Green finance and its impact on business models in emerging markets: mechanisms, transformations, and challenges

Sweta Srivastav, Deepti Patnaik*

[1] Department of Management, Kalinga University, Naya Raipur [C.G.], India
*Corresponding author: deepti.patnaik@kalingauniversity.ac.in

ARTICLE INFO

SDGs:

Received: 15 Jan 2025

Revised: 26 Feb 2025

Accepted: 27 Mar 2025

Keywords:

green finance, emerging markets, sustainability-linked loans, carbon credit trading, innovation

ABSTRACT

Green finance—the integration of environmental, social, and governance (ESG) criteria into financial systems—has emerged as a structural mechanism through which emerging market economies are beginning to realign capital flows with sustainability imperatives. Yet the pathways through which green finance instruments specifically reshape business models in developing economies remain incompletely theorized and unevenly evidenced in the existing literature. This review synthesizes empirical, institutional, and conceptual research on green finance published between 2016 and 2023 to examine three interconnected questions: how green finance mechanisms—including green bonds, sustainability-linked loans (SLLs), and carbon credit trading—operate in the emerging market context; how these instruments have catalyzed observable transformations in business model architecture across key emerging market regions and sectors; and what structural barriers constrain the scale and depth of green finance adoption in developing economies. The global green bond market reached approximately USD 650 billion in issuance in 2023, with emerging markets contributing approximately 20% of total volume. SLL issuance grew from USD 150 billion in 2019 to USD 500 billion in 2023, with the emerging market share expanding from 10% to 22% over the same period. ESG-integrated investment in emerging markets grew from USD 500 billion in 2019 to USD 1.8 trillion by 2023. Across these instruments, the evidence documents three principal business model transformation pathways: resource efficiency optimization driven by sustainability-linked financing conditions; renewable energy integration accelerated by green bond capital; and circular economy model adoption incentivized by ESG investment screening. Against these advances, three persistent structural barriers emerge: regulatory fragmentation and the absence of harmonized green taxonomies; limited institutional capacity and financial infrastructure in lower-income emerging economies; and underdeveloped domestic capital markets that restrict indigenous green finance scale-up. The review concludes with implications for policymakers, institutional investors, and corporate strategists, and identifies a research agenda addressing the macroeconomic effects of green finance, the role of financial technology in expanding access, and the underexplored social equity dimensions of green investment.

1. Introduction

The emergence of green finance as a mainstream institutional force represents one of the most consequential structural shifts in global capital markets over the past decade. Defined as the set of financial products, services, and instruments that integrate environmental sustainability criteria into investment and lending decisions (Zhang et al., 2021), green finance has moved decisively from the periphery of responsible investment practice to the center of mainstream financial strategy. The adoption of the Paris

Agreement in 2015 and the United Nations Sustainable Development Goals provided the international normative architecture that accelerated this shift, compelling governments, corporations, and financial institutions to align their capital allocation strategies with climate resilience and low-carbon transition objectives (OECD, 2020). The global issuance of labeled green bonds surpassed USD 500 billion annually by 2021 and approached USD 650 billion by 2023 (Climate Bonds Initiative, 2023); sustainability-linked loan volumes reached USD 500 billion globally in 2023 (OECD, 2023); and ESG-integrated assets under management in emerging markets alone exceeded USD 1.8 trillion by that year (UNEP FI, 2023). These are not marginal figures—they represent a structural reconfiguration of capital allocation at a scale that carries direct consequences for how businesses in every sector are designed, financed, and held accountable.

Emerging markets occupy a position of particular analytical importance in this green finance narrative. On one hand, they face the most acute environmental pressures: rapid industrialization, urbanization, and population growth in countries across Asia, Africa, and Latin America are producing carbon emissions trajectories, resource depletion rates, and climate vulnerability profiles that make the transition to sustainable economic models both urgent and existential (Wang & Zhi, 2016). On the other hand, they confront the most significant structural barriers to green finance adoption: weak regulatory institutions, shallow domestic capital markets, limited technical capacity for ESG measurement and reporting, and persistent tensions between short-term development imperatives and long-term sustainability objectives (Ameli et al., 2020). Understanding how green finance operates within these twin pressures—as both a solution to emerging market sustainability deficits and a challenge that those same deficits constrain—requires theoretical precision and empirical grounding that the existing literature, while growing, has not yet fully provided.

The business model dimension of this challenge has received insufficient systematic attention. While the financial dimensions of green finance—instrument design, pricing, market development—have been studied extensively, the mechanisms through which green finance instruments translate into changes in how firms create and deliver value are less thoroughly documented. How exactly does access to green bond capital change a manufacturing firm's energy sourcing strategy? How do sustainability-linked loan covenants alter the internal governance and operational priorities of a mining company in South Africa? How does participation in carbon credit markets reshape the strategic calculus of an Indonesian agribusiness firm considering deforestation? These are not peripheral questions—they are the mechanisms through which green finance's macroeconomic sustainability aspirations either materialize or fail to materialize at the level of the firm. This review addresses them systematically.

The paper is organized as follows. Section 2 establishes the theoretical framework situating green finance within institutional economics and stakeholder theory. Section 3 reviews the conceptual architecture of green finance, including its definitional boundaries, core instruments, and structural differences from conventional finance. Section 4 examines the regional adoption landscape in emerging markets across Asia, Africa, and Latin America. Section 5 presents the empirical evidence on each major green finance mechanism and its documented impacts on business model transformation. Section 6 analyzes the structural barriers that constrain adoption. Section 7 synthesizes the findings, develops implications for policymakers, businesses, and investors, and proposes a targeted agenda for future research.

2. Theoretical Basis

The analysis developed in this review is theoretically grounded in two complementary frameworks that together illuminate why green finance has assumed the institutional prominence it currently occupies and how it operates as a mechanism for business model change.

Institutional economics, and particularly its new institutional variant as developed by North (1990) and extended by Acemoglu and Robinson (2012), provides the foundational lens for understanding green finance as a system of rules, incentives, and enforcement mechanisms that shape organizational behavior. From this perspective, green finance instruments—green bonds, SLLs, carbon markets, ESG reporting requirements—function as institutional technologies that alter the cost and benefit structure within which firms make investment, operational, and governance decisions. Green taxonomies and sustainability reporting standards are formal institutional rules; ESG norms and investor sustainability expectations are informal institutions; accreditation bodies, stock exchange sustainability indices, and regulatory agencies are enforcement organizations. When these institutional elements are well-aligned and robustly enforced, green finance creates conditions in which sustainability-oriented business model adaptation is not merely ethically desirable but economically rational. When they are fragmented, inconsistent, or weakly enforced—as is characteristically the case in many emerging markets—the institutional preconditions for large-scale green finance adoption are absent, explaining many of the barriers documented in the empirical literature (Ameli et al., 2020).

Stakeholder theory, as articulated by Freeman (1984) and subsequently extended into the corporate sustainability domain by Donaldson and Preston (1995) and by Eccles and Krzus (2010), provides the firm-level analytical lens for understanding how green finance pressures manifest as business model change. Stakeholder theory posits that firms' long-term value creation depends not only on financial returns to shareholders but on the management of relationships with a broader constituency of stakeholders—employees, customers, suppliers, communities, regulators, and investors—whose interests and expectations shape the conditions of the firm's social license to operate. Green finance instruments amplify the salience of environmental and governance stakeholder expectations by embedding them directly in the financial relationship: a sustainability-linked loan covenant that ties interest rates to emissions reduction targets converts investor environmental expectations into a financial term with real cost consequences. This financial embeddedness of sustainability expectations—distinguishing green finance from purely normative corporate social responsibility—is the mechanism through which stakeholder theory predicts business model adaptation: firms respond to financially consequential stakeholder demands in ways they do not reliably respond to purely ethical or reputational ones.

Together, institutional economics and stakeholder theory generate testable predictions about where and when green finance will produce business model transformation: most strongly where institutional frameworks are well-developed and stakeholder financial expectations are concrete and measurable; most weakly where institutional fragmentation and diffuse stakeholder expectations reduce the financial salience of sustainability performance. This theoretical prediction maps directly onto the regional patterns and barrier landscape documented in the empirical literature reviewed in subsequent sections.

3. The Conceptual Architecture of Green Finance

3.1 ***Definition and Evolutionary Trajectory***

Green finance is most precisely defined as financial instruments, products, and services designed to channel investment capital toward economic activities that generate positive environmental outcomes while managing and disclosing environmental risks (OECD, 2020; Zhang et al., 2021). This definition encompasses a spectrum of financial products—from project-specific green bonds to performance-contingent sustainability-linked loans to market-based carbon pricing mechanisms—that are united by their common purpose of aligning financial incentives with environmental sustainability objectives. The critical distinguishing feature of green finance relative to conventional socially responsible investment is the specificity and verifiability of its environmental claims: where earlier ethical investment frameworks relied primarily on exclusion screens (avoiding investments in environmentally harmful industries), green finance instruments specify, measure, and report on the environmental outcomes they are designed to generate, creating a basis for accountability that exclusion screening cannot provide.

The evolutionary trajectory of green finance from marginal to mainstream can be traced through three broad phases. The first phase, spanning roughly the 1990s to 2007, was characterized by limited institutional investment in environmental projects through development finance institutions and philanthropic capital, with minimal private sector participation beyond niche responsible investment funds. The second phase, from the issuance of the first labeled green bond by the European Investment Bank in 2007 through the adoption of the Paris Agreement in 2015, saw the development of formal market infrastructure—the Green Bond Principles issued by the International Capital Markets Association (ICMA, 2021), early carbon trading schemes, and initial ESG rating methodologies—that began converting environmental investment from a niche preference into a structurally supported market category. The third phase, from 2015 to the present, is characterized by exponential growth in green finance volumes, the mainstreaming of ESG criteria in institutional investment processes, the proliferation of national and regional green taxonomies, and the beginning of mandatory sustainability disclosure regulation in major jurisdictions—a transition from market-driven to regulatory-driven green finance integration that has substantially altered the incentive landscape for both issuers and investors (World Bank, 2022).

3.2 ***Core Instruments***

Green Bonds. Green bonds are fixed-income debt instruments whose proceeds are earmarked exclusively for projects with demonstrable environmental benefits, typically spanning renewable energy, energy efficiency, sustainable water management, clean transportation, and climate-resilient infrastructure. The defining feature of green bonds relative to conventional bonds is use-of-proceeds specificity: issuers commit to deploying capital in identified environmental projects and are obligated to report on the environmental outcomes achieved, providing investors with a verifiable link between their investment and specific environmental impact. The ICMA Green Bond Principles (2021) provide the internationally most widely adopted voluntary framework governing

use-of-proceeds specification, project evaluation and selection, proceeds management, and reporting—though the absence of binding international standards has created a degree of definitional heterogeneity that complicates cross-market comparison and contributes to concerns about greenwashing. The global green bond market grew to approximately USD 650 billion in new issuance in 2023, with emerging markets contributing approximately 20% of total volume—a share that, while growing, remains disproportionately small relative to emerging markets' share of global greenhouse gas emissions and infrastructure investment needs (Climate Bonds Initiative, 2023).

Sustainability-Linked Loans. Sustainability-linked loans are financing instruments whose economic terms—most commonly the interest rate, but also covenant conditions and maturity structures—are contingent on the borrower's achievement of pre-defined sustainability performance targets (SPTs), typically measured through key performance indicators (KPIs) that may include carbon emission reduction targets, energy efficiency improvements, water consumption reduction, or scores on recognized ESG rating platforms. The critical structural difference between SLLs and green bonds lies in this performance contingency: where green bonds fund specific environmental projects and carry reputational accountability for use-of-proceeds, SLLs govern the borrower's overall sustainability trajectory across their operations, creating incentives for system-wide sustainability improvement rather than ring-fenced project-level investment. This breadth makes SLLs particularly relevant for business model transformation analysis: a company that accepts an SLL with emissions reduction covenants is, in effect, accepting financial consequences for its operational sustainability performance across the entire organization, which creates direct pressure for strategy-level rather than merely project-level change (Scholtens & Sievänen, 2021).

Carbon Credit Trading. Carbon credit trading mechanisms allow firms to buy and sell rights to emit greenhouse gases, creating a price signal for carbon that motivates emission reduction investments while providing flexibility in how firms achieve compliance with emission caps. Cap-and-trade systems—exemplified by the European Union Emissions Trading System (EU ETS) and China's national carbon market—set aggregate emission limits and allocate tradeable allowances, creating a market price that reflects the marginal cost of emission reduction across the regulated economy. Voluntary carbon markets operate alongside compliance systems, allowing companies beyond regulated sectors to purchase certified carbon credits to offset their emissions or advance voluntary net-zero commitments. Carbon prices across major markets have risen substantially—from approximately USD 25 per ton CO_2 in 2019 to USD 65 in 2023 (World Bank, 2023)—a trajectory that materially alters the financial calculus of emission-intensive business models and creates competitive advantages for early movers who invest in low-carbon processes before carbon pricing makes high-carbon operations prohibitively expensive.

ESG Integration in Investment Decision-Making. ESG integration refers to the systematic incorporation of environmental, social, and governance factors into investment analysis, portfolio construction, and risk management processes. Distinguished from earlier ethical investment approaches by its analytical rather than exclusionary character, ESG integration involves quantifying and modeling the financial

materiality of sustainability factors—assessing how carbon regulation exposure, supply chain environmental risks, labor management quality, and governance transparency affect the risk-adjusted returns of investment portfolios. Friede, Busch, and Bassen's (2015) meta-analysis of over 2,000 empirical studies found a positive relationship between strong ESG performance and financial returns in approximately 63% of cases, with negative relationships identified in only 8%—evidence that substantially undermined the earlier conventional wisdom that sustainability-oriented investment entailed a financial return penalty. ESG investment in emerging markets grew from USD 500 billion in 2019 to USD 1.8 trillion by 2023, representing a shift from 8% to 30% of total emerging market investment volumes (UNEP FI, 2023), reflecting both the growing financial materiality of sustainability risks in rapidly developing economies and the increasing global institutional investor demand for ESG-compliant asset allocation.

3.3 ***Green Finance versus Conventional Finance: A Structural Comparison***

The distinction between green finance and conventional finance is not merely definitional but structural, involving differences in investment objectives, risk assessment methodologies, regulatory frameworks, and time horizons that collectively produce different organizational incentives and different patterns of capital allocation. Conventional finance is organized primarily around risk-adjusted financial returns: it prices assets according to expected cash flows discounted for financial risk, where risk is conventionally measured through historical price volatility, credit ratings, and macroeconomic exposure. Environmental and social factors are incorporated only where they demonstrably affect these conventional financial risk dimensions—and they are typically modeled at shorter time horizons than those over which climate and sustainability risks materialize (Ameli et al., 2020).

Green finance extends this analytical framework in several material respects. It integrates climate-related financial risk—including physical risks from climate events, transition risks from policy and technology change, and liability risks from environmental damage—into asset valuation and portfolio construction, recognizing that these risks are systematically underpriced by conventional financial models at longer time horizons. It employs regulatory frameworks—green taxonomies, sustainability disclosure requirements, climate stress testing—that do not exist in conventional finance and that create both compliance costs and compliance advantages for firms operating under them. And it explicitly values positive environmental externalities that are invisible to conventional financial accounting—carbon sequestration, biodiversity conservation, reduced public health costs—through mechanisms such as green bond impact reporting and carbon credit pricing that create financial proxies for social value that markets would otherwise not recognize. These structural differences explain why green finance produces different investment patterns and different firm-level incentives than conventional finance, and why its mechanisms—rather than simply its volumes—are the appropriate focus for analyzing its impact on business model transformation.

4. Green Finance Adoption in Emerging Markets: Regional Landscape

The adoption of green finance across emerging market regions reflects a complex interaction of economic structure, institutional development, climate vulnerability, and

international financial integration that produces substantially different trajectories across Asia, Africa, and Latin America. Understanding this regional heterogeneity is essential for contextualizing the mechanisms and barriers analyzed in subsequent sections

4.1. Asia: Scale, Ambition, and Institutional Heterogeneity

Asian emerging economies—led by China and India but encompassing substantial variation across Southeast Asia—collectively represent the most consequential regional context for green finance in emerging markets, given the scale of their development trajectories and their disproportionate contribution to global emissions growth. China has developed what is now the world's most institutionally comprehensive domestic green finance architecture, encompassing the world's largest carbon trading market (covering approximately 40% of national CO_2 emissions upon its 2021 launch), an extensive green bond market with specific regulatory guidelines issued by the People's Bank of China, and the world's first nationally mandated mandatory environmental information disclosure requirements for listed companies and bond issuers (Zhao et al., 2020). The scale of China's green finance mobilization is extraordinary: Chinese green bond issuance reached USD 85 billion in 2021 alone, and the national carbon market encompassed over 2,000 power sector firms managing over 4.5 billion tons of CO_2 annually upon launch (World Bank, 2021). These figures establish China as a green finance scale leader globally, though questions about the stringency of its green taxonomy—which, unlike EU standards, permits certain coal power investments to qualify for green labeling—have prompted international scrutiny of its definitional rigor.

India has pursued a complementary but institutionally distinct green finance path. The Government of India's Sovereign Green Bond framework, established in 2022, represented the first government-level green bond issuance in the country's history and signaled the state's commitment to directing public capital toward the renewable energy, clean transportation, and energy efficiency investments required by India's nationally determined contribution under the Paris Agreement (Reserve Bank of India, 2022). India's private sector green finance engagement has been concentrated in the renewable energy sector, where green bonds have financed large-scale solar and wind installations that have contributed to India's status as one of the world's top five renewable energy markets. However, challenges of inconsistent state-level regulatory implementation, limited depth in domestic institutional investor markets, and the absence of a comprehensive Indian green taxonomy create conditions in which green finance growth, while substantial, remains below its potential scale given India's investment needs.

Across Southeast Asia, the heterogeneity of institutional development creates a more fragmented green finance landscape. Indonesia, Malaysia, and the Philippines have each established some form of green bond framework, and Indonesia's government issued USD 1.5 billion in sovereign green bonds for climate resilience projects (Zhao et al., 2020). However, the limited depth of domestic capital markets, the prevalence of state-owned enterprise financing outside capital market channels, and the political economy challenges of green transition in fossil-fuel-dependent economies create persistent structural constraints on Southeast Asian green finance adoption.

4.2. Africa: Development Finance Anchors and Institutional Gaps

In the African context, green finance adoption has been disproportionately driven by development finance institutions (DFIs)—the African Development Bank (AfDB), the International Finance Corporation (IFC), the European Investment Bank, and bilateral development agencies—rather than by domestic capital market development. The AfDB's Green Bond program and its Climate Change Initiatives have provided both direct financing for African green projects and crucial market-building functions—establishing pricing benchmarks, providing technical assistance for project preparation, and signaling international financial community confidence in African green assets—that domestic markets have been unable to generate independently (African Development Bank, 2021). South Africa stands as the most institutionally developed green finance market on the continent, with domestic commercial bank issuance of green bonds (including Nedbank's USD 600 million issuance cited in Table 1), a national carbon tax system, and the most advanced ESG reporting culture among African emerging economies. Kenya has developed significant green bond activity in the clean energy and climate-resilient agriculture sectors, supported by its strong position in East Africa's growing renewable energy market.

Across much of Sub-Saharan Africa, however, the structural prerequisites for domestic green finance markets—deep capital markets, creditworthy corporate issuers, institutional investor bases, robust regulatory frameworks, and technical capacity for ESG measurement—are significantly underdeveloped. Moyo and Jeke (2022) document the systematic relationship between capital market depth and green finance adoption capacity in the African context, finding that the constraints on green finance in lower-income African economies are primarily institutional and infrastructural rather than motivational: the private sector desire to access green capital frequently exists, but the institutional ecosystem within which green finance instruments function is absent. This analysis implies that DFI capacity-building and regulatory development investment in African green finance ecosystems may generate proportionately higher returns than direct project financing, because it creates the institutional preconditions for domestic market development that ultimately unlocks much larger private capital flows.

4.3. Latin America: Regulatory Ambition and Macroeconomic Instability

Latin America presents a distinctive green finance profile characterized by significant regulatory ambition and policy sophistication in its leading economies alongside persistent macroeconomic instability and political uncertainty that constrain capital market functioning and long-term investment horizons. Brazil has developed one of the most advanced emerging market sustainable finance regulatory architectures, including Central Bank ESG disclosure requirements for financial institutions, a National Sustainable Finance Strategy, and a banking sector with deep institutional roots in sustainable lending—reflecting in part the longstanding engagement of Brazilian development bank BNDES with environmental and social criteria in its project financing. Petrobras's USD 500 million sustainability-linked loan, tied to renewable energy transition commitments, represents one of the most high-profile corporate green finance transactions in the emerging market context and illustrates the capacity of large Latin

American corporate borrowers to engage with international sustainability-linked finance markets (UNEP FI, 2021).

Chile has pursued an ambitious sovereign green bond strategy, issuing USD 1.4 billion in sovereign green bonds in 2019 and becoming one of the first Latin American governments to align its sovereign borrowing program with climate commitments. Mexico has developed green bond markets through both sovereign and corporate issuance channels, and the regulatory framework for sustainable finance has been advanced through Mexico's financial sector sustainability guidelines. Despite these advances, Herculean macroeconomic challenges—currency volatility, inflation, fiscal constraints, and political cycles that create regulatory uncertainty—impose a persistent discount on the long-term credibility of green finance commitments in the region that international investors continue to price into the cost of capital for Latin American green instruments. The challenge for regional green finance development is not primarily institutional design—the policy sophistication is present—but institutional credibility, which requires macroeconomic stability and governance continuity that the region's political economy has not consistently delivered (World Bank, 2022).

5. Green Finance Mechanisms and their Impact on Business Models

5.1. Green Bonds and Business Model Transformation

Green bonds have operated as the most visible and volumetrically significant green finance mechanism, and their impact on business model transformation in emerging markets is documented across several distinct channels. Table 1 presents a representative sample of green bond transactions from major emerging market issuers, illustrating the diversity of sectors financed, the scale of individual transactions, and the reported environmental outcomes.

Table 1. *Selected green bond issuances in emerging markets: sector allocation and reported CO_2 impact*

Country	Issuer	Bond Value (USD Bn)	Sector Funded	CO_2 Reduction (Mt)
China	Industrial Bank	3.5	renewable energy	5.2
India	State Bank of India	1.2	solar and wind energy	2.8
Brazil	Banco do Brasil	1.0	sustainable agriculture	1.5
South Africa	Nedbank	0.6	green infrastructure	0.9
Indonesia	Government of Indonesia	1.5	climate resilience projects	2.1

Source. Climate Bonds Initiative (2023); World Bank (2022).

The business model implications of green bond financing operate through three primary mechanisms. The first is capital access expansion: for firms in capital-constrained emerging market contexts, green bonds open a new investor class—international ESG-mandated institutional investors—whose investment criteria were previously inaccessible to them, reducing their cost of capital for sustainable projects and enabling investment in renewable energy and efficiency infrastructure that conventional financing channels would price out of reach. This mechanism is most clearly evident in the Indian renewable energy sector, where the State Bank of India's USD 1.2 billion issuance financed solar and wind capacity that directly reduced corporate energy costs

and carbon exposure for the manufacturing and services firms that purchase that energy (Reserve Bank of India, 2022).

The second mechanism is strategic commitment and organizational alignment. The issuance of a green bond requires firms to publicly commit to specific environmental use-of-proceeds, establish governance mechanisms to ensure compliance, and report annually on environmental outcomes. This reporting and governance architecture—while often viewed as a compliance burden—creates internal organizational accountability for sustainability commitments that can drive changes in operational strategy, capital budgeting priorities, and management incentive structures beyond the funded project itself. Zhao et al. (2022) document that firms that have issued green bonds exhibit higher rates of ESG performance improvement across their broader operations relative to comparable non-issuing firms, suggesting that the accountability architecture of green bond issuance generates spillover effects on organizational sustainability behavior that exceed the direct environmental impact of the funded projects.

The third mechanism is reputational and market positioning. Green bond issuance signals environmental commitment to customers, employees, and regulators in a manner that conventional corporate sustainability reporting does not, because it attaches financial stakes and third-party verification to the claim. In consumer-facing sectors—where customers increasingly factor environmental credentials into purchase decisions—this reputational mechanism can translate directly into market share and premium pricing capacity. In regulated sectors—where green bond issuance can improve regulatory relationships and anticipate compliance requirements—the positioning value is expressed through reduced regulatory friction and preferential treatment in public procurement contexts.

5.2. Sustainability-Linked Loans and Performance-Driven Business Model Change

Sustainability-linked loans represent arguably the most structurally powerful green finance mechanism for business model transformation, because they directly embed sustainability performance requirements into the terms of core financing relationships rather than ring-fencing them in project-specific instruments. Table 2 documents the growth trajectory of the SLL market between 2019 and 2023, including the expanding share attributed to emerging market borrowers.

The mechanism through which SLLs drive business model change is fundamentally different from that of green bonds. Where green bond capital is committed to specific projects and impacts are measured at the project level, SLL covenants govern the borrower's sustainability performance across their entire operations, creating

Table 2. *Global sustainability-linked loan market growth and emerging market share, 2019–2023*

Year	Global SLL Issuance (USD Bn)	Emerging Market Share (%)
2019	150	10
2020	210	12
2021	310	15
2022	420	18
2023	500	22

Source. Scholtens and Sievänen (2021); OECD (2023).

financial consequences—typically interest rate step-ups on covenant breaches and step-downs on achievement—for the trajectory of organizational sustainability over the loan term. This creates a direct financial incentive for executive leadership and boards to treat sustainability performance targets not as discretionary commitments but as financially material operational objectives, integrated into management accountability structures and capital budgeting processes.

The corporate case studies from the original manuscript provide useful illustrative evidence of this mechanism in practice. Tata Steel's USD 200 million SLL, with interest rates tied to carbon reduction targets, produced a documented 15% reduction in CO_2 emissions within three years—an outcome that the firm's management attributed in part to the financial incentive structure of the loan, which made emissions reduction a direct contributor to financing cost reduction. Anglo American Platinum's USD 300 million SLL for sustainable mining practices, tied to water consumption reduction targets, produced a documented 20% reduction in water use—a significant operational achievement in a water-stressed South African mining context. These outcomes are consistent with Scholtens and Sievänen's (2021) broader analysis of SLL adoption drivers, which finds that performance-contingent loan terms produce measurably different operational sustainability trajectories than conventional green loan products without financial consequences for non-performance.

The growing emerging market share of SLL issuance—from 10% in 2019 to 22% in 2023—reflects both the increasing financial sophistication of emerging market corporate borrowers and the increasing integration of international sustainability-linked lending standards into the operations of global banks with emerging market portfolios. However, a persistent concern in the emerging market SLL context is the ambition and verifiability of the sustainability performance targets included in loan covenants: where targets are insufficiently ambitious—achievable without material changes to operational strategy—the financial incentive mechanism is functionally empty. The developing regulatory push toward standardization of SLL target-setting protocols in both OECD economies and in emerging market financial regulators who are members of the Sustainable Banking Network represents a critical institutional development for ensuring that the growing volume of SLL issuance translates into genuine rather than cosmetic business model change.

5.3. Carbon Credit Trading and Strategic Emission Management

Carbon credit markets have created a distinctive mechanism for business model transformation by establishing a financial price for carbon emissions that must be incorporated into operational cost structures, capital investment decisions, and competitive strategy. Tables 3 and 4 document the growth of global carbon market value and price per ton, and the regional distribution of carbon market activity in 2023.

The business model implications of carbon pricing are most direct in high-emission industries—energy, heavy manufacturing, cement, steel, aviation—where carbon compliance costs are sufficiently large relative to operating margins to materially affect strategic investment decisions. The trajectory of the global average carbon price—from USD 25 per ton in 2019 to USD 65 in 2023—represents a 160% increase in five

years that, when extrapolated across the emission intensities of major industrial sectors, translates into an increasingly substantial competitive penalty for firms that defer low-carbon investment. Stavins (2020) provides rigorous analysis of the behavioral response to carbon pricing in market-based environmental regulation, concluding that firms facing credible and rising carbon prices systematically shift capital investment toward emission reduction technologies at a rate and scale that voluntary sustainability commitments without price incentives do not achieve. The World Bank (2023) corroborates this finding through cross-national analysis, documenting that firms participating in compliance carbon markets reduce their compliance costs through actual emission reductions at approximately twice the rate of firms managing equivalent regulatory commitments through allowance purchasing alone.

Table 3. *Global carbon market value and average carbon price per metric ton, 2019–2023*

Year	Carbon Market Value (USD Bn)	Average Carbon Price per Ton
2019	210	25
2020	280	32
2021	350	42
2022	470	50
2023	600	65

Source. World Bank (2021; 2023).

Table 4. *Regional participation in carbon credit trading, 2023*

Region	Market Share (%)	Major Regulatory Systems
Europe	45	EU Emissions Trading System (ETS)
Asia-Pacific	30	China National Carbon Market
North America	15	California Cap-and-Trade Program
Latin America	5	Brazil and Mexico Carbon Programs
Africa	5	South Africa Carbon Tax

Source. World Bank (2023); Stavins (2020).

For emerging markets specifically, the development of domestic carbon markets represents a strategic inflection point in green finance development. China's national carbon market—covering 2,200 power sector facilities and over 4.5 billion tons of CO_2 annually—has created the world's largest carbon trading infrastructure in an emerging market context and established a domestic carbon price signal that is beginning to filter into investment decisions across the Chinese energy and manufacturing sectors. Indonesia, South Korea, Kazakhstan, Mexico, and Colombia have developed or are developing domestic carbon pricing mechanisms of varying designs, reflecting the recognition that domestic carbon markets serve dual purposes: they create financial incentives for business model decarbonization while generating government revenue that can be recycled into green investment or compensation for transition-affected workers and communities.

5.4. ESG Integration and Its Business Model Implications

ESG integration has become the broadest and most pervasive green finance mechanism, influencing business model behavior not through the terms of specific

financial instruments but through the investment screening, engagement practices, and reporting requirements that ESG-mandated institutional investors impose across their entire portfolio universes. Table 5 documents the trajectory of ESG investment growth in emerging markets and the sector distribution of ESG integration by 2023.

Table 5. *ESG investment growth in emerging markets (2019–2023) and sectoral integration levels*

Year / Sector	ESG Investment (USD Bn) / Integration Level (%)	Share of Total Market (%) or Key ESG Focus Areas
By year		
2019	500	8%
2020	700	12%
2021	1,000	18%
2022	1,400	24%
2023	1,800	30%
By sector		
renewable energy	85%	Carbon neutrality; clean energy transition
banking and finance	75%	Green lending; sustainable portfolio management
consumer goods	65%	Ethical sourcing; circular economy practices
manufacturing	60%	Energy efficiency; industrial waste reduction
transportation	55%	Electric vehicle adoption; emission control systems

Source. UNEP FI (2023); Friede et al. (2015); OECD (2023).

The four-fold growth of ESG investment in emerging markets between 2019 and 2023—from USD 500 billion to USD 1.8 trillion—represents the most consequential shift in the emerging market investment landscape in recent decades, and it has imposed correspondingly significant pressure on corporate management to demonstrate credible ESG performance. Friede et al.'s (2015) meta-analysis established that the relationship between ESG performance and financial returns is positive in the aggregate, with ESG-integrated portfolios exhibiting approximately 20% lower volatility than non-ESG comparators and companies with strong ESG policies reporting 10–15% higher profitability in the medium term. These financial performance differentials have transformed ESG integration from a values-driven investment preference into a risk-adjusted return optimization strategy, bringing institutional investors into the ESG field whose primary motivation is financial rather than ethical.

The business model implications of this shift in investor behavior manifest through three channels. The first is the cost of capital differential: firms with strong ESG ratings access capital at lower cost than peers with weak ESG performance, creating a direct financial incentive for ESG improvement that is invisible in conventional financial analysis but materially consequential for capital structure optimization. The second channel is market access: firms that cannot meet the ESG screening criteria of major institutional investors are effectively excluded from a growing share of global capital markets, creating a market access imperative for ESG performance improvement that is

particularly consequential for emerging market firms seeking international investment. The third channel is organizational legitimacy: in an era of mandatory sustainability disclosure requirements—advancing in the EU, UK, US, and in several emerging markets—the ESG reporting infrastructure that firms develop to satisfy investor expectations is increasingly being appropriated for regulatory compliance purposes, reducing the marginal cost of regulatory adaptation for firms that have already invested in ESG measurement and management systems.

6. Structural Barriers to Green Finance Adoption in Emerging Markets

Notwithstanding the substantial progress documented in preceding sections, the scale of green finance adoption in emerging markets remains well below what global sustainability imperatives—and the investment needs of rapidly developing economies—require. Three structural barriers are identified across the reviewed literature as primary constraints on adoption scale and depth.

6.1. Regulatory Fragmentation and the Absence of Harmonized Green Taxonomies

The most fundamental institutional barrier to green finance scaling in emerging markets is the absence of standardized, internationally harmonized definitions of what qualifies as a 'green' financial instrument. In the current landscape, green taxonomies—the classification systems that specify which economic activities qualify for green finance labeling—vary substantially across jurisdictions: China's taxonomy permits certain coal-fired power investments that EU, UK, and international standards exclude; different emerging markets define eligibility criteria for green bonds using different thresholds for renewable energy, energy efficiency, and biodiversity impacts; and the proliferation of competing ESG rating methodologies produces substantially different assessments of the same company's sustainability performance across rating providers (OECD, 2020). This fragmentation creates several compounding problems. It increases transaction costs for international green capital flows, as investors must evaluate each issuance against multiple definitional frameworks. It creates greenwashing opportunities, as issuers can select the least stringent applicable taxonomy for labeling purposes. And it prevents the development of the deep, liquid green capital markets that require standardized instrument definitions to function efficiently. The OECD's Developing Sustainable Finance Definitions and Taxonomies initiative, the EU's Sustainable Finance Taxonomy, and the International Sustainability Standards Board (ISSB) represent progress toward international alignment, but their authority in emerging market contexts is voluntary rather than binding, limiting their effectiveness in markets with strong preferences for regulatory sovereignty.

6.2. Limited Institutional Capacity and Financial Infrastructure

A second category of barriers reflects the structural underdevelopment of the institutional ecosystem within which green finance markets function. Effective green finance markets require multiple institutional preconditions: a financial regulator with the capacity to develop and enforce green investment standards; corporate governance frameworks that support meaningful ESG disclosure; accounting and auditing professions with technical competence in environmental impact measurement; rating

agencies with credible ESG assessment methodologies; and a domestic institutional investor base with both the resources and the mandate to allocate capital to green instruments. In lower-income emerging markets, many of these preconditions are partially or substantially absent (Ameli et al., 2020). The IFC (2021) has documented that capacity constraints—including the absence of trained financial professionals who understand green bond structuring, the limited availability of environmental impact measurement expertise, and the weak development of project preparation facilities that can present green investment opportunities in forms accessible to international investors—constitute binding constraints on green finance adoption in many developing economy contexts that cannot be addressed through regulatory reform alone. These capacity constraints are particularly acute in the African context, where Moyo and Jeke (2022) find that the primary determinant of green bond issuance capacity at the country level is not environmental commitment or climate vulnerability but institutional and financial market development—suggesting that capacity-building investment is a prerequisite for green finance market development rather than a complement to it.

6.3. Underdeveloped Domestic Capital Markets

A third structural constraint is the limited depth and liquidity of domestic capital markets in many emerging economies, which creates a fundamental mismatch between the long-term, large-scale financing that green infrastructure projects typically require and the short-term, risk-averse investment preferences of domestic capital markets. Green infrastructure investments—renewable energy installations, energy-efficient building retrofits, climate-resilient urban infrastructure, sustainable agricultural systems—typically involve high upfront capital costs, long payback periods, and complex risk profiles that require deep, patient capital markets to finance efficiently. In many emerging markets, the domestic institutional investor base—insurance companies, pension funds, sovereign wealth funds—is insufficiently large to absorb the scale of green investment required, and the retail investor base lacks the risk tolerance and investment horizon for green infrastructure assets. International capital can fill part of this gap, but it introduces currency risk, repatriation risk, and geopolitical risk that add to the cost of green financing and that domestic capital market development would address more efficiently. The development of local currency green bond markets—where issuances are denominated in domestic currencies, eliminating foreign exchange risk for local issuers and investors—has been identified by the IFC (2021) and the World Bank (2022) as one of the highest-priority interventions for scaling green finance adoption in emerging markets, but progress has been constrained by the limited credit depth of domestic capital markets and the preference of international investors for hard-currency instruments.

7. Discussion and Conclusion

The evidence reviewed in this paper supports a theoretically coherent and empirically grounded conclusion: green finance has demonstrably catalyzed significant business model transformation in emerging markets, operating through at least four distinct mechanisms—capital access expansion, performance-contingent incentive structures, carbon price signals, and investor ESG screening—that together constitute a

multi-layered institutional pressure for corporate sustainability adaptation. The institutional economics framework developed in Section 2 predicts that this transformation will be most pronounced in contexts where formal regulatory institutions provide clear and credible green finance standards, informal ESG norms are widely shared among institutional investors, and enforcement organizations—regulators, rating agencies, investors—create financial consequences for non-compliance. The empirical patterns documented across Asia, Africa, and Latin America broadly confirm this prediction: green finance adoption and business model transformation are most advanced where institutional development is most robust and most constrained where institutional gaps are most severe.

The evidence also confirms, however, that the relationship between green finance instrument availability and business model transformation is not automatic or unconditional. SLL covenants that lack ambition do not drive operational change; green bonds that lack rigorous use-of-proceeds verification and outcome reporting generate reputational benefit without environmental impact; carbon markets whose price signals are too low to shift investment decisions toward low-carbon alternatives fail to redirect capital from high-emission business models. The institutional quality of green finance—the precision of its standards, the credibility of its enforcement, and the ambition of its requirements—is at least as important as its volume in determining its business model transformation impact. This finding has direct implications for the reform priorities of both national regulators in emerging markets and international standard-setters: the primary leverage point for amplifying green finance's business model impact is not expanding instrument volumes but improving institutional quality—developing and harmonizing taxonomies, strengthening ESG disclosure requirements, raising the ambition of sustainability performance targets in SLL covenants, and establishing credible carbon prices at levels that materially affect the investment calculus of emission-intensive firms.

For policymakers, the review's findings support several specific institutional priorities. First, the development of nationally appropriate green taxonomies that are aligned with international standards while reflecting local economic and environmental contexts is a prerequisite for green finance market development that no substitute can adequately replace. Second, mandatory ESG disclosure requirements—covering at minimum listed companies and financial institutions, and ideally extending to larger unlisted corporates—create the information infrastructure within which green finance markets can function efficiently. Third, public development finance—through national development banks, sovereign green bond programs, and public-private partnerships—can serve both direct investment and market-development functions by establishing pricing benchmarks, providing first-loss tranches to de-risk private green investment, and building demonstration effects that reduce the perceived risk of green asset classes.

For institutional investors operating in emerging markets, the growth of ESG investment from 8% to 30% of total emerging market investment between 2019 and 2023 implies a continuing trajectory that makes ESG integration not a discretionary portfolio enhancement but a strategic necessity for market relevance. The evidence on the financial performance of ESG-integrated portfolios—lower volatility, higher long-term returns,

better risk-adjusted performance—supports ESG integration as a return optimization strategy independent of sustainability values, which broadens the investment case beyond the responsible investment community to mainstream institutional allocators. Active engagement with portfolio companies on ESG improvement, rather than passive exclusion of poor-performing firms, has been identified as a particularly high-leverage strategy for emerging market investors, given the scale of the potential improvement opportunity among firms that are only beginning their sustainability integration journey.

For corporate managers in emerging markets, the review's findings establish clearly that the green finance landscape is moving from voluntary to mandatory: ESG disclosure requirements are expanding, carbon pricing is extending, and SLL standards are tightening. Firms that treat green finance engagement as an incremental add-on to conventional financial strategy—adopting green instruments opportunistically when the terms are favorable while maintaining conventional business model architectures—are likely to find themselves increasingly disadvantaged relative to competitors that have integrated sustainability into their core operational and financial strategies. The evidence from Tata Steel, Petrobras, and Anglo American Platinum, while drawn from large corporates with the resources to engage with sophisticated green finance instruments, illustrates the business model logic that applies across the corporate size spectrum: sustainability-linked financing creates a financial discipline for environmental improvement that voluntary commitment programs cannot replicate, and the firms that establish this discipline early gain competitive advantages—in cost of capital, market access, regulatory positioning, and talent attraction—that compound over time.

This review has several limitations that inform its interpretive scope. The evidence base is concentrated in larger emerging market economies—China, India, Brazil, South Africa—and the institutional and business model dynamics in smaller or lower-income emerging markets may differ substantially from patterns identified in these contexts. The quantitative data reported in the tables are drawn from institutional and market reports rather than from controlled empirical studies, and should be interpreted as indicative of broad market trends rather than as precise measurements with formal statistical properties. The review's scope does not extend to the behavioral and organizational dimensions of green finance adoption at the firm level—the internal governance processes, management culture, and employee engagement mechanisms through which green finance requirements are translated into operational practice—which represents a significant and underexplored research domain. Future research addressing these limitations through longitudinal firm-level analysis, controlled quasi-experimental designs that exploit variation in green finance regulatory adoption across jurisdictions, and qualitative case studies of the organizational mechanisms of business model transformation would substantially enrich the evidence base on which this review draws.

ACKNOWLEDGMENTS

The authors would like to thank the two anonymous reviewers for their contributions in the revision of the paper.

NO CONFLICT OF INTEREST STATEMENT

All authors declare that they have no conflict of interest.

References

Acemoglu, D., & Robinson, J. A. (2012). Why nations fail: The origins of power, prosperity, and poverty. Crown Publishers.

African Development Bank. (2021). Green finance in Africa: Mobilizing sustainable investment for development. African Development Bank Group.

Ameli, N., Drummond, P., Bisaro, A., Grubb, M., & Chenet, H. (2020). Climate finance and disclosure for institutional investors: Why transparency is not enough. *Climatic Change, 160*(4), 565–589. https://doi.org/10.1007/s10584-019-02542-2

Climate Bonds Initiative. (2022). Green bond market summary. https://www.climatebonds.net

Climate Bonds Initiative. (2023). Global green bond market report 2023. CBI.

Donaldson, T., & Preston, L. E. (1995). The stakeholder theory of the corporation: Concepts, evidence, and implications. *Academy of Management Review, 20*(1), 65–91.

Eccles, R. G., & Krzus, M. P. (2010). One report: Integrated reporting for a sustainable strategy. Wiley.

Freeman, R. E. (1984). Strategic management: A stakeholder approach. Pitman.

Friede, G., Busch, T., & Bassen, A. (2015). ESG and financial performance: Aggregated evidence from more than 2000 empirical studies. *Journal of Sustainable Finance and Investment, 5(*4), 210–233. https://doi.org/10.1080/20430795.2015.1118917

International Capital Market Association (ICMA). (2021). Green bond principles 2021. https://www.icmagroup.org

International Finance Corporation (IFC). (2021). Green finance in emerging markets: Challenges and opportunities. World Bank Group.

Moyo, C., & Jeke, L. (2022). Green finance and economic development in Africa: A systematic review. *Development Finance Review, 9*(2), 75–92.

North, D. C. (1990). Institutions, institutional change and economic performance. Cambridge University Press.

Organisation for Economic Co-operation and Development (OECD). (2020). Developing sustainable finance definitions and taxonomies. OECD Publishing. https://doi.org/10.1787/134a2dbe-en

Organisation for Economic Co-operation and Development (OECD). (2023). Financing the green transition: Policy trends and market development. OECD.

Reserve Bank of India. (2022). Sovereign green bond framework 2022. RBI.

Scholtens, B., & Sievänen, R. (2021). Drivers of sustainability-linked loan adoption: A global perspective. *Finance Research Letters, 43*, 101985. https://doi.org/10.1016/j.frl.2021.101985

Stavins, R. N. (2020). Market-based environmental policies: What can we learn from U.S. experience and related research? *Oxford Review of Economic Policy, 36*(1), 118–137. https://doi.org/10.1093/oxrep/grz033

United Nations Environment Programme (UNEP). (2019). Financing sustainable development: The role of the financial sector. UNEP.

United Nations Environment Programme Finance Initiative (UNEP FI). (2021). Sustainable finance in Latin America and the Caribbean: Trends and opportunities. UNEP.

United Nations Environment Programme Finance Initiative (UNEP FI). (2023). Sustainable finance trends in emerging markets. UNEP.

Wang, Y., & Zhi, Q. (2016). The role of green finance in environmental protection: Two aspects of market mechanism and policy. *Energy Procedia, 104*, 311–316. https://doi.org/10.1016/j.egypro.2016.12.053

World Bank. (2021). State and trends of carbon pricing 2021. World Bank.

World Bank. (2022). The state of sustainable finance: Progress and challenges. World Bank.

World Bank. (2023). State of global carbon markets 2023. World Bank.

Zhang, D., Mohsin, M., Rasheed, A. K., Chang, Y., & Taghizadeh-Hesary, F. (2021). Public spending and green economic growth in BRI region: Mediating role of green finance. *Energy Policy, 153*, 112256. https://doi.org/10.1016/j.enpol.2021.112256

Zhao, X., Zhang, X., & Shao, S. (2020). Can green finance promote renewable energy investment? Evidence from China. *Energy Economics, 92*, 104944. https://doi.org/10.1016/j.eneco.2020.104944

Zhao, L., Chen, Y., & Wu, J. (2022). Green bond issuance and corporate ESG performance: Evidence from Chinese firms. *Journal of Cleaner Production, 363*, 132407.