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Development of a Decision Support System for Motorcycle Credit Eligibility Using the TOPSIS Method

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Abstract — The growing need for motorcycle financing in Indonesia has encouraged financial institutions to improve the accuracy and consistency of their credit evaluation processes. At PT FIFGROUP, the current assessment procedure still relies heavily on manual surveys and subjective judgments, which often leads to variations in decision outcomes and longer processing times. This study aims to design and develop a Decision Support System (DSS) that facilitates a more objective and efficient assessment of motorcycle credit eligibility by applying the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS). Recent advancements in decision-making research highlight TOPSIS as one of the most effective multi-criteria decision-making (MCDM) methods due to its structured approach in comparing alternatives against ideal benchmarks. Building on this body of work, the proposed system incorporates organizational criteria such as residential status, income stability, expenditure levels, and educational background into a standardized evaluation model. The research methodology includes system requirement analysis, conceptual and database design, and the integration of the TOPSIS algorithm into the application workflow. Through normalization, weighting, and distance calculations, the system generates a final ranking score that reflects each applicant's eligibility. The results of the study show that the DSS significantly improves the consistency of credit evaluations, reduces subjective bias, and accelerates the decision-making process. Overall, the implementation of a TOPSIS-based DSS provides a practical and reliable solution for PT FIFGROUP to enhance the quality and efficiency of motorcycle credit assessments.

Keywords – Decision Support System; Credit Eligibility; Motorcycle Financing; TOPSIS; Multi-Criteria Decision Making

I. INTRODUCTION

Motorcycle financing plays a critical role in Indonesia's transportation and economic ecosystem, as motorcycles remain the most widely used mode of mobility. As one of the nation's major financing institutions, PT FIFGROUP provides motorcycle credit services in partnership with authorized Honda dealerships. The company relies heavily on surveyors who conduct home visits to verify submitted documents and assess environmental and socioeconomic conditions. This traditional workflow ensures thorough evaluation; however, it also introduces several operational inefficiencies including lengthy processing times, inconsistent assessment results, and high dependency on subjective human judgment.

The rapid growth of digital technology has significantly transformed decision-making processes in financial and leasing institutions. Conventional credit eligibility assessment is often conducted manually, relying on subjective judgment and experience of credit analysts. This approach is time-consuming and vulnerable to inconsistency, particularly when handling a large volume of applications. To overcome these limitations, many institutions have adopted Decision Support Systems (DSS) based on Multi-Criteria Decision Making (MCDM) methods to produce faster, more accurate, and objective decisions [1], [2].

Among various MCDM techniques, the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) is widely applied due to its ability to rank

alternatives based on their closest distance to the ideal solution and the farthest distance from the negative ideal solution. Recent studies confirm that TOPSIS is highly effective in credit evaluation systems, including cooperative credit, microfinance, and banking loan eligibility assessments, by providing transparent and consistent ranking results [1], [3], [9]. Furthermore, web-based implementation of TOPSIS-based DSS improves accessibility and operational efficiency in financial services [4], [6].

In the motorcycle financing sector, particularly at leasing institutions such as FIFGROUP, credit approval must be performed quickly and accurately due to high daily application volumes. The evaluation process involves multiple criteria including applicant income, employment status, residential ownership, number of dependents, and credit history. These characteristics make credit eligibility assessment a multi-criteria decision problem that is well suited for TOPSIS implementation [2], [3].

Several recent studies demonstrate the successful application of TOPSIS in various decision-making domains, such as education, library accreditation, smartphone selection, and performance evaluation, highlighting its flexibility and robustness as a decision-support method [4]–[8]. However, research focusing specifically on motorcycle credit eligibility in leasing companies remains limited.

Based on these gaps, this research aims to: (1) Identify, structure, and formalize the criteria used in evaluating motorcycle credit eligibility at PT FIFGROUP. (2) Develop a web-based Decision Support System (DSS) that automates the evaluation workflow to enhance efficiency and reduce dependency on subjective human judgment. (3) Implement the TOPSIS method within the system to generate objective, consistent, and data-driven credit eligibility scores.

By integrating TOPSIS into an operational DSS built with PHP and MySQL, this study offers a practical solution that improves decision accuracy, transparency, and processing speed. The proposed system is expected to support FIFGROUP in achieving more consistent credit evaluations while enhancing customer experience in the financing application process.

II. METHODOLOGY

The methodology of this study combines system development and empirical validation to produce a Decision Support System (DSS) capable of evaluating motorcycle credit eligibility in a structured and objective manner. The research begins with data collection from both primary and secondary sources. Primary data were obtained through interviews with key personnel at PT FIFGROUP, including surveyors, sales staff, and credit analysts, to understand the decision-making process and the criteria considered most influential in determining customer creditworthiness. Direct observations were also conducted to map the existing workflow, from customers submitting application forms to surveyors conducting home assessments. Meanwhile, secondary data were drawn from historical credit application records provided by the company, which were anonymized to ensure confidentiality. These records were essential for understanding applicant patterns and validating the performance of the proposed system. To ensure diversity and representativeness, the study used stratified samples from different customer categories, income brackets, and approval outcomes.

Following the data collection phase, the study identified and refined the criteria used to assess credit eligibility. These criteria include residential status, income level, expenditure obligations, education background, employment stability, and several other socioeconomic indicators. Their selection was based on both literature findings and expert insights. The weighting of each criterion was established through consultations with credit analysts using a consensus-based approach, ensuring that the final weights reflected organizational priorities. The criteria were then translated into measurable scales to allow the system to compare applicants consistently.

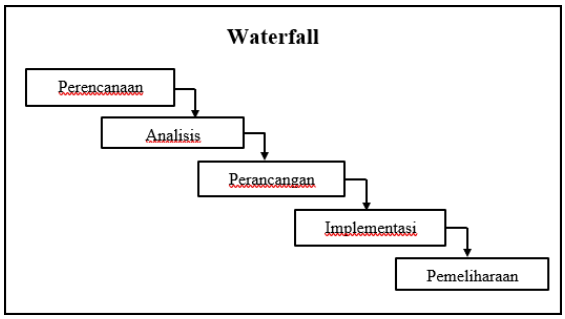


Fig.1. Waterfall Model

The development of the DSS followed the Waterfall model, which provides a clear and sequential structure suitable for systems requiring well-defined requirements. Waterfall phases are illustrated in Figure 1. The process began with in-depth requirements analysis, which documented functional needs such as user roles, data entry processes, scoring mechanisms, and reporting modules. The system design phase translated these needs into conceptual models, including use-case diagrams, activity flows, and a relational database schema. Implementation was carried out using PHP for the backend logic and MySQL as the database engine, ensuring compatibility with commonly used technologies in Indonesian financial institutions. The system was developed with four main user groups—customers, sales staff, surveyors, and credit analysts—each having distinct permissions and functionalities. After implementation, the system underwent unit and integration testing to

verify functional integrity, followed by user acceptance testing involving FIFGROUP personnel.

The TOPSIS method was integrated into the system as the core mechanism for calculating applicant eligibility scores. Its implementation begins by organizing applicant information into a structured decision matrix aligned with the selected evaluation criteria [10]. These criteria are first standardized to ensure fairness, as they represent different measurement units and levels of importance. Following this, each criterion is multiplied by its predetermined weight, reflecting its significance in the credit assessment process. Once standardized and weighted, the system evaluates each applicant by comparing their characteristics to the ideal applicant profile and to a least desirable profile. The ideal profile represents the best achievable values for each criterion, whereas the least desirable profile represents the worst. The system then determines how close each applicant is to these profiles, with those closer to the ideal profile receiving higher eligibility scores. The resulting numerical score provides a clear, objective basis for ranking applicants. The system stores all calculations in a log table to ensure that every recommendation is traceable and auditable.

To evaluate the accuracy and usefulness of the DSS, the study compared system-generated eligibility results against decisions previously made by credit analysts. Agreement levels were measured to determine consistency between human decisions and the system's recommendations. The evaluation also considered processing time improvements, as one of the goals was to reduce the time spent reviewing applications manually. Furthermore, sensitivity analysis was conducted by adjusting criterion weights to determine how significantly weight changes affect applicant rankings. This was essential to ensure that the system's recommendations remained stable and reliable even under slight variations in the weighting scheme.

Usability testing was conducted through a controlled pilot deployment involving selected FIFGROUP branches. Participants were asked to interact with the DSS and provide feedback on aspects such as system navigation, clarity of outputs, and overall user experience. Their responses were collected through structured questionnaires and interviews to refine the system interface and improve workflow alignment. The pilot testing demonstrated the system's potential to improve decision consistency while also making the workflow more efficient for credit analysts and surveyors.

Ethical considerations were central throughout the research process. All personal data were anonymized prior to analysis, and access to sensitive information was restricted through role-based permissions within the system. The research adhered to organizational data-handling policies, and informed consent was obtained during interviews. The study also acknowledged limitations, including the dependence on historical data quality and the bounded scope of pilot testing, which may influence generalizability. Despite these limitations, the methodology provides a solid foundation for developing a practical, data-driven credit assessment tool adaptable for future scaling.

A. System Design

The system design phase focuses on modeling user interactions and defining the structural components necessary to support the Decision Support System for motorcycle credit eligibility. Several Unified Modeling Language (UML) diagrams—particularly use case diagrams—were developed to illustrate the functional boundaries of the system and to clarify the responsibilities associated with each user role. These diagrams help ensure that all stakeholders' requirements are translated accurately into system functionalities.

The Customer use case diagram represents all functionalities available to general users who wish to submit a motorcycle credit application. This diagram describes how customers interact with the system primarily through account registration, login, submission of personal and financial data, and tracking the status of their credit application. The available use cases include creating a new account, completing the application form, updating personal information, and viewing approval results. This use case illustrated in Figure 2 to ensures that the customer's experience is straightforward, enabling applicants to digitally initiate the credit submission process without the need for in-person visits.

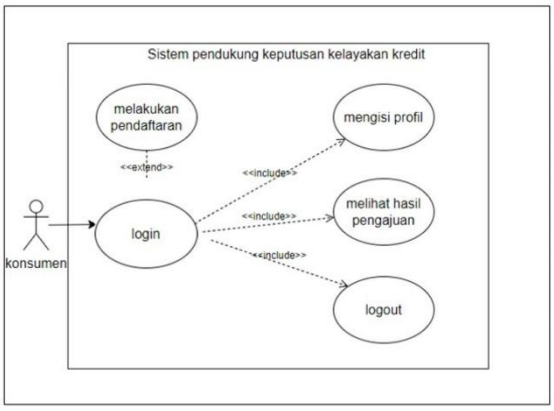


Fig.2. Use Case Diagram for Customer Access

The Sales user role has a broader range of functionalities compared to customers. The corresponding use case diagram illustrates Sales interactions, which include assisting customers in completing applications, validating preliminary

information, and forwarding applications to surveyors or credit analysts. Sales staff can also monitor application progress, communicate with applicants, and manage initial data entry when customers apply directly through marketing personnel, that illustrated in Figure 3. This diagram ensures that sales personnel can efficiently facilitate and oversee the front-end stages of the credit application workflow.

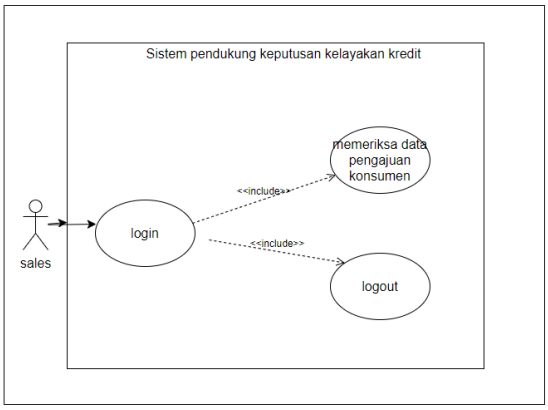


Fig.3. Use Case Diagram for Sales Access

Credit Analysts (CA) play a critical role in evaluating applications after surveyors complete their assessments. The use case diagram for this role highlights functionalities such as reviewing full application profiles, analyzing survey results, entering or adjusting evaluation criteria, generating TOPSIS-based eligibility scores, and making final recommendations. The diagram helps clarify how Credit Analysts interact with the automated scoring module while retaining oversight and decision-making authority, which illustrated in Figure 4. It also ensures that analysts maintain control over the verification and approval process while benefiting from objective system-generated decision support.

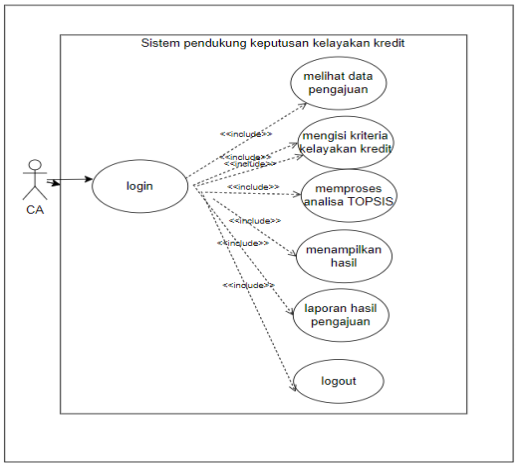


Fig.4. Use Case Diagram for Credit Analyst Access

The Admin use case diagram depicts the highest level of system control. Administrators have access to system-wide functionalities including user management, role configuration and master data. They are responsible for maintaining the integrity of system operations by managing roles for all users. Additionally, administrators can update system parameters, adjust criteria weights, and oversee log records generated during TOPSIS calculations. This diagram ensures the system remains secure, consistent, and aligned with organizational policies.

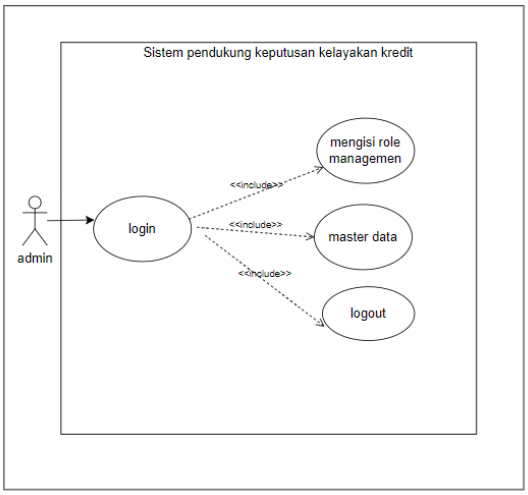


Fig.5. Use Case Diagram for Admin Access

The database design forms the structural backbone of the system by organizing how data is stored, retrieved, and related. The database schema, illustrated in the Figure 6, includes key entities such as users, sparepart and reservasis. Each table is thoughtfully constructed to ensure referential integrity and efficient data retrieval, particularly for the calculation and ranking processes.

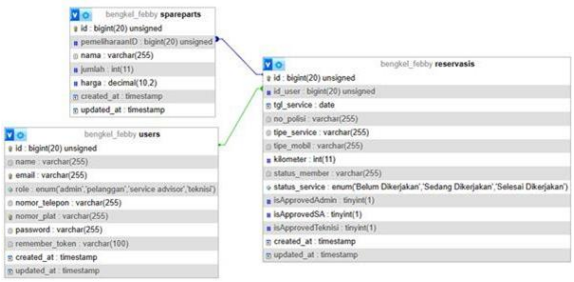


Fig.6. Entity Relational Diagram (ERD)

The design incorporates relational links between Customers, Sales, Surveyors, and Credit Analysts to support a seamless workflow across user roles. The use of foreign keys ensures that every credit application remains traceable from its initiation through its final approval. Meanwhile, the TOPSIS processing tables store weighted criteria, normalized values, and final scores to maintain transparency and auditability. The database structure thus ensures that the DSS can handle high volumes of applications while maintaining performance, accuracy, and data consistency.

B. System Implementation

The system was implemented using Next.js for front-end development and Firebase as the backend service. Firebase provides real-time database capabilities, cloud storage for file uploads, and authentication services. Customers can register, browse billboard availability, select flexible rental periods, upload design drafts, and view rental status. Admins handle customer data, verify payments, approve designs, and generate offer letters. Production staff access finalized design data and update project completion progress.

This implementation approach follows recent case studies that emphasize domain-specific system development for managing rental operations.

III. RESULTS AND DISCUSSION

The results of this study focus on the development, functionality, and performance evaluation of the Decision Support System (DSS) designed to assess motorcycle credit eligibility using the TOPSIS method. The system was successfully implemented as a web-based platform accessible to four primary user groups—Customers, Sales, Surveyors, and Credit Analysts—each with different interface views, functionalities, and access rights. The system's design ensures alignment with FIFGROUP's existing workflow while introducing automation and decision-support capabilities that improve efficiency and decision consistency.

1. System Interface and Functionality

The implemented system provides a structured interface for each user role. Customers are able to register, log in, and submit their application data directly through the online form. They can also monitor the real-time status of their credit application. This reduces the dependency on manual paper-based submissions and increases accessibility.

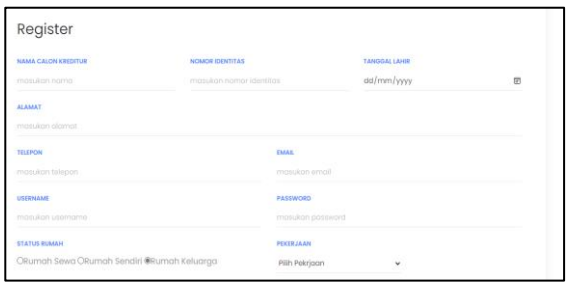


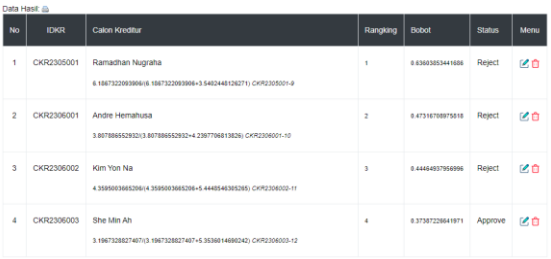
Fig.7. Display page Registration for Customer

Sales staff may review and validate customer submissions before forwarding them for further assessment. This aligns with their current role of assisting customers during the application process. Surveyors are provided with dedicated pages to enter field verification data, including residential conditions and supporting documentation. This digital entry mechanism significantly reduces delays associated with handwritten or offline forms.

Credit Analysts access a consolidated dashboard displaying customer profiles, survey results, and system-generated TOPSIS scores. From this interface, analysts can make approval decisions more quickly and with increased confidence. The final eligibility score is prominently displayed, accompanied by detailed breakdowns of each criterion's contribution. This transparency enables analysts to review the reasoning behind each recommendation, increasing trust and accountability in the automated system.

2. TOPSIS-Based Eligibility Ranking

The integration of the TOPSIS method successfully produced objective numerical scores for each applicant. Through normalization, weighting, and comparison against ideal applicant profiles, the system assigns a final score between 0 and 1. Applicants with higher scores are ranked as more eligible for credit approval. The system's implementation ensures that criteria such as income, expenses, residential status, employment stability, and education level are evaluated consistently without subjective bias.


Data Hasil

No	IDKR	Calon Kreditur	Rangking	Bobot	Status	Menu
1	CKR2305001	Ramadhan Nugraha 6.186732209390 6(6.186732209390 6+3.5462448126271) CKR2305001-9	1	0.6360853441686	Reject	
2	CKR2306001	Andre Hermahusa 3.807886552932(3.807886552932+4.239770681382 6) CKR2306001-10	2	0.4731670897 5618	Reject	
3	CKR2306002	Kim Yon Na 4.359500366528 6(4.359500366528 6+5.444854630526 5) CKR2306002-11	3	0.4446493795699 6	Reject	
4	CKR2306003	She Min Ah 3.196732682746 7(3.196732682746 7+5.353661469824 2) CKR2306003-12	4	0.3736722684197 1	Approve	

Fig.8. Result TOPSIS on Approval Credit

In Figure 8 showed the result of TOPSIS assessment on credit application which based on score and criteria that submitted. TOPSIS score help the system to reject or accept the application efficiently and suitable to the Applicant.

In the pilot testing phase, the system demonstrated a high level of agreement with decisions previously made by human credit analysts. Cases reviewed during the pilot indicated that the TOPSIS-generated recommendations were consistent with expert judgment in most scenarios, particularly for clear-cut high-eligibility and low-eligibility applicants. For borderline cases, the system provided nuanced scoring that helped analysts identify factors influencing the applicant's eligibility more transparently.

3. Performance Evaluation

Performance was evaluated based on processing time, decision consistency, and system usability. The

processing time for credit evaluation significantly decreased because analysts no longer needed to manually calculate or cross-check applicant data. The automated scoring mechanism reduces the evaluation time from several minutes per applicant to only a few seconds.

Decision consistency also improved, as the system provides a uniform framework for evaluating all applicants. By eliminating discrepancies caused by varying human interpretations, the DSS ensures a standardized assessment of each criterion. Sensitivity tests conducted on weighting variations further confirmed that the system remained stable, with only minor changes in rankings when small weight adjustments were applied. This robustness indicates that the system performs reliably even when operational policies evolve.

4. User Acceptance and Feedback

Feedback collected during the User Acceptance Testing (UAT) phase showed positive responses from all participating roles. Customers appreciated the ease of submitting applications online, while Sales and Surveyors found the digital forms to be more convenient and less error-prone than manual documentation. Credit Analysts reported that the system enhanced their ability to make faster and more informed decisions, particularly due to the clear scoring explanations and detailed criterion breakdowns.

Minor usability refinements were suggested during UAT, such as improving filter options on the analyst dashboard and adding status indicators for incomplete applications. These suggestions were incorporated into the final system revision before deployment.

5. Discussion

The findings demonstrate that the DSS successfully addresses several challenges associated with traditional credit evaluation processes. By incorporating the TOPSIS method, the system moves beyond subjective evaluation and introduces a quantitative, data-driven approach. This aligns with prior research [4][6][10], which highlights the effectiveness of MCDM methods in financial decision-making environments.

IV. CONCLUSION

This study successfully developed a web-based Decision Support System (DSS) designed to assist PT FIFGROUP in evaluating motorcycle credit eligibility using the TOPSIS method. The system effectively integrates multiple user roles—Customers, Sales, Surveyors, Credit Analysts, and Administrators—into a unified workflow that mirrors the organization's operational processes. By digitizing application submission, survey data entry, and credit assessment, the DSS significantly improves efficiency and reduces reliance on manual, paper-based procedures. The integration of the TOPSIS method provides a consistent and objective mechanism for evaluating applicants based on predetermined criteria. The system generates transparent eligibility scores that support decision-making while minimizing subjective bias traditionally associated with human evaluations. The results from the pilot implementation show that the DSS delivers strong alignment with decisions made by experienced credit analysts and enhances decision consistency across different applicant categories. Additionally, the notable reduction in processing time demonstrates the system's ability to optimize workflow performance. User feedback from the testing phase confirms that the system is intuitive and effective in supporting daily operational tasks. The structured interfaces and automated scoring contribute to a smoother evaluation process, benefiting both staff and customers. Although the system has proven successful in improving decision-making reliability, it still presents opportunities for further refinement. Future enhancements may include expanding the criteria set, integrating external credit data sources, applying automated document verification, and adopting machine learning models to complement TOPSIS for predictive risk analysis. Overall, the developed DSS demonstrates substantial potential to enhance the transparency, efficiency, and accuracy of credit evaluation at PT FIFGROUP, providing a solid foundation for broader implementation and continuous improvement.

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