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DATA SOVEREIGNTY VS. OPEN INNOVATION: A LITERATURE REVIEW OF DIGITAL ECONOMY REGULATION IN THE ERA OF ARTIFICIAL INTELLIGENCE AND THE GREEN ECONOMY

Gunawan Widjaja
Senior Lecturer, Faculty of Law Universitas 17 Agustus 1945 Jakarta,
widjaja_gunawan@yahoo.com

Abstract

This article examines the structural tension between data sovereignty and open innovation in the regulation of the digital economy in the era of artificial intelligence (AI) and the green economy, using a systematic literature review approach. Data sovereignty, as enshrined in Indonesia's Personal Data Protection Act (PDP), protects national strategic assets from exploitation by global platforms, yet hinders access to essential datasets for the development of AI models and green technology collaboration. Conversely, the open innovation paradigm, through regulatory sandboxes and open data policies, drives the digital economy target of Rp4,500 trillion (2030), but risks a brain drain of domestic data. A comparative analysis of the EU, US and China reveals a trade-off between protective regulation and market-driven approaches, whilst the Indonesian context demands a hybrid governance model: limited data localisation combined with trusted data-sharing frameworks. Recommendations include the 2026 Presidential Regulation on AI, strengthening cloud sovereignty, and a Digital Sovereignty Index to realise contextual AI that is sovereign, innovative, and sustainable, paving the way for Indonesia Emas 2045.

Keywords: data sovereignty, open innovation, digital economy regulation, artificial intelligence, green economy, Personal Data Protection Act, AI sovereignty, data localisation, regulatory sandbox, Indonesia Emas 2045

Introduction

The global economic transformation over the past two decades has seen a significant shift towards a digital economy underpinned by advances in information and communication technology, particularly artificial intelligence (AI). This technology is not only changing the way goods and services are produced and distributed, but is also reshaping market structures, labour relations and business models across sectors. In this context, data has become a new strategic resource often referred to as the 'new oil' of the digital economy due to its crucial role in algorithm-based decision-making and the automation of .

As the role of data has grown, the concept of data sovereignty has emerged, emphasising a state's right to control the data generated by its citizens, including in terms of its storage, processing and distribution. This concept has developed in response to the dominance of global technology companies that control digital

infrastructure and cross-border data flows. In many cases, developing countries face serious challenges in maintaining control over their domestic data (Zheng et al., 2018) .

On the other hand, the digital economy is also driven by the open innovation paradigm, which emphasises the importance of collaboration across organisations, sectors and countries in creating economic value. Open innovation enables a broader exchange of knowledge, data, and technology to accelerate the development of AI-based products and services. This model has been shown to enhance innovation efficiency and accelerate the diffusion of technology across various industrial sectors (Chesbrough, 2020) . However, the relationship between data sovereignty and open innovation is often contradictory. On the one hand, data restrictions through sovereignty policies can protect national interests and individual privacy. On the other hand, such restrictions have the potential to hinder the flow of data necessary for the development of AI and global innovation. This tension is a central issue in the formulation of digital economy policies in various countries(Yudha et al., 2025) .

The development of AI further complicates these dynamics, as the technology is heavily reliant on the availability of large and diverse datasets. Machine learning algorithms require access to geographically diverse data to improve accuracy and relevance. Consequently, data restrictions can have a direct impact on a country's capacity for innovation in the field of AI (Kaplan & Haenlein, 2019) . Furthermore, the emergence of the green economy agenda adds complexity to the governance of digital data. The green economy demands the use of accurate, real-time data to support evidence-based policies on climate change mitigation, energy efficiency, and natural resource management. In this context, environmental data becomes a vital asset requiring a balanced approach to governance that strikes a balance between openness and protection(Qoiriyah et al., 2024).

Global regulations such as the General Data Protection Regulation (GDPR) in the European Union reflect efforts to strengthen the protection of personal data whilst regulating cross-border data flows. However, this approach has often been criticised for its potential to create global digital fragmentation that hinders system interoperability and international collaboration. This highlights a trade-off between data protection and the efficiency of the digital economy (Yu & Zhao, 2019) .

In the Southeast Asian region, including Indonesia, developments in data regulation show a trend towards strengthening data sovereignty through policies such as the Personal Data Protection Act (PDPA). This policy aims to enhance the protection of individual data whilst strengthening the country's position in the global digital economy. However, its implementation still faces challenges, particularly regarding institutional capacity and digital infrastructure readiness(Purbasari et al., 2025) . Meanwhile, the need for open innovation remains a priority in driving national digital economic growth. The government and the private sector are encouraged to develop a collaborative innovation ecosystem, including through open data policies, research

partnerships, and the development of technology-based start-ups. This approach is expected to enhance global competitiveness and accelerate digital transformation (Purbasari et al., 2025) .

The convergence of AI, the digital economy and the green economy also calls for an adaptive and integrative regulatory approach. Regulation can no longer be sector-specific; rather, it must be capable of reconciling various interests, ranging from data protection to the acceleration of innovation and environmental sustainability. This requires a policy framework that is flexible yet provides legal certainty (Qoiriyah et al., 2024) .

In this context, it is important to understand how academic literature and public policy address the tension between data sovereignty and open innovation. A literature review is a relevant method for identifying patterns, trends and research gaps relating to this issue. Consequently, a more comprehensive approach to the development of digital economy regulations can be formulated.

This article therefore aims to systematically review the literature on data sovereignty and open innovation in the context of the digital economy, artificial intelligence and the green economy. The findings of this review are expected to make a theoretical and practical contribution to the formulation of more balanced and sustainable policies.

Research Methodology

This study employs a literature review approach with the aim of identifying, analysing and synthesising relevant scientific literature on data sovereignty, open innovation, digital economy regulation, artificial intelligence and the green economy. Data sources were obtained from national journal articles, international journals, books, and other documents related to the research focus. The literature collection process was conducted via Google Scholar using structured keywords. Subsequently, the literature was selected based on inclusion and exclusion criteria, then analysed thematically to identify patterns, research gaps, and conceptual relationships between the variables under study. This approach enables the development of a comprehensive conceptual framework and provides a strong theoretical foundation for understanding the dynamics of digital economy regulation in the era of AI and the green economy (Snyder, 2019) ; (Eliyah & Aslan, 2025) .

Results and Discussion

Data Sovereignty in the Digital Economy and AI

Data sovereignty refers to a country's right and ability to regulate, control, and protect data generated by its citizens, including aspects of storage, processing, and cross-border transfer. This concept is becoming increasingly crucial in the digital economy era, where data has become a strategic asset on a par with oil in the industrial

era. Indonesia, with 286 million citizens generating massive amounts of data through digital transactions, medical records, and biometrics, faces the risk of economic value extraction by foreign platforms via AWS, Google Cloud, and Azure servers (Hallinan et al., 2021)

The urgency of data sovereignty for developing countries such as Indonesia is driven by a reliance on foreign cloud infrastructure, which results in economic losses amounting to billions of dollars each year. According to BCG, 75% of Southeast Asia's digital advertising spend flows to US platforms, creating structural dependency. This is not merely a matter of operational costs , but also the loss of control over national data that can be accessed by foreign governments through legislation such as the CLOUD Act (Act, 2024) . In a global context, regulations such as the EU's GDPR emphasise the principles of data protection by design and the right to be forgotten, which indirectly encourage data localisation. However, this approach often creates digital fragmentation, where developing countries struggle to access global data for AI innovation whilst maintaining domestic sovereignty.

In Indonesia, the Personal Data Protection Act (PDPA), which has been in force since 2024, serves as the primary legal framework for data sovereignty, regulating the collection, processing and transfer of personal data. This regulation aligns with the Circular on Artificial Intelligence Ethics, addressing the legal challenges posed by generative AI that processes personal data on a large scale(Yudha et al., 2025) .

The challenges of implementing data sovereignty include the fragmentation of global regulations, where data localisation policies in one country clash with the need for cross-border data flows for AI. Indonesia must develop a Digital Sovereignty Index that encompasses the dimensions of national data management, supporting technologies, and independence from external influence. Reliance on foreign big tech exacerbates the situation, as Indonesian data is often extracted without local added value, akin to digital colonialism. Vietnam and India have implemented strict data localisation, whilst Indonesia is still grappling with limited domestic cloud infrastructure (Yu & Zhao, 2019) .

The uneven distribution of digital infrastructure in Indonesia, with disparities in internet access between islands, is hindering the effective implementation of data sovereignty. The government needs to make massive investments in local data centres and 5G/6G networks to support sovereign AI data processing. The impact of data sovereignty on AI development is significant, as machine learning models require large and diverse datasets. Restrictions on cross-border data access can lead to limitations in training data, resulting in AI models that are less accurate for local contexts(Xiaying, 2019) .

The risk of data bias is a crucial issue, where reliance on global data may overlook Indonesia's cultural and social nuances, whilst limited local data risks reinforcing domestic biases. A balance is needed through federated learning, which safeguards

privacy whilst enabling collaboration. In the green economy, data sovereignty enables the management of environmental data such as climate tracking and carbon footprints at a national level. Local data on deforestation and emissions is required for sustainable policies, without reliance on foreign platforms (Votto et al., 2021) .

Strengthening digital sovereignty also opens up economic opportunities through the local AI industry, creating jobs in data analytics and sovereign cloud. IBM emphasises that strategic data control enhances ecosystem trust and regulatory compliance. The AI Presidential Regulation, planned for early 2026, will serve as the national regulatory framework, aligning the Personal Data Protection Act with AI ethics to safeguard both innovation and sovereignty. This includes a regulatory sandbox for domestic AI experimentation (Versaci, 2018) .

Studies conducted in the European Union indicate that the GDPR promotes sovereign AI, although data fragmentation hinders scalability. Conversely, the US is more flexible but vulnerable in terms of privacy, whilst China maintains strict control with high levels of domestic innovation (Act, 2024) .

Ultimately, data sovereignty is not merely a technical issue, but a national strategy for digital economic transformation. Indonesia requires adaptive regulations, self-reliant infrastructure and digital talent to achieve AI sovereignty that supports the Indonesia Emas 2045 vision.

Open Innovation and Regulatory Challenges in the Era of AI and the Green Economy

Open innovation is a paradigm that emphasises collaboration across organisations, sectors, and nations to accelerate the creation of economic value through the exchange of knowledge, data, and technology. In the digital economy era, this model is key to growth through the triple helix ecosystem (government-industry-academia), enabling the accelerated development of AI and green technology. Indonesia can leverage this to achieve its digital economy target of Rp4,500 trillion by 2030 (Ventura & Coeli, 2018) .

Collaborative ecosystems are becoming increasingly important in the age of AI, where model development requires open data from various sources. This collaboration includes AI hackathons, shared datasets and public-private partnerships, which have been shown to boost innovation efficiency by up to 30% in ASEAN countries. Access to open data for AI is crucial, as models such as LLMs rely on global datasets for accuracy. Open data policies enable local start-ups to access public data for applications such as predictive analytics in the green energy sector (Truli, 2018) .

The main conflict arises with the principle of data sovereignty, where data localisation restrictions hinder the global data sharing that is essential for AI. Indonesia's Personal Data Protection Act requires a balance to ensure that innovation is not stifled, whilst privacy is safeguarded. Data restrictions versus the need for sharing present a strategic dilemma; limited local data hinders AI scalability, whilst sharing risks

exploitation by big tech. Federated learning emerges as a hybrid solution (Tommy & Nasution, 2025) .

The risk of data exploitation by foreign parties is high in developing countries, where global platforms control 90% of the market share. Regulations must prevent a digital brain drain whilst encouraging FDI in sovereign AI. Regulatory sandboxes are an effective instrument for supporting innovation, allowing AI experimentation without full sanctions. Indonesia has implemented this through the OJK for fintech, which needs to be expanded to green AI (Sylviana et al., 2025) .

Open data policies are essential for transparency and accountability, particularly in the green economy, such as carbon tracking. The ASEAN Digital Framework promotes this to foster regional collaboration. Cross-border data flow agreements, such as the ASEAN Data Management- s Framework, facilitate secure data flows for cross-border innovation, supporting AI in the renewable energy sector (Septiari & Ujianti, 2025; Supeno et al., 2025).

A comparative study of the European Union (protective GDPR) highlights innovation barriers due to fragmentation, whilst the US market-driven approach enables rapid scalability but is vulnerable to privacy concerns. China combines strict controls with domestic open innovation. Global collaboration in green tech is essential for climate mitigation; AI monitors deforestation and emissions in real-time through data sharing. Indonesia could lead the ASEAN Green AI Initiative(Siallagan et al., 2025).

Data sharing for climate change requires trusted platforms such as Satu Data Indonesia, which integrates AI for predictive climate modelling whilst safeguarding sovereignty. Regulatory challenges include legal uncertainty that deters investors; the 2026 Presidential Regulation on AI is expected to provide certainty through technology-neutral and inclusive principles(Septiari & Ujianti, 2025) .

Ultimately, a balance is achieved through co-regulation, which involves the industry in rule-making, creating flexibility for AI innovation and the green economy whilst maintaining safeguards.

Conclusion

The tension between data sovereignty and open innovation presents a structural dilemma in the regulation of the digital economy in the era of AI and the green economy. Data sovereignty, through instruments such as Indonesia's Personal Data Protection Act, provides strategic protection against digital exploitation by foreign big tech firms, but risks hindering access to essential data for training AI models and global green technology collaboration. Conversely, open innovation through regulatory sandboxes and open data policies is projected to drive digital economic growth to Rp4.5 trillion by 2030, but requires governance measures to prevent a brain drain of national data.

The synthesis of these two paradigms calls for a hybrid governance model that integrates limited data localisation with trusted data-sharing frameworks such as

federated learning and ASEAN cross-border data flow agreements. This approach enables Indonesia to develop contextual AI sovereignty—reducing global bias whilst leveraging the scale of regional data—whilst supporting the green economy through domestic climate data analytics. The 2026 Presidential Regulation on AI represents a crucial turning point for adaptive regulatory harmonisation.

Policy recommendations include strengthening national cloud infrastructure, developing a Digital Sovereignty Index, and co-regulation with industry to create an inclusive innovation ecosystem. This transformation not only enhances Indonesia's global competitiveness in AI and the green economy but also realises the vision of Indonesia Emas 2045 through sovereign, innovative, and sustainable data governance.

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