

The Impact of Blockchain Security on Cryptocurrency Investment Preferences Among Millennials in Indonesia

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ABSTRACT

This study explores the impact of blockchain security on cryptocurrency investment preferences among millennials in Indonesia. Despite the high volatility of cryptocurrencies, they continue to attract a significant number of millennial investors, driven by perceptions of security and potential high returns. The **study aim** of this research is to investigate how blockchain security influences the investment preferences of millennial investors, particularly concerning their decision-making process in the cryptocurrency market. This study **employs** a quantitative approach, gathering data through surveys targeting millennial cryptocurrency investors. The data is analyzed using Structural Equation Modeling (SEM) to assess the relationships between blockchain security perceptions and investment preferences. This research **provides** new insights by integrating blockchain security as a key factor influencing investment decisions, bridging the **gap** between technical and psychological aspects of investment behavior. While there is substantial research on cryptocurrency investments, limited studies address the specific influence of blockchain security on investment preferences, particularly in the context of millennial investors in Indonesia. The **finding** suggest that blockchain security significantly shapes the investment preferences of millennials, fostering trust and influencing their decision to engage in cryptocurrency investments. This study offers valuable insights for blockchain developers and regulators to enhance security features, helping to build investor confidence in Indonesia rapidly expanding cryptocurrency market.

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1. INTRODUCTION

Decision making has a critical role in financial behavior, particularly in investor decisions, which are often influenced by psychological biases, market behaviors, volatility, and the tendency to exploit opportunities for maximizing profits. Standard financial theory assumes that individuals in financial markets act rationally, preferring low-risk options for a given return. However, this is not the case with cryptocurrency investments, which are booming in Indonesia and globally. Despite their high volatility, cryptocurrencies continue to attract investors, experiencing rapid growth over the past decade. Cryptocurrencies, or digital currencies, are perceived as a modern form of payment and an appealing investment option[1].

In Indonesia, the number of cryptocurrency investors has grown substantially, from 4 million in 2020 to 12.4 million in February 2022. This growth highlights Indonesia as a leading country in terms of cryptocurrency asset ownership. Many individuals view crypto assets as a hedge against inflation. The "2022 Global

State of Crypto Report” indicates that 41% of Indonesians aged 18-75, earning over USD 14,000 annually, own crypto assets, showcasing the increasing appeal of cryptocurrency in the country[2].

This **research aims** to analyze the impact of blockchain security on cryptocurrency investment preferences among millennials in Indonesia. Specifically, the research will investigate how blockchain security factors influence investment decisions, particularly given the volatility of cryptocurrency prices. The study seeks to explore whether perceptions of blockchain security are a significant determinant in the decision making process for millennial investors. The **research employs** a quantitative approach, gathering data through surveys targeting millennial cryptocurrency investors in Indonesia[3]. The analysis will utilize Structural Equation Modeling (SEM) to examine the relationship between blockchain security perceptions and cryptocurrency investment preferences. While there is significant research on cryptocurrency investments, few studies address the specific impact of blockchain security on investment preferences, especially in Indonesia and among millennials. This study fills the **gap** by focusing on the psychological and technical aspects of blockchain security and its influence on investment behavior[4].

This **novelty** research in its integration of blockchain security as a key factor influencing cryptocurrency investment preferences among millennials in Indonesia. It offers a fresh perspective by connecting the technical elements of blockchain with investor psychology. The expected result is to uncover a significant relationship between blockchain security perceptions and investment preferences. This study will provide valuable insights for blockchain developers and regulators to address security concerns, helping to foster trust and influence investment decisions in Indonesia’s rapidly growing cryptocurrency market[5].

2. RESEARCH METHOD

2.1. Data Collection

Data collection in this study was conducted through a structured questionnaire, which was distributed to millennial investors in Indonesia who are actively involved in cryptocurrency investments. The questionnaire was designed to capture information on behavioural finance factors, including overconfidence, gambler’s fallacy, mental accounting, disposition effect, hindsight, and investment decisions[6]. The data was gathered using a convenience sampling method, allowing for the inclusion of participants who were readily accessible and willing to respond. The respondents were asked to complete the questionnaire based on their experiences and perceptions of investment decisions in cryptocurrency[7].

The questionnaire employed a Likert scale (1-5), a key tool that allowed respondents to express their level of agreement or disagreement with various statements concerning each variable. This scale played a crucial role in quantifying subjective opinions and behaviors, thereby ensuring a consistent and reliable data set for analysis[8]. The total number of respondents in this study was 452, a comprehensive sample size that allows for a thorough analysis of the relationships between the variables under investigation. This large sample size ensures that the findings are robust and reflective of the broader millennial investor demographic in Indonesia[9].

This descriptive study aims to examine or clarify the variables that influence each other in the existing phenomena, issues, and social realities. The population in this study consists of millennial investors in Indonesia, as investors often act irrationally when making investment decisions, significantly younger millennial investors who are more focused on profit from price volatility. The sample size is determined using the 1:10 method, meaning the minimum number of respondents is ten times the number of the most complex structural paths in the structural model. With the maximum number of structural paths being 6, the minimum sample size for this study is 60 respondents. Using convenience sampling and supported by the relatively high number of cryptocurrency investors in Indonesia, the study successfully gathered 452 respondents who participated in completing the questionnaire[10]. The questionnaire instrument was adapted from behavioral finance, which includes variables such as overconfidence, gambler’s fallacy, mental accounting, disposition effect, and hindsight as independent variables. Overconfidence refers to excessive self-confidence, where investors have unjustified beliefs in their investment decisions. Overconfidence can be explained as the tendency of individuals to overestimate their knowledge and skills in predicting the future and making decisions. Gambler’s fallacy is a situation where investors place excessive weight on available information, leading them to overestimate the probability of an event occurring and overreact to investment results (either positive or negative). As a result, this fallacy leads to poor decision-making. Mental accounting is an individual behavior that separates money into different categories, some for savings and others for riskier investments. In savings, individuals tend to

invest in low-risk instruments. The disposition effect is a behavior that provides empirical support for the disposition effect among individual investors. It was found that individuals reported regret for holding losing stocks too long and selling winning stocks too soon. Hindsight is a behavior where individuals become overconfident and overreact to new information. Hindsight is the tendency to revise one's original thoughts into something different due to newly provided information[11].

The structured to investigate the relationships between behavioral finance variables and investment decisions. The decision-making steps for investors include identifying investment goals, assessing risks, setting asset allocation policies, implementing policies, and rebalancing the portfolio. Risk perceptions, as a mediating variable, refer to how investors view the risk of financial assets based on their concerns and experiences. Risk perception involves how individuals understand the level of uncertainty and the potential losses associated with specific actions. Each of these variables was measured using a 1-5 Likert scale[12].

1. Investment Decision and Overconfidence

Overconfidence is a situation where individuals have high confidence in their decision-making because they possess what they believe to be sufficient information. However, the information obtained does not guarantee accuracy in decision-making. Overconfidence is a prediction based on an individual's self-assurance regarding an event, often resulting in exaggerated predictions. These exaggerated predictions, a potential pitfall of overconfidence, can lead to poor investment decisions. When individuals become overconfident, they tend to overemphasize and incorrectly estimate the potential investment returns. Investors frequently trade excessively because they believe their information is superior to others and maintain a risk tolerance, even when the investment's risk level is high. Overconfidence significantly and positively influences the level of irrationality in investment decision-making[13].

Overconfidence significantly impacts investment decisions because overly confident investors highly trust their abilities and rely on their knowledge, skills, and past information, as well as reference prices during trading. Overconfidence significantly influences investment decisions because excessive confidence can distort decision-making, leading to irrational choices. This is often caused by stress, depression, and anxiety, which impair cognitive performance. Therefore, the hypothesis for the relationship between these variables is as follows:

H1: Overconfidence significantly affects investment decisions.

2. Investment Decision and Gambler's Fallacy

Gambler's fallacy refers to a condition where investors place excessive importance on available information, leading them to overestimate the probability of an event occurring. This causes an exaggerated reaction to investment outcomes, whether positive or negative. As a result, this fallacy often leads to poor decision-making. Gambler's fallacy influences investment decisions because it contradicts the standard approach to decision-making related to event probabilities, which can create irrational beliefs[14].

Gambler's fallacy is negatively correlated with decision making. This result is consistent with investors' speculative nature, which leads them to make incorrect decisions because they believe that a series of affirmative or negative outcomes is unlikely to occur by chance. Therefore, the hypothesis for the relationship between these variables is as follows:

H2: Gambler's fallacy significantly affects investment decisions.

3. Investment Decision and Mental Accounting

Mental accounting, a crucial tool for investors, aids in the management and organization of investment portfolios across different accounts. This practice holds significant influence over asset prices, thereby shaping investment decisions. It is particularly beneficial for individuals with a strong grasp of financial considerations and literacy, as it encourages them to maintain more complex portfolios[15]. Mental accounting guides investors to segment their investments based on different objectives, thereby enhancing their portfolio management skills. In this study, mental accounting significantly influences investment decisions because it reflects investor characteristics in segmenting their investments according to various investment goals. Furthermore, younger investors are more likely to exhibit mental accounting biases than experienced investors[16]. H3: Mental accounting significantly affects investment decisions.

4. Investment Decision and Disposition Effect

The disposition effect significantly affects investment decisions because investors tend to hold on to losses for too long and rush to realize gains in their investments[17]. Investors act as if they believe that price changes will reverse. This study provides evidence that the belief in average returns is the primary cause of the disposition effect among investors. Therefore, the hypothesis for the relationship between these variables is as follows:

H4: The disposition effect significantly affects investment decisions.

5. Investment Decision and Hindsight

Hindsight occurs when an investor believes certain events could have been reasonably predicted. However, this belief can be dangerous because investors may form causal relationships between two events, even if there is no connection, leading to irrational decisions[18].

H5: The influence of hindsight on investment decisions is substantial and should not be underestimated.

6. Investment Decision and Overconfidence Risk Perceptions

Risk perceptions significantly mediate the relationship between overconfidence and investment decisions. This occurs because individuals with relatively high levels of self-confidence tend to have higher risk perceptions[19]. As a result, they are more likely to choose high-risk investments, which in turn negatively impacts their investment performance, highlighting the urgent need to understand and address this issue. Risk perceptions mediate the relationship between overconfidence and business decision-making. Risk perceptions fully mediate the relationship between overconfidence and financial literacy in investment decisions[20].

Therefore, the hypothesis for the relationship between these variables is as follows:

H6: Overconfidence significantly affects investment decisions through risk perceptions as a mediating variable.

Higher levels of risk perceptions will increase an individual's tendency to take risks. High risk perceptions will lead to investment decisions with lower risk. When unexpected events occur, decision-makers tend to overestimate the risks. They will seek available plans and solutions to guide their decision making process[21].

H7: Risk perceptions significantly affect investment decisions.

The data analysis method used in this study is Partial Least Squares-Structural Equation Modeling (PLS-SEM) with the application Smart PLS 4.1.0.6. PLS-SEM is a variance-based SEM analysis method that can analyze the structural relationships between variables in a research model[18]. PLS-SEM consists of two main analyses: Measurement Model Assessment (Outer Model) and Structural Model Assessment (Inner Model). The Measurement Model aims to assess the validity and reliability of the measurement instruments, while the Structural Model focuses on testing hypotheses between variables and evaluating the Goodness of Fit of the model[22].

3. RESULT AND DISCUSSION

Table 1 above presents the results of the Loading Factor and Average Variance Extracted (AVE) tests for various behavioral finance variables and their corresponding indicators[23]. Each variable, including Overconfidence, Gambler's Fallacy, Mental Accounting, Disposition Effect, Hindsight, Risk Perceptions, and Investment Decision, is evaluated using several indicators to assess their validity[24].

The loading factor values for all indicators range from 0.573 to 0.942, demonstrating significant validity across the variables. The AVE values also reflect the construct validity, with values above the threshold of 0.5, confirming the reliability of the measurement model[25]. The table indicates that each of the indicators is valid, as shown by the "Valid" results under the Test Result column. This robust analysis suggests that the measurement instruments used to assess these psychological factors in investment decisions are reliable and valid for the study.

Table 1. Most Cited Articles from 2019-2024

Variable/Indicator	Loading Factor	AVE	Test Result
Overconfidence			
Experience in Crypto	0.780	0.512	Valid
Self-confidence/skills	0.680		Valid
Crypto investment is better than stocks	0.713		Valid
Investment that aligns with expectations, from self-knowledge and actions	0.686		Valid
Gambler's Fallacy		0.601	Valid
Skilled speculator	0.797		Valid
Believes they will lose or win in Crypto	0.758		Valid
If others win, I will win too	0.803		Valid
Believes there will be loss and win	0.741		Valid
Mental Accounting		0.608	Valid
Investment purchases do not affect Crypto investments	0.573		Valid
Consider all investments	0.942		Valid
Disposition Effect		0.608	Valid
No quick response to crypto news	0.692		Valid
Does not recognize losses	0.799		Valid
Sells profitable coins, afraid of price drop	0.841		Valid
Hindsight		0.796	Valid
Can predict crypto losses	0.934		Valid
Believes financial crisis will occur if informed	0.848		Valid
Risk Perceptions		0.528	Valid
Believes risk is higher when making decisions	0.692		Valid
Income used for investments that are risk-free	0.753		Valid
Believes economic difficulties will arise	0.803		Valid
Believes there is uncertainty in crypto investments	0.651		Valid
Investment Decision		0.630	Valid
Depends on stock index in making investment decisions	0.810		Valid
Depends on industry index in making investment decisions	0.784		Valid
Considers the opinions of large investors in making investment decisions	0.809		Valid
Considers the opinions of local people in making investment decisions	0.771		Valid

Table 2. Adjusted R Square Results

Endogenous Variable	R Square	Explanation	Model Evaluation
Investment Decision	0.431	43.1%	Moderate
Risk Perceptions	0.024	2.4%	Weak

3.1. Model Fit Evaluation

Table 2 shows the flow of influence between variables in the model. Overconfidence, Disposition Effect, and Hindsight do not have a significant impact on Investment Decision. Meanwhile, Gambler's Fallacy, Mental Accounting, and Risk Perceptions significantly affect Investment Decision. Furthermore, Overconfidence influences Investment Decision through Risk Perceptions as a mediating variable[26].

A model is considered weak if it has an R-Square value less than 0.25, moderate if it is greater than 0.25 but less than 0.50, and strong if it is greater than 0.50. Table 5 shows that the independent variables are able to explain investment decisions with an Adjusted R-Square value of 0.431, or 43.1%, which falls under the Moderate category. Meanwhile, the Risk Perception variable, explained by Overconfidence, accounts for 2.4%, which is categorized as Weak.

Figure 1 shows the estimation of indicators to variables and the relationships between the variables. All indicators have contributed to forming their respective variables. Indicator O is the main indicator for Overconfidence, G for Gambler's Fallacy, M for Mental Accounting, D for Disposition Effect, H for Hindsight, R for Risk Perceptions, and I for Investment Decision[27].

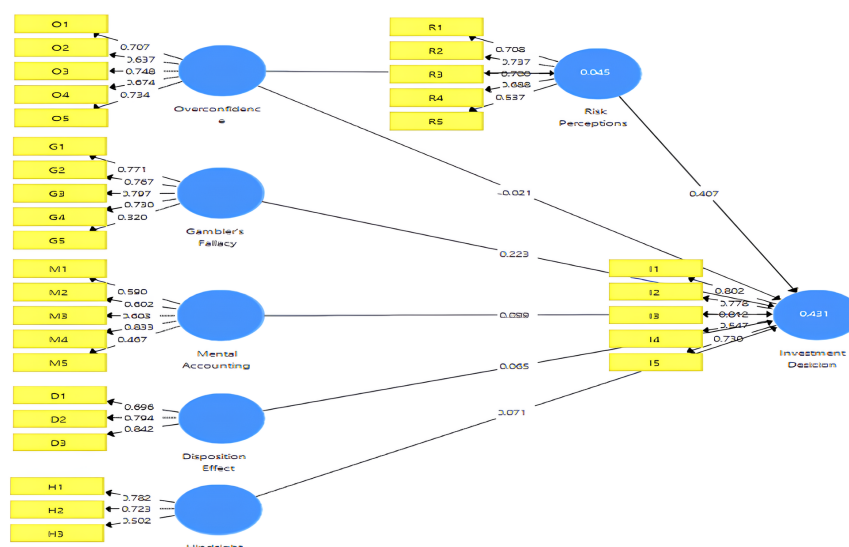


Figure 1. Network Visualization

3.2. The Effect of Overconfidence on Investment Decision

Overconfidence has a negative but insignificant effect on investment decisions, with a sample mean of -0.018. It can be concluded that millennial cryptocurrency investors have individual confidence in their own information and knowledge[28]. Investors have different characteristics and assessments related to their respective investments. Furthermore, although good financial literacy can increase excessive overconfidence, it does not necessarily influence investment decisions, as there are other factors that must be considered[29].

3.3. The Effect of Gambler's Fallacy on Investment Decision

Gambler's fallacy has a positive and significant effect on investment decisions, with a sample mean of 0.237. This finding aligns with previous theories, as young investors often place excessive weight on certain information and overestimate the probability of an event occurring, leading to exaggerated reactions to investment outcomes. This fallacy commonly occurs among young investors. Additionally, gambler's fallacy distorts investment decisions, as investors believe that affirmative or negative outcomes are unlikely to happen by chance.

3.4. The Effect of Mental Accounting on Investment Decision

Mental accounting significantly aids investors in managing and organizing their investment portfolios across different accounts, which can significantly influence asset prices. Mental accounting has a positive effect on investment decisions, with a sample mean of 0.140. Individuals who are skilled in financial considerations and financial literacy in investment decision-making tend to have more complex portfolios by segmenting their investments based on their investment goals. Furthermore, young investors are more likely to exhibit mental accounting bias compared to experienced investors[30].

3.5. The Effect of Disposition Effect on Investment Decision

Disposition effect does not have a significant effect on investment decisions, with a sample mean of 0.068. This result is inconsistent with previous studies that found a significant effect of the disposition effect on investment decisions, as investors tend to hold on to losses for too long and rush to realize profits. Investors act as though they believe that price changes will reverse in the future. Therefore, this study provides evidence that confidence in average returns is a major cause of the disposition effect[31].

3.6. The Effect of Hindsight on Investment Decision

Hindsight does not have a positive effect on investment decisions, with a sample mean of 0.040. Hindsight occurs when an investor believes that certain events could have been predicted. This happens because professional investors are not surprised by their investment returns, and most rely more on their own skills than on inputs from other professionals.

3.7. The Effect of Overconfidence on Investment Decision through Risk

Overconfidence has a positive effect on investment decisions through risk perceptions as a mediator, with a sample mean of 0.068. This finding aligns with previous research, as individuals with relatively high self-confidence tend to have relatively high risk perceptions. Furthermore, risk perceptions partially mediate the relationship between overconfidence and business decision-making. Risk perceptions also fully mediate the relationship between overconfidence and financial literacy in investment decisions[32].

3.8. The Effect of Risk Perceptions on Investment Decision

Risk perceptions have a positive effect on investment decisions, with a sample mean of 0.405. Risk perceptions refer to how investors view the risk of financial assets, based on their concerns and experiences. This finding aligns with previous theories. Risk perceptions play a role in the risk associated with all investment instruments, influencing individual decision-making behavior, as perception is the first step in forming a view on risk. When unexpected events occur, decision-makers tend to overestimate risks and seek available plans and solutions for decision-making.

4. CONCLUSION

Blockchain technology offers a transformative approach to managing academic records by enhancing security, privacy, and authenticity. With its decentralized and immutable nature, blockchain eliminates the risks associated with centralized data systems, such as unauthorized access, tampering, and fraud. The integration of blockchain in academic institutions provides a secure platform for storing and sharing sensitive educational data, ensuring the integrity and authenticity of academic records. Digital certificates based on blockchain technology are particularly beneficial, as they can be easily verified and authenticated, reducing the potential for forged credentials. This is a significant step forward in addressing longstanding issues of trust and transparency in educational systems.

The widespread implementation of blockchain in education offers several advantages, including improved data security, greater privacy for students, and reduced administrative costs. By providing a decentralized system that eliminates the need for intermediaries, blockchain not only secures academic records but also simplifies their management. Blockchain's ability to enable real-time verification of certificates and academic achievements ensures that institutions can maintain accurate and tamper-proof records, providing a reliable foundation for academic credentials worldwide. As demonstrated in various pilot programs and case studies, blockchain technology can revolutionize academic record-keeping on a global scale, benefiting both institutions and students.

However, challenges remain, particularly regarding scalability, regulatory compliance, and the integration of blockchain systems into existing educational infrastructures. Despite these hurdles, the potential benefits of blockchain in enhancing the security and privacy of academic records cannot be overstated. As blockchain technology continues to evolve, it is expected to become an essential tool in modernizing educational practices, offering long-term solutions to the complex issues surrounding academic records management. With further research and development, blockchain could become a standard technology used by educational institutions worldwide to safeguard the future of academic record-keeping.

REFERENCES

- [1] Q. Aini, E. P. Harahap, N. P. L. Santoso, S. N. Sari, and P. A. Sunarya, "Blockchain based certificate verification system management," *APTISI Transactions on Management*, vol. 7, no. 3, pp. 191–200, 2023.
- [2] D. Apriani, V. T. Devana, A. P. Sagala, P. A. Sunarya, U. Rahardja, and E. P. Harahap, "Security using blockchain-based otp with the concept of iot publish/subscribe," in *AIP Conference Proceedings*, vol. 2808, no. 1. AIP Publishing, 2023.
- [3] N. Azizah, G. P. Cesna, N. A. Santoso, Y. P. A. Sanjaya *et al.*, "Blockchain technology evolution trends bibliometrics analysis on scopus database using vosviewer," in *2022 IEEE Creative Communication and Innovative Technology (ICCIT)*. IEEE, 2022, pp. 1–6.
- [4] C. S. Bangun, T. Suhara, N. Septiani, A. Williams *et al.*, "Influence of third party funds on credit distribution," *ADI Journal on Recent Innovation*, vol. 4, no. 1, pp. 34–42, 2022.

- [5] K. Diantoro, D. Supriyanti, Y. P. A. Sanjaya, S. Watini *et al.*, “Implications of distributed energy development in blockchain-based institutional environment,” *Aptisi Transactions on Technopreneurship (ATT)*, vol. 5, no. 2sp, pp. 209–220, 2023.
- [6] K. Saurabh, N. Rani, and P. Upadhyay, “Towards blockchain led decentralized autonomous organization (dao) business model innovations,” *Benchmarking: An International Journal*, vol. 30, no. 2, pp. 475–502, 2023.
- [7] J. Mikl, D. M. Herold, M. Ćwiklicki, and S. Kummer, “The impact of digital logistics start-ups on incumbent firms: a business model perspective,” *The International Journal of Logistics Management*, vol. 32, no. 4, pp. 1461–1480, 2021.
- [8] R. Henríquez, F. X. M. de Osés, and J. E. M. Marín, “Technological drivers of seaports’ business model innovation: An exploratory case study on the port of barcelona,” *Research in Transportation Business & Management*, vol. 43, p. 100803, 2022.
- [9] A. Coskun-Setirek and Z. Tanrikulu, “Digital innovations-driven business model regeneration: A process model,” *Technology in Society*, vol. 64, p. 101461, 2021.
- [10] F. Muheidat, D. Patel, S. Tammisetty, A. T. Lo’ ai, and M. Tawalbeh, “Emerging concepts using blockchain and big data,” *Procedia Computer Science*, vol. 198, pp. 15–22, 2022.
- [11] V. Shcherbakov and G. Silkina, “Supply chain management open innovation: Virtual integration in the network logistics system,” *Journal of Open Innovation: Technology, Market, and Complexity*, vol. 7, no. 1, p. 54, 2021.
- [12] N.-P. Chen, K.-Y. Shen, and C.-J. Liang, “Hybrid decision model for evaluating blockchain business strategy: A bank’s perspective,” *Sustainability*, vol. 13, no. 11, p. 5809, 2021.
- [13] C. Magrini, J. Nicolas, H. Berg, A. Bellini, E. Paolini, N. Vincenti, L. Campadello, and A. Bonoli, “Using internet of things and distributed ledger technology for digital circular economy enablement: The case of electronic equipment,” *Sustainability*, vol. 13, no. 9, p. 4982, 2021.
- [14] A. Chandel, N. Bhanot, and R. Sharma, “A bibliometric and content analysis discourse on business application of blockchain technology,” *International Journal of Quality & Reliability Management*, vol. 41, no. 8, pp. 2095–2121, 2024.
- [15] S. Purnama and C. S. Bangun, “Strategic management insights into housewives consumptive shopping behavior in the post covid-19 landscape,” *APTISI Transactions on Management*, vol. 8, no. 1, pp. 71–79, 2024.
- [16] D. Niham, L. Elle, A. Yuriah, and I. Alifaddin, “Utilization of big data in libraries by using data mining,” *International Journal of Cyber and IT Service Management*, vol. 3, no. 2, pp. 79–85, 2023.
- [17] W. N. Wahid, W. Sejati *et al.*, “The implementation of blockchain technology in the education sector,” *Blockchain Frontier Technology*, vol. 3, no. 2, pp. 89–94, 2024.
- [18] C. Pramatha, I. M. Y. Mahendra, G. P. W. Rajeg, and I. W. Arka, “The development of semantic dictionary prototype for the balinese language,” *International Journal of Cyber and IT Service Management*, vol. 3, no. 2, pp. 96–106, 2023.
- [19] R. Ahli, M. F. Hilmi, and A. Abudaqa, “The influence of leadership dynamics and workplace stress on employee performance in the entrepreneurial sector and the moderating role of organizational support,” *Aptisi Transactions on Technopreneurship (ATT)*, vol. 6, no. 3, pp. 300–313, 2024.
- [20] I. M. A. Prayoga, G. Indrawan, and D. G. H. Divayana, “Pengelompokan laras suara berdasarkan pepatutan atau pathet gamelan bali menggunakan klasifikasi k-nearest neighbor dan support vector machine,” *Technomedia Journal*, vol. 8, no. 2 Special Issues, pp. 151–161, 2023.
- [21] U. Rahardja, P. A. Sunarya, Q. Aini, S. Millah, and S. Maulana, “Technopreneurship in healthcare: Evaluating user satisfaction and trust in ai-driven safe entry stations,” *Aptisi Transactions on Technopreneurship (ATT)*, vol. 6, no. 3, pp. 404–417, 2024.
- [22] I. Sembiring, D. Manongga, U. Rahardja, and Q. Aini, “Understanding data-driven analytic decision making on air quality monitoring an empirical study,” *Aptisi Transactions on Technopreneurship (ATT)*, vol. 6, no. 3, pp. 418–431, 2024.
- [23] Y. Sanjaya and M. Akhyar, “Blockchain and smart contract applications can be a support for msme supply chain finance based on sharia crowdfunding. blockchain frontier technology, 2 (1), 44–49,” 2022.
- [24] G. Jacqueline, Y. P. A. Senjaya, M. Z. Firli, and A. B. Yadila, “Application of smartpls in analyzing critical success factors for implementing knowledge management in the education sector,” *APTISI Transactions on Management*, vol. 8, no. 1, pp. 49–57, 2024.

- [25] N. Fahmi, D. E. Hastasakti, D. Zaspiagi, R. K. Saputra, and S. Wijayanti, "A comparison of blockchain application and security issues from bitcoin to cybersecurity," *Blockchain Frontier Technology*, vol. 2, no. 2, pp. 58–65, 2023.
- [26] A. Supriadi, M. F. Iqbal, A. N. Pratista, D. M. Sriyono, and D. J. Buanasari, "Blockchain and iot technology transformation in indonesian education," *Blockchain Frontier Technology*, vol. 2, no. 2, pp. 44–53, 2023.
- [27] F. Agustin, Q. Aini, A. Khoirunisa, and E. A. Nabila, "Utilization of blockchain technology for management e-certificate open journal system," *Aptisi Transactions on Management (ATM)*, vol. 4, no. 2, pp. 133–138, 2020.
- [28] A. Delhi, E. Sana, A. A. Bisty, and A. Husain, "Innovation in business management exploring the path to competitive excellence," *APTISI Transactions on Management*, vol. 8, no. 1, pp. 58–65, 2024.
- [29] F. T. Anaclaudia, D. Pramana, and I. M. A. B. Saputra, "Reactjs and expressjs implementation in pmk itb stikom bali activity management," *Aptisi Transactions on Technopreneurship (ATT)*, vol. 5, no. 3, pp. 216–226, 2023.
- [30] M. A. A. Faruq, M. R. Bassalamah, D. Sudaryanti, and N. N. Azizah, "Hedonic values and utilitarian values to improve behavioral intentions and consumer satisfaction on product," *Aptisi Transactions on Technopreneurship (ATT)*, vol. 5, no. 3, pp. 319–333, 2023.
- [31] T. Wahyuningsih, F. P. Oganda, M. Anggraeni *et al.*, "Design and implementation of digital education resources blockchain-based authentication system," *Blockchain Frontier Technology*, vol. 1, no. 01, pp. 74–86, 2021.
- [32] R. Panjaitan, D. P. Lazirkha, M. Kamil, R. Supriati, and W. N. Wahid, "Design of know your customer (kyc) using blockchain technology," in *2022 IEEE Creative Communication and Innovative Technology (ICCIT)*. IEEE, 2022, pp. 1–6.