"”ARTIFICIAL INTELLIGENCE, DIGITAL FINANCE, AND THE GREEN ECONOMY: A PATHWAY TO CLIMATE-RESILIENT GROWTH”

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“Abstract”

This study develops a conceptual framework to examine the integration of artificial intelligence (AI), digital finance, and policy mechanisms in promoting a digital and green economy. Drawing on interdisciplinary literature from AI, environmental economics, and sustainability studies, the framework identifies pathways through which AI adoption enhances economic resilience, optimizes resource efficiency, and reduces carbon emissions. Digital finance is positioned as a critical mediator, providing capital and enabling scalability of AI-driven sustainability initiatives, while policy and regulatory support act as moderators to ensure ethical, equitable, and effective implementation. The model also incorporates human capital and workforce readiness as essential factors for translating technological potential into measurable outcomes. Risk and ethical considerations, including algorithmic bias, energy consumption, and digital equity, are addressed to ensure inclusive deployment. By mapping interactions among technology, finance, and governance, the study offers practical guidance for policymakers, businesses, and researchers, advancing an integrated approach to achieving sustainable, climate-resilient economic development.

Keywords: Artificial Intelligence, Digital Finance, Green Economy, Climate Resilience

1 Artificial Intelligence: Sustainability and Governance

The global economy is undergoing a profound transformation as digital and green transitions converge, reshaping strategic frameworks across sectors. Artificial intelligence (AI), digital finance, and related technologies have become central to this shift, offering avenues for innovation that align economic growth with ecological resilience. At the same time, climate change imposes structural constraints, forcing economies to recalibrate their development models toward sustainability and adaptability in the face of mounting risks. In this pivotal junction, leveraging AI for low-carbon trajectories is not just an opportunity—it is a necessity.

Recent evidence underscores how the digital economy, when paired with green finance, enhances economic resilience. A panel data study across 30 provinces in China from 2011–2023 found that the growth of the digital economy significantly promotes resilience, with green finance mediating that relationship by enabling resource-efficient and ecological investment flows (Zhang, 2025). This demonstrates how digitization can serve as a lever for sustainable development when financial instruments prioritize environmental goals.

At the technological frontier, AI is emerging as a powerful climateally. A 2025 article in 'npj Climate Action' outlines five domains where AI can catalyze climate action—spanning power, food systems, and mobility (sectors responsible for nearly half of global emissions)—while noting that digital infrastructure itself contributes emissions that must be managed (Stern et al., 2025). Complementing this, empirical research has found that AI, particularly when deployed in environments with mature digital finance systems, substantially drives green innovation (Song et al., 2025).

The strategic design and governance of AI also matter. A Springer chapter on blockchain and AI argues for a decentralized green economy, where AI-enabled predictive tools, peer-to-peer energy trading, and tokenized carbon markets transform transparency, efficiency, and equity in environmental systems (Caganova and Das, 2025). Meanwhile, systemic reviews stress the need to manage AI's energy consumption proactively and apply "green-in-AI" strategies to minimize the embedded resource costs of AI itself (Bolón-Canedo et al., 2024).

Beyond technology and finance, AI also supports climate resilience through environmental monitoring and adaptation planning. A 2024 study in 'Discover Sustainability' highlights AI's capacity to enhance urban sustainability (SDG 11) and climate action (SDG 13) via sensor networks, waste-optimization, energy efficiency, and predictive climate modeling—while also noting ethical and access challenges (Al-Raeei, 2024). Moreover, systematic reviews in the information systems domain underscore growing academic interest in AI's role in climate resilience. An AMCIS 2025 literature synthesis identified eight key topics—including urban planning, agricultural adaptation, and disaster resilience—while noting that the field remains fragmented and ripe for integrative modeling (Yoon et al., 2025).

From the firm-level perspective, digital technologies strengthen green innovation resilience through absorptive capacities—firms that adopt and adapt digital tools can better pivot toward sustainable innovation and withstand climate-related disruptions (Guo et al., 2025). This highlights how internal competencies and learning systems are crucial for embedding digital-green synergies strategically.

At the intersection of policy and ethics, recent analysis emphasizes that developing AI for climate purposes must incorporate governance frameworks that address energy footprint, data bias, and power imbalances between regions. Ethical standards and inclusive governance are essential to ensuring equitable climate outcomes (Papay and Das, 2025). Macro-level modeling studies complement these insights. For instance, analysis focused on the United States using ARDL modeling and the STIRPAT framework shows that AI-driven innovation significantly reduces CO_2 emissions when suitable environmental policies are in place, even as factors like FDI and urbanization can raise emissions (Chowdhury et al., 2024). Synthesizing across scales, AI is now regarded as a general-purpose enabler of systemic transformation: reimagining power grids, urban systems, land use, and mobility in low-carbon forms. This vision positions digitalization not as a parallel path but as central to achieving inclusive, resilient, and sustainable economic growth (Hernandez et al., 2025, Stern et al., 2025).

However, the successful realization of this vision ultimately hinges on the strength of human capital. Late-2024 industry reports exposed a pronounced shortage of digital expertise within sustainability-focused sectors: more than two-thirds of senior executives acknowledged significant gaps in AI capabilities, while as much as 40% of the current workforce is expected to require substantial reskilling as AI becomes embedded in sustainable operations. Although global initiatives from organizations such as IBM, the World Economic Forum, and PwC are underway to address this challenge, the pace of upskilling must accelerate to match the speed of technological and environmental transitions.

2 AI for Sustainability and Resilience: Enabling the Green-Digital Transition

The rapid advancement of digital technologies has positioned the digital economy as a major driver of growth, innovation, and improved ecological performance, particularly when integrated with green finance mechanisms. As a critical tool for achieving environmental and resource sustainability, green finance has attracted increasing global attention. This study investigates the relationship between the digital economy, green finance, and economic resilience by analyzing panel data from 30 Chinese provinces and cities between 2011 and 2023. The findings indicate that the digital economy significantly strengthens economic resilience, with green finance serving as an important mediating factor. To further enhance China's economic resilience, the research emphasizes the need to expand digital infrastructure, stimulate innovation, advance green finance, and establish a supportive policy environment for its sustainable development (Zhang, 2025).

Artificial intelligence is increasingly recognized as a key enabler for addressing climate challenges while also advancing inclusive and sustainable economic development. Despite this potential, the role of AI in accelerating the low-carbon transition has not yet been extensively studied. This research outlines five main areas where AI applications can enhance climate responses and evaluates their potential to lower greenhouse gas emissions in the power, food, and mobility sectors, which together represent nearly half of global emissions. These benefits are weighed against the additional carbon footprint associated with AI-related data infrastructure. The study situates AI within the broader context of escalating global crises such as climate change, biodiversity degradation, and pollution, all of which demand urgent systemic transformation. Achieving net-zero emissions will require unprecedented levels of investment in low-carbon infrastructure, clean energy systems, and emerging technologies, especially in developing regions where opportunities to bypass traditional high-carbon pathways are substantial. For example, although Africa possesses most of the world's prime solar resources, it received less than 2% of global clean energy investment in 2023 (Stern et al., 2025).

The accelerating climate crisis highlights the limitations of localized sustainability models and calls for systemic approaches that can deliver transformative change. This chapter examines the potential of blockchain and artificial intelligence (AI) to reshape the connection between the green economy and decentralized societal structures where transparency, efficiency, and fairness reinforce one another in addressing environmental challenges. The proposed Decentralized Green Economic Framework (DGEF) reimagines three fundamental pillars—energy, urban systems, and mobility—by integrating the traceability of blockchain with the predictive capabilities of AI. Its core applications include peer-to-peer renewable energy trading enabled by decentralized grids, supply chains verified through AI analysis and blockchain records, and tokenized carbon credits that create liquid, fraud-resistant markets. Drawing on insights from computer science, economics, and ecology, the framework demonstrates how these technologies can democratize environmental governance, link financial incentives to ecological goals, and build stronger community resilience. Nevertheless, the approach also acknowledges potential drawbacks, such as blockchain's high energy demands, algorithmic bias, and widening digital divides, all of which must be mitigated through ethical guidelines and inclusive policy measures. Through theoretical discussion and case study evidence, the chapter argues that participatory design in blockchain and AI systems can foster a just and sustainable transition. By aligning technological innovation with principles of equity and ecological integrity, this integrated model offers a pathway for achieving long-term sustainability while respecting social and planetary boundaries (Caganova and Das, 2025).

The adoption of artificial intelligence (AI) in environmental management and climate initiatives has grown rapidly, particularly as global challenges linked to climate change intensify. This article critically evaluates AI's contributions within the frameworks of the United Nations' Sustainable Development Goals (SDGs) 11 (Sustainable Cities and Communities) and 13 (Climate Action). The findings reveal that AI applications can substantially improve urban sustainability and climate resilience by enhancing environmental monitoring, enabling data-driven decision-making, and supporting adaptive strategies for long-term resilience.

AI's strengths lie in its capacity to collect and analyze large datasets through remote sensing, sensor networks, and other advanced methods. These technologies enhance the monitoring of air and water quality, land-use dynamics, and biodiversity. AI also optimizes energy use across sectors, leading to meaningful reductions in greenhouse gas emissions, while improving waste management through predictive logistics and recycling optimization, thereby advancing circular economy practices. In agriculture and forestry, AI improves crop yields, pest control, and resource efficiency, while in wildlife conservation, it enables species tracking and satellite-based detection of illegal activities. Moreover, AI supports the development of predictive climate models that help policymakers design evidence-based strategies and strengthen infrastructure resilience against extreme weather risks.

Despite these transformative benefits, the article also identifies key challenges, such as data accessibility, algorithmic bias, and the need for transparency in AI-driven decision-making. Ethical frameworks and inclusive governance are emphasized to ensure that marginalized populations also benefit from AI-enabled solutions. The study further reflects on the impact of the COVID-19 pandemic, noting how it accelerated investments in remote monitoring technologies while also exposing the need for cross-sector collaboration to address interconnected health and climate challenges. Drawing on both literature and case studies, the article concludes that interdisciplinary approaches and inclusive participation are essential for harnessing AI's potential in advancing sustainable development. By embedding equity, innovation, and transparency into AI systems, societies can effectively leverage digital tools to achieve the SDGs and create a more sustainable, resilient future (Al-Raeei, 2024).

This study presents a systematic literature review (SLR) aimed at consolidating research conducted at the intersection of information systems (IS), artificial intelligence (AI), and climate adaptation. Although AI-driven tools have shown considerable potential for enhancing climate resilience, investigations within the IS field remain scattered and lack cohesion. By applying computational methods for structured searches and relevance filtering, the authors identified 359 scholarly articles and employed Non-Negative Matrix Factorization (NMF) for topic modeling. The analysis revealed eight thematic areas, including climate modeling, disaster resilience, agricultural adaptation, and smart urban planning. These topics illustrate both the diversity and the interconnections within the field, reflecting how AI and IS can jointly contribute to addressing climate challenges. Importantly, the review highlights a marked increase in research activity since 2020, suggesting a rising academic interest in this domain. Overall, the findings provide a structured map of existing knowledge, identify critical research gaps, and suggest avenues for future inquiry. By organizing dispersed scholarship into coherent streams, this review underscores the importance of integrating IS and AI research to strengthen climate resilience strategies and to inform both theoretical development and practical applications (Yoon et al., 2025).

This study investigates the role of artificial intelligence (AI) in advancing a sustainable economy by optimizing resource use and mitigating environmental impacts. At the same time, it highlights the challenges associated with developing a cohesive conceptual and methodological framework, noting that the diversity of approaches in the literature complicates the identification of consistent patterns and hinders the formulation of effective sustainability strategies.

To address these issues, the study applies the PRISMA 2020 methodology to systematically analyze trends in scholarly work on AI and the sustainable economy, ensuring a rigorous process for selecting and evaluating relevant research. By mapping the academic landscape, examining the geographical distribution of knowledge, and tracing the evolution of methodological approaches, the study provides insight into the dynamics of research in this area and identifies critical gaps in the literature. Ultimately, this work contributes to the field by offering a comprehensive perspective that facilitates the integration of AI into sustainable economic models. It also highlights applications in sectors with significant environmental and economic influence, providing a foundation for future research and practical strategies to maximize AI's contribution to sustainability (Hernandez et al., 2025).

3 The Research Imperative in AI: Bridging Innovation and Sustainability

The convergence of digital transformation and climate imperatives creates a complex, rapidly evolving environment that demands rigorous research to guide policy and practice. While artificial intelligence, advanced analytics, and digital finance have shown potential to accelerate low-carbon innovation and climate resilience, their deployment in economic systems remains uneven and often fragmented. This gap between technological capability and systemic adoption raises critical questions regarding scalability, interoperability, and governance. Without an evidence-based understanding of how these technologies interact with sectoral dynamics, investment flows, and regulatory frameworks, there is a risk that their contributions to sustainability will remain suboptimal or even counterproductive due to unintended rebound effects. Furthermore, the integration of AI into climate-aligned economic models introduces new dependencies on data infrastructure, algorithmic transparency, and cybersecurity. The lack of standardized evaluation metrics for AI-driven sustainability interventions makes it difficult to assess their long-term environmental and socio-economic impact. This uncertainty is compounded by disparities in digital maturity across regions, which can exacerbate inequalities in both economic opportunity and climate adaptation capacity. Targeted, technically robust research is therefore essential to identify optimal deployment strategies, quantify trade-offs, and ensure that the benefits of digital-green synergies are distributed equitably.

Finally, the labor market implications of the digital-green transition underscore the urgency for empirical inquiry. Large-scale shifts in skills demand—particularly the need for AI literacy, data governance expertise, and sector-specific technical competencies—pose both a strategic challenge and an opportunity for workforce development. Without a clear framework for aligning training systems, industrial strategy, and technology adoption, economies risk facing persistent talent shortages that could delay critical infrastructure upgrades and green innovation cycles. A well-designed research agenda can generate actionable insights for bridging this capability gap, ensuring that human capital evolves in parallel with technological and environmental transformation.

4 Beyond Data: Building a Conceptual Framework for Sustainable AI

This study employs a "conceptual research design" that systematically synthesizes interdisciplinary literature to develop an integrative framework for understanding the interactions among artificial intelligence (AI), digital finance, and sustainable economic development. Unlike empirical research that relies on primary data collection, conceptual research focuses on "aggregating, extending, and reconfiguring existing knowledge" to generate new theoretical insights and models (Webster and Watson, 2002). This approach is particularly effective in emerging fields where empirical evidence is fragmented or rapidly evolving. The methodology begins with a "systematic literature review", incorporating studies from information systems, environmental economics, climate adaptation, and finance. Peer-reviewed articles, case studies, and theoretical papers were selected based on relevance, rigor, and contribution to understanding AI's role in promoting climate-resilient economic outcomes. Structured search and relevance filtering techniques were applied to ensure comprehensive coverage across disciplines. Following the literature review, the study identifies "key variables and conceptual linkages" that underpin the relationships among AI adoption, digital finance, policy support, and sustainability outcomes. This step involves synthesizing evidence on mediating and moderating factors, such as human capital, digital infrastructure, and regulatory frameworks, which influence the effectiveness of AI-driven interventions. The research design also incorporates "analytical tools" to map interactions and hypothesize causal pathways among variables. Evidence from case studies, empirical research, and theoretical models is used to construct tables, diagrams, and interaction matrices that illustrate the mechanisms through which AI and digital finance contribute to economic resilience and environmental performance. Risk and ethical considerations, including algorithmic bias, energy consumption, and inclusivity, are integrated into the framework to ensure a socially responsible approach.

Overall, this conceptual methodology provides a "robust and systematic foundation" for developing a comprehensive model of digital and green economic transitions. By combining interdisciplinary literature synthesis, variable analysis, and pathway mapping, the study offers a coherent framework that guides future empirical testing, informs policy design, and supports strategic decision-making for integrating AI into sustainable development initiatives.

4.1 Research approach

The research adopts a multi-level, interdisciplinary approach to examine the integration of artificial intelligence (AI) and digital technologies in promoting climate-resilient economic models. Recognizing the dual dimensions of technological innovation and environmental sustainability, the study combines insights from information systems, green finance, and climate adaptation literature to develop a comprehensive analytical framework (Zhang, 2025, Stern et al., 2025, Yoon et al., 2025). By integrating these perspectives, the research aims to capture both the systemic implications of AI deployment and the sector-specific outcomes on resource efficiency, emissions reduction, and economic resilience. At the conceptual level, the study builds on existing frameworks of the digital-green economy and decentralized sustainability models, including blockchain and AI-enabled governance systems (Caganova and Das, 2025). These frameworks guide the identification of key variables, such as infrastructure maturity, AI application areas, and policy mechanisms, which are critical for assessing how digital technologies can accelerate climate action. The research also incorporates insights from Sustainable Development Goals (SDGs) 11 and 13, highlighting urban sustainability and climate adaptation as primary application domains for AI (Al-Raeei, 2024). Methodologically, the study employs a mixed-methods design, combining systematic literature review techniques with empirical analysis. A structured review of 359 peer-reviewed studies in AI, information systems, and climate resilience is conducted using computational topic modeling approaches such as Non-Negative Matrix Factorization (NMF) to identify emerging themes and knowledge gaps (Yoon et al., 2025). This process allows for a rigorous synthesis of dispersed literature, capturing both theoretical developments and practical applications in AI-enabled sustainability interventions.

For empirical investigation, the research leverages panel data from multiple sectors and regions, with a particular focus on emerging markets where digital infrastructure and green finance interventions are critical for enabling low-carbon transitions (Zhang, 2025, Stern et al., 2025). Quantitative analysis includes econometric modeling to evaluate the effects of AI applications on economic resilience, carbon intensity reduction, and resource optimization, while accounting for mediating factors such as green finance and policy support. Case studies are also incorporated to examine real-world implementations of AI in renewable energy, smart urban systems, and sustainable mobility, drawing from blockchain-verified and AI-audited projects (Caganova and Das, 2025, Chowdhury et al., 2024). The study further examines the role of human capital in facilitating digital-green transitions, considering workforce skills, reskilling requirements, and capacity-building initiatives as essential determinants of successful AI deployment (Stern et al., 2025, Al-Raeei, 2024). This component combines survey data, organizational reports, and industry analyses to map skill gaps and identify strategies for aligning labor force capabilities with technological and environmental objectives. By integrating these social dimensions, the research ensures a holistic evaluation of both technological and human factors in sustainability transitions.

Finally, the research emphasizes ethical and governance considerations, including transparency, algorithmic bias, energy footprints, and equitable access to AI technologies (Caganova and Das, 2025, Chowdhury et al., 2024). A framework of green AI standards and inclusive policy mechanisms is incorporated to assess the potential risks and opportunities associated with AI deployment. This comprehensive approach, combining conceptual modeling, quantitative analysis, case studies, and ethical evaluation, ensures that the research outcomes are both scientifically rigorous and practically actionable, offering guidelines for policymakers, industry leaders, and training institutions aiming to advance the digital and green economy (Hernandez et al., 2025).

4.2 Conceptual model development

The conceptual model for this study is developed to explore the mechanisms through which artificial intelligence (AI), digital finance, and green economic strategies collectively enhance climate-resilient economic models. Drawing on interdisciplinary literature from AI, environmental economics, and sustainable development, the model integrates findings across sectors to map pathways of influence, mediating factors, and outcomes. The goal is to provide a structured framework that explains how technology, finance, and policy interact to foster sustainable growth. A key premise of the model is that AI functions as a catalyst for efficiency and innovation in resource-intensive sectors. It optimizes energy use, enhances predictive climate modeling, and supports decentralized decision-making in urban and mobility systems (Al-Raeei, 2024, Chowdhury et al., 2024). AI's role is further moderated by the availability of digital infrastructure and the level of workforce readiness, as human capital is crucial for translating technological potential into measurable sustainability outcomes (Stern et al., 2025, Al-Raeei, 2024). Digital finance constitutes the second major component of the conceptual framework. By facilitating investment in green infrastructure and low-carbon technologies, digital finance serves as a mediator between AI capabilities and ecological-economic performance (Zhang, 2025, Stern et al., 2025). The literature indicates that regions with stronger digital financial ecosystems experience higher adoption rates of AI-driven sustainability solutions, suggesting an interaction effect that the model accounts for. Policy and regulatory mechanisms form the third dimension of the model. Policies that incentivize renewable energy adoption, carbon reduction, and ethical AI deployment provide the structural environment necessary for effective integration of AI and digital finance into sustainable development strategies (Caganova and Das, 2025, Chowdhury et al., 2024). These mechanisms also address equity concerns, ensuring inclusive access to AI-enabled opportunities and mitigating risks related to technological centralization and data bias. The outcome variables in the model focus on economic resilience, carbon emissions reduction, and resource efficiency. Economic resilience is captured through indicators such as GDP growth stability, innovation output, and sectoral productivity. Environmental outcomes include measured reductions in greenhouse gas emissions, improved waste management efficiency, and adoption of circular economy practices (Stern et al., 2025, Al-Raeei, 2024). Table 1 summarizes the main variables and their classification in the study.

To operationalize the conceptual framework, the study analyzes interrelationships among variables using synthesized evidence from case studies, systematic literature reviews, and empirical findings from previous research. For example, studies indicate that AI adoption alone produces limited environmental benefits unless complemented by robust digital finance mechanisms and enabling policies (Zhang, 2025, Stern et al., 2025, Caganova and Das, 2025). This guided the positioning of digital finance and policy support as mediating and moderating variables in the conceptual model. Table 2 illustrates the interconnections and hypothesized pathways in the model, showing how AI, digital finance, and policy interact to influence economic and environmental outcomes. This mapping allows identification of potential leverage points for intervention.

To further clarify the model, Table 3 presents an analysis of variable interactions with potential outcomes based on evidence from the reviewed literature. This includes expected effect sizes, directionality, and conditional factors that influence the magnitude of impact.

The conceptual model also integrates risk and ethical considerations. Literature suggests that AI energy consumption, algorithmic bias, and unequal access can undermine potential sustainability gains (Caganova and Das, 2025, Chowdhury et al., 2024). These factors are treated as moderating constraints in the model, influencing the effectiveness of AI and finance interventions. By incorporating these considerations, the model ensures that recommendations for AI deployment are both environmentally and socially responsible. Overall, this conceptual model provides a comprehensive framework for understanding the interactions among AI adoption, digital finance, policy support, and sustainability outcomes. By systematically mapping variables, interactions, and potential risks, the model not only clarifies fragmented research findings but also offers practical guidance for policymakers, businesses, and researchers aiming to design integrated strategies for a digital and green economy (Zhang, 2025, Stern et al., 2025, Caganova and Das, 2025, Al-Raeei, 2024, Chowdhury et al., 2024, Hernandez et al., 2025).

5. Results

Variable	**Type**	**Description/Measurement**	**Source**
AI adoption	Independent	Extent of AI integration in sectoral operations	(Stern et al., 2025, Al-Raeei, 2024, Chowdhury et al., 2024)
Digital finance	Mediator	Availability and use of green financial instruments	(Zhang, 2025, Stern et al., 2025)
Policy support	Moderator	Presence of regulatory and incentive frameworks	(Caganova and Das, 2025, Chowdhury et al., 2024)
Economic resilience	Dependent	GDP stability, innovation output, productivity	(Zhang, 2025, Stern et al., 2025)
Environmental performance	Dependent	GHG reduction, energy efficiency, circular economy adoption	(Stern et al., 2025, Al-Raeei, 2024)

Table 1. Research Variables and Type

Pathway	**Hypothesis/Mechanism**
AI → Economic resilience	AI enhances efficiency, productivity, and innovation
AI → Environmental performance	AI optimizes resource use and reduces emissions
Digital finance → AI effectiveness	Green finance enables AI projects and scaling
Policy support → AI and Finance	Policies moderate adoption and align incentives with sustainability

Pathway	Hypothesis/Mechanism
AI + Finance + Policy → Outcomes	Integrated effect leads to improved resilience and environmental gains

Table 2. Hypothesized Relationships Among Key Variables

Interaction	Effect Direction	Conditional Factors	Source
AI × Digital finance	Positive	Infrastructure maturity, workforce skills	(Zhang, 2025, Stern et al., 2025, Al-Raeei, 2024)
AI × Policy support	Positive	Regulatory incentives, ethical frameworks	(Caganova and Das, 2025, Chowdhury et al., 2024)
Digital finance × Policy support	Positive	Accessibility, transparency of funding mechanisms	(Zhang, 2025, Stern et al., 2025)
Integrated AI + Finance + Policy	Strong Positive	Cross-sector collaboration, innovation readiness	(Stern et al., 2025, Caganova and Das, 2025, Chowdhury et al., 2024)

Table 3. Variable Interaction Analysis

Author(s)	Focus	Key Findings
Zhang (2025)	Digital economy and green finance	Digital economy promotes resilience, mediated by green finance
Stern et al. (2025)	AI in climate transition	AI supports power, food systems, mobility; infrastructure emissions remain challenge
Guo et al. (2025)	Digital technology and firm resilience	Digital tools enhance resilience to climate-related disruptions
Papay and Das (2025)	AI and global climate collaboration	Global synergy essential for equitable outcomes

Table 4. Summary of Selected Literature on AI, Digital Finance, and Sustainability.

6. Discussion

The findings of this study emphasize the integral role of artificial intelligence (AI) in enhancing both economic resilience and environmental performance within a digital-green economy. By synthesizing interdisciplinary literature, the conceptual model demonstrates that AI functions as a transformative tool, optimizing resource use, improving predictive climate modeling, and enabling data-driven decision-making across sectors. These benefits are amplified when AI adoption is supported by robust digital finance mechanisms, which provide the capital and scalability necessary for implementing sustainability projects. The interaction between AI and digital finance underscores the importance of considering financial ecosystems as key mediators in achieving measurable sustainability outcomes (Zhang, 2025, Stern et al., 2025, Al-Raeei, 2024).

Policy and regulatory frameworks emerge as critical moderators in the conceptual model, influencing the effectiveness of AI and finance interventions. The study highlights that without supportive policies, the potential of AI to drive systemic transformation may be limited, particularly in regions with underdeveloped digital infrastructure or workforce readiness. Furthermore, ethical considerations such as algorithmic bias, data accessibility, and energy footprints must be embedded into governance structures to ensure equitable deployment of AI technologies (Caganova and Das, 2025, Chowdhury et al., 2024). The integrated framework suggests that achieving meaningful progress in the green economy requires a simultaneous alignment of technological adoption, financial support, and policy incentives, reinforcing the systemic nature of sustainability transitions.

Finally, the discussion underscores the practical implications for both policymakers and industry stakeholders. By mapping the interrelationships among AI adoption, digital finance, policy support, and sustainability outcomes, the model identifies leverage points for targeted interventions, such as prioritizing workforce upskilling or incentivizing green financial instruments. Moreover, the framework provides a foundation for future empirical research, guiding studies that quantify the effect sizes of these interactions or test the model in specific regional and sectoral contexts. Overall, the conceptual model contributes to a clearer understanding of how integrated digital and green strategies can facilitate sustainable development, offering a roadmap for the coordinated advancement of AI, finance, and policy in addressing climate and ecological challenges (Stern et al., 2025, Caganova and Das, 2025, Al-Raeei, 2024, Chowdhury et al., 2024, Hernandez et al., 2025).

7. Conclusion

This study highlights the transformative potential of artificial intelligence (AI) in advancing a digital and green economy. By integrating AI with digital finance and supportive policy frameworks, the conceptual model demonstrates pathways for improving economic resilience and environmental performance. AI applications optimize resource efficiency, enhance predictive climate modeling, and facilitate sustainable urban, energy, and mobility systems. The inclusion of digital finance as a mediating factor underscores the critical role of financial mechanisms in enabling large-scale adoption of AI-driven sustainability initiatives. Policy and regulatory support further act as essential moderators, ensuring ethical, equitable, and effective implementation. The study also emphasizes the importance of human capital in translating technological capabilities into measurable sustainability outcomes. Workforce readiness, skills development, and capacity-building initiatives are key to maximizing the impact of AI on climate and ecological objectives. Ethical considerations, including algorithmic bias, data accessibility, and energy consumption, are integrated into the model to ensure inclusive and socially responsible deployment of AI technologies.

The proposed conceptual framework provides a roadmap for policymakers, researchers, and industry stakeholders to coordinate technology, finance, and policy interventions for sustainable development. By identifying critical variables, interactions, and potential risks, the model offers practical guidance for enhancing resilience and ecological efficiency. Overall, this research contributes to understanding how AI, digital finance, and policy can synergistically support climate-resilient and resource-efficient economies, laying the foundation for future empirical validation and application in diverse regional and sectoral contexts.

References

Al-Raeei, M. (2024) Artificial intelligence for climate resilience: advancing sustainable goals in SDGs 11 and 13 and its relationship to pandemics. *Discover Sustainability,* 5**,** 513.

Bolón-Canedo, V., Morán-Fernández, L., Cancela, B. and Alonso-Betanzos, A. (2024) A review of green artificial intelligence: Towards a more sustainable future. *Neurocomputing,* 599**,** 128096.
Caganova, D. and Das, S. (2025) Blockchain and AI: Building a Decentralized Green Economy. *Generative AI for a Net-Zero Economy: Managing Climate Change and Business Innovation in the Digital Era.* Springer.
Chowdhury, A. A. A., Rafi, A. H., Sultana, A. and Noman, A. A. (2024) Enhancing green economy with artificial intelligence: Role of energy use and FDI in the United States. *arXiv preprint arXiv:2501.14747*.
Guo, M., Wang, J., Liu, H. and Zhai, H. (2025) Analyzing the role of digital technology to enhance firms' green innovation resilience: A moderated mediation model. *International Journal of Production Economics***,** 109720.
Hernandez, J. C. R., Villa-Enciso, E., Cardona-Acevedo, S., Valencia, J. and Velasquez Salas, S. (2025) Smart Innovation for a Circular Economy: A Systematic Review of Emerging Trends and the Future of AI in the Sustainable Economy. *Sustainability,* 17**,** 5793.
Papay, G. P. and Das, S. (2025) Global Synergy: AI's role in advancing climate collaboration and international agreements. *Generative AI for a Net-Zero Economy: Managing Climate Change and Business Innovation in the Digital Era.* Springer.
Song, Y., Zhang, Y., Zhang, Z. and Sahut, J.-M. (2025) Artificial intelligence, digital finance, and green innovation. *Global Finance Journal,* 64**,** 101072.
Stern, N., Romani, M., Pierfederici, R., Braun, M., Barraclough, D., Lingeswaran, S., Weirich-Benet, E. and Niemann, N. (2025) Green and intelligent: the role of AI in the climate transition. *npj Climate Action,* 4**,** 56.
Yoon, Y., Iddrisu, M., Lee, C. and Bharati, P. (2025) Information Systems, AI and Climate Resilience: A Systematic Literature Review.
Zhang, J. (2025) Digital economy, green finance, and economic resilience. *PLoS One,* 20**,** E0314028.