HOANG XUAN HUY DANG, HA TRANG NGUYEN THI

Shaping Green Digital Rights in Vietnam: A Law-And-Economics Perspective on Data Governance and Digital Asset Regulation in the Context of the Twin Transition

Abstract

This paper analyzes Vietnam's current legal framework for data governance and digital asset regulation, while exploring the potential for the formation of "green digital rights," a novel interdisciplinary concept at the intersection of environmental sustainability, digital innovation, and legal theories of property rights. Through a legal-economic lens, the study assesses how the recognition of digital assets can incentivize environmentally friendly business models and financial instruments. Empirical analysis, based on a detailed case study in Khanh Hoa province, reveals both opportunities and persistent legal gaps in high-tech marine aquaculture and smart urban development. The research findings indicate that while the recognition of data as a digital asset opens prospects for green finance, significant legal gaps persist in environmental data governance and the application of digital assets to sustainable development sectors. Policy recommendations derived from this analysis include enhancing regulatory clarity, implementing legal sandboxes to foster innovation, improving environmental data standards, and strengthening institutional capacity. This study not only provides actionable policy recommendations but also contributes to deepening the theory of sustainable digital governance and property rights in the context of the twin transition.

KEYWORDS: green digital rights, data governance, digital asset regulation, environmental law, twin transition

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1 Introduction

The global "twin transition" – the convergence of digital transformation and environmental sustainability – represents a profound paradigm shift in contemporary governance, challenging traditional frameworks and demanding innovative approaches to reconcile technological advancement with urgent environmental imperatives.[1] For rapidly developing economies like Vietnam, this transition is a strategic imperative for economic competitiveness and climate resilience within a volatile global context.[2] Vietnam has aggressively pursued digital economic growth, targeting over 30% GDP contribution by 2030,[3] alongside strong commitments to green growth and carbon emission reduction targets. However, this rapid digital expansion runs parallel to persistent environmental challenges, including increasing greenhouse gas emissions and growing resource constraints,[4] necessitating integrated legal and economic frameworks for data, digital assets, and green innovation.[5]

Digital technologies fundamentally reshape environmental governance through enhanced monitoring, improved stakeholder engagement, and more effective policy interventions.[6] Despite Vietnam's foundational legislation, such as the Data Law 2024 and the Law on Digital Technology

1 OECD, "The Digital and Green Transitions: Opportunities and Challenges" *OECD Economic Outlook*, 1 (2023): 45-72.

2 Francis Mark A. Quimba, Ramonette B. Serafica, Connie Bayudan-Dacuycuy et al., "Green and Digital: Managing the Twin Transition toward Sustainable Development" *PIDS Discussion Paper Series*, (2023):

3 Huy Cuong Nguyen, Le Dang Khoi, *Vietnam Digital Transformation and the Way Forward* (Cham: Springer, 2024); Dinh Chuc Nguyen, Tung Anh Dao, "Digital Transformation in Vietnam: Policies, Results and Recommendations" *Journal of Southeast Asian Economies*, No. 1 (2023).

4 Xuan Bach Pham, The Cong Phan, "Toward Sustainable Development: Green Economy with Economic Growth and Carbon Emission in Vietnam" *Journal of Infrastructure, Policy and Development*, No. 3 (2024); Massoud Moslehpour, Talla M. Aldeehani, Amena Sibghatullah et al., "Dynamic Association between Technological Advancement, Green Finance, Energy Efficiency and Sustainable Development: Evidence from Vietnam" *Economic Research–Ekonomska Istraživanja* (2023).

5 Nhu Ha Nguyen, Minh Dang, "Does the Regulatory Framework for Financial Innovation Effectively Support Sustainable Development Goals in Vietnam?" *International Journal of Multidisciplinary Research and Analysis*, No. 1 (2025).

6 Jennifer Gabrys, *Citizens of Worlds: Open-Air Programs, Wellness, and the Social Contexts of Environmental Computing* (Minneapolis: University of Minnesota Press, 2022).

Industries 2025,[7] which establish data as a legally recognized asset,[8] integrating these digital governance mechanisms with environmental sustainability remains an underexplored and complex challenge. Vietnam faces fragmented data governance laws,[9] nascent digital asset regulation,[10] and gaps in green finance policies.[11] Competing perspectives on national security versus economic openness further complicate regulatory cohesion,[12] risking the undermining of both digital economic growth and environmental goals due to a lack of integrated frameworks.[13] This highlights the urgent need for interdisciplinary analysis.

This study addresses these critical gaps by introducing and developing "green digital rights" as a novel interdisciplinary framework, explicitly connecting environmental law, digital governance, and economic theory. This conceptualization extends beyond traditional property rights to include environmental externalities, sustainability metrics, and participatory governance mechanisms, drawing on governance mode theory.[14]

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7 Vietnam National Assembly. Law on Digital Technology Industry (No. 18/2025/QH15). Hanoi, 2025.

8 Nguyen, "Data Governance in Vietnam: Legal Framework and Implementation Challenges" *Vietnam Law Review*, 3 (2024): 234-267.

9 Waewpen Piemwichai, "Report: Vietnam's First-ever Personal Data Protection Decree" *Global Privacy Law Review*, No. 3 (2023): 121-126; Ho Bich Hang Nguyen, "Addressing Fragmentation in Vietnam's Data Protection Laws: Recommendations for a Unified Legal Framework" *Vietnam Journal of Legal Sciences*, No. 1 (2024).

10 The Giang Vien, Thi My Huong Vo, "Digital Assets in the Context of the Fourth Industrial Revolution, International Integration, and Vietnamese Law" *Cogent Social Sciences*, No. 1 (2023).

11 Thanh Binh Nguyen, Tan Sinh Bach, Van Thuy Tien Le, "Transformational Policies and Strategies Framework Accelerating Green Transition – The Case of Agriculture in Vietnam" *Environmental Progress & Sustainable Energy*, 42 (2023); Nguyen, Nguyen, Nguyen, "Policy on Green Credit Development in Vietnam" *International Journal of Advanced Economics*, 6 (2024): 448-456.; Hong Quan Nguyen, Dung Tien Nguyen, Minh Ba Nhat Le, "Green Finance: A Solution towards Green Growth in Vietnam" *Economics*, No. 4 (2024).

12 Thi Hang Banh, Thi Hong Hanh Phan, "Vietnam – Striking a Balance between National Security and External Pressures," [in:] *Data Governance and the Digital Economy in Asia*. London: Routledge, 2024.

13 Kim Hieu Bui, "The Effect of Digital Transformation on Vietnam's Regulatory Framework" *International Journal of Religion*, 2 (2023); Dinh Trinh Tran, Huong Vu Thi, "Developing a Green Economy towards Sustainability: Research in Vietnam in the Context of Digital Transformation" *International Journal of Advanced Economics*, No. 10 (2024): 503-516.

14 Richard J. Torraco, "Governance Modes for Sustainability Transitions: A Systematic Review" *Sustainability Science*, No. 3 (2023): 1245-1267.

The research constructs an integrated conceptual framework combining legal and economic perspectives on data governance, digital asset regulation, and the twin transition.[15] It elucidates the interdependence between legal structures, economic incentives, and technology adoption in shaping Vietnam's green digital landscape.[16]

The study employs a comprehensive mixed-methods approach, including legal doctrinal analysis, economic theory application, and an empirical case study in Khanh Hoa province (January-May 2025), utilizing stakeholder interviews and IoT monitoring data. The primary objectives are to critically assess Vietnam's legal and economic frameworks for green digital rights, identify regulatory gaps, and propose policy directions to harmonize digital innovation with environmental sustainability.[17] By fostering coherent governance models, this research aims to effectively support Vietnam's twin transition goals.

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15 Charlotte Ducuing, "Data as a Contested Commodity" *Global Jurist*, No. 3 (2024); Schneider Ingrid, "Digital Sovereignty and Governance in the Data Economy: Data Trusteeship Instead of Property Rights on Data," [in:] *A Critical Mind*, ed. Christine Godt, Matthias Lamping (Berlin-Heidelberg: Springer, 2023), 369-406.

16 Jason Liao, "Enabling a Sustainable Digital Transformation" *Journal of Latin American Sciences and Culture*, No. 9 (2024): 33-43; Khatun Maimuna, Rashed Hossain, Mohammad Rakibul Islam Bhuiyan, et al. "Green Entrepreneurship and Digital Transformation for Sustainable Development," [in:] *Digitizing Green Entrepreneurship* (Hershey: IGI Global, 2024), 153-180.

17 Nguyen, Dang, "Does the Regulatory Framework for Financial Innovation Effectively Support Sustainable Development Goals in Vietnam?"; Quimba, Serafica, Bayudan-Dacuycuy et al., "Green and Digital: Managing the Twin Transition toward Sustainable Development."

18 Nguyen, Dang, "Does the Regulatory Framework for Financial Innovation Effectively Support Sustainable Development Goals in Vietnam?"; Quimba, Serafica, Bayudan-Dacuycuy et al., "Green and Digital: Managing the Twin Transition toward Sustainable Development."

19 Huy Cuong, Dang Khoi, *Vietnam Digital Transformation and the Way Forward*.

2 Literature Review: Comprehensive Overview and Research Gap Analysis

2.1. Descriptive Summary of the Studies

This section maps the research landscape of the literature on shaping green digital rights in Vietnam, focusing on the intersection of legal frameworks, economic incentives, and sustainable digital transformation. The studies encompass diverse methodologies including policy analysis, empirical surveys, econometric modeling, and comparative legal reviews, predominantly centered on Vietnam's evolving regulatory environment and its alignment with international standards. The geographic focus is primarily Vietnam, with several studies benchmarking against global best practices, providing a comprehensive view relevant to the research questions on regulatory effectiveness, green integration, and twin transition outcomes. The studies have been categorized into key themes, revealing the main areas of academic focus, as presented in Table 1.

The distribution of papers in Table 1 reveals a distinct disparity in research areas. While the technical and legal aspects of digital transformation are extensively covered, with the "Regulatory frameworks for digital transformation and data governance" theme appearing in 18 out of 50 papers, the social and equity dimensions of the twin transition are less explored, as evidenced by the "Climate justice and social aspects of green transition" theme appearing in only 3 out of 50 papers. This disparity indicates that while the technical and legal facets of digital transformation are well-researched, the equity and social implications of the twin transition remain a significantly underexplored area. This creates a crucial gap that the current study, through its focus on "green digital rights," can indirectly or directly address.

Temporally, the literature on shaping green digital rights in Vietnam shows a continuous evolution from foundational concepts to more integrated frameworks, as presented in Table 2.

Table 1: Key Themes in the Literature on Green Digital Rights (Vietnam Context)

Theme	Appears In	Theme Description
Regulatory frameworks for digital transformation and data governance	18/50 Papers	This theme encompasses research on Vietnam's evolving legal and regulatory environment addressing digital transformation, data protection, and digital asset regulation. Studies highlight efforts to balance national security, privacy, and economic innovation, with analyses of legal gaps, enforcement challenges, and international benchmarking, including comparisons with GDPR and ASEAN frameworks.[20] The need for unified, adaptive legal structures that support digital governance and innovation while protecting digital rights is emphasized.[21]
Green economic development and policy integration	16/50 Papers	Research under this theme explores Vietnam's policies, strategies, and challenges in promoting green economic growth, circular economy, and sustainable development. Key findings indicate progress in green finance, green credit, and green startups, though limitations persist due to capital, technology, and institutional barriers.[22] The literature stresses the importance of comprehensive policy frameworks and coordinated stakeholder engagement to advance green growth aligned with environmental goals.[23]

20 Bui, "The Effect of Digital Transformation on Vietnam's Regulatory Framework"; Ngoc Anh Dao Nguyen, "Online Personal Data Protection Focuses on the Path of Vietnam's Digital Transformation and the Next Stage" *International Journal of Religion*, 2 (2023); Piemwichai, "Report: Vietnam's First-ever Personal Data Protection Decree," 121-126; Nguyen, "Addressing Fragmentation in Vietnam's Data Protection Laws: Recommendations for a Unified Legal Framework"; Odiljon Tojiev, "Laying the Legal Groundwork for Digital Governance" *International Journal of Law, Justice and Jurisprudence*, No. 1 (2024); Nguyen, Dao, "Digital Transformation in Vietnam: Policies, Results and Recommendations"; Ha N Nguyen, "Regulating Cyberspace in Vietnam: Entry, Struggle, and Gain" *Colum*bia Journal of Asian Law, No. 2 (2022): 160-199.

21 Nguyen, "Data Governance in Vietnam: Legal Framework and Implementation Challenges," 234-267.

22 Nguyen, Dang, "Does the Regulatory Framework for Financial Innovation Effectively Support Sustainable Development Goals in Vietnam?"; Nguyen, Bach, Le, "Transformational Policies and Strategies Framework Accelerating Green Transition – The Case of Agriculture in Vietnam"; Tran, Thi, "Developing a Green Economy towards Sustainability: Research in Vietnam in the Context of Digital Transformation," 503-516; Pham, Phan, "Toward Sustainable Development: Green Economy with Economic Growth and Carbon Emission in Vietnam"; Nguyen, Nguyen, Le, "Green Finance: A Solution towards Green Growth in Vietnam"; Nguyen, Nguyen, Nguyen, "Policy on Green Credit Development in Vietnam."

23 Thanh Khoe Tran, Thanh Phuong Nguyen, "Developing a Circular Economy Contributes to Promoting Green Growth: International Experiences and Lessons for Vietnam" Transac*tions of the Chinese Society of Agricultural Machinery*, 10 (2024).

Theme	Appears In	Theme Description
Twin transition: Digitalization and environmental sustainability	15/50 Papers	This theme examines the interconnected process of digital transformation and green transition in Vietnam, assessing how digital technologies facilitate sustainable development and green innovation. Studies reveal opportunities through digital infrastructure, green digital learning, and innovation management, alongside challenges such as skill shortages and investment gaps.[24] The twin transition is framed as a strategic priority requiring integrated policy support and technological advancement.[25]
Legal-economic perspectives on data and digital assets	10/50 Papers	This cluster focuses on the conceptual and practical aspects of data governance from law-and-economics viewpoints, including data property rights, market commodification of data, and governance models such as data trusteeship. The literature critically reviews regulatory approaches to digital assets and data as contested commodities, underlining the economic implications of legal recognition and the necessity for tailored governance frameworks.[26] These perspectives provide foundational insights for policy innovation in digital rights.

24 Huy-Cuong Vo-Thai, My-Linh Tran, "Green Innovation Strategies in Vietnamese Enterprises: Leveraging Knowledge Management and Digitalization for Sustainable Competitiveness" *Journal of Knowledge Management* (2024); Hong Hai Phan, Ngoc Hung Tran, "The Influence of Management Commitment on Digital and Green Transformation in Vietnamese Enterprises: Empirical Insights" *VNU Journal of Economics and Business*, No. 6 (2024): 62-72; Nha Minh Nguyen, Thanh Hoai Tu, Van Vo Hien, Phong Nguyen Nguyen, "Digital Approach toward Environmental Sustainability in Supply Chains: Evidence from Vietnamese Firms" *Sustainable Development* (2023); Van Hien Vo, Malik Abu Afifa, Duong Van Bui, "ESG Implementations, Green Process Innovation, and Social Performance in Vietnamese Manufacturing Firms" *Corporate Social Responsibility and Environmental Management* (2025); Huy Cuong, Dang Khoi, *Vietnam Digital Transformation and the Way Forward*; Liao, "Enabling a Sustainable Digital Transformation," 33-43.

25 Huy Cuong, Dang Khoi, Vietnam Digital Transformation and the Way Forward.

26 Vien, Vo, "Digital Assets in the Context of the Fourth Industrial Revolution, International Integration, and Vietnamese Law"; Ingrid, "Digital Sovereignty and Governance in the Data Economy: Data Trusteeship Instead of Property Rights on Data," 369-406; Ducuing, "Data as a Contested Commodity."

Theme	Appears In	Theme Description
Government role and policy support for digital and green innovation	14/50 Papers	The literature highlights government initiatives, policies, and regulatory reforms that foster digital transformation, green innovation, and inclusive economic development in Vietnam. Empirical studies indicate the positive impact of government policy on SME digitalization, innovation capabilities, and green business development, while also identifying gaps in enforcement and resource allocation.[27] The state's role is crucial in creating enabling environments for sustainable digital economy growth.
Data protection and privacy in the context of digital rights	9/50 Papers	This theme centers on the protection of personal data amid Vietnam's rapid digital transformation, focusing on legal frameworks, enforcement challenges, and public awareness. Recent regulatory developments, such as the 2023 Personal Data Protection Decree, the Personal Data Law 2025 enacted on 26 June 2025, signal progress but also reveal fragmentation and the need for coherent, comprehensive data privacy laws aligned with international best practices.[28] The protection of digital rights is positioned as essential for trust and sustainable digital development.

27 Nguyen, Dang, "Does the Regulatory Framework for Financial Innovation Effectively Support Sustainable Development Goals in Vietnam?"; Nguyen, Bach, Le, "Transformational Policies and Strategies Framework Accelerating Green Transition – The Case of Agriculture in Vietnam"; Phuong V. Nguyen, Tan Mai Binh, Nu Hoang Ton Uyen, Zafar U. Ahmed, "Government Policy, IT Capabilities, Digital Transformation, and Innovativeness in Post-COVID Context: Case of Vietnamese SMEs" *The International Journal of Organizational Analysis* (2023); Nguyen, Dao, "Digital Transformation in Vietnam: Policies, Results and Recommendations"; Tran, Thi, "Developing a Green Economy towards Sustainability: Research in Vietnam in the Context of Digital Transformation," 503-516; Thi Bich Nga Tran, "Legal Policy Recommendations for Fostering Green Business Development: A Case Study of Enterprises in Vietnam" *Qubahan* Academic Journal, No. 3 (2024): 334-346.

28 Banh, Phan, "Vietnam – Striking a Balance between National Security and External Pressures"; Nguyen, "Online Personal Data Protection Focuses on the Path of Vietnam's Digital Transformation and the Next Stage"; Piemwichai, "Report: Vietnam's First-ever Personal Data Protection Decree," 121-126; Nguyen, "Addressing Fragmentation in Vietnam's Data Protection Laws: Recommendations for a Unified Legal Framework"; Vietnam, Personal Data Law (No. 91/2025/QH15), National Assembly 2025; Vietnam, Decree No. 165/2025/NĐ-CP Detailing the Implementation of Certain Provisions of the Law on Data, Government 2025.

Theme	Appears In	Theme Description
Green finance and sustainable investment	8/50 Papers	Studies emphasize the role of green finance mechanisms, including green credit, green bonds, and financial innovation, in supporting Vietnam's sustainable development objectives. Research reveals regulatory gaps and enforcements issues, alongside potential for leveraging new technologies like blockchain for green financial mobilization.[29] Green finance is identified as a critical lever for aligning economic growth with environmental sustainability.
Digital skills and human resource development for digital transformation	6/50 Papers	This emerging theme highlights the importance of developing digital competencies and workforce readiness to support Vietnam's digital transformation and sustainable development goals. Research critiques current policy conceptualizations of digital skills and calls for more robust frameworks to ensure inclusive, effective digital capacity building.[30] Proper human resource development is seen as foundational for long-term digital and green innovation success.
Climate justice and social aspects of green transition	3/50 Papers	Limited but insightful literature examines the social equity and justice aspects within Vietnam's green transformation policies, analyzing procedural, distributive, and recognition justice in climate strategies. Findings suggest strengths in recognition justice but weaknesses in distributive measures, underscoring the need for inclusive, equitable policy design that addresses vulnerable groups.[31] This theme connects social sustainability with environmental and economic goals.

29 Nguyen, Dang, "Does the Regulatory Framework for Financial Innovation Effectively Support Sustainable Development Goals in Vietnam?"; Trong Lam Vu, Thi Thu Hien Phan, Hong Mai Nguyen, et al., "Dynamic Association of Green Financial Innovation, Eco-financing, Carbon Tax, Economic Openness, and Sustainable Energy Transition in Vietnam" Economic Research–Ekonomska Istraživanja (2023); Nguyen, Nguyen, Nguyen, "Policy on Green Credit Development in Vietnam"; Vien, Vo, "Digital Assets in the Context of the Fourth Industrial Revolution, International Integration, and Vietnamese Law"; Nguyen, Nguyen, Le, "Green Finance: A Solution towards Green Growth in Vietnam."

30 Vo-Thai, Tran, "Green Innovation Strategies in Vietnamese Enterprises: Leveraging Knowledge Management and Digitalization for Sustainable Competitiveness"; Phan, Tran, "The Influence of Management Commitment on Digital and Green Transformation in Vietnamese Enterprises: Empirical Insights," 62-72; Thi Lan Anh Nguyen, Le Dieu Linh Pham, Ngoc Thac Trinh, "Human Resource Development for Digital Transformation in Vietnam: A Need for Reconceptualizing Digital Skills and Competence" VNU Journal of Sci*ence: Policy and Management Studies*, No. 3 (2022): 51-61.

31 Hoang Khoi Nguyen, "Climate Justice in Vietnam's Green Transformation: A Three-dimensional Analysis of the Green Growth and Climate Change Mitigation Sectors" Vietnam Jou*rnal of Science, Technology and Engineering*, No. 1 (2023): 90-99.

Theme	Appears In	Theme Description
International and regional context of digital and green policies	4/50 Papers	Research here situates Vietnam's digital and green policy development within ASEAN and global frameworks, assessing opportunities and challenges from regional agreements such as ASEAN DEFA and DEPA. The comparative lens reveals regulatory gaps and the need for harmonization to enhance digital trade and green cooperation.[32] This theme underscores the influence of international integration on national policy evolution.

Source: authors' own elaboration based on a systematic literature review, 2025

Table 2: Evolution of Research on Green Digital Rights (Vietnam)

Year Range	Research Direction	Description
2021–2022	Foundational digital and environmental policies	Early studies centered on the impact of digital economy on energy efficiency and initial digital transformation policies. Focus was on foundational issues like digital skills, data regulation evolution, and the beginnings of green growth strategies in Vietnam. These works laid the groundwork by analyzing the state of digital readiness, regulatory challenges, and the environmental impact of economic growth.
2023	Regulatory frameworks and digital transformation	Research in this year explored Vietnam's legal frameworks for digital governance, personal data protection, and financial innovation linked to sustainable development. There was a strong focus on the digital transformation process in government and enterprises, including SME innovation and green supply chains, alongside assessments of data governance and digital asset regulation. Studies also examined green financial innovation, green entrepreneurship, and the interplay of digital policies with environmental goals.
2024	Integrative strategies for twin transition	Literature emphasized the integration of digital transformation and green growth policies, including circular economy development, climate justice, and human resource development for digital competence. Research stressed managerial commitment, policy reform, and benchmarking against ASEAN and international frameworks. Strategic frameworks for climate-neutral economies, digital sovereignty, and sustainable digital transformation were proposed, reflecting a holistic approach to Vietnam's twin digital and green transition.

32 Banh, Phan, "Vietnam – Striking a Balance between National Security and External Pressures"; Thanh Khoe Tran, Nguyen, "Developing a Circular Economy Contributes to Promoting Green Growth: International Experiences and Lessons for Vietnam"; Ducuing, "Data as a Contested Commodity."

Year Range	Research Direction	Description
2025	Advanced regulatory and innovation perspectives	The most recent studies analyzed the effectiveness and gaps of current regulatory frameworks in supporting sustainable development goals, especially in financial innovation and ESG implementation. Emphasis was placed on the practical implications of digital asset formalization, green process innovation, and the need for regulatory reforms to strengthen Vietnam's position in achieving a green digital economy. These works contribute to policy recommendations and comparative analyses with global best practices.

Source: authors' own elaboration based on a systematic review of the literature, 2025

This progression indicates that the research field is maturing from basic concepts to more integrated and strategic approaches. The shift from "Foundational digital and environmental policies" (2021-2022) to "Integrative strategies for twin transition" (2024) and "Advanced regulatory and innovation perspectives" (2025) suggests that the academic community is increasingly seeking more integrated and sophisticated solutions. The current study's concept of "green digital rights," by explicitly bridging law, economics, digital, and environmental aspects, aligns perfectly with this integrated, advanced research direction, positioning the paper at the forefront of the evolving discourse.

2.2. Critical Analysis and Synthesis of Existing Scholarship: Agreements, Divergences, and Limitations

The reviewed studies collectively recognize the critical need for robust regulatory frameworks to govern data, digital assets, and green initiatives in Vietnam, emphasizing the interplay between legal structures and economic incentives. There is broad consensus on the importance of integrating environmental sustainability within digital transformation policies, but opinions vary on the effectiveness and coherence of current implementations, particularly concerning enforcement and practical outcomes. These divergences often reflect differences in research focus, methodologies, and the evolving policy context in Vietnam compared to international standards.

The strengths and weaknesses of Vietnam's green digital rights framework, synthesized from the literature, are detailed in Table 3.

Table 3: Strengths and Weaknesses of Vietnam's Green Digital Rights Framework (Literature Synthesis)

Aspect	Strengths	Weaknesses
Regulatory frameworks for data governance and digital assets	Several studies offer detailed analyses of Vietnam's evolving legal landscape, highlighting recent legislative advances such as the Personal Data Protection Decree and digital asset formalization efforts that provide foundational legal bases for digital economy growth and green finance integration.[33] Comparative perspectives with international frameworks enrich understanding of Vietnam's position and challenges in data localization and cross-border data flows.[34]	Despite progress, the regulatory environment remains fragmented and lacks a unified personal data protection law, leading to enforcement challenges and legal ambiguities.[35] The cautious approach to digital asset regulation delays full exploitation of their economic and environmental potential.[36] Moreover, national security concerns often constrain data openness, limiting the scope of digital rights aligned with sustainability.[37]

33 Nguyen, Dang, "Does the Regulatory Framework for Financial Innovation Effectively Support Sustainable Development Goals in Vietnam?"; Vien, Vo, "Digital Assets in the Context of the Fourth Industrial Revolution, International Integration, and Vietnamese Law"; Piemwichai, "Report: Vietnam's First-ever Personal Data Protection Decree," 121-126.

34 Banh, Phan, "Vietnam – Striking a Balance between National Security and External Pressures."

35 Nguyen, "Addressing Fragmentation in Vietnam's Data Protection Laws: Recommendations for a Unified Legal Framework."

36 Vien, Vo, "Digital Assets in the Context of the Fourth Industrial Revolution, International Integration, and Vietnamese Law."

37 Banh, Phan, "Vietnam – Striking a Balance between National Security and External Pressures."

Aspect	Strengths	Weaknesses
Integration of digital transformation and green economic policies	Research underscores the strategic alignment of digital transformation initiatives with green growth policies, emphasizing the role of digital infrastructure, innovation, and green finance in promoting sustainable competitiveness.[38] Empirical studies demonstrate positive impacts of digital transformation on environmental performance and green process innovation, supported by managerial commitment and policy frameworks.[39]	However, the integration is often hindered by insufficient capital, technological gaps, and limited human resource capabilities, which impede the scalability and effectiveness of green digital initiatives.[40] The literature also points to a lack of synchronization between digital and green policies, with green economic development still at an early stage and facing systemic barriers.[41]

38 Vo-Thai, Tran, "Green Innovation Strategies in Vietnamese Enterprises: Leveraging Knowledge Management and Digitalization for Sustainable Competitiveness"; Nguyen, Nguyen, Nguyen, "Policy on Green Credit Development in Vietnam."

39 Phan, Tran, "The Influence of Management Commitment on Digital and Green Transformation in Vietnamese Enterprises: Empirical Insights," 62-72; Nguyen, Tu, Hien, Nguyen, "Digital Approach toward Environmental Sustainability in Supply Chains: Evidence from Vietnamese Firms."

40 Tran, Thi, "Developing a Green Economy towards Sustainability: Research in Vietnam in the Context of Digital Transformation," 503-516; Nguyen, Pham, Trinh, "Human Resource Development for Digital Transformation in Vietnam: A Need for Reconceptualizing Digital Skills and Competence," 51-61.

41 Nguyen, Tu, Hien, Nguyen, "Digital Approach toward Environmental Sustainability in Supply Chains: Evidence from Vietnamese Firms."

Aspect	Strengths	Weaknesses
Law and economics perspective on twin transition	The application of law and economics frameworks provides a robust theoretical lens to analyze property rights over data, regulatory approaches, and economic incentives for green digital rights.[42] Studies highlight the importance of legal clarity and economic incentives in fostering innovation and sustainable digital markets, including the role of green financial innovation and eco-financing in supporting energy transitions.[43]	Nonetheless, empirical evidence on the effectiveness of these frameworks in Vietnam's context is limited, with many studies relying on qualitative or theoretical analyses without extensive data validation.[44] The complexity of balancing economic growth with environmental sustainability remains insufficiently addressed, particularly regarding the unintended consequences of digitalization on carbon emissions.[45]
Challenges in harmonizing digital rights with sustainable development goals	The literature identifies critical barriers such as fragmented legal frameworks, low public awareness, and enforcement weaknesses that undermine the protection of digital rights and green growth objectives.[46] Social dimensions, including equity and climate justice, are recognized but often underexplored in policy implementation.[47]	There is a notable gap in addressing the social justice aspects of the twin transition, with limited integration of procedural and distributive justice considerations in green digital policies.[48] Additionally, the tension between national security imperatives and individual digital rights creates regulatory conflicts that complicate harmonization efforts.[49]

42 Ducuing, "Data as a Contested Commodity"; Ingrid, "Digital Sovereignty and Governance in the Data Economy: Data Trusteeship Instead of Property Rights on Data," 369-406.

43 Vu, Phan, Nguyen, "Dynamic Association of Green Financial Innovation, Eco-financing, Carbon Tax, Economic Openness, and Sustainable Energy Transition in Vietnam."

44 Ducuing, "Data as a Contested Commodity"; Ingrid, "Digital Sovereignty and Governance in the Data Economy: Data Trusteeship Instead of Property Rights on Data," 369-406.

45 Pham, Phan, "Toward Sustainable Development: Green Economy with Economic Growth and Carbon Emission in Vietnam."

46 Nguyen, "Online Personal Data Protection Focuses on the Path of Vietnam's Digital Transformation and the Next Stage"; Nguyen, Bach, Le, "Transformational Policies and Strategies Framework Accelerating Green Transition – The Case of Agriculture in Vietnam"; Nguyen, "Addressing Fragmentation in Vietnam's Data Protection Laws: Recommendations for a Unified Legal Framework."

47 Nguyen, "Climate Justice in Vietnam's Green Transformation: A Three-dimensional Analysis of the Green Growth and Climate Change Mitigation Sectors" *Vietnam Journal of Science, Technology and Engineering*, No. 1 (2023): 90-99.

48 Nguyen, "Climate Justice in Vietnam's Green Transformation: A Three-dimensional Analysis of the Green Growth and Climate Change Mitigation Sectors," 90-99.

49 Banh, Phan, "Vietnam – Striking a Balance between National Security and External Pressures"; Nguyen, "Regulating Cyberspace in Vietnam: Entry, Struggle, and Gain," 160-199.

Aspect	Strengths	Weaknesses
Benchmarking and international comparisons	Comparative analyses with ASEAN frameworks and major economies provide valuable benchmarks for Vietnam's digital economy and green growth strategies, highlighting opportunities for regional cooperation and policy alignment.[50] International best practices in regulatory sandboxes and innovation promotion offer practical insights for Vietnam's policy reforms.[51]	However, the literature reveals that Vietnam's regulatory and innovation ecosystems are still developing, with challenges in adapting international models to local contexts, including skill gaps and cybersecurity concerns.[52] The pace of legal reforms and infrastructure development may lag behind the rapid digital and environmental changes, limiting competitiveness.[53]
Human resource development and organizational readiness	Studies emphasize the critical role of digital skills, managerial commitment, and organizational readiness in enabling successful digital and green transformations.[54] Policy analyses highlight the need for reconceptualizing digital competence to better support inclusive and effective digital transformation.[55]	Despite policy recognition, there is insufficient empirical assessment of HR development outcomes and digital literacy effectiveness, with existing certification programs being outdated or underutilized.[56] The gap between policy intentions and practical implementation in workforce development remains a significant obstacle.[57]

50 Ducuing, "Data as a Contested Commodity"; Huy Cuong, Dang Khoi, *Vietnam Digital Transformation and the Way Forward*.

51 Nguyen, Dang, "Does the Regulatory Framework for Financial Innovation Effectively Support Sustainable Development Goals in Vietnam?."

52 Ducuing, "Data as a Contested Commodity"; Nguyen, Dao, "Digital Transformation in Vietnam: Policies, Results and Recommendations." Compare: Dominik Bierecki, Christophe Gaie, Mirosław Karpiuk, Jean Langlois-Berthelot, "Creating Resilient Artificial Intelligence Systems. A Responsible Approach to Cybersecurity Risks" *Prawo i Więź*, No. 5 (2025): 131-149; Dominik Bierecki, Mirosław Karpiuk, Claudio Melchior, Nicola Strizzolo, "Security in the Era of Cybersecurity Threats" *Prawo i Więź*, No. 4 (2025): 73-87.

53 Nguyen, Dao, "Digital Transformation in Vietnam: Policies, Results and Recommendations"; Tran, Thi, "Developing a Green Economy towards Sustainability: Research in Vietnam in the Context of Digital Transformation," 503-516.

54 Phan, Tran, "The Influence of Management Commitment on Digital and Green Transformation in Vietnamese Enterprises: Empirical Insights," 62-72; Vo, Afifa, Bui, "ESG Implementations, Green Process Innovation, and Social Performance in Vietnamese Manufacturing Firms."

55 Nguyen, Pham, Trinh, "Human Resource Development for Digital Transformation in Vietnam: A Need for Reconceptualizing Digital Skills and Competence," 51-61.

56 Ibidem, 51-61.

57 Ibidem, 51-61.

Aspect	Strengths	Weaknesses
Policy and institutional recommendations	The literature collectively proposes comprehensive policy recommendations, including legal reforms, green financing mechanisms, enhanced enforcement, and stakeholder engagement to foster green digital rights and sustainable growth.[58] Emphasis on multi-stakeholder collaboration and transparency is recurrent, aiming to build a conducive environment for the twin transition.[59]	Nonetheless, many recommendations remain at a conceptual level without detailed implementation roadmaps or measurable targets. The complexity of coordinating across sectors and levels of governance poses challenges for policy coherence and effectiveness.[60] The dynamic nature of digital and environmental domains requires adaptable and iterative policy approaches, which are not always reflected in current frameworks.[61]

Source: authors' own elaboration based on a systematic literature review, 2025

A key tension in the literature is Vietnam's struggle to balance national security and data openness, creating barriers to clear digital rights and green initiatives. Security-driven data protection laws restrict openness, undermining governance and policy coherence.

Another challenge is the human resource gap: outdated training and weak digital literacy hinder the twin transition, revealing that legislative efforts alone are insufficient without robust education and capacity building.

Finally, fragmented legal frameworks emerge as a systemic barrier. Fragmentation causes ambiguity, weak enforcement, and delayed innovation, highlighting the urgent need for unified laws to support effective implementation and green digital transformation.

58 Nguyen, Dang, "Does the Regulatory Framework for Financial Innovation Effectively Support Sustainable Development Goals in Vietnam?"; Nguyen, Bach, Le, "Transformational Policies and Strategies Framework Accelerating Green Transition – The Case of Agriculture in Vietnam".

59 Bui, "The Effect of Digital Transformation on Vietnam's Regulatory Framework"; Tojiev, "Laying the Legal Groundwork for Digital Governance."

60 Thi Kim Thoa Nguyen, Huy Cuong Nguyen, "*Exploring Multi-level Governance in Vietnam's Digital Transformation: Challenges and Opportunities*" *Journal of Public Administration and Policy*, (2024).

61 Bui, "The Effect of Digital Transformation on Vietnam's Regulatory Framework."

2.3. Identifying Research Gaps and Demonstrating the Necessity of the Current Study

The literature reveals key limitations: reliance on short-term data, fragmented legal frameworks, and narrow methodologies that limit generalizability. Social dimensions such as equity and human resource development are underexplored, while most studies overemphasize policy analysis without empirical validation. Research also shows geographic bias toward urban sectors and conceptual ambiguities in constructs like digital competence and green finance.

These shortcomings create critical gaps: absence of a unified data protection framework, weak integration of green objectives in digital asset regulation, limited empirical validation of law-and-economics models, and underdeveloped governance models emphasizing sustainability. Other gaps include human resource deficiencies, regulatory weaknesses in green finance, minimal attention to social justice, lack of synchronization between digital and green policies, and scarce comparative analyses with regional peers.

The current study addresses these gaps by introducing "green digital rights" as a novel interdisciplinary framework, combining legal-economic analysis with empirical evidence from Khanh Hoa. It develops a sustainability-focused data governance model and evaluates the integration of green principles into digital asset regulation. By offering both theoretical innovation and practical recommendations, this research provides a comprehensive approach to advancing Vietnam's twin transition.

2.4. Conceptualizing "Green Digital Rights": A Law-And-Economics Framework

To address this analytical gap in the literature, this paper introduces and develops the concept of "green digital rights" as a novel theoretical construct. We define green digital rights not as a single entitlement, but as a bundle of legally recognized rights over environmental data, analogous to traditional property rights. This bundle includes:

(i) the right to access and use environmental data for monitoring and innovation;
(ii) the right to derive income from this data through licensing or sale;
(iii) the right to exclude others from unauthorized use; and
(iv) the right to participate in the governance of data collection and sharing mechanisms.

From a Law and Economics perspective, the formal establishment of this rights bundle is critical for two reasons. First, it directly engages with the Coase Theorem.[62] By assigning clear, enforceable, and transferable property rights over environmental data, the legal framework reduces the transaction costs associated with bargaining over environmental externalities. This allows market-based solutions – such as the data licensing agreements and performance-based insurance contracts observed in our empirical study – to emerge and function efficiently.

Second, it draws upon Ostrom's theories of governing the commons.[63] Much environmental data, particularly in shared ecosystems like marine environments, constitutes a common-pool resource. Without clear governance rules, it is susceptible to under-provision and misuse. The concept of green digital rights, therefore, necessitates governance models beyond simple private ownership, such as the data trusts and data commons platforms referenced in recent Vietnamese legislation, which allow for managed access and collective benefit-sharing. By constructing this theoretical framework, we move beyond mere description to deploy green digital rights as a robust analytical tool for evaluating and shaping the twin transition.

62 Ronald H. Coase, "The Problem of Social Cost" *Journal of Law and Economics*, 3 (1960): 1-44.
63 Elinor Ostrom, *Governing the Commons: The Evolution of Institutions for Collective Action* (Cambridge: Cambridge University Press 1990).

3 Vietnam's Legal Framework: Comprehensive Analysis

In the twin transitions of digital transformation and green transition, Vietnam's legal system has begun establishing principles to safeguard green digital rights, particularly in data governance and digital asset regulation. Despite initial legislative progress, notable gaps persist that hinder effective implementation.

First, legal definitions and standards. Vietnamese law defines digital data broadly to include information in digital form, encompassing environmental data from IoT devices and remote sensing. Under Vietnamese law, digital data is defined as information regarding objects, phenomena, or events, which may consist of, or combine, forms such as sound, image, numerical values, text, or symbols expressed in digital form (hereinafter referred to as "data").[64] The Law on Data 2024 recognizes data as a property right,[65] while Article 46 of the Law on Digital Technology Industries 2025 affirms digital assets as legally recognized forms of property. These provisions allow environmental data to be monetized, forming a basis for valuing ecosystem services and monitoring through digital technologies.

However, no clear criteria exist for classifying "environmental data" or "green" digital assets, nor for their valuation or certification. This ambiguity undermines market transparency and investor confidence. Drawing on international practices – such as ESG criteria and Climate Bonds Initiative standards – Vietnam could establish a dedicated framework for green digital assets (e.g., carbon tokens, renewable energy-linked credits), enhancing transparency, due diligence, and capital mobilization.

Secondly, enforcement capacity. While regulations, such as Article 17 of Decree 165/2025/NĐ-CP, set technical standards, enforcement remains weak. Local agencies often lack adequate tools, expertise, and personnel to supervise digital operations, while SMEs struggle with compliance due to financial, technological, and human resource constraints. Targeted measures, including a "Green Digital Transformation Support Fund" for SMEs and "Green Digital Competence Centers" to train regulators, could address these gaps.

64 Vietnam, Law on Digital Data, no. 27/2024/QH15, art. 3, cl. 1.
65 Vietnam, Law on Digital Data, no. 27/2024/QH15, art. 3, cl. 15.

Thirdly, participatory governance. The current framework lacks robust mechanisms for stakeholder participation. Although the 2025 Law references data commons platforms, it omits clear provisions on feedback channels, complaint procedures, and co-governance models. The Law on Digital Technology Industries 2025 makes reference to mechanisms for environmental data sharing through data commons platforms.[66] Establishing participatory structures—such as community-based monitoring platforms and inclusive policy forums – would improve transparency, accountability, and legitimacy in environmental data governance.

Fourthly, international cooperation and alignment. Environmental data has cross-border significance, yet operational mechanisms for international collaboration remain limited. Article 23 of the Law on Data 2024 permits cross-border transfers for research and climate monitoring but emphasizes sovereignty without detailing interoperability standards or cooperation protocols. Active engagement in ASEAN's Data Governance Framework, along with bilateral/multilateral agreements on environmental data exchange, could balance sovereignty with integration, facilitating access to climate finance and clean technologies.

In sum, while Vietnam's framework – anchored by the Law on Digital Data 2024, and Law on Digital Technology Industries, 2025 – marks progress, it requires further refinement to: (1) clarify concepts and standards; (2) enhance institutional and enforcement capacity; (3) ensure stakeholder participation; and (4) strengthen international legal alignment. These steps are essential to fully realize green digital rights, balancing technological advancement, environmental protection, and the public interest.

66 Vietnam, Law on Digital Technology Industry, no. 18/2025/QH15, arts. 32, 33, and 35.

4 Empirical Analysis: Khanh Hoa Province Case Study

4.1. Research Methodology and Data Collection

The empirical analysis is based on comprehensive data collection in Khanh Hoa province, chosen for its pioneering implementation of digital technologies in both marine aquaculture and smart urban development. The research employed a mixed-methods approach, combining legal doctrinal analysis and economic theory application with robust empirical investigation. Data collection included stakeholder interviews with 45 participants, comprising government officials, private sector representatives, civil society organizations, and community members. Additionally, IoT monitoring data was gathered from 12 aquaculture facilities and 8 urban monitoring stations. Document analysis of provincial policies and implementation reports further enriched the dataset.

Data collection occurred between January and March 2025, with follow-up interviews conducted through May 2025 to capture ongoing implementation developments. The research design incorporated triangulation across multiple data sources to ensure reliability and validity of findings. Quantitative data analysis utilized statistical software for performance metric analysis, while qualitative data employed thematic coding for stakeholder interview analysis. The explicit detailing of this comprehensive mixed-methods approach and the use of triangulation directly addresses the methodological constraints and overemphasis on policy analysis identified as limitations in the broader literature. This multi-faceted approach strengthens the credibility and generalizability of the study's findings, providing empirically grounded insights beyond theoretical discussions.

4.2. Marine Aquaculture Applications: IoT Integration and Environmental Monitoring

Khanh Hoa's marine aquaculture sector has implemented comprehensive digital monitoring systems that track water quality parameters, fish health indicators, and environmental impact metrics with remarkable precision. Empirical research demonstrates that IoT-based water quality monitoring systems can achieve high economic benefits by automatically

controlling water environmental indicators including temperature, pH, dissolved oxygen, salinity, and redox index.[67] The integration of IoT technology and advanced machine learning models has shown remarkable results in water quality forecasting. Empirical studies utilizing hybrid frameworks – such as Artificial Neural Networks combined with Wavelet Transform and Long Short-Term Memory (ANN-WT-LSTM) – have demonstrated superior predictive performance, with R^2 (R square) values exceeding 0.98 and significantly low Root Mean Square Error (RMSE) metrics.[68]

The high R^2 value and significant revenue generated from data licensing demonstrate the tangible economic value and accuracy of environmental data, confirming the theoretical premise of data as a valuable asset for sustainability. This provides empirical evidence that environmental data is not merely an abstract concept but a real, monetizable asset, strongly supporting the paper's core argument regarding the economic aspect of green digital rights.

Under the new legal framework, this environmental data is recognized as a valuable digital asset that can be monetized through several mechanisms:

Data licensing and Revenue generation: Aquaculture operator license their environmental monitoring data to research institutions, government agencies, and private companies. Analysis of 12 participating facilities reveals average annual revenue generation of VND 192 million per facility from data licensing agreements, with total sector revenue of VND 2.3 billion annually. Data purchasers include marine research institutes (45% of revenue), environmental consulting companies (30%), and government monitoring agencies (25%). This revenue is not merely a statistic; it is the direct economic outcome of a newly created market. From an L&E perspective, the Law on Data 2024, by legally recognizing data as a property right,

67 Luong Vinh Quoc Danh, Vu Minh Dung Dang, Huu Danh Tran, Chi Ngon Nguyen, "Design and Deployment of an IoT-Based Water Quality Monitoring System for Aquaculture in Mekong Delta" *International Journal of Mechanical Engineering and Robotics Research*, No. 8 (2020): 1170-1175; Cesar Encinas, Erica Ruiz, Joaquin Cortez, Adolfo Espinoza, "Design and Implementation of a Distributed IoT System for the Monitoring of Water Quality in Aquaculture", [in:] *2017 Wireless Telecommunications Symposium (WTS)*. 1-7. Chicago: Institute of Electrical and Electronics Engineers, 2017.

68 Thai-Nghe Nguyen, Thanh Hai Nguyen, Chi Ngon Nguyen, "Deep Learning Approach for Forecasting Water Quality in IoT Systems" *International Journal of Advanced Computer Science and Applications*, No. 8 (2020): 690-696; Junhao Wu, Zhaocai Wang, "A Hybrid Model for Water Quality Prediction Based on an Artificial Neural Network, Wavelet Transform, and Long Short-Term Memory" *Water*, No. 4 (20222).

performed a market-creating function. It transformed an intangible informational good into a tradable asset, thereby providing the direct financial incentive for aquaculture operators to invest in sustainable monitoring technologies.

Insurance premium reductions: Environmental data demonstrating sustainable practices results in 20-30% reduced insurance premiums for participating operators. Statistical analysis reveals that facilities with certified environmental monitoring systems experience 35% fewer insurance claims and 40% lower average claim values, creating substantial cost savings for operators. This demonstrates a market-based solution to information asymmetry. Insurers traditionally face high costs in verifying the sustainable practices of their clients. The standardized, IoT-generated environmental data acts as a credible and low-cost signal of responsible behavior, reducing the insurer's monitoring and verification costs (a key type of transaction cost) and allowing them to offer lower premiums. This aligns economic incentives (cost savings) with environmental goals (sustainable practices).

Market access advantages: Buyers prefer products from digitally-monitored, environmentally sustainable operations, commanding 15-20% premium prices in international markets. Export analysis reveals that certified sustainable aquaculture products achieve average price premiums of 18% compared to conventional products, with particularly strong demand from EU and Japanese markets. These market-based incentives, enabled by digital monitoring, illustrate how green digital rights can shift economic behavior towards environmental management without solely relying on command-and-control regulations. The willingness of buyers to pay premium prices for sustainable products indicates that market forces, when informed by reliable digital environmental data, can create powerful incentives for greening. This is a crucial law-and-economics insight: how property rights (over data) and information can generate efficient market solutions to environmental problems, complementing or even replacing traditional regulatory approaches.

Research collaboration revenue: Partnerships with universities and research institutions for data sharing generate additional revenue averaging VND 67 million per facility annually. These collaborations support marine ecosystem research, climate change impact studies, and sustainable aquaculture technology development.

However, significant legal challenges persist. The current framework lacks clear guidelines for environmental data ownership when multiple

stakeholders contribute to data collection. Additionally, cross-border data sharing for regional marine conservation efforts faces regulatory obstacles under current data sovereignty provisions, limiting participation in regional monitoring networks. These challenges regarding environmental data ownership with multiple contributors and cross-border data sharing highlight the complexity of applying traditional property rights concepts to fluid, collaborative digital environmental data. This suggests that while data is recognized as an asset, the nuances of "collective data creation" and "transnational data flows" necessitate more sophisticated legal frameworks than simple individual ownership. This reinforces the need for innovative governance models (such as data commons or data trusteeship) that go beyond conventional property rights, as suggested in the theoretical framework.

4.3. Smart Urban Development: Comprehensive Environmental Monitoring

Khanh Hoa's smart city initiatives demonstrate both the potential and limitations of current green digital rights frameworks. The city has implemented comprehensive environmental monitoring systems that collect data on air quality, energy consumption, water usage, and waste management across 8 monitoring stations and 150 IoT sensors throughout the urban area. Research demonstrates that cities with larger ICT sectors are more likely to experience the emergence of green technologies, with dynamic ICT sectors contributing to notable advancements in cutting-edge technological fields including carbon capture and storage, energy production, and transportation.[69] Khanh Hoa's experience confirms these findings, with measurable improvements across multiple environmental indicators.

Environmental performance improvements: Air quality monitoring reveals a 20% reduction in PM2.5 levels and a 25% reduction in NO2 concentrations compared to pre-implementation baselines. Water quality

[69] Dunping Huang, Fan Yang, Donghui Wang, Kai Yin, Bin Gong, Lianbiao Cui, "Exploring the Impacts of the Digital Economy on Carbon Emissions: Lessons from 268 Cities in China" *Sustainability*, No. 18 (2024): 1-20; Le Dong, Fei Ren, Yusong Li, "Does the Digital Economy Promote Environmental Performance Increase? Evidence from China 258 Cities" *Environment Development and Sustainability*, 27 (2025): 24309-24338.

indicators show a 15% improvement in municipal water systems, while energy efficiency improvements average 25% across monitored public buildings. These significant environmental performance improvements and policy optimizations demonstrate a direct causal link between real-time environmental data and effective urban environmental governance. The quantitative improvements are presented as direct results of data-driven policy, providing strong empirical validation for the "smart governance" mode and the value of digital environmental governance in an urban context.

Policy optimization and Evidence-based decision making: Environmental data informs policy decisions, resulting in a 25% improvement in environmental outcomes and a 30% reduction in policy implementation costs. Real-time data enables rapid response to environmental incidents, with average response times improving from 4.2 hours to 1.5 hours. This outcome illustrates the L&E principle of efficiency in public governance. The real-time data drastically reduces the information costs for policymakers, enabling a more efficient allocation of public resources (e.g., deploying environmental response teams) and minimizing the economic and social costs associated with environmental incidents. The digital framework effectively internalizes the information externality that previously hampered swift administrative action.

Public-private partnership development: Environmental data sharing with private companies supports innovation in green technology, attracting VND 15.2 billion in additional private investment to the province. Analysis reveals that data sharing agreements have facilitated the establishment of 12 new green technology companies and the creation of 450 new jobs in environmental technology sectors. The success in attracting private investment and creating new jobs through environmental data sharing highlights the catalytic role of green digital rights in fostering a green economic ecosystem, moving beyond mere regulatory compliance to create dynamic markets. This indicates that green digital initiatives, when supported by data sharing, can stimulate growth and diversification. This is a strong economic argument for green digital rights, showing they are not just about environmental protection but also about economic development and job creation. The attraction of VND 15.2 billion in private capital is a direct response to a reduction in regulatory risk. By establishing a clear legal framework for data sharing and digital assets, the government lowered the uncertainty and ambiguity that often deters private investment in nascent green technology sectors. This stable institutional environment

("the rules of the game") provided the confidence for capital to flow towards innovation, demonstrating how law can serve as a catalyst for economic development.

Citizen engagement and Transparency: Public access to environmental data promotes citizen participation in sustainability efforts, with a 40% increase in citizen-reported environmental issues and a 60% improvement in government response times. Mobile applications providing real-time environmental data have been downloaded by 65% of city residents, with high user satisfaction ratings (4.2/5.0). The high rates of citizen engagement and satisfaction with public access to environmental data confirm the importance of transparency and participatory governance in building public trust and co-producing environmental outcomes. This directly supports the "participatory governance" mode discussed in the theoretical framework. It demonstrates that digital tools can empower citizens, enhance their involvement, and improve government responsiveness.

4.4. Economic Impact Assessment and Performance Metrics

Comprehensive economic analysis reveals that green digital rights implementation in Khanh Hoa province has generated measurable economic, environmental, and social benefits that exceed implementation costs by a factor of 3.2:1. The high benefit-cost ratio provides a compelling economic argument for the broader adoption of green digital rights, indicating that these initiatives are not only environmentally beneficial but also financially prudent investments. This refutes any potential arguments that green initiatives are merely cost centers, instead positioning green digital rights as a smart investment strategy for sustainable development. The detailed performance metrics are presented in Table 4.

Table 4: Economic and Environmental Performance Indicators (Khanh Hoa case study)

Category	Specific Indicator	Quantitative Result
Overall Economic Benefit	Benefit-cost ratio	3.2:1
Revenue generation and market development	Additional revenue from environmental data monetization	VND 2.3 billion (75% aquaculture, 25% urban)
	Annual revenue from premium valuation of sustainable products	VND 4.1 billion (15-20% price premium)

Category	Specific Indicator	Quantitative Result
Cost savings and efficiency improvements	Avoided environmental remediation costs	VND 4.7 billion
	Annual savings from reduced insurance premiums (average 25%)	VND 890 million
	Annual savings from improved energy efficiency (average 25%)	VND 1.8 billion
Investment attraction and economic development	Additional private investment attracted to the province	VND 15.2 billion (60% green technology, 40% monitoring infrastructure)
	New jobs created in green technology sectors	450 jobs (average salaries 35% higher than provincial average)
Environmental performance indicators	Improvement in marine water quality indicators	35%
	Improvement in municipal water systems	15%
	Reduction in PM2.5 levels	20%
	Reduction in NO_2 concentrations	25%
	Average energy efficiency improvement across monitored facilities	25%
	Reduction in municipal waste generation through smart monitoring systems	30%

Source: authors' calculations and synthesis from empirical research data, 2025

The creation of 450 new jobs in green technology sectors with average salaries 35% higher than provincial averages suggests that the twin transition can foster a higher-value, more skilled economy. This indicates that green digital transformation can lead to an improvement in the quality of the labor market, attracting talent and potentially reducing brain drain, which is a significant consideration for developing economies.

5 Legal Gaps and Policy Recommendations

5.1. Comprehensive Regulatory Framework

Vietnam should establish an inter-ministerial working group (Natural Resources, Information & Communications, Justice) to develop precise definitions for environmental data and green digital assets. Introducing

a tiered certification system based on environmental impact will incentivize continuous improvement. Frameworks for stakeholder participation, including legal standing and public engagement, are essential for inclusive governance.

5.2. Legal Sandboxes with Performance Metrics

Multi-province pilot programs (e.g., Khanh Hoa, HCMC, Dong Nai, Can Tho) can test green digital models in diverse contexts. Sandboxes should allow regulatory flexibility, such as eased data sovereignty for environmental data and expedited green tech approvals, balancing security with openness. Robust KPIs across environmental, economic, and governance metrics will enable adaptive, evidence-based policy adjustments.

5.3. Environmental Data Standards

Develop technical standards for data collection, QA, and interoperability (formats, APIs, metadata) to lower transaction costs and enhance market value. Certification systems for monitoring equipment and lifecycle management will ensure accuracy and secure sharing. IP and ownership frameworks should define rights and licensing models to foster collaboration and data monetization.

5.4. Institutional Capacity and International Cooperation

Capacity building for regulators through targeted training in law, governance, and technology is critical. SMEs need financial incentives and technical assistance for inclusive participation. International cooperation – via technology transfer, joint R&D, and global standards engagement – will address weak coordination and help Vietnam integrate into global, green, digital ecosystems.

6 Conclusion

This paper develops the green digital rights concept as an interdisciplinary framework to integrate law, economics, and technology for sustainable governance. Vietnam's emerging legislation demonstrates progress but faces gaps in clarity, enforcement, and coordination. Empirical evidence from Khanh Hoa confirms that green digital rights generate significant economic and environmental benefits, validating the law-and-economics approach.

Policy success depends on harmonizing regulations, fostering innovation through legal sandboxes, and strengthening institutional capacity. With these measures, Vietnam can advance its twin transition toward a sustainable, digitally empowered economy, while enhancing global competitiveness.

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