Eduvest – Journal of Universal Studies
Volume 5 Number 4, April, 2025
p- ISSN 2775-3735- e-ISSN 2775-3727

THE ROLE OF ARTIFICIAL INTELLIGENCE IN OPTIMIZING SCHOLARSHIP PROGRAMS: IMPLICATIONS FOR INDONESIA'S EDUCATIONAL DEVELOPMENT

Muhammad Teguh Prasetyo[1], Erick Dazki[2], Nurhaliza Vania Akbariani[3], Muhammad Alfathan Harriz[4], Harlis Setiyowati[5*]
Universitas Pradita, Banten, Indonesia[1,2,5]
Sekolah Tinggi Terpadu Nurul Fikri, Depok, Indonesia[3]
Universitas Matana, Banten, Indonesia[4]
Email: muhammad.teguh@student.pradita.ac.id[1], erick.dazki@pradita.ac.id[2], nurhaliza.akbariani@gmail.com[3], muhammad.harriz@matanauniversity.ac.id[4], harlis.setiyowati@pradita.ac.id[5*]

ABSTRACT

This study explores the potential of Artificial Intelligence (AI) in optimizing scholarship allocation processes within Indonesia's higher education system. The research highlights the challenges faced in the traditional scholarship distribution methods, including inefficiencies and biases, which hinder equitable access to educational opportunities for underprivileged students. By employing a systematic literature review (SLR) using the PRISMA methodology, the study investigates various AI techniques, including K-Nearest Neighbors, Naive Bayes, Decision Trees, and Fuzzy Logic, to improve the accuracy and efficiency of scholarship selection. The findings demonstrate that AI-driven approaches can enhance transparency, fairness, and resource allocation, aligning with the Sustainable Development Goals (SDGs), particularly SDG 4 (Quality Education) and SDG 10 (Reduced Inequalities). The integration of AI can help optimize government programs like KIP Kuliah, ensuring that scholarships are awarded to the most deserving candidates. However, challenges such as improving data quality, model selection, and ensuring fairness and transparency in decision-making remain. Future research should focus on addressing these challenges, exploring more advanced AI techniques, and assessing the long-term impact of AI-driven scholarship allocation on educational outcomes and social mobility in Indonesia.

How to cite: Prasetyo, M. T., Dazki, E., Akbariani. N. V,., Harriz, M. A. Setiyowati, H. (2025). The Role of Artificial Intelligence in Optimizing Scholarship Programs: Implications for Indonesia's Educational Development. Journal Eduvest. *5*(4): 3775-3788.
E-ISSN: 2775-3727
Published by: https://greenpublisher.id/

KEYWORDS *Artificial Intelligence, Scholarship Allocation, Educational Development, Indonesia, Systematic Literature Review, PRISMA*

Article Info:
Submited: 05-10-24 Final Revised: 23-04-25 Accepted: 25-04-25 Published: 28-04-25

INTRODUCTION

Indonesia, spanning Southeast Asia and Oceania, is home to over 261 million people Harriz (2023b), making it one of the world's most populous nations. In this republic, education is integral to developing human potential and advancing intellect (Rakista, 2020; Shintia et al., 2023). However, the specter of financial hardship often casts a long shadow over academic aspirations, underscoring the pivotal role of scholarships in bridging the chasm between ambition and attainment (Ismayani et al., 2019; Sulistiyanto et al., 2024). In response to this educational quandary, the Indonesian government has unfurled a tapestry of scholarship initiatives. Among these, the Program Indonesia Pintar (PIP) emerges as a beacon of hope for economically disadvantaged youth (Hamdi et al., 2020; Retnaningsih, 2019) The Kartu Indonesia Pintar Kuliah (KIP Kuliah) is designed to facilitate access to higher education for aspiring students (Amin et al., 2022). These programs serve as testament to the Indonesian government's unwavering commitment to eradicating poverty through educational empowerment (Mariana et al., 2022); Rohmah & Kasmawanto, 2022; Suardi et al., 2021). Despite good intentions, many scholarships do not reach their intended recipients, leaving many underprivileged individuals without the chance to fulfill their potential Dimmera (2020); Yusup (2019).This unfair use of resources keeps inequality going, limiting social mobility and slowing economic progress. If not addressed, it widens the gap between the privileged and the marginalized, passing down disadvantages through generations (Priyuli & Sugandi, 2024).

Artificial intelligence (AI) offers a promising solution to this issue Maslej (2023); (Simion & Kelp, 2023). AI has transformed various sectors (Al-Zahrani & Alasmari, 2024; Harriz et al., 2023a; Laupichler et al., 2022); Tzirides (2024), and its ability to process and analyse large amounts of data Crompton (2023) makes it particularly suited to address the scholarship allocation problem (Hua et al., 2023). By leveraging advanced algorithms and data analytics, AI can help scholarship providers make more informed and unbiased decisions, ensuring that educational opportunities are equitably distributed. While recent studies have explored the application of AI in this domain Sulistiyanto (2024), their findings have been overly generalized and lack the precise insights needed to drive meaningful change. This study aims to address the gap in knowledge regarding the application of AI in Indonesian scholarship allocation, particularly within the highly competitive higher education sector. To achieve this, a systematic literature review (SLR) adhering to

PRISMA guidelines will be conducted. This research will categorize studies based on their AI methodologies to identify the most promising approaches for optimizing scholarship allocation processes.

The increasing demand for higher education in Indonesia has highlighted the importance of scholarship programs in ensuring equitable access to education for underprivileged students. However, despite the Indonesian government's substantial investment in scholarship programs like the Kartu Indonesia Pintar Kuliah (KIP Kuliah), inefficiencies in the scholarship allocation process remain, leading to disparities in the distribution of resources. Many deserving students fail to receive scholarships due to the reliance on outdated and manual selection methods that are prone to bias and errors. This inefficiency not only affects the fairness of the system but also limits the educational opportunities available to disadvantaged groups, undermining efforts to promote inclusive education.

In light of these challenges, Artificial Intelligence (AI) has emerged as a potential solution to optimize the scholarship allocation process. AI has the ability to process large amounts of data and make decisions based on objective criteria, reducing human bias and improving the efficiency of scholarship selection. Despite the potential benefits of AI, there remains a gap in the understanding of how to effectively implement AI-driven scholarship allocation systems in Indonesia's educational landscape. This research aims to explore the role of AI in optimizing scholarship distribution and identify the best practices for its integration into Indonesia's higher education system.

The urgency of this research is underscored by the growing inequity in access to higher education in Indonesia, exacerbated by inefficiencies in the scholarship allocation system. With increasing numbers of students applying for scholarships, it is essential to adopt more effective, transparent, and fair methods of selection. AI-driven scholarship allocation systems have the potential to transform the process by ensuring that scholarships are awarded to students who are most in need, based on a more comprehensive and data-driven analysis. By improving the fairness and efficiency of scholarship programs, AI can help Indonesia achieve its educational goals, ensuring that financial constraints do not hinder deserving students from pursuing higher education.

Previous studies have explored the use of AI in various aspects of educational administration, including student selection and resource allocation. For example, research by Razi (2022) and Aliman (2022) demonstrated the effectiveness of AI algorithms like K-Nearest Neighbors (KNN) and Naive Bayes in accurately predicting scholarship recipients based on a variety of student attributes such as academic performance, family income, and extracurricular activities. These studies highlight the potential of AI to streamline scholarship allocation, ensuring that resources are distributed more equitably and efficiently.

Additionally, research by Novianto (2024) compared different AI methods for predicting scholarship eligibility and found that machine learning models, including KNN and Support Vector Machine (SVM), outperformed traditional methods in terms of accuracy and speed. This aligns with the findings of Arfyanti et al. (2022), who utilized Decision Trees to predict scholarship recipients, achieving high levels of accuracy. These studies underscore the growing trend of integrating AI into

scholarship programs and suggest that such technologies can enhance the fairness and efficiency of the allocation process.

Moreover, studies by Dita & Chairunisyah (2021) and Hadad (2024) explored the use of multi-criteria decision-making (MCDM) techniques and fuzzy logic in scholarship selection, offering insights into how AI can handle complex, multi-dimensional data. These findings suggest that AI-driven approaches can not only improve the accuracy of scholarship selection but also ensure that a broader range of factors, such as socioeconomic background and academic potential, are taken into account in the decision-making process.

Despite the promising results of previous studies, there remains a gap in research regarding the implementation of AI-driven scholarship allocation systems specifically in Indonesia's higher education context. Most studies have focused on AI applications in general education administration or in other countries, but few have addressed the unique challenges and opportunities in Indonesia's educational landscape. This research seeks to fill this gap by investigating how AI can be effectively integrated into Indonesia’s scholarship programs, focusing on the specific needs and constraints of the country’s higher education system.

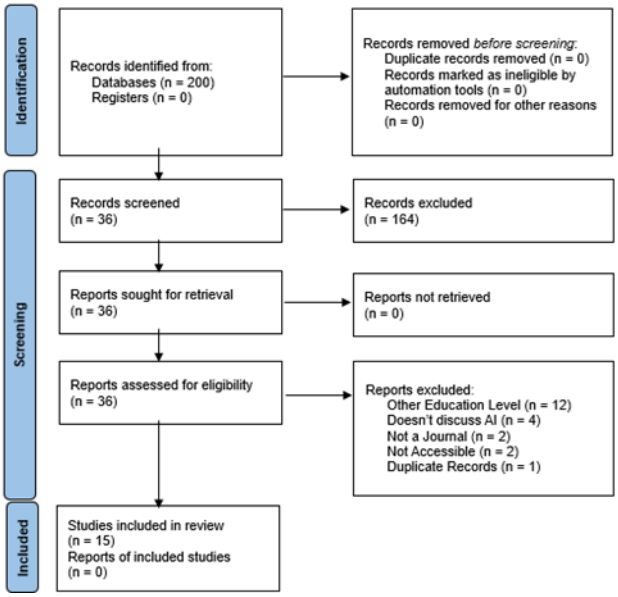
This study offers a novel contribution by examining the application of AI in optimizing scholarship allocation specifically within the context of Indonesia’s higher education system. Unlike previous studies that have focused on general AI applications in education or have applied AI in scholarship systems in other countries, this research focuses on identifying the best AI methodologies for the Indonesian context. By using a systematic literature review (SLR) methodology, the study provides detailed insights into how AI can be integrated into Indonesia’s scholarship programs, offering a unique perspective on improving the fairness and efficiency of scholarship distribution in the country.

The primary objective of this research is to explore the role of AI in optimizing scholarship allocation processes in Indonesia's higher education system. The study aims to identify the most effective AI techniques for scholarship selection, assess the potential benefits of using AI to reduce bias and inefficiency, and recommend best practices for integrating AI into existing scholarship programs. Additionally, the research seeks to evaluate the impact of AI-driven scholarship allocation on educational equity in Indonesia, particularly in ensuring that resources are allocated to students who need them most.

The findings of this study will provide valuable insights for policymakers, educational institutions, and scholarship providers in Indonesia. By demonstrating how AI can enhance the efficiency and fairness of scholarship allocation, the research offers practical recommendations for improving the scholarship process. For policymakers, the study highlights the potential of AI to create more equitable and transparent scholarship programs, while for educational institutions, it provides guidance on how to integrate AI technologies into their existing systems. Ultimately, the research aims to contribute to the development of more inclusive higher education policies in Indonesia, ensuring that financial barriers do not prevent deserving students from accessing higher education opportunities.

RESEARCH METHODS

The SLR was conducted following a rigorous methodology, incorporating predefined search criteria and a systematic approach (Labadze et al., 2023). The primary objective was to perform a comprehensive, systematic, transparent, and reproducible evaluation of both published and unpublished research. This approach is designed to minimize bias and enhance the objectivity of data analysis. The study employed the PRISMA framework, a widely accepted methodology for conducting systematic reviews, ensuring transparency and completeness in reporting (Page et al., 2021).



Search Strategy

Our search focused on finding literature about using AI to allocate scholarships. We didn't find relevant results in the Scopus database, so we used Google Scholar as our main source. We gathered up to 200 papers using the Publish or Perish tool. Our search included specific keywords like "beasiswa" and "kecerdasan buatan" or "machine learning" or "regresi" or "klasifikasi" or "pendidikan" and "Indonesia," focusing on publications from 2019 to 2024. This timeframe helps us understand the latest developments in the field. We used the logical operators AND and OR to include a wide range of relevant keywords. Only papers found through Publish or Perish were considered, with no secondary sources included. We used Microsoft Excel to identify, evaluate, and thoroughly examine the dataset.

Screening and Extraction

An initial search yielded 200 potential articles. Through a rigorous selection process, which included screening for relevance to higher education, artificial intelligence, and scholarly publication standards, the pool was narrowed to 15 articles. Challenges encountered during this phase included inaccessible documents and irrelevant content. This meticulous approach ensured that only the most

pertinent research informed our study, thereby enhancing the reliability and validity of our findings.

No.	Publication Titles	Year Publication	Authors
P1	Perbandingan Metode K-Nearest Neighbor dan Support Vector Machine Untuk Memprediksi Penerima Beasiswa Keringanan UKT	2024	Novianto, E., Hermawan, A., & Avianto, D.
P2	Metode Simple Multi-Attribute Rating Technique (SMART) dan Rank Reciprocal (RR) dalam Penentuan Penerima Beasiswa	2024	Hadad, S. H.
P3	Implementasi Metode Simple Additive Weighting (SAW) Seleksi Pemberian Beasiswa	2023	Karnadi, V.
P4	Sistem Pakar Menggunakan Metode Forward Chaining Untuk Identifikasi Penerimaan Beasiswa (Studi Kasus Di Universitas Islam Negeri Sjech M. Djamil Djambek Bukittinggi).	2023	Farma, T. A., & Nurcahyo, G. W.
P5	Metode Backward Chaining Penerimaan Beasiswa Dipa Universitas Islam Negeri Sumatera Utara.	2023	Adithia, M. K. P., & Utami, U.
P6	Perancangan Sistem Rekomendasi Pemberian Beasiswa dengan Metode Fuzzy Tsukamoto	2022	Gloria, P., & Sediyono, E.
P7	Klasifikasi Penerima Beasiswa Aceh Carong (Aceh Pintar) Di Universitas Malikussaleh Menggunakan Algoritma Knn (K-Nearest Neighbors)	2022	Razi, A.
P-8	Implementasi Metode Naïve Bayes untuk Menentukan Persetujuan Pemberian Beasiswa Penuh pada Penerimaan Mahasiswa Baru di Institusi Pendidikan X	2023	Aliman, W.
P9	Penerapan Algoritma Decision Tree Untuk Penentuan Pola Penerima Beasiswa KIP Kuliah	2022	Arfyanti, I., Fahmi, M., & Adytia, P.

P-10	Uji Efektifitas Metode Fuzzy Logic Mamdani Pada Penerimaan Beasiswa Bantuan Menggunakan MATLAB	2022	Elfaladonna, F., & Isa, I. G. T.
P11	Penerapan Naive Bayesian Classifier Dalam Penyeleksian Beasiswa PPA.	2021	Dita, C. A. P., & Chairunisyah, P.
P12	Aplikasi Logika Fuzzy untuk Penentuan Beasiswa Peningkatan Prestasi Akademik Menggunakan Metode Fuzzy Mamdani Pada ITB Indonesia	2021	Raheliya Br Ginting, R., Sinuhaji, N., Dewi, S. I., & Ginting, M. B.
P13	Prediksi Penerima Beasiswa dengan Menggunakan Teknik Data Mining di Universitas Muhammadiyah Pringsewu	2021	(Baskoro et al., 2021)h.
P14	Aplikasi Penentuan Penerima Beasiswa Menggunakan Algoritma C4.5	2020	Suweleh, A. S., Susilowati, D., & Hairani, H.
P15	Identifikasi Penerimaan Beasiswa Dipa Menggunakan Metode Backward Chaining.	2020	Iskandar, W.

RESULT AND DISCUSSION

RQ1: How can AI be used to identify and select scholarship recipients more effectively?

AI Classification Algorithms

Novianto (2024) compared two AI classification methods, K-Nearest Neighbor (KNN) and Support Vector Machine (SVM), to predict students eligible for tuition fee reduction scholarships (UKT). They found that KNN had an accuracy of 92.92%, while SVM had 85.84%. Therefore, KNN was deemed the best method for predicting UKT scholarship recipients in the Bachelor of Law program. This study demonstrates that AI, particularly KNN, can significantly improve the accuracy and efficiency of scholarship selection compared to traditional manual methods. The automated and data-driven capabilities of KNN enable a more streamlined and objective scholarship selection process.

In another study, Razi (2022) used the KNN algorithm to classify scholarship recipients for the Aceh Carong program at Malikussaleh University. The KNN algorithm automated and improved the selection process, which was previously manual. It used four criteria: GPA, current semester, parents' income, and number of dependents. The algorithm calculates the distance between new applicant data and existing training data to classify applicants. This AI-based approach achieved

82% accuracy. Therefore, the automated system enables faster application processing and more targeted recipient selection compared to the manual process.

Moreover, Aliman (2022) demonstrated the power of AI, specifically the Naive Bayes algorithm, in improving scholarship recipient selection. The algorithm achieved 80.6% accuracy in predicting successful enrollment after receiving scholarships. Key factors influencing enrollment were identified, including application timing, religion, entrance exam scores, city of origin, and high school of origin. Remarkably, the AI model could pinpoint specific applicant profiles most likely to enroll if awarded scholarships, such as early applicants from certain high-performing high schools in Bandung. Therefore, AI can help streamline and enhance the scholarship selection process, ensuring resources are allocated to those most likely to benefit.

Additionally, Dita (2021) used the Naive Bayes Classifier algorithm to improve the classification and selection of scholarship recipients. This method uses probability calculations based on historical data to classify new applicants. It considers multiple criteria, including academic achievement (GPA), extracurricular activities, and parents' occupation. The algorithm efficiently processes large amounts of data, providing quick, probability-based recommendations. Therefore, this approach offers an objective, data-driven complement to human decision-making in the selection process.

AI Data Mining Techniques

Arfyanti et al. (2022) used the Decision Tree algorithm to find patterns and create rules for selecting KIP Kuliah scholarship recipients. The study used historical data and considered attributes like income level, number of dependents, home ownership, and academic achievements. The decision tree classifies applicants as "Accepted" or "Not Accepted" based on these attributes. It also generates clear rules, such as "IF Number of Dependents = Many THEN Accepted." Therefore, this approach streamlines the selection process and ensures decisions are based on data-driven insights, enhancing both efficiency and fairness. This work highlights the potential of data mining techniques in improving scholarship allocation.

Building on this potential, Rini (2021) demonstrated the effective use of AI and data mining techniques to predict scholarship recipients. Algorithms like Random Forests, Naive Bayes, and KNN were used to classify and predict recipients based on various student attributes. Notably, the Random Forests algorithm achieved the highest accuracy, at 98.08%. Thus, AI enables faster, more efficient, and potentially more accurate scholarship allocation compared to manual methods. Attributes such as distance from campus, GPA, extracurricular activities, parent's occupation, and income level were used to train the AI models. This study showcases the power of AI in enhancing the scholarship selection process.

Similarly, (2020) demonstrated the use of the C4.5 decision tree algorithm to classify and predict scholarship recipients, achieving 92% accuracy. The algorithm generated decision rules based on criteria like family income, number of dependents, GPA, and credits completed. Therefore, this AI approach facilitates faster, and more objective decision-making compared to manual selection

processes, particularly when dealing with many applicants. This research further underscores the benefits of AI in managing scholarship programs.

Expert Systems

Tri (2023) developed a forward chaining expert system to identify eligible candidates based on predefined criteria. By codifying expert knowledge into a computerized system, this approach automates and standardizes the scholarship matching process, enhancing efficiency and consistency compared to manual methods.

Adithia (2023) employed a backward chaining expert system to select DIPA scholarship recipients at the State Islamic University of North Sumatra. Their system utilized a decision tree to evaluate applicants based on criteria such as GPA, TOEFL score, and academic achievements. Demonstrating a 95% accuracy rate in recommending recipients, the system significantly streamlined the scholarship selection process.

Similarly, Iskandar (2021) applied a backward chaining expert system to identify DIPA scholarship recipients at the Faculty of Economics and Islamic Business, UIN North Sumatra. By automating the evaluation of scholarship criteria, this system contributed to an efficient and streamlined selection process.

Fuzzy Logic and Multi-Criteria Decision-Making Techniques

Elfaladonna (2022) utilized fuzzy logic to determine scholarship amounts based on various factors such as income, academic achievements, and grades. By transforming qualitative data into quantitative values, their model enabled more nuanced scholarship allocation, achieving a 74% effectiveness rate.

Similarly, Ginting (2021) applied fuzzy logic to enhance scholarship recipient selection. Their model considered factors like GPA, discipline, and parental income, demonstrating the method's ability to handle imprecise criteria. By automating the process through a MATLAB application, they aimed to improve objectivity and efficiency in the selection process.

Karnadi (2023) employed the Simple Additive Weighting (SAW) method for scholarship selection. This MCDM technique involves assigning weights to different criteria, evaluating applicants based on these criteria, and ranking them accordingly. The SAW method promotes a systematic, transparent, and objective selection process.

Enhancing Traditional Methods with AI

Lastly, Hadad (2024) primarily explores the application of the Simple Multi-Attribute Rating Technique (SMART) and the Rank Reciprocal (RR) method in determining scholarship recipients. Although the study does not explicitly address AI, the methodologies presented could be significantly enhanced through AI applications. AI has the potential to augment the selection process by automating data collection and analysis, thereby facilitating a more comprehensive evaluation of candidates based on multiple criteria such as academic performance, extracurricular activities, and financial need. By integrating AI algorithms, the selection process can be made more efficient, mitigating human bias and increasing

the accuracy of assessments. For example, AI can analyze extensive datasets to identify patterns and predict which candidates are most likely to succeed with scholarship support.

RQ2: What are the best practices in AI methods for scholarship allocation?

Recent research in AI-driven scholarship allocation underscores the importance of rigorous data preparation, including feature selection and preprocessing Novianto (2024); Aliman, 2023). Subsequent model selection often favors interpretable algorithms like decision trees (Arfyanti et al., 2022) and rule-based systems (Farma & Nurcahyo, 2023) to enhance transparency and trust. Evaluation metrics extend beyond accuracy, incorporating specificity and sensitivity (Suweleh et al., 2020). Continuous model refinement is essential (Hadad, 2024; Razi, 2022). Methodological innovations include multi-criteria decision-making (Karnadi, 2023), fuzzy logic systems (Elfaladonna & Isa, 2022; Ginting (2021), and knowledge-based expert systems (Farma & Nurcahyo, 2023; Adithia & Utami, 2023; Iskandar, 2020). Practical implementation necessitates robust training datasets (Aliman, 2023; Rini, 2021) and seamless integration with administrative systems (Novianto et al., 2024; Adithia & Utami, 2023).

RQ3: What are the areas for further improvement in the implementation of AI for scholarship allocation?

Data and Model Enhancement

Research consistently highlights the need for advancements in data and model selection to improve AI-driven scholarship allocation. Expanding dataset diversity, incorporating a wider range of variables, and exploring alternative classification algorithms are key areas for improvement Novianto (2024); Aliman (2022). Researchers also advocate for the integration of more sophisticated AI/ML techniques, such as fuzzy logic and neural networks, to enhance decision-making capabilities (Karnadi, 2023). While the potential benefits of these approaches are promising, rigorous evaluation and comparison with existing methods are essential to determine their effectiveness in real-world applications.

System Integration and Continuous Evaluation

Effective implementation of AI-driven scholarship allocation systems necessitates seamless integration with existing university infrastructure. Researchers emphasize the importance of combining the AI system with other university databases to optimize processes, enhance data accessibility, and facilitate continuous model improvement (Novianto et al., 2024; Farma & Nurcahyo, 2023; Adithia & Utami, 2023). This integrated approach is crucial for ensuring the system's efficiency, accuracy, and adaptability to changing needs.

Transparency, Bias Mitigation, and Ethical Considerations

Ensuring transparency, interpretability, and fairness is paramount in AI-driven scholarship allocation. Researchers emphasize the need for models that are understandable to stakeholders and free from bias (Hadad, 2024; Aliman, 2023; Iskandar, 2020). Utilizing diverse training data and conducting rigorous bias

assessments are crucial steps towards developing equitable AI systems. Additionally, adhering to ethical guidelines is essential for maintaining public trust (Elfaladonna & Isa, 2022).

Expanded Applications and Future Directions

Expanding the scope and capabilities of AI in scholarship allocation is a promising avenue for future research. Integrating qualitative assessments with quantitative data can provide a more holistic evaluation of candidates (Hadad, 2024). Moreover, developing AI systems capable of handling diverse scholarship types and utilizing advanced techniques like neural networks and natural language processing can significantly enhance the allocation process (Karnadi, 2023; Adithia & Utami, 2023; Suweleh (2020). These advancements have the potential to create more equitable and effective scholarship allocation systems.

CONCLUSION

This systematic literature review highlights the substantial potential of artificial intelligence (AI) in transforming scholarship allocation processes within Indonesian higher education. The studies reviewed suggest that AI-driven approaches can significantly improve the efficiency, objectivity, and accuracy of identifying and selecting scholarship recipients. Various AI techniques, such as classification algorithms, data mining, expert systems, and fuzzy logic, have proven effective in addressing the complexities associated with scholarship allocation. The integration of AI into scholarship systems aligns with the Sustainable Development Goals (SDGs), particularly in promoting quality education and reducing inequalities, thereby ensuring more equitable access to higher education for underprivileged students. The application of AI can also enhance government programs like Program Indonesia Pintar and Kartu Indonesia Pintar Kuliah, which aim to increase educational opportunities for marginalized populations. However, the implementation of AI comes with challenges, such as the need for continuous improvement in data quality, model selection, and ensuring transparency and fairness in decision-making processes.

Future research should focus on overcoming these challenges by exploring more advanced AI techniques like neural networks and natural language processing, which can provide a more nuanced and holistic evaluation of scholarship candidates. Additionally, integrating qualitative assessments with quantitative data could enhance the evaluation process and offer a more comprehensive understanding of an applicant's potential. It is also crucial for future studies to examine the long-term effects of AI-driven scholarship allocation systems, particularly regarding educational outcomes and social mobility. As AI continues to evolve, ongoing research should critically evaluate the ethical implications of these systems, ensuring they are transparent, fair, and beneficial for students, while also aligning with Indonesia's broader development goals.

REFERENCES

Adithia, M. K. P., & Utami, U. (2023). Metode Backward Chaining Penerimaan Beasiswa Dipa Universitas Islam Negeri Sumatera Utara. *Innovative: Journal Of Social Science Research*, *3*(2), 14266–14275.

Al-Zahrani, A. M., & Alasmari, T. M. (2024). Exploring the impact of artificial intelligence on higher education: The dynamics of ethical, social, and educational implications. *Humanities and Social Sciences Communications*, *11*(1), 1–12. https://doi.org/10.1057/s41599-024-03432-4

Aliman, W. (2022). Implementasi Metode Naïve Bayes untuk Menentukan Persetujuan Pemberian Beasiswa Penuh pada Penerimaan Mahasiswa Baru di Institusi Pendidikan X. *Media Informatika*, *21*(3), 175–186. https://doi.org/10.37595/mediainfo.v22i1.91

Amin, A., Sasongko, R. N., & Yuneti, A. (2022). Kebijakan Kartu Indonesia Pintar untuk memerdekakan mahasiswa kurang mampu. *Journal Of Administration and Educational Management (ALIGNMENT)*, *5*(1), 98–107. https://doi.org/10.31539/alignment.v5i1.3803

Baskoro, B., Sriyanto, S., & Rini, L. S. (2021). Prediksi penerima beasiswa dengan menggunakan teknik data mining di Universitas Muhammadiyah Pringsewu. *Prosiding Seminar Nasional Darmajaya*, *1*, 87–94. https://doi.org/10.30865/mib.v8i1.6913

Crompton, H., & Burke, D. (2023). Artificial intelligence in higher education: the state of the field. *International Journal of Educational Technology in Higher Education*, *20*(1), 22.

Dimmera, B. G., & Purnasari, P. D. (2020). Permasalahan Dan Solusi Program Indonesia Pintar Dalam Mewujudkan Pemerataan Pendidikan Di Kabupaten Bengkayang. *Sebatik*, *24*(2), 307–314.

Dita, C. A. P., Chairunisyah, P., & Mesran, M. (2021). Penerapan Naive Bayesian Classifier Dalam Penyeleksian Beasiswa PPA. *Journal of Computer System and Informatics (JoSYC)*, *2*(2), 194–198.

Elfaladonna, F., & Isa, I. G. T. (2022). Uji Efektifitas Metode Fuzzy Logic Mamdani Pada Penerimaan Beasiswa Bantuan Menggunakan Matlab. *SINTECH (Science and Information Technology) Journal*, *5*(1), 75–86. https://doi.org/10.31598/sintechjournal.v5i1.1043

Ginting, R. B., Sinuhaji, N., Dewi, S. I., & Ginting, M. B. (2021). Aplikasi Logika Fuzzy untuk Penentuan Beasiswa Peningkatan Prestasi Akademik Menggunakan Metode Fuzzy Mamdani Pada ITB Indonesia. *Jurnal Media Informasi Analisa Dan Sistem (MEANS)*, *6*(1), 70–79. https://doi.org/10.54367/means.v6i1.1263

Hadad, S. H. (2024). Metode Simple Multi-Attribute Rating Technique (SMART) dan Rank Reciprocal (RR) dalam Penentuan Penerima Beasiswa. *Journal of Data Science and Information Systems*, *2*(1), 18–28.

Hamdi, S., Setiawan, R., & Musyadad, F. (2020). Evaluation of the implementation of Indonesia Pintar program in vocational school. *Jurnal Penelitian Dan Evaluasi Pendidikan*, *24*(1), 102–115. https://doi.org/10.21831/pep.v24i1.32603

Harriz, M. A., Akbariani, N. V., Setiyowati, H., & Santoso, H. (2023a). Classifying

village fund in west Java, Indonesia using catboost algorithm. *Jurnal Indonesia: Manajemen Informatika Dan Komunikasi*, *4*(2), 691–697. https://doi.org/10.35870/jimik.v4i2.269

Harriz, M. A., Akbariani, N. V., Setiyowati, H., & Santoso, H. (2023b). Enhancing the efficiency of Jakarta's mass rapid transit system with XGBoost algorithm for passenger prediction. *Jambura Journal of Informatics*, *5*(1), 1–6. https://doi.org/10.37905/jji.v5i1.18814

Hua, H., Li, Y., Wang, T., Dong, N., Li, W., & Cao, J. (2023). Edge computing with artificial intelligence: A machine learning perspective. *ACM Computing Surveys*, *55*(9), 1–35. https://doi.org/10.1145/3555802

Iskandar, W. (2021). Identifikasi Penerimaan Beasiswa Dipa Menggunakan Metode Backward Chaining. *Jupiter: Journal of Computer & Information Technology*, *2*(2), 96–108.

Ismayani, M. S., Darusman, Y., Syaefuddin, S., & Kurniawan, D. (2019). Implementasi Program Indonesia Pintar (PIP). *Jendela PLS*, *4*(1), 38–45.

Karnadi, V. (2023). Implementasi Metode Simple Additive Weighting (SAW) Seleksi Pemberian Beasiswa. *Brahmana: Jurnal Penerapan Kecerdasan Buatan*, *5*(1), 51–57. https://doi.org/10.30645/brahmana.v5i1.277

Labadze, L., Grigolia, M., & Machaidze, L. (2023). Role of AI chatbots in education: systematic literature review. *International Journal of Educational Technology in Higher Education*, *20*(1), 56. https://doi.org/10.1186/s41239-023-00426-1

Laupichler, M. C., Aster, A., Schirch, J., & Raupach, T. (2022). Artificial intelligence literacy in higher and adult education: A scoping literature review. *Computers and Education: Artificial Intelligence*, *3*, 100101. https://doi.org/10.1016/j.caeai.2022.100101

Mariana, D., Purwanto, E., & Wikartika, I. (2022). Pengaruh Perilaku Pengelolaan Keuangan terhadap Penerima Kartu Indonesia Pintar pada Mahasiswa UPN â€ Veteranâ€ Jawa Timur. *Jurnal Ilmiah Universitas Batanghari Jambi*, *22*(3), 1536–1544. https://doi.org/10.33087/jiubj.v22i3.2554

Maslej, N., Fattorini, L., Brynjolfsson, E., Etchemendy, J., Ligett, K., Lyons, T., Manyika, J., Ngo, H., Niebles, J. C., & Parli, V. (2023). Artificial intelligence index report 2023. *ArXiv Preprint ArXiv:2310.03715*. https://doi.org/10.48550/arXiv.2310.03715

Novianto, E., Hermawan, A., & Avianto, D. (2024). Perbandingan Metode K-Nearest Neighbor dan Support Vector Machine untuk memprediksi Penerima Beasiswa Keringanan UKT. *Jurnal Media Informatika Budidarma*, *8*(1), 654–662. https://doi.org/10.30865/mib.v8i1.6913

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., & Brennan, S. E. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *Bmj*, *372*. https://doi.org/10.1136/bmj.n71

Priyuli, S., & Sugandi, F. (2024). Penerapan Algoritma Decision Tree Untuk Penentuan Pola Penerima Beasiswa Kip Siswa Uptd Smp Negeri 4 Sekampung. *Jurnal Mahasiswa Ilmu Komputer*, *5*(1), 1–8.

Rakista, P. M. (2020). *Implementasi Kebijakan Program Indonesia Pintar (PIP).*

Sawala: Jurnal Administrasi Negara, 8 (2), 224–232. https://doi.org/10.30656/sawala.v8i2.2774

Razi, A. (2022). Klasifikasi Penerima Beasiswa Aceh Carong (Aceh Pintar) Di Universitas Malikussaleh Menggunakan Algoritma Knn (K-Nearest Neighbors). *Jurnal Tika*, *7*(1), 79–84. https://doi.org/10.51179/tika.v7i1.1116

Retnaningsih, H. (2019). Program Indonesia Pintar: Implementasi Kebijakan Jaminan Sosial Bidang Pendidikan. *Aspirasi: Jurnal Masalah-Masalah Sosial*, *8*(2), 161–177. https://doi.org/10.46807/aspirasi.v8i2.1263

Shintia, D., Asbari, M., Khairunisa, F., & Azizah, N. (2023). Rapor Pendidikan Indonesia: Quo Vadis Kualitas Pendidikan Indonesia? *Journal of Information Systems and Management (JISMA)*, *2*(6), 18–21. https://doi.org/10.4444/jisma.v2i6.633

Simion, M., & Kelp, C. (2023). Trustworthy artificial intelligence. *Asian Journal of Philosophy*, *2*(1), 8. https://doi.org/10.1007/s44204-023-00063-5

Sulistiyanto, S., Nadeak, E., Rahmi, N., & Malahayati, M. (2024). Metode Data Mining dalam Kasus Seleksi Beasiswa: Literature Review. *Jurnal Penelitian Inovatif*, *4*(3), 1091–1100. https://doi.org/10.54082/jupin.468

Suweleh, A. S., Susilowati, D., & Hairani, H. (2020). Aplikasi Penentuan Penerima Beasiswa Menggunakan Algoritma C4. 5. *Jurnal Bumigora Information Technology (BITe)*, *2*(1), 12–21.

Tri, T. A. F., & Nurcahyo, G. W. (2023). Sistem Pakar Menggunakan Metode Forward Chaining Untuk Identifikasi Penerimaan Beasiswa di Universitas Islam Negeri Sjech M. Djamil Djambek Bukittinggi. *RJOCS (Riau Journal of Computer Science)*, *9*(2), 143–153.

Tzirides, A. O. O., Zapata, G., Kastania, N. P., Saini, A. K., Castro, V., Ismael, S. A., You, Y., dos Santos, T. A., Searsmith, D., & O'Brien, C. (2024). Combining human and artificial intelligence for enhanced AI literacy in higher education. *Computers and Education Open*, *6*, 100184. https://doi.org/10.1016/j.caeo.2024.100184

Yusup, W. B., Ismanto, B., & Wasitohadi, W. (2019). Evaluasi Program Indonesia Pintar dalam peningkatan akses pendidikan di sekolah menengah pertama. *Kelola: Jurnal Manajemen Pendidikan*, *6*(1), 44–53. https://doi.org/10.24246/j.jk.2019.v6.i1.p44-53