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A Coefficient-Based Method for the Allocation of Indirect Costs

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Forecasting the Volatility of Leading Banking Institutions Using the EGARCH (1.1) Model

Measuring Regional Economic Opportunities: A New Approach Through the Regional Economic Opportunities Index and the Regional Deficit Coefficient

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GREEN BANKING AS A CATALYST FOR SUSTAINABLE DEVELOPMENT – EVIDENCE FROM THE BANKING SECTOR

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Abstract: This article examines the role of green banking as a catalyst for sustainable development, with particular attention to the global banking sector. A mixed-methods, desk-based research design is employed. The quantitative component synthesizes secondary evidence concerning global climate-finance flows, green and sustainable bond markets, financial inclusion and the development of sustainable banking practices. The qualitative component analyses academic literature, international banking frameworks, regulatory developments and evidence from banking-sector practices. The findings indicate that green banking can contribute to sustainable development through several mutually reinforcing channels: allocation of credit to low-carbon and environmentally beneficial activities; integration of environmental and climate risks into credit decisions; development of green financial products; Digitalization and operational efficiency; financial inclusion; and mobilization of private capital. The article argues that the catalytic potential of green banking is greatest when sustainability is integrated into core banking strategy, risk management, lending decisions and performance measurement rather than treated as a separate corporate social responsibility activity. Effective regulation, credible disclosure standards, blended finance, digital innovation and

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transparent impact measurement are therefore necessary to transform green banking commitments into measurable sustainable-development outcomes.

Keywords: green banking; sustainable development; green finance; sustainable banking; climate finance; financial inclusion; banking sector; ESG; responsible banking; sustainable finance.

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Introduction

Sustainable development has increasingly become a central concern for governments, corporations, financial institutions and international organizations. The concept requires economic development to be pursued in a manner that preserves environmental resources, supports social well-being and maintains economic opportunities for future generations. The achievement of the United Nations Sustainable Development Goals (SDGs) and the objectives of the Paris Agreement requires substantial investment in renewable energy, energy efficiency, sustainable transport, resilient infrastructure, sustainable agriculture, affordable housing and other activities that generate environmental and social benefits.

The financial system occupies a particularly important position in this transformation because it determines, to a significant extent, which economic activities receive capital and under what conditions. Banks are especially influential because bank lending remains a major source of external finance for households and firms in many economies. Consequently, the environmental and social consequences of banking extend far beyond the energy consumption of bank branches and data centres. The most significant sustainability effects of banks are often associated with the activities they finance.

Green banking has developed in response to this challenge. In its broadest sense, green banking refers to the integration of environmental and sustainability considerations into banking strategy, operations, risk management, lending, investment and financial-product development. It therefore includes both the reduction of banks' direct environmental footprint and the redirection of financial resources toward activities that contribute to sustainable development.

The growing importance of sustainable banking is reflected in international initiatives. The United Nations Environment Programme Finance Initiative (UNEP FI) Principles for Responsible Banking provide a framework

for aligning banking strategies and practices with the Sustainable Development Goals and the Paris Agreement. More than 350 banks, representing approximately half of global banking assets, participate in the Principles for Responsible Banking framework. This development demonstrates that sustainability is moving from the margins of banking strategy toward the mainstream of financial-sector governance.

At the same time, the scale of the financing challenge remains substantial. Climate Policy Initiative data indicate that global climate finance reached approximately USD 1.9 trillion in 2023 and exceeded USD 2 trillion for the first time in 2024 according to preliminary estimates. Private climate finance exceeded USD 1 trillion in 2023, demonstrating the increasing importance of private financial institutions in funding the transition. Similarly, the International Finance Corporation reported that global issuance of green, sustainability, sustainability-linked and social bonds reached approximately USD 1 trillion in 2024, an increase of 3% over the previous year.

These developments indicate progress, but they should not be interpreted as evidence that the financial system has already become sustainable. Significant capital continues to support carbon-intensive economic activities, while sustainable projects in developing and emerging economies frequently face high financing costs, currency risks, weak institutional capacity and insufficient access to long-term capital. Climate finance also remains unevenly distributed. According to the Climate Policy Initiative, international climate finance to emerging market and developing economies amounted to USD 196 billion in 2023, with 78% coming from public actors.

The purpose of this article is therefore to examine whether and under what conditions green banking can operate as a catalyst for sustainable development. Rather than viewing green banking solely as a collection of environmentally friendly banking products, the article considers it as a transformation of the banking business model.

The research addresses four questions:

1. Through which mechanisms can green banking contribute to sustainable development?
2. What does existing quantitative and qualitative evidence indicate about the relationship between green banking and banking-sector performance?
3. What institutional and market barriers limit the effectiveness of green banking?
4. What policy and managerial measures can strengthen the contribution of banks to sustainable development?

The central argument is that green banking has significant catalytic potential, but its effectiveness depends on whether environmental and social

considerations become embedded in the core processes through which banks allocate capital, manage risk and measure performance.

1. Conceptual foundation of green banking

The concept of green banking has developed from the broader literature on sustainable finance, responsible investment and environmental management. Initially, the environmental role of banks was often understood primarily in terms of operational efficiency. Banks could reduce paper consumption, electricity use, travel and physical infrastructure through digital banking and environmentally efficient offices. Although such measures remain relevant, they represent only a small part of the potential sustainability impact of banking.

The more consequential dimension of green banking concerns financed activities. A bank that reduces its electricity consumption but continues to provide large-scale financing to highly polluting activities may have a limited overall environmental impact. Consequently, contemporary green banking increasingly emphasizes lending and investment decisions.

Green banking can therefore be conceptualized through five interconnected dimensions:

- *green credit allocation* refers to the provision of loans for renewable energy, energy efficiency, sustainable transport, green buildings, circular-economy activities, sustainable agriculture, pollution control and other environmentally beneficial investments.
- *environmental and climate-risk management* incorporates physical and transition risks into traditional banking processes. Physical risks include losses associated with floods, droughts, storms, wildfires and other climate-related events. Transition risks arise when economies move toward lower-carbon production, potentially reducing the value of assets and business models dependent on carbon-intensive activities.
- *green financial innovation* involves products such as green loans, green mortgages, sustainability-linked loans, green bonds, transition finance instruments and environmentally focused savings and investment products.
- *green operational banking* seeks to reduce the direct environmental footprint of banking institutions through digitalization, energy-efficient buildings, renewable electricity, paperless processes and efficient data infrastructure.
- *socially inclusive banking* recognizes that environmental sustainability cannot be separated from social sustainability. Affordable financial services, responsible digital banking and access to finance for low-income

households and small businesses can contribute to poverty reduction, resilience and inclusive economic development.

This multidimensional perspective is consistent with the Principles for Responsible Banking, which emphasize alignment, impact and target setting, clients and customers, stakeholders, governance and culture, and transparency and accountability. UNEP FI identifies climate, nature, human rights and healthy and inclusive economies as interconnected sustainability priorities.

Green banking is therefore broader than corporate environmental responsibility. It is fundamentally connected with the allocation of financial resources and the management of financial risk.

The contribution of green banking to sustainable development can be explained through the three dimensions of sustainability: environmental, economic and social.

The environmental contribution of banking is primarily transmitted through credit allocation. Renewable-energy projects, energy-efficient buildings, electric mobility, sustainable agriculture and pollution-reduction technologies generally require significant upfront investment. Banks can reduce financing constraints by providing loans with appropriate maturities, pricing and risk-sharing arrangements.

Green lending can also influence corporate behaviour. When banks incorporate environmental performance into credit assessments, firms have incentives to improve energy efficiency, reduce emissions and strengthen environmental management systems. In this sense, banks can become intermediaries between environmental policy and corporate investment decisions.

However, the relationship is not automatic. A green label does not necessarily guarantee environmental additionality. A project can satisfy a broad definition of green finance while producing limited incremental environmental benefits. This creates a need for credible taxonomies, impact metrics and verification systems.

Sustainable development requires environmental investment without undermining financial stability. Green banking can contribute to long-term economic resilience by directing capital toward sectors expected to benefit from structural changes in the global economy.

Renewable energy, energy efficiency, sustainable infrastructure and climate-resilient technologies can create new markets and employment opportunities. Banks that understand these structural trends may also reduce their exposure to long-term transition risks.

The International Monetary Fund emphasizes that the financial sector has an important role in reducing climate-related risks and supporting mitigation, while financial instruments and improved climate-related disclosure can help reallocate investment toward greener activities.

Green banking can therefore be understood not merely as a cost of sustainability but as a potential source of long-term competitive advantage. Banks that develop expertise in sustainable sectors may gain access to new customers, new markets and new sources of investment.

Sustainable development also requires financial systems to be inclusive. Green banking should not become a system in which environmental investments are accessible only to large corporations and wealthy consumers.

Small and medium-sized enterprises, households and communities frequently face greater barriers to financing energy efficiency, renewable energy and climate adaptation. Banks can address these barriers through simplified green-loan products, digital financial services, credit guarantees and partnerships with development institutions.

The World Bank's Global Findex evidence illustrates the importance of financial access as a development mechanism. The 2025 Global Findex is based on nationally representative surveys of approximately 148,000 adults in 141 economies and examines financial access, payments, saving, borrowing and digital connectivity.

The previous Global Findex showed that global account ownership increased from 51% of adults in 2011 to 76% in 2021. In developing economies, account ownership reached 71% in 2021. These developments demonstrate the potential of financial institutions and digital technologies to expand economic participation.

The implication for green banking is important: sustainability finance should increasingly combine environmental objectives with affordability and inclusion.

The academic literature on green banking has expanded considerably during the past decade. Existing studies generally examine three major relationships: green banking and environmental performance, green banking and financial performance, and green banking and broader sustainable-development outcomes.

Khatun, Sarker and Mitra (2021), examining Bangladesh, found that commercial banks had increasingly adopted green banking activities and green financing policies between 2014 and 2019. Their study demonstrates that green banking can extend beyond individual environmental products to institutional policies and practices.

Chen et al. (2022) examined the effects of green banking practices on banks' environmental performance and green financing. Their findings support the argument that internal banking practices can influence green financial activity and environmental outcomes.

Research has also considered the financial consequences of green lending. A study of SME credit portfolios in BRIC countries found a positive

relationship between green SME lending and net interest margin. The finding is significant because SMEs frequently face financing constraints but can play an important role in technological and environmental transition.

More recent evidence strengthens the argument that green banking can be compatible with bank performance. Lalon, Faruk and Amir (2025) examined 13 banks in Bangladesh using data covering 2013–2022 and considered profitability indicators including return on assets, return on equity and net interest margin. The study provides empirical evidence concerning the relationship between green banking determinants and conventional measures of bank performance.

Another recent study using bank-loan announcements in China found that banks with superior green-credit performance experienced higher market valuation around loan announcements. This suggests that financial markets may recognize credible green-credit performance as a source of value rather than merely an additional cost.

The literature nevertheless identifies important limitations. Many studies rely on single-country samples, employee surveys or relatively narrow measures of green banking. The use of self-reported data may also produce common-method bias. Furthermore, bank-level green-finance indicators are not standardized globally, making cross-country comparisons difficult.

Recent research also indicates that the relationship between green banking and sustainable performance may operate through mediating mechanisms. For example, research involving bank employees in India found that several internal green-banking practices influence sustainability performance through green finance, while customer-related practices were less consistently associated with sustainability outcomes.

The emerging literature therefore supports a more integrated model in which green banking affects sustainable development through multiple channels rather than through lending volume alone.

This article combines stakeholder theory, institutional theory and the resource-allocation perspective of financial intermediation.

From a stakeholder perspective, banks are responsible not only to shareholders but also to depositors, borrowers, employees, regulators, communities and future generations. Sustainability-oriented banking reflects the interests of these stakeholders by considering the broader consequences of financial decisions.

From an institutional perspective, banks respond to regulations, international standards, investor expectations, social pressure and changing market norms. The rapid expansion of sustainability reporting, climate-risk supervision and responsible-banking frameworks demonstrates that sustainability is becoming increasingly institutionalized within financial systems.

From the financial-intermediation perspective, banks reduce information and transaction costs between savers and borrowers and allocate capital toward productive investments. If environmental risks and opportunities are incorporated into this process, financial intermediation can contribute to structural economic transformation.
The resulting conceptual model is:

Green banking practices → Capital reallocation → Green investment and innovation → Environmental and social outcomes → Sustainable development

This relationship is moderated by: regulatory quality; availability of sustainability data; cost of capital; financial literacy; technological infrastructure; institutional capacity; market demand; green taxonomy quality; And the credibility of sustainability disclosures.

The model also recognizes a feedback mechanism. Sustainable economic activities can reduce banks' long-term risk exposure, improve asset quality and create new lending opportunities, which may reinforce banks' incentives to expand green finance.

2. Research methodology

The study uses a mixed-methods, desk-based research design. The approach combines quantitative secondary evidence with qualitative analysis to provide a broader assessment of the role of green banking in sustainable development.

The quantitative component does not claim to produce a new econometric estimate for the entire global banking sector. Instead, it synthesizes internationally comparable indicators and findings from empirical banking studies.

The qualitative component analyses academic literature, international policy frameworks, regulatory developments and documented banking-sector practices.

The mixed-methods approach is appropriate because sustainable banking is a multidimensional phenomenon. Quantitative indicators can demonstrate the scale and direction of financial flows, while qualitative evidence is necessary to understand institutional mechanisms, implementation barriers and differences between banking systems.

The research draws on five principal categories of secondary data:

1. international institutional reports from organizations such as the World Bank, IFC, IMF, UNEP FI, CPI and NGFS;

2. peer-reviewed empirical studies on green banking and bank performance;

3. evidence concerning green, sustainability-linked and social bond markets;

4. global indicators of financial inclusion and digital finance; and

5. regulatory and supervisory frameworks concerning climate and sustainability risks.

The review emphasizes recent evidence while retaining earlier studies where they provide important conceptual or empirical foundations.

The quantitative analysis focuses on four indicators:

A. Global climate-finance flows. These indicate the scale of capital being directed toward climate-related activities.

B. GSSS bond issuance. Green, sustainability, sustainability-linked and social bonds provide an indication of the development of sustainable capital markets and the ability of financial institutions to mobilize investment.

C. Financial inclusion. Account ownership and digital financial access provide a proxy for the social dimension of sustainable banking.

D. Bank-performance evidence. Published empirical studies examining ROA, ROE, NIM, market valuation and other financial indicators are synthesized to assess whether green banking necessarily conflicts with bank profitability.

The qualitative component uses thematic analysis. Evidence is classified into six themes: sustainable lending and capital allocation; climate and environmental risk management; financial innovation; operational sustainability and digitalization; financial inclusion and social sustainability; And governance, transparency and greenwashing.

The final stage of the methodology is triangulation. Quantitative trends are compared with qualitative evidence to determine whether the two types of evidence support consistent conclusions.

3. Empirical evidence from the global banking sector

The first major finding is that sustainable finance has moved from a niche segment toward a significant component of global financial markets.

Global climate finance reached USD 1.9 trillion in 2023, according to Climate Policy Initiative estimates. Preliminary data indicated that global climate finance exceeded USD 2 trillion in 2024. Private actors accounted for more than USD 1 trillion in 2023.

These figures demonstrate two important developments. First, the financial system is increasingly capable of mobilizing capital at a scale relevant

to the climate transition. Second, private financial institutions are becoming central actors rather than passive intermediaries.

However, the figures should be interpreted carefully. Total climate finance is not equivalent to bank lending. It includes multiple financial sources and instruments. Nevertheless, banks remain important because they participate in loan origination, bond underwriting, project finance, corporate finance and institutional investment.

Table 1.

Selected indicators of sustainable finance and financial inclusion

Indicator	Evidence	Development implication
Global climate finance, 2023	USD 1.9 trillion	Rapid expansion of climate-related capital
Private climate finance, 2023	> USD 1 trillion	Increasing importance of private finance
International climate finance to EMDEs, 2023	USD 196 billion	Continued financing gap in emerging markets
Public share of international EMDE climate finance	78%	Strong role for public-sector catalytic finance
GSSS bond issuance, 2024	Approximately USD 1 trillion	Maturing sustainable capital market
Global account ownership, 2021	76% of adults	Expanding financial inclusion
Developing-economy account ownership, 2021	71% of adults	Progress but persistent access gaps

Source: compiled from Climate Policy Initiative, IFC and World Bank evidence.

The evidence also reveals a major geographical imbalance. International climate finance to emerging market and developing economies reached USD 196 billion in 2023, but 78% was provided by public actors. This suggests that commercial banks and private investors have not yet fully overcome the risks associated with sustainable investment in developing economies.

The implication is that green banking policies should not focus solely on increasing the quantity of green lending. They should also address the risk and cost structures that determine whether such lending is commercially viable.

The rapid expansion of sustainable bond markets provides another indication of the transformation of financial intermediation.

According to IFC's 2025 report, issuance of green, sustainability, sustainability-linked and social bonds reached approximately USD 1 trillion in 2024, representing a 3% increase over 2023. The report also notes that approximately USD 330 billion of GSSS debt was expected to mature and require refinancing, illustrating the increasing maturity of the market.

Banks participate in these markets in several ways. They can issue their own green bonds, underwrite corporate green bonds, provide financing to eligible projects and distribute sustainable investment products to clients.

The expansion of these markets also demonstrates the importance of standardization. Investors require reliable information about the environmental and social characteristics of projects. Without credible definitions and verification mechanisms, the market may suffer from adverse selection and greenwashing.

One of the most important questions is whether green banking compromises financial performance.

The empirical evidence does not support a simple conclusion that green lending reduces profitability. Studies in emerging markets have identified positive or neutral relationships between green-financing practices and measures such as net interest margin and overall bank performance. Research on BRIC SME portfolios, for example, identified a positive relationship between green SME lending and net interest margin.

Recent evidence from Bangladesh also suggests that green-banking initiatives can be associated with bank performance when bank-specific and macroeconomic factors are considered.

The relationship can be explained through several mechanisms:

- green projects may create new lending opportunities in expanding industries such as renewable energy and energy efficiency.
- green lending can strengthen relationships with customers that increasingly demand sustainable financial products.
- environmental risk assessment can improve credit-quality analysis by identifying long-term risks that conventional models may overlook.
- credible sustainability performance can improve reputation and investor perceptions.

Evidence from Chinese bank loan announcements is particularly revant. Banks with stronger green-credit performance experienced higher market valuation following loan announcements, suggesting that investors may assign value to credible sustainable lending performance.

Nevertheless, green banking can also create short-term costs. Green projects may require specialized technical assessment, additional monitoring

and longer investment horizons. Some emerging technologies have limited historical performance data, which can increase perceived credit risk.

Thus, the financial impact of green banking depends on the design and maturity of the market rather than on the "green" characteristic alone.

The social dimension of green banking is closely connected with digitalization.

Digital banking can reduce the environmental costs associated with paper-based transactions, physical branches and transportation while simultaneously expanding financial access.

The World Bank's Global Findex 2025 provides extensive evidence of the continuing expansion of digital financial services and financial inclusion across 141 economies. The database also examines disparities affecting women and poorer adults.

This creates an opportunity for banks to combine digital transformation with sustainability. Mobile banking, digital payments and remote customer identification can reduce operational costs and improve access for underserved populations.

However, digitalization is not automatically inclusive. Digital exclusion can occur because of inadequate internet access, limited digital literacy, lack of appropriate identification, cybersecurity risks or insufficient consumer protection.

Green banking should therefore incorporate responsible digital finance into its sustainability strategy.

The second major channel through which green banking supports sustainable development is risk management.

Banks are exposed to physical climate risks through their borrowers and collateral. A flood can reduce the value of property used as collateral. A drought can reduce agricultural borrowers' repayment capacity. Extreme weather can disrupt supply chains and business operations.

Transition risks are also significant. Policies that increase carbon prices, technological changes that make fossil-fuel technologies less competitive, or shifts in consumer preferences can reduce the value of carbon-intensive assets.

The Network for Greening the Financial System has developed climate scenarios that help financial institutions and supervisors explore physical and transition risks. The NGFS has emphasized the role of scenario analysis in understanding the macro-financial implications of alternative climate pathways. In 2025, the NGFS released an updated guide reflecting advances in climate scenario design, data and modelling.

This development demonstrates an important transformation: climate risk is increasingly treated as a financial-risk issue rather than solely an environmental issue.

For banks, this means that green banking is not only about increasing green assets. It is also about understanding the sustainability characteristics of the entire loan portfolio.

4. Qualitative evidence: how banks can act as catalysts

The qualitative analysis identifies six principal mechanisms through which banks can catalyse sustainable development.

1. *Redirecting capital.* Banks can influence the economy by changing the relative availability and price of capital. A bank that provides preferential financing for energy-efficient buildings or renewable-energy projects can accelerate investment in those activities. Conversely, stricter environmental due diligence for environmentally harmful projects can reduce the availability of finance for unsustainable activities. The catalytic effect is therefore achieved through portfolio composition, not merely through individual green products.
2. *Creating financial incentives.* Banks can design loan conditions that reward sustainability performance. Sustainability-linked loans, for example, can connect borrowing costs with environmental or social performance indicators. Such instruments can create incentives for borrowers to improve sustainability performance while preserving the flexibility of general-purpose corporate finance. However, the targets must be measurable and material. Weak targets can turn sustainability-linked products into marketing instruments rather than genuine mechanisms of transition.
3. *Mobilizing private capital.* Banks can combine their balance sheets with capital-market instruments, development-finance institutions and government guarantees. This is particularly important in emerging markets where green projects may have high perceived risks. Guarantees and concessional finance can reduce risk sufficiently to attract commercial banks. The strong public component of international climate finance to emerging economies demonstrates the continued importance of this mechanism.
4. *Supporting SMEs.* Small and medium-sized enterprises are crucial to employment and economic development but often lack the financial and technical capacity required to implement sustainability investments. Banks can provide standardized green SME loans, technical assistance, advisory services and simplified reporting requirements. This approach can produce a multiplier effect because thousands of smaller firms may collectively generate significant environmental improvements.
5. *Influencing corporate governance.* Banks can use their relationships with corporate borrowers to encourage improved environmental governance. Environmental criteria can be incorporated into credit assessments, covenants

and monitoring procedures. This can encourage firms to improve sustainability reporting, risk management and resource efficiency.

6. *Building sustainable consumer behaviour.* Retail banks can influence consumer behaviour through green mortgages, energy-efficiency loans, sustainable payment products, responsible investment products and financial education. This creates a direct connection between banking and household-level sustainable development.

Despite its potential, green banking faces significant challenges:

- *Greenwashing.* Greenwashing occurs when financial products or institutional claims exaggerate their environmental benefits. The problem is particularly serious because sustainability information is often difficult for customers and investors to verify. Effective green banking therefore requires transparent definitions, credible verification and standardized impact metrics.
- *Data limitations.* Banks cannot effectively assess environmental risks without reliable data. Many firms, particularly SMEs, lack consistent information on emissions, energy consumption, water use, biodiversity impacts and climate vulnerability. Banks may consequently rely on estimates or sector-level averages. This creates model uncertainty and makes comparisons between borrowers difficult. Green investments in emerging markets may face higher financing costs because of country risk, currency risk, technology risk and weak infrastructure. This explains why the expansion of global climate finance does not automatically imply adequate financing for developing countries. Bank managers are often evaluated on relatively short-term financial indicators. Sustainable investments may have long payback periods, creating a potential conflict between short-term performance objectives and long-term sustainability. The solution is not to abandon profitability but to broaden performance measurement so that long-term risk and sustainability impacts are incorporated into strategic decisions.
- *Transition risk.* A rapid withdrawal from carbon-intensive sectors can create financial and social instability. For this reason, green banking should not be interpreted simply as immediate exclusion of every carbon-intensive borrower. Transition finance is often necessary. A bank can support a high-emitting company in reducing emissions if the borrower has a credible, measurable transition plan. This approach can be more effective than simply withdrawing finance and transferring the problem elsewhere. Different countries and institutions use different definitions of green finance. This can increase compliance costs and create uncertainty for international banks. Greater interoperability among taxonomies and disclosure standards is therefore important for scaling sustainable finance. Large international banks may possess sophisticated sustainability teams, climate models and reporting systems, while smaller banks may lack such resources.

Policy frameworks should therefore be proportionate and accompanied by technical assistance.

5. Discussion

The mixed-methods evidence supports the central proposition that green banking can operate as a catalyst for sustainable development, but only when it is integrated into the fundamental functions of banking.

The first important conclusion is that green banking is primarily a capital-allocation mechanism. Operational environmental improvements are valuable but relatively limited compared with the potential impact of lending and investment decisions. The second conclusion is that green banking and financial performance are not necessarily contradictory. Evidence from emerging markets indicates that green lending can coexist with profitability, while evidence from bank-loan announcements suggests that credible green-credit performance can be valued by financial markets.

The third conclusion is that risk management is as important as green lending. A bank cannot be considered sustainable if it expands its green portfolio while failing to recognize climate and environmental risks embedded in its conventional portfolio.

The fourth conclusion is that financial inclusion must remain part of sustainable banking. Sustainability cannot be reduced to carbon emissions. A financial system that finances renewable energy while excluding low-income households from essential financial services does not fully satisfy the broader objectives of sustainable development.

The fifth conclusion is that public policy remains essential. The evidence from emerging economies shows that public finance continues to play a major role in mobilizing climate investment. Governments and development institutions can therefore use guarantees, concessional finance, technical assistance and risk-sharing mechanisms to crowd in commercial capital.

The sixth conclusion is that credibility is a strategic asset. Banks that make sustainability commitments without measurable targets risk reputational damage. The Principles for Responsible Banking framework emphasizes impact analysis, target setting, implementation and transparency, illustrating the movement toward measurable rather than purely declaratory sustainability commitments.

Banks should treat sustainability as a core business issue rather than an isolated CSR programme. Boards should establish measurable sustainability objectives linked to lending, risk management and executive performance.

Banks should also invest in environmental data capabilities. Without reliable borrower-level information, green lending and climate-risk assessment will remain incomplete.

Furthermore, banks should expand transition finance rather than relying exclusively on exclusion policies. The objective should be to support credible decarbonization while managing the associated financial risks.

Regulators should establish consistent definitions and reporting requirements while avoiding excessive complexity. Supervisors should also encourage scenario analysis and climate-risk management. The development of NGFS climate scenarios illustrates the increasing sophistication of this area.

Regulators should distinguish between genuine sustainability performance and marketing claims.

Governments should strengthen green taxonomies, disclosure systems and public guarantee mechanisms. In developing countries, public intervention is particularly important because high capital costs can prevent commercially viable green projects from obtaining financing. Governments can also support sustainable finance by improving energy policy, infrastructure, land-use planning and public procurement.

Multilateral development banks and development-finance institutions can play a catalytic role by absorbing part of the risk associated with emerging technologies and underserved markets. Guarantees, first-loss capital, technical assistance and concessional credit can enable commercial banks to expand green lending without compromising prudential standards.

Conclusion

This article examined green banking as a potential catalyst for sustainable development using a mixed-methods analysis of global banking-sector evidence. The findings indicate that banks occupy a strategically important position in the sustainability transition because their lending and investment decisions influence the allocation of capital throughout the economy.

The evidence demonstrates significant progress. Global climate finance has reached unprecedented levels, private climate finance has exceeded USD 1 trillion annually, and the market for green and other sustainable bonds has reached approximately USD 1 trillion in annual issuance. At the same time, financial inclusion continues to expand, creating opportunities for digital banking to combine environmental efficiency with social inclusion.

Empirical studies also suggest that green banking does not necessarily reduce financial performance. Green lending can create new business opportunities, strengthen customer relationships, improve risk management and

potentially enhance market valuation. However, these benefits depend on the quality of implementation and the credibility of sustainability strategies.

The analysis also demonstrates that significant barriers remain. Greenwashing, data limitations, inconsistent taxonomies, high financing costs, transition risks and unequal institutional capacity can prevent green banking from delivering its full potential.

The central conclusion is therefore that green banking should not be understood as simply "banking with green products." It should be understood as a transformation of how banks define opportunity, measure risk, allocate capital and evaluate long-term value.

Banks become genuine catalysts for sustainable development when environmental and social considerations are incorporated into the entire banking cycle: governance, strategy, credit assessment, portfolio management, product development, customer relationships and impact measurement.

The future of sustainable banking will consequently depend less on the number of green products introduced and more on whether sustainability becomes embedded in the financial decision-making architecture of banks.

Green banking can thus serve as a bridge between financial intermediation and sustainable development. Its greatest contribution will occur when commercial incentives, regulatory requirements and sustainability objectives reinforce rather than contradict one another. The challenge for banks, regulators and policymakers is not simply to increase the amount of "green" finance, but to ensure that financial capital produces genuine and measurable improvements in environmental resilience, social inclusion and long-term economic prosperity.

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APPENDIX A.

SUGGESTED TABLE FOR EMPIRICAL EVIDENCE

Study/ source	Geographic scope	Method/ evidence	Main finding
Khatun et al. (2021)	Bangladesh	Secondary data	Expansion of green banking practices
Chen et al. (2022)	Banking sector	Empirical analysis	Green practices associated with environmental performance and green finance
Gambacorta et al. (2022)	Euro area	Credit-register evidence	Governance characteristics associated with green lending
BRIC SME study (2023)	Brazil, Russia, India, China	Bank panel data	Green SME lending positively associated with NIM
Kumar et al. (2024)	India	PLS-SEM	Green finance mediates relationships between green banking practices and sustainability
Lalon et al. (2025)	Emerging economy	Static/dynamic models	Green banking determinants associated with bank performance
Chinese bank-loan study (2025)	China	Event study	Stronger green-credit performance associated with higher market valuation
Ding & Li (2026)	42 emerging economies	Regression analysis	Green banking associated with environmental sustainability and financial resilience
Duy & Le (2026)	Vietnam	PLS-SEM	Green banking influences environmental performance through green finance and ethical commitment

The table demonstrates that evidence comes from different methodologies and geographical contexts. This supports the use of a mixed-methods approach rather than reliance on a single empirical technique.

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