

Sustainable Digital Finance Through Artificial Intelligence and Green Cloud Computing: Emerging Technologies for ESG-Oriented Financial Systems

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Abstract:

The rapid digital transformation of the financial sector is creating new opportunities to integrate sustainability into financial decision-making. Artificial Intelligence (AI), cloud computing, big-data analytics and FinTech are increasingly being used for credit assessment, investment management, climate-risk analysis, ESG evaluation, fraud detection and regulatory compliance. However, the growing use of AI and cloud infrastructure also increases energy consumption and the environmental footprint of digital financial services. This paper examines how Artificial Intelligence and Green Cloud Computing can jointly support sustainable digital finance and ESG-oriented financial systems. The present paper analyses that AI can improve ESG data analysis, climate-risk prediction, sustainable investment and financial decision-making, while Green Cloud Computing can reduce energy consumption, carbon emissions and inefficient use of computing resources. Recent evidence from Indian banking indicates that infrastructure readiness, financial investment and competitive pressure are significant drivers of Green AI adoption, while Green AI adoption is positively associated with sustainability outcomes. The research study proposes an integrated model combining AI intelligence, Green Cloud infrastructure, ESG analytics and responsible governance. This paper emphasises that sustainable digital finance requires not only intelligent financial decisions but also environmentally sustainable digital infrastructure.

Keywords: Artificial Intelligence, Sustainable Digital Finance, Green Cloud Computing, ESG, Green AI, Green Finance, Sustainable Banking.

Introduction

Digital technologies are transforming the financial services industry. Banks, insurance companies, investment institutions and FinTech firms increasingly use Artificial Intelligence, machine learning, cloud computing and big-data analytics to improve financial decision-making and operational efficiency. At the same time, increasing environmental concerns have encouraged financial institutions to

incorporate Environmental, Social and Governance (ESG) principles into lending, investment and risk-management decisions.

Sustainable digital finance represents the convergence of digital technology, financial services and sustainability. Recent research identifies digital financial inclusion, sustainable financial development, green finance, FinTech and digital transformation as major themes in the emerging sustainable digital-finance literature. A bibliometric and integrative review of 168 Web of Science publications identified sustainable digital finance as an emerging field connecting digital transformation with sustainability and Sustainable Development Goals.

Artificial Intelligence has particular relevance to ESG-oriented finance because it can analyse large volumes of financial and non-financial information. AI-based natural language processing can analyse sustainability reports, machine-learning models can predict climate-related risks, and intelligent systems can support sustainable investment and lending decisions. A comprehensive review of AI and ESG in finance identifies eight major research areas, including ESG disclosure and measurement, risk management, forecasting, investment and responsible AI.

However, AI and cloud computing also create environmental challenges. AI models require computational power, while cloud data centres consume electricity for processing, storage and cooling. Green Cloud Computing therefore becomes an important component of sustainable digital finance. Research on Green Cloud Computing highlights energy efficiency, resource optimisation, virtualisation, workload management and reduction of carbon emissions as important sustainability mechanisms.

In the Indian context, this issue is particularly relevant because India's banking sector is undergoing rapid digital transformation while simultaneously responding to growing ESG and sustainability requirements. Recent Indian research has specifically examined Green AI adoption in banking and its relationship with sustainability outcomes.

Literature Review

Sustainable Digital Finance- Sustainable digital finance combines digital technologies with financial sustainability objectives. Digital platforms can improve access to finance, reduce transaction costs, support green investment and improve financial information availability.

Bansal et al. identified seven major themes in sustainable digital finance: financial inclusion and participation, sustainable financial development, green finance, digital venture capital, FinTech, financial performance and digital strategy. Their study also identified four broader dimensions: digital financial inclusion, digital sustainable revolution, digital financial transformation and technology for social good.

Artificial Intelligence and ESG

AI provides financial institutions with advanced capabilities for processing large datasets. Its applications include: ESG scoring, Climate-risk prediction, Sustainable portfolio optimisation, Green credit assessment, Fraud detection, ESG disclosure analysis, Financial forecasting, Regulatory monitoring. Lim's systematic analysis of AI and ESG research in finance identified eight major research domains and highlighted ESG disclosure, measurement, governance, risk management and responsible AI as important areas for future research.

AI can therefore act as an ESG intelligence engine, converting complex sustainability information into decision-useful financial indicators.

Green AI and Indian Banking

Green AI focuses on designing and deploying AI systems with lower energy consumption and reduced environmental impact.

A recent study of the Indian banking sector collected data from 412 mid- and senior-level professionals across six leading public and private banks. The study found that banking infrastructure, financial investment and competitive pressure were among the strongest predictors of Green AI adoption. Green AI adoption was also positively associated with sustainability outcomes.

This is highly relevant to the present study because it demonstrates that sustainable AI adoption in Indian banking depends not only on technology but also on infrastructure, investment and organisational readiness.

Artificial Intelligence and ESG Reporting in India

Mohapatra et al. examined the role of Artificial Intelligence in ESG reporting in India. Their work focuses on AI, ESG disclosure and sustainability within the Indian corporate context.

AI can improve ESG reporting by automating data collection, identifying information from corporate reports and improving the speed of ESG analysis. However, the accuracy of AI-generated ESG information depends on data quality, disclosure consistency and appropriate governance.

Green Cloud Computing

Green Cloud Computing focuses on reducing the environmental impact of cloud infrastructure.

Important approaches include: 1. Energy-efficient data centres, 2. Virtualisation, 3. Server consolidation, 4. Intelligent workload scheduling, 5. Renewable-energy utilisation, 6. Carbon-aware computing, 7. Efficient cooling systems, 8. Resource optimisation.

For financial institutions, Green Cloud Computing is important because banking increasingly depends on cloud-based transaction processing, AI analytics, digital banking and data storage.

FinTech and Green Finance in India

Recent research on Indian banks indicates that FinTech adoption and green finance can contribute to sustainable banking performance. This supports the argument that digital transformation and sustainability should be addressed together rather than as separate strategic activities.

Objectives of the Study

1. To examine the role of Artificial Intelligence in sustainable digital finance.
2. To analyse the contribution of Green Cloud Computing to sustainable financial systems.
3. To examine the relationship between AI and ESG-oriented financial decision-making.
4. To analyse the importance of Green AI in the Indian banking sector.
6. To propose recommendations for implementing sustainable digital finance.

Analysis**AI Intelligence**

AI contributes through: Financial Data → AI Analytics → ESG Intelligence → Financial Decision.

Applications include ESG scoring, climate-risk prediction, sustainable investment analysis and green credit assessment.

Green Cloud Infrastructure

Green Cloud Computing provides: Cloud Infrastructure → Energy Optimisation → Carbon Reduction → Sustainable Digital Operations.

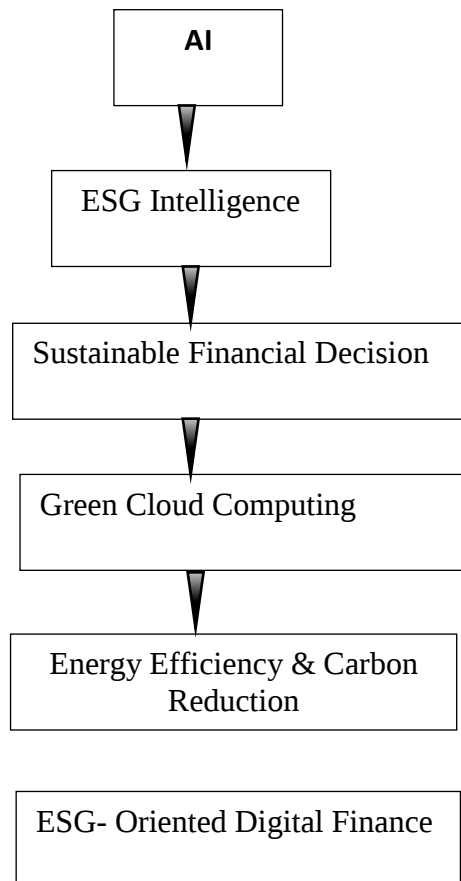
ESG Integration

AI-generated insights can support: Environmental risk assessment, social impact analysis, governance monitoring, ESG reporting, sustainable investment

Responsible Governance

The effectiveness of AI depends on transparency, explainability, data quality, privacy, cybersecurity, Bias control, Human oversight

Thus, the proposed model can be represented as:



Findings

- **AI strengthens ESG analysis-** AI enables financial institutions to analyse large volumes of structured and unstructured ESG information more efficiently. Research shows that AI and ESG finance research increasingly covers ESG measurement, disclosure, governance and risk management.
- **Green Cloud Computing supports environmental sustainability-** Green Cloud Computing can reduce energy consumption, resource wastage and carbon emissions through efficient infrastructure, virtualisation, workload management and renewable-energy integration.
- **Green AI is increasingly relevant to Indian banking-** Indian banking research indicates that infrastructure, financial investment and competitive pressure are important factors influencing Green AI adoption. Green AI adoption was positively associated with sustainability outcomes.
- **Technology alone is insufficient-** AI adoption does not automatically produce sustainability. The benefits depend on data quality, governance, energy-efficient infrastructure, regulatory support and organisational readiness.

- **AI and Green Cloud Computing should be integrated**-The strongest conceptual finding is that AI should not be evaluated independently from its computing infrastructure. A genuinely sustainable financial system must consider both Sustainability of Financial Decisions and Sustainability of Digital Infrastructure.

Recommendations

- **Adopt Green Cloud Infrastructure**- Financial institutions should prioritise cloud providers and data centres using renewable energy, efficient cooling and carbon-aware workload management.
- **Measure AI Carbon Footprint**-Banks should measure energy consumed by AI systems, cloud computing consumption, carbon emissions, renewable-energy usage, Computing efficiency.
- **Strengthen ESG Data Governance**- Financial institutions should establish standardised ESG-data collection, validation and auditing mechanisms.
- **Implement Explainable AI**- AI-generated credit, investment and ESG decisions should be explainable to financial managers, regulators and customers where appropriate.
- **Indian banks should integrate Green AI** into their digital transformation strategies and align AI investments with sustainability and ESG objectives. Recent Indian evidence indicates that infrastructure and financial investment are particularly important for Green AI adoption.
- **Regulators should encourage common standards** for AI governance, ESG data, Green AI, Digital carbon reporting, Sustainable cloud infrastructure.

Conclusion

Sustainable digital finance represents a major transformation in the financial sector, combining digital technologies with environmental, social and governance objectives. Artificial Intelligence can provide the intelligence required to analyse ESG information, predict climate-related risks and support sustainable investment and lending decisions. Green Cloud Computing provides the infrastructure required to make digital financial operations more environmentally sustainable.

The Indian banking sector further demonstrates the growing relevance of Green AI. Infrastructure, financial investment and competitive pressure are important factors in Green AI adoption, and Green AI adoption has been associated with improved sustainability outcomes. The future of sustainable finance is consequently not merely digital finance, but intelligent, energy-efficient, transparent and ESG-oriented digital finance.

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