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Bridging Regulation and Reality: A Comparative Study of Artificial Intelligence Regulation in the Financial Sectors

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Abstract

This study compares AI regulations in Indonesia and Singapore's banking and fintech sectors, focusing on the gap between regulation and real-world conditions. Artificial Intelligence (AI) has become essential in banking and fintech sectors, enhancing operational efficiency, detecting fraud, and performing risk analysis. However, the adoption of AI also poses challenges, particularly concerning regulation and consumer protection. The research employs normative or doctrinal methods with a comparative law approach. It evaluates various regulations issued by the Financial Services Authority (OJK) and Bank Indonesia (BI) in Indonesia, as well as the Monetary Authority of Singapore (MAS) in Singapore, specifically the FEAT and Veritas frameworks. The findings indicate that Singapore has proactively implemented principles of ethics, transparency, and accountability, while Indonesian regulations remain focused on consumer protection and operational stability, with a need for a more specific framework related to AI. The study concludes that harmonising regulation between innovation and consumer protection is crucial. Recommendations include the adoption of a regulatory sandbox and the implementation of ethical principles, such as FEAT, in Indonesia.

INTRODUCTION

The world has entered an era of rapid information and communication technology development. The influence of the digital era permeates various aspects of life, including the global financial sector. Artificial Intelligence (AI) represents one of the technological

advancements that can potentially transform multiple sectors of human life (Hapsari et al., 2024; Al-Fatih, S. et. al, 2025). The use of AI has increased dramatically. In the latest Year 2024 survey on AI conducted by McKinsey Global Survey, nearly 65% of respondents said that their organisation or company regularly uses AI genes (McKinsey, 2024). This is almost double the figure in the previous survey conducted ten months earlier. In the banking and financial sectors, 46% of financial organizations that use AI report that their customers appreciate a better experience (Cherniak, 2025). The Financial Services GenAI Survey 2023 has also been made public by Ernst & Young LLP (EY US). All respondents stated they are now utilising or intend to employ generative artificial intelligence (GenAI), particularly within their organizations, while nearly all (99%) of the financial services leaders polled stated that artificial intelligence (AI) is being implemented in some capacity within their companies (Americas, 2023).

The financial sector is one of the most affected by advancements in AI technology. Globally, including in Indonesia and Singapore, the banking and Financial Technology (Fintech) sectors are experiencing rapid growth, evidenced by the emergence of AI-driven innovations to enhance efficiency, user experience, and security. AI in Fintech is leveraged for fraud detection, where AI algorithms analyse large datasets to identify suspicious activities, significantly reducing financial fraud (G M, 2024). In credit analysis, AI can improve credit assessment and risk evaluation (Oluwafemi Elias et al., 2024), supporting more informed decision-making (G M, 2024). AI is also applied in customer service roles, utilising natural language processing tools to enhance user interactions, market analysis, and overall customer experience (Oluwafemi Elias et al., 2024).

While there are many advantages to the financial industry's adoption of AI, there are also drawbacks, like breaches of personal data (He, 2024; Hilmy Rizqullah Ramadhan et al., 2024), legal uncertainties (Xu et al., 2024) due to a lack of clear, responsive, and adaptive regulations (Ridzuan et al., 2024), and notable cybersecurity risks (Xu et al., 2024). Although AI offers transformative potential for financial services, addressing these regulatory risks and challenges is essential to ensure sustainable growth in the sector.

Singapore's proactive approach to regulating artificial intelligence in the finance sector illustrates a well-balanced ecosystem that promotes innovation while upholding ethical norms. To encourage responsible innovation and draw in investment, Singapore, a major financial centre in Asia, established a regulatory sandbox that permits financial firms to test AI technologies in a regulated setting (Everhart, 2020). This approach improves operational effectiveness and fortifies ethical governance and consumer protection. Singapore has established itself as a paradigm for AI regulation in the financial sector due to this strategy (Goo & Heo, 2020).

The regulatory sandbox provides a safe space for fintech companies to test AI applications without the immediate burden of compliance, which can positively impact

investment. Singapore's regulatory framework attracts greater investment by presenting a lower-risk, supportive regulatory environment (Fenwick et al., 2018). Singapore emphasises ethical AI use in consumer protection, ensuring consumer rights are safeguarded amidst technological advancements (Ridzuan et al., 2024). AI integration raises concerns about data privacy, necessitating a robust governance framework to mitigate the risk of user data breaches. Additionally, AI-driven regulatory technology streamlines compliance processes, enhancing transparency and risk management (Omolara Patricia Olaiya et al., 2024).

A comparative analysis of AI regulation between a developing country like Indonesia and a developed country like Singapore reveals a significant gap in regulatory frameworks and their implications for innovation and risk management. While both contexts face challenges, the regulatory environment in each country shapes the adoption and effectiveness of AI technology in the financial sector.

In developing countries such as Indonesia, AI regulations in financial services are often fragmented and less adaptive to technological developments (Ramachandran, 2010), which may hinder the effective implementation of AI in financial services. In addition, the lack of cohesive policies can lead to inefficiencies (Adebayo Olusegun Aderibigbe et al., 2023) and increased risk (Nneka Adaobi Ochuba et al., 2024). Rigid regulatory frameworks tend to hinder the adoption of new technologies because *rules-based regulation* is more dominant than *principles-based regulation* in developed countries such as Singapore (Robert et al., 2012). Meanwhile, developed countries like Singapore have established a more structured regulatory atmosphere encouraging innovation while ensuring consumer protection and market integrity. This balance facilitates the integration of AI technologies in financial services (Sushkova & Minbaleev, 2021). Regulatory sandbox has proven to be an effective approach in encouraging AI innovation in the financial sector (Douglas et al., 2017). However, its implementation in Indonesia is still hampered by the lack of coordination between agencies such as the Financial Services Authority (henceforth referred to as OJK), Bank Indonesia, and the Ministry of Communication and Information Technology (henceforth referred to as Kominfo). In addition, Indonesia has not fully adopted the risk-based regulation approach implemented by the Monetary Authority of Singapore (MAS) through the Veritas Consortium (Bounds & Malyshev, 2010). Therefore, Indonesia needs to develop a more flexible and risk-based regulatory approach to support the growth of AI in financial services.

Previous research conducted in 2023 by Michele Febriyanti and Imam Haryanto compared digital bank regulations in Indonesia and Singapore but did not provide an in-depth analysis of how these regulations affect the application of AI in the financial sector (Michele Febriyanti & Imam Haryanto, 2023). Furthermore, research by Dimas Bhayu Akoso and Syahrul Salam in 2024 discussed the implementation of cooperation between Indonesia and Singapore in the field of financial technology but did not

specifically examine the impact of regulations on the use of AI in the banking and fintech sectors (Bhayu Akoso & Salam, 2024). Mogaji, E., Soetan, T. O., & Kieu, T. A., in 2020, discussed the impact of AI on the digital marketing of financial services, particularly towards vulnerable customers. While providing insight into the ethical and marketing implications, this study does not specifically examine AI regulation in the banking and fintech sectors (Mogaji et al., 2020). Arner, D. W., Barberis, J., & Buckley, R. P., in 2017 discussed the concepts of Regulatory Technology (RegTech) and Financial Technology (FinTech), as well as the role of regulatory sandboxes in driving financial innovation. However, the focus is more on the general framework without an in-depth analysis of the comparison of AI regulation between Indonesia and Singapore (Douglas et al., 2017). In 2017 Zavolokina, L., Dolata, M., & Schwabe, G., explored the factors driving financial innovation according to popular media, including the role of technology such as AI. However, this study did not address regulatory aspects or comparison between countries (Zavolokina et al., 2016).

The studies above have comprehensively addressed a variety of fintech and regulatory issues, but there has not been a thorough analysis of the specific ways that laws analytically affect AI's major role in banking and fintech sectors in Singapore and Indonesia. This study aims to bridge this gap by carefully analysing the many ways that regulations affect the application of AI in the banking and fintech sectors in the two countries. Furthermore, the study recognises several best practices that can be employed to improve the integration of AI in financial services, all while considering the existing regulatory framework.

As such, this study offers a significant new contribution to understanding the interaction between regulation and AI technology innovation in the financial sector in Indonesia and Singapore. This research aims to analyse the differences in regulatory approaches between Indonesia and Singapore in overseeing AI use in the banking and fintech sectors and identify challenges and opportunities for Indonesia in adopting innovative regulatory approaches like those applied in Singapore.

To complement the analysis of AI regulation in Indonesia and Singapore, this research also draws on recent global studies that contribute to understanding AI regulation in the financial sector. Brent Daniel Mittelstadt and colleagues' study highlights the importance of fairness and accountability in the development of AI-based technologies, which is also a major concern for Singapore (Mittelstadt et al., 2016). Singapore has proactively addressed this through the FEAT (Fairness, Ethics, Accountability, Transparency) principles, which provide a framework for responsible AI use in financial services. In contrast, Indonesia lacks specific guidelines incorporating fairness and accountability principles in AI regulation, indicating a regulatory gap that must be addressed (Wardoyo & Hapsari, 2023). Similarly, research conducted by Michael Veale on algorithmic regulation shows that transparency is a key challenge that must be addressed through an adaptive regulatory framework (Veale et al., 2018). Singapore has

integrated transparency measures into its AI governance through the Veritas Initiative, which helps financial institutions assess AI model risks. Indonesia, however, has not yet developed a comparable framework, making its AI regulatory approach less structured and potentially riskier for consumers.

Furthermore, Christine Aicardi, in her ethical analysis of AI, emphasises the need for global guidelines that reduce bias in AI systems (Aicardi, 2021). This perspective is particularly relevant for Indonesia, which lacks explicit ethical standards in AI governance. While Singapore adheres to ethical AI principles through regulatory sandboxes and policy frameworks, Indonesia has yet to incorporate such guidelines into its financial sector regulations. Another study by Floridi stresses that a regulatory framework should prioritise innovation and emphasise ethical values. This aligns with Singapore's AI strategy, which balances regulatory flexibility with ethical safeguards.

On the other hand, Indonesia focuses more on operational risks and consumer protection, with limited emphasis on AI ethics, highlighting a need for improvement (Floridi et al., 2018). Additionally, Kaminski argues for harmonisation between countries in AI regulation. This is relevant in the context of ASEAN, where Indonesia and Singapore could benefit from greater regulatory alignment. Given Singapore's advanced AI governance and Indonesia's developing framework, a cooperative regional approach could help bridge the regulatory gap and ensure consistency in AI policies across Southeast Asia (Kaminski, 2021).

In addition to Singapore and Indonesia, current AI rules in other places offer especially perceptive details. The European Union's General Data Protection Regulation (GDPR) is a prime illustration of an established regulatory structure. GDPR's stringent privacy rules and strong data security guarantee AI systems are transparent and uphold user rights (Jędrzejczak, 2024). Singapore fully complies with several of these criteria with its thorough Personal Data Protection Act (PDPA), which requires responsible AI data usage. Conversely, Indonesia's Personal Data Protection Law (PDP Law No. 27/2022) is relatively weaker as it is still at the grassroots and lacks regulations directly concerning AI.

The Securities and Exchange Commission (SEC) and the Consumer Financial Protection Bureau (CFPB) are two organisations that regulate AI in the financial industry in the United States using a sectoral approach (Deshpande, 2024). Unlike Singapore's centralised AI governance under the Monetary Authority of Singapore (MAS), AI regulation in the U.S. varies by sector, creating fragmented oversight. Indonesia, facing similar regulatory fragmentation across OJK, Bank Indonesia, and Kominfo, could benefit from adopting Singapore's more unified AI governance model. By incorporating these global regulatory perspectives, this study provides a more comprehensive comparative analysis, identifying best practices that Indonesia could adopt to enhance its AI regulatory framework.

This research is crucial given the rapid changes in financial technology and the regulatory challenges faced by both countries. Indonesia can discover better methods to address existing regulatory differences, mitigate risks associated with AI use, and enhance consumer protection by studying AI regulations in Singapore. Additionally, this research can offer recommendations for policy harmonisation at the ASEAN level, considering the potential for collaboration between the two countries in the financial industry. The results of this study can help regulators, legislators, and industry participants build an atmosphere that encourages innovation while guaranteeing security and compliance in the application of AI in the financial sector.

METHOD

This study uses comparative and statutory approaches and a normative or doctrinal legal research methodology (Negara, T. A. S., 2023; Marzuki, 2010). A qualitative legal analysis is used to systematically compare AI regulations in the banking and fintech sectors between Indonesia and Singapore. The comparative approach is chosen to identify regulatory differences, highlight best practices, and assess the effectiveness of existing legal frameworks (Amiruddin & Asikin, 2021) to address the legal issues that form the subject of this study. The research compares AI regulations in the banking and fintech sectors between Indonesia and Singapore. Collecting legal materials is done through library research, including primary and secondary legal sources. Primary Legal Sources provide a binding and authoritative foundation for legal analysis, ensuring that the study is grounded in formal regulations. The primary legal materials used include:

1. The FEAT Principles issued by the Monetary Authority of Singapore (MAS) which define AI governance and ethical AI use in the financial sector. This is essential for understanding Singapore's structured regulatory approach.
2. Indonesia's Personal Data Protection Law (UU PDP No. 27/2022), which serves as the primary regulation on data protection but does not yet fully address AI governance.
3. The OJK Regulations and Bank Indonesia Regulations described in more detail in the discussion of this research.

The analysis of these primary sources determines the extent to which AI regulations in each country ensure fairness, transparency, and accountability in financial services. The study identifies regulatory gaps and best practices for adoption in Indonesia by directly comparing these regulations.

Secondary Legal Sources complement the primary sources by providing contextual analysis, interpretations, and theoretical perspectives. The secondary legal materials include Scientific literature on AI governance and financial regulations to assess the theoretical basis of AI regulation, policy reports from international organisations to understand global AI regulatory trends, and Journal articles and previous studies that discuss AI adoption in financial services, regulatory challenges, and

comparative legal studies. The secondary sources help interpret and critique primary legal materials to establish a broader regulatory context and evaluate the effectiveness of AI regulation in different jurisdictions.

These legal materials are selected based on their regulatory authority, applicability, and relevance to AI governance in the financial sector. Singapore's regulatory approach is chosen as a benchmark due to its well-defined AI governance framework, including the FEAT Principles and Veritas Initiative. Indonesia's regulations are examined to assess how AI is currently governed and identify regulatory shortcomings compared to Singapore. The study also considers global regulatory frameworks such as the EU's GDPR and the US sectoral AI regulations, providing a broader perspective on regulatory strategies.

The regulations in Indonesia and Singapore demonstrate distinct approaches to AI governance, making them relevant for comparative analysis. This study focuses on three key aspects of comparison. Singapore applies a principles-based regulation (e.g., FEAT Principles), which provides flexibility in AI implementation while ensuring ethical compliance. In contrast, Indonesia relies on a rules-based approach, which is more rigid and lacks specific AI guidelines. Regarding ethical and Consumer Protection Frameworks, Singapore has developed Veritas and regulatory sandbox frameworks to assess AI risks, while Indonesia's AI governance remains fragmented, with no unified approach to AI ethics in the financial sector. Singapore's AI regulation is centralised under the Monetary Authority of Singapore (MAS), whereas Indonesia's regulatory responsibilities are split between OJK, Bank Indonesia, and Kominfo, creating potential regulatory overlaps. These elements are contrasted to find Singaporean best practices that can be modified to fortify Indonesia's AI laws, ensuring a balance between innovation and consumer safety.

The regulations in Indonesia and Singapore show different approaches to AI regulation, making them relevant for comparative analysis. The analytical technique used is prescriptive analysis (Muhaimin, 2020), which involves three key steps:

1. Identification of Regulatory Gaps: Primary legal materials from Indonesia and Singapore are examined to determine weaknesses in Indonesia's AI regulation, such as the absence of ethical AI principles and a regulatory sandbox.
2. Comparative Evaluation: Legal norms, concepts, and regulatory mechanisms from Singapore are assessed to identify adaptable best practices for Indonesia. This includes evaluating the effectiveness of FEAT Principles, Veritas, and the regulatory sandbox in mitigating AI-related risks.
3. Regulatory Recommendations: Based on comparative findings, the study proposes regulatory reforms for Indonesia, such as adopting a unified AI governance framework, integrating ethical AI principles into OJK and Bank Indonesia regulations, and establishing a regulatory sandbox for AI-based financial services. These recommendations provide actionable insights for Indonesian policymakers,

enabling the country to develop a more adaptive and structured AI regulatory framework.

RESULTS AND DISCUSSION

The digital transformation and revolution era has spread widely across almost all layers of society and sectors of human life. It is vast, encompassing the digitalisation of information, which enables the transformation of data from analogue to digital formats, as well as product and service innovations that rely on digital platforms. This phenomenon has impacted the economy and the social, political, and cultural fields, shaping a new paradigm in how we interact with and understand the world (Hidayah, Rahadiyan, et al., 2024).

Artificial Intelligence (AI) is integrated into various aspects of life (Hidayah, Wicaksono, et al., 2024), from virtual assistants like Siri and Alexa to more complex applications such as big data analysis to predict trends in the healthcare and business industries (Syaifudin, 2024). While technology brings progress, it also creates new challenges in terms of regulation. An innovative and flexible legal approach is urgently needed to adapt to the rapid and often unpredictable changes brought about by the digital revolution. A dynamic legal framework is required to ensure that innovation can thrive while maintaining public safety and privacy. Managing digital technology in this fast-paced era brings forth a range of complex and dynamic issues (Feng, 2024). As technological advancements occur so rapidly, slower legislative processes often hinder regulation, leading to dangerous imbalances. One of the biggest issues in digital regulation is the speed disparity between legal processes and technological progress (Wiguna et al., 2023).

Artificial intelligence has become crucial to maximising banking and fintech services in the financial industry (Hapsari & Pratama, 2022). It can help banks and fintech service providers detect fraud, assess credit risk, and predict customer behaviour. Among the dangers of using AI are algorithmic bias, data security issues, and the opaqueness of automated judgments. Therefore, appropriate and adaptable rules are required to guarantee that technological innovations continue to progress alongside consumer protection and the stability of the financial system.

The regulatory perspective for AI in the banking and fintech sectors shows significant differences between Indonesia and Singapore, especially in the ethical framework established by Singapore. The Monetary Authority of Singapore (MAS) released AIDA (Artificial Intelligence and Data Analytics) rules on November 12, 2018, which financial institutions should take into account when making decisions. The guidelines—The Principles to Promote Fairness, Ethics, Accountability, and Transparency (FEAT) in the Use of AI and Data Analytics in Singapore's Financial Sector which highlight the significance of fairness, ethics, accountability, and transparency in how businesses use AIDA concerning their customers—are thought to

be the first AIDA guidelines released by a central bank or financial regulator (Singapore, 2018).

The key message of these guidelines is that companies should not rely solely on AIDA solutions without understanding how those solutions are designed to operate, the types of data used as analytical inputs, and whether the application of these technological solutions produces fair, equitable, accountable, and transparent outcomes for customers, partners, and the market at large. Thus, the MAS guidelines also serve as a useful reminder that, while technology can be highly beneficial in eliminating bias and ensuring fair treatment, it can also be applied—either intentionally or unintentionally—in ways that are unfair or lead to unintended outcomes (Gurrea-Martínez, 2020).

The FEAT principles were co-created by the MAS and a committee comprising senior industry partners from Singapore's largest banks and financial institutions, as well as tech companies like Microsoft and Amazon Web Services. Although these guidelines do not create enforceable standards, they are intended to provide a "baseline framework" for using AIDA. They may also help companies implement AIDA in a manner that does not violate enforceable behavioural standards.

The MAS has established the Fairness, Ethics, Accountability, and Transparency (FEAT) principles, which guide financial institutions in adopting AI responsibly. Further details of the FEAT principles are outlined as follows:

a. Fairness: This principle ensures that AI systems are non-discriminatory and promote fair treatment across different user groups by ensuring that the AI system does not discriminate against individuals or specific groups (Howard et al., 2019). Companies can use AIDA to tailor the services available to customers, but they should not use AIDA in ways that disadvantage customers without proper justification. For example, while companies can use AIDA to assess whether to increase a customer's credit limit, they must be able to justify the selection and weighting of variables entered into the AIDA system. Additionally, companies must ensure that the AIDA system functions as intended and does not inadvertently introduce bias against different customers. To address this, these principles recommend having an internal governance framework to review the performance of the AIDA system to ensure its accuracy.
b. Ethics: This principle encourages adherence to moral standards in using AI, fostering consumer trust. AI should be implemented in compliance with high ethical standards, particularly with regard to the use of consumer data (Ridzuan et al., 2024). Companies should consider whether the use of AIDA aligns with their ethical values and whether their decisions, from an ethical standpoint, would differ if a human were assigned to perform the same task that the AIDA system is executing. For example, companies may establish and use ethical review boards when making AIDA-based decisions.

c. Accountability: This principle establishes clear responsibility for AI outcomes, enhancing organisational transparency. The parties using AI must be accountable for the decisions and impacts of the automated system (Howard et al., 2019). Companies should develop an internal structure that ensures decisions related to AIDA are made by the appropriate authority and explained to internal stakeholders. Specifically, the principles recommend that companies clarify who within the organisation will make decisions related to AIDA and hold informational sessions for internal stakeholders on how AIDA is used. Externally, companies should provide sufficient information to customers and stakeholders about the AIDA systems they employ so that these groups can hold the company accountable. For example, companies can offer customers a way to learn more about how AIDA is used and to review and update the information utilised by the company's AIDA system.
d. Transparency: This principle supports explainable AI, allowing stakeholders to understand the decision-making process. There must be sufficient transparency in the AI processes and decisions so that users and regulators can comprehend how decisions are made. Companies should explain clearly to their customers and the public how they use AIDA and the impacts resulting from its use. As a result, companies will build public trust in their decision-making and AIDA in general. The principles acknowledge the business risks associated with transparency, such as exposing a company's competitive advantage. For example, companies using AIDA systems to detect fraud may not want to share information about how the system works, as malicious actors might exploit that information to manipulate the system. Nevertheless, companies can still maintain transparency with their customers on other uses of AIDA, such as explaining how AIDA is employed to determine customer insurance premiums (Fjeld et al., 2020).

The FEAT principles reflect a thoughtful consideration of how technology is applied in the financial services sector. These principles serve as an important guide for companies operating in Singapore, but they are also useful for companies outside of Singapore to consider when evaluating their use of technology. Companies must consider the transparency of their AIDA solutions when selecting and implementing them. They need to ensure that they understand and can adjust the factors and weights used to classify data. Companies must carefully consider what types of algorithms and processes drive classifications within the AIDA solutions before implementing them (Gurrea-Martínez, 2020).

The evaluation of AIDA solutions does not end once the technology is implemented. Companies must continually assess how the solution functions and develop metrics to measure its impact on outcomes. The quality of AIDA is only as good as its inputs, and these inputs must be well-understood. When evaluating the effectiveness of technology solutions, companies should consider whether their systems

rely on robust and accurate data and whether this data includes factors (e.g., race or ethnicity) that might be inappropriate for consideration in the decision-making process (Gurrea-Martínez, 2020).

AIDA solutions that focus on services provided to the general public require greater oversight. This is important given the increasing prevalence of Robo-Advisors, which offer financial advice based on algorithmic models. This consideration is also relevant to other systems that interface with the public, such as those used for screening job resumes or evaluating credit application approvals (Barbara Quek, 2022).

The FEAT principles represent MAS's ongoing efforts to maintain its position at the forefront of financial services regulation in an ever-evolving industry, particularly in relation to new and innovative technological solutions. These principles provide sensible and practical guidance for financial services firms that rely on or implement AIDA solutions. Given the extensive industry consultation that informed them, they are worthy of consideration.

MAS has collaborated with the Veritas Consortium to develop an evaluation framework that enables financial institutions to monitor the implementation of the FEAT principles. The consortium also provides open-source software for financial institutions to assess their algorithms for bias and risks. Additionally, Singapore facilitates a regulatory sandbox where fintech companies can test their products in a controlled environment without the full risk of regulatory compliance. This framework indicates that Singapore has a proactive AI regulation approach, focusing on balancing innovation with consumer protection (Budiyanti et al., 2022).

Regulations governing the use of AI in Indonesia's banking and fintech industries are underway (Hapsari et al., 2025). Although Bank Indonesia and the OJK, as institutions with the functions and authority to regulate the financial services sector, have established policies on fintech and digital innovation, there is no specific legislation regulating AI, as seen with the FEAT principles in Singapore (Disemadi, 2022).

Table 1. Indonesian Regulations Related to AI in the Financial Sector

Regulation	Focus Setting
Law No. 27 of 2022 concerning Personal Data Protection (PDP Law)	This regulation governs the protection of personal data, which is a critical element in using AI in the financial sector. The use of AI that involves customer data must comply with the provisions of this law concerning data security and confidentiality.
Presidential Regulation No. 74 of 2017 concerning the Roadmap for the National	Although broader in scope, this roadmap covers the development of infrastructure

Electronic-Based Trading System (E-Commerce Roadmap) for 2017-2019.	and regulations to support new technologies, such as AI, in the digital trade sector, including in fintech services.
OJK Regulation No. 77/2016 concerning Peer-to-Peer Lending Services Based on Information Technology	This OJK Regulation No. 77/2016 is a crucial regulation governing fintech in Indonesia (Budiyanti et al., 2022). Although it does not explicitly address AI, POJK No. 77 provides a legal foundation for using digital technologies in the fintech sector, including AI technologies used for credit risk assessment and consumer behaviour analysis.
OJK Regulation No. 13/POJK.02/2018 concerning Digital Financial Innovation (IKD) in the Financial Services Sector	This regulation allows using AI as part of digital innovation in the financial services sector. AI can be applied to various digital financial services, such as risk management, automated customer service, and data analytics. This rule makes it easier to integrate cutting-edge technology to boost customer satisfaction and operational efficiency in the financial industry by promoting the use of AI.
OJK Regulation No. 12/POJK.03/2021 concerning Commercial Banks	In this regulation, AI can be integrated into banking operations to enhance efficiency, services, and risk mitigation. This regulation focuses on the use of technology to accelerate processes and improve operational transparency in commercial banks. By incorporating AI, banks can optimise their operations, improve customer service through automation, and enhance decision-making processes in areas such as credit evaluation, fraud detection, and risk management while ensuring compliance with the established regulatory framework.

Bank Indonesia Regulation No. 19/12/PBI/2017 concerning the Implementation of Financial Technology	This regulation sets standards and the scope for FinTech to maintain monetary stability and the security of payment systems. It includes provisions related to a regulatory sandbox, which allows for the experimentation of FinTech innovations within defined limits. This framework allows companies to test their FinTech products in a controlled environment before full-scale implementation, ensuring that innovations adhere to regulatory requirements while minimising risks to the financial system.
Bank Indonesia Regulation No. 18/40/PBI/2016 concerning Payment Transaction Processing; organising the standards and requirements for the processing of payment transactions	This regulation aims to ensure the safety, efficiency, and security of payment systems within the financial sector. It covers various aspects of payment transactions, including the operational processes, governance, and risk management of payment transaction service providers. By establishing clear guidelines for transaction processing, this regulation facilitates the integration of new technologies, including AI, to improve the performance and security of payment systems while maintaining consumer trust and financial stability.
Bank Indonesia Regulation No. 22/23/PBI/2020 concerning the Payment System in Indonesia	This regulation aims to ensure the reliability, security, and efficiency of payment transactions in Indonesia while supporting the integration of new technologies, including Artificial Intelligence (AI), to enhance payment system services. It provides comprehensive guidelines for payment system providers' governance, operational processes, and risk management mechanisms, thus

	contributing to the stability and trust in Indonesia's financial ecosystem.
Bank Indonesia Regulation No. 2 of 2024 concerning Information System Security and Cyber Resilience for Payment System Providers, Money Market and Foreign Exchange Market Participants, and Other Regulated and Supervised Entities	This regulation encompasses oversight of the implementation of digital technologies, including AI, in transactions and operations of digital financial institutions. While acknowledging the dangers of using these technologies, Bank Indonesia promotes digitisation. This regulation generally mandates that financial institutions establish information system security and cyber resilience through anticipatory, adaptive, and proactive measures against cyber risks.
Blueprint for Indonesia's Payment System 2025	It outlines the strategic plan and vision for developing Indonesia's payment systems over the next few years. It aims to enhance the efficiency, security, and accessibility of payment systems, including those within the digital and financial technology sectors. To increase the quickness, security, and inclusivity of payment transactions, the blueprint strongly emphasises integrating cutting-edge technology like artificial intelligence (AI).
OJK Circular Letter No. 21/SEOJK.03/2017 concerning the Implementation of Risk Management in the Use of Information Technology by Commercial Banks	This circular establishes the obligation for banks to identify, manage, and supervise risks associated with the use of technology, including AI, in banking operations. It emphasises the importance of implementing a comprehensive risk management framework to ensure that potential risks related to the adoption of technological innovations are effectively mitigated. This includes addressing operational, security, and compliance risks and ensuring that AI solutions adhere to best practices in risk

	management and regulatory compliance when integrated into banking services.
Guidelines for the Code of Ethics concerning Responsible and Trustworthy Artificial Intelligence (AI) in the Financial Technology Industry issued by OJK	This code of ethics focuses on the governance of AI usage in the financial sector to mitigate risks, ensure accountability, and protect consumer data. Although it is not a formal regulation, this code serves as a guiding framework for the industry to use AI responsibly and ethically. It provides best practices for integrating AI technologies while safeguarding consumer interests and ensuring that AI systems operate transparently, fairly, and securely.

Source: Indonesian National Legal Documents and Information Network (JDIHN), 2025

Although there is yet to be a specific law regulating AI in the banking and fintech sectors (Hapsari & Kurniawan, 2020), both OJK and Bank Indonesia have made efforts to create an adaptive policy framework (Noveri, 2021). In addition, they work to reduce any risks by guaranteeing financial system security, consumer protection, and transparency in the face of this technology's rapid development. While covering aspects of consumer protection and financial system stability, Indonesia's AI regulatory approach faces some significant challenges:

a. Fragmentation of Regulation

Kominfo, Bank Indonesia, and OJK are in charge of regulatory monitoring of AI and financial technology in Indonesia (Anggraeny et al., 2023). Via OJK Regulation No. 13/POJK.02/2018 concerning Digital Financial Innovation (IKD), OJK regulates fintech businesses, such as digital banks and peer-to-peer (P2P) lending.

However, the regulation does not provide specific AI governance guidelines, creating uncertainty for AI-driven financial service providers. Bank Indonesia Regulation No. 22/23/PBI/2020 concerning the Payment System regulates digital payment systems and financial transactions, including AI-based payment fraud detection. However, the regulation does not address ethical concerns related to AI decision-making. Meanwhile, Kominfo focuses on cybersecurity and data protection, enforcing Law No. 27 of 2022 concerning Personal Data Protection (PDP Law). While this law establishes a foundation for AI data governance, it does not offer sector-specific AI guidelines for fintech and banking.

This fragmented regulatory environment leads to inconsistent regulations, making compliance difficult for AI-based financial companies. The absence of effective

coordination among these institutions creates the risk of overlapping or inconsistent regulations, which may ultimately hinder AI innovation. Indonesia's fintech legal framework is spread across the civil, administrative, and criminal sectors, leading to inconsistencies (Saifullah et al., 2023). Regulatory challenges arise from financial system decentralisation, which complicates the establishment of a cohesive regulatory approach (Masduqie & Santoso, 2023). Therefore, effective regulation is essential to encourage innovation while ensuring consumer protection. Regulatory sandboxes and collaborative efforts between regulators and industry stakeholders can foster a favourable environment for fintech to thrive (Etinosa Igbinenikaro & Adefolake Olachi Adewusi, 2024). However, the current fragmented regulatory environment can hinder the development of innovative solutions, as companies face uncertainties related to compliance (Suryadarma & Faqih, 2024).

The lack of coordination among these agencies forces AI-based fintech companies to comply with multiple regulatory bodies, increasing administrative burdens and slowing innovation. In contrast, Singapore's Monetary Authority of Singapore (MAS) acts as a single regulator, simplifying compliance for AI-based financial firms. Similarly, The Financial Conduct Authority (FCA) in the UK (Ferran, 2014) has an integrated approach to fintech and AI regulation, reducing regulatory uncertainty. As such, Indonesia should establish an AI Regulatory Coordination Body to harmonise AI regulations across OJK, Bank Indonesia, and Kominfo. This body could function similarly to MAS in Singapore or FCA in the UK, providing clear AI governance guidelines and reducing regulatory inconsistencies.

b. Lack of Ethical Framework

The regulatory landscape in Indonesia lacks integration of ethical principles such as fairness, transparency, and accountability, which raises concerns about algorithmic discrimination and consumer trust in AI technologies. In contrast, Singapore's FEAT principles provide a strong framework to mitigate these risks. The following section outlines the implications of the regulatory gaps in Indonesia and the potential benefits of implementing ethical guidelines. AI systems in Indonesia have been shown to perpetuate bias due to inadequate data governance, leading to discriminatory results (Zuwanda et al., 2024). Furthermore, the lack of transparency in the absence of clear ethical guidelines results in unclear decision-making processes, reducing public trust in AI applications (Mardiani et al., 2023).

Fintech companies using AI in credit risk assessment or anti-money laundering (AML) face unclear compliance expectations, increasing legal risks. This regulatory gap hinders AI-based financial innovation. Compared to the EU, GDPR Mandates explainability and fairness in automated financial decisions. Meanwhile, Singapore provides assessment tools to measure AI fairness and transparency. Indonesia's challenge is to develop an AI Ethics Framework for Financial Services, modelled on

Singapore's FEAT Principles, which require fintech companies to ensure fairness, transparency, and accountability in AI decision-making.

In addition, applying ethical principles can increase consumer confidence, as seen in other jurisdictions that prioritise transparency and accountability (Mishra & Varshney, 2024). The study suggests creating a comprehensive ethical framework to regulate AI, including periodic impact assessments and public engagement to ensure responsible use of AI (Patil, 2024). The author also argues that the rapid advancement of AI technology can outpace regulatory efforts, potentially stifling innovation if overly strict regulations are imposed. Balancing ethical considerations with technological advancements remains an important challenge for Indonesia.

c. Limited Technology Infrastructure and Human Resources

The implementation of AI in Indonesia's financial technology sector faces considerable challenges, mainly due to limited technology infrastructure and skilled labour, especially in remote areas. This situation hinders the widespread adoption of AI, critical to improving efficiency and decision-making in financial services (Bhat, 2024). The following section outlines the main barriers and potential solutions. Infrastructure limitations particularly affect remote areas of Indonesia, which still lack adequate technology infrastructure critical for AI implementation. The infrastructure gap between urban and rural areas leads to unequal access to AI tools (Fachriyah & Anggraeni, 2024). Meanwhile, there is a shortage of skilled professionals capable of implementing and managing AI technologies in the financial sector. Smaller firms, in particular, struggle with financial constraints and lack of expertise, which hinders their ability to adopt AI solutions (Hargyatni et al., 2024). Furthermore, regulatory uncertainty and high implementation costs further complicate the integration of AI in financial services (Cao, 2024). Smaller companies often face challenges in navigating these regulations, which can deter investment in AI technologies (Kouam, 2024). Despite these challenges, the potential benefits of AI in improving financial decision-making and operational efficiency are immense (Khan, 2024). Overcoming barriers through targeted training and better infrastructure can foster a more inclusive financial ecosystem in Indonesia.

South Korea has government-led AI training programs (Kim & Kwon, 2023) and cloud infrastructure investments (Nam et al., 2024) that have accelerated fintech AI adoption, while Singapore provides financial incentives for AI skill development in fintech (Barbara Quek, 2022). Learning from South Korea and Singapore, Indonesia can create a government-funded AI training program to build local expertise in AI regulation and fintech innovation and invest in cloud computing and AI infrastructure, especially in rural areas.

d. Resistance to Regulatory Reform

Regulatory changes that aim to accommodate new technologies often face resistance from stakeholders concerned about the economic and administrative

implications. This resistance can create significant barriers to the adoption of innovative regulatory frameworks such as regulatory sandboxes and principles like FEAT. Some studies have found that stakeholders may be concerned that new regulations may impose additional costs or disrupt existing business models, leading to reluctance to accept change (Raudla et al., 2024). Estonia, for example, has been slow to adopt the regulatory sandbox, while others, such as Lithuania and Latvia, have embraced it, highlighting the influence of political and legal factors in its adoption (Johnson, 2023). The need for Legislative Adaptation is urgent, given the dynamic nature of technology. Traditional regulatory frameworks often lag behind technological advancements, necessitating a re-evaluation of existing laws to better accommodate innovation (Monika Wyszomirska, 2023). A greater outreach program of self-regulation and civil liability can help mitigate the risks associated with new technologies, promoting a more adaptable regulatory environment. Lithuania and Latvia have quickly embraced the Regulatory Sandbox (Rupeika-Apoga & Wendt, 2022), enabling the growth of AI-driven fintech, while Estonia has struggled with slow regulatory adaptation (Gavrilova & Gurvitsh-Suits, 2020), similar to Indonesia. Meanwhile, OJK should provide financial incentives for fintech startups to participate in the regulatory sandbox program. In addition, the government also needs to amend financial regulations to explicitly include AI governance, ensuring a proactive rather than reactive regulatory approach.

The in-depth identification of AI regulations in the banking sector in Indonesia and Singapore leads to the following comparative analysis:

Table 2. Comparison of AI Regulations Financial Sector in Indonesia and Singapore

Comparative Aspects	Indonesia	Singapore
Policy Approach and Governance	***Rules-Based*** The main focus of regulation in Indonesia is on consumer protection and operational risk, but there are no specific guidelines related to AI. Initiatives such as the payment blueprint and fintech regulation are still in the early stages of integrating AI.	***Principles-Based*** Singapore implements ethical principles and transparency through FEAT, focusing on accountability and algorithm monitoring. It also provides a regulatory sandbox that allows innovation without full legal risk.
Consumer Protection and Ethical Framework	***Not Integrated Yet*** Indonesian regulations emphasise operational risk	***Veritas Initiative*** In collaboration with industry, MAS developed

	mitigation and data protection, but there is no comprehensive ethical framework for using AI in the financial sector.	the Veritas Project to provide guidelines and tools to ensure the responsible use of AI in financial services. It focuses on transparency and fairness in the application of AI, ensuring that algorithms do not introduce discriminatory bias. FEAT principles help build public trust in new financial technologies.
AI Model Risk Management	***No Specific Guidelines*** Risk management related to AI models has not been specifically regulated in existing regulations.	***AI Model Risk Management Guidelines exist*** In December 2024, MAS released the Artificial Intelligence Model Risk Management Paper, which provides best practices for risk management of AI models, including Generative AI.
Fintech Regulation	***General Fintech Regulation*** The Financial Services Authority (OJK) issued regulations related to digital financial innovation, but none specifically focuses on AI.	***Payment Services Act 2019*** This regulation provides a framework for the regulation of payment service providers and payment systems, supporting innovation while ensuring consumer protection.
Approach to Generative AI	***No Specific Regulation*** There are no specific regulations or guidelines regarding the use of Generative AI in the financial sector.	***Governance Standards for Generative AI*** MAS is mapping out governance standards for Generative AI to ensure safe and ethical

	implementation in the financial sector.

Source: Author, 2025

The comparative analysis of AI regulations in Indonesia and Singapore highlights significant differences in their regulatory approaches, impacting AI adoption in the financial sector. Indonesia's rules-based approach focuses on consumer protection and operational risk but lacks AI-specific governance, creating uncertainty for financial institutions. In contrast, Singapore's principles-based model, supported by the FEAT Principles and regulatory sandbox, fosters responsible AI innovation while ensuring transparency and accountability. Additionally, Indonesia lacks a structured ethical AI framework, whereas Singapore's Veritas Initiative ensures fairness and consumer trust in AI applications. The absence of AI model risk management guidelines in Indonesia further increases regulatory uncertainty, whereas Singapore's 2024 MAS AI Model Risk Management Paper establishes clear risk mitigation practices. Moreover, Indonesia has not yet developed governance standards for Generative AI, while Singapore is proactively mapping out regulatory frameworks to ensure safe and ethical AI implementation. These differences indicate that Indonesia must move towards a more adaptive regulatory framework, integrating ethical AI principles, a coordinated oversight mechanism between OJK, Bank Indonesia, and Kominfo, and a dedicated regulatory sandbox for AI-based financial services to foster innovation while maintaining accountability and consumer protection.

CONCLUSION

AI regulation in the banking and fintech sectors shows significantly different approaches between Indonesia and Singapore. By implementing FEAT and the Veritas Consortium initiative, Singapore has created an innovative yet controlled ecosystem. Meanwhile, Indonesia is still in the process of building an adaptive regulatory framework, focusing on consumer protection and financial system stability. By studying Singapore's approach, Indonesia can develop more comprehensive AI regulations, balance innovation and supervision, and increase public trust in financial technology. The author finds that Indonesia can learn from Singapore by adopting an Ethical Framework. OJK and Bank Indonesia can consider applying principles similar to FEAT to ensure fair and transparent use of AI. Indonesia can also build an Innovation Ecosystem by implementing a regulatory sandbox for AI-based fintech so that companies can experiment without facing the full regulation risk. Inter-agency collaboration can also be considered.

Implementing FEAT principles in Indonesia requires a clear national policy framework to establish ethical AI governance in the financial sector. OJK and Bank Indonesia should issue national ethical guidelines that emphasise fairness, transparency, and accountability, ensuring AI systems in banking and fintech operate responsibly.

These guidelines must incorporate clear evaluation standards for AI algorithms, a mandatory regulatory audit process, and data governance protocols aligned with Law No. 27 of 2022 concerning Personal Data Protection (PDP Law). This ensures financial institutions comply with data security and privacy obligations while integrating AI technologies. Additionally, technical guidelines specific to AI usage in banking and fintech operations should be introduced, covering technology standards, cybersecurity measures, and risk mitigation strategies to prevent algorithmic bias and discrimination.

A regulatory sandbox should be established through institutional collaboration between Bank Indonesia, OJK, and Kominfo to prevent regulatory overlaps. A structured sandbox framework must set clear criteria for piloted AI technologies, particularly in micro-lending and fraud detection, to enhance financial inclusion (Ayu Purnamawati et al., 2024). The sandbox implementation should follow a phased approach consisting of risk assessment, limited-scale testing, and full-scale implementation based on regulatory evaluation. Financial incentives such as tax benefits for AI-driven fintech firms participating in the sandbox should be considered to align with Indonesia's legal and economic framework.

Furthermore, legal harmonisation with Indonesian laws is crucial to prevent conflicts between AI regulations and traditional financial laws. Adjustments to banking and fintech regulations under OJK Regulation No. 13/POJK.02/2018 concerning Digital Financial Innovation (IKD) and Bank Indonesia's Payment System Regulations should explicitly incorporate AI governance provisions. Regulatory bodies must also establish AI compliance mechanisms integrating civil liability standards and legal accountability frameworks to protect consumers from AI-related financial risks. Lastly, infrastructure investment is essential to ensure the effective implementation of AI in financial services. The Indonesian government must support digital infrastructure development, including data centres, cloud computing, and nationwide high-speed internet connectivity, to facilitate AI-driven banking and fintech operations. Indonesia should also engage in regional and international regulatory cooperation, such as ASEAN's Financial Technology Collaboration Initiatives, to adopt best regulatory practices from countries like Singapore. By integrating ethical AI standards, regulatory sandbox mechanisms, legal harmonisation, and infrastructure development, Indonesia can create a robust AI regulatory framework that supports innovation while ensuring compliance, accountability, and consumer protection in the financial sector.

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