criterion's and alternatives from AHP Model, the author uses application of Super Decision Software as described below:

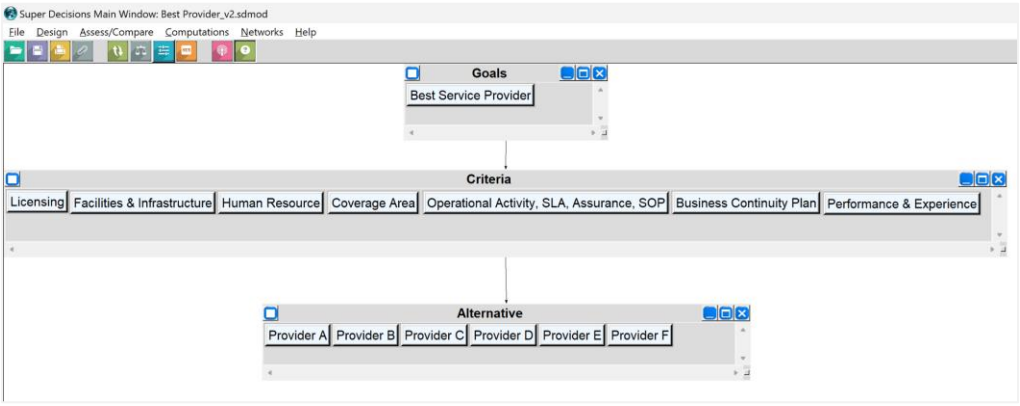


Figure 3. AHP Model using Super Decision Software

As shown in figure 3 above, the super decision application that becomes the cluster goals is the Service Provider Choice, then the cluster criteria consist of Business Continuity Plan, Coverage Area, Operational Activity, SLA, Assurance & SOP, Experience and Performance, Licensing, Facilities & Infrastructure, Human Resources, Meanwhile, the alternative cluster section consists of Provider A, Provider B, Provider C, Provider D, Provider E, Provider F.

The Super Decision tool is employed to simulate a hierarchical process, assess criteria, and determine the best alternative. Tables IV.10 show conclusions the total weight sum calculation for criteria and alternatives as follows :

Table 11. Weighted for Criteria and Alternatives

Hierarchy AHP Results	Weighted Sum
Criteria:	
Licensing	0.14286
Facilities & Infrastructure	0.14286

Human Resource	0.14286
Coverage Area	0.14286
Operational Activity, SLA, Insurance, SOP	0.14286
Business Continuity Plan	0.14286
Performance & Experience	0.14286
Alternatives:	
Provider A	0.18082
Provider B	0.19511
Provider C	0.15567
Provider D	0.16505
Provider E	0.15455
Provider F	0.14878

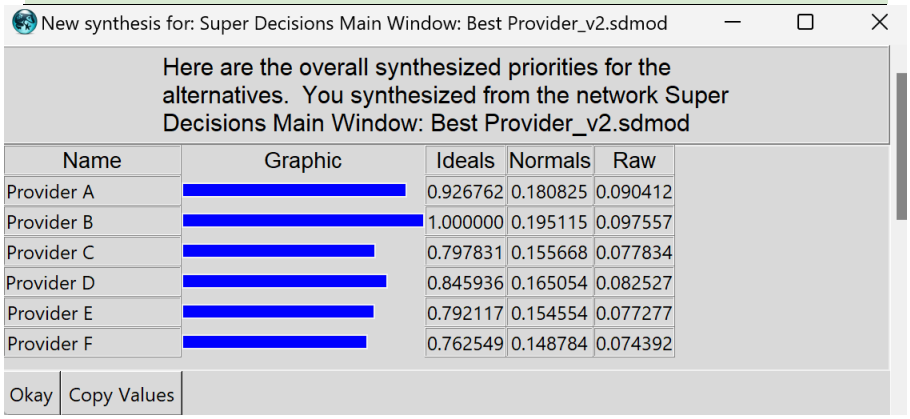


Figure 4. Overall syntesized priorities result

According to the calculations presented in table IV.10 and figure IV.5, which identify the optimal service provider for cash replenishment ATMs and first-level maintenance, and based on the model constructed by the author considering the predetermined criteria, Provider B emerges as the unequivocal victor. With a "Ideal" value of 1.000000 and the maximum "Normal" value of 0.195115, Super Decision quantitatively endorses Provider B as the optimal service provider selection. It can be determined that, among all the evaluated factors, including Licensing, Facilities & Infrastructure, Human Resources, Coverage Area, Operational Activity, SLA, Insurance, SOP, Business Continuity Plan, and Performance & Experience, Provider B is the most exemplary. Concurrently, Provider A occupies the second position, with a marginal difference of 0.926762 in "Ideals" and 0.180825 in "Normals." This may serve as an option should issues arise with Provider

B. Provider F is the least competent of all contenders, possessing the lowest "Ideal" and "Normal" values.

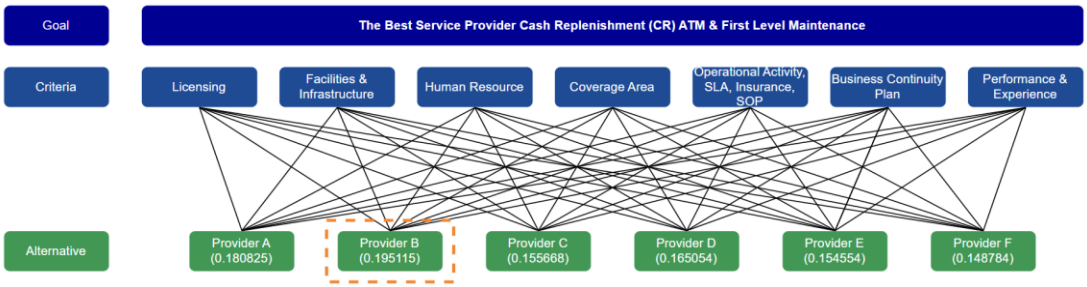
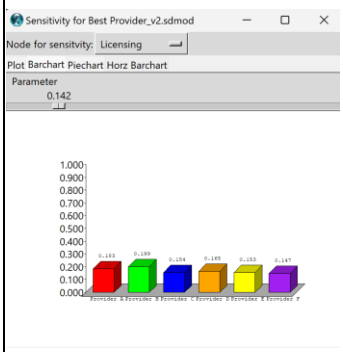
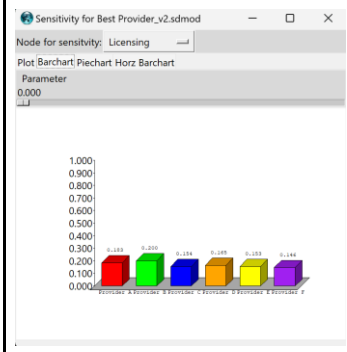
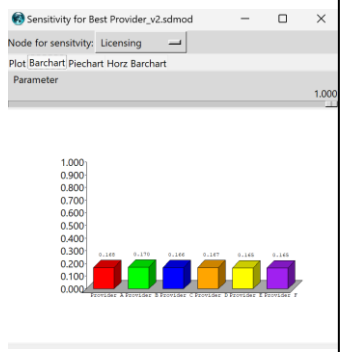


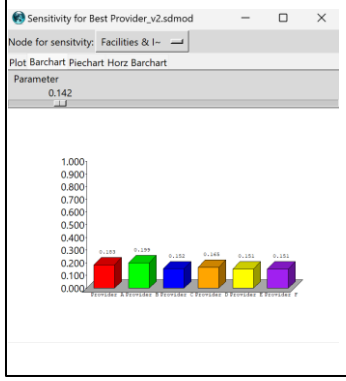
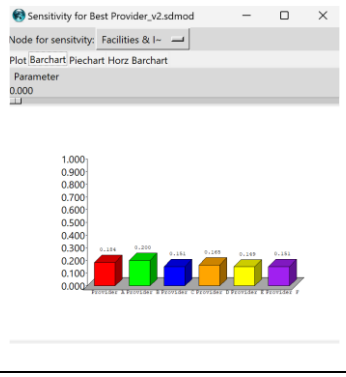
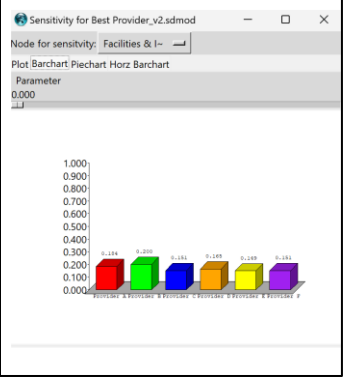
Figure 5. Result of AHP Hiearchy Structure for Best Service Provider CR & FLM

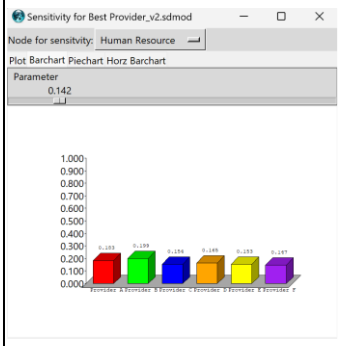
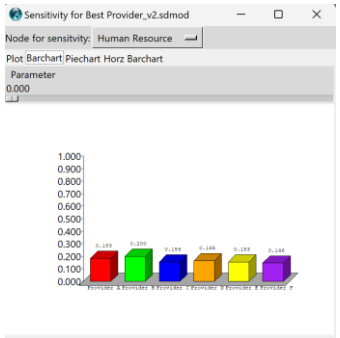
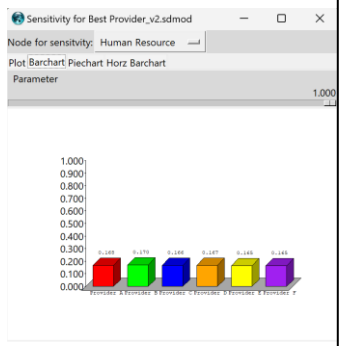
Sensitivity Analysis

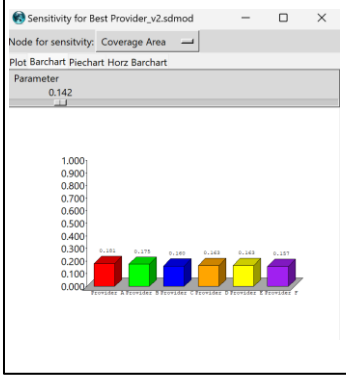
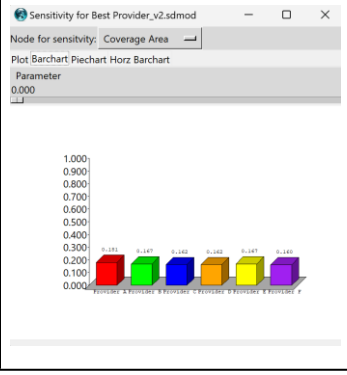
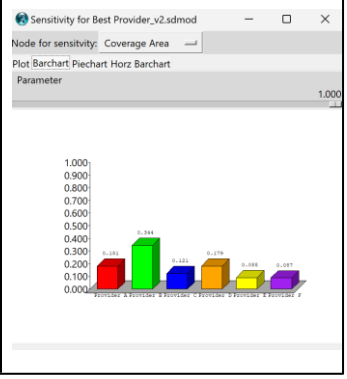
Sensitivity analysis is used to analyze how stable the priority of an alternative that has been selected is to changes in the simulated criteria. The sensitivity analysis of the decision-making results is analyzed to understand the robustness of the model (Bhanu and Amit, 2019). AHP sensitivity analysis was evaluated in this study by identifying the most critical endpoints. It shows how the priorities of all alternatives change when the priorities of the given criteria change.

In this research, the author uses the Super Decision application to conduct sensitivity analysis by changing the parameter values of the Licensing, Facilities & Infrastructure, Human Resource, Coverage Area, Operational Activity, SLA, Insurance, SOP, Business Continuity Plan, Performance & Experience criteria from the initial value to the minimum and maximum values. Based on the sensitivity analysis simulation, it shows that the best alternative remains in Provider B compared to other alternatives. Therefore, it can be concluded that the decision taken is robust. The simulation results can be described as follows:

Criteria : Licensing		
Weight Sum Value: 0.142	**Minimum Value : 0.00**	**Maximum Value : 1.00**
		

Criteria : Facilities & Infrastructure		
Weight Sum Value: 0.142	**Minimum Value : 0.00**	**Maximum Value : 1.00**
		

Criteria : Human Resource		
Weight Sum Value: 0.142	**Minimum Value : 0.00**	**Maximum Value : 1.00**
		

Criteria : Coverage Area		
Weight Sum Value: 0.142	**Minimum Value : 0.00**	**Maximum Value : 1.00**
		

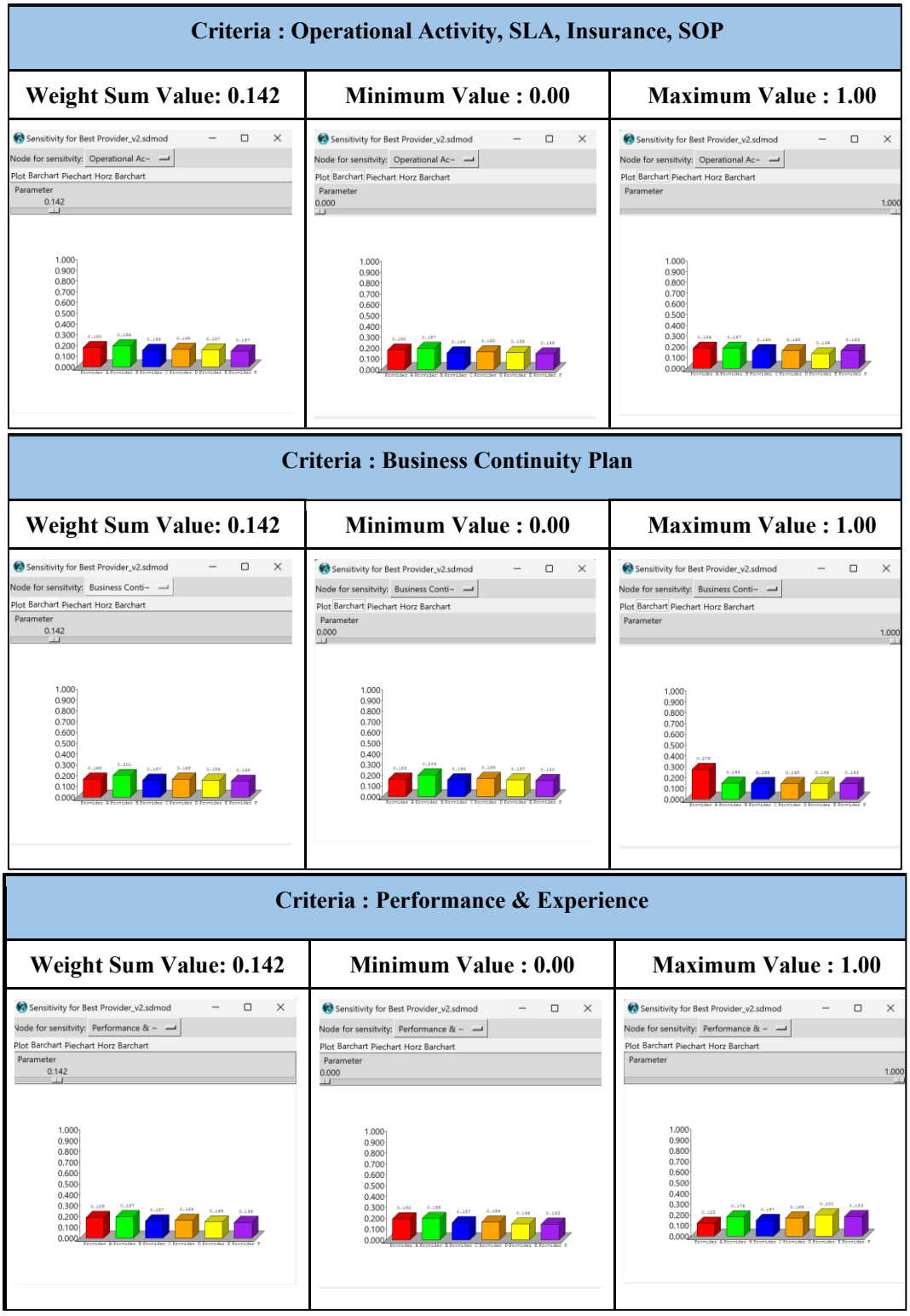


Figure 6. Sensitivity Analysis by Changing the Criterion Parameter Values

Business Solution

In selecting ATM Cash Replenishment (CR) & First Level Maintenance service providers at Bank BJB, several justification approaches are required to define various criteria and conditions needed to select the best strategy to be applied in implementing the Project using Analytic Hierarchy Process (AHP). Therefore, several analyses have been conducted through literature studies and interviews through in-depth questionnaires to answer the Research Questions as mentioned in chapter 1 with the following solutions:

1. How to design a decision support system (DSS) that is suitable for accelerating and improving the accuracy of provider assessment evaluation in ATM Cash Replenishment (CR) and First Level Maintenance service procurement projects at Bank BJB?

The development of a decision support system (DSS) suitable for accelerating and improving the accuracy of service provider evaluation in the Cash Replenishment (CR) ATM and First Level Maintenance (FLM) service procurement project at Bank BJB can be designed by adopting the Analytic Hierarchy Process (AHP) framework integrated into the Super Decision application. This DSS design focuses on a structured approach to identify, evaluate, and select the best service providers based on predetermined criteria and expert assessments.

1) Identification of DSS Needs and Objectives

The main objective of this DSS is to facilitate Bank BJB in selecting the most optimal CR ATM and FLM service providers. This process begins with a literature review and in-depth interviews through questionnaires to identify the criteria factors and parameters that could potentially pose threats or opportunities for Bank BJB. PESTEL analysis (Political, Economic, Social, Technological, Environmental, Legal) is used as a reference to develop a list of questions in the in-depth questionnaire related to the project target.

2) Development of Criteria and Alternatives

After gathering insights from respondents through questionnaires, the criteria that have a significant impact as drivers of the CR ATM & FLM procurement project were identified. This research aims to obtain the best AHP model for service providers. The author compiled these criteria, considering the seven main criteria listed in the company's Terms of Reference (TOR) document. These criteria include Licensing, Facilities & Infrastructure, Human Resource, Coverage Area, Operational Activity, SLA, Insurance, SOPBusiness Continuity Plan, and Performance & Experience.

As an alternative, the CR & FLM procurement project aims to determine the best and most competent service providers that can have a significant impact on the budget and services to ATM customers. Based on the company's internal documents, six CR ATM & FLM service providers who have met the administrative requirements and criteria for this project have been identified.

3) Creation of AHP Decision Hierarchy Structure

The relationship between objectives, criteria, and alternatives is depicted in the form of a hierarchical structure. This structure serves as the foundation for the AHP model in Super Decision with the aim of selecting the best service provider for Cash Replenishment (CR) ATM & First Level Maintenance at Bank BJB.

2. What are the impacts of decision support system implementation on operational smoothness, effectiveness of service provider selection process, and quality of banking services in ATM Cash Replenishment and First Level Maintenance service procurement project at Bank BJB?

The implementation of a decision support system (DSS) based on the Analytic Hierarchy Process (AHP) in the procurement project of Cash Replenishment (CR) ATM and First Level Maintenance (FLM) services at Bank BJB has a significant impact on operational smoothness, the effectiveness of the service provider selection process, and the quality of banking services.

1) Impact on Operational Smoothness

The implementation of the DSS, which produces recommendations for the best service providers, such as Provider B in this case study, directly contributes to the smooth operation of CR ATM and FLM. This smoothness is realized through several aspects:

a. Choosing the Right Partner

By selecting the most optimal service provider based on a comprehensive evaluation, the risk of operational disruptions due to inadequate provider performance can be minimized. The document shows that Provider B consistently remains the best alternative, even after conducting a sensitivity analysis against various criteria. This indicates that Provider B has high capabilities in crucial aspects such as Human Resource, Operational Activity, SLA, Insurance, SOP, and Business Continuity Plan (BCP). This capability is essential to ensure a stable supply of ATM cash and quick initial handling of technical issues, thereby minimizing ATM downtime.

b. Service Reliability

Criteria such as Performance & Experience and Coverage Area, which are factors in provider selection, indicate that DSS encourages the selection of providers that not only have a good track record but also extensive coverage areas. This ensures that ATMs in various locations can be serviced efficiently, reducing the potential for cash shortages or non-functioning ATMs for extended periods.

Reduction of Operational Risk: Licensing and Business Continuity Plan criteria become important in the evaluation. The selection of providers that meet licensing standards and have a strong BCP will reduce legal and operational risks that could disrupt service continuity. Thus, Bank BJB can ensure that CR and FLM operations run in accordance with regulations and have a mitigation plan in case of unexpected incidents.

2) Impact on the Effectiveness of the Service Provider Selection Process

The implementation of DSS fundamentally enhances the effectiveness of the service provider selection process by transforming the subjective approach into a more objective, structured, and transparent one.

a. Objectivity and Transparency

AHP-based DSS provides a systematic framework for evaluating various service provider alternatives based on agreed-upon criteria that are measured quantitatively. This replaces processes that might be based solely on intuition or individual preferences, thereby enhancing decision-making objectivity. The document explicitly states the use of the AHP method to

answer the Research Question as a business solution, which emphasizes the commitment to this structured approach.

b. Acceleration of the Decision-Making Process
With the computerized AHP method through Super Decision, the complex calculations of pairwise comparisons and priority synthesis can be done quickly. This is very important for procurement projects that are often time-bound. DSS allows stakeholders to quickly see aggregate results and make faster decisions compared to manual methods.

c. Improvement in Assessment Accuracy
AHP allows for the weighting of criteria and sub-criteria according to their level of importance, as well as the evaluation of alternatives based on those criteria. The use of the Saaty scale and the calculation of the consistency ratio (CR) ensure that the input evaluations have an acceptable level of consistency, making the evaluation results more accurate and accountable. Although it does not explicitly display the CR, the presence of result synthesis (as shown in the Synthesized.png image) implies that the AHP process has been conducted with consistency in mind.

d. Sensitivity Analysis for Decision Robustness
The document shows the use of sensitivity analysis in Super Decision. This analysis allows Bank BJB to understand how changes in the priority of certain criteria (for example, if Facilities & Infrastructure become more important) can affect the ranking of alternatives. The results show that "the best alternative remains in Provider B compared to other alternatives," indicating that the decision made is robust. This is very important for effectiveness, as it ensures that the choice of service provider will not change drastically due to minor changes in initial assumptions or criteria priorities.

3) Impact on the Quality of Banking Services

The improvement of banking service quality is the ultimate goal of selecting superior CR ATM and FLM service providers.

a. Optimal ATM Availability
With a provider that is efficient in cash replenishment (CR) and responsive in first-line maintenance (FLM), ATM availability for customers will increase. This means that customers will encounter empty or non-functioning ATMs less frequently, which directly increases customer satisfaction. The criteria for Operational Activity, SLA, Insurance, SOP (Figure IV.6) are crucial here, as they ensure that the provider is committed to the agreed-upon service standards and response times.

b. Increased Customer Trust
Smooth and reliable ATM services build customer trust in Bank BJB. Customers will feel safe and comfortable conducting cash or non-cash transactions whenever needed.

c. Positive Image of Bank BJB
High-quality service will ultimately shape a positive image for Bank BJB as a reliable financial institution oriented towards customer satisfaction. Emphasis on criteria such as Performance & Experience (Figure IV.6) ensures that the selected provider has a solid track record in delivering quality services.

Overall, the design and implementation of the AHP-based decision support system using Super Decision allows Bank BJB to transform from an evaluation approach that may tend to be subjective into a systematic, accurate, and data-driven process. This not only accelerates the selection process but also increases confidence that the chosen service providers are the best, which in turn will positively impact the smooth operation of CR ATM and FLM, as well as the overall quality of banking services for Bank BJB customers.

CONCLUSION

This study successfully identified the optimal service provider for Cash Replenishment (*CR*) ATMs and First Level Maintenance (*FLM*) at *Bank BJB* by integrating literature reviews, surveys, and the Analytical Hierarchy Process (*AHP*), and evaluating six providers using the *PESTEL* framework and seven key criteria. Provider B emerged as the top choice, consistently achieving the highest scores across all criteria, with sensitivity analysis confirming its robustness under various scenarios. The findings underscore the importance of a structured and impartial decision-making process in selecting service providers for critical banking operations to maintain operational excellence and customer satisfaction. For future research, it is suggested to expand the *AHP* model by including additional factors such as customer feedback and service scalability, as well as to examine the long-term impacts of provider performance on operational efficiency and customer satisfaction amid evolving market and technological conditions. Additionally, applying this methodology to other banking sectors, such as loan management or customer support, could further validate its versatility and broader applicability.

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