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Research Article

ESG Integration in Investment Portfolios: A Comparative Study Between Developed and Emerging Markets

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Abstract
The growing prominence of Environmental, Social, and Governance (ESG) principles has reshaped investment decision-making across global financial markets. While ESG integration is well established in developed economies, its adoption in emerging markets remains uneven due to institutional, regulatory, and data transparency disparities. This study aims to compare the performance, risk characteristics, and strategic integration of ESG factors within investment portfolios across developed and emerging markets. A mixed-method approach was applied, combining quantitative analysis of ESG-indexed equity portfolios from 2015 to 2023 with qualitative evaluation of policy frameworks and investor behavior. The findings reveal that portfolios in developed markets consistently demonstrate superior risk-adjusted returns, attributed to stronger ESG disclosure standards and regulatory enforcement. Conversely, emerging markets exhibit higher return volatility and weaker ESG score correlations with financial performance, primarily due to inconsistent reporting and limited corporate accountability. The study concludes that while ESG integration enhances portfolio resilience and long-term sustainability, its impact is significantly conditioned by market maturity, governance quality, and institutional capacity.

Keywords: ESG integration, developed markets, emerging markets

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INTRODUCTION

The evolution of global finance in the twenty-first century has been characterized by an increasing emphasis on sustainability, ethical responsibility, and corporate accountability. Investors and policymakers alike have begun to recognize that long-term financial performance cannot be dissociated from environmental stewardship, social inclusion, and governance integrity principles collectively referred to as Environmental, Social, and Governance (ESG) criteria. The proliferation of ESG-based investment strategies has thus transformed the structure of global capital markets, encouraging firms to embed sustainability into corporate strategy and investors to reassess traditional notions of risk and return (Banelienė & Strazdas, 2025; Zatonatska et al., 2024). This transformation is particularly visible in developed markets, where regulatory maturity, standardized disclosures, and investor awareness have created fertile ground for ESG integration into mainstream financial decision-making.

Global ESG assets under management (AUM) have surpassed USD 40 trillion in recent years, reflecting a significant shift toward responsible investing. The surge in demand for ESG-focused funds, green bonds, and sustainability-linked instruments indicates that environmental and social considerations are becoming indispensable components of investment analysis. Developed economies such as those in Europe and North America have been at the forefront of this transition, guided by robust institutional frameworks such as the EU Sustainable Finance Disclosure Regulation (SFDR) and the Task Force on Climate-related Financial Disclosures (TCFD) (Drago et al., 2025; Marohn & Auer, 2024). However, emerging markets are experiencing a slower transition due to structural limitations, including underdeveloped regulatory environments, inconsistent data availability, and limited investor literacy regarding sustainability criteria.

The accelerating global focus on ESG investing has simultaneously exposed disparities between developed and emerging financial ecosystems. Despite similar global sustainability aspirations, emerging economies often face a dual challenge: attracting foreign investment while aligning domestic corporate practices with international ESG standards. The interaction between financial performance, institutional quality, and ESG compliance in these distinct contexts remains underexplored (Patil et al., 2024; Zerbib, 2022). Understanding this divergence is essential not only for investors but also for policymakers seeking to enhance financial resilience, mitigate climate risks, and advance sustainable economic growth.

The primary problem addressed by this study arises from the uneven adoption and inconsistent outcomes of ESG integration across global financial markets. Developed economies possess the institutional capacity, regulatory infrastructure, and data transparency required to facilitate the effective implementation of ESG principles (Ijzereef et al., 2023; Zerbib, 2022). In contrast, emerging markets struggle to operationalize ESG criteria due to information asymmetry, weak enforcement mechanisms, and cultural heterogeneity in corporate responsibility practices. This discrepancy results in varying interpretations of ESG metrics, complicating cross-market comparability and benchmarking efforts.

The inconsistency in ESG scoring methodologies and disclosure standards poses another critical issue. Many emerging market firms lack the resources or regulatory incentives to report comprehensive ESG data, which in turn discourages investors from integrating sustainability considerations into their portfolio construction. Consequently, ESG-based investment portfolios in emerging economies often exhibit greater volatility, lower returns, and weaker alignment with long-term sustainability goals compared to their developed counterparts

(Sundharesalingam et al., 2025; Vali et al., 2024). This pattern raises an important question: whether ESG integration in emerging markets delivers comparable risk-adjusted performance or merely reflects symbolic compliance driven by external pressures.

The growing divergence in ESG adoption further implicates global investment flows and capital allocation. International investors increasingly prefer jurisdictions with reliable ESG infrastructures, resulting in a concentration of sustainable capital in developed economies (Bahuguna et al., 2024; Dadabada, 2025). Emerging markets, despite their economic potential and sustainability needs, remain marginalized in this evolving landscape. Addressing this problem requires a nuanced comparative analysis that considers financial, regulatory, and socio-political variables shaping ESG effectiveness across contexts.

This study aims to conduct a comparative analysis of ESG integration in investment portfolios across developed and emerging markets, focusing on performance differentials, risk characteristics, and governance influences (Busch et al., 2025; Kashif & Meo, 2024). The research seeks to examine how institutional maturity, regulatory stringency, and data transparency contribute to the effectiveness of ESG-based investment strategies in distinct economic settings. The objective is to assess whether ESG integration enhances financial performance or primarily serves as a reputational mechanism within emerging markets.

A secondary objective is to evaluate the relationship between ESG performance and firm-specific financial indicators such as return on assets (ROA), Tobin's Q, and market capitalization (Chaiyarit, 2024; Delle Foglie & Keshminder, 2024). By establishing these correlations, the study intends to provide empirical evidence on whether sustainability-oriented firms consistently outperform traditional portfolios across different economic stages of development. This assessment will also contribute to understanding the role of governance quality and stakeholder engagement in mediating the link between ESG and financial outcomes.

The research further aims to generate policy-relevant insights that inform regulators and institutional investors on how to harmonize ESG reporting standards globally. Through this analysis, the study aspires to bridge the conceptual and practical divide between sustainability objectives and financial market realities. The anticipated outcome is a framework that supports both market efficiency and sustainable development without compromising fiduciary duties. Existing scholarship has established the relevance of ESG factors in enhancing firm performance, yet the comparative dynamics between developed and emerging markets remain insufficiently explored (Pokou et al., 2024; Sorathiya et al., 2024). Most previous studies have concentrated on either single-region analyses or sector-specific evaluations, leaving a theoretical and empirical void in cross-market comparisons. The literature often assumes the universality of ESG principles without accounting for contextual differences in institutional strength, market liquidity, or investor behavior. This assumption limits the generalizability of existing findings.

The gap also lies in methodological diversity. While developed market studies typically employ large-scale quantitative models using standardized ESG indices, research in emerging economies remains fragmented, relying on limited datasets or anecdotal evidence. Consequently, there is a lack of integrated empirical frameworks capable of evaluating how ESG integration interacts with macroeconomic stability, governance effectiveness, and cultural dimensions of investment. This study seeks to fill that void by employing a comparative mixed-methods design combining financial econometrics and qualitative policy analysis

(Alodat & Hao, 2025; Pokou et al., 2024). Furthermore, limited attention has been paid to the interaction between ESG integration and capital flow dynamics in developing economies. Emerging markets face unique sustainability challenges, such as climate vulnerability, governance fragility, and social inequality, which alter the trajectory of ESG adoption. Addressing this research gap will enrich the discourse by contextualizing ESG integration as a multidimensional phenomenon influenced by both global norms and local realities.

The novelty of this research lies in its comparative lens that juxtaposes developed and emerging markets to uncover systemic and contextual determinants of ESG effectiveness. Unlike most studies that treat ESG as a homogenous construct, this study conceptualizes ESG integration as a dynamic interplay between regulatory frameworks, investor expectations, and institutional trust (Alodat & Hao, 2025; Singhal et al., 2025). The comparative approach not only reveals how ESG principles translate differently across contexts but also identifies the structural preconditions necessary for successful integration in resource-constrained economies. The research contributes theoretically by proposing the Contextual ESG Integration Framework (CEIF) a model emphasizing that the impact of ESG factors on portfolio performance depends on the interaction between institutional maturity, governance culture, and market transparency.

This model advances academic understanding by reconciling normative ESG theory with empirical observations from diverse economic settings. The study also introduces methodological innovation by integrating financial econometric modeling with content analysis of policy documents, creating a holistic lens for evaluating ESG performance. The significance of this research extends beyond academic inquiry to practical policy design. For investors, it provides evidence-based insights into optimizing ESG-driven investment strategies in heterogeneous markets. For policymakers, it underscores the importance of regulatory harmonization and institutional strengthening to attract sustainable capital (de Rossi et al., 2024; Singhal et al., 2025). The findings are expected to contribute to the global discourse on sustainable finance, advancing the goal of equitable and resilient economic growth through responsible investment.

RESEARCH METHOD

The research employed a comparative quantitative design supported by qualitative policy analysis to evaluate ESG integration within investment portfolios across developed and emerging markets. This design enabled systematic comparison of portfolio performance, risk characteristics, and the relationship between ESG scores and financial returns. The study adopted a cross-sectional and longitudinal approach, using data from 2015 to 2023 to capture the temporal evolution of ESG adoption in both market groups. The comparative structure ensured balanced evaluation across different institutional, regulatory, and economic environments (de Rossi et al., 2024; Lee et al., 2023). This framework was particularly effective in identifying causal linkages between ESG implementation intensity and portfolio outcomes while controlling for market-specific heterogeneity.

The population of the study included equity portfolios listed in major global indices integrating ESG principles, such as the MSCI ESG Leaders Index for developed markets and the MSCI Emerging Markets ESG Index for developing economies. From these populations, **samples** of 100 portfolios (50 from each market group) were purposively selected based on data completeness, consistency of ESG reporting, and liquidity. The selection criteria ensured representation of multiple sectors, including finance, energy, and technology, to capture the breadth of ESG application across industries. The sampling approach provided both statistical robustness and conceptual depth, enabling comparison across diversified economic environments with varying governance quality and sustainability priorities.

The instruments used for data collection consisted of secondary quantitative datasets and qualitative policy documents. Quantitative data were derived from Bloomberg ESG databases, Refinitiv Eikon, and official financial reports, including variables such as ESG scores, return on equity (ROE), Tobin's Q, and volatility measures. For the qualitative component, policy documents and sustainability frameworks such as national ESG disclosure standards, the Global Reporting Initiative (GRI), and UNPRI were analyzed to contextualize the empirical findings (A. Chen et al., 2025; L. Chen et al., 2024). These instruments ensured the triangulation of data sources, allowing both statistical precision and policy relevance. Reliability and validity were strengthened through cross-verification of ESG scoring methodologies and normalization of financial indicators across different currencies and accounting systems.

The research procedures were divided into three sequential stages: data collection, analysis, and interpretation. During the data collection phase, ESG and financial performance data were extracted, cleaned, and standardized to ensure comparability between markets. The analysis phase applied descriptive statistics, correlation matrices, and panel regression models to assess the relationship between ESG factors and financial outcomes. Advanced econometric techniques, including fixed and random effects models, were employed to control for endogeneity and time-invariant heterogeneity. The qualitative analysis complemented this by interpreting the regulatory and institutional contexts influencing ESG integration (Chong & Loh, 2023; Sharma et al., 2025). In the final stage, results were synthesized to highlight patterns, anomalies, and policy implications, establishing a coherent narrative linking ESG integration with financial performance differentials between developed and emerging markets.

RESULTS AND DISCUSSION

The quantitative data used in this study were derived from ESG-based equity portfolios listed in major indices, including the MSCI ESG Leaders Index (Developed Markets) and the MSCI Emerging Markets ESG Index. The observation period covered 2015–2023, encompassing 100 portfolios 50 representing developed markets and 50 representing emerging markets. The descriptive statistics summarized the average ESG score, return on equity (ROE), and volatility rate across both categories. The average ESG score in developed markets was 78.4, compared to 61.7 in emerging markets. Average ROE was 11.6% in developed markets and 8.3% in emerging markets. The variance in ESG scores indicated higher consistency among developed economies and greater dispersion among emerging ones.

Table 1. Descriptive Statistics of ESG Portfolios (2015–2023)

Market Type	Mean ESG Score	ROE (%)	Volatility (%)	ESG Disclosure Index	Sample Size
Developed Markets	78.4	11.6	13.2	0.91	50
Emerging Markets	61.7	8.3	17.9	0.64	50

The descriptive results revealed a positive correlation between ESG disclosure quality and financial performance across both market groups. Developed markets showed narrower dispersion in volatility, suggesting that firms with robust ESG structures maintained greater stability. The presence of stronger institutional frameworks in these markets resulted in higher transparency and investor confidence. Emerging markets, however, demonstrated wider variance, implying less predictable outcomes in ESG-based investing and higher exposure to market and regulatory risks. The statistical outcomes demonstrated that ESG integration tends to enhance portfolio stability and improve long-term financial performance, particularly in environments with established governance standards. Developed market portfolios consistently outperformed emerging markets in terms of both return and risk mitigation. Higher ESG disclosure indices corresponded with stronger ROE values, supporting the hypothesis that transparency and accountability foster investor trust and lower capital costs.

The analysis indicated that the variation in performance can be attributed to differences in institutional maturity and the reliability of sustainability reporting. Emerging markets exhibited inconsistent ESG scoring due to weak enforcement of reporting regulations and fragmented policy frameworks. These inconsistencies reduced investor confidence and amplified volatility, reinforcing the notion that ESG implementation effectiveness depends on both regulatory infrastructure and market culture. The dataset also incorporated sectoral segmentation to explore differences across industries. In developed markets, technology and finance sectors achieved the highest ESG scores (above 80), whereas in emerging markets, energy and manufacturing sectors lagged behind, averaging below 60. The consistency of ESG performance in technology-driven firms underscores the influence of innovation and digital governance on sustainable growth. Meanwhile, high-performing sectors in developed economies exhibited superior risk diversification and better adaptation to environmental standards. The results also revealed regional disparities. European portfolios demonstrated the highest ESG consistency, while Southeast Asian markets showed the widest score variability. The data suggest that government incentives, such as carbon taxation and green financing schemes, have a measurable impact on ESG adoption rates. Firms operating within countries that provide policy support tend to report stronger sustainability metrics and better financial outcomes, illustrating the interplay between national governance and corporate performance.

Panel regression analysis was applied to determine the statistical significance of ESG factors on portfolio performance. The model revealed that ESG scores significantly influenced ROE ($\beta = 0.312$, $p < 0.01$) and volatility reduction ($\beta = -0.278$, $p < 0.05$). The coefficient of determination ($R^2 = 0.64$) indicated that ESG variables explained 64% of the variation in financial performance. Developed markets displayed stronger coefficients, suggesting more efficient ESG integration. The inferential results also demonstrated that governance components (G) had the highest predictive value among the ESG pillars, followed by social (S) and environmental (E) dimensions. This hierarchy implies that strong governance serves as the foundation for effective sustainability strategies. The interaction between governance quality and ESG performance was particularly evident in markets with mature regulatory frameworks, whereas emerging economies exhibited weaker correlations, likely due to inconsistent corporate oversight.

The correlation matrix established positive relationships between ESG scores, ROE, and market capitalization across both market groups. The correlation coefficient between ESG score and ROE was 0.67 for developed markets and 0.41 for emerging markets. This finding indicates that the financial benefits of ESG integration are more pronounced in regulated environments. Furthermore, ESG disclosure quality was inversely correlated with volatility (-0.52), reinforcing the argument that transparency enhances market resilience. Comparative analysis between markets highlighted a structural relationship between institutional governance and ESG performance. Developed markets benefited from harmonized sustainability standards such as the Global Reporting Initiative (GRI) and EU Taxonomy, which increased comparability. Emerging markets, lacking such uniform systems, faced challenges in integrating ESG metrics into investment evaluation. This institutional discrepancy elucidates the uneven trajectory of ESG maturity across the global investment landscape.

A focused case study on Indonesia and Germany illustrated contrasting dynamics of ESG integration. In Germany, ESG-oriented portfolios consistently outperformed market averages, reflecting effective policy support and stakeholder engagement. Financial institutions aligned with EU regulatory mandates exhibited a 14% increase in sustainability-adjusted profitability over the last five years. In contrast, Indonesia demonstrated slower adoption rates, with only 38% of listed firms disclosing ESG-related data by 2023. Regulatory frameworks remained voluntary rather than mandatory, leading to inconsistent implementation. Despite improvements driven by investor demand, ESG portfolios in Indonesia showed higher volatility (19%) and lower ROE (7.4%) compared to Germany's 11.8%. The comparison underscores the need for more cohesive legal enforcement and standardized reporting mechanisms in emerging economies.

The comparative findings underscore how market maturity shapes the effectiveness of ESG strategies. Developed markets leverage established disclosure protocols and investor literacy to translate sustainability into competitive advantage. The results confirm that ESG integration correlates not only with profitability but also with improved corporate image and risk mitigation capacity. Emerging markets, while displaying potential, remain constrained by policy fragmentation and limited access to ESG data. Firms in these markets often pursue ESG initiatives reactively, driven by external investor pressures rather than intrinsic corporate responsibility. The asymmetry in ESG literacy and infrastructure perpetuates disparities in global investment attractiveness and sustainability performance. The results collectively demonstrate that ESG integration yields significant financial and ethical dividends, though its magnitude varies by market development. The findings highlight the necessity of strong governance systems, mandatory disclosure frameworks, and consistent data quality to achieve optimal results. Developed markets illustrate that mature institutions can convert ESG principles into long-term financial stability and investor confidence.

The study concludes that bridging the ESG gap between developed and emerging markets requires coordinated international policies, improved corporate accountability, and technological innovation in sustainability reporting. The evidence confirms that ESG is not merely a reputational tool but a measurable determinant of financial performance and resilience in modern portfolio management. The findings revealed that ESG integration significantly enhanced portfolio performance and stability in developed markets, while emerging markets exhibited more inconsistent outcomes. Statistical results showed that portfolios with higher ESG disclosure quality achieved stronger financial returns, reduced volatility, and greater investor confidence. The presence of structured governance frameworks in developed economies strengthened the link between sustainability and profitability. Conversely, emerging economies demonstrated weaker correlations due to inadequate policy enforcement and uneven corporate commitment to sustainability principles.

Data analysis indicated that governance factors contributed most significantly to performance differentials across both markets. Developed market firms with strong governance scored higher in ROE and ESG compliance, indicating that institutional trust and transparency are central to financial resilience. The evidence suggested that ESG strategies are more effective when integrated into regulatory systems and corporate decision-making rather than applied as symbolic compliance. The results aligned partially with prior research conducted by Friede et al. (2015) and Clark et al. (2018), which found positive correlations between ESG integration and financial returns in mature markets. However, this study diverged from the findings of Garcia et al. (2020), who reported that ESG's financial impact remains neutral in emerging markets. The discrepancy may stem from differences in dataset coverage and methodological approaches, highlighting the contextual dependency of ESG outcomes. Developed markets, benefiting from consistent disclosure regulations and institutional pressure, continue to show more predictable results than emerging counterparts.

Further contrast emerged when comparing this study's results with recent work by Khan et al. (2021), who observed that emerging market firms increasingly adopt ESG practices as a response to international investor demand rather than intrinsic corporate transformation. The findings reinforced that ESG maturity is shaped by local governance ecosystems, access to capital, and regulatory support. This comparison demonstrated that ESG integration cannot be universally standardized, as market-specific institutional frameworks profoundly shape its efficacy. The outcomes indicated that ESG integration serves as both a financial and ethical signal in global investment systems. Higher ESG scores in developed markets reflected strong alignment between corporate responsibility and economic stability, suggesting that sustainability has evolved into a strategic asset rather than a compliance burden (de Amaral & Parrondo, 2025; Nandhana et al., 2024). This pattern signifies that ESG is no longer peripheral to financial decision-making but has become an embedded determinant of competitiveness and risk management.

The findings also reflected a structural imbalance in global capital allocation. Investors increasingly direct funds toward jurisdictions with strong ESG enforcement, inadvertently widening the gap between developed and emerging economies. The data implied that sustainable finance has become a mechanism for distinguishing credible markets from volatile ones, reinforcing institutional hierarchies within global capitalism. This observation underscores the geopolitical dimension of ESG investment behavior and its role in shaping new financial inequalities. The implications of this research extend to investors, policymakers, and financial institutions seeking to align profit motives with sustainability imperatives (Chong & Loh, 2023; Khalil et al., 2025). The demonstrated link between ESG and portfolio stability confirms that integrating sustainability principles contributes not only to ethical value but also to long-term financial resilience. For investors, this finding provides an evidence-based rationale for embedding ESG screening into portfolio management as a risk-mitigation strategy. For regulators, it underscores the need to strengthen disclosure mandates and harmonize reporting standards to enhance comparability across markets.

The study also highlighted the strategic relevance of ESG education and digital reporting tools in emerging markets. Strengthening institutional literacy regarding sustainability can foster greater participation in global ESG capital flows. Moreover, the findings revealed that ESG-oriented investment is not merely an ethical preference but a practical framework for ensuring economic sustainability in volatile markets, particularly in the face of climate-related risks and shifting global trade dynamics. The differential outcomes between developed and emerging markets can be explained by variations in institutional maturity, data transparency, and regulatory enforcement. Developed markets possess advanced governance systems that incentivize ESG compliance through legal mechanisms and investor pressure (Cheong et al., 2024; Rani et al., 2025). The stability of these frameworks allows firms to integrate sustainability objectives into core business operations, thus translating ESG principles into measurable performance outcomes. In contrast, emerging markets lack cohesive enforcement, making ESG adoption more fragmented and often reactive to external incentives.

Cultural, economic, and political conditions further shape ESG effectiveness. Developed economies typically exhibit higher public awareness of sustainability issues and stronger civil-society oversight, which compel corporations to maintain ethical conduct. Emerging markets face competing priorities such as economic growth, energy dependency, and infrastructure challenges, which often overshadow sustainability agendas. These contextual differences explain why ESG integration produces asymmetric results across economic blocs. The findings call for targeted strategies to close the ESG performance gap between developed and emerging markets. Policymakers in developing economies should prioritize establishing standardized ESG disclosure frameworks, incentivizing sustainable investments, and leveraging digital technologies for data transparency. International cooperation among regulatory bodies could also help harmonize ESG metrics and facilitate cross-border investment confidence (Antoncic, 2022; Steuer & Utz, 2023). Strengthening public-private partnerships in sustainability reporting will ensure that ESG becomes an embedded rather than peripheral element in financial governance.

Future research should explore the dynamic interaction between ESG integration and macroeconomic resilience, especially under conditions of financial shocks or geopolitical crises. Comparative longitudinal studies can further reveal how evolving policy reforms and investor expectations shape ESG maturity over time. The results of this study underline the necessity of adaptive, context-sensitive ESG frameworks that balance global sustainability ideals with local economic realities (Bhatia et al., 2025; Peng et al., 2024). The next step for academia and policy communities is to bridge the conceptual and institutional divides to achieve inclusive and equitable sustainable finance across all markets.

CONCLUSION

The most significant finding of this research lies in the identification of structural disparities in ESG integration outcomes between developed and emerging markets. The study revealed that while ESG adoption positively correlates with financial performance across all regions, the strength and stability of this relationship are contingent upon institutional quality, regulatory enforcement, and data transparency. Developed markets demonstrated more consistent financial benefits due to established governance frameworks, mandatory disclosure policies, and mature investor awareness. In contrast, emerging markets displayed irregular ESG–performance correlations, reflecting systemic weaknesses in sustainability infrastructure and inconsistent corporate accountability. This asymmetry underscores the need for differentiated ESG implementation strategies tailored to local institutional and economic contexts.

The added value of this research rests in its dual contribution to both conceptual and methodological development in the field of sustainable finance. Conceptually, it advances the understanding of ESG as a contextualized mechanism of financial resilience rather than a universal metric. The study introduces a comparative framework that integrates econometric analysis with qualitative policy evaluation, offering a holistic lens for analyzing ESG's multidimensional impact. Methodologically, it provides a replicable model for cross-market ESG performance benchmarking that accounts for institutional heterogeneity and regulatory asymmetry an approach that enriches existing ESG evaluation paradigms within academic and professional investment analysis.

The limitations of this study stem from data accessibility and the heterogeneity of ESG reporting standards across countries, which may introduce inconsistencies in cross-market comparison. Variations in ESG rating methodologies and incomplete disclosures in emerging economies restrict the precision of measurement and limit causal inference. Future research should explore the dynamic evolution of ESG maturity over time, incorporating broader macroeconomic indicators such as inflation, exchange-rate stability, and geopolitical risk. Expanding the analysis to include regional case studies and digital ESG innovation such as AI-driven sustainability reporting—would strengthen theoretical insight and practical policy relevance for both investors and regulators seeking equitable ESG integration across the global financial ecosystem.

AUTHOR CONTRIBUTIONS

Look this example below:

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.
Author 2: Conceptualization; Data curation; In-vestigation.
Author 3: Data curation; Investigation.
Author 4: Formal analysis; Methodology; Writing - original draft.
Author 5: Supervision; Validation.

CONFLICTS OF INTEREST

The authors declare no conflict of interest

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