

ARTIFICIAL INTELLIGENCE AND RETAIL INVESTORS SUSTAINABLE INVESTMENT DECISION-MAKING A CONCEPTUAL FRAMEWORK

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Abstract—Artificial intelligence (AI) has significantly impacted financial markets and investment services. specifically, ai is increasingly used to improve data analysis, market research, portfolio management, and risk assessment of investments. simultaneously, sustainable investment has received increased interest among investors to consider environmental, social, and governance (ESG) factors in addition to traditional risk and return calculations while investment technology continues to advance and ai is making inroads into investment options available to retail investors, retail investors continue to face issues like information overload, behavioral biases, lack of financial literacy and understanding, inconsistent information on ESG attributes of investment options, and confusion in assessing sustainability aspects of long-term investment.

While numerous studies have investigated the technology adoption of ai, role of robo-advisory services, trust in ai, and factors contributing to sustainable investment behavior separately, little has been written about the processes that translate ai capabilities into retail investor's decisions to invest sustainably.

This paper proposes an integrated conceptual framework outlining the pathways that link AI-enabled investment capabilities with retail investors' sustainable investment decision-making. integrating principles of behavioral finance theory, information asymmetry, technology acceptance research, and sustainability investments, we suggest that ai-enabled investment capabilities lead to enhanced perceived information quality on esg factors and improve perceived quality of investment decisions. furthermore, we posit that ai explainability leads to greater investor trust, which further increases acceptance of ai-enabled investment recommendations, and that financial and digital literacy may be key conditional influences to the successful use of insights generated through ai in investment decision-making.

The conceptualization contributes to this underexplored intersection of AI, behavioral finance, and sustainable investment, thereby shifting focus from just technology acceptance to actual mechanisms facilitating AI-driven investment choices.

Keywords: Artificial intelligence, retail investors, sustainable investment, ESG, AI explainability, investor trust, investment decision-making, FinTech.

INTRODUCTION

Artificial Intelligence (AI) is undergoing a revolution, and the financial services sector is not to be exempted. Innovative developments of technology like machine learning, data analytics, natural language processing, automated portfolio management, robo-advisors and generative AI are being increasingly applied to investment and financial decision-making activities. Such technologies provide capacities for the processing of large amount of financial information and have the analytical insights that had hitherto only been available to institutional investors and professional financial analysts.

The increasing proliferation of digital financial services has also led to rising participation of retail investors in financial market activities. These innovations – such as online trading platforms, investment apps and digital advisory services and various FinTech solutions have reduced investment barriers for retailers, by far. However, easy access to investment products does not equate to sound investment decisions.

The following are the main challenges facing retail investors during their investment and financial decision-making: information asymmetry, financial illiteracy, financial market volatility, emotional decisions and biases, etc.

The research in behavioral finance shows that investor behavior can also deviate from its rational assumptions due to a range of psychological factors such as overconfidence, herd behavior, prospect theory (loss aversion), anchoring, availability biases etc. In more sophisticated trading environment, these limits can be exacerbated by information overload, rapidly evolving market conditions.

Sustainable investment is another significant topic that has been addressed by financial market professionals at the worldwide level. Investors are faced with greater demands to consider not only financial variables but also environmental, social and governance factors when investing; Sustainable investment entails consideration for the long-run impact of financial resources due to the effect of factors such as environmental risks, social responsibility, governance factors and the broader nature of Sustainability challenges. These factors are not easy to consider for retail investors due to various reasons; the information used for ESG assessment is scattered around corporate annual/sustainability reports, annual financial reports, third-party ranking firms, news media/online websites, etc. The different rating practices also pose some difficulty in ESG information comparability.

AI provides opportunities to overcome these hurdles. AI-powered investment solutions are capable of collecting, analyzing and interpreting information from abundant financial and non-financial data. Through machine learning and NLP algorithms, complex financial data and report-based information can be processed to deliver insights with relevant investment advice using robo-advisor systems at both individual investor level and in large scales for financial institution.

The capacity of AI to provide individual-level of customized investment advice thus can support the incorporation of ESG factors in individual investor's financial decisions.

Nevertheless, investment choices cannot and should not be determined solely based on AI recommendations; factors such as information quality and algorithmic transparency are also important. Investor's confidence, judgment and discretion are all vital. The purpose of this conceptual paper is to propose an integrative framework that shows how AI-enabled investment capacity affects retail investors' sustainable investment decisions-making processes.

Thus, behavioral serves as a robust background theory for the artificial intelligence-supported investment process.

PROBLEM STATEMENT

The financial and investment institutions, or FinTechs, continue adopting artificial intelligence in the decision-making of investment operations. Investment institutions, such as investment platforms and investment banks, utilize AI functionalities. Artificial intelligence functionalities such as decision support in financial analysis, custom recommendations, robo-advisory, and information processing in relation to ESG aspects are offered and/or used by these institutions.

However, a theoretical and research problem remains unsolved.

Much research work has examined adoption of AI and FinTech services, use of robo-advisory services, investor trust in automated systems, investor choice toward sustainability, and ESG investment decisions. These topics have in many cases been analyzed separately, and, so far, no clear explanation has been provided for the process that translates AI-based investment-driving capabilities into sustainable investment decisions of retail investors. Therefore, the paper presents a conceptually oriented framework aiming at explaining how the AI investment capabilities have an impact on the sustainable investment decision-making, as suggested herein that AI investment features do not lead directly into the sustainable investment decision.

AI will have an effect on the investment behavior by working through decision mechanisms specified below. These decision mechanisms are AI-based investment capabilities, ESG information quality, investment decision-making quality, and sustainable investment decision-making. Together with those decision-making mechanisms as specified by AI explainability, investor trust, and sustainable investment decision-making.

OBJECTIVES OF THE STUDY

The objective of the conceptual study includes:

1. To investigate the part played by ai-powered investment capabilities in retail investment decisions.
2. To propose the role of ai in enhancing the quality of ESG information.

3. To analyze the association between the quality of ESG information and the quality of investment decisions.
4. To investigate the significant part to be played by the explainability of AI in enhancing investors' trust.
5. To establish the role of investors' trust in sustainable investment decision-making processes.
6. To establish an integrative conceptual framework regarding the relationship between AI, investor behavior, and sustainable investment.

FOUNDATIONS OF THEORY

The Theory of Behavioral Finance:

According to behavioral finance, investors' choices are influenced by behavioral and emotional psychology to some extent rather than being entirely rational.

Some of the examples of behavior affecting retail investors are : overconfidence (confidence bias); loss aversion bias; herd behavior bias; anchoring bias; availability bias; representativeness bias.

By employing objective techniques to analyse large amounts of data, AI-driven investment systems can promote a more objective approach. However, as long as investors read the data analyses and base their decisions on the AI's recommendations and analysis, behaviour biases cannot be completely eliminated. Hence, behavior finance provides a platform for investigating the impact of AI on investment decision

THEORY OF INFORMATION ASYMMETRY

A situation known as "information asymmetry" occurs when various actors in an economy have varying degrees of access to transaction-related information.

Information-wise, retail investors are at a disadvantage when compared to:

Investors from institutions Financial experts; Professional managers of funds; Financial advisors. Information technology can help reduce the advantage that retail investors have over these groups, especially through enhanced access to financial and ESG-related data made accessible by artificial intelligence. AI may be used to analyse a greater variety of data, examine information from business reports and scan markets, forecast stock price risk, and customize information for specific investors to help them make better decisions. Therefore, the notion of information asymmetry provides the justification for information technology that could be advantageous to retail investors, such artificial intelligence.

INVESTMENT IN A SUSTAINABLE WAY

This perspective aims to broaden our investment thinking to consider ESG-factors. ESG Environmental factors - climate risk, carbon emissions, efficiency of use of natural capital, sustainable or renewable energy, social factors - employee well-being and human rights, responsible consumer behaviour, community well-being. Governance factors - corporate disclosure and transparency, responsible leadership, company behaviour and accountability. The intention of this perspective is to make aware of the fact that this way of doing investments is in many ways a multi-perspective analysis.

AI-ENABLED INVESTMENT CAPABILITIES

AI-Enabled Investment Capabilities pertains to the technologically provided capabilities of an AI system that allows making an investment analyses and decision. These key capabilities are categorized as: Machine Learning ML technologies make use of historical and cross-sectional financial data, enabling financial analysts to discover complex relationships between different financial variables and to spot patterns across huge sets of data.

Predictive Analytics Leveraging its analytical strengths, AI can analyse its internal historic data and in-real time market data in an effort to predict market behaviour and risks.

Natural Language Processing NLP techniques are utilized to analyze: corporate financial statements and disclosure; environmental, social, and governance(ESG) reports; financial news articles and market news and other sentiment data; robo-advisory A robot adviser is a system of algorithm that provides automatic investment advice and portfolio management. Personalized Investment Recommendations AI systems can evaluate large volumes of investors' characteristics, including an investor's preference for risk (risk aversion), financial targets and sustainability objectives, as well as social preferences. AI-Enabled ESG Analytics AI can interpret financial data and alternative data for investors to examine a corporation's sustainability performances. This can improve the scope and availability of information for investment.

AI-ENABLED INVESTMENT CAPABILITIES AND ESG INFORMATION QUALITY

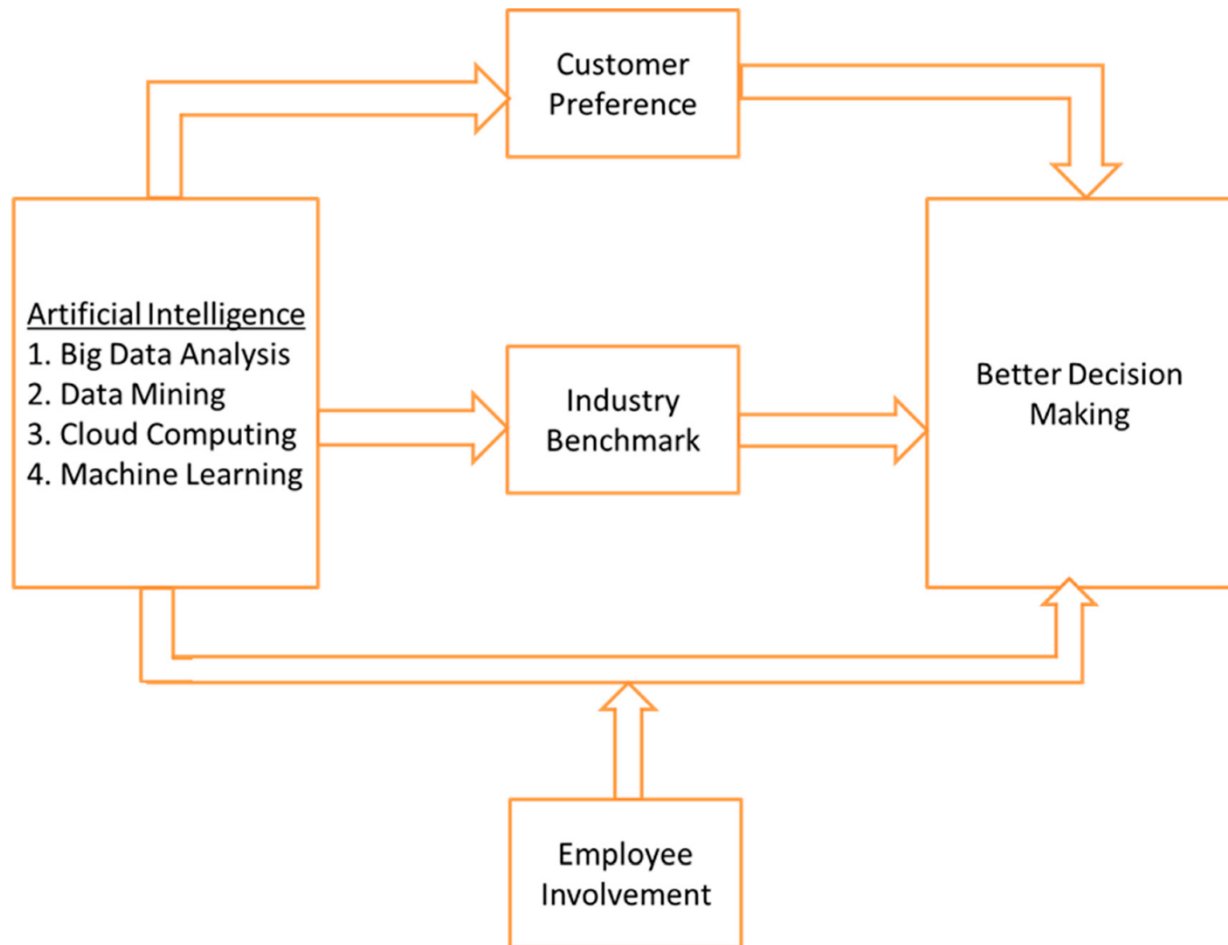
Accessible and intelligible ESG information represents a necessary component for sustainable investing; nevertheless, it can be difficult for individual investors to undertake detailed analysis of various sustainability metrics.

AI technology has the potential of improving ESG information quality in the following ways (not mutually exclusive): information sourcing from diverse sources ;discerning materialESGindices; processing high volumes of ESG data; simplifying the processing information; expanding the availability of information.

Therefore, AI technology can relieve burden faced by individual investors in information processing. Proposition 1: AI-enabled investment capabilities have a positive effect ones information quality.

PROPOSED CONCEPTUAL FRAMEWORK Proposed conceptual framework The conceptual model presents two main pathways. Pathway 1: Information and Decision-Support Mechanism Artificial Intelligence- Enabled Investment Capabilities Environmental, Social and Governance (ESG) Information Quality Investment Decision Quality Sustainable Investment Decision- Making Pathway 2: Trust Mechanism Artificial Intelligence Explainability Investor Trust Sustainable Investment Decision- Making Moderating Mechanism Financial and Digital Literacy Moderates between: AI Enabled Investment Capabilities Investment Decision Quality.

CONCEPTUAL FRAMEWORK DIAGRAM



MANAGERIAL IMPLICATIONS

Financial institutions and FinTechs need to: Create transparent, explainable, reliable, and user-friendly AI-enabled investment systems.

Provide investment platforms with ESG information, risks explanations, personalized recommendations, clear explanations of AI outputs etc. AI should provide decision support rather than encouraging blind reliance of user on automated system recommendations.

Policy Implication

Regulators & policy makers should give attention to: - AI transparency, - Investor protection - Algorithmic accountability - Data privacy - Avoiding bias/ discrimination by algorithm - Harmonisation of ESG Information - Financial literacy & digital literacy Responsible regulations will help AI promote sustainable and inclusive financial market.

POTENTIAL DIRECTIONS FOR FUTURE STUDIES

The proposed conceptual framework could be empirically validated by future researchers. Following are a few potential strategies for research:

Quantitative Research

Through an empirical survey, probe into the attitudes of retail investors who are making use of:

- online trading platforms,
- FinTech applications,
- robo-advisory services and/or
- AI-based investment platforms.

Statistical Analysis

Subsequently, validate the framework using.

- SEM,
- PLS-SEM,
- Mediation Analysis and/or
- Moderation Analysis.

Cross-country studies

Future research may analyse and compare it between:

- emerging economies and developed economies;
- between different groups of investors.

CONCLUSION

The growing prevalence of artificial intelligence will invariably contribute to a change in our investment decisions, as there is now better information available, analysis capabilities and personalised support offered for investments. Meanwhile, the emergence of sustainable investment necessitates the investors to analyse and examine ever more sophisticated financial and ESG-related information. Therefore, this conceptual paper contributes by proposing that AI-enabled investment capacities enhance ESG information and investment decision-making qualities to a greater extent to aid retail investors' decisions on sustainable investment and that AI explainability builds investor trust in investing in the advice provided by AI, which is supported by the investors' use of financial and digital literacy.

The conceptualisation goes beyond an AI adoption view by elaborating on the influencing mechanisms that AI impacts retail investors' decisions for sustainable investment.

In the future, the AI role for sustainable investment would certainly require consideration of transparency of AI, investor trust, quality of information, and the ability for retail investors to evaluate the quality of advice generated from AI.

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