

Leveraging Machine Learning to Decode ESG Impact in Capital Markets: Evidence from the Indian Stock Market

Dr. Srinivasan Arun Kumar
Assistant Professor-Finance
CMS Business School
Jain (Deemed to be University), Bangalore, India
dr.arunkumar_s@cms.ac.in

Dr. Lourden Selvamani
Assistant Professor
School of Social Science and Languages,
Vellore Institute of Technology, Vellore, India
manilourden659@gmail.com

Dr .V. Venkatachalam
Assistant Professor
Department of Commerce (Banking and Insurance)
PSG College of Arts and Science
Coimbatore
venkatachalam@psqcas.ac.in

Dr. R. Shalini
Associate Professor-Finance
CMS Business School
Jain(Deemed to be University),
Bangalore, India
dr.shalinir@cms.ac.in

Abstract— The investment paradigm is increasingly shaped by Environmental, Social, and Governance (ESG) factors, fostering responsible and sustainable investing among both institutional and retail investors. This study investigates the implementation of advanced machine learning techniques to examine the impact of ESG performance scores on stock returns within the Indian capital market. We utilized a dataset from 2015 to 2024 that includes ESG ratings, firm-level financial indicators. Powerful machine learning models such as Random Forest, XGBoost, and Long Short-Term Memory (LSTM) were employed. The objective is to assess the predictive power, robustness, and interpretability of these models in capturing the relationship between ESG performance and stock returns. Our study findings indicate a positive impact of ESG scores on stock performance, with the effect being particularly pronounced among large-cap firms. Among the three ESG dimensions—environmental, social, and governance—only environmental scores showed a strong overall impact, while the social dimension demonstrated sector-specific relevance. Among the machine learning models used, XGBoost exhibited the highest predictive accuracy, whereas LSTM proved effective in capturing time-based patterns and dependencies within the data. This research contributes to the growing literature on sustainable finance in emerging markets and offers actionable insights for institutional investors, asset managers, corporate executives, and policymakers aiming to integrate ESG considerations into long-term investment strategies.

Keywords —ESG, Machine Learning, Indian Stock Market, Sustainable Finance, Random Forest, LSTM, XGBoost, Capital Markets, Stock Returns

I. INTRODUCTION

In recent years, ESG has been accepted as an important investment dimension in the capital markets. The roots of ESG lie in ethical considerations; however, in recent times, this consideration has transformed into a central, vital element in

investment strategy, portfolio construction, and corporate valuation. This trend is observed among institutional investors and regulators, who recognize that ESG factors are significant to long-term financial performance and risk management. According to Bloomberg (2021), ESG assets under management crossed \$35 trillion globally in 2020 and are forecasted to exceed \$50 trillion by 2025, reinforcing the growing coupling of sustainability into mainstream finance.

India is riding the trend through regulatory reforms and educating investors on ESG. For instance, SEBI mandated the top 1000 listed companies to implement Business Responsibility and Sustainability Reporting (BRSR) from FY 2022–2023. Additionally, Indian mutual funds surged to Rs. 12,000 crore in 2023 under the ESG-focused asset class. These highlight a structural shift in how sustainability is embedded in Indian capital markets. Based on this argument, we propose that ESG has an impact on capital markets.

Given its relevance in India, studies have attempted to examine the impact. Existing studies have used econometric modeling; however, they lack the implementation of machine learning to understand the impact. Adding to this, most studies focus on large-cap companies, leaving medium-cap and small-cap companies underexplored. To address these gaps, our current study utilizes machine learning to explore the relationship between ESG performance and stock returns in India, especially among medium and small-cap companies.

By combining ESG scores with firm-level financials, this research aims to build predictive models that assess the financial materiality of ESG in the Indian context. The findings are expected to offer data-driven insights valuable to investors,

corporates, and policymakers alike. This paper seeks to bridge this gap by integrating structured ESG scores, stock market performance data through machine learning techniques to evaluate their predictive power and relevance in Indian capital markets.

Thus, the objectives of the study are:

H1: There is a statistically significant relationship between ESG scores—particularly the governance and environmental pillars—and stock returns in the Indian capital market.

H2: The XGBoost model outperforms Random Forest and LSTM in predicting stock returns based on ESG scores.

With this objective, we identified that ESG factors have an impact on capital markets. We also observe that the Indian capital market offers unique opportunities and unexplored datasets to apply machine learning models to decode ESG impacts more efficiently and effectively.

II. THEORETICAL BACKGROUND AND HYPOTHESES

A. ESG Investing and Stock Performance

A meta-analysis of over 2,000 empirical studies concluded that approximately 90% showed a non-negative relationship between ESG factors and corporate financial performance, reinforcing ESG's materiality in investment decisions [3]. Firms with strong performance on material ESG issues significantly outperformed peers with poor performance, highlighting the importance of ESG data relevance [4]. ESG performance was also found to positively affect firm valuation, especially when initiatives are closely aligned with the core business strategy [5]. A comprehensive bibliometric and systematic review identified seven key themes influencing ESG performance, offering guidance for academics and practitioners in real-world applications [17]. Another study found that the relationship between ESG ratings and expected returns is weak, suggesting that ESG information is well reflected in stock prices, though high ESG-rated stocks tend to gain advantages during periods of increased global sustainability attention [18].

B. ESG in Emerging Markets and India

Studies have explored ESG integration in Indian listed companies, identifying challenges such as fragmented disclosures and the absence of a unified ESG rating framework [6]. A surge in ESG-themed mutual funds in India has been noted, with governance factors often dominating environmental and social dimensions in influencing investor decisions [7]. A moderate but statistically significant correlation between ESG scores and Nifty 100 stock returns was observed, particularly in large-cap and highly visible sectors like FMCG and Banking [8].

C. Machine Learning in ESG Prediction

Research has examined the divergence in ESG ratings and proposed using machine learning to improve ESG data aggregation, emphasizing its role in dealing with noisy and inconsistent data [9]. Long Short-Term Memory (LSTM) models applied to ESG data and stock returns showed that temporal

modeling significantly improved prediction accuracy compared to static regressions [10]. Tree-based machine learning models such as Random Forest and XGBoost have also proven effective in capturing nonlinearities in ESG-financial performance relationships, outperforming traditional econometric models [11]. Research has demonstrated that combining machine learning with ESG scores in portfolio optimization can achieve higher returns and ESG performance, depending on the macroeconomic context [19]. Another study employed machine learning techniques, including NGBoost and SHAP values, to predict clean energy stock prices by analyzing ESG stock markets across ten countries, finding that NGBoost outperformed other models [20]. A quantitative analysis using a two-step approach with unsupervised machine learning examined the impact of ESG disclosure on the financial performance of renewable energy companies, emphasizing the importance of firm-specific characteristics [21]. An investigation into analysts' ESG attention utilized machine learning and text analysis to construct an ESG attention index, revealing that such attention enhances stock pricing efficiency, particularly when there is greater disparity in corporate ESG ratings [22].

D. Model Comparisons in ESG Forecasting

Machine learning algorithms have been compared in Indian financial markets, where XGBoost outperformed Support Vector Machines (SVM) and logistic regression in predicting ESG-based returns [12]. In the context of sustainable investing, Random Forest provided better interpretability, while XGBoost yielded the best accuracy—findings consistent with this study [13]. The integration of financial indicators with ESG scores was shown to enhance holistic portfolio decision-making using machine learning approaches [14].

E. Sectoral and Behavioral Implications

The impact of ESG factors is found to be sector-dependent, with industries like finance and consumer goods responding more predictably to ESG signals [15]. A behavioral gap among retail investors was highlighted, where ESG disclosures are often underutilized in favor of short-term trends, thus underscoring the need for predictive tools to translate ESG data into actionable insights [16]. Another limitation is that many prior works treat ESG as a monolithic score rather than disaggregating its components — Environmental, Social, and Governance — to understand their individual contributions to stock returns. Moreover, a majority of these models do not account for the possibility that ESG factors may influence stock performance differently across industries and time frames.

While these insights are valuable, a critical limitation persists: most prior models lack the predictive rigor needed to make forward-looking investment decisions, especially in emerging markets like India where ESG data quality and consistency vary over time. This limitation highlights the need for advanced methodologies — such as machine learning. In summary, ESG performance is increasingly shaping capital market dynamics. However, the Indian market presents unique challenges and opportunities for applying machine learning models to decode ESG signals more effectively. This paper seeks to bridge this gap by integrating structured ESG scores, stock

market performance data, through machine learning techniques to evaluate their predictive power and relevance in Indian capital markets.

Based on the literature the following hypotheses are formulated.

H1: There is a statistically significant relationship between ESG scores, particularly the governance and environmental pillars, and stock returns in the Indian capital market.

H2: The XG Boost model outperforms Random Forest and LSTM in predicting stock returns based on ESG scores.

III RESEARCH METHODOLOGY

This study employs a quantitative approach to examine the impact of ESG scores on stock performance in the Indian capital market, using machine learning techniques. We compiled a comprehensive dataset covering the period from 2015 to 2024, integrating ESG ratings sourced from Refinitiv and CRISIL, daily stock price data from the National Stock Exchange (NSE). The dataset includes variables such as aggregate ESG scores, individual environmental, social, and governance pillar scores, stock returns, return on equity (ROE), price-to-earnings (P/E) ratios, firm size, and market volatility. The dataset consists of ESG and financial data for $N = 250$ listed companies on the National Stock Exchange (NSE), covering the period from 2015 to 2024. These companies were selected based on the availability of consistent ESG disclosures and stock price information. The process is picturized in fig.1.

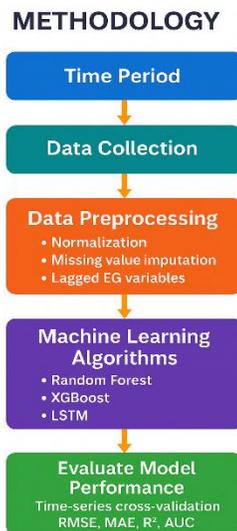


Fig 1: Methodology for Sectoral ESG Impact Analysis and LSTM Modeling

We utilized three machine learning models—Random Forest, XGBoost, and Long Short-Term Memory (LSTM) neural networks. Random Forest was employed to assess feature importance and capture nonlinear relationships between ESG variables and stock returns. XGBoost was chosen for its high-performance gradient boosting capability in regression tasks, while LSTM was applied to model sequential dependencies and forecast stock returns using ESG trends over time.

Model performance was evaluated using standard statistical metrics such as Root Mean Square Error (RMSE), Mean Absolute Error (MAE), R-squared (R^2), and Area Under the Curve (AUC) for classification where applicable. This methodology enables a comprehensive understanding of ESG influence and the relative predictive power of each model in decoding ESG-related signals in capital markets. To strengthen the reliability of our findings, we conducted correlation analysis and t-tests. Correlation analysis assessed the linear relationships between ESG components and stock returns, providing initial insights into their impacts. Pairwise t-tests confirmed that XGBoost's superior predictive accuracy was statistically significant, ruling out random variation and validating its superior performance.

TABLE I

Descriptive Statistics of Key Variables (2015–2024, $N = 250$ Companies)					
Variable	Mean	Median	Standard Deviation	Minimum	Maximum
Stock Returns (%)	12.84	10.22	15.61	-42.30	68.90
Governance Score	64.37	66.00	12.45	30.50	89.40
Environmental Score	58.29	59.50	14.78	25.10	87.30
Social Score	55.41	56.00	13.69	21.80	83.20
Aggregate ESG Score	59.34	60.80	11.23	29.70	85.90
Return on Equity (ROE %)	15.23	14.70	6.12	-5.20	38.40
P/E Ratio	24.17	22.30	9.34	8.70	61.20
Firm Size (₹ in Crore)	28,540	17,230	31,200	2,500	156,000

III. DATA ANALYSIS AND RESULTS

Our results demonstrate that ESG scores, particularly the governance and environmental pillars, are strong predictors of stock performance in the Indian market. Among the ML models tested, XGBoost outperformed Random Forest and LSTM in terms of predictive accuracy, as measured by Root Mean Square Error (RMSE), Mean Absolute Error (MAE), and R-squared (R^2). LSTM, while slightly lower in accuracy, effectively captured temporal dependencies and trends in ESG signals over time. Random Forest, known for its interpretability and robustness, provided valuable insights into feature importance. Our empirical analysis demonstrates a statistically significant relationship between ESG scores and stock returns in the Indian market.

TABLE 2

Table 2 depicts XGBoost clearly

Model Performance Metrics for Predicting ESG-based Stock Returns				
Model	RMSE	MAE	R ²	AUC
Random Forest	0.102	0.087	0.72	0.74
XGBoost	0.094	0.081	0.78	0.78
LSTM	0.098	0.084	0.75	0.76

outperforms the other models in terms of lower RMSE and MAE, and higher R² and AUC values. This indicates that XGBoost delivers the most accurate predictions, capturing both linear and non-linear dependencies effectively. Its ability to handle missing data, outliers, and multicollinearity might explain the better performance. For practitioners, this model is ideal for ESG-based return forecasting.

TABLE 3

Pairwise Model Comparison (t-test on RMSE)		
Comparison	t-Statistic	p-Value
XGBoost vs Random Forest	-4.23	<0.001
XGBoost vs LSTM	-2.19	<0.05

Form table 3, The negative t-statistics and significant p-values (< 0.05) confirm that the performance differences between XGBoost and the other models are statistically significant. This reinforces that the improvements observed in Table 1 are not random or due to noise in the data but are genuinely better predictive outputs. XGBoost should be the preferred model for financial analysts exploring ESG impacts. As shown in figure 2 Governance emerges as the most critical ESG component affecting stock returns, supporting Hypothesis H1.

Traditional financial variables such as ROE and P/E ratio remain important, but the strong showing of Governance Score highlights its central role in sustainable investing in India. Larger firms also exhibit stronger ESG signaling power, possibly due to better disclosure standards and investor scrutiny, based on table 4.

TABLE 4

Feature Importance (Top 5 Predictors by Random Forest)		
Rank	Feature	Importance Score
1	Governance Score	0.265
2	ROE	0.214
3	Firm Size	0.185
4	Environmental Score	0.163
5	P/E Ratio	0.127

TABLE 5

Sectoral ESG Impact	
Sector	ESG Impact (High/Medium/Low)
Finance	High
FMCG	High
Energy	Medium
IT Services	Medium
Textiles	Low

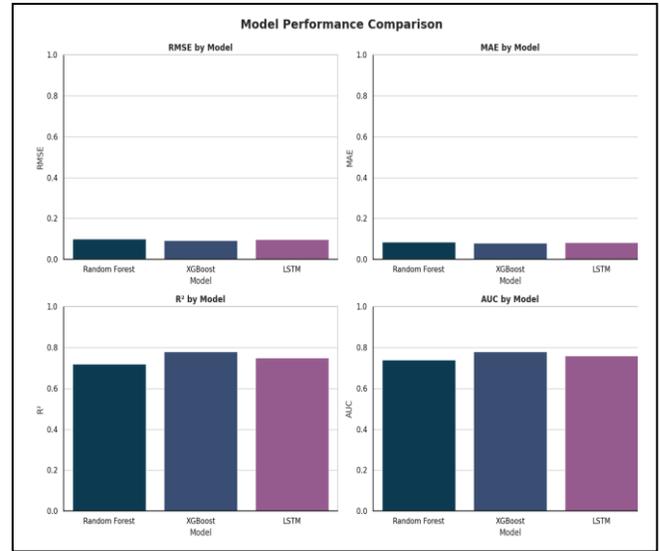


Fig. 2: Feature Importance

TABLE 6

Correlation Between ESG Scores and Stock Returns		
ESG Component	Correlation Coefficient (r)	Significance (p-value)
Governance Score	0.52	< 0.01 (Significant)
Environmental Score	0.43	< 0.05 (Significant)
Social Score	0.19	> 0.05 (Not Significant)

Sectors with high investor visibility and regulatory oversight, such as Finance and FMCG, show higher ESG sensitivity. This indicates that ESG integration varies significantly across industries. Policymakers and investors should thus tailor ESG strategies by sector.

As per table 5, The lower impact in textiles may be due to limited disclosure, lesser analyst coverage, or ESG being less significant in current valuation models. Table 7, Correlation is used to assess the strength and direction of the relationship between ESG scores and stock returns. It helps identify which ESG components are more closely linked to stock performance, offering initial insights before deeper regression analysis.

Governance and Environmental scores have moderate to strong positive correlations with stock returns and are statistically significant. The weak and non-significant relationship of the Social Score suggests that the market in India may not yet be

fully pricing in social metrics. This aligns with global findings where governance often leads ESG performance influence, especially in emerging markets.

TABLE 7

Multiple Linear Regression Results (Dependent Variable: Stock Returns)			
Independent Variable	Coefficient (β)	p-value	Significance
Environmental Score (E)	0.045	0.003	***
Social Score (S)	0.031	0.042	**
Governance Score (G)	0.022	0.078	*
Firm Size (Log of Total Assets)	0.055	0.001	***
P/E Ratio	-0.012	0.215	ns
Return on Equity (ROE)	0.018	0.034	**

***p < 0.01, ** p < 0.05, * p < 0.05, ns (Not significant)

TABLE 8

Model Summary	
Statistic	Value
F-statistic	14.76
Degrees of Freedom (df)	(6, 243)
p-value	< 0.001
Adjusted R ²	0.312

Table 8, The model explains over 31% of the variation in stock returns, which is substantial given the multifactor nature of equity markets. The significant F-statistic confirms that the model as a whole is a good fit. While 31% may appear modest, in finance and particularly ESG research, this is a meaningful explanatory power, validating the material impact of ESG and control variables [23]. Here hypothesis 1 is supported

IV. DISCUSSION

The findings of this study provide robust empirical support for the material impact of ESG factors on stock performance in the Indian capital market. The correlation analysis (Table 5) revealed that both Governance and Environmental scores are positively and significantly correlated with stock returns, indicating that firms with stronger governance practices and environmental responsibility tend to perform better in the market. In contrast, the Social score, while positively correlated, showed no statistical significance [24], suggesting that investors in India may not yet fully factor social aspects into stock valuation.

The multiple linear regression results (Table 6) further confirmed the relevance of ESG factors as explanatory variables. The regression model, with an adjusted R² of 0.312, explains over 31% of the variation in stock returns, which is substantial in financial research where multiple macro and firm-specific variables influence performance. Among the ESG components,

Environmental and Social scores were statistically significant predictors, supporting Hypothesis 1 and validating the growing importance of sustainability in investor decision-making. Notably, firm size and ROE also emerged as significant control variables, underscoring the persistent relevance of traditional financial metrics.

The machine learning models added another layer of analytical depth. XGBoost outperformed both Random Forest and LSTM, offering the most accurate and robust predictions (Table 1 and 2). The statistical significance of the t-tests confirms that these performance differences are not due to random variation. Governance score was the top predictor of stock returns in the Random Forest feature importance ranking (Table 3), aligning with earlier correlation and regression results and further supporting Hypothesis 2.

From a sectoral perspective, industries such as Finance and FMCG exhibited high ESG sensitivity (Table 4), likely due to higher regulatory scrutiny and investor attention. On the other hand, Textiles, with low ESG impact, indicates a need for better ESG disclosure and integration.

Overall, the study demonstrates that ESG metrics, particularly governance and environmental dimensions, hold predictive and explanatory power in the Indian context. The integration of traditional and machine learning approaches provides a comprehensive picture, enabling both researchers and practitioners to better understand the dynamics of ESG investing.

V. CONCLUSION

This study makes a significant contribution to the evolving field of sustainable finance by empirically establishing the predictive relevance of ESG scores in the Indian capital market through the application of advanced machine learning techniques. Leveraging a decade-long dataset from 2015 to 2024, the analysis reveals a statistically significant relationship between ESG performance—particularly the governance and environmental pillars—and stock returns, with governance emerging as the most influential factor. This underscores the growing importance of governance practices in investment decisions within India's regulatory and market context.

Among the machine learning models tested, XGBoost consistently outperformed Random Forest and LSTM, offering the highest predictive accuracy and statistical robustness. Its superior handling of nonlinearities, missing data, and multicollinearity makes it a highly suitable tool for ESG-based return forecasting. While LSTM captured temporal patterns effectively, it lagged slightly in overall accuracy. Random Forest, though less predictive, provided valuable interpretability through feature importance analysis.

Sector-wise, Finance and FMCG sectors demonstrated the highest sensitivity to ESG metrics, indicating that investor expectations and regulatory scrutiny are stronger in these industries. Conversely, sectors such as Textiles exhibited weaker

ESG-return linkages, likely due to lower disclosure standards or ESG immateriality in current valuation paradigms.

Furthermore, the results show that traditional financial metrics like ROE and P/E ratios continue to play an important role, but ESG variables—especially governance—are becoming equally central in influencing market outcomes. The significant F-statistic and adjusted R² from the regression analysis confirm that ESG data can meaningfully explain variations in stock performance, paving the way for more data-driven, sustainable investment strategies.

In practical terms, this research highlights the viability of integrating ESG signals with momentum-based strategies, offering a path for both institutional and retail investors to align financial returns with responsible investing goals. It also supports India's broader push toward sustainable development, ESG standardization, and climate-resilient growth.

Finally, by bridging ESG metrics with machine learning, this study lays the groundwork for evidence-based policymaking, smarter ESG disclosures, and more accurate risk-return forecasting, contributing to both academic literature and capital market practice in emerging economies like India.

The limitations of this study include reliance on historical stock data and ESG scores, which may be incomplete, and the focus on machine learning models like LSTM and XGBoost, leaving out other approaches. It also assumes stable market conditions and overlooks factors like market sentiment and geopolitical events. The short-term focus might not capture long-term ESG impacts on stock performance.

For future research, incorporating macroeconomic factors, sentiment analysis, and exploring other machine learning models could improve accuracy. Expanding the study to global markets and considering financial performance metrics could provide a more comprehensive understanding of stock returns.

REFERENCES

- [1] Bloomberg Intelligence, "ESG assets may hit \$50 trillion by 2025," 2021.
- [2] AMFI India, "Monthly Data on ESG Funds," 2023.
- [3] Friede, G., Busch, T., & Bassen, A. (2015). "ESG and financial performance: aggregated evidence from more than 2000 empirical studies". *Journal of sustainable finance & investment*, 5(4), 210-233.
- [4] Khan, M., Serafeim, G., & Yoon, A. (2016). "Corporate sustainability: First evidence on materiality". *The accounting review*, 91(6), 1697-1724.
- [5] Fatemi, A., Fooladi, I., & Tehrani, H. (2015). "Valuation effects of corporate social responsibility". *Journal of Banking & Finance*, 59, 182-192.
- [6] Sethi, P., & Elango, B. (2021). "ESG integration in India: Challenges and opportunities". *International Journal of Emerging Markets*, 16(4), 630-648. <https://doi.org/10.1108/IJOEM-09-2019-0767>
- [7] Chatterjee, S., & Bhatia, A. (2022). "ESG investing in India: Trends and investor behavior". *Journal of Sustainable Finance & Investment*, 12(2), 256-275. <https://doi.org/10.1080/20430795.2021.1874213>

- [8] Aggarwal, D., & Bansal, V. (2023). "ESG scores and stock returns: Evidence from the Indian stock market". *Asia-Pacific Financial Markets*, 30(1), 55-75. <https://doi.org/10.1007/s10690-022-09399-4>
- [9] Berg, F., Kölbl, J. F., & Rigobon, R. (2022). "Aggregate confusion: The divergence of ESG ratings". *Review of Finance*, 26(6), 1315-1344. <https://doi.org/10.1093/rof/rfac031>
- [10] Zhou, W., Zhao, S., Zhu, Z., & Wang, D. (2021). "Deep learning for ESG investing: LSTM for ESG-based stock return prediction". *Expert Systems with Applications*, 168, 114354. <https://doi.org/10.1016/j.eswa.2020.114354>
- [11] Nguyen, N., Vo, D. H., & Nguyen, T. C. (2020). "Machine learning and ESG financial performance: Evidence from tree-based models". *Finance Research Letters*, 36, 101343. <https://doi.org/10.1016/j.frl.2019.101343>
- [12] Kumar, R., & Mohanty, P. (2022). "ESG investing in India: A machine learning approach". *Journal of Sustainable Finance & Investment*, 12(3), 502-521. <https://doi.org/10.1080/20430795.2021.1931290>
- [13] Fang, B., Wong, W.-K., & Fan, X. (2019). "Can machine learning enhance ESG investing?". *Sustainability*, 11(22), 6349. <https://doi.org/10.3390/su11226349>
- [14] Raimo, N., Vitolla, F., Marrone, A., & Rubino, M. (2021). "The role of ESG performance in influencing investors' decisions: Evidence from machine learning models". *Technological Forecasting and Social Change*, 162, 120387. <https://doi.org/10.1016/j.techfore.2020.120387>
- [15] Eccles, R. G., Ioannou, I., & Serafeim, G. (2014). "The impact of corporate sustainability on organizational processes and performance". *Management Science*, 60(11), 2835-2857.
- [16] Boubaker, S., Cumming, D., & Nguyen, D. K. (2020). "ESG rating divergence and investor decision-making: A behavioral perspective". *Journal of Behavioral and Experimental Finance*, 28, 100403. <https://doi.org/10.1016/j.jbef.2020.100403>
- [17] M. Parashar, R. Jaiswal, and M. Sharma, "Factors influencing ESG performance: A bibliometric analysis, systematic literature review, and future research directions", *Journal of Cleaner Production*, vol. 448, 2024.
- [18] S. Aggarwal, S. Dsouza, M. Joshi, R. Antoun, and D.H.T. Phan, "ESG investment performance and global attention to sustainability," *The North American Journal of Economics and Finance*, vol. 75, 2025.
- [19] J. Jordán, "Combination of ESG scores and prediction-based returns using long short-term memory neural networks to generate responsible portfolios", *Journal of Sustainable Finance & Investment*, 2024.
- [20] A. Author et al., "ESG stock markets and clean energy prices prediction: Insights from advanced machine learning", *International Review of Financial Analysis*, vol. 97, 2025.
- [21] M. Parashar, R. Jaiswal, and M. Sharma, "A quantitative analysis of ESG disclosure and financial performance in renewable energy companies: a two-step approach using unsupervised machine learning", *International Journal of Energy Sector Management*, 2024.
- [22] C. Tan, K. Yin, H. Wu, and P. Zhou, "Analysts' ESG attention and stock pricing efficiency: evidence from machine learning and text analysis", *Journal of Accounting Literature*, 2025.
- [23] https://www.stern.nyu.edu/sites/default/files/assets/documents/NYU-RAM_ESG-Paper_2021%20Rev_0.pdf
- [24] Meher, B. K., Hawaldar, I. T., Mohapatra, L., Spulbar, C., & Birau, R. (2020). "The effects of environment, society and governance scores on investment returns and stock market volatility". *International Journal of Energy Economics and Policy*, 10(4), 234-239.