AI and Big Data in Green Credit Risk Assessment: A Framework for Sustainable Banking

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ABSTRACT

The convergence of Artificial Intelligence (AI), Big Data analytics, and Environmental, Social, and Governance (ESG) principles is transforming credit risk measurement in India's banking sector. As India works toward its Net-Zero 2070 target and the Reserve Bank of India (RBI) develops a green finance regulatory framework, banks must manage climate-related financial risks while funding sustainable projects. India's cumulative green, social, sustainability, and sustainability-linked (GSS+) debt rose by 186% from USD 21.4 billion in 2021 to USD 55.9 billion by December 2024, highlighting rapid growth in sustainable finance. However, traditional credit assessment models remain inadequate in capturing environmental risk exposure. This study proposes an AI–Big Data-based Green Credit Risk Assessment (GCRA) model tailored to the Indian banking sector. Using secondary data from RBI reports, SEBI disclosures, NABARD guidelines, and sustainability reports of major banks (SBI, HDFC Bank, ICICI Bank, Bank of Baroda, and Axis Bank), the research maps regulatory developments and data gaps while introducing a multi-dimensional GCRA scorecard. Statistical tools such as regression analysis, an ESG-adapted Altman Z-Score, Pearson correlation, and descriptive statistics are applied to evaluate the framework. The findings indicate that machine-learning-based ESG credit models reduce default prediction errors by up to 23% compared to traditional models. Integrating green risk parameters can also help further reduce India's Gross NPA ratio, which stood at a three-year low of 2.7% in FY 2023-24. The paper concludes with policy recommendations for RBI, SEBI, and Indian banks to institutionalize AI-enabled sustainable credit assessment.

Keywords: Green Credit Risk Assessment, Artificial Intelligence, Big Data, Sustainable Banking, ESG, Non-Performing Assets, RBI Green Deposit Framework, Machine Learning, India

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