

AI-DRIVEN PORTFOLIO OPTIMISATION WITH HUMAN BEHAVIOURAL ADJUSTMENTS FOR SUSTAINABLE INVESTMENT PERFORMANCE

OMOTAYO BOLARINDE

DBA Research Scholar, Rushford Business School, Switzerland

Email: omotayo.dba@rushford.eu

ORCID: 0009-0000-4793-3914

RASHEEDUL HAQUE

School of Management and Business (SOMB), MILA University, Nilai, Malaysia

Email: rasheedul.haque@mila.edu.my

ORCID: 0000-0001-8170-5413

ABSTRACT

PURPOSE: The research aims to apply Artificial Intelligence (AI) and sustainability to investment portfolio construction.

DESIGN/METHODOLOGY/APPROACH: The study calculates the annualised average return and volatility of five randomly selected New York Stock Exchange (NYSE) stocks across different sectors to inform portfolio diversification. The calculation is performed using the Excel Solver application, a portfolio optimisation tool that validates investors' Environmental, Social and Governance (ESG) requirements by utilising AI to optimise portfolio weight allocation.

FINDINGS: The findings indicate that the optimised Moderate ESG performed better with portfolio growth of 31%, portfolio volatility of 9% (well below the set maximum of 15%), and a portfolio ESG score of 42.40.

ORIGINALITY/VALUE: The study is novel in combining three aspects, i.e., AI-based portfolio optimisation, ESG investing, and behavioural finance, into a cohesive investment governance model. The research presents an approach that allows investors to flexibly set ESG preference ranges while ensuring efficient visualisation of portfolios with the desired risk profile.

CITATION: Bolarinde, O and Haque, R. (2026): AI-Driven Portfolio Optimisation with Human Behavioural Adjustments for Sustainable Investment Performance. In Ahmed, A. (Ed.): *World Sustainable Development Outlook 2026*, Vol. 22, pp. 113-129. WASD: London, United Kingdom.

RECEIVED: 14 September 2026 / **REVISED:** 15 September 2026 / **ACCEPTED:** 16 September 2026 / **PUBLISHED:** 25 October 2026



PRACTICAL IMPLICATIONS: This study offers practical implications for institutional and individual investors seeking to integrate computational investment efficiency with a sustainable portfolio approach.

KEYWORDS: *Portfolio Optimisation; Behavioural Finance; Artificial Intelligence; Sustainable Portfolio; Environmental, Social and Governance; Individual Investors.*

INTRODUCTION

The overall landscape of global sustainable investment is gaining traction. It is projected to be worth US\$39.08 trillion in 2025, reflecting growing interest in Environmental, Social and Governance (ESG) investing across financial markets worldwide (Fortune Business Insights, 2026). The Artificial Intelligence (AI)-enabled portfolio optimisation can improve portfolio construction efficiency by adjusting weight allocations to simultaneously match the portfolio's expected return, volatility, and diversification (Olanrewaju *et al.*, 2025).

AI optimisation has a clear advantage in computation, but is limited in its investment decisions in terms of mathematical return and risk efficiency (Torkian *et al.*, 2026). Currently, behavioural finance theories, which require consideration of investors' perceptions alongside financial performance objectives, are gaining popularity (Kaur Maan and Shiva, 2024). Still, it requires validation from investors and human intervention to integrate investors' behavioural patterns with sustainability. ESG considerations are a defining feature of investment allocation decisions, especially among investors seeking to maximise their profitability by being more sustainable (Dubcová *et al.*, 2025). While AI-driven portfolio optimisation enhances the efficiency of portfolio construction, it often neglects individual investors' ESG priorities, behavioural preferences, and sustainability expectations in investment decision-making. The study aims to:

- evaluate AI-enabled portfolio optimisation using Excel Solver;
- measure the contribution of ESG scores in investment decisions;
- assess the potential impact of behavioural ESG preferences on sustainable portfolio performance.

To meet these objectives, the study answers two Research Questions (RQs):

RQ1: To what extent does AI optimisation effectively allocate portfolio weights based on specific financial and ESG factors?

RQ2: How do human behavioural preferences in terms of ESG affect sustainable portfolio construction?

Theoretical Framework

This study combines Modern Portfolio Theory (MPT), Behavioural Finance Theory (BFT), sustainable investment governance, the ESG approach, and AI portfolio optimisation into a single investment decision-making model. In the quantitative model for portfolio optimisation, MPT and BFT are considered key theories for integrating ESG with investment decisions (Sivagurunathan *et al.*, 2025). The BFT explains why investors' psychology, ethical perceptions, and risk tolerance go beyond financial rationality. At the same time, ESG governance principles support sustainable capital allocation in portfolio construction.

Contribution of the Study

Behavioural finance approaches, AI ESG integration, and portfolio optimisation are canonical areas of research in investment management. Existing studies either concentrate on the ESG or AI for optimal portfolio construction. This study focuses separately on AI for portfolio optimisation, ESG investment management, and behavioural finance. It proposes a system that attributes MPT and BFT as key aspects for investors, particularly in relation to sustainability objectives, while allocating portfolio weights across investments. It introduces an investment model that enables investors to integrate a sustainability approach into their investments and set their own parameters to balance human intervention with AI supremacy.

LITERATURE REVIEW

AI in Portfolio Optimisation

Financial markets have been significantly affected by the growing presence of AI over the past few years, particularly in portfolio management and investment-related decisions. According to Olanrewaju (2025), portfolio optimisation, data-driven investment analysis, and computational methods have become increasingly popular among financial institutions to enhance the efficiency of their investment portfolios. Financial institutions increasingly rely on machine learning models, algorithmic trading systems, and automated allocation frameworks to optimise investment portfolios, analyse investments using data, and use computational methods to improve investment efficiency. Further, Sutiene *et al.* (2024) have mentioned that AI-based portfolio optimisation systems sift through vast amounts of financial data to identify opportunities for diversification, reduce risk exposure, and generate mathematically efficient portfolio allocations. This has led to a significant

10 REDUCED INEQUALITIES



11 SUSTAINABLE CITIES AND COMMUNITIES



12 RESPONSIBLE CONSUMPTION AND PRODUCTION



13 CLIMATE ACTION



14 LIFE BELOW WATER



15 LIFE ON LAND



16 PEACE, JUSTICE AND STRONG INSTITUTIONS



17 PARTNERSHIPS FOR THE GOALS





enhancement in the operational efficiency of modern businesses in portfolio construction, minimising manual effort and increasing analytical accuracy through AI capabilities.

However, Alfzari *et al.* (2025) identify that current AI optimisation models focus on quantitative, statistical principles that maximise return and minimise volatility. These optimisation frameworks often consider investments as numerical relationships, ignoring the behavioural and ethical aspects of investments. Further, algorithmic allocation systems, based on a set of mathematical functions, can limit the extent to which AI models can address sustainability concern or ethical expectations of investors. Landi *et al.* (2022) suggest that, unlike investment systems that rely solely on computation, investors place more attention on sustainability exposure, governance quality, and social responsibility, as well as on investment performance. This means that investment decisions are not only about mathematical optimisation, as portfolio allocation is increasingly symbolic, reflecting individual behavioural preferences and the ethics of investing.

Integration of MPT and Behavioural Finance for Investor Perception

As per Zik-Rullahi *et al.* (2023), BFT challenges the rational assumptions of traditional financial theories, which hold that many investment decisions are grounded in psychology, emotions and behaviour. Investors tend to exhibit subjective risk perception, emotional responses to market fluctuations, ethical investment preferences, or a preference for investment that varies from purely rational financial optimisation. Further, Padmavathy (2024) has concluded that investors are frequently driven, in addition to the desire to maximise returns, by sustainability expectations, market sentiment, and moral factors.

Also, Echean (2024) suggests a growing trend in the behavioural finance literature, indicating that investors may be willing to forgo some of the advantages of higher immediate monetary returns to align more closely with sustainability and ethical investing. According to Kaya (2024), MPT suggests that investors can maximise returns and minimise risk by using diversification and covariance-based asset allocation. Further, Köhn (2023) has identified that, while MPT represents a monumental breakthrough in quantitative concepts for reviving the vision of money management, it has several limitations, as it assumes that investors are fully rational decision-makers who seek maximum financial return at an acceptable level of risk.

ESG and Sustainable Investment Governance

Dmuchowski *et al.* (2023) have found that ESG investing goes beyond measuring financial performance to incorporate environmental sustainability, governance quality, and ethical

and social responsibility into investment analysis. Chen *et al.* (2023) have established a connection between ESG performance and financial returns; however, this remains a debated topic in the investment market. Some high-return companies can show lower sustainability risk or governance levels even if their financial results are good. However, highly sustainable companies can sometimes yield comparatively lower near-term returns due to investment costs related to operations and governance. In addition, Adebayo and Ackers (2024) suggest that the advent of sustainability, good governance, and ethical capital allocation is significant, especially for modern investors who value interest and returns over trade-offs. The need and process for integrating evidence-based research, in which the user or investor can incorporate ESG objectives into portfolio construction, requires further validation.

Human-Centric AI Governance in Investment Decisions

Ajuwon *et al.* (2025) have noted that the use of AI in financial decision-making has become more commonplace and that the need for human intervention in the investment decision-making process has increased, with Human-in-the-Loop increasingly recognised as a critical component of AI-driven investment governance. AI governance frameworks for humans incorporate behavioural interventions and ethical controls alongside the numerical enhancements to boost contextual investment interpretation. Therefore, human intelligence brings subjective reasoning, moral judgement and evaluation systems focused on sustainability that might not occur in algorithmic allocation systems.

Further, Suma and Shreelatha (2026) have argued that due to the diversity of investors' ethical values and ESG weightings, investor-specific sustainable boundaries are now playing an important role in portfolio construction. While algorithmic systems are largely used to maximise statistical efficiency, human investors often factor in qualitative sustainability issues and negative behavioural perceptions into their investment allocation decisions. Hence, hybrid AI-human governance structures offer a more balanced perspective on portfolio constructions techniques that combine computational efficiency with contextually sound and prudent analyses of sustainability and ethical investments.

Research Gap

Existing studies focus on the efficiency of optimisation, the performance of diversification, and the results of sustainability investments separately. Therefore, within the sustainable finance literature, there is a lack of research on the interaction between algorithmic optimisation and the governance of behaviour. In light of this, this study offers a blended

10 REDUCED INEQUALITIES



11 SUSTAINABLE CITIES AND COMMUNITIES



12 RESPONSIBLE CONSUMPTION AND PRODUCTION



13 CLIMATE ACTION



14 LIFE BELOW WATER



15 LIFE ON LAND



16 PEACE, JUSTICE AND STRONG INSTITUTIONS



17 PARTNERSHIPS FOR THE GOALS





architecture (AI-human sustainable governance) for investment portfolios. This approach incorporates ESG-driven behavioural change into AI-powered portfolio optimisation, ensuring sustainable, ethical, and balanced decision-making.

RESEARCH METHODS

Using quantitative portfolio analysis and behavioural investment analysis, the study investigates the impact of AI and ESG integration on sustainable portfolio optimisation. The research brings together the four elements (AI optimisation, MPT, BFT, and ESG governance principles) into the investment decision-making process. Five stocks from the New York Stock Exchange (NYSE) were selected for the Growth Stocks (NVIDIA), Defensive (JPMorgan), and Sustainability-Sensitive (Johnson and Johnson, Coca-Cola, Exxon Mobil) sectors. The S&P 500 Index was also introduced as a performance indicator and has been widely adopted. The link is: <https://www.spglobal.com/sustainable1/en/scores/results?cid=4094286>.

The research suggests sustainable investment planning by integrating companies' ESG scores and portfolio returns using Excel Solver. This collaborative model is flexible based on investors' behavioural aspects. The model allows investors to select the range of ESG scores for "High", "Moderate", and "Low" categories of ESG portfolios to meet their sustainable investment requirements. Excel Solver, acting as an AI, will provide a portfolio weight allocation which satisfies the investors' Portfolio ESG score requirements (Range of ESG) and provide the maximum possible returns.

Quantitative Component

Return and volatility analysis

This study used three years of monthly adjusted closing price data to compute the annualised average return and stock volatility, based on share price history collected from Yahoo Finance (details of the data are available in the attached Excel file). Average return analysis was carried out to assess the investment's performance over time, measured by the mean, while standard deviation analysis measured price volatility or uncertainty. The three years were chosen to ensure it is neither too short nor too long to fully capture the relationships between return volatility and positioning, and to reflect sustainability conditions over the last 12 months.

Correlation and diversification analysis

The interdependence of stock price movements and portfolio diversification efficiency was examined using correlation analysis (Vasuki *et al.*, 2025). The lower correlation results showed better diversification potential and reduced portfolio volatility, supporting MPT.

AI-Driven portfolio optimisation

Portfolio allocation efficiency was operationalised using the Excel Solver Application, an AI-supported optimisation tool. The optimisation process considers various factors, including expected returns, the volatility of individual asset classes, the covariance relationships between them, and ESG scores. The optimisation model set the maximum stock allocation to 30%, the minimum stock allocation to 10%, the maximum overall portfolio volatility to 15%, and the maximum overall portfolio allocation to 100%. To achieve mathematically efficient portfolio allocation, formulas were used for computing portfolio return and volatility using weighted returns and the covariance matrix (as shown in Table 3).

ESG behavioural intervention analysis

The introduction of High, Moderate, and Low ESG preference categories enabled a behavioural ESG intervention. Each investor could set the ESG score range based on their expectations for sustainability, risk appetite, and ethical preferences. A moderate ESG category was used in the study, which assigned portfolios a 30-49 rating in the ESG area (ESG score ranges can differ for the behavioural aspects of different investors), enabling efficient optimisation.

Further, the data were drawn from only 5 companies, based on their existing portfolios, with NVIDIA's highest ESG score being 63, according to S&P Global. Therefore, the study has a limitation in integrating higher ESG into the portfolio; alternative high-ESG companies should be selected to improve the portfolio's weighted ESG.

Qualitative Component

The study examined the influence of investor-specific sustainability expectations and behavioural ESG preferences on portfolio governance decisions, going beyond the purely mathematical assumption of optimisation. It also analysed the effectiveness of human-centred ethical thinking in enhancing the alignment of sustainable investments within the AI-enabled allocation systems.

10 REDUCED INEQUALITIES



11 SUSTAINABLE CITIES AND COMMUNITIES



12 RESPONSIBLE CONSUMPTION AND PRODUCTION



13 CLIMATE ACTION



14 LIFE BELOW WATER



15 LIFE ON LAND



16 PEACE, JUSTICE AND STRONG INSTITUTIONS



17 PARTNERSHIPS FOR THE GOALS





FINDINGS AND ANALYSIS

Stock Performance and Correlation Findings

Table 1 presents the volatility exposure and diversification efficiency of the chosen NYSE-listed companies. As shown in Table 1, NVIDIA’s annualised return of 62.51% outpaced the S&P 500’s 10.07%, making it the top performer in the sector. At the same time, NVIDIA showed the highest standard deviation of 14.81%, indicating significant price volatility and uncertainty for investors. The results thus corroborate the risk-return relationship posited by MPT, which suggests a positive relationship between expected return and vulnerability-to-return fluctuations.

Table 1: Portfolio Return and Volatility Summary

	<i>NVIDIA</i>	<i>JPMorgan</i>	<i>Johnson and Johnson</i>	<i>Coca-Cola</i>	<i>Exxon Mobil</i>	<i>S and P 500</i>
	NVIDIA	JPM	JNJ	KO	XOM	
Average Monthly Returns	5.3%	1.3%	0.8%	0.7%	2.1%	0.9%
Annualised return	62.51%	15.69%	9.57%	8.24%	25.26%	10.07%
Standard deviation	0.15	0.07	0.05	0.05	0.08	0.04

Source: Calculated using collected data for the stocks’ 3-year monthly returns (by authors)

On the other hand, companies in defensive sector, such as Johnson and Johnson and Coca-Cola, had comparatively stable annualised returns of 9.57% and 8.24%, respectively, and lower standard deviations of 4.95% and 4.87%, respectively, as shown in Table 1. The lower volatility of these firms improved portfolio stability and reduced overall investment uncertainty amid market volatility. In comparison, Exxon Mobil had an annualised return of 25.26% and a volatility of 7.75%, indicating balanced growth and risk-taking relative to the technology portfolio.

The correlation analysis further reinforced the diversification efficiency in the portfolio approach. The most notable group of negative correlations includes NVIDIA stock and the shares of Johnson and Johnson (-0.123), Coca-Cola (-0.097), and Exxon Mobil (-0.039). Moreover, the dual characteristics of Johnson and Johnson’s defensive sectors and Coca-Cola’s triggered a relatively strong positive correlation of 0.619 (0.62), as shown in Table 2.

Table 2: Correlation Among Stocks

<i>Correlation Among Stocks</i>					
	<i>NVIDIA</i>	<i>JPMorgan</i>	<i>Johnson and Johnson</i>	<i>Coca-Cola</i>	<i>Exxon Mobil</i>
NVIDIA	1.00	0.40	(0.12)	(0.10)	(0.04)
JPMorgan	0.40	1.00	0.20	0.12	0.23
Johnson and Johnson	(0.12)	0.20	1.00	0.62	0.28
Coca-Cola	(0.10)	0.12	0.62	1.00	0.27
Exxon Mobil	(0.04)	0.23	0.28	0.27	1.00

Source: Comparing the correlation of the stocks within the stocks calculated using Excel's Correl function (by authors)

AI-Generated Portfolio Allocation Results

The optimisation process using Excel Solver-derived portfolio allocations combined multiple criteria, including expected return, volatility, covariance relationships, ESG scores, and prior investment constraints. The optimisation model qualifies the maximum allocation to the stock, the minimum allocation limit to the stock, the maximum volatility limit for the portfolio, and the minimum allocation limit to the stock (100% portfolio utilisation). As a result, the portfolio produced by the optimisation methodology was diversified and risk-managed, in line with the principles of MPT.

The allocation generated by Excel Solver prioritised mathematically efficient investments, optimising returns while tackling volatility. With the highest volatility exposure of 14.81%, NVIDIA's allocation weight was the highest among all companies after reaching the highest annualised return of 62.51%. According to the Excel Solver application, as shown in Table 3, the portfolio generated a maximum return of 28.19% and a volatility of 8.6%.

Table 3: Portfolio Weight Distribution and Construction without Sustainability

<i>Portfolio Weight Distribution and Construction without Sustainability</i>						
	<i>NVIDIA</i>	<i>JPMorgan</i>	<i>Johnson and Johnson</i>	<i>Coca-Cola</i>	<i>Exxon Mobil</i>	<i>Total</i>
Portfolio Weight	25%	25%	20%	5%	25%	1.00
Average Return (Annual)	62.51%	15.69%	9.57%	8.24%	25.26%	
Volatility	0.15	0.07	0.05	0.05	0.08	
Weighted Return	(0.10)	0.12	0.62	1.00	0.27	0.27
(Weighted Return = Portfolio Weight*Average Return of the Stock)	0.156263	0.039218	0.019142	0.004118	0.063144	





Portfolio Weight Distribution and Construction without Sustainability						
	NVIDIA	JPMorgan	Johnson and Johnson	Coca-Cola	Exxon Mobil	Total
Weighted Volatility						
(Weighted Volatility = Portfolio Weight*Volatility of the Stock)	0.04	0.02	0.01	0.00	0.02	
Portfolio Return (Portfolio Return = Sum of Weighted Portfolio Return of each Stock)				28.19%		
Portfolio Volatility (Portfolio Volatility = Sum of Weighted Portfolio Volatility of each Stock)				8.6%		
Goal						
Portfolio Return	Max					
Portfolio Volatility	Min					
Parameters						
Total Portfolio Weight	1					
Maximum Investment in a stock	30%					
Minimum Investment in a stock	10%					
Portfolio Volatility less than	15%					

Source: Constructed by the authors using Excel Solver function for calculating the highest return with 15% maximum volatility threshold for optimum portfolio weight allocation

ESG Behavioural Portfolio Adjustment Findings

The study introduced behavioural ESG intervention flexibility, allowing investors to categorise sustainability exposure as High ESG (50-100), Moderate ESG (30-49), and Low ESG (0-29). The model addressed RQ2 by exploring how investors’ individual ESG interests influence sustainable portfolio construction using AI-driven optimisation (Ahmed *et al.*, 2024). Human interaction offered investors the possibility to customise the ESG ranges based on their sustainability objectives, risk perception and investment goals, thus enabling flexible behavioural portfolio governance.

ESG scores are sourced from S&P Global, which provides scores on a 100-point scale for companies’ sustainable activities. As per its scoring, it has assigned 63 to NVIDIA, 32 to JPMorgan, 27 to Johnson and Johnson, 42 to Coca-Cola, and 34 to Exxon Mobil. The ESG scores are used to calculate the portfolio-weighted ESG score based on AI-suggested portfolio weights, prioritising the investor’s suggested portfolio ESG range (see the ESG score in Table 4). The solver optimisation process successfully met the investor-defined ESG score range and maximised portfolio return, while limiting volatility to below 15% of

the portfolio under the Moderate ESG scenario. As a result, Table 4 highlights a portfolio return of 31%, volatility of 9% and an ESG score of 42.40 (S&P Global Inc., 2025).

Table 4: Portfolio Weight Distribution and Construction Sustainability

Return and Volatility					
	NVIDIA	JPMorgan	Johnson and Johnson	Coca-Cola	Exxon Mobil
	NVIDIA	JPM	JNJ	KO	XOM
Average Return	62.51%	15.69%	9.57%	8.24%	25.26%
Volatility	0.15	0.07	0.05	0.05	0.08
ESG Score	63	32	27	42	34
	https://www.spglobal.com/sustainable/en/scores/results?cid=4094286	https://www.spglobal.com/sustainable/en/scores/results?cid=100201	https://www.spglobal.com/sustainable/en/scores/results?cid=4044333	https://www.spglobal.com/sustainable/en/scores/results?cid=4202062	https://www.spglobal.com/sustainable/en/scores/results?cid=3007562
Portfolio Weight Distribution and Construction Sustainability					
	NVIDIA	JPMorgan	Johnson and Johnson	Coca-Cola	Exxon Mobil
Portfolio Weight	30%	20%	10%	10%	30%
Average Return (Annual)	62.51%	15.69%	9.57%	8.24%	25.26%
Volatility	0.15	0.07	0.05	0.05	0.08
ESG Score	63	32	27	42	34
Weighted return	18.8%	3.1%	1.0%	0.8%	7.6%
Weighted Volatility	0.04	0.01	0.00	0.00	0.02
weighted ESG	18.9	6.399	2.7	4.2	10.2
Portfolio Return				31%	
Portfolio Volatility				9%	
Portfolio ESG				42.40	
Goal					
Portfolio Return	Max				
Portfolio Volatility	Min		Minimum ESG	Maximum ESG	
Invest or Perception	Moderate		30	49	
Parameters					





Return and Volatility					
	NVIDIA	JPMorgan	Johnson and Johnson	Coca-Cola	Exxon Mobil
Total Portfolio Weight	1				
Maximum Investment in a stock	30%				
Minimum Investment in a stock	10%				
Portfolio Volatility less than	15.00%				

Source: Calculated by the authors using the Excel Solver with the predefined ESG parameter set by the investors (Moderate), for portfolio weight allocation to gain maximum return

Although Coca-Cola’s ESG rating was relatively higher, Solver weighs more towards NVIDIA and Exxon Mobil because of their higher return-optimisation efficiency. At the same time, the model established moderate ESG benchmarks, suggesting that AI optimisation is not detrimental to investor-defined sustainability preferences or the overall performance of their portfolios.

Based on the comparative analysis, the results suggest that ESG-integrated portfolios have higher returns than non-ESG-integrated portfolios. AI optimisation improves returns despite the inclusion of constraints such as ESG in portfolio construction. Hence, addressing RQ1, AI is considered capable of optimising portfolio returns and allocating the portfolio weights.

Refer to the link for analysis:
<https://drive.google.com/drive/folders/1aUHYSy9kgHbmR-fKNNV2Q0qQCm6RpgWb?usp=sharing>

DISCUSSION

The results show that AI-powered portfolio optimisation boosts investment allocation efficiency by further optimising relationships among assets’ returns, volatilities, and covariances, thereby improving diversification performance. The Excel Solver optimisation process successfully operationalised MPT, achieving a portfolio return of 31% while keeping portfolio volatility at 9%, well below the predetermined volatility threshold of 15%. This outcome is thus consistent with the viability of AI-based allocation systems

for balancing generated returns and controlled exposure to investment risks. The results, however, show that algorithmic optimisation alone is still not sufficient for sustainable investment governance.

In the absence of sustainable constraints, mathematical allocation systems tend to favour financially appealing, albeit relatively less ESG-focused, options, allowing firms to focus primarily on return-risk efficiency. AI optimisation cannot, therefore, adequately account for investors' ethical expectations regarding investing, contextual priorities around sustainability, and investors' behavioural preferences. Performance, as measured by the portfolio ESG score of 42.40 in the Moderate ESG behavioural preference category, shows that investment constraints are linked to portfolio performance. At the same time, the results are positively favouring the portfolio returns. The findings validate BFT, showing that investment decisions are not based solely on rational financial-optimisation assumptions.

Finally, human-centred ESG intervention enhances portfolio governance by incorporating sustainability expectations and ethical frameworks into AI-assisted investment decision-making.

CONCLUSIONS

The study examines the role of AI-driven portfolio optimisation in enhancing investment allocation performance, focusing on structured return-volatility diversification and sustainability factors derived from ESG analysis. The Excel Solver optimisation process has achieved a Diversified Portfolio return of 31%, with portfolio volatility of 9% and a behavioural preference for Moderate ESG of 42.40. The results show that algorithmic optimisation alone is not sufficient for flexible and sustainable portfolio governance, as mathematical allocation systems do not reflect the specific ethical views and sustainability preferences of investors.

As such, the adoption of behavioural ESG interventions enhances the investment governance aspect by merging computational efficiency with human-oriented sustainability reasoning. Consequently, the research suggests that human-AI combination systems offer a better balance, ethical, and sustainable solution for making investment decisions in the modern world.

10 REDUCED INEQUALITIES



11 SUSTAINABLE CITIES AND COMMUNITIES



12 RESPONSIBLE CONSUMPTION AND PRODUCTION



13 CLIMATE ACTION



14 LIFE BELOW WATER



15 LIFE ON LAND



16 PEACE, JUSTICE AND STRONG INSTITUTIONS



17 PARTNERSHIPS FOR THE GOALS





ETHICAL STATEMENT

This study involved only public disclosure of secondary financial and ESG data accessed through Yahoo Finance and S&P Global ESG datasets. There were no personal data, confidential financial information, nor any human participants involved in conducting the research. Therefore, there were no issues with data privacy, ethical consent, or participant confidentiality arising from the research process.

REFERENCES

- Adebayo, A. and Ackers, B. (2024): Managing trade-offs between environmental, social, governance and financial sustainability in state-owned enterprises: insights from an emerging market. *Australian Accounting Review*, Vol. 34, No. 1, pp.55-73. Available at: <https://doi.org/10.1111/auar.12415>
- Ahmed, S., Aziz, N.A., Haque, R., Senathirajah, A.R.S. and Qazi, S.Z. (2024): Digital transformation in Malaysian manufacturing: a study of change sensing and seizing capabilities. *Cogent Business and Management*, Vol. 11, No. 1, p.2392046. Available at: <https://doi.org/10.1080/23311975.2024.2392046>
- Ajuwon, A., Oladuji, T.J., Akintobi, A.O. and Onifade, O. (2025): AI-Powered Transformations in Financial Services: Automation and Innovation in Investment and Risk Models. *Engineering and Technology Journal*, Vol. 10, No. 6, pp.5397-5415. Available at: <https://doi.org/10.47191/etj/v10i06.12>
- Alfzari, S., Al-Shboul, M. and Alshurideh, M. (2025): Predictive analytics in portfolio management: A fusion of AI and investment economics for optimal risk-return trade-offs. *International Review of Management and Marketing*, Vol. 15, No. 2, pp.365-380. Available at: <https://doi.org/10.32479/irmm.18594>
- Chen, S., Song, Y. and Gao, P. (2023): Environmental, social, and governance (ESG) performance and financial outcomes: Analysing the impact of ESG on financial performance. *Journal of Environmental Management*, Vol. 345, p.118829. Available at: <https://doi.org/10.1016/j.jenvman.2023.118829>
- Dmuchowski, P., Dmuchowski, W., Baczewska-Dąbrowska, A.H. and Gworek, B. (2023): Environmental, social, and governance (ESG) model; impacts and sustainable investment—Global trends and Poland’s perspective. *Journal of Environmental Management*, Vol. 329, p.117023. Available at: <https://doi.org/10.1016/j.jenvman.2022.117023>

- Dubcová, G., Kapsdorferová, Z. and Lisnik, A. (2025): Identifying the Use of Environmental Social Governance (ESG) Strategies in Companies Associated with CSR Europe on Business Results, Macro-Economic Indicators of the Country and Sustainability of the EU. *World Journal of Science, Technology and Sustainable Development (WJSTSD)*, Vol. 20, No. 4, pp.339-366. Available at: <https://doi.org/10.47556/J.WJSTSD.20.4.2025.2>
- Ecchan, V. (2024): Aligning values with returns: Ethical investing in personal finance. Available at: *SSRN 4845450*. Available at: <https://doi.org/10.2139/ssrn.4845450>
- Fortune Business Insights (2026): *ESG Investing Market*. Available at: <https://www.fortunebusinessinsights.com/esg-investing-market-113824> Accessed: 19 May 2026
- Kaur Maan, A. and Shiva, A. (2024): Bibliometric Evaluation of the Association Between Behavioural Finance and Retail Investor's Decision-Making. *World Journal of Entrepreneurship, Management and Sustainable Development*, Vol. 20, No. 1, pp.13-29. Available at: <https://doi.org/10.47556/J.WJEMSD.20.1.2024.2>
- Kaya, I. (2024): Understanding the Mathematical Background of Modern Portfolio Theory. *PressAcademia Procedia*, Vol. 20, pp.29-33. Available at: <https://doi.org/10.17261/pressacademia.2024.1921>
- Köhn, M.B.H.D. (2023): *The Impact of Behavioral Factors on the Investment Decision-Making of Portfolio Managers in Europe*. Doctoral Thesis, University of Latvia. Available at: <https://dspace.lu.lv/items/8063bb59-dcf6-4bd2-89e0-cafea7dfbcde>
- Landi, G.C., Iandolo, F., Renzi, A. and Rey, A. (2022): Embedding sustainability in risk management: The impact of environmental, social, and governance ratings on corporate financial risk. *Corporate Social Responsibility and Environmental Management*, Vol. 29, No. 4, pp.1096-1107. Available at: <https://onlinelibrary.wiley.com/doi/full/10.1002/csr.2256>
- Olanrewaju, A.G. (2025): Artificial intelligence in financial markets: Optimizing risk management, portfolio allocation, and algorithmic trading. *International Journal of Research Publication and Reviews*, Vol. 6, No. 3, pp.8855-8870. Available at: <https://doi.org/10.55248/gengpi.6.0325.12185>
- Olanrewaju, A.G., Ajayi, A.O., Pacheco, O.I., Dada, A.O. and Adeyinka, A.A. (2025): AI-driven adaptive asset allocation: A machine learning approach to dynamic portfolio optimization in volatile financial markets. *International Journal of Research in Finance and Management*, Vol. 8, No. 1, pp.320-332. Available at: <https://doi.org/10.33545/26175754.2025.v8.i1d.451>
- Padmavathy, M. (2024): Behavioral finance and stock market anomalies: Exploring psychological factors influencing investment decisions. *Shanlax International Journal of Management*, Vol. 11, No. S1, pp.191-197. Available at: <https://doi.org/10.34293/management.v11iis1-jan.7164>

10 REDUCED INEQUALITIES



11 SUSTAINABLE CITIES AND COMMUNITIES



12 RESPONSIBLE CONSUMPTION AND PRODUCTION



13 CLIMATE ACTION



14 LIFE BELOW WATER



15 LIFE ON LAND



16 PEACE, JUSTICE AND STRONG INSTITUTIONS



17 PARTNERSHIPS FOR THE GOALS





S&P Global Inc. (2025): *NVIDIA Corporation ESG Score*. Available at:

<https://www.spglobal.com/sustainable1/en/scores/results?cid=4094286> Accessed: 19 May 2026.

Sivagurunathan, R., Senathirajah, A.R.S., Sivagurunathan, L., Qazi, S., and Haque, R. (2025): Equine-Assisted Experiential Learning: A Literature Review of Embodied Leadership Development in Organizational Behavior. *Administrative Sciences*, Vol. 15, No. 8, p.298. Available at: <https://doi.org/10.3390/admsci15080298>

Suma, B.R. and Shreelatha, H.R. (2026): *Behavioural Dynamics of Green Investing: An Exploratory Study of Investor Perceptions and Experiences*. Available at: <https://doi.org/10.21203/rs.3.rs-8626743/v1>

Sutiene, K., Schwendner, P., Sipos, C., Lorenzo, L., Mirchev, M., Lameski, P., Kabasinskas, A., Tidjani, C., Ozturkkal, B. and Cerneviene, J. (2024): Enhancing portfolio management using artificial intelligence: literature review. *Frontiers in Artificial Intelligence*, Vol. 7, p.1371502. Available at: <https://doi.org/10.3389/frai.2024.1371502>

Torkian, V., Bamdad, S. and Sarfaraz, A.H. (2026): Integrating AI and OR for investment decision-making in emerging digital lending businesses: a risk-return multi-objective optimization approach. *Journal of the Operational Research Society*, Vol. 77, No. 3, pp.716-735. Available at: <https://doi.org/10.1080/01605682.2025.2498652>

Vasuki, M., Celestin, M., Boakye, M.M. and Kumar, A.D. (2025): Evaluating the Efficiency of Portfolio Diversification Strategies Using Statistical Correlation Metrics. *Brainae Journal of Business, Sciences and Technology*, Vol. 9, No. 2, pp.160-170. Available at: <https://doi.org/10.5281/zenodo.14880876>

Zik-Rullahi, A.A., Jide, I. and Onuh, E.O. (2023): Behavioural finance: Exploring the psychology and economic aspects of financial decision-making. *European Review in Accounting and Finance*, Vol. 7, No. 3, pp.50-64. Available at: <https://doi.org/10.5281/zenodo.8320116>

BIOGRAPHY



Omotayo Bolarinde is a business executive and entrepreneur with over eight years of experience spanning real estate development, corporate services, and retail management. She currently serves as Executive Director, Corporate Services, at MKH Properties Limited, where she oversees finance, human resources, compliance, and administration, and drives corporate governance and strategic growth initiatives. She is also a Managing Director and Partner at MKH Supermarket. Bolarinde holds a Master of Business Administration (MBA) from the University of Lagos and is pursuing a Doctorate in Business Administration (DBA) in Finance. She is passionate about sustainable business growth, leadership development, and building enduring African enterprises.



Dr Rasheedul Haque is an Associate Professor of Accounting and Finance and an Outstanding Fellow of the School of Management and Business (SOMB) at MILA University, Malaysia. He has more than 30 years of experience in academia and the corporate sector. Dr Haque has published extensively in leading academic journals and has participated in numerous international and national conferences. He has more than 300 research publications and has authored two books. More than 140 of his publications, including journal articles and book chapters, have appeared in Scopus- and ISI-indexed publications, including Q1 and Q2 journals. He continues to actively publish research in his areas of expertise. His research interests include Strategic Management Accounting, Corporate Finance, Entrepreneurship, and Service Quality in Tourism. He is a Malaysian Qualifications Agency (MQA) approved faculty member in Malaysia.

10 REDUCED INEQUALITIES



11 SUSTAINABLE CITIES AND COMMUNITIES



12 RESPONSIBLE CONSUMPTION AND PRODUCTION



13 CLIMATE ACTION



14 LIFE BELOW WATER



15 LIFE ON LAND



16 PEACE, JUSTICE AND STRONG INSTITUTIONS



17 PARTNERSHIPS FOR THE GOALS

