

## ETHICAL INVESTMENT IN THE AGE OF AI – THE IMPACT OF MACHINE LEARNING USING ESG FRAMEWORK

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### Abstract:

*In today's era of investment, investors anticipate key corporate earnings report, as India's financial markets are experiencing continuous movements. Also, today AI plays an important role in investment industry. Nowadays many financial institutions and hedge funds extensively used AI for algorithmic trading, portfolio management and its optimization, risk assessment. The awareness among investors regarding AI in investment depends upon various factors like investors experience, knowledge level and exposure to financial technology. Retail investors use AI-driven robot-advisors and trading apps. It is essential to assess whether companies adopting AI in investment align with ethical standards under the ESG framework.*

*The main aim of this research is to find out the interest of investors in investment using AI technology, the role of AI in investing transforms the investment landscape using ESG Framework. The data were collected through structured questionnaire, total 49 respondents were responding the same and case studies were reviewed for further clarifications. The study examined AI-driven investment platforms for ethical investing. Findings revealed that most investors are beginners or intermediates, leading to limited awareness of AI in investment and a lack of trust in machine-driven decisions. However, some investors appreciate AI's ability to reduce human errors, enable faster trading, and enhance decision-making. Despite these benefits, integrating AI into ethical investment faces several challenges, highlighting the need for greater awareness and transparency.*

**Keywords** – Ethical-investing, machine-driven, Predictive analytics

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### Introduction:

Investment plays a very important role in managing persons financial planning, portfolio management, daily transactions with the securities, undertaking research and so on. Nowadays ethical investing is a key highlight in the financial investment. Ethical investing is a strategy where investors prioritize companies and assets that align with their personal and societal values. It often considers ESG framework i.e., Environmental, Social and Government in addition to financial returns. It often involves avoiding companies involved in harmful activities like tobacco or fossil fuels) and favoring those with positive contribution to society.

### 1. ESG Frameworks

Environmental, Social and Governance (ESG) framework are used to evaluate companies three broad factors:

- ❖ **Environmental:** It refers to an environmental impact and management practices by an organization (e.g., renewable energy sources like solar and wind, carbon footprint reduction, waste management and recycling.
- ❖ **Social:** Companies relationship with their employees and stakeholders (e.g., fair labor practices, community engagement, diversity and inclusion and contribute positively towards society.

❖ **Governance:** Companies with strong governance structure, Ethical management practices such as (e.g., transparency, executive accountability).

## 2. The Role of AI (Artificial Intelligence) in investing

Artificial Intelligence (AI) is elementarily reshaping investment analysis through advanced data processing and decision-making capabilities. The financial institutions undertaking portfolio management of an investments held by the investors is increasingly reliant on AI for assisted decision making transforming the way of investment managers analyze.

AI is transforming investment landscape by enabling:

- ❖ **Big Data Analysis;** AI processes vast amounts of data to identify trends and opportunities.
- ❖ **Predictive Analytics:** Machine Learning algorithms predict market movements, helping investors make informed decisions.
- ❖ **Automation:** AI powered system executes trades more efficiently and without human bias.

Thus, further challenges have been raised through AI investing such as algorithmic bias, lack of transparency, and data privacy issues. These challenges impact how companies using AI are evaluated for their ethical practices.

### Statement of Problem:

AI is becoming more common in ESG investing, but we don't fully understand its long-term impact on investment performance and corporate sustainability. While AI helps in making better decisions, there are concerns about its transparency, ethics and whether it truly supports sustainable goals. Many investors are still not sure about using AI for ESG investments. This study aims to explore investors awareness, preferences, and how AI-driven ESG strategies affect investments and companies in the long run.

### Objectives of the study:

- 1) The aim of the researcher is to explore ESG integration of AI in investment.
- 2) This paper seeks to address long term societal impact on AI-driven ESG strategies on investment performance and corporate sustainability.
- 3) The present study assesses investor awareness of AI in investment and analyze their preferences and comfort levels in using AI-driven investment platforms.

### Hypothesis:

- 1) **H<sub>0</sub>:** AI-driven ESG strategies doesn't have long term impact on investment performance and corporate sustainability.  
**H<sub>1</sub>:** AI-driven ESG strategies have positively long-term investment impact on performance by improving adjusted returns.
- 2) **H<sub>0</sub>:** There is a lack of awareness among investors towards AI-driven investment platforms.  
**H<sub>1</sub>:** Investors with higher awareness of AI in investment are more likely to adopt AI-driven investment platforms.

### Literature Review:

- 1) **(Sung Une Lee, 2024)** – The researcher focused on ESG – AI framework that helps assess the ethical impact of AI, including machine learning. It evaluates ESG factors, and responsible AI practices which will help an investor to make ethical and informed investment decisions. The data was collected through collaborative research methodology to developed ESG-AI framework from insights with 28 companies, further structured approach used through interviews for assessing AI's environmental and social impacts. The researcher found out that how AI improves ESG investing by using data-driven models. It also brings new technology that changes the way sustainable investing works.

- 2) **(Itishree Behera, 2024)** – The main aim of the study is to explore the implications of AI driven sustainable investments in society and focused on proactive policies and ethical guidelines for integration of AI. The data was collected through live data provided from various platforms such as social media, news articles and financial database to evaluate the Uninterrupted compliance. The researcher found that AI enhances investors for cognizant decision making in sustainable investments and while monitoring performance promotes transparency and accountability in ESG performance.
- 3) **(Nitin Rane, 2024)** – The main purpose of the research is to find the role of AI in enhancing ESG strategies to analyze AI's impact on sustainable investment practices. The study is empirical in nature where real world ESG data use to train AI models and validate their predictions. The study employs AI-based tools such as machine learning, NLP and real time monitoring, which process large datasets computationally. The researcher discovered AI-driven strategies that contribute to the creation of sustainable investment portfolios, promoting long term value highlighting the transformative role of AI in advancing ESG strategies within the financial sector.
- 4) **(Liang, 2023)** – In the present study the researcher explores machine learning applications in enhancing ESG and address the challenges in ESG data quality and standardization. The study is empirical in nature where data has been collected through applying machine learning methods, statistical modeling, supervised learning, predictive analytics and data science workflow. The study reveals the trends and patterns in ESG performance data and amplifies ESG analysis and portfolio management through machine learning.

- 5) **(Brusseau, 2020)** – In the present study the researcher evaluates AI-Intensive companies for ethical investment decisions and develop metrics for human investing in AI companies. Here mixed method approaches used for data analysis where both qualitative and quantitative insights have been incorporated integrating ethical considerations. The study reveals nine performance indicators for ethical evaluation of AI-Intensive companies and indicates inadequate established ESG frameworks for AI-centric companies' assessment.

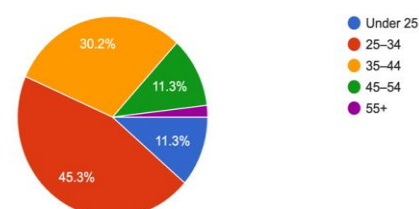
### Research Methodology:

The research methodology highlights the individual investment behavior with reference to ethical investment in the age of AI, further clarifies the impact of machine learning using ESG framework. Here mixed-Methods Approach has been adopted combining both quantitative data and case study analysis to elaborate and understand the subject. The primary data has been collected through surveys conducted through questionnaire which include both open-ended and close-ended questions. Total 53 data have been conducted through time constraint. Here analysis of case studies provides in-depth insights of the topic.

### Analysis and Interpretation of the Data:

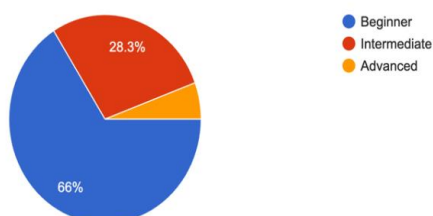
#### Survey data analysis:

a) What is your age group?  
53 responses



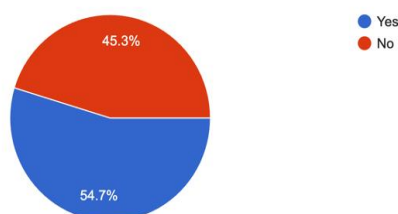
**Inference** – There are 45.3% are between the age group of 25-34, 30.2% between 35-44 age, 11.3% in under 25 age and between 45-54 and minimum above 55 years of age. Here maximum number of respondents are between the age group of 25-34.

b) What is your level of investment experience?  
53 responses



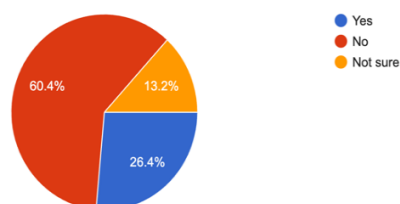
Inferences – Here 66% of investors are beginners, 28% intermediate and minimum at advanced level.

c) Are you currently an active investor?  
53 responses



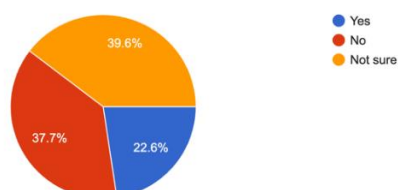
Inferences – It depicts 54.7% investors are active investors and 45.3% are passive investors.

a) Are you aware of how AI is being used in the investment industry?  
53 responses



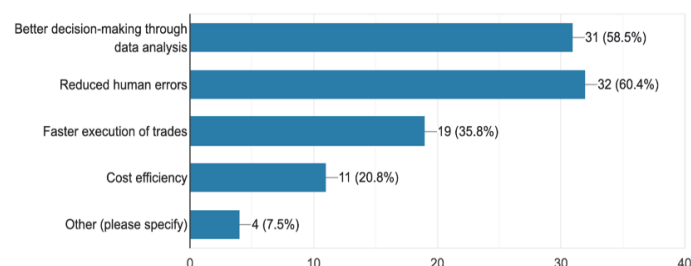
Inferences – It depicts 60.4% investors are unaware about AI used in investment, 13.2% investors are not sure about it and only few i.e., 26.4% of investors are aware AI used in investments.

b) Would you trust AI to make investment decisions for you?  
53 responses



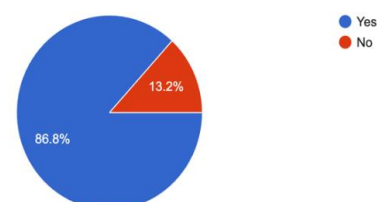
Inferences – Here only few investors i.e., 22.6% trust AI to make investment decisions, 39.6% are not sure about it and 37.7% investors doesn't prefer AI used in investment decision.

c) What do you believe are the biggest benefits of using AI in investing?  
53 responses



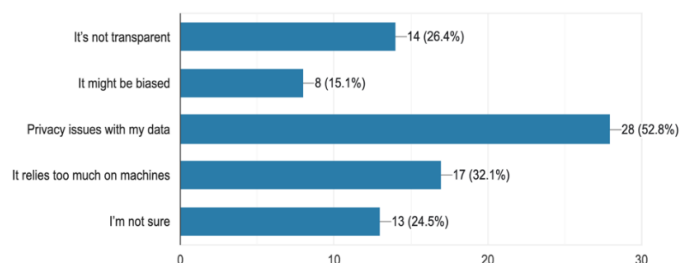
Inferences – The above chart depicts benefits of AI in investing where majority it is believed that it reduces human errors and data analysis leads to better decision making.

a) Do you think it's important for AI to follow ethical rules in investing?  
53 responses



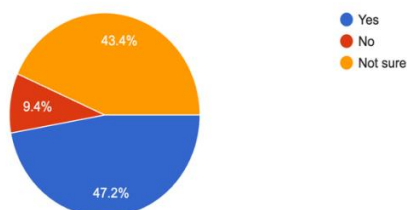
Inferences – Here 86.8% investors considers ethical rules need to be followed for AI used in investments and 13.2% doesn't consider it.

b) What worries you the most about AI in investing?  
53 responses



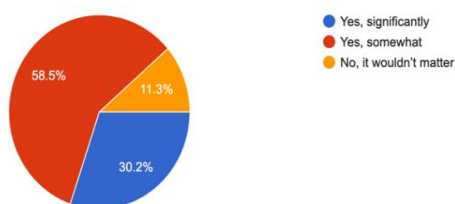
Inferences – The chart depicts risk associated using AI in invested such as its transparency, biasness, privacy issues of data and relevance of machine and some are not sure about it.

c) Would you invest in a company that uses AI if it follows ethical rules?  
53 responses



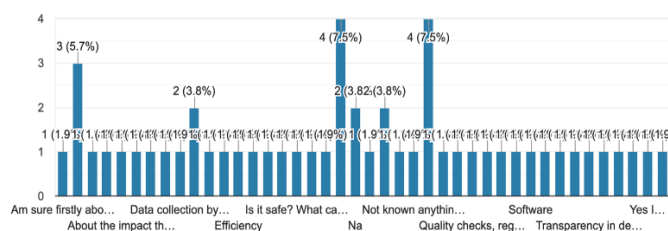
**Inferences –** Here 47.2 % investors are ready to invest in companies following ethical AI rules, 43.4% investors are still doesn't prefer AI in investing though it follows ethical rules and 9.4% are not sure about it.

b) Would ethical AI practices influence your decision to invest in a company?  
53 responses



**Inferences –** It depicts that if companies adopt ethical AI practices then it could have an impact on investment decision making by an investor.

c) What additional factors would you like to know about AI-driven companies before investing?  
53 responses



**Inferences –** The chart depicts an additional factors investors prefer before doing investments in AI-driven companies such as maximum returns, efficacy in transactions, quality checks, Authenticity, trustworthiness, regulations, high security.

### Case Study Report Analysis in the research paper:

**a) Responsible investment in the age of AI  
(Australia's National Science Agency-CSIRO-by  
Eliza Keck, April 2024)**

**Introduction to Case study analysis -** This case study examines how companies publicly disclose their responsible AI policies. It focuses on companies with strong management systems, which are more open to using AI for investment while managing both risks and benefits. Because this case study is closely related to the research topic, the researcher chose to study it. The study also explores how companies with a good history of ESG performance build trust among investors. Strong leadership, clear reporting, and a commitment to ESG values help investors feel more confident in AI-driven investments

**Presentation of case study findings –** The study found that only 10% of companies that adopt Responsible AI (RAI) policies publicly share information. Global companies are more likely to implement AI strategies than American companies. It was also observed that some companies do not include AI risk statements, strategic pillars, or AI-related details in their annual reports. This gap has sparked discussions on AI technology in investment.

This case study shows that AI helps in ESG screening efficiently. However, investor trust remains crucial, especially for those unfamiliar with AI in investing. It is also challenging for companies to maintain ethical standards while using AI.

**b) AI Pioneers in Investment Management  
(Research and Policy Centre - By Larry Cao,  
CFA, September, 2019)**

**Introduction to case study analysis-** This case study explores different AI strategies used by investment companies to meet investor needs, as AI is transforming the investment industry. However, only a few companies adopt AI technology due to its high cost, making it difficult for smaller firms to compete. The study aims to examine the impact of machine learning on investment. However, there is

a possibility that some successful investment professionals may misuse AI opportunities, leading to unethical practices.

**Presentation of case study analysis-** Signals generated through machine learning tools play a significant role in identifying risk factors, supporting decision-making, and analysing investment opportunities. Various strategies have been developed for adopting AI technology in investment while ensuring ethical principles and fair trade practices. The case study discusses different levels of AI adoption across companies, including American investment firms, China Life Asset Management Company, Ping An Group, and Bloomberg. Expert teams are actively working to make AI in investing economically sound and thoughtfully implemented.

Thus, successful investment firms can thrive by wisely adopting AI technology while following ethical principles. This approach not only meets investor expectations but also helps identify and explore the best investment opportunities

**c) Creating Value from Big Data in the Investment Management Process: A Workflow Analysis (Research and Policy Centre – By Cheryl-Ann Wilson, CFA, Jan, 2025)**

**Introduction to case study analysis -** The case study highlights the increasing use of AI techniques in investment, considering factors such as analytics, investment decisions, risk management, ethical issues, data quality, and the complexity of AI models. To explore this, a two-pronged approach and a cross-sectional survey were conducted. The study discusses key skills needed to overcome challenges in ethical investing through technology transformation. Additionally, the survey analysed participants' plans to pursue AI investment training to stay competitive in the industry.

**Presentation of case study analysis -** A mixed-method approach was used, and surveys were conducted across various regions, including Asia-Pacific, America, and EMEA. The study further assesses the level of AI adoption and how data technologies are integrated into the workflows of investment professionals. To overcome the challenges of AI in investing, financial institutions strive to create a flexible and transparent market. They analyse various opportunities for regulators to improve efficiency, enhance risk management in decision-making, and strengthen oversight.

The case study highlights the growing importance of AI and technical skills in the investment industry, emphasizing the need to adapt and compete in the rapidly evolving digital world. Overall, this case study provides valuable insights by exploring techniques and strategies for ethical AI adoption in investing.

**Findings and Conclusion:**

1. The majority of investors are unaware of AI in investment and continue to rely on traditional investment methods.
2. Some investors are aware of AI but hesitate to use it due to trust issues, risks, and challenges.
3. A few investors wisely utilize AI in investment, recognizing its benefits.
4. Many investors believe that if investment companies follow ethical principles, they would be more willing to adopt AI for better investment decision-making.
5. Ethical AI strategies and technologies are crucial for investors to make effective investment decisions.
6. When aligned with the ESG framework, machine learning can have a positive impact on AI-driven investing if used wisely.
7. The findings reveal that investment companies face several challenges in adopting AI-driven investment strategies within the ESG framework. Providing

proper training to investment professionals is essential to guide investors toward ethical investing.

### Suggestions:

*As AI evolves rapidly, companies must act wisely and adopt AI-driven technology to stay competitive. The biggest challenge in implementing ethical AI strategies for investment is the cost factor, which needs careful consideration. Additionally, raising awareness among investors about ethical AI-driven technologies and government regulations is essential to build trust in financial and investment management. Investment professionals should also receive proper training to guide investors on the use of AI in investing.*

**Scope for future study** - There is a need for further exploration of AI-driven technologies adopted by companies using the ESG framework. To stay competitive, companies must improve their AI adoption in investing, as many still rely on traditional methods. This study is limited to Mumbai due to time constraints. Future research can extend the study to different regions and cities for broader insight

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