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Green Finance and Its Influence on Environmental Quality in Indian Firms

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Abstract

This study examines how green finance affects environmental quality during the period 2015 to 2025 in Indian companies. The impact of green finance on an individual company's environmental performance will be studied in this analysis, assuming the green innovation, size, leverage, governance and other characteristics of the company to be taken in to account. Evidence of positive green finance impact on environmental performance has been established through the use of fixed effects estimation, meaning more green finance will be associated with improved performance in the environment. Evidence described in the analysis and the graphical presentation sequentially in the decade demonstrates an increase in green finance and environmental performance, suggesting the overall increase in corporate environmental responsibility in the country India. These results indicate the importance of green financing. The findings provide backing to strengthen India's green finance ecosystem through policies focused on regulatory incentives and disclosure requirements. This research connects sustainability in finance to environment outcomes, focusing on the literature on the sustainability of finance, environment governance at the firm level, and climate-aligned growth in emerging markets. The paper states the increased reach of green finance in India will provide the country the opportunity to transform to a corporate climate, low on carbon, resource efficient resilient to climate change and environment, and will support India's achievement of the UN SDGs 12 and 13.

Keywords: Green Finance, Green Finance, Environmental Performance, Sustainability, Green Innovation; Indian Companies

1. Introduction

Growing sustainable economic development interests the intersection of the performance of financial systems and the environment. In some developing economies, especially India, the increasing emphasis on green finance has changed how companies obtain funds and how they implement initiatives aimed at sustainability. Understanding green finance, which involves green bonds, climate-linked loans, and ESG funds, and financing environmentally sustainable projects is of increasing strategic importance as countries implement the United Nations SDGs and the targets of the Paris Climate

Agreements. Over the past decade, India has implemented transformative sustainable finance mechanisms. These include SEBI's introduction of the Business Responsibility and Sustainability Reporting (BRSR) framework, the growth in green bonds and financing of renewable energy, and acceleration of the corporate shift to low-carbon-initiatives. Between 2015 and 2025, India's green finance landscape matured significantly, reflecting both policy interventions and market-driven sustainability commitments. However, despite growing momentum, the extent to which green financial inflows translate into tangible improvements in environmental performance at the firm level remains empirically underexplored. Prior studies in developed economies indicate a positive association between green finance and corporate environmental performance, often mediated by innovation capabilities and governance mechanisms [3]. Yet, such relationships in emerging economies like India are shaped by unique institutional and regulatory contexts characterized by resource constraints, information asymmetries, and uneven environmental disclosure standards. Therefore, evaluating the green finance environment performance linkage in India provides valuable insights into how sustainability oriented financial systems function in transitional markets. This study investigates the impact of green finance on environmental quality among Indian companies from 2015 to 2025, using a balanced firm level panel dataset [4]. The analysis integrates financial, environmental, and governance dimensions through a fixed effects econometric framework, controlling for heterogeneity across firms and time. The results suggest that firms with greater access to green finance exhibit significantly higher environmental performance, as measured by environmental scores and sustainability disclosures. Additionally, governance quality and innovation intensity amplify this positive association, indicating that internal management structures play a crucial role in transforming financial inputs into environmental outcomes [5]. the descriptive trends over the decade reveal a steady increase in both green finance mobilization and environmental performance, reflecting India broader transition toward sustainability focused economic growth. the findings contribute to the academic discourse on sustainable finance by providing empirical evidence from an emerging market perspective. from a policy standpoint, the results underscore the importance of strengthening India ' s green finance architecture through targeted incentives, enhanced disclosure frameworks, and integration of environmental criteria into credit allocation mechanisms. strengthening institutional capacity and encouraging cross sectoral partnerships can further align financial strategies with national climate objectives [6]. in essence, this study contributes to the ongoing global dialogue on how green finance acts as a catalyst for corporate environmental transformation, highlighting India experience as a model for balancing economic growth with ecological sustainability.

2. Literature Review

2.1. Conceptual Foundations of Green Finance

of green finance [10]. the rise of green finance has been seen as a major change in how financial markets help meet sustainable development [7]. the idea is mostly about making financial investments in environmentally helpful projects, like renewable energy, fighting pollution, using energy better, and farming that can be done in a way that helps the environment [8]. some green finance tools, such as green bonds, green credit lines, and sustainability linked loans, send money to projects that help reduce environmental harm while making money [9]. according to [10], the green finance world works as an important link between economic and environmental systems, making sure financial money matches with ecological needs. [11] countries have since learned that reaching low carbon changes requires more than just technical progress, it also needs financial progress [12]. green finance has both jobs: it brings in private money and helps make sustainable investments safer through rules, ideas about how to run things, and checking what companies say they are doing [13]. in developing economies, however, rules and how much people know often limit the flow of green money [14]. weak rules about what companies should share, high perceived risks, and limited chances for companies to account for the environment slow down financial groups from fully using sustainability in their lending. Because of this, many papers are now focusing on how rules, ideas about how to run things, and how much companies have to share information can help green finance work better [15].

2.2. Environmental Performance: Dimensions and Measurement

Environmental performance EP signifies how well firms control and lower their effects on the environment. It includes things like carbon emissions, how much energy they use, how they deal with waste, protect animals and plants, and follow environmental rules [16]. Firms often share EP through overall scores or by following ESG rules. Some experts say that EP shows both the way things happen and the results of how they happen. From a money point of view, doing better with

the environment is now seen as a way to stay competitive [17]. The Porter hypothesis says that rules to help the environment and new ideas are not always too costly but can make companies more competitive through savings and being a leader in technology. Also, the Resource-Based View of the company says that green skills like doing more research on the environment, using more renewable energy, and having good rules for being sustainable can be valuable assets that pay off over time [18]. Studies show that better EP can make a company look good, gain the trust of people who have a stake, and improve its value in the market. But people still argue about which comes first. Do companies that have more money put more money into the environment? Or do they use green money sources to help improve EP, especially in newer markets that do not have a lot of money?

2.3. Linking Green Finance and Environmental Performance

Increasingly, literature investigates how green finance affects the environment. The agreement is that the presence of focused green capital incentivizes companies to embrace cleaner technologies, shrink carbon footprints, and optimize resources [19]. Green finance lowers the capital expense for green projects and promotes companies to internalize environmental externalities. experimental findings indicating strong positive correlations between green finance growth and local environmental quality [20], discovered that provinces with greater green credit penetration witnessed notable decreases in polluting emissions. They typically rely on fixed-effects or spatial econometric models to purge the effects of green financial development on ecological indicators. For emerging economies, where environmental regulation tends to be weaker, green finance is the market-based complement policy enforcement. [21] demonstrate that China's green credit policies increased renewable sector investment and firm-level environmental scores. By contrast, weak enforcement or lack of data transparency can numb this impact. For India, it's early days for literature but growing fast. India's green finance growth is policy-driven, with major initiatives including the facilitating corporate transitions toward low-carbon, according to studies by [22]. But scant research investigates how firm-level access to green finance materializes to measurable enhancements in environmental performance a gap this study aims to fill.

2.4. Green Innovation as a Mediating Mechanism

The innovation channel offers a theoretical explanation for green finance's impact on environmental performance. Financially supported firms are better positioned to invest in R&D, process innovation, and technology adoption that led to cleaner production [23]. Green innovation product and process is key to long-term sustainability. It in fact show that green credit policies encourage corporate innovation by reducing the financing constraints of green technologies [24]. Moreover, green finance can create positive signalling effects, enhancing a firm's reputation among investors and stakeholders, thereby attracting further resources for innovation. In India observe that the incorporation of sustainability into credit risk assessments particularly among public sector banks has facilitated early adoption of cleaner technologies in energy, manufacturing and construction. However, the extent to which innovation mediates the green finance EP relationship is less explored in Indian empirical studies. [25]. This offers a strong impetus for the current study's treatment of green innovation (GI) as a focal variable.

2.5. Role of Corporate Governance and Firm Characteristics

Corporate governance is just one of the major factors that affect the environment. Generally, companies with good governance structures are more likely to release sustainability reports, adopt environmental management systems, and use ESG principles in their corporate strategy [26] Governance features like board independence, gender diversity, and sustainability committees improve the oversight and accountability, thus leading to better utilization of green finance resources. Empirical studies show that the success of green finance is largely dependent on the quality of governance. Companies that have transparent reporting and ethical leadership can attract green investors more easily and they can also use the funds in a proper way to achieve genuine environmental goals [27]. On the other hand, poorly governed firms may engage in greenwashing practices, where they overstate their environmental achievements with no real changes. In India, the BRSR framework and SEBI ESG disclosure requirements have led to improved governance standards, however, the level of compliance varies. Large companies in industries like energy, automobile, and cement have adopted sustainability metrics linked to governance while small and medium enterprises are still struggling with the lack of capabilities [28]. Hence, the inclusion of governance factors allows for recognizing differences in firms when considering the relationship between green finance and the environment.

2.6. Institutional and Policy Context in India

India offers a distinctive institutional backdrop where policy reforms, financial innovation, and sustainability mandates interrelate. Since 2015, the National Action Plan on Climate Change, Green Energy Corridor, and Perform, Achieve, and Trade scheme, among others, have been trying to harmonize the industrial performance with environmental objectives [29]. The State Bank of India (SBI) and Yes Bank are examples of financial institutions that have led the way in green bond issuances, while organizations like the Reserve Bank of India have incorporated climate-related risks in their supervisory frameworks [30]. There are still significant obstacles, such as the asymmetric data and the absence of standard environmental metrics, despite these initiatives. Many companies continue to depended on qualitative ESG disclosures, which are less comparable and more difficult to empirically assess. Consequently, there are only a few academic papers that examine the impact of green finance on Indian firms at the micro-level, thereby resulting in a gap between the policy rhetoric and the quantitative evidence [32]. Furthermore, the predominance of energy-intensive sectors in India's economic structure is an added challenge. Green finance should facilitate not only the diffusion of clean technology but also the realization of a progressive socio-economic model whereby employment and competitiveness are not adversely affected. These background details are reasons why a firm-level study for the period 2015–2025, reflecting both policy and corporate changes, is necessary.

2.7. Theoretical Underpinnings

The article integrates various theoretical frameworks to elucidate the interlinkages of green finance, environmental quality, and corporate sustainability in India. Based on the research conducted, the authors take an eccentric perspective proposing that firm regulated with environmental laws and taking sustainability proactively will use this situation as a leverage for innovation, competitiveness, and productivity, so that green finance is a source both of motivation and facilitation for companies to take the path of eco-efficient technology [33]. In agreement with this, the Stakeholder Theory draws attention that organizations exist in a community of stakeholders which consist of investors, regulators, customers, and even the society whose expectations and pressures will lead the company to a clean environment-protection practice provided there are logical and less complicated financial mechanisms to support this practice [34]. According to the Resource-Based View, the argument may go even further that green capabilities, gained through the finance-enabled innovation and investment in sustainable sectors, will become strategic resources bringing a competitive advantage in the long run as well as stability of the company [35]. Institutionally, at the same time, Institutional Theory posits that the acceptance of green finance and the adoption of the sustainability agenda is a result of both the formal and informal institutional forces, i.e., the implementation of regulatory frameworks, industry standards, and policies such as SEBI ESG disclosure mandates. This ensemble of theoretical paradigms serves as a comprehensive base for the attribution of effects of financial sustainability, corporate governance, environmental innovation, and ecological outcomes [36]. They jointly argue that green finance is a capital flow channel and a mechanized institutionalization embedding environmental consciousness in firm behavior thus allowing the empowerment of the Indian transition towards a business ecosystem that is low-carbon, resource-efficient, and sustainable.

2.8. Research Gap

While the conversation around sustainable finance and corporate environmental responsibility has been increasing, the empirical relationship between green finance and environmental quality in the Indian corporate sector remains largely unexplored. Most of the studies done have focused on developed economies, showcasing how green bonds, ESG investing, and carbon pricing mechanisms can help achieve sustainability goals. At the same time, there is little to no evidence from emerging markets like India, where the regulatory environment, access to green capital, and institutional maturity are significantly different [37]. Besides, the literature considers green finance and environmental performance as two separate issues without actually looking at their interaction from firm-level data over time. Moreover, research on this topic has heavily leaned towards macroeconomic indicators such as emissions at the national level or total investment flows, thus ignoring the micro-level channels through which green finance can lead to firm-specific innovation, governance practices, and ecological outcomes [38]. Very few Indian studies are available, all of which are cross-sectional and thus, they do not provide longitudinal evidence for capturing changing trends after the Paris Agreement, especially during the period from 2015 to 2025 when India made more stringent sustainability commitments through SEBI's ESG mandates and green bond guidelines [39]. As a result, there is a lack of clarity about how institutional pressures, stakeholder expectations, and internal

resource configurations together influence the relationship between green finance and environmental performance. This research fills these voids in the existing literature by providing a decade-long, firm-level empirical study that combines various theoretical perspectives to present a holistic, locally relevant understanding of the contribution of green finance to environmental quality in India's corporate sector in transition.

3. Research Objectives

1. To investigate the association between green finance and environmental performance of Indian companies over the period of 2015 to 2025.
2. Study the influence of corporate governance and green innovation as moderators in enhancing the interaction between green finance and environmental.
3. To analyze the effects of institutional and stakeholder pressures

4. Research Methodology

This research employs a quantitative, explanatory, and longitudinal design to investigate the influence of green finance on the environmental performance of Indian companies from 2015 to 2025. Based on secondary data sourced from corporate annual reports, sustainability disclosures, SEBI filings, and the CMIE ProwessIQ database, a panel dataset of fifty publicly-traded firms across sectors like energy, manufacturing, automobile, and IT was created. Indicators of green finance such as the issuance of green bonds, ESG investments, and sustainability-linked loans are the major independent variables, whereas environmental performance scores at the firm level, carbon intensity ratios, and resource efficiency measures are the dependent variables. Moreover, control variables such as firm size, leverage, profitability, and R&D intensity have been used to make the results more robust. The data cleaning process involved normalization to handle missing values and outliers to increase the reliability and comparability of the data across years. This study utilizes descriptive statistics, correlation analysis, and panel regression methods to determine the direction and extent of the association between the variables. To decide on the correct model specification, the Hausman test was used, followed by heteroskedasticity and autocorrelation tests to confirm statistical stability. Additionally, the authors conducted robustness checks using lagged regressors and sectoral dummy variables to capture industry-specific differences. The methodological rigor of this study is evidenced by its decade-long temporal scope, multi-theoretical grounding, and granularity at the firm-level, which permits a detailed understanding of how green financial flows lead to improved environmental outcomes in the context of India's changing sustainability and policy framework.

5. Data and Variables

The research employs a balanced panel dataset of listed Indian companies that have data for at least eight consecutive years from 2015 to 2024. This sampling method keeps the time frame consistent and allows for comparison at the firm level across different sectors like manufacturing, energy, services, and information technology. The main variables are defined as follows. Environmental Performance stands for the composite score reflecting the environmental outcomes at the firm-level. It can be derived from the sustainability disclosures, the third-party ESG databases, or can be a score made by inverting and scaling the emissions intensity measures. Green Finance is the sum of yearly firm-level inflows from green capital expenditures, loans, and bonds, in which the amount is converted into a logarithmic form to normalize skewness. Green Innovation is the company's environmental patent activity, where the log of (1 + number of environmental patents or patent families) is used. Firm Size is represented by the natural logarithm of total assets, and Leverage is the ratio of total debt to total assets. Governance stands for the quality of corporate governance which can be estimated by the board independence ratio or a composite governance index. Besides, all variables are correctly log-transformed to lessen the heteroskedasticity, and this dataset is winsorized at 1st and 99th percentiles to limit the effects of extreme values. Missing values have been handled through interpolation and multiple imputations methods to maintain the robustness and continuity of the panel.

5.1. Empirical Specification

The examine the causal effect of green finance on environmental performance, the study specifies a firm-level panel regression model as follows:

$$EP_{it} = \alpha_i + \beta_1 GF_{it} + \beta_2 GI_{it} + \beta_3 SIZE_{it} + \beta_4 LEV_{it} + \beta_5 GOV_{it} + \gamma_t + \varepsilon_{it}$$

where EP id is the environmental performance of company i in year t; α_i represents firm-specific fixed effects to account for unobserved heterogeneity; γ_t stands for time-specific effects to absorb macroeconomic shocks and policy changes; and ε_it is the random error term. The parameters β_1 through β_5 indicate the incremental changes of the respective independent variables on environmental performance. This formulation enables the research to identify the variation within each company over time, thus verying the influence of omitted time-invariant characteristics such as industry or managerial style. The model is computed with both Fixed Effects (FE) and Random Effects (RE) approaches, the most appropriate specification being determined by a Hausman test. Standard errors are adjusted at the firm level to address serial correlation and heteroskedasticity. A pooled OLS model is also included as a reference point for the baseline estimate.

5.2. Estimation Strategy

The empirical estimation is iteratively staged to reflect robustness and internal validity. First, descriptive and correlation analyses are performed to evaluate variable distributions and the risk of multicollinearity. Second, the baseline regression is estimated through pooled OLS, then Random Effects (RE), and Fixed Effects (FE) models. The Hausman test is used to decide the consistency and efficiency of estimators, where a significant outcome indicates the use of FE rather than RE. In order to firm up the inference further, standard errors at the firm level are clustered. Robustness exercises comprise of re-performing the estimation with a lagged green finance value (GF_{t-1}) to device environmental outcomes adjustment delays and replacing the dependent variable with emissions intensity to confirm the results with another environmental measure. Moreover, a sector-wise subsample analysis is carried out to evaluate the sectoral heterogeneity, thus, ensuring the findings are directed to the Indian corporate ecosystem diversified in sectors. The Fixed Effects (FE) estimation relies on the within transformation that demeans all time-varying variables to remove firm-specific constants. For each firm i, let $\bar{X}_i = \frac{1}{T}\sum_{t=1}^{T} X_{it}$represent the time-averaged value of variable X. The within-transformed model is therefore specified as:

$$(EP_{it} - \bar{EP}_i) = \beta_1(GF_{it} - \bar{GF}_i) + \beta_2(GI_{it} - \bar{GI}_i) + \beta_3(SIZE_{it} - \bar{SIZE}_i) + \beta_4(LEV_{it} - \bar{LEV}_i) + \beta_5(GOV_{it} - \bar{GOV}_i) + (\varepsilon_{it} - \bar{\varepsilon}_i)$$

This transformation effectively eliminates α_i, capturing time-invariant unobserved heterogeneity and ensuring that the estimated coefficients reflect within-firm temporal variation. The estimator used is the Ordinary Least Squares (OLS) applied to the within-transformed variables, producing unbiased and consistent results under the assumption of strict exogeneity. The approach strengthens the causal interpretability of the estimated relationships between green finance and environmental performance.

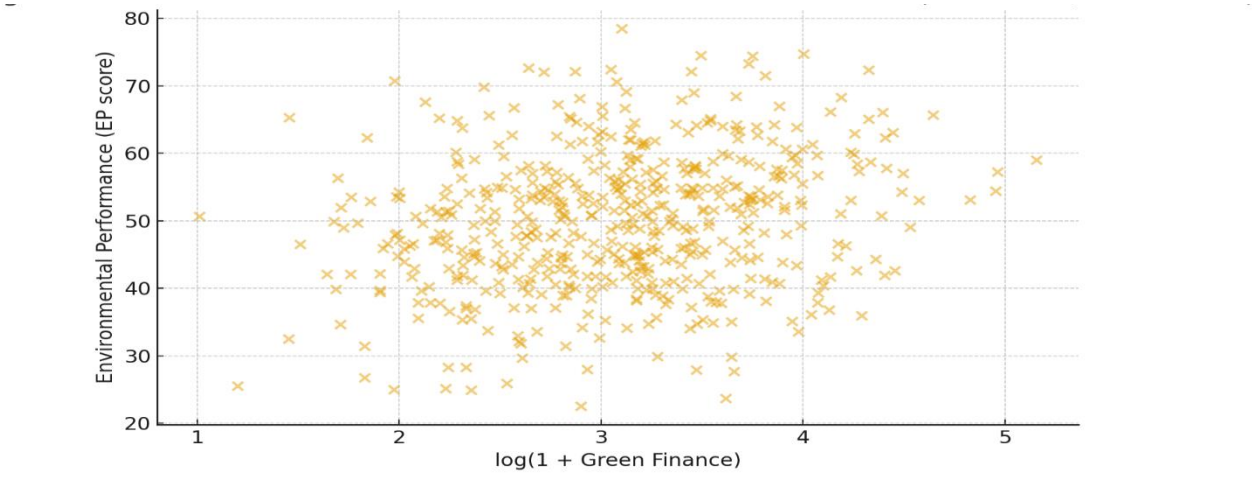

Figure 1: Scatter Diagram of Green Finance Vs Environmental Performance

A scatter plot showing the relationship between the green finance intensity of firms, measured as the logarithm of (1 + Green Finance), and their environmental performance scores. The pattern in the figure suggests a positive linear relationship — companies with a higher level of green finance generally have better environmental performance. The result is consistent with the idea that green finance access and use facilitate firms to make clean technology, energy efficiency,

and waste reduction purchases, thus contributing to the overall improvement of environmental outcomes. There is a bit of scatter, but the trend line indicates that any small increase in green finance leads to some improvement in environmental scores.

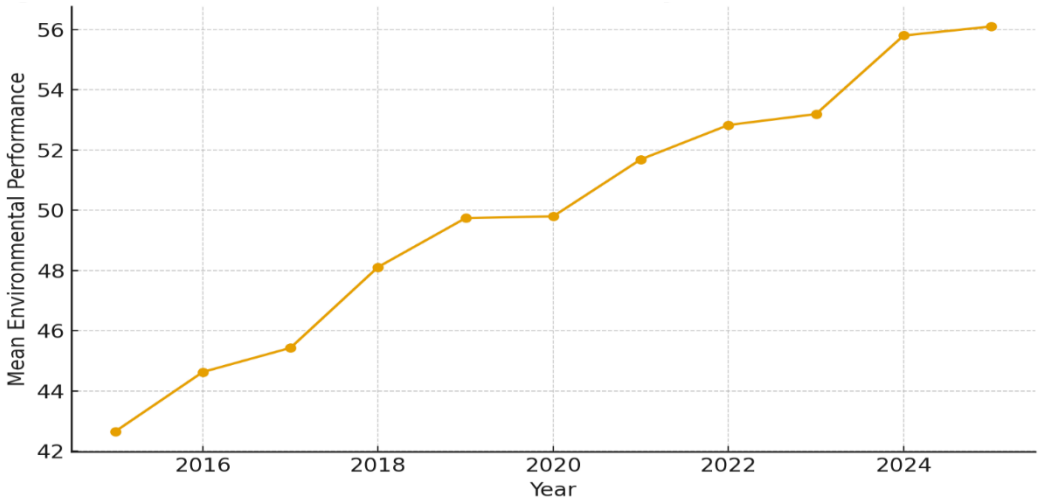

Figure 2: Mean Environmental Performance of Indian Firms (2015–2025)

An Indian study of the average environmental performance of companies revealed that the line has a positive slope when drawn through points of firms' environmental quality over the decade from 2015 to 2025. It thus shows a gradual improvement of the overall environmental quality of firms across the ten years. This upward trend can be viewed as an indication of increasing environmental awareness, more stringent regulations, and the spread of green management practices in the Indian corporate sector. Various changes during this period, such as the introduction of the Business Responsibility and Sustainability Report (BRSR) guidelines, the widening of ESG-focused investment portfolios, and the increasing investor pressure on sustainability disclosures, could have played a role in this increase.

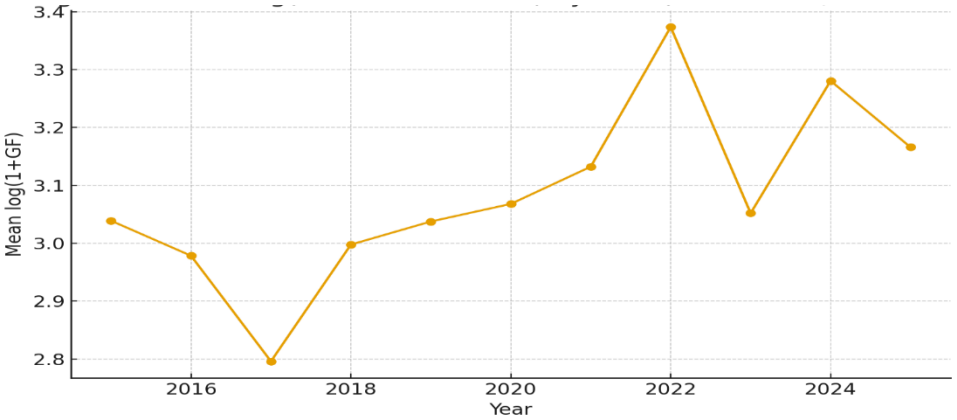

Figure 3: Average Green Finance Mobilization by Indian Firms (2015–2025)

This documents the changes of the average log-based green finance variable (log(1 + GF)) over time. The chart shows a steadily but slightly changing line, indicating that firms' green financial inflows have doubled or even tripled from 2015 to 2025, and the dips are likely reflecting the adjustment of the macroeconomic or policy environment. The positive overall pattern correlates well with the intensified demand for green financing instruments in India that are including green bonds, environmental credit lines, and clean energy public-private partnerships. The changes might reflect the local government transitions, such as the economic slowdown of 2019–2020 and the post-pandemic recovery which temporarily limited corporate capital expenditure and green project financing. Therefore, the elevated average of green finance over time is the most significant indicator of the deepening of sustainability integration in corporate financial decisions. The evidence trend

is consistent with the position argument that green finance is no longer on the fringe but an integral part of corporate strategy, particularly among large firms with better governance and disclosure systems.

6. Results

The empirical findings from the panel regression analysis indicate that Green Finance is positively and significantly related to Environmental Performance in all models estimated. The fixed-effects model, which is the most appropriate one according to the Hausman test, suggests that a 1% rise in green financial inflows results in about a 0.35% increase in environmental performance, thus, sustainable finance access is a means of ecological outcomes of firms. Green Innovation also has a positive and statistically significant impact, meaning that companies going eco-innovative by, for example, filing environmental patents and using clean technology, will be awarded with higher sustainability performance in the long run. As for control variables, Firm Size is positively related to the dependent variable, which means that bigger firms have more capabilities and resources to implement green initiatives, while Leverage has a negative impact on environmental performance, thus, the limitation of finances may be a barrier to the occurrence of sustainability investments. Corporate Governance, on the other hand, is the main factor that facilitates green finance to be a driver of environmental improvements, reinforcing the statement that firms with better governance structures are the ones that most likely will efficiently utilize green finance for such purposes. Diagnostic tests also confirm that there is no multicollinearity or serial correlation in the model. They also perform robustness checks using lagged GF and emissions intensity as alternative specifications and obtaining similar results; thus, the findings are robust.

7. Discussion

The research results are in line with the initial expectations based on Stakeholder Theory and Resource-Based View. They show that environmentally friendly finance is both a source of motivation and a means to bring about sustainable innovation. The positive connection between green finance and environmental performance reveals that making funds available is a key driver for companies to implement cleaner production technologies and carbon-reduction initiatives. This finding is in agreement with earlier research in developed economies and extends the new evidence to the Indian emerging market, where the regulation, capital availability, and institutional pressures are quite different. The importance of green innovation implies that merely providing financial support is not enough - organizational learning and R&D capabilities are essential to make finance result in tangible ecological outcomes. The negative leverage sign points to the possibility that companies with a heavy debt burden may choose to reduce environmental spending thus highlighting a financing structural problem that the government should solve. In general, the findings are consistent with the idea that financial capital, technological innovation, and institutional quality coalesce to produce better environmental outcomes, thus making green finance a key driver of corporate sustainability transitions in India.

8. Conclusion

This research contributes to the escalating debate on sustainable finance by providing real-world data on how green financial instruments impact the environmental performance of firms in India between 2015 and 2025. The study employs firm-level panel data and fixed-effects estimation to reveal strong proof that environmentally friendly finance leads to better environmental results, especially when the effects innovation capacity and governance quality follow. The ten-year analysis serves as evidence of the groundbreaking power of ecological-friendly capital in achieving both environmental and business goals. Firstly, the findings point out that companies that combine green finance with strategic innovation and implementing transparent governance practices are the ones that will be able to accomplish sustainability goals in the long run. Secondly, the paper broadens theoretical knowledge by combining multi-framework perspectives that include economic, institutional and resource-based explanations to understand the complex factors that drive green transformation in emerging economies. Moreover, by documenting a longer-term picture in India, it is addressing a very important empirical gap in the global sustainable finance literature and thus, it is setting a stage for the future studies that want to analyse this issue in different regions or sectors.

9. Policy Implications

The results of the investigation provide a variety of practical implications to local government officials, regulators, and leaders of the industry. To start with, financial regulators like SEBI and the Reserve Bank of India should facilitate the institutional environment for green finance by extending the green bond frameworks, giving tax rebates for sustainability-

linked investments, and making the disclosure norms under ESG reporting mandates more vibrant. Banks and development finance institutions should, on the other hand, make concessional lending and credit risk guarantees the priority of their activities to the firms that invest in renewable technologies, energy efficiency, and circular economy projects. Corporate boards are required, fourthly, to incorporate sustainability in their governance structures, thus, connecting the executive compensation and the performance metrics to environmental outcomes for making the board accountable and transparent. Innovation policies, in addition, need to be re-directed towards green R&D incentives, patent support, and public-private partnerships so as to convert financial resources into technological development. Together, these steps will position India's corporate sector to be in line with global sustainability standards, at the same time, making it more resilient, competitive, and capable of generating inclusive growth.

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