



Legal Liability of Autonomous Artificial Intelligence Systems in Emerging Regulatory Frameworks A Comparative Perspective from Indonesia

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ABSTRACT

The development of autonomous Artificial Intelligence (AI) systems has created new legal challenges regarding the determination of liability for damages caused by AI-based systems. This study aims to analyze the legal liability of autonomous AI systems within emerging regulatory frameworks and to compare Indonesia's regulatory readiness with the regulatory model of the European Union. The research employed a normative juridical method using statutory, conceptual, and comparative approaches. Primary and secondary legal materials were obtained from legislation, policy documents, and international AI governance instruments, including the Personal Data Protection Law, the Electronic Information and Electronic Transactions Law, and the European Union AI Act. The findings indicate that AI regulation in Indonesia remains sectoral and does not specifically regulate the liability of autonomous AI systems.

INTRODUCTION

The rapid development of autonomous Artificial Intelligence (AI) technologies has significantly transformed global economic structures, legal systems, and digital governance practices across various sectors, including finance, transportation, healthcare, cybersecurity, and public administration. Autonomous AI systems are increasingly capable of performing independent decision-making processes without direct human intervention, thereby creating substantial legal implications regarding accountability, transparency, and liability for damages caused by algorithmic actions. The integration of AI technologies within industrial and governmental systems has accelerated alongside the expansion of digital transformation initiatives and Industry 4.0 implementation in both developed and developing countries (Kerber, 2022). In response to these technological developments, the European Union introduced the European Union Artificial Intelligence Act as a comprehensive risk-based regulatory framework aimed at ensuring transparency, accountability, human oversight, and consumer protection in AI governance (Hacker, 2023). In Indonesia, AI technologies have increasingly been implemented in financial technology platforms, digital commerce systems, biometric surveillance, healthcare services, and smart public administration; however, the legal framework governing autonomous AI liability remains fragmented and insufficiently regulated, thereby creating legal uncertainty for developers, operators, and users of AI systems (Siregar & Wibowo, 2024).

The increasing use of autonomous AI systems has generated growing concerns regarding ethical violations, algorithmic discrimination, cybersecurity threats, and erroneous automated decision-making processes affecting individuals and institutions globally. Several contemporary studies have demonstrated that AI-based systems may produce biased outcomes due to opaque algorithmic structures, insufficient human supervision, and uncontrolled machine-learning adaptation mechanisms (Nemitz, 2021). Furthermore, autonomous AI systems operating independently from explicit human commands create substantial challenges in determining legal liability when algorithmic actions result in economic losses, privacy violations, or public harm (Abbott, 2022). Existing international regulatory discussions increasingly emphasize the importance of adaptive legal governance capable of addressing AI-related risks while simultaneously supporting technological innovation and economic development (Cihon, 2023). Nevertheless, many developing countries, including Indonesia, continue to face regulatory limitations due to the absence of comprehensive legal frameworks specifically addressing liability allocation for autonomous AI systems within emerging digital governance ecosystems (Arifin & Nugroho, 2023).

In Indonesia, existing legal instruments such as Electronic Information and Transactions Law and Personal Data Protection Law primarily regulate electronic systems, cybersecurity practices, and personal data protection rather than establishing explicit legal responsibility for autonomous AI behavior. The absence of specific AI liability provisions creates significant legal ambiguity regarding the allocation of accountability among developers, software providers, operators, and end users of AI technologies. This condition becomes increasingly problematic as AI technologies continue to expand into high-risk sectors such as autonomous transportation, digital finance, predictive policing, healthcare diagnostics, and public decision-making systems (Buiten, 2022). In comparison, the European Union has adopted a more structured regulatory approach through the European Union Artificial Intelligence Act, which categorizes AI systems according to risk classifications and establishes obligations concerning transparency, accountability, and human oversight (Madiega, 2021). Consequently, Indonesia's current regulatory framework demonstrates significant limitations in addressing future legal disputes involving autonomous AI technologies and algorithmic decision-making systems.

Recent scholarly discussions concerning AI governance have predominantly focused on ethical principles, transparency requirements, human rights protection, and cybersecurity governance rather than comprehensively examining liability allocation for autonomous AI systems within comparative legal frameworks. Research conducted by Bennett Moses and Chan (2022) highlighted the necessity of adaptive legal mechanisms for regulating emerging technologies but did not extensively examine civil liability attribution for autonomous AI systems in developing legal jurisdictions. Similarly, studies by Wagner (2023) explored the regulatory implications of the European Union Artificial Intelligence Act yet provided limited contextual analysis concerning its applicability within Southeast Asian regulatory environments. Indonesian scholarship concerning AI governance has generally concentrated on digital ethics, electronic transactions, and fintech supervision while relatively few studies have specifically analyzed legal liability allocation for autonomous AI behavior under comparative regulatory approaches (Kusuma & Ramadhan, 2022). This condition indicates the existence of a substantial research gap regarding the harmonization of international AI liability principles with Indonesia's evolving legal and technological governance framework. Therefore, this study seeks to address these limitations through a comparative legal analysis focusing on autonomous AI liability between Indonesia and the European Union regulatory model.

The novelty of this study lies in its specific examination of legal liability allocation for autonomous Artificial Intelligence systems within emerging regulatory frameworks from a comparative Indonesian perspective. Previous studies have primarily emphasized ethical AI governance, cybersecurity protection, or digital privacy concerns without comprehensively analyzing liability attribution mechanisms applicable to autonomous AI technologies operating independently from direct human control. This study integrates comparative legal analysis, statutory interpretation, and conceptual examination to evaluate Indonesia's regulatory readiness in addressing AI-related liability disputes. In addition, the study critically analyzes the compatibility between Indonesia's current legal framework and international AI governance standards established by the European Union Artificial Intelligence Act and related global regulatory principles (Schuett, 2023). By focusing on legal accountability mechanisms for autonomous AI systems, this research contributes to the expansion of contemporary legal discourse concerning technology governance and digital regulatory adaptation within developing countries.

Theoretically, this research contributes to the development of contemporary technology law, cyber law, and AI governance studies by expanding the conceptual understanding of legal liability attribution within autonomous technological systems. The study also enriches comparative legal scholarship by examining the interaction between emerging AI governance principles and Indonesia's evolving digital regulatory framework. Practically, the findings are expected to provide policy recommendations for legislators, regulators, technology companies, and public institutions in formulating adaptive legal frameworks capable of ensuring legal certainty, accountability, transparency, and consumer protection within AI-based ecosystems. Furthermore, this study is expected to support the development of responsible AI governance practices capable of balancing technological innovation with legal protection and public trust (Gless et al., 2021). The establishment of a clear legal liability framework is essential to minimize regulatory uncertainty and strengthen institutional preparedness in addressing future technological disputes involving autonomous AI systems.

This study aims to analyze the legal liability of autonomous Artificial Intelligence systems within emerging regulatory frameworks and to evaluate Indonesia's regulatory readiness through a comparative perspective with the European Union AI governance model. The study further seeks to identify regulatory gaps, accountability limitations, and legal challenges associated with the implementation of autonomous AI technologies within Indonesia's digital governance environment. In addition, this research examines the extent to which existing Indonesian legal regulations are capable of accommodating future legal disputes arising from autonomous AI operations and algorithmic decision-making systems. Through a comparative legal approach, the study also evaluates international best practices that may serve as references for strengthening Indonesia's future AI regulatory framework. Ultimately, this research is expected to contribute toward the formulation of a more comprehensive, adaptive, and

accountable AI governance framework capable of ensuring sustainable digital innovation and legal certainty in Indonesia.

THEORETICAL REVIEW

Autonomous Artificial Intelligence and Legal Responsibility Theory

The development of Autonomous Artificial Intelligence (AI) has transformed the paradigm of legal responsibility within modern digital technology systems. Autonomous AI no longer merely functions as a technological support tool but has evolved into a system capable of conducting independent decision-making processes through machine learning mechanisms and adaptive algorithms. From the perspective of modern legal theory, this condition has shifted the concept of liability from human-centered responsibility toward technology-assisted accountability, which requires new regulatory approaches (Turner, 2021). Legal liability theory explains that legal responsibility arises when an action causes harm to another party, whether through fault, negligence, or strict liability in high-risk activities (Balkin, 2022). In the context of autonomous AI, liability attribution becomes increasingly complex because system decisions are not always under direct human control, thereby creating a responsibility gap among developers, operators, and users of AI technologies (Mokrynski, 2023).

Studies concerning AI liability are also closely related to risk society theory developed within modern technology governance studies. AI technologies generate new risks in the form of algorithmic bias, autonomous decision failure, privacy infringement, and cyber vulnerability that directly affect the rights of digital society (Renda, 2022). Research conducted by Pasquale (2021) emphasized that black-box AI systems create difficulties in determining responsible parties when damages occur as a result of algorithmic decisions. Furthermore, research by Wischmeyer and Rademacher (2020) demonstrated that traditional legal approaches are not yet fully capable of accommodating autonomous systems characterized by self-learning capabilities and continuous adaptation. Therefore, the development of an AI liability framework has become essential for ensuring legal certainty, consumer protection, and accountability within contemporary digital technology governance.

Regulatory Governance and Comparative Legal Frameworks

The concept of regulatory governance in AI governance emphasizes the importance of adaptive regulations capable of balancing technological innovation with legal protection and public interests. In recent years, the European Union has become one of the most progressive global actors in developing AI regulation through the European Union Artificial Intelligence Act. The regulation adopts a risk-based regulatory approach that classifies AI systems according to levels of risk, ranging from minimal-risk systems to unacceptable-risk systems (Veale, 2021). This approach is considered more comprehensive because it not only regulates technical aspects of AI technology but also integrates the principles of transparency, accountability, explainability, and human oversight in AI implementation (Smuha, 2022). Meanwhile, research conducted by De Gregorio (2023) indicated that risk-based regulatory models

provide more effective legal flexibility in responding to the highly dynamic and complex development of AI technologies.

In Indonesia, AI-related regulations remain dispersed across various sectoral legal instruments and have not yet formed an integrated legal framework specifically governing autonomous AI liability. Existing relevant regulations include Law Number 27 of 2022 concerning Personal Data Protection and Law Number 11 of 2008 concerning Electronic Information and Transactions, which primarily focus on data protection, electronic systems, and digital transaction security. Research conducted by Ramli and Putri (2023) explained that Indonesia's regulatory framework still faces substantial limitations in regulating liability for autonomous decision-making systems because no specific legal definitions or classifications of AI currently exist. This condition differs significantly from the regulatory approach adopted within Europe, where AI governance frameworks have been developed through preventive regulation and ex-ante compliance obligations (Helberger & Diakopoulos, 2023). Therefore, a comparative legal approach becomes essential for evaluating Indonesia's regulatory readiness in addressing global AI developments.

Algorithmic Accountability and Consumer Protection

The issue of algorithmic accountability has become one of the primary concerns within AI legal discourse because algorithmic decisions may directly affect the economic, social, and legal rights of society. In practice, autonomous AI systems have been utilized in credit scoring, healthcare diagnostics, predictive policing, and automated recruitment systems, all of which potentially generate algorithmic discrimination and non-transparent decisions (Zarsky, 2021). Research conducted by Citron and Pasquale (2022) demonstrated that the lack of explainability in AI systems makes it difficult for users to understand the basis of algorithmic decisions affecting their rights. Additionally, research by Selbst (2021) explained that unclear liability attribution within AI systems may weaken consumer protection mechanisms and increase the risk of legal uncertainty in digital dispute resolution.

Within the Indonesian context, consumer protection concerning AI utilization continues to face significant regulatory challenges, particularly regarding data transparency, digital security, and accountability for automated decisions. Research conducted by Prasetyo and Hidayah (2024) revealed that the implementation of AI within Indonesia's financial technology sector has not yet been accompanied by adequate legal accountability mechanisms for algorithmic errors and misuse of personal data. Furthermore, regulations concerning automated decision-making within Indonesia's legal system remain implicit and fragmented across sectoral regulations, thereby failing to provide strong legal certainty for digital society. Research conducted by Kamarinou (2022) also emphasized that legal protection for AI users requires integration among data protection law, consumer protection law, and AI-specific regulation to more effectively reduce the risks of algorithmic discrimination and autonomous harm. Therefore, strengthening algorithmic accountability mechanisms is highly important for establishing responsible AI governance oriented toward public protection.

Research Gap and Importance of the Study

Previous studies concerning Artificial Intelligence have predominantly focused on digital ethics, data privacy, cybersecurity governance, and algorithmic transparency without comprehensively examining liability allocation within autonomous AI systems from a comparative legal perspective. Research conducted by Floridi (2021) primarily emphasized ethical governance aspects in AI development, whereas research conducted by Cobbe (2023) focused on explainability and fairness within automated decision systems. On the other hand, studies in Indonesia continue to predominantly discuss personal data protection, electronic transactions, and financial technology regulation without developing liability frameworks specifically governing the legal responsibility of autonomous AI systems (Firmansyah & Nugraheni, 2023). This condition indicates the existence of a significant research gap concerning the harmonization between international liability principles and Indonesia's national regulatory readiness in addressing AI-based legal disputes. Therefore, this study is important because it offers a comparative legal analysis between Indonesia and the European Union in developing a more adaptive, accountable, and legally certain AI liability framework within the era of global digital transformation.

METHODOLOGY

Research Design and Approach

This study employed a qualitative legal research approach using a normative juridical method combined with comparative legal analysis. The normative juridical approach was selected because the research focuses on examining legal norms, statutory regulations, legal doctrines, and international governance frameworks concerning the legal liability of autonomous Artificial Intelligence (AI) systems. According to legal research theory, normative juridical research is appropriate for analyzing legal principles, regulatory consistency, and legal system harmonization within emerging technological governance frameworks (Taekema, 2021). This study also adopted a comparative legal approach to evaluate differences and similarities between Indonesia's AI-related regulations and the regulatory framework established by the European Union through the European Union Artificial Intelligence Act. Furthermore, a conceptual approach was utilized to analyze theories of legal liability, algorithmic accountability, strict liability, risk governance, and digital regulatory adaptation within autonomous AI systems (Michaels & Hilgendorf, 2022).

Sources of Legal Materials and Data Collection Techniques

The study utilized both primary and secondary legal materials obtained through documentation and literature review techniques. Primary legal materials consisted of national and international regulations relevant to AI governance and legal liability, including Law Number 27 of 2022 concerning Personal Data Protection, Law Number 11 of 2008 concerning Electronic Information and Transactions, the European Union Artificial Intelligence Act, the General Data Protection Regulation, and regulatory policy documents issued by international digital governance institutions. Secondary legal materials included international journal articles, books, conference proceedings, legal

commentaries, policy reports, and scholarly publications discussing AI governance, legal responsibility, and comparative cyber law. The selection of literature sources was conducted purposively based on relevance, academic credibility, publication recency, and alignment with the research objectives (Flick, 2022). Data collection was carried out through systematic document analysis using digital academic databases such as Scopus, ScienceDirect, SpringerLink, HeinOnline, Google Scholar, and institutional legal repositories to ensure the reliability and validity of legal references used within the study.

Data Classification and Legal Material Analysis

The collected legal materials were classified into several analytical categories, including AI governance principles, liability attribution models, algorithmic accountability mechanisms, consumer protection regulations, and comparative regulatory frameworks. This classification process aimed to facilitate systematic legal interpretation and comparative analysis between Indonesia's legal framework and international AI governance models. Legal materials were then analyzed using statutory interpretation techniques, conceptual legal analysis, and comparative legal interpretation methods (Van Hoecke, 2021). The statutory approach focused on examining the consistency and adequacy of existing Indonesian regulations in governing autonomous AI liability, particularly concerning electronic systems, data protection, and digital accountability. Meanwhile, the comparative approach examined the legal structure, risk classification, compliance obligations, and accountability mechanisms established under the European Union Artificial Intelligence Act to identify best practices potentially applicable within Indonesia's digital legal ecosystem (Brownsword, 2023). Through this analytical process, the study sought to identify regulatory gaps, legal ambiguities, and institutional limitations concerning liability allocation for autonomous AI systems.

Research Procedures and Analytical Stages

The research was conducted through several systematic stages to ensure methodological consistency and analytical rigor. The initial stage involved identifying legal problems related to liability attribution within autonomous AI systems through preliminary literature review and regulatory mapping. The second stage focused on collecting and selecting relevant legal materials, including statutory regulations, international legal instruments, scholarly publications, and policy reports concerning AI governance and digital accountability. The third stage involved categorizing legal materials according to thematic issues such as autonomous decision-making, algorithmic transparency, legal responsibility, and consumer protection mechanisms (Klabbers, 2022). Subsequently, the legal materials were interpreted and comparatively analyzed to evaluate Indonesia's regulatory readiness in addressing legal disputes involving autonomous AI systems. The final stage consisted of synthesizing analytical findings to formulate policy recommendations and conceptual frameworks aimed at strengthening adaptive AI governance and legal certainty within Indonesia's emerging digital regulatory environment.

Validity, Reliability, and Research Credibility

To ensure the credibility and trustworthiness of the study, legal material triangulation and source validation techniques were applied throughout the research process. Triangulation was conducted by comparing statutory regulations, scholarly publications, international governance frameworks, and institutional policy documents to minimize interpretative bias and strengthen analytical consistency (Yin, 2021). In addition, the study utilized peer-reviewed international journal articles and officially published legal documents to maintain the academic reliability of legal interpretations and comparative analyses. The consistency of legal interpretation was further strengthened through cross-referencing among legal doctrines, international AI governance principles, and comparative legal studies discussing technology liability and digital governance. Furthermore, analytical transparency was maintained by systematically documenting the stages of data collection, legal classification, comparative analysis, and interpretative procedures used throughout the study. This methodological approach was intended to ensure that the research findings remain academically valid, logically coherent, and replicable within future studies concerning AI governance and legal liability.

Analytical Tools and Research Contribution

The legal analysis process was supported by qualitative data management and academic reference tools to improve research organization and analytical efficiency. Reference management software such as Mendeley and Zotero was utilized to organize legal materials, citations, and bibliographic references according to APA 7th edition standards. Meanwhile, thematic coding and comparative categorization of legal materials were conducted manually through qualitative legal interpretation techniques to maintain contextual understanding of regulatory provisions and liability principles. The analytical framework developed within this study integrated comparative legal analysis, statutory interpretation, and governance theory to evaluate Indonesia's readiness in addressing legal challenges associated with autonomous AI systems (Contissa & Lasagni, 2023). Through this methodological framework, the study contributes not only to the development of contemporary technology law and AI governance scholarship but also to the formulation of adaptive legal policy recommendations capable of supporting sustainable digital transformation and legal certainty in Indonesia.

RESEARCH RESULTS AND DISCUSSION

Uncertainty of Legal Liability in Autonomous Artificial Intelligence Systems

The findings of this study indicate that Indonesia's legal system still faces uncertainty in determining legal liability for Autonomous Artificial Intelligence (AI) systems capable of making independent decisions without direct human control. These findings were obtained through an analysis of various national and international regulations demonstrating that there are still no specific rules governing the attribution of legal responsibility for autonomous decision-making systems. In practice, when AI systems generate harm due to algorithmic errors, system failures, or autonomous harm, Indonesia's legal system continues to experience difficulties in determining the responsible party, whether the developer, software provider, operator, or end user of the AI system. This condition reflects the existence of a responsibility gap within Indonesia's AI governance framework, resulting in legal uncertainty in resolving algorithm-based digital disputes. The findings further demonstrate that AI technological development progresses more rapidly than the evolution of legal regulations governing it, causing traditional liability mechanisms to become increasingly inadequate in accommodating autonomous technological systems.

From a regulatory perspective, the study found that Law Number 11 of 2008 concerning Electronic Information and Transactions remains primarily focused on electronic system administration and digital transactions without explicitly regulating the legal responsibility of autonomous AI systems. Article 15 paragraph (1) stipulates that every Electronic System Operator is obligated to operate electronic systems in a reliable, secure, and accountable manner; however, it does not specifically regulate autonomous algorithmic decision-making or liability attribution for autonomous AI. In addition, Law Number 27 of 2022 concerning Personal Data Protection through Article 4 paragraph (1) and Article 5 only regulates the rights of personal data subjects concerning data processing without clarifying legal responsibility for damages caused by autonomous systems. In contrast, the European Union Artificial Intelligence Act has developed a risk-based regulatory approach that regulates the obligations of AI developers and operators according to the level of risk posed by AI systems. Article 9 of the European Union Artificial Intelligence Act regulates risk management systems for high-risk AI, while Article 13 requires transparency obligations for AI providers, thereby enabling liability attribution to be conducted in a more structured and preventive manner (Veale, 2021).

The findings of this study are further reinforced through analysis of the General Data Protection Regulation, OECD AI Principles, UNESCO Recommendation on the Ethics of Artificial Intelligence, as well as various international journal articles concerning comparative cyber law and digital governance. Article 22 of the General Data Protection Regulation grants individuals the right not to be fully subjected to automated decision-making without human intervention, whereas Indonesian regulations have not specifically regulated explainability rights within AI systems. From the perspective of legal liability theory, this condition demonstrates that Indonesia's legal system still applies a human-centered responsibility approach that is less relevant to autonomous systems possessing self-learning and adaptive algorithm

capabilities (Binns, 2022). Research conducted by Sartor and Lagioia (2020) explained that autonomous AI requires a combination of strict liability and regulatory supervision because autonomous technologies generate unpredictable outcomes that cannot always be controlled by humans. Other studies by Ulfbeck et al. (2021) also demonstrated that European countries have begun developing AI-specific liability frameworks to minimize legal uncertainty within digital dispute resolution.

The similarity between this study and previous research lies in the recognition that AI governance requires adaptive regulations based on accountability and transparency. Research conducted by Pagallo (2021) stated that autonomous systems create new challenges for conventional liability concepts because algorithms are capable of generating decisions beyond human prediction. Research by Hacker et al. (2022) also demonstrated that legal responsibility for AI can no longer be imposed solely upon end users because machine learning systems possess a high degree of autonomy. Nevertheless, this study differs from previous research because it specifically analyzes the responsibility gap within the context of harmonizing Indonesian regulations and those of the European Union. The novelty of this research lies in the argument that the primary weakness of Indonesian regulation is not merely the absence of AI-specific regulation, but also the lack of integration of algorithmic accountability principles within the national digital legal system.

Fragmentation of AI Regulation in Indonesia

The findings reveal that AI regulation in Indonesia remains fragmented because its governance is dispersed across various sectoral legal instruments without establishing an integrated national AI legal framework. This condition causes AI supervision to operate inconsistently across sectors, particularly within financial technology, digital commerce, healthcare systems, and biometric surveillance. The study found that existing regulations primarily emphasize data protection and electronic system security rather than regulating liability for autonomous AI. Consequently, Indonesia still lacks an AI governance framework specifically regulating risk classification, accountability mechanisms, and legal obligations for autonomous systems. This fragmentation potentially increases regulatory ambiguity and weakens legal protection for digital society as well as legal certainty for the technology industry.

Analysis of Law Number 11 of 2008 concerning Electronic Information and Transactions demonstrates that Article 16 paragraph (1) only regulates the obligation of Electronic System Operators to ensure the confidentiality, integrity, and availability of electronic information, but does not regulate AI risk classification or conformity assessment obligations for autonomous systems. Meanwhile, Law Number 27 of 2022 concerning Personal Data Protection focuses more on personal data protection than on supervision of autonomous algorithmic systems. Unlike Indonesia, the European Union Artificial Intelligence Act specifically classifies AI systems into unacceptable risk, high-risk AI, limited risk, and minimal risk systems in order to establish different compliance and accountability standards according to technological risk levels.

Article 14 of the European Union Artificial Intelligence Act requires human oversight for high-risk AI systems to ensure autonomous technologies remain under human control. According to adaptive governance theory, risk-based regulation is more effective in responding to technological development than conventional sectoral approaches because it is capable of adapting to highly dynamic digital transformation (Abbott & Snidal, 2021).

The findings of this study are supported by various international documents and previous studies emphasizing the importance of regulatory integration within global AI governance. Research conducted by Gasser and Almeida (2022) demonstrated that fragmented governance weakens oversight of autonomous technologies and increases the risk of regulatory inconsistency across sectors. In addition, UNESCO reports concerning AI governance emphasize that developing countries need to establish unified digital governance frameworks in order to anticipate AI development sustainably. Research conducted by Wouters and Atkinson (2023) found that the AI governance model implemented in the European Union is more effective because it integrates principles of legal certainty, risk management, and human rights protection within a coordinated regulatory framework. This study demonstrates that Indonesia still faces institutional challenges in establishing intersectoral coordination for supervising risk-based AI systems.

The similarity between this study and previous studies lies in the finding that fragmented regulation constitutes one of the primary obstacles in modern AI governance. Research conducted by Floridi and Cowls (2021) stated that AI regulations dispersed across various legal sectors increase the likelihood of overlapping authority and regulatory conflict. Research by Allen and Masters (2022) also demonstrated that developing countries tend to experience delays in establishing AI governance frameworks because their digital regulatory systems remain partial in nature. Nevertheless, this study differs because it specifically analyzes the relationship between regulatory fragmentation and the responsibility gap within the Indonesian legal system. The novelty of this study lies in the argument that the establishment of AI-specific regulation in Indonesia should be conducted through an integrated governance approach based on risk classification and algorithmic accountability to ensure legal certainty within the national digital ecosystem.

Weaknesses of Algorithmic Accountability and AI Transparency

The findings demonstrate that the implementation of algorithmic accountability within Indonesia's AI governance remains insufficient, resulting in low transparency regarding automated decision-making processes. Autonomous AI systems operate through machine learning and adaptive algorithms that generate decisions using complex computational processes that are difficult for the public to understand. The study found that most AI users do not have adequate access to understand how algorithms generate decisions affecting their economic and social rights. This condition creates black-box decision-making that increases the risks of algorithmic discrimination, prediction errors, and digital data misuse. These findings indicate that weak algorithmic

transparency contributes to low legal accountability in the implementation of autonomous AI systems in Indonesia.

From a regulatory perspective, the European Union Artificial Intelligence Act through Article 13 and Article 15 requires transparency obligations, technical documentation, and accuracy requirements for high-risk AI systems to ensure accountability and auditability. In contrast, Indonesian regulations still lack specific provisions concerning explainability and algorithmic accountability within autonomous systems. Law Number 27 of 2022 concerning Personal Data Protection only regulates personal data protection and the rights of data subjects without establishing mandatory audits for algorithmic decisions. In addition, Article 22 of the General Data Protection Regulation grants individuals the right to protection from automated decision-making without human intervention. According to algorithmic governance theory, algorithmic transparency constitutes a primary requirement for establishing legitimacy and accountability within modern digital governance (Yeung, 2021).

The findings of this study are reinforced by various previous studies concerning AI transparency and algorithmic accountability. Research conducted by Diakopoulos (2021) explained that opacity within autonomous systems may reduce public trust in digital technology because society cannot understand the basis of algorithmic decisions. Research by Ananny and Crawford (2022) also demonstrated that black-box AI systems may generate hidden discrimination when not accompanied by adequate auditability and transparency mechanisms. The similarity between this study and previous studies lies in the recognition that explainability constitutes an important element within modern AI governance. However, this study differs because it specifically connects weak algorithmic accountability with responsibility gaps and legal uncertainty within the Indonesian legal system.

Another similarity can be observed in the study conducted by Coeckelbergh (2023), which emphasized that AI ethics without accountability mechanisms is insufficient to ensure fairness within autonomous decision-making systems. Nevertheless, this study differs because it places greater emphasis on the need for harmonization between transparency regulation and AI liability frameworks within the comparative law context between Indonesia and the European Union. The novelty of this study lies in the argument that strengthening algorithmic accountability must be conducted through the integration of explainability rights, mandatory audit systems, and risk-based governance within national regulations. This study also demonstrates that legal certainty within AI governance cannot be achieved without transparency concerning the operation of autonomous systems. Therefore, strengthening transparency obligations constitutes an important part of AI governance reform in Indonesia.

Weaknesses of Consumer Protection in Autonomous AI Systems

The findings indicate that the development of autonomous AI systems in Indonesia has not been accompanied by adequate digital consumer protection mechanisms. The use of AI within financial technology, e-commerce, digital healthcare, and automated recommendation systems has increased the risks of algorithmic discrimination and autonomous harm toward digital society. The study found that users of AI-based digital services frequently do not understand how algorithmic systems determine decisions affecting access to services, credit, and public information. This condition causes consumers to occupy a weaker position compared to technology companies that control data, algorithms, and automated decision-making systems. These findings demonstrate that AI development not only creates technical challenges but also intensifies power imbalances within legal relationships between users and digital technology providers.

From a regulatory perspective, consumer protection regarding AI utilization in Indonesia remains dispersed across various sectoral regulations and has not yet formed a digital consumer protection framework specifically governing autonomous systems. Law Number 8 of 1999 concerning Consumer Protection through Article 4 grants consumers the right to receive accurate, clear, and honest information concerning the goods and services they utilize. However, the regulation does not establish obligations for AI providers to explain the basis of algorithmic decisions to users. Meanwhile, the General Data Protection Regulation and the European Union Artificial Intelligence Act have developed consumer-centered governance approaches through transparency obligations, data subject rights, and mandatory risk assessments for high-risk AI systems. According to digital consumer protection theory, informational balance constitutes a primary element in ensuring fairness and accountability within digital legal relationships (Micklitz, 2022).

The findings of this study are supported by various international studies concerning consumer protection within AI governance. Research conducted by Edwards and Veale (2023) demonstrated that automated decision-making systems may increase the risk of economic discrimination when users are not granted access to information regarding how algorithms operate. Furthermore, research conducted by Helberger et al. (2022) explained that autonomous systems potentially affect the social and economic rights of society through non-transparent automated decisions. The similarity between this study and previous studies lies in the recognition that transparency and accountability constitute important elements within digital consumer protection. However, this study differs because it specifically connects weaknesses in consumer protection in Indonesia with the absence of an AI-specific liability framework within national regulations.

This study also demonstrates that strengthening digital consumer rights within AI governance is not limited to personal data protection but also concerns society's right to obtain legal justice within autonomous decision-making systems. Research conducted by Lynskey (2021) demonstrated that digital consumer rights should be expanded to include rights to explainability and algorithmic fairness within AI utilization. Additionally, research conducted by Busch (2022) emphasized that digital consumers require clearer legal remedy mechanisms for damages caused by autonomous systems. The difference between this study and previous studies lies in its analytical focus on the relationship between consumer protection and legal liability within the context of Indonesian AI regulation. The novelty of this research lies in the development of the argument that digital consumer protection must become an integral part of establishing a national AI governance framework based on accountability and transparency.

CONCLUSIONS AND RECOMMENDATIONS

This study concludes that Indonesia's regulatory framework concerning Autonomous Artificial Intelligence (AI) systems remains fragmented and has not specifically regulated legal liability for damages caused by autonomous AI systems. Existing regulations, including Law Number 11 of 2008 concerning Electronic Information and Transactions and Law Number 27 of 2022 concerning Personal Data Protection, primarily focus on electronic systems and personal data protection without establishing comprehensive AI-specific liability mechanisms. In contrast, the European Union through the European Union Artificial Intelligence Act has implemented a risk-based governance model integrating transparency, accountability, human oversight, and conformity assessment for high-risk AI systems. The findings indicate that Indonesia requires a more adaptive and integrated AI governance framework capable of addressing responsibility gaps, algorithmic accountability, consumer protection, and legal certainty within autonomous AI implementation. Therefore, this study recommends the development of AI-specific regulation in Indonesia through a risk-based regulatory approach, mandatory algorithmic transparency, and integrated digital governance mechanisms to strengthen accountability and public trust in AI technologies.

ADVANCED RESEARCH

This study is limited to normative juridical and comparative legal analysis focusing on Indonesia and the European Union regulatory frameworks without incorporating empirical perspectives from AI developers, regulators, technology companies, or digital society stakeholders. In addition, the study primarily examines legal documents, policy frameworks, and scholarly publications related to AI governance and legal liability. Future research is recommended to employ empirical legal studies, socio-legal approaches, or mixed-method research designs involving policymakers, legal practitioners, AI developers, and digital platform users to obtain broader insights regarding the implementation of AI governance and liability mechanisms in practice. Further studies may also explore sector-specific AI governance within healthcare, financial technology,

cybersecurity, and public administration systems to strengthen the development of contextual AI regulatory frameworks in emerging economies.

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