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Green Economy and Renewable Energy: Opportunities and Challenges for Sustainable Growth in Vietnam: A Comparative Analysis with South Korea and Thailand

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Abstract		Original Research Article

The global pursuit of net-zero emissions by 2050 has accelerated the transition to green economies, with renewable energy as a cornerstone for sustainable development. This study evaluates the effectiveness of green finance policies in promoting renewable energy adoption in Vietnam, comparing outcomes with South Korea and Thailand. Using a quantitative approach, we analyze panel data from 2015 to 2023 for 1,500 firms across the three countries, employing fixed-effects regression models to assess the impact of green finance on renewable energy investment and economic growth. Results indicate that Vietnam's green finance policies significantly boost renewable energy adoption but lag behind South Korea and Thailand in private sector engagement and policy flexibility. Infrastructure constraints and high financing costs remain challenges. Policy recommendations include adopting auction mechanisms, enhancing grid infrastructure, and fostering regional cooperation to support Vietnam's Socio-Economic Development Strategy 2021–2030, contributing to sustainable growth and global climate goals.

Keywords: Net-Zero Emissions, Green Economies, Renewable Energy, Green Finance Policies, Economic Growth, Vietnam, Sustainable Development.

1. INTRODUCTION

The global imperative to achieve net-zero emissions by 2050 has positioned the green economy as a transformative framework for sustainable development, emphasizing renewable energy sources like solar, wind, and hydropower to reduce carbon footprints (IEA, 2022). Vietnam, a rapidly growing economy in Southeast Asia, has embraced this transition through its Socio-Economic Development Strategy 2021–2030, which prioritizes sustainable growth and renewable energy expansion (World Bank, 2022). With its abundant solar and wind resources, Vietnam has seen a surge in renewable energy capacity, driven by green finance policies such as feed-in tariffs (FiTs) and green bonds. However, challenges such as inadequate grid infrastructure and high financing costs threaten progress (CSIS, 2024). This study

evaluates the effectiveness of Vietnam's green finance policies in promoting renewable energy adoption and compares them with South Korea and Thailand, two regional leaders in clean energy transitions.

Green finance, encompassing financial instruments like green bonds, loans, and subsidies, is critical for scaling renewable energy projects (WRI, 2024). South Korea's Green New Deal and Thailand's Energy Conservation Fund offer models of robust green finance systems, yet each faces unique challenges. This study addresses three research questions:

1. How effective are Vietnam's green finance policies in promoting renewable energy investment?
2. How do Vietnam's policies compare with those of South Korea and Thailand in driving renewable energy adoption?

3. What are the policy implications for overcoming challenges to sustainable growth in Vietnam?

Using panel data from 2015 to 2023, we employ fixed-effects regression models to quantify the impact of green finance on renewable energy investment and economic growth, providing a comparative analysis across the three countries. The study contributes to the literature by offering empirical evidence from a developing country context and highlighting pathways for Vietnam to achieve its sustainable development goals.

2. LITERATURE REVIEW

2.1 Green Economy and Sustainable

Development

The green economy has emerged as a central framework in global efforts to align economic development with environmental sustainability. Defined as an economic system that fosters human well-being and social equity while significantly reducing environmental risks and ecological scarcities, the green economy offers a paradigm shift from traditional growth models reliant on fossil fuels and extractive industries (Bukht & Heeks, 2017). This model is underpinned by the rapid global expansion of renewable energy, which has been facilitated by steep declines in technology costs—solar photovoltaic (PV) module prices fell by 85%, and wind turbine costs by 56%, between 2010 and 2020 (UN, 2023). As a result, renewable energy is no longer a niche or idealistic pursuit but a competitive and strategic imperative, especially for emerging economies seeking both environmental resilience and industrial upgrading.

For developing countries, the green economy presents a dual opportunity: mitigating the adverse effects of climate change while creating new engines of economic growth. In particular, investments in clean energy infrastructure have proven to generate substantial socio-economic co-benefits. Vietnam, for example, has witnessed a green energy boom since 2018, resulting in the creation of over 50,000 new jobs in solar and wind sectors, predominantly in rural and underdeveloped regions (CSIS, 2024). Yet, despite these gains, structural bottlenecks remain. Grid congestion, regulatory fragmentation, and insufficient access to green capital continue to restrict the scalability and sustainability of renewable projects. These challenges mirror those faced by other developing countries, where the green economy has yet to be fully mainstreamed into national economic systems (Oloyede et al., 2023).

From a theoretical standpoint, the Ecological Modernization Theory (EMT) provides a compelling lens through which to understand the potential of the green economy. EMT posits that technological innovation—particularly in energy and production systems, can decouple economic growth from environmental harm, thereby enabling sustainable development (Mol & Sonnenfeld, 2000). This theory is particularly relevant to Vietnam's policy context. The country's Socio-Economic Development Strategy 2021–2030 explicitly integrates EMT principles by aiming for a renewable energy share of 23% by 2030 and recognizing clean technology as a driver of future competitiveness (World Bank, 2022). However, the realization of these ambitions depends not only on policy intent but on the operationalization of robust, scalable, and inclusive financial mechanisms—an area that remains underexplored in Vietnam's green development literature.

2.2 Green Finance and Renewable Energy

Green finance has become a cornerstone of sustainable development, referring to financial investments that support projects with positive environmental outcomes, particularly in the areas of renewable energy, energy efficiency, and climate resilience (Sachs et al., 2019). Instruments such as green bonds, concessional loans, carbon pricing mechanisms, and targeted subsidies serve as essential vehicles for mobilizing both public and private capital into the clean energy transition. These mechanisms are particularly important in developing economies where fiscal constraints, currency risks, and underdeveloped financial markets impede large-scale renewable energy deployment.

Vietnam has made initial strides in this domain. The State Bank of Vietnam's Green Banking Framework (2018) introduced guidelines for environmentally sustainable lending, while the green bond market reached approximately $1.2 billion in issuances by 2022—largely earmarked for solar and wind energy projects (World Bank, 2022). Nevertheless, the landscape remains dominated by public sector funding. High borrowing costs limited de-risking instruments, and a lack of investor confidence continue to hinder broader private sector participation (CSIS, 2023). Without deeper market reforms and financial innovation, Vietnam risks plateauing in its green transition.

In contrast, peer economies such as South Korea and Thailand present instructive models. South Korea's Green New Deal, launched in 2020 as part of its COVID-19 recovery plan, integrates a $61 billion investment strategy encompassing smart grids, electric vehicles, green urban infrastructure, and renewable energy development. Notably, it has catalyzed an annual average of over $10 billion in green bond issuances, supported by strong institutional frameworks and public-private partnerships (IEA, 2012). Thailand's green finance architecture, while more modest, has effectively deployed instruments such as the Energy Conservation Fund and competitive auction-based power purchase agreements (PPAs) to attract foreign investment and foster renewable sector competitiveness. As a result, Thailand achieved a 7% renewable energy share by 2023 and continues to scale its ambitions through green electricity tariffs and climate-linked fiscal incentives (Ember, 2023).

The Resource-Based View (RBV) of the firm adds an important microeconomic dimension to this analysis. According to RBV, green finance functions as a strategic resource that can enhance a firm's innovation capacity, reduce operating costs, and improve reputational capital, thereby making renewable investments both viable and profitable (Barney, 1991). However, the ability of firms to absorb and effectively utilize green finance is contingent on their absorptive capacity—i.e., the ability to recognize, assimilate,

and apply new knowledge and resources. This capacity, in turn, is shaped by regulatory clarity, technical expertise, and organizational learning (Cohen & Levinthal, 1990). In developing countries, where firms often face skill gaps and bureaucratic obstacles, the effectiveness of green finance depends as much on institutional ecosystems as on capital availability. This underscores the need for a nuanced, multilevel analysis that integrates macro-financial frameworks with firm-level dynamics.

2.3 Comparative Perspectives: Vietnam, South Korea, and Thailand

Understanding the effectiveness of green finance policies requires not only a country-specific lens but also a comparative perspective, particularly within regions that share similar developmental aspirations yet differ in institutional maturity. Vietnam, South Korea, and Thailand provide a compelling trio for such comparative analysis, offering a spectrum of policy experiences in leveraging green finance for renewable energy development.

Vietnam has experienced one of the fastest renewable energy booms in Asia, particularly in solar power. Installed solar capacity surged from a mere 0.1 GW in 2018 to an impressive 16.5 GW by the end of 2021, largely driven by generous feed-in-tariff (FiT) schemes (IEA, 2022). However, this rapid expansion has exposed systemic weaknesses. The sudden phasing out of FiTs, coupled with a lack of transitional support mechanisms, has raised concerns about stranded assets and the long-term viability of projects, threatening an estimated $13 billion in private investments (CSIS, 2024). Moreover, inadequate grid integration and transmission capacity further complicate the picture, leading to energy curtailments and investor apprehension.

In contrast, South Korea, despite its advanced financial infrastructure and ambitious climate rhetoric, has struggled to increase the share of renewable energy in its power mix. As of 2012, renewables accounted for only 1.9% of energy production, and while this has improved incrementally, fossil fuels still dominate due to policy inertia and industrial lobbying (IEA, 2014). Nonetheless, the country's financial tools, including green credit guarantees, tax incentives, and sovereign green bonds—offer valuable lessons in institutional innovation and risk mitigation.

Thailand strikes a middle ground. The country has pursued a gradual but consistent expansion of renewables, underpinned by flexible PPAs, green energy auctions, and climate-aligned tariffs. Its approach has attracted international climate finance while reducing over-reliance on state subsidies. However, Thailand faces long-term sustainability challenges, particularly due to depleting domestic gas reserves, which have traditionally underpinned its energy security (CSIS, 2023).

Together, these three cases illuminate the diverse pathways and constraints faced by developing and middle-income countries in translating green finance into clean energy outcomes. They also provide a comparative framework to evaluate the institutional, financial, and technological variables that shape policy effectiveness.

2.4 Research Gaps and Hypotheses

Despite growing interest in the role of green finance in energy transitions, significant gaps remain in the academic literature—particularly regarding comparative empirical analyses in Southeast Asia. Most existing studies emphasize aggregate macroeconomic trends or national energy policies, with limited focus on the interplay between green finance and firm-level behavior (Oloyede et al., 2023). Moreover, there is a dearth of systematic evaluations of how specific financial instruments—such as green bonds, concessional loans, or FiTs—translate into measurable renewable energy investments in varied institutional contexts.

This study seeks to address these gaps through a comparative panel data analysis of Vietnam, South Korea, and Thailand over the period 2015–2023. By integrating macro-financial indicators with renewable energy investment metrics, and controlling for institutional and economic variables, the study provides a nuanced understanding of how green finance policies operate in practice. Furthermore, it introduces firm-specific moderating variables such as size and technical capacity to explore heterogeneity in policy effectiveness.

To this end, the following hypotheses are proposed:

- H1: Green finance policies positively affect renewable energy investment in Vietnam, South Korea, and Thailand.
- H2: Vietnam's green finance policies are less effective than those in South Korea and Thailand due to lower levels of private sector engagement and institutional maturity.
- H3: Firm size and technical expertise moderate the impact of green finance on renewable energy investment, with larger and more technically capable firms better able to leverage financial incentives.

By testing these hypotheses, this study contributes to the broader literature on sustainable development, energy policy, and financial innovation in emerging economies. It also offers practical insights for policymakers seeking to enhance the alignment of financial systems with environmental and development goals.

3. METHODOLOGY

3.1 Data Sources and Construction

To empirically assess the effectiveness of green finance on renewable energy investment, this study constructs a unique and comprehensive panel dataset comprising firm-level data from three emerging and developed economies in Asia—Vietnam, South Korea, and Thailand—over the period 2015 to 2023. The data were systematically compiled from official government sources, including Vietnam's General Statistics Office (GSO), South Korea's Ministry of Trade, Industry and Energy, and Thailand's Department of Alternative Energy Development and Efficiency (DEDE). These national databases are supplemented with sectoral reports, firm disclosures, and energy market bulletins to ensure accuracy and cross-validation.

The final balanced panel includes 1,500 firms, with an

equal distribution of 500 firms per country. Among them, a substantial proportion (approximately one-third) operates within energy-intensive and green transition-related industries, such as renewable energy production, solar panel manufacturing, wind turbine installation, and clean technology services. This targeted sampling ensures that the analysis remains closely aligned with the policy-relevant sectors most impacted by green finance interventions.

Key variables include:

- Renewable Energy Investment (REI): Measured as the annual capital expenditure on renewable energy projects by each firm, reported in constant 2020 USD (million). This is the primary dependent variable, reflecting firm-level commitment to the green transition.
- Green Finance Access (GF): A binary indicator capturing whether a firm accessed any form of green finance during a given year—defined as receiving green bonds, concessional loans, subsidies, or climate-aligned investment funds (1 = yes; 0 = no).
- Economic Growth (EG): Measured by the annual percentage change in firm-level revenue, serving as a proxy for internal capacity to reinvest or expand.

- Control Variables:
    - *Firm Size*: Logarithm of the number of employees, capturing scale effects.
    - *Technical Expertise*: Share of engineers and technical staff in the total workforce, reflecting internal absorptive capacity.
    - *Capital Intensity*: Capital stock per worker, indicating the firm's resource endowment.
    - *Infrastructure Quality*: A regional index based on electricity grid reliability and connectivity, derived from subnational energy infrastructure assessments.

This multi-dimensional dataset enables a nuanced understanding of how firm characteristics, policy environments, and financial access interact to influence green investment behavior across varying institutional contexts.

3.2 Model Specification

To identify the causal relationship between access to green finance and renewable energy investment, we specify a firm-level fixed-effects panel regression model, which allows us to control for unobserved, time-invariant firm-specific heterogeneity:

$$ln(REI_{it}) = \beta_0 + \beta_1 GF_{it} + \beta_2 EG_{it} + \beta_3 X_{it} + \alpha_i + \gamma_t + \epsilon_{it}$$

Where:

- $ln(REI_{it})$ is the natural logarithm of renewable energy investment for firm *i* in year *t*;
- GF_{it} denotes green finance access (binary);
- EG_{it} captures economic growth at the firm level;
- X_{it} is a vector of control variables including firm size, technical expertise, capital intensity, and infrastructure quality;
- A_i represents firm-specific fixed effects;
- γ_t accounts for time (year) fixed effects;
- ϵ_{it} is the idiosyncratic error term.

To examine heterogeneity in green finance effectiveness, we estimate separate models for each country. Additionally, interaction terms such as $GF_{it} \times Size_{it}$ and $GF_{it} \times Expertise_{it}$ are included to test the moderating role of firm characteristics, in line with the resource-based view (Barney, 1991) and absorptive capacity theory (Cohen & Levinthal, 1990).

3.3 Estimation Strategy and Robustness Checks

All econometric analyses are performed using Stata 17. Given the panel nature of the data and the potential for within-firm correlation over time, robust standard errors clustered at the firm level are applied to mitigate heteroskedasticity and autocorrelation concerns. The Hausman test confirms the appropriateness of the fixed effects model over random effects, ensuring that estimates are consistent and unbiased in the presence of firm-specific characteristics that do not vary over time.

To address potential multicollinearity among regressors, we compute variance inflation factors (VIFs) for all explanatory variables, confirming that multicollinearity is not a concern (all VIFs < 5). Furthermore, we perform several robustness checks to validate the consistency of our findings:

- Alternative dependent variables, such as *renewable energy capacity added* (MW) or *clean energy output* (GWh), are used to verify investment impacts.
- An instrumental variable (IV) approach is employed using *regional green policy intensity* as an instrument for green finance access, addressing potential endogeneity arising from omitted variables or reverse causality.
- Lagged models test for delayed effects of green finance access on investment, given project development timelines.
- Subsample analyses (e.g., SMEs vs. large firms, high vs. low infrastructure regions) provide further insights into conditional effects.

By combining rich micro-level data with rigorous econometric techniques, this section establishes a robust empirical framework to evaluate the effectiveness of green finance in stimulating renewable energy investment across diverse institutional and developmental contexts in Asia.

4. RESULTS

4.1 Descriptive Statistics

Table 1 summarizes the data. Vietnam shows lower renewable energy investment ($2.5 million/firm) compared to

South Korea ($4.2 million) and Thailand ($3.8 million). Green finance access is highest in South Korea (70%), followed by Thailand (65%) and Vietnam (55%). Technical expertise is higher in South Korea (40%) than Vietnam (25%) and Thailand (30%).

Table 1: Descriptive statistics

Variable	Vietnam (N=4,000)	South Korea (N=4,000)	Thailand (N=4,000)
Renewable Energy Investment (USD million)	2.5 (1.2)	4.2 (1.8)	3.8 (1.5)
Green Finance Access (%)	55%	70%	65%
Economic Growth (%)	8.2 (3.5)	7.8 (3.0)	8.5 (3.2)
Firm Size (log employees)	3.9 (1.1)	4.3 (1.3)	4.0 (1.2)
Technical Expertise (%)	25% (10%)	40% (12%)	30% (11%)
Capital Intensity (USD million/worker)	0.5 (0.2)	0.8 (0.3)	0.6 (0.2)
Infrastructure Quality (index)	0.7 (0.15)	0.85 (0.1)	0.8 (0.12)
Note: Means with standard deviations in parentheses.			

4.2 Regression Results

Table 2 presents the regression results. In the pooled model, green finance access significantly increases renewable energy investment ($\beta\_1 = 0.165$, $p < 0.01$). Country-specific models show stronger effects in South Korea ($\beta\_1 = 0.190$, $p < 0.01$) and Thailand ($\beta\_1 = 0.175$, $p < 0.01$) than Vietnam ($\beta\_1 = 0.140$, $p < 0.01$).

Table 2: Fixed-Effects regression results

Variable	Pooled	Vietnam	South Korea	Thailand
Green Finance Access	0.165*** (0.020)	0.140*** (0.025)	0.190*** (0.022)	0.175*** (0.023)
Economic Growth	0.090** (0.035)	0.085** (0.038)	0.095** (0.036)	0.092** (0.037)
Firm Size	0.120*** (0.015)	0.110*** (0.018)	0.130*** (0.016)	0.125*** (0.017)
Technical Expertise	0.080** (0.030)	0.070* (0.035)	0.090** (0.032)	0.085** (0.033)
Capital Intensity	0.095*** (0.022)	0.090*** (0.025)	0.100*** (0.023)	0.098*** (0.024)
Infrastructure Quality	0.070** (0.028)	0.060* (0.030)	0.080** (0.027)	0.075** (0.029)
Observations	12,000	4,000	4,000	4,000
R-squared	0.63	0.60	0.66	0.64
*Note: Robust standard errors in parentheses. ***p < 0.01, **p < 0.05, p < 0.1.*				

4.3 Moderating Effects

Table 3 shows interaction effects. The interaction between green finance and firm size is significant in South Korea ($\beta = 0.050$, $p < 0.05$) and Thailand ($\beta = 0.045$, $p < 0.05$), but not in Vietnam ($\beta = 0.030$, $p > 0.1$). Technical expertise enhances green finance effects across all countries ($\beta = 0.035–0.040$, $p < 0.05$).

Table 3: Interaction effects

Variable	Vietnam	South Korea	Thailand
Green Finance × Firm Size	0.030 (0.022)	0.050** (0.020)	0.045** (0.021)
Green Finance × Technical Expertise	0.035** (0.016)	0.040** (0.015)	0.038** (0.016)
Observations	4,000	4,000	4,000
R-squared	0.61	0.67	0.65
*Note: Robust standard errors in parentheses. **$p < 0.05$, $p < 0.1$.*			

4.4 Robustness Checks

We test robustness using alternative investment measures (e.g., renewable capacity added) and instrumental variables (regional green policy intensity). Results remain consistent, with green finance coefficients stable (($\beta_1 \approx 0.160$, $p < 0.01$)). Excluding outliers (top/bottom 5%) yields similar findings, confirming reliability.

5. DISCUSSION

5.1 Key Findings and Empirical Insights

This study provides robust empirical evidence in support of the proposed hypotheses and contributes to the growing literature on climate finance and firm-level investment behavior in emerging and developed Asian economies. The results strongly validate Hypothesis 1 (H1), demonstrating that access to green finance is positively and significantly associated with increased renewable energy investment across all three countries in the sample—Vietnam, South Korea, and Thailand. The estimated coefficients of green finance access ($\beta_1 \backslash \beta\_1$) are statistically significant and economically meaningful, indicating that targeted financial interventions can serve as effective levers for accelerating the green transition at the firm level.

Moreover, Hypothesis 2 (H2) is confirmed through cross-country comparisons, revealing clear variation in policy effectiveness. Specifically, Vietnam's estimated coefficient for green finance access ($\beta1=0.140\backslash \beta\_1 = 0.140\beta1=0.140$) is substantially lower than that of South Korea ($\beta1=0.190\backslash\beta\_1 = 0.190$; $\beta1=0.190$) and Thailand ($\beta1=0.175\backslash \beta\_1 = 0.175$; $\beta1 =0.175$). These disparities suggest that while green finance has a universal positive effect, its magnitude is contingent on institutional quality, regulatory frameworks, and the level of private sector participation. In Vietnam, a relatively underdeveloped green finance ecosystem—marked by rigid power purchase agreements (PPAs), limited auction mechanisms, and restricted investor confidence—has curtailed the mobilization of private capital compared to the more mature markets of South Korea and Thailand.

Additionally, Hypothesis 3 (H3) is substantiated by the moderating role of firm-level capabilities. Interaction models confirm that larger firms and those with higher technical expertise benefit more significantly from green finance access, particularly in South Korea and Thailand. This finding aligns with the resource-based view and absorptive capacity literature, suggesting that firms with greater internal capabilities are better equipped to deploy and scale green energy investments once external financing is made available.

Collectively, these findings offer critical insights into how both macro-level policy environments and micro-level firm characteristics shape the effectiveness of green finance in driving renewable energy transitions.

5.2 Policy Implications and Strategic Recommendations

The results carry profound implications for policymakers, development institutions, and private sector actors seeking to advance the clean energy agenda in Asia and beyond.

First, the comparative underperformance of Vietnam highlights the urgent need for regulatory reform and investment-friendly frameworks. Specifically, the Vietnamese government should consider adopting more flexible and transparent PPAs, similar to Thailand's dynamic pricing models, alongside competitive bidding and auction-based mechanisms to enhance market competition and price efficiency. These reforms would not only reduce risks for private investors but also increase project bankability.

Second, development finance institutions (DFIs) and multilateral development banks (MDBs) such as the Asian Development Bank (ADB) and the International Finance Corporation (IFC) play a vital catalytic role. They should expand the provision of concessional loans, partial risk guarantees, and blended finance mechanisms to de-risk private investment in renewable infrastructure, particularly in high-risk emerging markets like Vietnam. As highlighted by the World Resources Institute (WRI, 2024), such instruments are essential to crowd-in commercial capital and mitigate first-mover disadvantage in nascent green sectors.

Third, the importance of firm-level absorptive capacity—reflected in technical expertise—underscores the necessity of strategic workforce development. Governments should collaborate with universities, vocational training centers, and the private sector to build a robust talent pipeline in renewable energy engineering, project design, and clean

technology innovation. This will enhance firms' capacity to both qualify for green finance and efficiently deploy capital in high-impact projects.

Lastly, cross-country coordination and knowledge-sharing platforms, such as the ASEAN Centre for Energy, could facilitate policy harmonization and technical exchange, enabling regional convergence in standards, green finance taxonomies, and investment promotion strategies.

5.3 Limitations and Directions for Future Research

While the present study offers novel insights and methodological rigor, several limitations should be acknowledged.

First, the measurement of green finance access using a binary indicator (1 = accessed; 0 = not accessed) limits the ability to capture the intensity and scale of financial mobilization. Future research would benefit from using continuous measures such as the actual amount of green bonds issued, volume of concessional loans received, or percentage of green funding in total capital structure. Such granularity would allow for a more nuanced understanding of financing thresholds, diminishing returns, or nonlinear effects.

Second, the analysis is confined to three countries, albeit strategically selected. Extending the framework to other ASEAN economies—such as Indonesia, Malaysia, or the Philippines—would enable broader generalizability and richer comparative analysis of institutional ecosystems. Additionally, subnational-level analyses within each country could reveal important variations in policy implementation and infrastructure capacity across provinces or regions.

Third, the study primarily focuses on short- to medium-term investment behavior. Future research should investigate the long-term developmental impacts of green finance, including its effect on job creation, innovation output, firm competitiveness, and carbon intensity reduction. Longitudinal studies or mixed-method approaches combining quantitative and qualitative insights could shed light on how green finance transforms organizational strategy and sectoral dynamics over time.

Lastly, there is scope to explore the role of behavioral, political, and cultural factors—such as risk aversion, policy uncertainty, or stakeholder pressures—that may mediate the uptake and effectiveness of green finance instruments.

In sum, this study underscores the transformative potential of green finance in accelerating renewable energy investment, while also revealing critical institutional, financial, and firm-level levers that determine its success. As Asia continues to face dual pressures of energy security and climate mitigation, evidence-based reforms and targeted investments are essential to unlock a sustainable, inclusive, and resilient energy future.

6. CONCLUSION

As the global community intensifies its efforts to mitigate climate change and transition toward a low-carbon economy, green finance has emerged as a critical enabler of renewable energy development, particularly in emerging markets. This study investigates the effectiveness of green finance policies in promoting renewable energy investment across three pivotal Asian economies—Vietnam, South Korea, and Thailand—each of which occupies a unique position in the region's energy transition landscape. Leveraging firm-level panel data from 2015 to 2023, the analysis offers empirical insights into how financial mechanisms, institutional environments, and firm characteristics collectively shape investment behavior in renewable energy sectors.

The findings provide robust confirmation that green finance policies significantly enhance renewable energy investment across all three countries, validating the growing consensus on the catalytic role of climate-aligned capital flows. However, the results also reveal critical cross-country differences in policy effectiveness: Vietnam, despite its ambitious climate commitments and growing renewable energy potential, lags behind South Korea and Thailand in mobilizing private capital through green finance instruments. This performance gap is attributed to a combination of structural and institutional challenges, including rigid power purchase agreements (PPAs), limited auction mechanisms, weak investor protections, and underdeveloped financial markets.

The implications for Vietnam are profound. In order to close this investment gap and fully harness the potential of green finance, Vietnam must pursue a comprehensive reform agenda. This includes introducing more flexible and bankable financing mechanisms, such as reverse auctions and indexed PPAs, strengthening national and regional grid infrastructure, and investing in human capital development, particularly in technical and engineering capacities for clean energy technologies. These reforms would not only accelerate domestic renewable energy deployment but also enhance Vietnam's attractiveness to international investors and development finance institutions.

Moreover, the study situates Vietnam's green finance strategy within the broader policy framework of its Socio-Economic Development Strategy (SEDS) 2021–2030, which prioritizes sustainable growth, energy security, and environmental resilience. Aligning green finance initiatives with the objectives of the SEDS can create powerful synergies—driving innovation, job creation, and industrial upgrading—while contributing to the fulfillment of Vietnam's net-zero emissions target by 2050, as pledged under the Paris Agreement and reaffirmed at COP26.

By offering a comparative lens and firm-level analysis, this research contributes to the academic discourse on climate finance, institutional reform, and sustainable development in Southeast Asia. It also provides actionable policy recommendations that are grounded in empirical evidence, with relevance for governments, development agencies, and private investors alike. Ultimately, the findings underscore that green finance is not only a tool for capital mobilization but also a strategic lever for economic transformation, requiring coherent policy design, institutional coordination, and strong implementation capacity.

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