

IMPLEMENTATION OF A FLEXIBLE AND ADAPTIVE ISLAMIC MSME CREDIT ANALYSIS DECISION SUPPORT SYSTEM MODEL USING THE SAW METHOD

Mezan el-Khaeri Kesuma^{1*}, Tulus Suryanto², Meilia Risna³, Nur Azizah Zuhriyah⁴

mezankesuma7390@gmail.com*

Sekolah Tinggi Ekonomi dan Bisnis Islam (STEBI) Lampung, Indonesia^{1,3,4}

UIN Raden Intan Lampung, Indonesia^{1,2}

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Abstract

The quality of financing portfolios in Islamic microfinance institutions is significantly influenced by the efficiency and accuracy of prospective debtor feasibility analysis. Traditional manual assessments, which often focus exclusively on formal financial ratios, are susceptible to elevated Non-Performing Financing (NPF) rates due to evaluator subjectivity and an inability to adequately capture the qualitative characteristics inherent in informal Micro, Small, and Medium Enterprises (MSMEs). This study endeavors to design and develop a flexible and adaptive Decision Support System (DSS) for Islamic MSME credit analysis. This is achieved through the integration of qualitative descriptive methods, prototyping development methodologies, and the Simple Additive Weighting (SAW) algorithm. A case study was conducted involving 60 Women Farmer Groups (KWT) and 60 local food-processing MSMEs, all operating within a Muslim context. The qualitative approach reinterpreted the 5C criteria (Character/Amanah, Capacity, Capital, Collateral/Rahn, and Condition/Maslahah) into standardized quantitative indicators. A key feature of the system is a Hard Constraint Filter, designed to definitively exclude non-compliant business activities prior to any mathematical computation. Black Box Testing demonstrated 100% functional validity, while User Acceptance Testing (UAT) confirmed that the iterative prototyping cycle effectively mitigated user resistance and substantially accelerated credit analysis processing time, reducing it from days to minutes.

Keywords: *Decision Support System (DSS); Islamic MSME Financing; Simple Additive Weighting (SAW); Prototyping; 5C Sharia*



By Authors

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1. Introduction

Micro, Small, and Medium Enterprises (MSMEs) represent a strategic pillar of the national economy, contributing significantly to Gross Domestic Product (GDP) and employment absorption (Rahmawati & Aroningtias, 2024). Within the Islamic financial ecosystem, micro-financing aims to stimulate the real sector, enhance business capacity, and expand capital access based on principles of justice, transparency, and public welfare (*maslahah*). Despite their vital role, most MSME actors still face fundamental barriers in accessing formal financing facilities due to limited administrative track records, lack of standardized financial reports, and a scarcity of formally recognized physical collateral.

Conversely, Islamic Financial Institutions (IFIs)—such as Islamic Banks, Islamic People's Financing Banks (BPRS), Baitul Maal wat Tamwil (BMT), and Islamic Cooperatives—are required to strictly adhere to prudential banking principles. Managing financing quality is a crucial metric, as high Non-Performing Financing (NPF) rates can erode profitability, disrupt liquidity, and elevate operational risks. The Financial Services Authority (OJK) noted that the non-performing loan/financing ratio (NPL/NPF) at rural and rural banks surged to 11.91% in early 2025, far exceeding the safe threshold of 5%. In practice, however, credit feasibility evaluation at many institutions is still conducted manually and conventionally, relying on evaluator subjectivity, taking substantial time, and being prone to human error (Hamin et al., 2025; Hanifah, n.d.; A. F. S. Putra & Purnomo, 2025).

To mitigate non-performing credit risks and enhance selection efficiency, a Decision Support System (DSS) provides a computer-based solution designed to support decision-making in semi-structured and unstructured situations. Although various credit analysis DSS models have been developed, most existing systems are rigid, utilize static parameters, and focus solely on conventional formal financial ratios. In contrast, assessing Islamic MSME feasibility requires a multi-dimensional set of criteria that not only encompasses the 5C principles (Character, Capacity, Capital, Collateral, Condition of Economy) but also incorporates Maqashid Syariah values, ethical-social integrity, contract compliance, and local micro-business dynamics.

To realize a targeted and highly effective Decision Support System (DSS) model in the field, this study integrates a qualitative descriptive approach to formulate contextual indicators alongside a prototyping methodology to interactively validate system

requirements with users. The case study was conducted across 60 Women Farmer Groups (KWT) with 120 members and 60 productive MSMEs, all of whom are Muslim. The primary objective of this research is to design a flexible and adaptive web-based financing feasibility DSS model using the Simple Additive Weighting (SAW) algorithm to mitigate NPF risk and enhance the transparency of financing decisions

2. Literature Review

The literature review provides a conceptual theoretical foundation linking prior research with the development of the proposed Islamic financing decision support system model.

2.1 Decision Support System and Simple Additive Weighting (SAW)

A Decision Support System (DSS) is an interactive, flexible, computer-based information system designed to assist decision-makers in solving semi-structured problems (Lubis et al., 2022). In credit feasibility analysis, a DSS combines data, mathematical models, and user interfaces to process financial and non-financial criteria into rational recommendations (Riyanto & Yunus, 2021). The Simple Additive Weighting (SAW) method is a highly popular Multi-Attribute Decision Making (MADM) technique due to its straightforward normalization process and intuitive weighting logic. SAW determines the final preference score ($V_{\{i\}}$) through the weighted sum of normalized performance ratings ($R_{\{ij\}}$) across criterion weights ($W_{\{j\}}$) (Nst et al., 2024; Prawiratama et al., 2024; J. A. Putra et al., 2024; Riyanto & Yunus, 2021; Sudarsana & Safitri, 2023; Wibowo & Kunendra, 2018).

2.2 Transformation of 5C Principles, Maqashid Syariah, and Prototyping

Conventional credit feasibility assessments relying on the 5C principles (Character, Capacity, Capital, Collateral, Condition) are transformed within Islamic finance to align with Fiqh Muamalah and Maqashid Syariah/ Hifz al-Mal (Pramasatya et al., 2025; S et al., 2021). Character is re-interpreted as a measurement of honesty (siddiq), contract commitment (amanah), and moral track record. Capacity and Capital ensure cash flow sustainability without creating financial distress (la dharar). Collateral functions as a pledge contract (Rahn) to mitigate negligence (at-ta'addi), while Condition eliminates non-compliant business risks through a Hard Constraint Filter that free from Maysir, Gharar, and Riba (Hamin et al., 2025).

Meanwhile, the Prototyping methodology (Pressman, 2000) serves as a system engineering framework that actively engages administrators and financing committee members from initial requirements analysis through quick design to prototype evaluation. This iterative approach effectively reduces user resistance and ensures the system interface matches real operational workflows.

2.3 Transformation of 5C Principles, Maqashid Syariah, and Comparative Literature Context) to highlight our model's two primary methodological advancements:

1. Non-Compensatory Kill-Switch vs. Conventional Compensatory Models: Conventional MADM models (e.g., standard SAW, WASPAS, Weighted Product) operate compensatorily—where high financial scores can mask zero-tolerance ethical or religious non-compliance. Our model introduces a pre-computational Hard Constraint Filter that immediately rejects non-compliant applicants regardless of financial capacity.
2. Transparent SAW + Prototyping vs. Opaque Complex Hybrids: While complex hybrid algorithms (e.g., AHP-TOPSIS, Fuzzy-AHP) suffer from black-box opacity and low user adoption in informal microfinance, our model pairs transparent SAW logic with an iterative Prototyping cycle, achieving high user acceptance and operational flexibility through dynamic weighting.

3. Research Method

This study adopts a Research and Development (R&D) approach combining qualitative descriptive exploration with Pressman's Prototyping system engineering methodology (Pressman, 2000; Sugiyono, 2013). The research subjects consist of 60 Women Farmer Groups (KWT). This study involved a target population of 60 fostered MSMEs, from which a sample of 3 MSMEs was selected for model testing and numerical simulation. Additionally, User Acceptance Testing (UAT) engaged 10 respondents consisting of administrators and credit committee members in Central Lampung Regency.

Primary data were obtained through structured interviews with KWT leaders and MSME owners, with the criteria that all participants are Muslim. This study also conducted operational observations of credit provisioning as well as random file sampling of fostered MSMEs. Secondary data included internal financing policy documents, profiles of the 60 fostered MSMEs, and OJK regulations concerning information technology and consumer protection (Azmi & Muzakir, 2024; Peraturan Otoritas Jasa Keuangan Republik Indonesia, 2023; Siyamto, 2025; Yuspin & Fauzie, 2023).

Target Population & Empirical Field Locus (60 KWTs & 60 MSMEs). The 60 Women Farmer Groups (KWT) with 120 members and 60 fostered food-processing MSMEs (all Muslim) represent the empirical field setting. This target population provided qualitative data regarding informal micro-business operations, cash flow characteristics, and financing bottlenecks.

Evaluator Group (10 UAT Respondents). A panel of 10 respondents comprising cooperative administrators and credit committee members was selected from KWT leadership to conduct the User Acceptance Testing (UAT) to evaluate system usability and workflow alignment.

The system development methodology comprised four iterative phases: (1) Communication to identify qualitative requirements and operational constraints; (2) Quick Plan & Modeling Quick Design involving UML modeling (Use Case, Activity, Sequence, Class Diagrams) and ERD database schema; (3) Construction of Prototype using PHP Laravel 10 and a MySQL database; (4) Deployment, Delivery, and Feedback consisting of Black Box functional testing and User Acceptance Testing-(UAT) (De Vries et al., 2019; Pressman, 2000).

Interpretation of Testing Results is to explicitly differentiate technical functionality from usability: Black Box Testing (Functional Correctness): Evaluates whether system features execute without software bugs or logic errors. Calculated as:

User Acceptance Testing (UAT — Usability & Workflow Alignment): Evaluates end-user satisfaction, interface clarity, and operational readiness among 10 actual administrators and credit committee members using a 5-point Likert scale questionnaire across 5 dimensions (perceived usefulness, ease of use, interface design, decision speed, and workflow alignment). Calculated as:

Derivation of Criteria Weights (W_j): Weights were determined via an Analytical Hierarchy Process (AHP) and Focus Group Discussion (FGD) consensus among 5 domain experts (including senior Islamic microfinance managers, advisors, and credit committee members):

- a. C_1 : Character ($W_1 = 0.30 / 30\%$): Weighted highest because moral integrity (Amanah/Siddiq) is the primary determinant of default prevention in unbankable microfinance where formal collateral is limited.
- b. C_2 : Capacity ($W_2 = 0.25 / 25\%$): Assesses cash flow adequacy and Debt Service Coverage Ratio (DSCR) to ensure repayment capability without creating financial hardship (la dharar).
- c. C_3 : Capital ($W_3 = 0.15 / 15\%$), C_4 Collateral ($W_4 = 0.15 / 15\%$), C_5 Condition ($W_5 = 0.15 / 15\%$): Weighted equally to balance equity self-reliance, pledge security (Rahn), and market viability/ compliance.

Derivation of Feasibility Cutoff Thresholds: Cutoff thresholds were aligned with credit risk policies of Islamic microfinance institutions:

- a. $V_{\{i\}} > 0.85$: S Highly Feasible (Full plafond approval).
- b. $0.70 < V_{\{i\}} < 0.85$: Standard Feasible (Standard approval, 80–90% plafond).
- c. $0.55 < V_{\{i\}} < 0.70$: Conditional (Pending; requires additional pledge/coaching).
- b. $V_{\{i\}} < 0.55$: Unfeasible (Rejection). Filter Trigger ($C_{\{1\}} < 2.0$ or $C_{\{5\}} < 2.0$): Absolute Reject ($V_{\{1\}} = 0.0000$).

Simulation Sample A_1, A_2, A_3 : 3 representative case profiles selected via purposive sampling to stress-test all computational pathways of the DSS software engine A_1 = full approval, A_2 = kill-switch trigger, A_3 = marginal/conditional pending).

4. Results and Discussion

The research findings present the operational re-interpretation of the 5C criteria, mathematical formulation of the SAW algorithm, a worked numerical simulation, and evaluation results from functional and user acceptance testing.

Table 1. Operationalization of 5C Criteria and Model Weighting

Code	5C Criteria	Attribute	Weight (wj)
C1	Character (Amanah / Siddiq)	Benefit	30% (0.30)
C2	Capacity (Cash Flow / DSCR)	Benefit	25% (0.25)
C3	Capital (Equity Portion)	Benefit	15% (0.15)
C4	Collateral (Agunan / Rahn)	Benefit	15% (0.15)
C5	Condition (Maslahah / Halal)	Benefit	15% (0.15)

Source: Developed by the Authors (2026)

Decision Matrix Formation (X):

The SAW computation process begins with forming an: $m \times n$, decision matrix X . The system enforces a Hard Constraint Filter prior to mathematical calculation:

if score $C_1 < 2.0$ or $C_5 < 2.0$,

indicating non—compliant business activities), the candidate debtor is automatically flagged as Disqualified (Absolute Reject) with a preference score $V = 0.0000$

For passing candidates, matrix elements are normalized into

$$R = [R_{ij}] \text{ using } R_{ij} = X_{ij} / \max(X_{ij}). \quad (1)$$

The final preference score V_i is calculated by multiplying matrix R with weight vector $W = [0.30 \ 0.25 \ 0.15 \ 0.15 \ 0.15]$.

Purposive Sample Selection for Numerical Simulation. Three representative MSME case profiles were selected using purposive sampling to stress-test all computational pathways of the Simple Additive Weighting (SAW) algorithm and the Hard Constraint Filter: A_{1} (Halal Batik / Optimal Profile): High performance across all 5C criteria, representing the full approval path (Non-Compliant Business — Kill-Switch Profile): High operational/financial scores but violating compliance (presence of MAGHRIB elements), designed to validate the pre-computational Hard Constraint Filter (Absolute Reject). A_{3} (Micro Bamboo Crafts-Marginal Profile): Moderate/low financial and collateral capacity, representing the conditional approval path (Pending/Requires Additional Collateral).

Table 2. Worked Numerical Simulation and SAW Preference Ranking

Rank	Alternative (A _i)	SAW Score (V _i)	Feasibility Category	Action Recommendation
1	A1 (Halal Batik)	1.0000	Highly Feasible	Fully Approved (Top Priority)
2	A3 (Bamboo Crafts)	0.5600	Under Consideration	Suspended / Requires Additional Collateral
3	A2 (Non-Compliant Business)	0.0000	Disqualified	Absolute Reject (<i>MAGRIBH</i> Filter)
-	Threshold Cutoff	0.7000	Standard Feasibility	Minimum Approval Threshold for Plafond

Source: Developed by the Authors (2026)

Key Evaluation Summary of table 2:

- 1) A1 (Halal Batik - Score $V\{1\} = 1.0000$): Achieves maximum scores across all 5C indicators, earning top priority for full plafond financing approval.
- 2) A3 (Bamboo Crafts - Score $V\{3\} = 0.5600$): Falls below the standard approval threshold (0.7000) but remains above the rejection threshold (<0.5500); recommended for suspension or requiring additional pledge/collateral (Rahn).
- 3) A2 (Non-Compliant Business - Score $V\{2\} = 0.0000$): Triggers the Hard Constraint MAGHRIBH Filter (Maysir, Gharar, Riba, Haram) at the pre-computation phase, resulting in an automatic absolute rejection regardless of other performance metrics.

The functionality testing results using Black Box Testing across all primary modules (Authentication, Filter, SAW Engine, and Dynamic Weighting) recorded a 100% validity rate. Meanwhile, User Acceptance Testing (UAT) conducted with 10 respondents consisting of administrators and credit committee members yielded an average acceptance score of 91.4% (Very Good Category). Explicitly differentiate technical correctness from operational impact:

Table 3. Black Box Test Module Suite & Result Summary

Module ID & Scope	Expected System Behavior	Executed Test Cases	Status
M1: Multi-Role Authentication	Validates login access rights for Admin, Account Officer, and Credit Committee.	3 Cases	100% Valid
M2: Hard Constraint Sharia Filter	Triggers automatic kill-switch ($V_i = 0.0000$) when $C_1 < 2.0$ or $C_5 < 2.0$ (<i>MAGRIBH</i> filter).	4 Cases	100% Valid
M3: 5C Criteria Rating Form	Processes Likert 1–5 qualitative score entries for Character, Capacity, Capital, Collateral, Condition.	3 Cases	100% Valid
M4: SAW Preference Engine	Executes matrix normalization (R) and weighted synthesis (V_i) according to SAW formulas.	5 Cases	100% Valid
M5: Dynamic Weighting & Thresholds	Allows real-time weight re-configuration and threshold adjustments without code modification.	3 Cases	100% Valid

Source: Developed by the Authors (2026)

Table 3 shows the result 100% Black Box Testing. Demonstrates functional correctness across 18 test cases (confirming code features run without software bugs). Black Box Functional Validity 100.0% or 18/18 Test Cases Valid.

Table 4. UAT Dimension Breakdown & Score Distribution

Dimension	Assessment Scope	Ideal Score	Actual Score	Acceptance (%)
Perceived Usefulness	Enhances decision quality, standardizes 5C evaluation, and provides audit trail.	100	92	92.0%
Perceived Ease of Use	Interface navigation, clear input fields, and simple form submission.	100	90	90.0%
Interface Design	Visual layout clarity, readable typography, and structured score displays.	100	91	91.0%
Decision Speed	Accelerates processing duration from 3–7 days to < 5 minutes per applicant.	100	93	93.0%
Workflow Alignment	Seamless alignment with micro-cooperative credit committee procedures.	100	91	91.0%

Source: Developed by the Authors (2026)

Table 5. UAT Percentage Interpretation Scale

Dimension	Assessment Scope	Ideal Score	Actual Score	Acceptance (%)
Perceived Usefulness	Enhances decision quality, standardizes 5C evaluation, and provides audit trail.	100	92	92.0%
Perceived Ease of Use	Interface navigation, clear input fields, and simple form submission.	100	90	90.0%
Interface Design	Visual layout clarity, readable typography, and structured score displays.	100	91	91.0%
Decision Speed	Accelerates processing duration from 3–7 days to < 5 minutes per applicant.	100	93	93.0%
Workflow Alignment	Seamless alignment with micro-cooperative credit committee procedures.	100	91	91.0%

Source: Developed by the Authors (2026)

Table 4 and 5 explain 91.4% UAT Score. Reflects user satisfaction and workflow alignment among 10 actual cooperative administrators and credit committee members. User Acceptance Score (UAT) 91.4% by Category: Very Good.

On the other hand, explicit Scope Statement Added: Explicitly stated that initial prototype testing metrics confirm technical software correctness and user interface acceptance, but do not directly prove long-term NPF reduction or complete elimination of subjective bias in live multi-year banking operations (which requires future longitudinal field evaluation).

Flexible and Adaptive Feature

- 1) During economic recessions or high inflation, an institution can adaptively adjust criteria weights—e.g., increasing C_2 (Capacity/Cash Flow) from 25% to 35% and reducing C_4 (Collateral) from 15% to 10% to prioritize immediate liquidity over

physical assets—or raise the cutoff threshold from 0.7000 to 0.7500 to tighten risk controls.

- 2) Crucially, the mandatory Hard Constraint (Criteria Filter $C_1 \geq 2.0$ and $C_5 \geq 2.0$) remains invariant, ensuring policy flexibility never compromises compliance.

The Main Findings (Novelty) of this research are threefold:

- 1) Synergy of Quantitative-Mathematical Modeling and Religious Ethos (-Empowered DSS): The primary scientific novelty lies in a modeling approach capable of quantifying ethical-religious variables (Amanah, Siddiq, Maslahah) into a structured linear computational matrix without eroding their moral essence.
- 2) Pre-Computational Hard Constraint Filter: Unlike conventional MADM models where variables compensate for one another (compensatory model), the filter acts as an absolute kill-switch that guarantees strict compliance with principles.
- 3) Prototyping Cycle as a Technology Resistance Reducer: Active management involvement from the quick design phase through UAT proved effective in reducing technology adoption resistance among micro-cooperative managers.

These findings demonstrate that the Prototyping approach successfully bridges field operational needs with system computational reliability. The Practical and Theoretical Implications of this study include:

- 1) Theoretical Implication: Enriches the body of knowledge in management information systems and Islamic finance by proving that classical algorithms like SAW can be harmoniously adapted to process non-financial ethical parameters.
- 2) Practical Implications) to separate empirical prototype outcomes from long-term operational projections:

Directly Demonstrated Outcomes (Verified during Prototype Testing):

- 1) Reduction in decision processing duration from 3–7 business days (under manual paper-based processes) to & 5 minutes per applicant once data is entered into the web interface (empirically timed during UAT scenarios).
- 2) Complete elimination of mathematical calculation human errors and scoring variance across evaluators (verified via test case comparisons).

Projected Operational Benefits (Requiring Longitudinal Evaluation):

- 1) Long-term reduction in institutional Non-Performing Financing (NPF) portfolio rates.
- 2) Sustained operational cost savings per application across multi-year live deployments.

5. Conclusion and Suggestions

The conclusions of this study confirm that developing a Decision Support System (DSS) for Islamic MSME credit analysis integrating qualitative descriptive methods, prototyping approaches, and the Simple Additive Weighting (SAW) algorithm produces a highly efficient, flexible, and adaptive model. The qualitative approach successfully

formulated ethical-religious indicators based on 5C Principles (Character/Amanah, Capacity, Capital, Collateral/Rahn, and Condition/Maslahah), while the hard constraint filter mechanism accurately screened compliance and prevented moral hazard. Supported by an iterative prototyping cycle involving decision-makers, the system can be customized to diverse informal MSME characteristics and Islamic financial institution policy dynamics, effectively cutting analysis processing time from days to under 5 minutes, mitigating non-performing financing (NPF) risks, and enhancing financing decision accountability.

A limitation of this study lies in system testing being confined to a micro association/cooperative scale with a sample scope of 60 fostered MSMEs. Based on these limitations, future research should integrate Fuzzy logic with SAW (F-SAW) or Machine Learning algorithms to handle higher data uncertainty among larger-scale MSMEs. Additionally, developing Application Programming Interface (API) modules is strongly recommended to connect this DSS model in real-time with Core Banking Systems (CBS) across national Islamic banks.

6. References

- Azmi, N., & Muzakir, M. (2024). Analisis Peranan Sistem Layanan Informasi Keuangan (SLIK) dalam Pemberian Kredit Umum (Studi kasus pada PT. Bank Syariah Indonesia KCP Meulaboh Imam Bonjol). *Jurnal Ilmiah Ekonomi Terpadu (Jimetera)*, 4(1), 01. <https://doi.org/10.35308/jimetera.v4i1.8284>
- De Vries, C., Dunsworth, Q., & Lewis, D. (2019). Prototyping a prototype-based project with minimal equipment requirements. *2019 FYEE Conference Proceedings*, 33722. <https://doi.org/10.18260/1-2--33722>
- Hamin, D. I., Dungga, M. F., & Abdullah, A. (2025). Rancang Bangun Awal Sistem Skoring Kredit Alternatif Untuk Umkm Berbasis Prinsip Keuangan Syariah Di Kota Gorontalo. 12.
- Hanifah, R. (n.d.). Implementasi Metode Promethee Dalam Penentuan Penerima Kredit Usaha Rakyat (KUR).
- Nst, K. K., Zufria, I., & Fakhriza, M. (2024). Sistem Pendukung Keputusan Pemberian Kelayakan Kredit Usaha Rakyat Dengan Menggunakan Metode SAW & Topsis. *Jurnal Responsif: Riset Sains dan Informatika*, 6(1), 143–154. <https://doi.org/10.51977/jti.v6i1.1552>
- Peraturan Otoritas Jasa Keuangan Republik Indonesia, Pub. L. No. 22, Pelindungan Konsumen Dan Masyarakat Di Sektor Jasa Keuangan 131 (2023). <https://www.ojk.go.id/id/regulasi/Documents/Pages/Pelindungan-Konsumen-dan-Masyarakat-di-Sektor-Jasa-Keuangan/POJK%2022%20Tahun%202023%20Pelindungan%20Konsumen%20dan%20Masyarakat%20di%20Sektor%20Jasa%20Keuangan.pdf>

- Pramasatya, D. B., Dharmawan, B., & Putri, D. D. (2025). Analisis Pengaruh Prinsip 5C Terhadap Keputusan dan Efektivitas Penyaluran Kredit Usaha Rakyat (KUR) bagi Sektor Agribisnis di BRI KC Purwokerto. *Journal of Agribusiness and Community Empowerment (JACE)*, 8(1), 59–70. <https://doi.org/10.32530/jace.v8i1.789>
- Prawiratama, D. H., Helilintar, R., & Kasih, P. (2024). Sistem Pendukung Keputusan Penentuan Kelayakan Pemberian Pinjaman Menggunakan Metode Smart. 3.
- Pressman, R. S. (2000). *Software engineering: A practitioner's approach* (5th ed). McGraw Hill.
- Putra, A. F. S., & Purnomo, A. S. (2025). Sistem Pendukung Keputusan Penentuan Kelayakan Pemberian Kredit UMKM Menggunakan Metode AHP dan Weighted Product. *Bulletin of Computer Science Research*, 5(5), 1261–1271. <https://doi.org/10.47065/bulletincsr.v5i5.646>
- Putra, J. A., Fajriansyah, A., Mulyanto, Y., Susanto, E. S., & Yuliadi, Y. (2024). Sistem Pendukung Keputusan Pemilihan Nasabah Penerima Pinjaman Kredit Menggunakan Metode Simple Additive Weighthing (SAW). *JUTECH : Journal Education and Technology*, 5(1), 244–257. <https://doi.org/10.31932/jutech.v5i1.3729>
- Rahmawati, D., & Aroningtias, Y. (2024). Analysis Of The Influence Of Human Resources Skills, Experience, And Abilities On Umkm Performance. *Business, Entrepreneurship, and Management Journal*, 3(1). <https://doi.org/https://doi.org/10.36563/bemj.v3i1.1119>
- Riyanto, R. D., & Yunus, M. (2021). Sistem Pendukung Keputusan Pemberian Kredit Berbasis Web Menggunakan Kombinasi Metode Analytical Hierarchy Process (AHP) dan Simple Additive Weighting (SAW). *Jurnal Manajemen Informatika (JAMIKA)*, 11(2), 102–117. <https://doi.org/10.34010/jamika.v11i2.4936>
- S, Z., S, S. A., & Mujahidin. (2021). Analisis Character, Capacity, Capital, Collateral Dan Condition Dalam Efektivitas Pembiayaan Pada Koperasi Simpan Pinjam Di Kota Palopo. *Al-Kharaj: Journal of Islamic Economic and Business*, 3(1), 64–78. <https://doi.org/10.24256/kharaj.v3i1.1980>
- Siyanto, Y. (2025). Perkembangan Kualitas Pembiayaan Bank Syariah di Indonesia: Tren Kategori dan Non-Performing Financing 2015–2024. *Jurnal Ilmiah Keuangan Akuntansi Bisnis*, 4(2), 747–758. <https://doi.org/10.53088/jikab.v4i2.224>
- Sudarsana, I. P. E., & Safitri, N. W. N. (2023). Analisis Metode Hybrid Saw – Topsis Dalam Sistem Pendukung Keputusan Kelayakan Penerimaan Kredit.
- Sugiyono. (2013). *Metode Penelitian Kuantitatif Kualitatif dan R&D*. <https://www.semanticscholar.org/paper/abbabc85d324273c55d36e355a8ff874d6fae2bf>

- Wibowo, A., & Kunendra, K. (2018). Sistem Pendukung Keputusan Penilaian Kelayakan Kredit Menggunakan Metode Simple Additive Weighting (SAW). JOURNAL OF APPLIED INFORMATICS AND COMPUTING, 1(1), 22–25. <https://doi.org/10.30871/jaic.v1i1.511>
- Yuspin, W., & Fauzie, A. (2023). Good Corporate Governance In Sharia Fintech: Challenges and Opportunities In The Digital Era. Quality-Access to Success, 24(196). <https://doi.org/10.47750/QAS/24.196.28>