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Developing AI Regulations in Indonesia: Policy Recommendations Based on Comparative Policy Analysis from the European Union, the United States, and Singapore

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Abstrak

Kecerdasan buatan (AI) semakin menjadi pendorong utama transformasi digital di berbagai sektor seperti pendidikan, kesehatan, dan keuangan. Namun, perkembangan ini memunculkan tantangan regulasi, khususnya terkait perlindungan privasi, transparansi algoritma, dan etika penggunaan AI. Indonesia, dengan tingkat adopsi teknologi yang tinggi namun tanpa kerangka hukum yang spesifik, menghadapi risiko penyalahgunaan teknologi ini. Penelitian ini menggunakan studi literatur dan pendekatan analisis kebijakan perbandingan untuk mengkaji regulasi AI di Uni Eropa, Amerika Serikat, dan Singapura. Hasil analisis menunjukkan bahwa Uni Eropa menekankan perlindungan data dan pengawasan ketat, Amerika Serikat mengedepankan fleksibilitas untuk inovasi, sementara Singapura menawarkan keseimbangan antara tanggung jawab sosial dan kemajuan teknologi. Berdasarkan temuan tersebut, artikel ini merekomendasikan pengembangan kerangka regulasi AI di Indonesia dengan menggabungkan prinsip pendekatan berbasis risiko, transparansi, dan audit algoritmik, serta pembentukan lembaga pengawas AI yang independen. Regulasi ini diharapkan mampu mendorong inovasi yang aman, etis, dan adaptif terhadap dinamika teknologi.

Kata Kunci: Kecerdasan Buatan (AI); Regulasi AI; Rekomendasi Kebijakan; Privasi Data; Transparansi Algoritma.

Abstract

Artificial intelligence (AI) is increasingly becoming the main driver of digital transformation in various sectors such as education, health, and finance. However, this development raises regulatory challenges, particularly regarding privacy protection, algorithm transparency, and AI usage ethics. Indonesia, with a high level of technology adoption but without a specific legal framework, faces the risk of misuse of this technology. This study uses a literature review and a comparative policy analysis approach to examine AI regulations in the European Union, the United States, and Singapore. The results of the analysis show that the European Union emphasizes data protection and strict supervision, the United States promotes flexibility for innovation, while Singapore offers a balance between social responsibility and technological progress. Based on these findings, this article recommends developing an AI regulatory framework in Indonesia by combining the principles of a risk-based approach, transparency, and algorithmic auditing, as well as the establishment of an independent AI regulatory agency. This regulation is expected to encourage innovation that is safe, ethical, and adaptive to technological dynamics.

Keyword: Artificial Intelligence (AI); AI Regulation; Policy Recommendations; Data Privacy; Algorithm Transparency.

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1. Introduction

Artificial Intelligence (AI) has become one of the most transformative technologies of the 21st century, changing the global social, economic, and political landscape. This technology is widely used in various sectors, including education, health, finance, and government, to improve efficiency, accuracy, and data-based decision making (Crawford & Calo, 2016; Wu, 2024). In the education sector, for example, AI plays a role in personalizing learning and analyzing student performance, enabling a more adaptive instructional approach (Holmes *et al.*, 2019). In the health sector, AI supports the process of diagnosis and patient care through data-based systems and the recognition of complex medical patterns (Topol, 2019). Meanwhile, in the financial sector, AI is used for risk analysis, fraud detection, and automated portfolio management (Oladele *et al.*, 2024). However, widespread adoption of AI also presents major challenges related to ethics, security, and data privacy (Mittelstadt *et al.*, 2016). Complex and non-transparent AI systems can lead to inequalities in decision-making and have the potential to cause algorithmic discrimination, especially if the data used is biased or unrepresentative (Caplan, 2018). In the health sector, for example, the use of AI for diagnosis can lead to medical errors if the algorithm is not strictly supervised or does not have adequate clinical validation (Topol, 2019). In the education sector, the use of AI for automated assessment can also raise questions about fairness and accuracy in student evaluation (Holmes *et al.*, 2019). Another issue that has come to the fore is related to the protection of personal data. AI systems generally require large amounts of data, including sensitive data such as medical records, financial information, and user preferences, which can be misused if not strictly regulated (Voigt & Bussche, 2017). Therefore, regulation is an important instrument in managing the risks arising from the use of AI and ensuring that this technology is used ethically, fairly, and safely (Taeihagh, 2021). Indonesia, as a country with rapid digital economic growth, has its own challenges in facing the wave of AI-based transformation. Based on data from APJII (2024), Indonesia has more than 200 million internet users, and the adoption of AI in the public and private sectors continues to increase. However, until now, Indonesia does not have a specific and comprehensive regulatory framework to regulate the use of AI. Some relevant regulations can form the basis for the development of AI regulations, such as Law No. 11 of 2008 concerning Electronic Information and Transactions (ITE), Law No. 27 of 2022 concerning Personal Data Protection (PDP), Government Regulation No. 71 of 2019 concerning the Implementation of Electronic Systems and Transactions (Government of Indonesia, 2024). The law does not explicitly regulate the mechanism of artificial intelligence (AI) governance in Indonesia. Without clear regulations, the potential for misuse of AI technology will increase, especially in terms of the use of sensitive personal data (Erdélyi & Goldsmith, 2022).

Globally, a number of countries have taken concrete steps to develop contextual and anticipatory AI regulations. The European Union, through the Artificial Intelligence Act (2021), proposes a risk-based approach to classify AI systems into low, medium, and high categories, based on their impact on basic human rights and public security (European Commission, 2021). This regulation is also complemented by the General Data Protection Regulation (GDPR) which sets strict standards in the protection of personal data and user rights against automated decision-making systems (Voigt & Bussche, 2017). The United States, although it does not yet have comprehensive federal AI regulations, has initiated the Algorithmic Accountability Act to encourage companies to conduct ethical and technical evaluations of the algorithmic systems they develop (Caplan, 2018). In Asia, Singapore stands out as a country that encourages the responsible use of AI through its AI Governance Framework Model which focuses on transparency, fairness, and internal corporate oversight (IMDA & PDPC, 2020). Previous studies have generally focused on sectoral or technical approaches to AI governance (Holmes *et al.*, 2019; Oladele *et al.*, 2024; Topol, 2019). Meanwhile, studies that integrate comparative policy analysis from various countries to provide strategic recommendations in the context of developing countries, such as Indonesia, are still limited. Thus, there is a gap in the literature that needs to be bridged through cross-country analysis to understand best practices in the formulation of AI regulations and how these principles can be adapted

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contextually. This article aims to conduct a comparative policy analysis of AI regulations in the European Union, the United States, and Singapore to provide policy recommendations for Indonesia. This study identifies five main aspects of AI regulation, namely: (1) data and privacy protection, (2) algorithm transparency and accountability, (3) innovation flexibility, (4) social and ethical responsibility, and (5) oversight and enforcement mechanisms. This study uses a literature review method and qualitative analysis based on official documents and scientific publications to examine the regulatory approaches in the three countries and adapt them to the context of Indonesia's needs. By comparing policies across the board and highlighting regulatory gaps in Indonesia, this article is expected to provide theoretical and practical contributions to the development of a national AI regulatory framework. The findings of this study are relevant not only to policy makers in Indonesia, but also to researchers, technology developers, and civil society involved in the AI-based technology governance ecosystem.

2. Research Methods

This study uses a qualitative approach with a literature study method and comparative policy analysis, which aims to evaluate artificial intelligence (AI) regulations in the European Union, the United States, and Singapore, and formulate policy recommendations relevant to Indonesia. This approach was chosen because it is suitable for answering normative and reflective research questions, as well as for analyzing regulatory dynamics in the context of society and public policy (Silverman, 2020). The data used in this study comes from secondary sources including scientific journals, policy reports, and legal documents (Bryman & Bell, 2019). Scientific journals include academic articles discussing AI regulation, data protection, and the social and ethical impacts of AI implementation in key sectors such as health, education, and finance. The policy reports to be analyzed include official documents such as the Artificial Intelligence Act proposed by the European Union (European Commission, 2021), the Algorithmic Accountability Act of the United States (Voigt & Bussche, 2017), and the AI Governance Framework of Singapore (IMDA & PDPC, 2020). In addition, legal documents related to data privacy and algorithm transparency in each region will be used to understand how these regulations are designed and implemented. The literature was collected purposively, taking into account thematic relevance, recency (published between 2017 and 2024), and source credibility.

The analysis was conducted using a thematic content analysis approach, with five main categories used as a comparative matrix: (1) data protection and privacy, (2) algorithm transparency and accountability, (3) flexibility towards innovation, (4) social responsibility and ethics, and (5) oversight and law enforcement mechanisms. Each category is analyzed to identify the regulatory approach taken by each country, as well as to assess the potential for adoption in the Indonesian context. These themes were selected based on the most prominent issues in the global literature on AI governance (Caplan, 2018; Oladele *et al.*, 2024; Voigt & Bussche, 2017). Data validity is maintained through source triangulation, which compares official documents and scientific literature from various disciplines, such as law, information technology, and public policy (Yin, 2015). Data interpretation is done carefully to ensure that the policy context of each country is fully understood, including the political, social, and technological backgrounds that influence the form of their AI regulation. This study has limitations in the absence of primary data, such as interviews with stakeholders or field studies, so the results obtained are exploratory and normative. However, this approach still makes a significant contribution in providing a conceptual framework and initial policy direction for Indonesia in developing comprehensive, adaptive, and contextual AI regulations.

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3. Results and Discussion

3.1 Results

The results of a comparative analysis of the AI regulatory framework in three main jurisdictions the European Union, the United States, and Singapore—reveal differences in approach that reflect the policy orientation and social values of each country. These findings are analyzed based on five main dimensions, namely: data protection, transparency, innovation flexibility, social responsibility, and oversight mechanisms.

3.1.1 Privacy and Data Protection

The European Union is at the forefront of personal data protection through the General Data Protection Regulation (GDPR), which gives individuals full rights over the management of their data, including the right to access, correct, and delete data collected by AI systems (Voigt & Bussche, 2017). In the context of the Artificial Intelligence Act, the European Union also emphasizes risk evaluation based on the classification of AI applications (European Commission, 2021). In contrast, the United States does not yet have comprehensive national privacy regulations. The approach taken tends to be sectoral and state-based, although the Algorithmic Accountability Act proposes an audit framework for the use of algorithmic systems (Oladele *et al.*, 2024). Singapore, although not as strict as the European Union, incorporates data protection principles through the Personal Data Protection Act and an AI governance framework that encourages companies to maintain accountability for data use (IMDA & PDPC, 2020).

3.1.2 Algorithm Transparency and Accountability

Transparency is an important pillar in building public trust in AI technology. The European Union, through the AI Act, requires AI system developers to explain how algorithms work, especially for high-risk applications, and to provide technical documentation and records of system use (European Commission, 2021). The United States, through the Algorithmic Accountability Act, emphasizes the importance of internal algorithm audits by companies to measure their social impact (Oladele *et al.*, 2024). Singapore takes a pragmatic approach by encouraging openness through the Governance Framework Model, without making transparency a legal obligation, but as an ethically recommended good practice (IMDA & PDPC, 2020). All three recognize the importance of accountability, albeit with different degrees of legal binding.

3.1.3 Flexibility towards Innovation

The United States prioritizes the principle of light-touch regulation, which provides ample room for the growth of technological innovation and experimentation, especially in the private sector (Crawford & Calo, 2016). This flexibility is considered to encourage competitive advantage in the development of AI technology. In contrast, the European Union is faced with the challenge of strict regulation and a slowdown in innovation among startups, especially in meeting complex administrative requirements (Mittelstadt *et al.*, 2016). Singapore tries to balance the two by creating a flexible but purposeful regulatory environment, providing ethical guidelines that are not legally binding but still encourage compliance through voluntary certification and public-private collaboration (IMDA & PDPC, 2020).

3.1.4 Social Responsibility and Ethics

All the analyzed jurisdictions pay attention to the ethical dimension of AI use. The European Union encourages the explicit integration of ethical principles in policy documents, including the principles of non-discrimination, fairness, and harm avoidance (European Commission, 2021). The United States is still in the early stages of incorporating ethical principles into the legal framework, but various initiatives from academia and industry have emerged to develop consensus-based ethical

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standards (Oladele *et al.*, 2024). Singapore has developed ethical principles that are aligned with local values and applies them in certification programs and ethics training for developers and technology companies (IMDA & PDPC, 2020).

3.1.5 Regulatory Oversight and Enforcement

In terms of supervision, the European Union has a strong structure through independent supervisory bodies in each member country that are responsible for the implementation of the GDPR and the AI Act (Voigt & Bussche, 2017). The sanctions imposed are also strict and measurable. The United States relies more on a sectoral approach, with enforcement depending on agencies such as the Federal Trade Commission (FTC), which has limited authority to crack down on AI abuse (Caplan, 2018). Singapore uses a collaborative approach, where oversight is carried out jointly by regulators and industry players through consultative forums and certification programs (IMDA & PDPC, 2020).

Table 1. Comparative Matrix of AI Laws in Europe, America, and Singapore
Source: Processed by Researcher

Criteria	European Union (GDPR and AI Act)	United States (Algorithmic Accountability Act)	Singapore (AI Governance Framework)
Privacy and Data Protection	Very strong, the GDPR strictly protects personal data privacy, including users' rights over their data. The AI Act also assesses AI risks to privacy (Voigt & Bussche, 2017) .	Privacy protection is sector dependent, there is no comprehensive national privacy regulation, but a focus on oversight of specific sectors such as health and finance (Caplan, 2018) .	Privacy protection through flexible data regulation, emphasizing transparency and data management with clear ethical guidelines (IMDA, 2020) .
Transparency and Accountability	The AI Act requires strict transparency, especially on high-risk applications. AI developers must provide information on how algorithms work (European Commission, 2021) .	Transparency and accountability are regulated sectorally. Companies are required to conduct internal algorithm audits and impact evaluations (Caplan, 2018) .	Emphasize the importance of algorithmic auditing and accountability, with clear guidelines for AI developers to maintain transparency (IMDA, 2020) .
Flexibility for Innovation	Less flexible, especially for startups. Focus on risk management may limit technological innovation in some sectors (Mittelstadt *et al.*, 2016) .	Flexible, enabling innovation without many regulatory barriers. Sector-based regulation supports rapid technological growth (Crawford & Calo, 2016) .	Flexible, supporting innovation in AI technologies while maintaining transparency and social responsibility (IMDA, 2020) .
Social Responsibility and Ethics	Highly emphasized, especially in terms of preventing	Focus on social impact evaluation, but implementation is still	Strongly emphasized through strong ethical guidelines and

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	discrimination and bias in the use of AI (Mittelstadt *et al.*, 2016) .	limited to specific sectors (Caplan, 2018) .	certification programs for responsible AI development (IMDA, 2020) .
Supervision and Law Enforcement	Strict oversight through independent institutions. The AI Act requires oversight of high-risk AI applications (European Commission, 2021) .	Sector-based oversight with minimal oversight from the federal government. Enforcement depends on the regulation of each sector (Oladele *et al.*, 2024) .	Oversight is flexible, focusing on voluntary compliance and certification to ensure social responsibility (IMDA, 2020) .

3.1.6 Regulation in the European Union: Privacy and Risk Protection

The EU is known for its strict regulatory approach regarding the use of AI technologies, with a primary focus on protecting privacy and managing the risks presented by such technologies (Tallberg *et al.*, 2024). The most notable regulation is the General Data Protection Regulation (GDPR), which was implemented in 2018 and serves as the legal foundation for the protection of personal data across EU member states (Ulnicane, 2022). The GDPR sets strict standards on how personal data should be collected, used and stored, and gives individuals the right to control the use of their data (Voigt & Bussche, 2017). This is particularly relevant in the context of AI, where algorithms often need access to personal data to function optimally, especially in the education and health sectors, which process large amounts of sensitive data (Tallberg *et al.*, 2023). In addition to the GDPR, the EU is also proposing the Artificial Intelligence Act, which is a comprehensive legal framework to regulate AI. This regulation uses a risk-based approach, where AI applications are categorized based on the potential risk they pose to society (Erdélyi & Goldsmith, 2022). Low-risk AI applications, such as chatbots, are more loosely regulated, while applications that are considered high-risk, such as AI systems in healthcare or law enforcement, are subject to stricter oversight (European Commission, 2021). This risk-based approach aims to ensure that AI can be used safely without limiting technological innovation in low-risk sectors (Ricciardi Celsi, 2023). However, despite the strong privacy protections and risk management in the European Union, some critics claim that these regulations can stifle technological innovation. Tech startups based in Europe face challenges in complying with the strict GDPR standards, which may limit their innovation space. In addition, the risk-based approach in the Artificial Intelligence Act could potentially delay the adoption of AI in critical sectors as companies have to meet complex compliance requirements (Mittelstadt *et al.*, 2016).

3.1.7 Regulation in the United States: Flexibility and Innovation

In contrast to the European Union, the United States takes a more flexible and decentralized approach to regulating the use of artificial intelligence (AI). Instead of having one comprehensive national regulation like the EU's General Data Protection Regulation (GDPR), the United States relies on an industry- and sector-based regulatory framework (Mokander *et al.*, 2024). This means AI regulation in the US varies depending on the sector being regulated, such as finance, healthcare, or education, with multiple laws related to AI use in each of these sectors (Horneber & Laumer, 2023). This approach encourages technological innovation, as these sectors have greater freedom to develop and implement AI technologies without being restricted by strict regulations (Caplan, 2018). One prominent piece of legislation in the United States related to AI regulation is the Algorithmic Accountability Act proposed in 2019 (US Congress, 2023). This law requires companies to conduct impact evaluations of the algorithms they develop, specifically in terms of privacy, transparency, and potential discrimination (Tillu *et al.*, 2023).

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Companies that use AI for automated decision-making are required to evaluate whether their systems introduce bias or unfairness, especially in contexts such as hiring, lending, or legal decisions (Caplan, 2018). While these laws are a step forward in AI regulation, implementation is still limited, and many large tech companies operate with minimal oversight from the federal government (Ricciardi Celsi, 2023). A key advantage of the United States' approach is the flexibility given to tech companies to innovate without being hindered by overly strict regulations (Buhmann *et al.*, 2020). This has allowed the United States to become a global center of technological innovation, with many startup companies and tech giants such as Google, Facebook, and Amazon continuing to develop advanced AI technologies (Selbst, 2021). This flexibility has also enabled the application of AI in critical sectors such as education and healthcare, where AI technologies are used to improve efficiency, data analysis, and personalization of services (Crawford & Calo, 2016). However, this flexibility also brings some disadvantages. As there are no strict national regulations, many AI systems are implemented without adequate oversight. This raises concerns related to data privacy, security, and potential discrimination in the use of AI. Some studies show that poorly regulated AI systems can result in algorithmic bias, which can disadvantage certain groups in society, especially in job recruitment or lending (Oladele *et al.*, 2024). Furthermore, the lack of strong regulation means that tech companies are often not transparent in explaining how their AI systems operate, which reduces public accountability and control over such technologies (Erdélyi & Goldsmith, 2022).

3.1.8 Regulation in Singapore: Responsible Innovation

Singapore is recognized as one of the countries with a progressive approach to artificial intelligence (AI) regulation, focusing on the balance between encouraging innovation and ensuring social responsibility (Falco *et al.*, 2021). This approach is articulated through the Model AI Governance Framework launched in 2020 by the Personal Data Protection Commission (PDPC). The framework is designed to provide guidelines for organizations to use AI in a safe, transparent, and responsible manner (IMDA, 2020). This regulation offers flexibility that allows AI innovation to flourish without neglecting the principles of ethics and social responsibility. One of the core principles of the framework is transparency and accountability, where AI developers are required to explain how their AI systems work and how decisions are made by the algorithms (Frana, 2024). Developers are also encouraged to disclose relevant information to users about how AI processes their data, as well as ensure that the data used is accurate and unbiased (IMDA, 2020). In this context, Singapore encourages companies to implement algorithmic audits and conduct periodic evaluations of the AI systems they use, especially in applications that have a large social impact, such as in the education and finance sectors (Zhang *et al.*, 2023). Singapore's approach also focuses on social responsibility in the use of AI. Singapore regulations emphasize that AI should be used in a way that does not discriminate or exacerbate social injustice. To support this, the Singapore government actively facilitates cooperation between the public and private sectors in developing ethical standards for the use of AI. Singapore has even launched various initiatives to build an ethical AI ecosystem, including a certification program for companies that develop AI responsibly (Holmes *et al.*, 2022).

This creates an environment that allows technological innovation to occur within a clear ethical corridor, which is essential for maintaining public trust in AI. Flexibility is also a key element in Singapore's AI regulation. Unlike the European Union which has a stricter risk-based approach, Singapore adopts more flexible regulations, allowing startup companies and technology developers to innovate faster (Taeihagh, 2021). The education sector, for example, has leveraged AI technology for personalization of learning and analysis of student performance, while the financial sector uses AI to analyze risk and detect fraud (Crawford & Calo, 2016). This approach positions Singapore as one of the centers of AI innovation in Asia, with regulations that balance technological growth and social protection (GovInsader, 2023). However, while the flexibility offered by Singapore facilitates innovation, there is criticism that this regulation may still be lacking in terms of stricter enforcement and oversight of companies that do not adhere to ethical standards (Mittelstadt *et al.*, 2016). While algorithmic audits are encouraged, more formal oversight mechanisms are needed to ensure that any

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AI system is truly subject to the standards set (Zhang *et al.*, 2023). The results of a comparative analysis of AI regulations in the European Union, the United States, and Singapore show that Indonesia needs to urgently develop an appropriate regulatory framework to manage both the potential and risks presented by artificial intelligence. As the use of AI increases in strategic sectors such as education, healthcare, finance, and transportation, Indonesia is faced with the challenge of striking a balance between encouraging technological innovation and protecting the public interest from potential misuse of this technology.

1) Privacy and Data Protection
   As seen in the EU's approach through the GDPR and Artificial Intelligence Act, privacy protection and risk management are top priorities in AI regulation (Voigt & Bussche, 2017). In Indonesia, data privacy protection is very important, especially in the context of AI that relies on big data to operate. The use of AI in the education and healthcare sectors, for example, requires strict safeguards on the personal data of students and patients. However, Indonesia currently lacks a strong legal framework for data privacy protection in the context of AI. Therefore, adopting elements from the GDPR that focus on individual control over personal data will be crucial for Indonesia to ensure that AI technologies are not misused.
2) Transparency and Accountability
   One of the biggest concerns regarding the use of AI is the lack of transparency in decision-making by algorithms. In some cases, AI algorithms may produce unexplained decisions, potentially leading to discrimination or bias (Mittelstadt *et al.*, 2016). Singapore's approach of encouraging algorithmic audits and transparency in AI processes can be a good model for Indonesia to ensure that AI systems used in critical sectors are accountable. In addition, algorithmic audits can help ensure that AI systems do not contain biases that disadvantage certain groups of people, especially in the context of public service delivery or finance.
3) Flexibility for Innovation
   The United States' more flexible approach to AI regulation is driving rapid innovation, especially in the tech and startup sectors. In Indonesia, the digital technology sector is booming, with many local startups starting to adopt AI to improve their services, especially in the fintech, transportation, and e-commerce sectors (Caplan, 2018). While Indonesia needs to adopt privacy and social responsibility protections as implemented in the European Union and Singapore, it is also important to leave room for innovation. Overly restrictive regulations can hinder the development of the local tech sector, so Indonesia must find a balance between regulations that protect public privacy and flexibility that encourages innovation.
4) Social Responsibility and Ethics
   Social responsibility is an important element in the use of AI, especially in the context of the potential social impacts generated by these technologies. As outlined in Singapore's approach, AI social responsibility should be prioritized, with development companies required to ensure that their AI technologies do not create injustice or exacerbate social inequality (Taeihagh, 2021). Indonesia needs to ensure that the use of AI does not reinforce bias or discrimination, especially in public services such as health and education, where equality of access is crucial. Therefore, regulations that promote social responsibility and ethical auditing can help ensure that AI is used for the common good.
5) Supervision and Law Enforcement
   Indonesia also needs strong oversight institutions to regulate and monitor the use of AI in the public and private sectors. As seen from the cases of Singapore and the European Union, effective oversight is needed to ensure that any violations of AI regulations are addressed immediately (Goodman Bryce & Flaxman Seth, 2017). This oversight should also include periodic audits of algorithms, as well as ensuring that companies using AI comply with applicable ethical and legal standards. In Indonesia, the establishment of an independent agency tasked with monitoring AI implementation could be a solution to ensure that this technology is used in a safe and ethical manner.

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3.1.9 Implications for Indonesia's AI Regulations

1) Indonesia's Specific Needs

Indonesia faces complex challenges in regulating artificial intelligence (AI) due to the high adoption rate of the technology and the variety of sectors that are already using AI. However, despite the increasing use of this technology, legal and regulatory frameworks that protect users and ensure the safe use of AI are still lacking. This puts Indonesia in a vulnerable situation, where potential negative impacts of AI-including data misuse, social injustice, and discrimination-could occur if not immediately anticipated.

a) Education Sector

Education is one of the key sectors in Indonesia that has begun to adopt AI technologies, especially for learning personalization, student performance analysis, and online classroom management. However, with the widespread use of these technologies, there is an urgent need for the protection of students' personal data. The data generated by AI systems in education is highly sensitive, covering academic performance, family background, and student health information. Without strong regulations, there is a risk of misuse or leakage of such data. In addition, AI used to assess student performance must be monitored so as not to produce biased or discriminatory assessments (Soelistiono & Wahidin, 2023).

c) Financial Sector

AI in the financial sector, such as in fintech and insurtech, is increasingly being used for risk analysis, fraud detection, and data-driven financial services. However, Indonesia currently lacks adequate regulations to oversee automated decision-making by AI in this sector. Individual financial data is highly vulnerable to misuse if not properly regulated. In addition, AI systems in this sector have the potential to influence people's access to credit or other financial services, which could lead to bias or social injustice. Therefore, regulations that protect users and ensure transparency in AI-based decision making are urgently needed (Adeyelu *et al.*, 2024).

d) Health Sector

AI in the healthcare sector is starting to be applied to diagnosis, treatment, and patient data management. The use of AI in image-based diagnosis, for example, helps doctors make faster and more accurate decisions. However, this technology also requires access to highly sensitive patient health data. Without clear regulations, there is potential for data misuse, bias in diagnosis, or non-transparent automated medical decision-making. The absence of strong rules regarding data privacy and protection in the healthcare sector can pose risks to patients, especially if the data falls into the hands of unauthorized parties (Meiliana *et al.*, 2019).

Legal Challenges The absence of comprehensive laws to protect user data, especially in sensitive sectors such as education, finance, and health, is Indonesia's biggest challenge in adopting AI. So far, although the Personal Data Protection Law (PDP Law) has been passed, its implementation has not been comprehensive (Jannah, 2022). This law needs to be harmonized with more specific regulations related to AI, given the evolving nature of this technology and its integration into various fields. Without regulations that can keep up with the development of AI, the risk of privacy violations, data abuse, and social injustice will be greater in the future (Tomašev *et al.*, 2020). Regulatory Framework Indonesia needs an adaptive and sustainable regulatory framework to protect the public interest. This regulation should be able to regulate the use of AI in priority sectors by emphasizing privacy protection, data security, transparency, and accountability in AI-automated decision-making. The establishment of an independent oversight institution with the authority to enforce regulations and conduct audits of AI technologies used in various sectors is also urgently needed.

2) Recommendations for AI Regulation Model in Indonesia

Based on the comparative analysis of AI regulations from the European Union, the United States, and Singapore, as well as the regulatory diagram you have uploaded earlier, Indonesia needs a

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regulatory model that is gradual and adaptive to balance privacy protection, transparency, innovation, and social and ethical responsibility

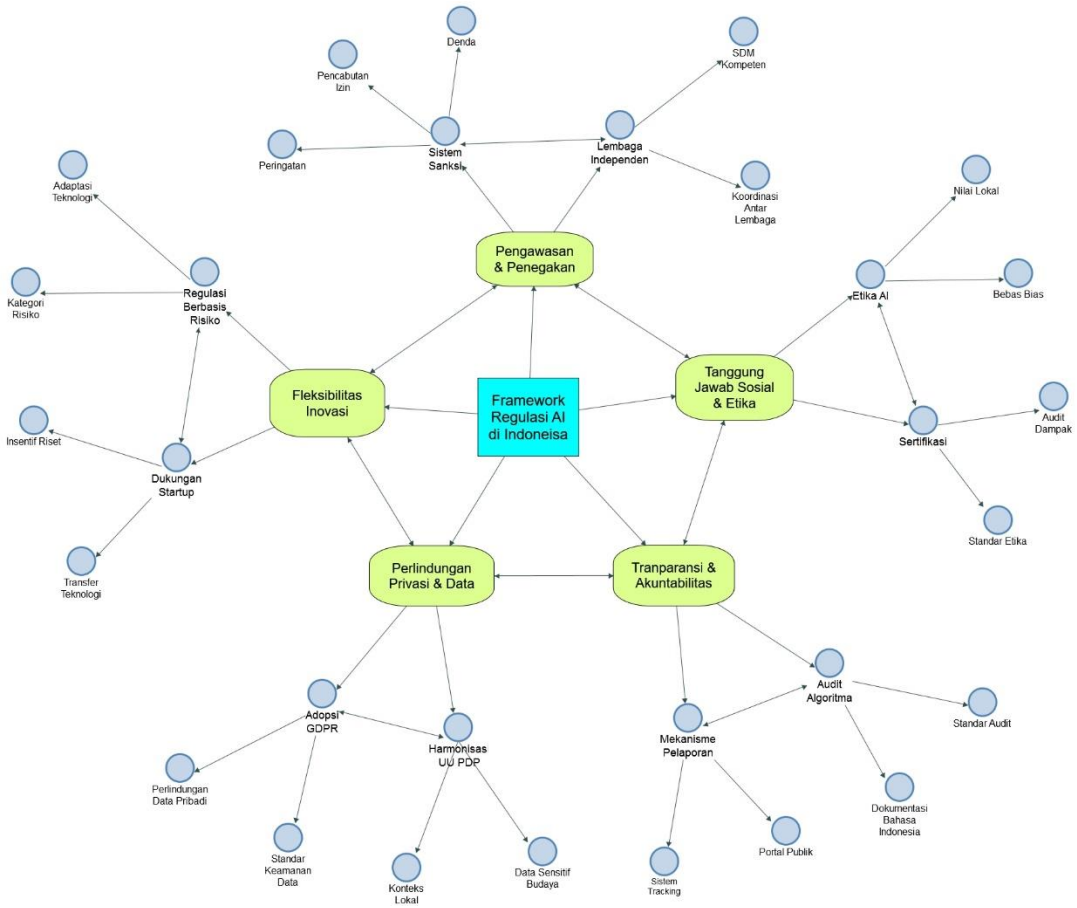

Figure 1. Framework Model for AI Regulation in Indonesia

Indonesia can adopt the key principles of the European Union's General Data Protection Regulation (GDPR) to ensure strict protection of personal data, particularly in AI applications handling sensitive data like health and cultural information. Regulations should be harmonized with the existing Personal Data Protection Law (PDP Law), taking into account local cultural aspects and national needs. Clear sanctions, such as fines or license revocation, must be outlined for entities that violate personal data protection rules, and an independent agency should oversee these regulations, conducting regular audits and enforcing compliance. All AI systems must undergo regular algorithm audits to ensure fairness and transparency, with audit standards documented in Bahasa Indonesia. Additionally, a public reporting mechanism should be established, allowing citizens to report violations or issues with AI use, and AI systems should be certified to ensure they are free from bias and aligned with local values. Ethical standards must be adhered to by developers to prevent bias in decision-making, ensuring that AI is used fairly and for the common good. Regular social impact audits should be conducted to assess the ethical and social consequences of AI in sectors such as health, education, and public services, with a focus on preventing bias that may disadvantage certain groups. Regulations should foster innovation by supporting local startups with research incentives and policies that adapt AI technology to Indonesia's needs, while applying a risk-based approach where high-risk AI applications face stricter supervision. Collaboration between the government, universities, and the private sector should be encouraged to facilitate technology transfer and sustainable AI development. An independent AI supervisory agency should be established to monitor

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compliance, with inter-agency coordination to ensure effective enforcement across sectors such as education, health, and finance. The agency should be staffed with competent professionals with expertise in AI technology, law, and public policy. The implementation of AI regulations in Indonesia should follow a phased approach. In the preparation stage, regulations should be drafted, incorporating elements from global standards like the GDPR, risk-based regulation, and innovation flexibility, with public consultations involving stakeholders from the government, industry, academia, and civil society. After incorporating feedback, the regulatory framework should be finalized. During the basic stage, data protection standards must be implemented, and minimum standards for AI use, including transparency, audits, and documentation requirements, should be established to minimize risks. In the development stage, AI systems should undergo audits to ensure they meet ethical standards, with certification granted to systems that pass the audits. An independent supervisory agency should monitor the implementation and take action against violations. The reinforcement stage involves full enforcement of the regulations, with legal sanctions applied to entities that fail to comply. Periodic evaluation of the effectiveness of the regulations should also be conducted, with adjustments made as necessary to keep pace with technological developments and societal needs.

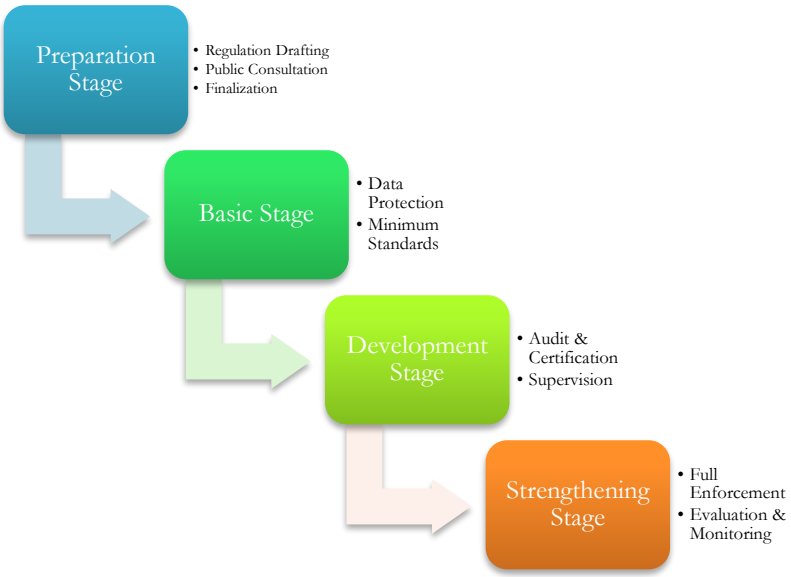

Figure 2. Stages of AI Regulation Implementation in Indonesia

3.2 Discussion

The implementation of Artificial Intelligence (AI) in Indonesia presents significant opportunities for digital transformation across sectors such as education, healthcare, and finance. However, it also brings substantial challenges, particularly in data privacy protection, algorithm transparency, innovation, and social responsibility. To address these challenges, Indonesia can draw upon best practices from developed countries, such as the European Union (EU), the United States, and Singapore, to develop a more robust and adaptive regulatory framework for AI. Data protection is a critical issue, especially given that AI systems rely heavily on the collection and processing of personal, often sensitive, data. The European Union's General Data Protection Regulation (GDPR) provides a high standard for data protection, ensuring individuals have control over their data (Voigt & Bussche, 2017). Indonesia can adopt key principles from the GDPR and harmonize them with its existing Personal Data Protection (PDP) Law, while considering local social and cultural contexts (Jannah, 2022). Clear sanctions, ranging from warnings to license revocation, should be established to enforce these regulations, ensuring compliance by entities handling personal data (Erdélyi & Goldsmith, 2022).

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Moreover, an independent regulatory agency should be empowered to conduct regular audits and enforce compliance, guaranteeing that data privacy and security are maintained. Transparency and accountability in AI algorithms are also fundamental to building public trust. In the EU, the AI Regulation mandates transparency, especially for high-risk applications, requiring developers to explain how their systems work and provide technical documentation (Commission, 2021). Indonesia can implement similar requirements by mandating regular algorithm audits to ensure fairness and transparency in AI systems (Bryce & Seth, 2017). Additionally, a public reporting mechanism should be put in place, allowing citizens to report issues or violations, and AI systems should be certified to ensure they are free from bias and aligned with local values (Falco *et al.*, 2021). Social responsibility and ethics are crucial in preventing AI from exacerbating societal inequalities. Research by Mittelstadt *et al.* (2016) emphasizes that AI systems, if left unchecked, can worsen existing biases, particularly when the data used is unrepresentative or biased. Thus, Indonesia must ensure that AI developers adhere to strict ethical standards to prevent discrimination and ensure that AI is used for the common good (Mokander *et al.*, 2024). Regular social impact audits should be conducted to assess the effects of AI on society, especially in critical sectors like healthcare, education, and public services. This will ensure that AI does not perpetuate biases or inequality (Taeihagh, 2021). While it is essential to regulate AI, overly stringent regulations can stifle innovation, which is critical for advancing Indonesia's technological sector. The United States, for example, adopts a more flexible regulatory approach that allows tech companies to innovate while minimizing regulatory barriers (Crawford & Calo, 2016). Indonesia can adopt a similar risk-based approach, where AI applications are classified based on the level of risk they pose. Low-risk AI applications could face fewer regulations, while high-risk applications, such as those used in healthcare or law enforcement, would be subject to stricter oversight (Ricciardi Celsi, 2023). This will allow Indonesia to foster innovation without compromising safety and public interest.

Effective oversight is also essential to ensure the proper implementation of AI regulations. In Singapore, a collaborative model between regulators and industry players has proven successful in promoting compliance with ethical AI standards (IMDA & PDPC, 2020). Indonesia can establish an independent supervisory agency with the authority to conduct audits and enforce regulations across various sectors, such as education, healthcare, and finance, where AI is increasingly being deployed (Zhang *et al.*, 2023). Inter-agency coordination will also be crucial to ensure that regulations are consistently applied and enforced across different industries (Bryman & Bell, 2019). The implementation of AI regulations in Indonesia should follow a phased approach. In the preparation stage, regulations should be drafted by adopting key elements from global frameworks, such as the EU's GDPR and risk-based approach from Singapore, while engaging in public consultations to ensure the regulations are appropriate to local conditions (Celsi, 2023). In the basic stage, high standards for data protection and regular algorithm audits should be implemented. In the development stage, AI systems should undergo audits and be certified to meet ethical standards. An independent supervisory agency should be established to monitor compliance, take corrective actions, and enforce penalties for violations. In the reinforcement stage, full enforcement of the regulations should be implemented, and periodic evaluations should be conducted to ensure the regulations remain relevant to technological advancements and societal needs (Mittelstadt *et al.*, 2016). In conclusion, Indonesia must develop a balanced AI regulatory framework that ensures data protection, algorithm transparency, innovation, and social responsibility. By adopting key principles from global best practices such as the EU's GDPR and Singapore's risk-based approach, Indonesia can build an effective regulatory system that promotes innovation while safeguarding public interests. Strong oversight, through an independent agency with enforcement powers, is critical for ensuring that AI technologies are used responsibly and ethically. By developing adaptive and context-specific AI regulations, Indonesia can harness the potential of AI while protecting individual rights and promoting social equity.

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4. Conclusion

The regulation of artificial intelligence (AI) is a strategic challenge that involves not only technical aspects, but also ethical values, human rights, and social governance. The results of a comparative analysis of three main jurisdictions—the European Union, the United States, and Singapore show that there is no single ideal approach, but each has strengths that can be used as a reference. The European Union emphasizes data protection and a strict risk-based approach through the GDPR and the Artificial Intelligence Act, making the right to privacy the main pillar in the use of AI. The United States, on the other hand, adopts a more flexible approach to encourage innovation, with an emphasis on algorithm auditing and sectoral accountability through the Algorithmic Accountability Act. Singapore offers a balanced model that combines transparency, flexibility, and social responsibility, with ethical guidelines integrated into the AI governance framework. For Indonesia, an important lesson to be learned is the need to develop a comprehensive, adaptive, and contextual AI regulatory framework. These regulations must protect personal data, guarantee algorithmic transparency and accountability, and still leave room for inclusive and responsible innovation. A risk-based approach such as that applied in the European Union can be used to categorize AI applications based on their potential impact, so that oversight can be carried out proportionately. Indonesia also needs to adopt algorithmic audit mechanisms and ethical standards in technology development, as applied in Singapore and the United States.

Furthermore, the establishment of an independent AI supervisory agency is a strategic step to ensure compliance and bridge the dialogue between policy makers, technology developers, and the community. This institution can be tasked with developing implementation guidelines, overseeing algorithm audits, and handling legal violations related to the use of AI. With the right regulatory framework, Indonesia can maximize the potential of AI for national development without compromising the principles of social justice, transparency, and citizens' rights. This study provides a normative basis for the development of AI regulations in Indonesia and can serve as a reference for policymakers in formulating a national AI strategy that balances innovation and public protection. Further studies are needed to test the effectiveness of the proposed regulations in the context of implementation in priority sectors, such as health, finance, education, and digital government.

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